



# PowerFlex® 700 Adjustable Frequency AC Drive

Frames 0...6

0.37...132 kW (0.5...200 Hp)

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

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

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

| Title                                                                           | Publication  |
|---------------------------------------------------------------------------------|--------------|
| PowerFlex 700 Standard Control User Manual                                      | 20B-UM001    |
| PowerFlex 700 Vector Control User Manual (v4.001 & up)                          | 20B-UM002    |
| PowerFlex Comm Adapter Manuals                                                  | 20COMM-UM    |
| PowerFlex 70 and PowerFlex 700 Reference Manual                                 | PFLEX-RM001  |
| PowerFlex 70 Enhanced Control and PowerFlex 700 Vector Control Reference Manual | PFLEX-RM004  |
| Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives       | DRIVES-IN001 |

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

To find your local Rockwell Automation distributor, visit [www.rockwellautomation.com/locations](http://www.rockwellautomation.com/locations)

## Allen-Bradley Drives Technical Support

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

| Online at...                                                                 | By Email at...                                                                     | By Telephone at... |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------|
| <a href="http://www.ab.com/support/abdrives">www.ab.com/support/abdrives</a> | <a href="mailto:support@drives.ra.rockwell.com">support@drives.ra.rockwell.com</a> | 262-512-8176       |

## Installation Instructions in Other Languages

|                      |                                                                                                                                                                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| English              | This instruction sheet is available in multiple languages at <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> .<br>Select publication language and type "20B-IN019" in the search field.                             |
| Deutsch              | Dieses Instruktionsblatt kann in mehreren Sprachen unter <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> gelesen werden.<br>Bitte Ihre Sprache anwählen und "20B-IN019" im Suchfeld eintippen.                      |
| Français             | Ces instructions sont disponibles dans différentes langues à l'adresse suivante: <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> .<br>Sélectionner la langue puis taper << 20B-IN019 >> dans le champ de recherche. |
| Italiano             | La presente scheda d'istruzione è disponibile in varie lingue sul sito <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> .<br>Selezionare la lingua desiderata e digitare "20B-IN019" nel campo di ricerca.           |
| Español              | Puede encontrar esta hoja de instrucciones en varios idiomas en <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> .<br>Seleccione el idioma de publicación y escriba "20B-IN019" en el campo de búsqueda.             |
| Português            | Esta folha de instruções está disponível em várias línguas em <a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> .<br>Selecione a língua de publicação e entre com "20B-IN019" no espaço de busca.                     |
| Chinese (simplified) | 从以下网页可以获得本说明书的多种语言的版本：<br><a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a> 。<br>请选择出版物的语言，并在搜索栏输入“20B-IN019 印”                                                                                                       |

## Summary of Changes

The information below summarizes the changes since the last release.

### Change

Updated MOV and Common Mode Cap information on pages [43](#) through [54](#).

Added Alternate Junction Box to Frame 6 Dimension Drawing on page [19](#).

Updated Common I/O Programming Changes on page [71](#).

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## Catalog Number Explanation

| 1-3      | 4        | 5-7      | 8        | 9        | 10       | 11       | 12       | 13       | 14       | 15       | 16       | 17-18    | 19-20    |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 20B      | D        | 2P1      | A        | 3        | A        | Y        | N        | A        | R        | C        | 0        | NN       | AD       |
| <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> | <i>m</i> | <i>n</i> |

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

| <i>b</i><br>Voltage Rating |         |     |         |        |
|----------------------------|---------|-----|---------|--------|
| Code                       | Voltage | Ph. | Prechg. | Frames |
| B                          | 240V AC | 3   | -       | 0...6  |
| C                          | 400V AC | 3   | -       | 0...6  |
| D                          | 480V AC | 3   | -       | 0...6  |
| E                          | 600V AC | 3   | -       | 0...6  |
| F                          | 690V AC | 3   | -       | 5...6  |
| H                          | 540V DC | -   | N       | 5...6  |
| J                          | 650V DC | -   | N       | 5...6  |
| N                          | 325V DC | -   | Y       | 5...6  |
| P                          | 540V DC | -   | Y       | 5...6  |
| R                          | 650V DC | -   | Y       | 5...6  |
| T                          | 810V DC | -   | Y       | 5...6  |
| W                          | 932V DC | -   | Y       | 5...6  |

| <i>c</i><br>ND Output Rating |      |          |
|------------------------------|------|----------|
| Example                      |      |          |
| Code                         | Amps | kW (Hp)  |
| 2P1                          | 2.1  | 0.75 (1) |
| 022                          | 22   | 11 (15)  |

| <i>d</i><br>Enclosure |                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------|
| Code                  | Enclosure                                                                                   |
| A                     | IP20, NEMA/UL Type 1                                                                        |
| F                     | Open/Flange Mount<br>Front: IP00, NEMA/UL Type Open<br>Back/Heatsink: IP54, NEMA/UL Type 12 |
| G                     | Stand-Alone/Wall Mount<br>IP54, NEMA/UL Type 12                                             |
| M                     | IP20, NEMA/UL Type 1 with Conformal Coat                                                    |

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

⚡ Only available with Vector Control option.

| <i>e</i><br>HIM |                                                                  |
|-----------------|------------------------------------------------------------------|
| Code            | Operator Interface                                               |
| 0               | Blank Cover                                                      |
| 3               | Full Numeric LCD                                                 |
| J               | Remote (Panel Mount), IP66, NEMA/UL Type 12 Full Numeric LCD HIM |
| K               | Remote (Panel Mount), IP66, NEMA/UL Type 12 Prog. Only LCD HIM   |

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

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

| <i>g</i><br>Brake |                |
|-------------------|----------------|
| Code              | w/Brake IGBT ⚡ |
| Y                 | Yes            |
| N                 | No             |

⚡ Brake IGBT is standard on Frames 0-3 and optional on Frames 4-6.

| <i>h</i><br>Internal Braking Resistor |            |
|---------------------------------------|------------|
| Code                                  | w/Resistor |
| Y                                     | Yes        |
| N                                     | No         |

⚠ Not available for Frame 3 drives or larger.

| <i>i</i><br>Emission |             |          |
|----------------------|-------------|----------|
| Code                 | CE Filter ‡ | CM Choke |
| A                    | Yes         | Yes      |
| B                    | Yes         | No       |
| N                    | No          | No       |

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

⚡ Only available for 20B...240V Frame 0-3 drives.

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

| <i>k</i><br>Control & I/O |          |           |
|---------------------------|----------|-----------|
| Code                      | Control  | I/O Volts |
| A                         | Standard | 24V DC/AC |
| B                         | Standard | 115V AC   |
| C                         | Vector ⚡ | 24V DC    |
| D                         | Vector ⚡ | 115V DC   |
| N                         | Standard | None      |

⚡ Vector Control Option utilizes DPI Only.

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

| <i>m</i><br>Future Use |  |
|------------------------|--|
|------------------------|--|

| <i>n</i><br>Special Firmware (Frames 0...6 Only) |                            |
|--------------------------------------------------|----------------------------|
| Code                                             | Type                       |
| AD                                               | 60 Hz Maximum              |
| AE                                               | Cascading Fan/Pump Control |
| Ax                                               | 82 Hz Maximum              |
| BA                                               | Pump Off (for pump jack)   |

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

## Step 1 Read the Precautions and General Information

### Qualified Personnel



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

### Personal Safety



**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the following points (refer to pages [28](#) through [30](#) for locations):

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

The voltage must be zero for all three measurements.



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



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



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

## Product Safety

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



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



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

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

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

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## EMC Instructions

### CE Conformity

Conformity with the Low Voltage (LV) Directive and Electromagnetic Compatibility (EMC) Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex Drives<sup>(1)</sup> comply with the EN standards listed below when installed according to the information supplied in this publication, the User Manual and the Wiring & Grounding Guidelines Manual.

CE Declarations of Conformity are available online at:  
<http://www.ab.com/certification/ce/docs>.

### Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations.

### EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

<sup>(1)</sup> 600V class drives below 77A (Frames 0...4) are declared to meet the essential requirements of the Low Voltage Directive. It is the responsibility of the user to determine compliance to the EMC directive.

## General Notes

- Some drives are equipped with an adhesive label on the top of the drive. If the adhesive label is removed from the top of the drive, the drive must be installed in an enclosure with side openings less than 12.5 mm (0.5 in.) and top openings less than 1.0 mm (0.04 in.) to maintain compliance with the LV Directive.
- The motor cable should be kept as short as possible in order to avoid electromagnetic emission as well as capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- PowerFlex drives may cause radio frequency interference if used in a residential or domestic environment. The installer is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.
- PowerFlex drives can generate conducted low frequency disturbances (harmonic emissions) on the AC supply system.
- When operated on a public supply system, it is the responsibility of the installer or user to ensure, by consultation with the distribution network operator and Rockwell Automation, if necessary, that applicable requirements have been met.

## Essential Requirements for CE Compliance

Conditions 1...6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN61800-3**.

1. Standard PowerFlex 700 CE compatible Drive.
2. Review important precautions/attention statements throughout this publication and the User Manual before installing the drive.
3. Grounding as described in this publication and the User Manual.
4. Output power, control (I/O) and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit, or equivalent attenuation.
5. All shielded cables should terminate with the proper shielded connector.

6. The following conditions:

- First Environment Restricted Distribution - For any drive and option a filter may be required for motor cable lengths greater than 150 m (492 ft.).
- Second Environment (Industrial) - Motor cable is limited to 30 m (98 ft.) for installations without additional external line filters.

External filters for First Environment installations and increasing motor cable lengths in Second Environment installations are available. Roxburgh models KMFA (RF3 for UL installations) and MIF or Schaffner FN3258 and FN258 models are recommended. Refer to [Table A](#) and <http://www.deltron-emcon.com> and <http://www.mtec corp.com> (USA) or <http://www.schaffner.com>, respectively.

**Table A PowerFlex 700 Recommended Filters**

| Manufacturer | Frame                 | Manufacturer Part Number <sup>(1)</sup> | Class         |               | Manufacturer Part Number <sup>(1)</sup> | Class         |               |
|--------------|-----------------------|-----------------------------------------|---------------|---------------|-----------------------------------------|---------------|---------------|
|              |                       |                                         | A<br>(Meters) | B<br>(Meters) |                                         | A<br>(Meters) | B<br>(Meters) |
| Deltron      | 0                     | KMF318A                                 | –             | 100           | MIF316                                  | –             | 150           |
|              | 1                     | KMF325A                                 | –             | 150           | –                                       | –             | –             |
|              | 2                     | KMF350A                                 | 200           | 150           | –                                       | –             | –             |
|              | 2 w/o DC CM Capacitor | KMF350A                                 | 176           | 150           | –                                       | –             | –             |
|              | 3                     | KMF370A                                 | 150           | 100           | –                                       | –             | –             |
|              | 3 w/o DC CM Capacitor | KMF370A                                 | 150           | 100           | –                                       | –             | –             |
| Schaffner    | 0                     | FN3258-16-45                            | –             | 150           | –                                       | –             | –             |
|              | 1                     | FN3258-30-47                            | –             | 150           | –                                       | –             | –             |
|              | 2                     | FN3258-42-47                            | 50            | 50            | –                                       | –             | –             |
|              | 2 w/o DC CM Capacitor | FN3258-42-47                            | 150           | 150           | –                                       | –             | –             |
|              | 3                     | FN3258-75-52                            | 100           | 100           | –                                       | –             | –             |
|              | 3 w/o DC CM Capacitor | FN3258-75-52                            | 150           | 150           | –                                       | –             | –             |

<sup>(1)</sup> Use of these filters assumes that the drive is mounted in an EMC enclosure.

## DC Input (Common Bus) and Precharge Notes

The following notes must be read and understood. Also refer to pages [24](#) through [30](#) for additional DC input information.

### Important Application Notes

1. If drives without internal precharge are used (Frames 5 & 6 only), then:
  - a) precharge capability must be provided in the system to guard against possible damage, and
  - b) disconnect switches Must Not be used between the input of the drive and a common DC bus without the use of an external precharge device.
2. If drives with internal precharge (Frames 0...6) are used with a disconnect switch to the common bus, then:
  - a) an auxiliary contact on the disconnect must be connected to a digital input of the drive. The corresponding input (parameter 361...366) must be set to “30, Precharge Enable.” This provides the proper precharge interlock, guarding against possible damage to the drive when connected to a common DC bus.
  - b) the drive must have firmware version 2.002 or above

## Step 2 Mount the Drive

### Accessing the Terminals

#### Opening the Cover



#### Frames 0...4

Locate the slot in the upper left corner. Slide the locking tab up and swing the cover open. Special hinges allow cover to move away from drive and lay on top of adjacent drive (if present). See below for frame 4 access panel removal.

#### Frame 5

Slide the locking tab up, loosen the right-hand cover screw and remove. See below for access panel removal.

#### Frame 6

Loosen 2 screws at bottom of drive cover. Carefully slide bottom cover down & out. Loosen the 2 screws at top of cover and remove.

#### Cable Entry Plate Removal

If additional wiring access is needed, the Cable Entry Plate on 0...3 Frame drives can be removed. Simply loosen the screws securing the plate to the chassis. The slotted mounting holes assure easy removal.

**Important:** Removing the Cable Entry Plate limits the maximum ambient temperature to 40 degrees C (104 degrees F).

#### Power Wiring Access Panel Removal

| Frame       | Removal Procedure <i>(Replace when wiring is complete)</i>         |
|-------------|--------------------------------------------------------------------|
| 0, 1, 2 & 6 | Part of front cover, see above.                                    |
| 3           | Open front cover and gently tap/slide cover down and out.          |
| 4           | Loosen the 4 screws and remove.                                    |
| 5           | Remove front cover (see above), gently tap/slide panel up and out. |

Environment

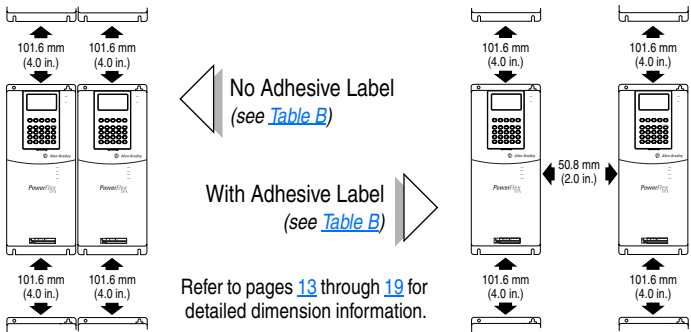
Operating Temperatures

PowerFlex 700 drives are designed to operate at 0 to 40 °C ambient. To operate the drive in installations between 41 and 50 °C, see the information below and refer to pages 33 through 41 for exceptions.

Table B    Acceptable Surrounding Air Temperature & Required Actions

| Enclosure Rating                                                                          | Temperature Range              | Drive                                     |
|-------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------|
| IP20, NEMA/UL Type 1 (with Top Label) <sup>(1)</sup>                                      | 0...40 °C                      | Frames 0...4, All Ratings                 |
|                                                                                           | 0...50 °C                      | Frames 5...6, Most Ratings <sup>(2)</sup> |
| IP20, NEMA/UL Type Open (Top Label Removed) <sup>(1)</sup>                                | 0...50 °C                      | Most Ratings <sup>(2)</sup>               |
|                                                                                           | 0...45 °C                      | 20BC072 Only                              |
| IP00, NEMA/UL Type Open (Top Label & Vent Plate Removed)                                  | 0...50 °C                      | 20BC072 Only <sup>(3)</sup>               |
| Flange Mount<br>Front - IP00, NEMA/UL Type Open<br>Back/Heat Sink - IP54, NEMA/UL Type 12 | 0...40 °C Back (External)      | Frames 5...6                              |
|                                                                                           | 0...55 °C Front (Inside Encl.) |                                           |
| Stand-alone/Wall Mount - IP54, NEMA/UL 12                                                 | 0...40 °C                      | Frames 5...6                              |

- (1) Removing the adhesive top label from the drive changes the NEMA/UL enclosure rating from Type 1 to Open. Frames 5 and 6 do not have a top label.
- (2) Refer to pages 33 through 41 for exceptions.
- (3) To remove vent plate (refer to User Manual for location), lift top edge of plate from the chassis. Rotate the plate out from the back plate.

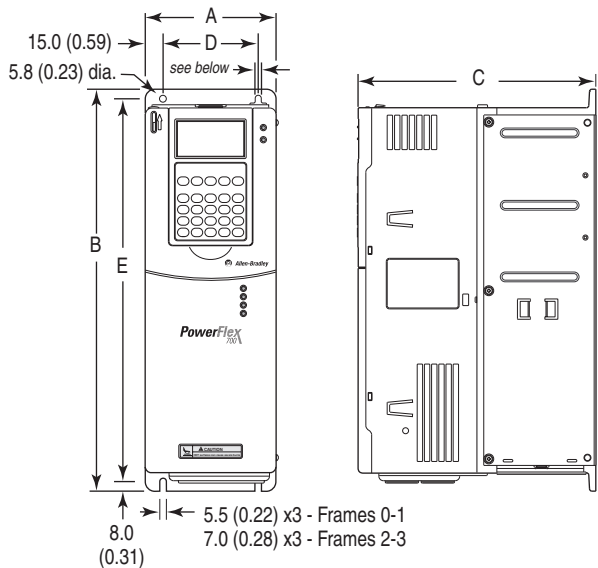


Minimum Mounting Clearances

Specified vertical clearance requirements are intended to be from drive to drive. Other objects can occupy this space; however, reduced airflow may cause protection circuits to fault the drive. In addition, inlet air temperature must not exceed the product specification.

Dimensions

Frames 0...3 (0 Frame Shown)



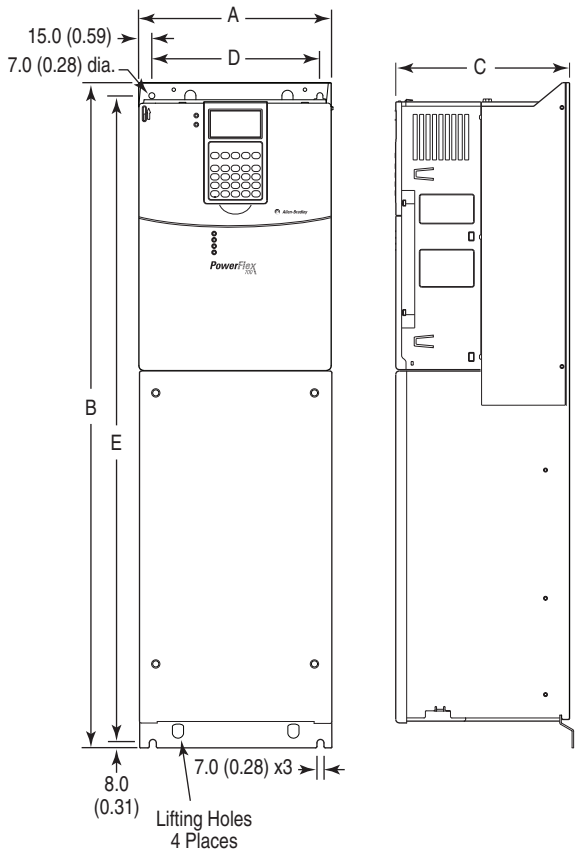
Dimensions are in millimeters and (inches)

| Frame <sup>(1)</sup> | A            | B             | C            | D            | E             | Weight <sup>(2)</sup> kg (lbs.) |                   |
|----------------------|--------------|---------------|--------------|--------------|---------------|---------------------------------|-------------------|
|                      |              |               |              |              |               | Drive                           | Drive & Packaging |
| 0                    | 110.0 (4.33) | 336.0 (13.23) | 200.0 (7.87) | 80.0 (3.15)  | 320.0 (12.60) | 5.22 (11.5)                     | 8.16 (18)         |
| 1                    | 135.0 (5.31) | 336.0 (13.23) | 200.0 (7.87) | 105.0 (4.13) | 320.0 (12.60) | 7.03 (15.5)                     | 9.98 (22)         |
| 2                    | 222.0 (8.74) | 342.5 (13.48) | 200.0 (7.87) | 192.0 (7.56) | 320.0 (12.60) | 12.52 (27.6)                    | 15.20 (33.5)      |
| 3                    | 222.0 (8.74) | 517.5 (20.37) | 200.0 (7.87) | 192.0 (7.56) | 500.0 (19.69) | 18.55 (40.9)                    | 22.68 (50)        |

(1) Refer to pages 33 through 41 for frame information.

(2) Weights include HIM and Standard I/O.

Frame 4

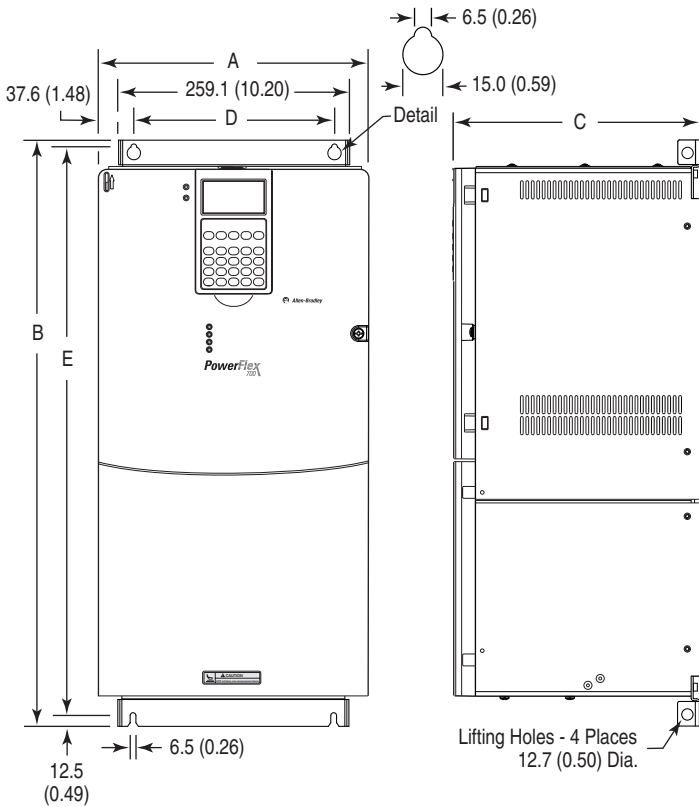


Dimensions are in millimeters and (inches)

| Frame <sup>(1)</sup> | A (Max.)     | B             | C (Max.)     | D            | E             | Approx. Weight <sup>(2)</sup> kg (lbs.) |                   |
|----------------------|--------------|---------------|--------------|--------------|---------------|-----------------------------------------|-------------------|
|                      |              |               |              |              |               | Drive                                   | Drive & Packaging |
| 4                    | 220.0 (8.66) | 758.8 (29.87) | 201.7 (7.94) | 192.0 (7.56) | 738.2 (29.06) | 24.49 (54.0)                            | 29.03 (64.0)      |

(1) Refer to pages 33 through 41 for frame information.  
(2) Weights include HIM and Standard I/O.

Frame 5

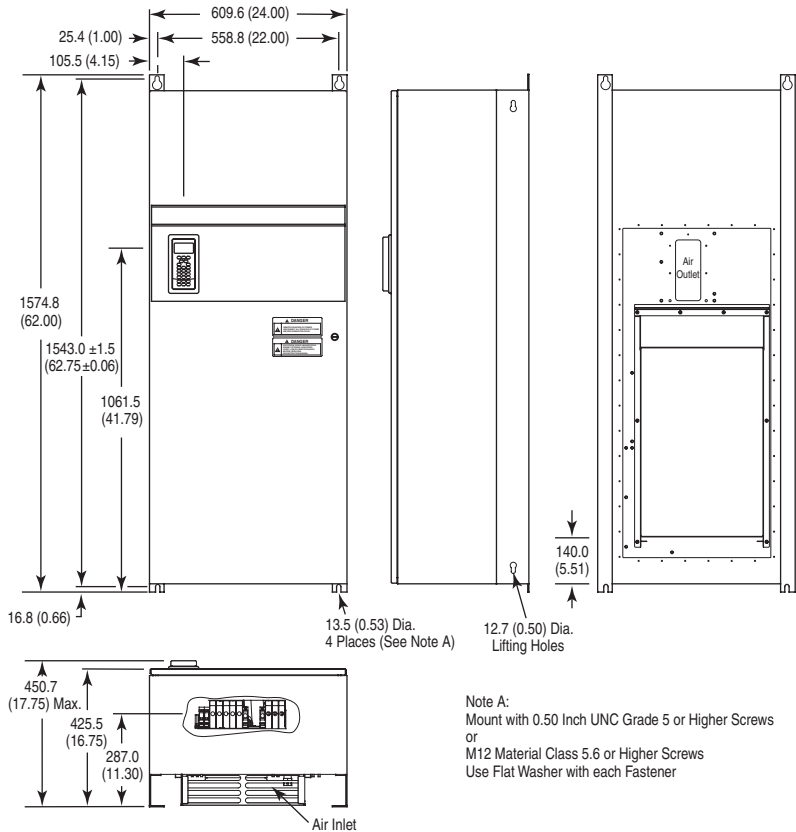


Dimensions are in millimeters and (inches)

| Frame <sup>(1)</sup> | A (Max.)      | B                            | C (Max.)      | D            | E             | Approx. Weight <sup>(2)</sup> kg (lbs.) |                   |
|----------------------|---------------|------------------------------|---------------|--------------|---------------|-----------------------------------------|-------------------|
|                      |               |                              |               |              |               | Drive                                   | Drive & Packaging |
| 5                    | 308.9 (12.16) | 644.5 (25.37) <sup>(3)</sup> | 275.4 (10.84) | 225.0 (8.86) | 625.0 (24.61) | 37.19 (82.0)                            | 49.50 (109.0)     |

- (1) Refer to pages 33 through 41 for frame information.
- (2) Weights include HIM and Standard I/O. Add 2.70 kg (6.0 lbs.) for the 20BC140 drive.
- (3) When using the supplied junction box (100 Hp drives Only), add an additional 45.1 mm (1.78 in.) to this dimension.

Frame 5 NEMA/UL Type 12 Standalone (400...690V drives only)

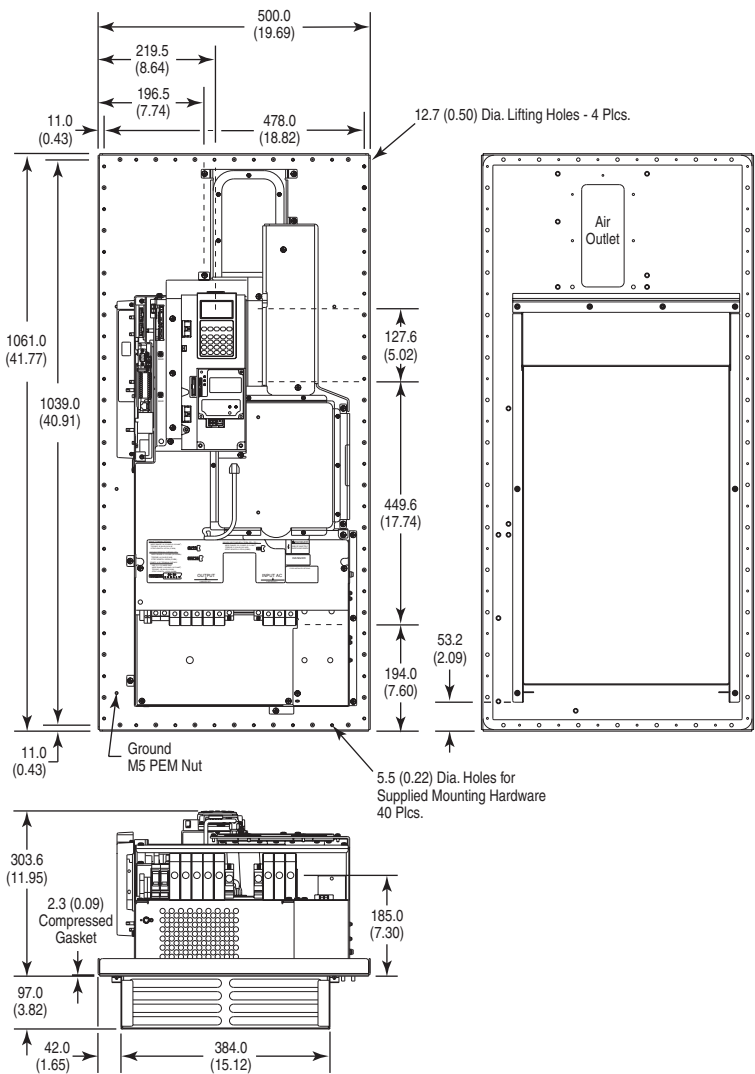


Dimensions are in millimeters and (inches)

| Frame | Description | Approx. Weight <sup>(1)</sup> kg (lbs.) |                   |
|-------|-------------|-----------------------------------------|-------------------|
|       |             | Drive                                   | Drive & Packaging |
| 5     | Standalone  | 102.51 (226.0)                          | 154.68 (341.0)    |

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

Frame 5 NEMA/UL Type 12 Flange Mount (400...690V drives only)

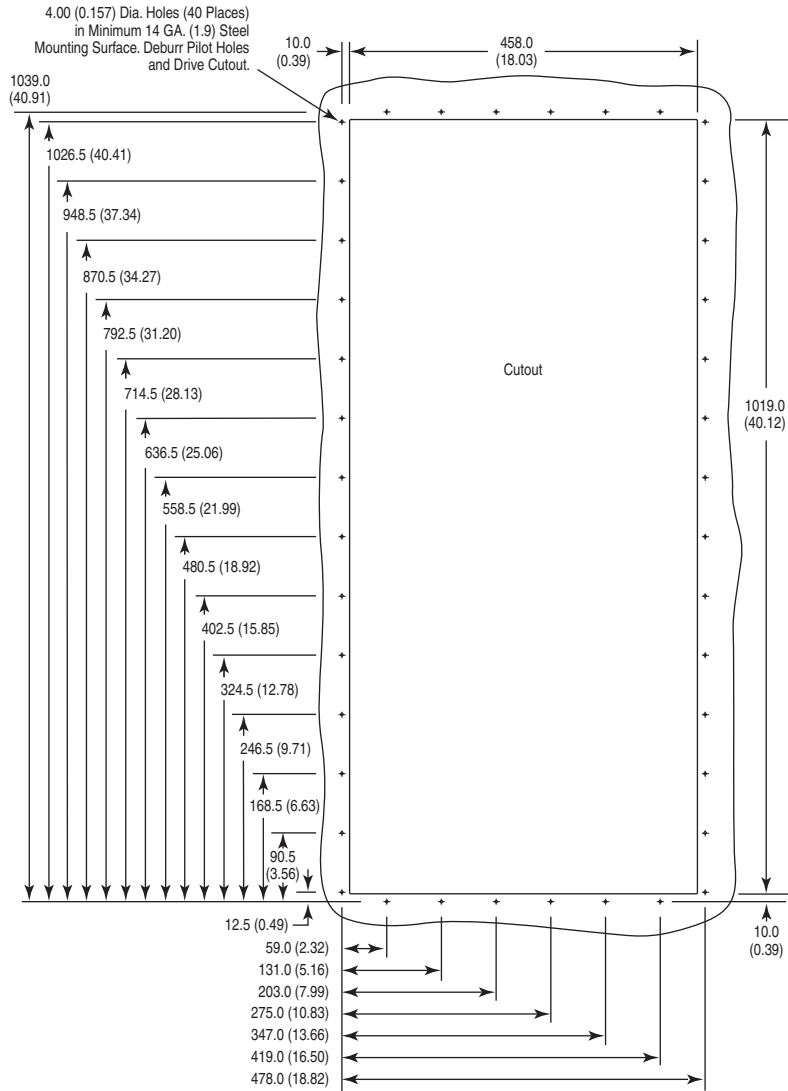


Dimensions are in millimeters and (inches)

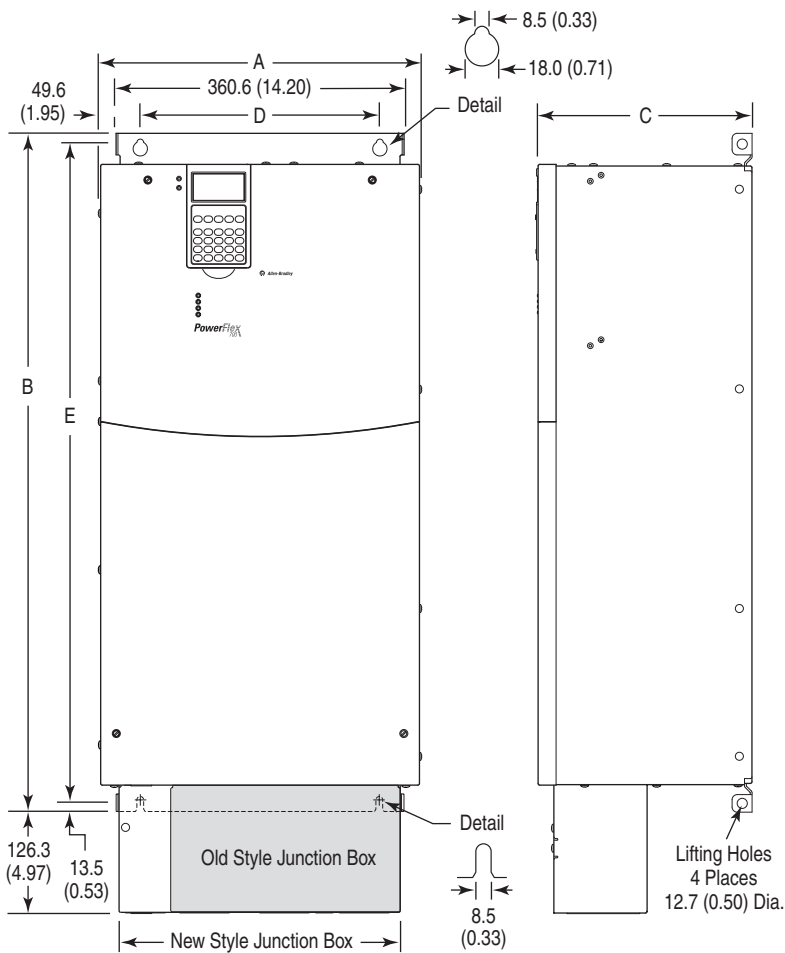
| Frame | Description  | Approx. Weight <sup>(1)</sup> kg (lbs.) |                   |
|-------|--------------|-----------------------------------------|-------------------|
|       |              | Drive                                   | Drive & Packaging |
| 5     | Flange Mount | 61.69 (136.0)                           | 81.65 (180.0)     |

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

Frame 5 Flange Mount Cutout



Frame 6



Dimensions are in millimeters and (inches)

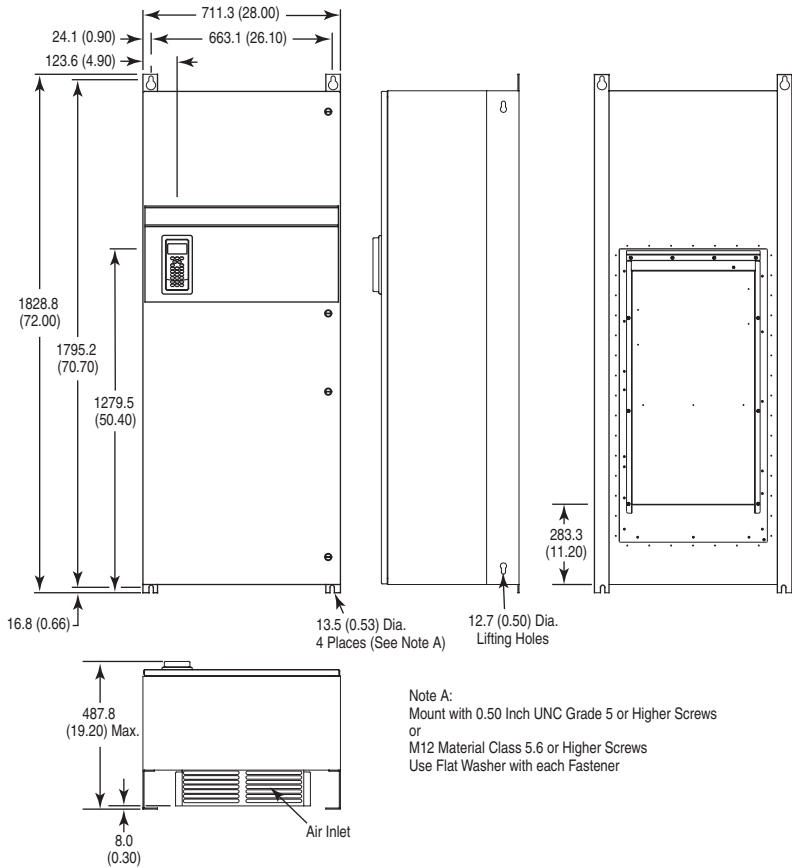
| Frame <sup>(1)</sup> | A (Max.)      | B <sup>(2)</sup> | C (Max.)      | D             | E             | Approx. Weight <sup>(3)</sup> kg (lbs.) |                   |
|----------------------|---------------|------------------|---------------|---------------|---------------|-----------------------------------------|-------------------|
|                      |               |                  |               |               |               | Drive                                   | Drive & Packaging |
| 6                    | 403.9 (15.90) | 850.0 (33.46)    | 275.5 (10.85) | 300.0 (11.81) | 825.0 (32.48) | 71.44 (157.5)                           | 100.9 (222.0)     |

(1) Refer to pages 33 through 41 for frame information.

(2) Junction Box can be removed if drive is mounted in a cabinet.

(3) Weights include HIM and Standard I/O. Add 13.60 kg (30.0 lbs.) for the following drives; 20BB260, 20BC260 and 20BD248.

Frame 6 NEMA/UL Type 12 Standalone (400...690V drives only)

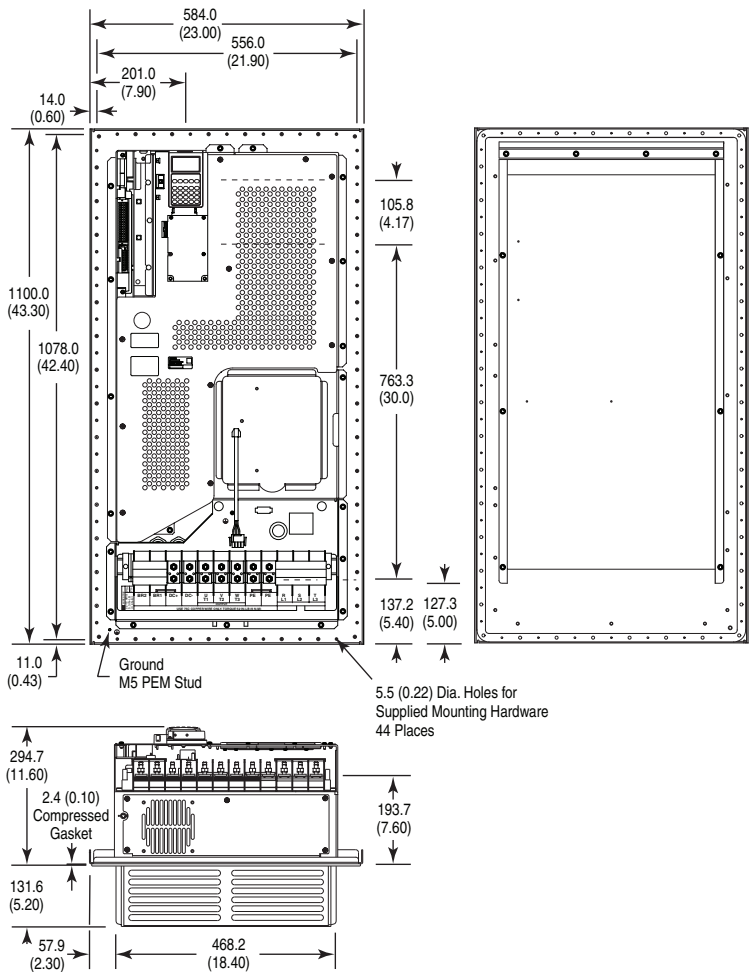


Dimensions are in millimeters and (inches)

| Frame | Description | Approx. Weight <sup>(1)</sup> kg (lbs.) |                   |
|-------|-------------|-----------------------------------------|-------------------|
|       |             | Drive                                   | Drive & Packaging |
| 6     | Standalone  | 176.90 (390.0)                          | 229.07 (505.0)    |

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

Frame 6 NEMA/UL Type 12 Flange Mount (400...690V drives only)

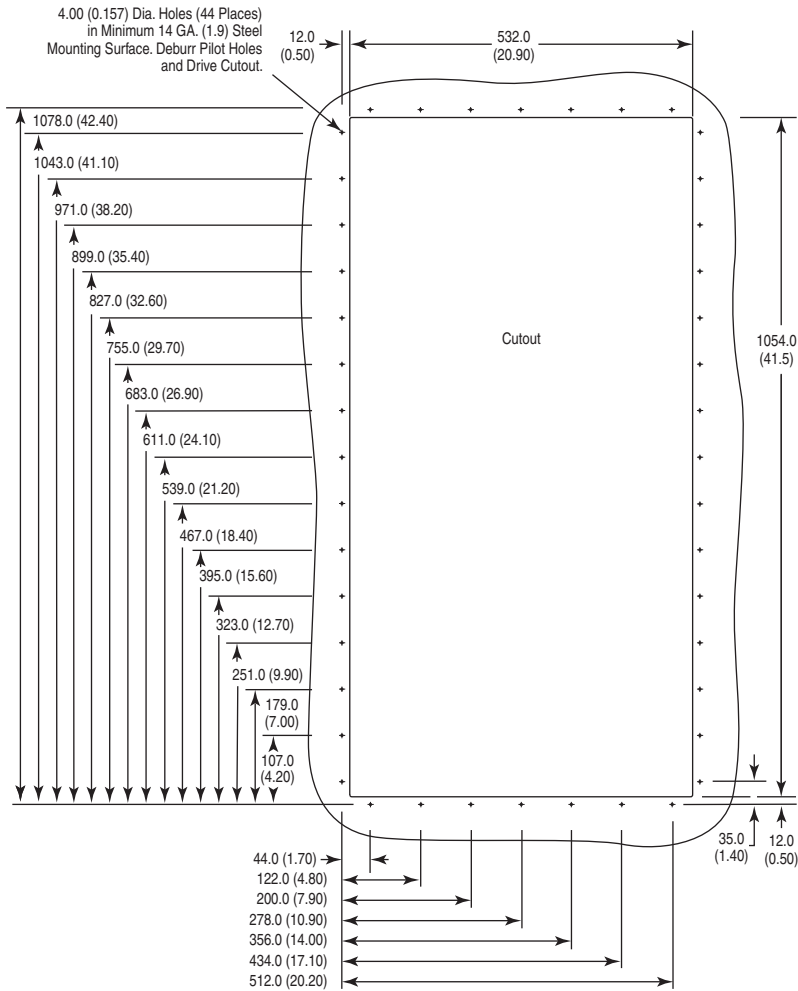


Dimensions are in millimeters and (inches)

| Frame | Description  | Approx. Weight <sup>(1)</sup> kg (lbs.) |                   |
|-------|--------------|-----------------------------------------|-------------------|
|       |              | Drive                                   | Drive & Packaging |
| 6     | Flange Mount | 99.79 (220.0)                           | 119.75 (264.0)    |

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

Frame 6 Flange Mount Cutout



## Step 3 Wire the Drive

### Special Considerations

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



**ATTENTION:** To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified on [page 32](#).

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

### Input Power Conditioning

Certain events on the power system supplying a drive can cause component damage or shortened product life. These conditions are divided into 2 basic categories:

#### 1. All drives

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

#### 2. 5 Hp or Less Drives (in addition to “1” above)

- The nearest supply transformer is larger than 100 kVA or the available short circuit (fault) current is greater than 100,000A.
- The impedance in front of the drive is less than 0.5%.

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance can be calculated using the information supplied in Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001.

## Single-Phase Input Power

The PowerFlex 700 drive is typically used with a three-phase input supply. Single-phase operation is possible with output current derated by 50% (at maximum ambient temperature of 25 °C) of the three-phase ratings identified on pages 33 through 38. Refer to the PowerFlex 700 Vector Control User Manual (publication 20B-UM002) for details.

### AC Input Phase Selection (Frames 5...6 Only)

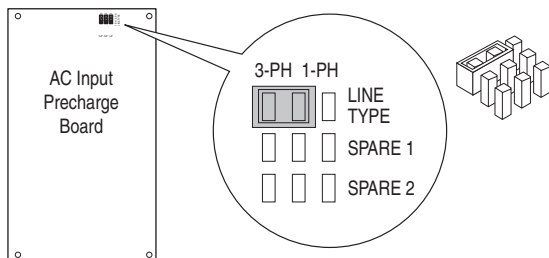


**ATTENTION:** To avoid a shock hazard, ensure that all power to the drive has been removed before performing the following.

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

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

#### Typical Location - Phase Select Jumper



## Selecting/Verifying Fan Voltage (Frames 5 & 6 Only)

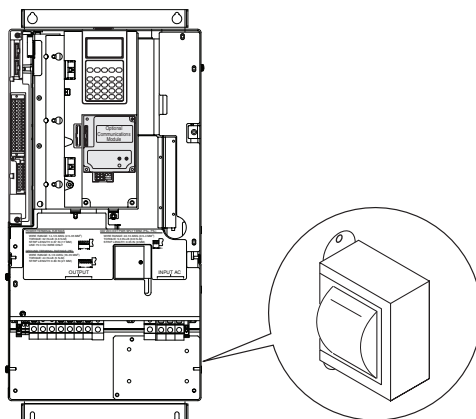


**ATTENTION:** To avoid a shock hazard, ensure that all power to the drive has been removed before performing the following.

Frames 5 & 6 utilize a transformer to match the input line voltage to the internal fan voltage. If your line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps as described. DC input drives require user supplied 120 or 240V AC to power the cooling fans. The power source is connected between “0 VAC” and the terminal corresponding to your source voltage.

| Frames 5 & 6 Fan Connections |                         |                                      |             |                                                                                                                                                                                                                                           |
|------------------------------|-------------------------|--------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drive Type                   | Enclosure               | Rating (120VAC)                      | No. of Fans | Connect at ...                                                                                                                                                                                                                            |
| DC Input                     | IP00, NEMA/UL Type Open | 100 VA (Frame 5)<br>138 VA (Frame 6) | 1           | Power Terminal Block                                                                                                                                                                                                                      |
|                              | IP20, NEMA/UL Type 1    | 100 VA (Frame 5)<br>138 VA (Frame 6) | 1           | Requires user supplied 120 or 240V AC. See page 30 for TB locations and terminal designations.                                                                                                                                            |
| AC Input                     | IP00, NEMA/UL Type Open | 100 VA (Frame 5)<br>138 VA (Frame 6) | 1           | N/A (Connected internally)                                                                                                                                                                                                                |
|                              | IP20, NEMA/UL Type 1    | 100 VA (Frame 5)<br>138 VA (Frame 6) | 1           | A transformer (located behind Power TB) matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps. |

Fan Transformer Typical Location (Frame 5 shown)



#### Frame 6 Transformer Tap Access

The transformer is located behind the Power Terminal Block. Access is gained by releasing the terminal block from the rail. To release terminal block and change tap:

1. Locate the small metal tab at the bottom of the end block.
2. Press the tab in and pull the top of the block out. Repeat for next block if desired.
3. Select appropriate transformer tap.
4. Replace block(s) in reverse order.

## Auxiliary Control Power Supply

An Auxiliary Control Power Supply such as the 20-24V-AUX1 can provide control power for certain PowerFlex 700 drives. See details below.



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

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The Auxiliary Control Power Supply **Must Not be used** with...

- Any Standard Control drive (15<sup>th</sup> position of the catalog number string equals “A,” “B,” or “N”).
- Any 200/240V PowerFlex 700 drive, Standard or Vector Control (4<sup>th</sup> position of the catalog number string equals “B”).

The Auxiliary Control Power Supply **Can be used** with...

- 400/480 and 600/690 Volt drives with Vector Control (15<sup>th</sup> position of the catalog number string equals “C,” or “D”). Consult the factory when using an auxiliary power supply in these instances.

Use of an auxiliary power supply to keep the drive control logic up when the main AC power is removed requires the use of some type of AC line monitoring as well as control of the Precharge Enable signal. Consult the factory for additional guidance.

## Wire Recommendations

| Type                            |                                                 | Wire Type(s)                                                                                               | Description                                                                                                                                                                                                     | Min. Insulation Rating                |
|---------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Power</b><br>(1)(2)          | Standard                                        | 600V, 90 °C (194 °F)<br>XHHW2/RHW-2<br>Anixter<br>B209500-B209507,<br>Belden 29501-29507,<br>or equivalent | <ul style="list-style-type: none"> <li>Four tinned copper conductors with XLPE insulation.</li> <li>Copper braid/aluminum foil combination shield and tinned copper drain wire.</li> <li>PVC jacket.</li> </ul> |                                       |
|                                 | Standard Analog I/O                             | Belden 8760/9460 (or equivalent)<br><br>Belden 8770 (or equivalent)                                        | 0.750 mm <sup>2</sup> (18 AWG), twisted pair, 100% shield with drain.<br><br>0.750 mm <sup>2</sup> (18 AWG), 3 conductor, shielded for remote pot only.                                                         | 300V,<br>75...90 °C<br>(167...194 °F) |
| <b>Signal</b><br>(1)(3)(4)      | Encoder/Pulse I/O <30 m (100 ft.)               | Combined:<br>Belden 9730 <sup>(5)</sup>                                                                    | 0.196 mm <sup>2</sup> (24 AWG)                                                                                                                                                                                  |                                       |
|                                 | Encoder/Pulse I/O 30 to 152 m (100 to 500 ft.)  | Signal:<br>Belden 9730/9728 <sup>(5)</sup>                                                                 | 0.196 mm <sup>2</sup> (24 AWG)                                                                                                                                                                                  |                                       |
|                                 |                                                 | Power: Belden 8790 <sup>(6)</sup>                                                                          | 0.750 mm <sup>2</sup> (18 AWG)                                                                                                                                                                                  |                                       |
|                                 |                                                 | Combined:<br>Belden 9892 <sup>(7)</sup>                                                                    | 0.330 mm <sup>2</sup> (18 AWG), power is 0.500 mm <sup>2</sup> (20 AWG)                                                                                                                                         |                                       |
|                                 | Encoder/Pulse I/O 152 to 259 m (500 to 850 ft.) | Signal:<br>Belden 9730/9728 <sup>(5)</sup>                                                                 | 0.196 mm <sup>2</sup> (24 AWG)                                                                                                                                                                                  |                                       |
|                                 |                                                 | Power: Belden 8790 <sup>(6)</sup>                                                                          | 0.750 mm <sup>2</sup> (18 AWG)                                                                                                                                                                                  |                                       |
| <b>Digital I/O</b><br>(1)(3)(4) | Shielded                                        | Combined:<br>Belden 9773/9774 <sup>(8)</sup>                                                               | 0.750 mm <sup>2</sup> (18 AWG)                                                                                                                                                                                  | 300V,<br>60 °C (140 °F)               |
|                                 |                                                 | Multi-conductor shielded cable such as Belden 8770 (or equivalent)                                         | 0.750 mm <sup>2</sup> (18 AWG), 3 conductor, shielded.                                                                                                                                                          |                                       |

- (1) Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
- (2) The use of shielded wire for AC input power may not be necessary but is always recommended.
- (3) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.
- (4) I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.
- (5) 9730 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9728.
- (6) 8790 is 1 shielded pair.
- (7) 9892 is 3 individually shielded pairs (3 channel) + 1 shielded pair for power.
- (8) 9773 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9774.

## Terminal Block Specifications

| No. | Name                         | Frame                                  | Description                                                 | Wire Size Range <sup>(1)</sup>                                         |                                                                    | Torque                 |                        |
|-----|------------------------------|----------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------|------------------------|
|     |                              |                                        |                                                             | Maximum                                                                | Minimum                                                            | Maximum                | Recommended            |
| ❶   | Power Terminal Block         | 0 & 1                                  | Input power and motor connections                           | 4.0 mm <sup>2</sup><br>(12 AWG)                                        | 0.5 mm <sup>2</sup><br>(22 AWG)                                    | 1.7 N•m<br>(15 lb•in)  | 0.8 N•m<br>(7 lb•in)   |
|     |                              | 2                                      | Input power and motor connections                           | 10.0 mm <sup>2</sup><br>(8 AWG)                                        | 0.8 mm <sup>2</sup><br>(18 AWG)                                    | 1.7 N•m<br>(15 lb•in)  | 1.4 N•m<br>(12 lb•in)  |
|     |                              | 3                                      | Input power and motor connections                           | 25.0 mm <sup>2</sup><br>(3 AWG)                                        | 2.5 mm <sup>2</sup><br>(14 AWG)                                    | 3.6 N•m<br>(32 lb•in)  | 1.8 N•m<br>(16 lb•in)  |
|     |                              |                                        | BR1, 2 terminals                                            | 10.0 mm <sup>2</sup><br>(8 AWG)                                        | 0.8 mm <sup>2</sup><br>(18 AWG)                                    | 1.7 N•m<br>(15 lb•in)  | 1.4 N•m<br>(12 lb•in)  |
|     |                              | 4                                      | Input power and motor connections                           | 35.0 mm <sup>2</sup><br>(1 AWG)                                        | 10.0 mm <sup>2</sup><br>(8 AWG)                                    | 4.0 N•m<br>(35 lb•in)  | 4.0 N•m<br>(35 lb•in)  |
|     |                              | 5<br>75 Hp,<br>480V<br>100 Hp,<br>600V | Input power, BR1, 2, DC+, DC-, PE and motor connections     | 50.0 mm <sup>2</sup><br>(1/0 AWG)                                      | 4.0 mm <sup>2</sup><br>(12 AWG)                                    | See Note (2)           |                        |
|     |                              | 5<br>100 Hp                            | Input power, DC+, DC- and motor<br>BR1, 2, and PE terminals | 70.0 mm <sup>2</sup><br>(2/0 AWG)<br>50.0 mm <sup>2</sup><br>(1/0 AWG) | 10.0 mm <sup>2</sup><br>(8 AWG)<br>4.0 mm <sup>2</sup><br>(12 AWG) |                        |                        |
| ❷   | SHLD Terminal                | 0...6                                  | Terminating point for wiring shields                        | —                                                                      | —                                                                  | 1.6 N•m<br>(14 lb•in)  | 1.6 N•m<br>(14 lb•in)  |
|     |                              |                                        |                                                             |                                                                        |                                                                    |                        |                        |
| ❸   | AUX Terminal Block           | 0...4                                  | Auxiliary Control Voltage                                   | 1.5 mm <sup>2</sup><br>(16 AWG)                                        | 0.2 mm <sup>2</sup><br>(24 AWG)                                    | —                      | —                      |
|     |                              | 5...6                                  | PS+, PS- <sup>(4)</sup>                                     | 4.0 mm <sup>2</sup><br>(12 AWG)                                        | 0.5 mm <sup>2</sup><br>(22 AWG)                                    | 0.6 N•m<br>(5.3 lb•in) | 0.6 N•m<br>(5.3 lb•in) |
| ❹   | Fan Terminal Block (CB Only) | 5...6                                  | User Supplied Fan Voltage                                   | 4.0 mm <sup>2</sup><br>(12 AWG)                                        | 0.5 mm <sup>2</sup><br>(22 AWG)                                    | 0.6 N•m<br>(5.3 lb•in) | 0.6 N•m<br>(5.3 lb•in) |

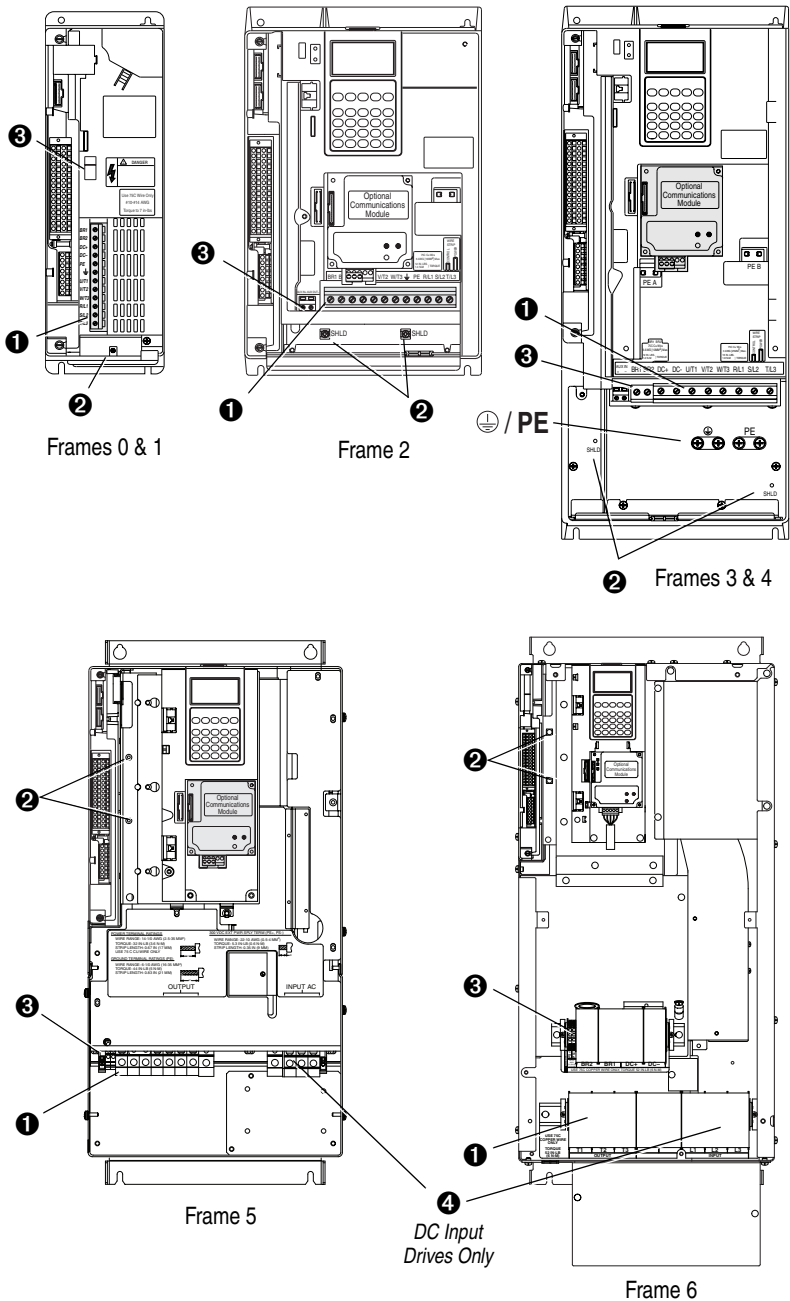
(1) **Maximum/minimum wire sizes that the terminal block will accept - these are not recommendations.**

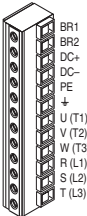
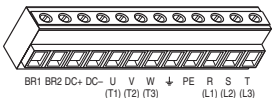
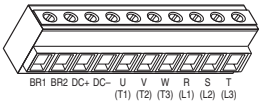
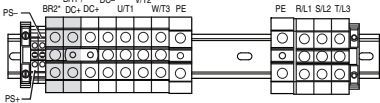
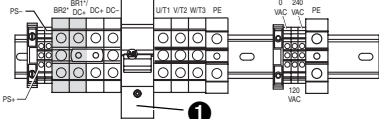
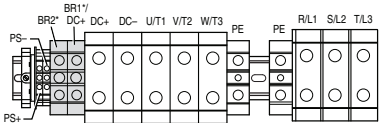
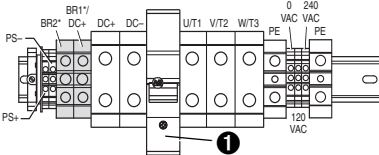
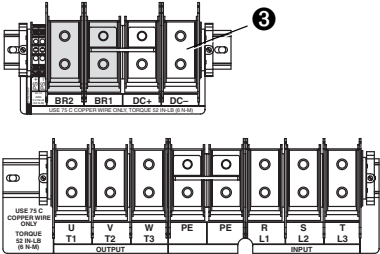
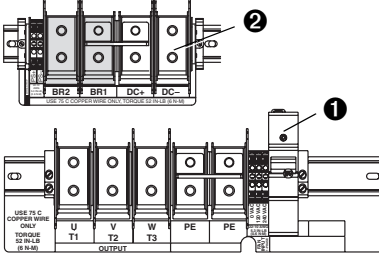
(2) Refer to the terminal block label inside the drive.

(3) Two wires connected in parallel to any of these terminals using two lugs may be required.

(4) External control power: UL Installation-300V DC,  $\pm 10\%$ , Non UL Installation-270...600V DC,  $\pm 10\%$   
0...3 Frame - 40 W, 165 mA, 5 Frame - 80 W, 90 mA. Refer to the User Manual for further information.

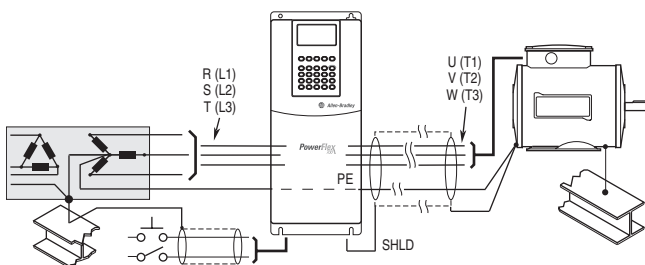
Typical Terminal Block Location



| Frame                              |                                                                                     | Power Terminal Blocks                                                                                                                                                                                                                                                                                                                                                                         |                            |                              |
|------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------|
| 0<br>&<br>1                        |    | <p><b>Notes:</b><br/>Shaded BR1 &amp; BR2 Terminals will only be present on drives ordered with the Brake Option.</p> <ul style="list-style-type: none"><li>❶ Precharge Resistor Fuse – DCT12-2 (DC input drives w/precharge only)</li><li>❷ M8 Stud (All Terminals)<br/>Max. Lug Width = 25.4 mm (1 in.)</li><li>❸ M8 Stud (All Terminals)<br/>Max. Lug Width = 31.8 mm (1.25 in.)</li></ul> |                            |                              |
|                                    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                               |                            |                              |
| 2                                  |    |                                                                                                                                                                                                                                                                                                                                                                                               |                            |                              |
| 3<br>&<br>4                        |    |                                                                                                                                                                                                                                                                                                                                                                                               |                            |                              |
| AC Input (Ratings are Normal Duty) |                                                                                     | DC Input (Ratings are Normal Duty)                                                                                                                                                                                                                                                                                                                                                            |                            |                              |
| 5                                  | 240V, 40 Hp<br>400V, 55 kW                                                          | 480V, 75 Hp<br>600V, 75 Hp                                                                                                                                                                                                                                                                                                                                                                    | 690V, 45...90 kW           | 240V, 40 Hp<br>400V, 55 kW   |
|                                    |    |                                                                                                                                                                                                                                                                                                              | 480V, 75 Hp<br>600V, 75 Hp | 690V, 45...90 kW             |
|                                    | 240V, 50 Hp<br>400V, 75 kW                                                          | 480V, 100 Hp<br>600V, 100 Hp                                                                                                                                                                                                                                                                                                                                                                  | 240V, 50 Hp<br>400V, 75 kW | 480V, 100 Hp<br>600V, 100 Hp |
|                                    |  |                                                                                                                                                                                                                                                                                                            |                            |                              |
| 6                                  | 125...200 Hp                                                                        | 125...200 Hp                                                                                                                                                                                                                                                                                                                                                                                  | 125...200 Hp               | 125...200 Hp                 |
|                                    |  |                                                                                                                                                                                                                                                                                                            |                            |                              |

| Terminal                                                                          | Description                  | Notes                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BR1<br>BR2                                                                        | DC Brake (+)<br>DC Brake (-) | DB Resistor Connection - <b>Important:</b> Only one DB resistor can be used with Frames 0...3. Connecting an internal & external resistor could cause damage.<br><br>Twisted pair wiring must be used from these terminals to the resistor. Wiring must be routed separately from other cabling. |
| DC+<br>DC-                                                                        | DC Bus (+)<br>DC Bus (-)     | DC Input/Brake Connections (chopper and resistor).                                                                                                                                                                                                                                               |
| PE                                                                                | PE Ground                    | Refer to <a href="#">page 29</a> for location on Frame 3 drives                                                                                                                                                                                                                                  |
| PS+<br>PS-                                                                        | AUX (+)<br>AUX (-)           | Auxiliary Control Voltage                                                                                                                                                                                                                                                                        |
|  | Motor Ground                 | Refer to <a href="#">page 29</a> for location on Frame 3 drives                                                                                                                                                                                                                                  |
| U<br>V<br>W                                                                       | U (T1)<br>V (T2)<br>W (T3)   | To Motor/Load                                                                                                                                                                                                                                                                                    |
| R<br>S<br>T                                                                       | R (L1)<br>S (L2)<br>T (L3)   | AC Line Input Power<br>Three-Phase = R, S & T<br>Single-Phase = R & S Only (refer to User Manual for details)                                                                                                                                                                                    |

## Power & Ground Wiring



**Important:** Do Not discard or replace grounding hardware.

## Drive, Fuse & Circuit Breaker Ratings

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

### Fusing

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

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

### Circuit Breakers

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

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

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

Table C 208 Volt AC Input Protection Devices (See [page 38](#) for Notes)

| Drive<br>Catalog<br>Number | Hp<br>Rating<br>NEMA<br>UL | PWM<br>Freq.<br>kHz | Temp.<br>(1)<br>°C | Input<br>Ratings | Output Amps |      |       | Dual<br>Element Time<br>Delay Fuse |        | Non-Time<br>Delay Fuse | Circuit<br>Breaker<br>(3) | Motor<br>Circuit<br>Protector<br>(4) | 140M Motor Protector with Adjustable Current<br>Range(5)(6) |         |         |           |           |           |           |           |
|----------------------------|----------------------------|---------------------|--------------------|------------------|-------------|------|-------|------------------------------------|--------|------------------------|---------------------------|--------------------------------------|-------------------------------------------------------------|---------|---------|-----------|-----------|-----------|-----------|-----------|
|                            |                            |                     |                    |                  | Amps        | kVA  | Cont. | 1 Min.                             | 3 Sec. |                        |                           |                                      |                                                             | Min.(1) | Max.(2) | Max.(6)   | Max.(8)   |           |           |           |
| 208 Volt AC Input          |                            |                     |                    |                  |             |      |       |                                    |        |                        |                           |                                      |                                                             |         |         |           |           |           |           |           |
| 208B2P2                    | 0 0.5                      | 0.33                | 4                  | 50               | 1.9         | 0.7  | 2.5   | 2.8                                | 3.8    | 3                      | 6                         | 3                                    | 10                                                          | 15      | 3       | M-C2E-B25 | M-D8E-B25 | -         | -         |           |
| 208B4P2                    | 0 1                        | 0.75                | 4                  | 50               | 3.7         | 1.3  | 4.8   | 5.6                                | 7      | 6                      | 10                        | 6                                    | 17.5                                                        | 15      | 7       | M-C2E-B63 | M-D8E-B63 | -         | -         |           |
| 208B6P8                    | 1 2                        | 1.5                 | 4                  | 50               | 6.8         | 2.4  | 7.8   | 10.4                               | 13.8   | 10                     | 15                        | 10                                   | 30                                                          | 30      | 15      | M-C2E-C10 | M-D8E-C10 | M-F8E-C10 | -         |           |
| 208B8P6                    | 1 3                        | 2                   | 4                  | 50               | 9.5         | 3.4  | 11    | 12.1                               | 17     | 12                     | 20                        | 12                                   | 40                                                          | 40      | 15      | M-C2E-C16 | M-D8E-C16 | M-F8E-C16 | -         |           |
| 208B015                    | 1 5                        | 3                   | 4                  | 50               | 15.7        | 5.7  | 17.5  | 19.3                               | 26.3   | 20                     | 35                        | 20                                   | 70                                                          | 70      | 30      | M-C2E-C20 | M-D8E-C20 | M-F8E-C20 | -         |           |
| 208B022                    | 1 7.5                      | 5                   | 4                  | 50               | 23          | 8.3  | 25.3  | 27.8                               | 38     | 30                     | 50                        | 30                                   | 100                                                         | 100     | 30      | M-C2E-C25 | M-D8E-C25 | M-F8E-C25 | -CMN-2500 |           |
| 208B028                    | 2 10                       | 7.5                 | 4                  | 50               | 29.6        | 10.7 | 32.2  | 38                                 | 50.6   | 40                     | 70                        | 40                                   | 125                                                         | 125     | 50      | -         | -         | M-F8E-C32 | -CMN-4000 |           |
| 208B042                    | 3 15                       | 10                  | 4                  | 50               | 44.5        | 16   | 48.3  | 53.1                               | 72.5   | 60                     | 100                       | 60                                   | 175                                                         | 175     | 70      | -         | -         | M-F8E-C45 | -CMN-6300 |           |
| 208B052                    | 3 20                       | 15                  | 4                  | 50               | 51.5        | 17.1 | 56    | 64                                 | 86     | 80                     | 125                       | 80                                   | 200                                                         | 200     | 100     | -         | -         | -         | -CMN-9000 |           |
| 208B070                    | 4 25                       | 20                  | 4                  | 50               | 72          | 25.9 | 78.2  | 93                                 | 124    | 90                     | 175                       | 90                                   | 300                                                         | 300     | 100     | -         | -         | -         | -CMN-9000 |           |
| 208B080                    | 4 30                       | 25                  | 4                  | 50               | 84.7        | 30.5 | 92    | 117                                | 156    | 110                    | 200                       | 110                                  | 350                                                         | 350     | 150     | -         | -         | -         | -CMN-9000 |           |
| 208B104<br>(12)            | 5 40                       | -                   | 4                  | 50               | 113         | 40.7 | 120   | 132                                | 175    | 150                    | 250                       | 150                                  | 475                                                         | 350     | 150     | -         | -         | -         | -CMN-9000 |           |
|                            | -                          | -                   | 30                 | 4                | 50          | 84.7 | 30.5  | 92                                 | 138    | 175                    | 125                       | 200                                  | 125                                                         | 350     | 300     | 150       | -         | -         | -         | -CMN-9000 |
| 208B130<br>(12)            | 5 50                       | -                   | 4                  | 50               | 141         | 44.1 | 130   | 143                                | 175    | 175                    | 275                       | 175                                  | 500                                                         | 375     | 250     | -         | -         | -         | -         | -         |
|                            | -                          | -                   | 40                 | 4                | 50          | 113  | 35.3  | 104                                | 156    | 175                    | 125                       | 225                                  | 125                                                         | 400     | 300     | 150       | -         | -         | -         | -         |
| 208B154<br>(12)            | 6 60                       | -                   | 4                  | 50               | 167         | 60.1 | 177   | 195                                | 266    | 225                    | 350                       | 225                                  | 500                                                         | 500     | 250     | -         | -         | -         | -         | -         |
|                            | -                          | -                   | 50                 | 4                | 50          | 141  | 50.9  | 150                                | 225    | 300                    | 200                       | 300                                  | 200                                                         | 500     | 450     | 250       | -         | -         | -         | -         |
| 208B192<br>(12)            | 6 75                       | -                   | 4                  | 50               | 208         | 75   | 221   | 243                                | 308    | 300                    | 450                       | 300                                  | 600                                                         | 600     | 400     | -         | -         | -         | -         | -         |
|                            | -                          | -                   | 60                 | 4                | 50          | 167  | 60.1  | 177                                | 266    | 308                    | 225                       | 350                                  | 225                                                         | 500     | 500     | 250       | -         | -         | -         | -         |
| 208B260<br>(12)            | 6 100                      | -                   | 2                  | 45               | 255         | 91.9 | 260   | 286                                | 390    | 300                    | 575                       | 300                                  | 750                                                         | 750     | 400     | -         | -         | -         | -         | -         |
|                            | -                          | -                   | 75                 | 2                | 50          | 199  | 71.7  | 205                                | 305    | 410                    | 225                       | 450                                  | 225                                                         | 600     | 600     | 400       | -         | -         | -         | -         |

Table D 240 Volt AC Input Protection Devices (See [page 38](#) for Notes)

| Drive Catalog Number     | Hp Rating<br>Frame<br>A B C D E | PWM Freq.<br>kHz | Temp.<br>Freq.<br>°C | Input Ratings<br>Amps kVA | Output Amps<br>Cont. 1 Min. 3 Sec. | Dual Element Time<br>Delay Fuse<br>Min. (1) Max. (2) | Non-Time<br>Delay Fuse<br>Min. (1) Max. (2) | Circuit Breaker<br>(3) Max. (8) | Motor<br>Circuit<br>Protector<br>(4) Max. (8) | 140M Motor Protector with Adjustable Current<br>Range (5)(6) Available Catalog Numbers - 140... (7) |
|--------------------------|---------------------------------|------------------|----------------------|---------------------------|------------------------------------|------------------------------------------------------|---------------------------------------------|---------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>240 Volt AC Input</b> |                                 |                  |                      |                           |                                    |                                                      |                                             |                                 |                                               |                                                                                                     |
| 20BB2P2                  | 0 0.5                           | 0.33 4           | 50                   | 1.7                       | 2.2 2.4                            | 3.3 3                                                | 3 3                                         | 15 15                           | 3                                             | M-C2E-B25 M-D8E-B25 - -                                                                             |
| 20BB4P2                  | 0 1                             | 0.75 4           | 50                   | 3.3                       | 4.2 4.8                            | 6.4 5                                                | 5 5                                         | 15 15                           | 7                                             | M-C2E-B63 M-D8E-B63 - -                                                                             |
| 20BB6P8                  | 1 2                             | 1.5 4            | 50                   | 5.9                       | 2.4 6.8                            | 9 12                                                 | 10 15                                       | 25 25                           | 15                                            | M-C2E-C10 M-D8E-C10 M-F8E-C10 - -                                                                   |
| 20BB8P6                  | 1 3                             | 2 4              | 50                   | 8.3                       | 3.4 9.6                            | 10.6 14.4                                            | 12 20                                       | 35 35                           | 15                                            | M-C2E-C10 M-D8E-C10 M-F8E-C10 - -                                                                   |
| 20BB015                  | 1 5                             | 3 4              | 50                   | 13.7                      | 5.7 15.3                           | 16.8 23                                              | 20 30                                       | 60 60                           | 30                                            | M-C2E-C16 M-D8E-C16 M-F8E-C16 - -                                                                   |
| 20BB022                  | 1 7.5                           | 5 4              | 50                   | 19.9                      | 8.3 22                             | 24.2 33                                              | 25 50                                       | 80 80                           | 30                                            | M-C2E-C25 M-D8E-C25 M-F8E-C25 -CMN-2500                                                             |
| 20BB028                  | 2 10                            | 7.5 4            | 50                   | 25.7                      | 10.7 28                            | 33 44                                                | 35 60                                       | 100 100                         | 50                                            | M-F8E-C32 -CMN-4000                                                                                 |
| 20BB042                  | 3 15                            | 10 4             | 50                   | 38.5                      | 16 42                              | 46.2 63                                              | 50 90                                       | 150 150                         | 50                                            | M-F8E-C45 -CMN-6300                                                                                 |
| 20BB052                  | 3 20                            | 15 4             | 50                   | 47.7                      | 19.8 52                            | 63 80                                                | 60 100                                      | 200 200                         | 100                                           | - -CMN-9000                                                                                         |
| 20BB070                  | 4 25                            | 20 4             | 50                   | 64.2                      | 26.7 70                            | 78 105                                               | 90 150                                      | 275 275                         | 100                                           | - -CMN-9000                                                                                         |
| 20BB080                  | 4 30                            | 25 4             | 50                   | 73.2                      | 30.5 80                            | 105 140                                              | 100 180                                     | 300 300                         | 100                                           | - -CMN-9000                                                                                         |
| 20BB104                  | 5 40                            | - 4              | 50                   | 98                        | 40.6 104                           | 115 175                                              | 125 225                                     | 400 300                         | 150                                           | - -CMN-9000                                                                                         |
| (12)                     | -                               | 30 4             | 50                   | 73                        | 30.5 80                            | 120 160                                              | 100 175                                     | 300 300                         | 100                                           | - -CMN-9000                                                                                         |
| 20BB130                  | 5 50                            | - 4              | 50                   | 122                       | 50.7 130                           | 143 175                                              | 175 275                                     | 500 375                         | 250                                           | - -CMN-9000                                                                                         |
| (12)                     | -                               | 40 4             | 50                   | 98                        | 40.6 104                           | 156 175                                              | 125 225                                     | 400 300                         | 150                                           | - -CMN-9000                                                                                         |
| 20BB154                  | 6 60                            | - 4              | 50                   | 145                       | 60.1 154                           | 169 231                                              | 200 300                                     | 600 450                         | 250                                           | - -CMN-9000                                                                                         |
| (12)                     | -                               | 50 4             | 50                   | 122                       | 50.7 130                           | 195 260                                              | 175 275                                     | 500 375                         | 250                                           | - -CMN-9000                                                                                         |
| 20BB192                  | 6 75                            | - 4              | 50                   | 180                       | 74.9 192                           | 211 288                                              | 225 400                                     | 600 575                         | 250                                           | - -CMN-9000                                                                                         |
| (12)                     | -                               | 60 4             | 50                   | 145                       | 60.1 154                           | 231 308                                              | 200 300                                     | 600 450                         | 250                                           | - -CMN-9000                                                                                         |
| 20BB260                  | 6 100                           | - 2              | 45                   | 233                       | 96.7 260                           | 286 390                                              | 300 575                                     | 750 750                         | 300                                           | - -CMN-9000                                                                                         |
| (12)                     | -                               | 75 2             | 50                   | 169                       | 70.1 205                           | 305 410                                              | 225 450                                     | 600 600                         | 250                                           | - -CMN-9000                                                                                         |

Table E 400 Volt AC Input Protection Devices (See [page 38](#) for Notes)

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

Table F 480 Volt AC Input Protection Devices (See page 38 for Notes)

| Drive<br>Catalog<br>Number | Hp<br>Rating | PWM<br>Freq.<br>kHz | Temp.<br>°C | Input<br>Ratings | Output Amps |      | Dual<br>Element Time<br>Delay Fuse | Non-Time<br>Delay Fuse | Circuit<br>Breaker<br>(3) | Motor<br>Protector<br>(4) | 140M Motor Protector with Adjustable Current<br>Range(5)(6) |        |        |         |           |           |           |
|----------------------------|--------------|---------------------|-------------|------------------|-------------|------|------------------------------------|------------------------|---------------------------|---------------------------|-------------------------------------------------------------|--------|--------|---------|-----------|-----------|-----------|
|                            |              |                     |             |                  | Amps        | kVA  |                                    |                        |                           |                           |                                                             | 1 Min. | 3 Sec. | Min.(1) | Max.(2)   | Max.(8)   | Max.(8)   |
| 480 Volt AC Input          |              |                     |             |                  |             |      |                                    |                        |                           |                           |                                                             |        |        |         |           |           |           |
| 20BD1P1                    | 0 0.5        | 0.33                | 4           | 50(11)           | 0.9         | 0.7  | 1.1                                | 1.2                    | 1.6                       | 3                         | 3                                                           | 6      | 15     | 3       | M-C2E-B16 | -         | -         |
| 20BD2P1                    | 0 1          | 0.75                | 4           | 50(11)           | 1.6         | 1.4  | 2.1                                | 2.4                    | 3.2                       | 3                         | 6                                                           | 3      | 8      | 15      | 3         | M-C2E-B25 | -         |
| 20BD3P4                    | 0 2          | 1.5                 | 4           | 50(11)           | 2.6         | 2.2  | 3.4                                | 4.5                    | 6                         | 4                         | 8                                                           | 4      | 12     | 15      | 7         | M-C2E-B40 | M-D8E-B40 |
| 20BD5P0                    | 0 3          | 2                   | 4           | 50(11)           | 3.9         | 3.2  | 5                                  | 5.5                    | 7.5                       | 6                         | 10                                                          | 6      | 20     | 20      | 7         | M-C2E-B63 | M-D8E-B63 |
| 20BD8P0                    | 0 5          | 3                   | 4           | 50(11)           | 6.9         | 5.7  | 8                                  | 8.8                    | 12                        | 10                        | 15                                                          | 10     | 30     | 30      | 15        | M-C2E-C10 | M-D8E-C10 |
| 20BD011                    | 1 7.5        | 5                   | 4           | 50(11)           | 9.5         | 7.9  | 11                                 | 12.1                   | 16.5                      | 15                        | 20                                                          | 15     | 40     | 40      | 15        | M-C2E-C16 | M-D8E-C16 |
| 20BD014                    | 1 10         | 7.5                 | 4           | 50(11)           | 12.5        | 10.4 | 14                                 | 16.5                   | 22                        | 17.5                      | 30                                                          | 17.5   | 50     | 50      | 20        | M-C2E-C16 | M-D8E-C16 |
| 20BD022                    | 1 15         | 10                  | 4           | 50(11)           | 19.9        | 16.6 | 22                                 | 24.2                   | 33                        | 25                        | 50                                                          | 25     | 80     | 80      | 30        | M-C2E-C25 | M-D8E-C25 |
| 20BD027                    | 2 20         | 15                  | 4           | 50(11)           | 24.8        | 20.6 | 27                                 | 33                     | 44                        | 35                        | 60                                                          | 35     | 100    | 100     | 50        | -         | M-F8E-C32 |
| 20BD034                    | 2 25         | 20                  | 4           | 50(11)           | 31.2        | 25.9 | 34                                 | 40.5                   | 54                        | 40                        | 70                                                          | 40     | 125    | 125     | 50        | -         | M-F8E-C45 |
| 20BD040                    | 3 30         | 25                  | 4           | 50(11)           | 36.7        | 30.5 | 40                                 | 51                     | 68                        | 50                        | 90                                                          | 50     | 150    | 150     | 50        | -         | M-F8E-C45 |
| 20BD052                    | 3 40         | 30                  | 4           | 50(11)           | 47.7        | 39.7 | 52                                 | 60                     | 80                        | 60                        | 110                                                         | 60     | 200    | 200     | 70        | -         | -         |
| 20BD065                    | 3 50         | 40                  | 4           | 50(11)           | 59.6        | 49.6 | 65                                 | 78                     | 104                       | 80                        | 125                                                         | 80     | 250    | 250     | 100       | -         | -         |
| 20BD077                    | 4 60         | -                   | 4           | 50(11)           | 72.3        | 60.1 | 77                                 | 85                     | 116                       | 100                       | 170                                                         | 100    | 300    | 300     | 100       | -         | -         |
| 20BD096                    | 5 75         | -                   | 4           | 50(11)           | 90.1        | 74.9 | 96                                 | 106                    | 144                       | 125                       | 200                                                         | 125    | 350    | 350     | 125       | -         | -         |
| 20BD125                    | 5 100        | -                   | 4           | 50(9)            | 117         | 97.6 | 125                                | 138                    | 163                       | 150                       | 250                                                         | 150    | 500    | 375     | 150       | -         | -         |
| 20BD156                    | 6 125        | -                   | 4           | 50(9)            | 147         | 122  | 156                                | 172                    | 234                       | 200                       | 350                                                         | 200    | 600    | 450     | 250       | -         | -         |
| 20BD180                    | 6 150        | -                   | 4           | 50(9)            | 169         | 141  | 180                                | 198                    | 270                       | 225                       | 400                                                         | 225    | 600    | 500     | 250       | -         | -         |
| 20BD248                    | 6 200        | -                   | 2           | 45(9)            | 233         | 194  | 248                                | 273                    | 372                       | 300                       | 550                                                         | 300    | 700    | 400     | 250       | -         | -         |
|                            | -            | 150                 | 2           | 50(9)            | 169         | 141  | 180                                | 270                    | 360                       | 225                       | 400                                                         | 225    | 600    | 500     | 250       | -         | -         |

Table G 600 Volt AC Input Protection Devices (See [page 38](#) for Notes) <sup>(13)</sup>

| Drive Catalog Number | Hp Rating | PWM Freq. kHz | Temp. (1) °C | Input Ratings |      | Output Amps |        | Dual Element Time Delay Fuse |          | Non-Time Delay Fuse | Circuit Breaker (3) | Motor Protector (4) | 140M Motor Protector with Adjustable Current Range (5)(6) |          |           |           |           |
|----------------------|-----------|---------------|--------------|---------------|------|-------------|--------|------------------------------|----------|---------------------|---------------------|---------------------|-----------------------------------------------------------|----------|-----------|-----------|-----------|
|                      |           |               |              | Amps          | kVA  | Cont.       | 1 Min. | 3 Sec.                       | Min. (1) |                     |                     |                     |                                                           | Max. (2) |           |           |           |
| 600 Volt AC Input    |           |               |              |               |      |             |        |                              |          |                     |                     |                     |                                                           |          |           |           |           |
| 20BE1P7              | 0 1       | 0.5           | 4            | 50            | 1.3  | 1.4         | 1.7    | 2                            | 2.6      | 4                   | 2                   | 6                   | 15                                                        | 3        | M-C2E-B16 | -         | -         |
| 20BE2P7              | 0 2       | 1             | 4            | 50            | 2.1  | 2.1         | 2.7    | 3.6                          | 4.8      | 3                   | 6                   | 3                   | 10                                                        | 15       | 3         | M-C2E-B25 | -         |
| 20BE3P9              | 0 3       | 2             | 4            | 50            | 3    | 3.1         | 3.9    | 4.3                          | 5.9      | 6                   | 9                   | 6                   | 15                                                        | 15       | 7         | M-C2E-B40 | M-D8E-B40 |
| 20BE6P1              | 0 5       | 3             | 4            | 50            | 5.3  | 5.5         | 6.1    | 6.7                          | 9.2      | 9                   | 12                  | 9                   | 20                                                        | 20       | 15        | M-C2E-B63 | M-D8E-B63 |
| 20BE9P0              | 0 7.5     | 5             | 4            | 50            | 7.8  | 8.1         | 9      | 9.9                          | 13.5     | 10                  | 20                  | 10                  | 35                                                        | 30       | 15        | M-C2E-C10 | M-D8E-C10 |
| 20BE011              | 1 10      | 7.5           | 4            | 50            | 9.9  | 10.2        | 11     | 13.5                         | 18       | 15                  | 25                  | 15                  | 40                                                        | 40       | 15        | M-C2E-C10 | M-D8E-C10 |
| 20BE017              | 1 15      | 10            | 4            | 50            | 15.4 | 16          | 17     | 18.7                         | 25.5     | 20                  | 40                  | 20                  | 60                                                        | 50       | 20        | M-C2E-C16 | M-D8E-C16 |
| 20BE022              | 2 20      | 15            | 4            | 50            | 20.2 | 21          | 22     | 25.5                         | 34       | 30                  | 50                  | 30                  | 80                                                        | 80       | 30        | M-C2E-C25 | M-D8E-C25 |
| 20BE027              | 2 25      | 20            | 4            | 50            | 24.8 | 25.7        | 27     | 33                           | 44       | 35                  | 60                  | 35                  | 100                                                       | 100      | 50        | -         | M-F8E-C25 |
| 20BE032              | 3 30      | 25            | 4            | 50            | 29.4 | 30.5        | 32     | 40.5                         | 54       | 40                  | 70                  | 40                  | 125                                                       | 125      | 50        | -         | M-F8E-C32 |
| 20BE041              | 3 40      | 30            | 4            | 50            | 37.6 | 39.1        | 41     | 48                           | 64       | 50                  | 90                  | 50                  | 150                                                       | 150      | 100       | -         | M-F8E-C45 |
| 20BE052              | 3 50      | 40            | 4            | 50            | 47.7 | 49.6        | 52     | 61.5                         | 82       | 60                  | 110                 | 60                  | 200                                                       | 200      | 100       | -         | -         |
| 20BE062              | 4 60      | 50            | 2            | 50            | 58.2 | 60.5        | 62     | 78                           | 104      | 80                  | 125                 | 80                  | 225                                                       | 225      | 100       | -         | -         |
| 20BE077 (12)         | 5 75      | -             | 2            | 50(9)         | 72.3 | 75.1        | 77     | 85                           | 116      | 90                  | 150                 | 90                  | 300                                                       | 300      | 100       | -         | -         |
| 20BE082 (12)         | -         | 60            | 2            | 50(9)         | 58.2 | 60.5        | 63     | 94                           | 126      | 90                  | 125                 | 90                  | 250                                                       | 250      | 100       | -         | -         |
| 20BE099 (12)         | 5 100     | -             | 2            | 40(9)         | 92.9 | 96.6        | 99     | 109                          | 126      | 125                 | 200                 | 125                 | 375                                                       | 375      | 150       | -         | -         |
| 20BE125 (12)         | 6 125     | -             | 2            | 50(9)         | 72.3 | 75.1        | 77     | 116                          | 138      | 100                 | 175                 | 100                 | 300                                                       | 300      | 100       | -         | -         |
| 20BE144 (12)         | 6 150     | -             | 2            | 50(9)         | 117  | 122         | 125    | 138                          | 188      | 150                 | 250                 | 150                 | 375                                                       | 375      | 250       | -         | -         |
| 20BE144 (12)         | -         | 100           | 2            | 50(9)         | 93   | 96.6        | 99     | 149                          | 198      | 125                 | 200                 | 125                 | 375                                                       | 375      | 150       | -         | -         |
| 20BE144 (12)         | 6 150     | -             | 2            | 50(9)         | 135  | 141         | 144    | 158                          | 216      | 175                 | 300                 | 175                 | 400                                                       | 400      | 250       | -         | -         |
| 20BE144 (12)         | -         | 125           | 2            | 50(9)         | 117  | 122         | 125    | 188                          | 250      | 150                 | 275                 | 150                 | 375                                                       | 375      | 250       | -         | -         |

Table H 690 Volt AC Input Protection Devices (13)

| Drive<br>Catalog<br>Number | Frame<br>kW<br>Rating | PWM<br>Freq.<br>kHz | Temp. <sup>(11)</sup><br>°C | Input<br>Ratings  |                   | Output Amps       |        |        | Dual<br>Element Time<br>Delay Fuse |                     | Non-Time<br>Delay Fuse |                     | Circuit<br>Breaker <sup>(3)</sup><br>Max. <sup>(8)</sup> | Motor<br>Circuit<br>Protector <sup>(4)</sup><br>Max. <sup>(8)</sup> |     |     |
|----------------------------|-----------------------|---------------------|-----------------------------|-------------------|-------------------|-------------------|--------|--------|------------------------------------|---------------------|------------------------|---------------------|----------------------------------------------------------|---------------------------------------------------------------------|-----|-----|
|                            |                       |                     |                             | Amps              | kVA               | Cont.             | 1 Min. | 3 Sec. | Min. <sup>(1)</sup>                | Max. <sup>(2)</sup> | Min. <sup>(1)</sup>    | Max. <sup>(2)</sup> |                                                          |                                                                     |     |     |
|                            |                       |                     |                             |                   |                   |                   |        |        |                                    |                     |                        |                     |                                                          |                                                                     |     |     |
| 690 Volt AC Input          |                       |                     |                             |                   |                   |                   |        |        |                                    |                     |                        |                     |                                                          |                                                                     |     |     |
| 20BF052<br>(12)            | 5 45                  | —                   | 4                           | 50 <sup>(9)</sup> | 46.9              | 56.1              | 52     | 57     | 78                                 | 60                  | 110                    | 60                  | 175                                                      | 175                                                                 | —   |     |
| 20BF060<br>(12)            | 5 55                  | —                   | 37.5                        | 4                 | 50 <sup>(9)</sup> | 40.1              | 48     | 46     | 69                                 | 92                  | 50                     | 90                  | 50                                                       | 150                                                                 | 150 |     |
|                            |                       | —                   | 4                           | 50 <sup>(9)</sup> | 4                 | 50 <sup>(9)</sup> | 57.7   | 68.9   | 60                                 | 66                  | 90                     | 80                  | 125                                                      | 80                                                                  | 225 | 225 |
| 20BF082<br>(12)            | 5 75                  | —                   | 45                          | 4                 | 50 <sup>(9)</sup> | 46.9              | 56.1   | 52     | 78                                 | 104                 | 60                     | 110                 | 60                                                       | 175                                                                 | 175 | —   |
|                            |                       | —                   | 2                           | 50 <sup>(9)</sup> | 79                | 94.4              | 82     | 90     | 123                                | 100                 | 200                    | 100                 | 375                                                      | 375                                                                 | —   |     |
| 20BF098<br>(12)            | 5 90                  | —                   | 55                          | 2                 | 50 <sup>(9)</sup> | 57.7              | 68.9   | 60     | 90                                 | 120                 | 80                     | 125                 | 80                                                       | 225                                                                 | 225 | —   |
|                            |                       | —                   | 2                           | 40 <sup>(9)</sup> | 94.7              | 113               | 98     | 108    | 127                                | 125                 | 200                    | 100                 | 375                                                      | 375                                                                 | —   |     |
| 20BF119<br>(12)            | 6 110                 | —                   | 75                          | 2                 | 40 <sup>(9)</sup> | 79                | 94.4   | 82     | 123                                | 140                 | 100                    | 200                 | 100                                                      | 375                                                                 | 375 | —   |
|                            |                       | —                   | 2                           | 50 <sup>(9)</sup> | 115               | 137               | 119    | 131    | 179                                | 150                 | 250                    | 150                 | 400                                                      | 400                                                                 | —   |     |
| 20BF142<br>(12)            | 6 132                 | —                   | 90                          | 2                 | 50 <sup>(9)</sup> | 94.7              | 113    | 98     | 147                                | 196                 | 125                    | 200                 | 125                                                      | 375                                                                 | —   | —   |
|                            |                       | —                   | 2                           | 50 <sup>(9)</sup> | 138               | 165               | 142    | 156    | 213                                | 175                 | 300                    | 175                 | 450                                                      | —                                                                   | —   |     |
| 20BF154<br>(12)            | 6 150                 | —                   | 110                         | 2                 | 50 <sup>(9)</sup> | 115               | 137    | 119    | 179                                | 238                 | 150                    | 250                 | 150                                                      | 400                                                                 | —   | —   |
|                            |                       | —                   | 2                           | 50 <sup>(9)</sup> | 138               | 165               | 142    | 156    | 213                                | 175                 | 300                    | 175                 | 450                                                      | —                                                                   | —   |     |

**Notes:**

- (1) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
- (2) Maximum protection device size is the highest rated device that supplies drive protection. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
- (3) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
- (4) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor FLA. Ratings shown are maximum.
- (5) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.
- (6) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600V/347. Not UL listed for use on 480V or 600V Delta/Delta systems.
- (7) The AIC ratings of the Bulletin 140M Motor Protector may vary.
- (8) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
- (9) UL Type 12/IP54 (flange mount) heat sink ambient temperature rating is 40° C/ambient of unprotected drive portion (inside enclosure) is 55° C. The ambient temperature for the UL Type 12/IP54 stand-alone drives is 40° C.
- (10) Must remove top label and vent plate, drive enclosure rating will be IP00, NEMA/UL Type Open.
- (11) Drive frames 0...4 temperature rating is for NEMA/UL Type Open. The adhesive top label must be removed to operate drive at this temperature. Frames 5 & 6 do not have a top label.
- (12) Drives have dual current ratings; one for normal duty applications, and one for heavy duty applications. The drive may be operated at either rating.
- (13) Note: 600V class drives below 77 Amps (Frames 0...4) are declared to meet the Low Voltage Directive. It is the responsibility of the user to determine compliance to the EMC directive.

Table I 325 Volt DC Input Protection Devices (See [page 41](#) for Notes)

| Drive Catalog<br>Number | Frame | Hp Rating |      | PWM<br>Freq. | Temp.<br>(1) | DC Input<br>Ratings | Output Amps |        |        | Fuse | Non-Time<br>Delay<br>Fuse(2) |
|-------------------------|-------|-----------|------|--------------|--------------|---------------------|-------------|--------|--------|------|------------------------------|
|                         |       | ND        | HD   | kHz          | °C           | Amps                | Cont.       | 1 Min. | 3 Sec. |      |                              |
| 325 Volt DC Input       |       |           |      |              |              |                     |             |        |        |      |                              |
| 20BB2P2                 | 0     | 0.5       | 0.33 | 4            | 50           | 2                   | 2.2         | 2.4    | 3.3    | 5    | JKS-5                        |
| 20BB4P2                 | 0     | 1         | 0.75 | 4            | 50           | 3.8                 | 4.2         | 4.8    | 6.4    | 10   | JKS-10                       |
| 20BB6P8                 | 1     | 2         | 1.5  | 4            | 50           | 6.9                 | 6.8         | 9      | 12     | 15   | HSJ15                        |
| 20BB9P6                 | 1     | 3         | 2    | 4            | 50           | 9.7                 | 9.6         | 10.6   | 14.4   | 20   | HSJ20                        |
| 20BB015                 | 1     | 5         | 3    | 4            | 50           | 16                  | 15.3        | 16.8   | 23     | 30   | HSJ30                        |
| 20BB022                 | 1     | 7.5       | 5    | 4            | 50           | 23.3                | 22          | 24.2   | 33     | 45   | HSJ45                        |
| 20BB028                 | 2     | 10        | 7.5  | 4            | 50           | 30                  | 28          | 33     | 44     | 60   | HSJ60                        |
| 20BB042                 | 3     | 15        | 10   | 4            | 50           | 45                  | 42          | 46.2   | 63     | 90   | HSJ90                        |
| 20BB052                 | 3     | 20        | 15   | 4            | 50           | 55                  | 52          | 63     | 80     | 100  | HSJ100                       |
| 20BB070                 | 4     | 25        | 20   | 4            | 50           | 75.3                | 70          | 78     | 105    | 150  | HSJ150                       |
| 20BB080                 | 4     | 30        | 25   | 4            | 50           | 86.8                | 80          | 105    | 140    | 175  | HSJ175                       |
| 20BN104(3)              | 5     | 40        | —    | 4            | 50           | 114.1               | 104         | 115    | 175    | 200  | HSJ200                       |
|                         |       | —         | 30   | 4            | 50           | 85.8                | 80          | 120    | 160    | 200  | HSJ200                       |
| 20BN130(3)              | 5     | 50        | —    | 4            | 50           | 142.6               | 130         | 143    | 175    | 200  | HSJ200                       |
|                         |       | —         | 40   | 4            | 50           | 114.1               | 104         | 156    | 175    | 200  | HSJ200                       |
| 20BN154(3)              | 6     | 60        | —    | 4            | 50           | 169                 | 154         | 169    | 231    | 300  | HSJ300                       |
|                         |       | —         | 50   | 4            | 50           | 142.6               | 130         | 195    | 260    | 300  | HSJ300                       |
| 20BN192(3)              | 6     | 75        | —    | 4            | 50           | 210.6               | 192         | 211    | 288    | 350  | HSJ350                       |
|                         |       | —         | 60   | 4            | 50           | 169                 | 154         | 231    | 308    | 350  | HSJ350                       |
| 20BN260(3)              | 6     | 100       | —    | 2            | 45           | 285.3               | 260         | 286    | 390    | 400  | HSJ400                       |
|                         |       | —         | 75   | 2            | 50           | 210.6               | 205         | 305    | 410    | 400  | HSJ400                       |

Table J 540 Volt DC Input Protection Devices (See [page 41](#) for Notes)

| Drive Catalog Number | Frame | kW Rating |      | PWM Freq. | Temp. (1) | DC Input Ratings | Output Amps |        |        | Fuse | Non-Time Delay Fuse (2) |
|----------------------|-------|-----------|------|-----------|-----------|------------------|-------------|--------|--------|------|-------------------------|
|                      |       | ND        | HD   | kHz       | °C        | Amps             | Cont.       | 1 Min. | 3 Sec. |      |                         |
| 540 Volt DC Input    |       |           |      |           |           |                  |             |        |        |      |                         |
| 20BC1P3              | 0     | 0.37      | 0.25 | 4         | 50        | 1.3              |             | 1.3    | 1.4    | 1.9  | 3                       |
| 20BC2P1              | 0     | 0.75      | 0.55 | 4         | 50        | 2.1              |             | 2.1    | 2.4    | 3.2  | 6                       |
| 20BC3P5              | 0     | 1.5       | 0.75 | 4         | 50        | 3.7              |             | 3.5    | 4.5    | 6    | 8                       |
| 20BC5P0              | 0     | 2.2       | 1.5  | 4         | 50        | 5.3              |             | 5      | 5.5    | 7.5  | 10                      |
| 20BC8P7              | 0     | 4         | 3    | 4         | 50        | 9.3              |             | 8.7    | 9.9    | 13.2 | 15                      |
| 20BC011              | 0     | 5.5       | 4    | 4         | 50        | 12.6             |             | 11.5   | 13     | 17.4 | 20                      |
| 20BC015              | 1     | 7.5       | 5.5  | 4         | 50        | 16.8             |             | 15.4   | 17.2   | 23.1 | 25                      |
| 20BC022              | 1     | 11        | 7.5  | 4         | 50        | 24               |             | 22     | 24.2   | 33   | 40                      |
| 20BC030              | 2     | 15        | 11   | 4         | 50        | 33.2             |             | 30     | 33     | 45   | 50                      |
| 20BC037              | 2     | 18.5      | 15   | 4         | 50        | 40.9             |             | 37     | 45     | 60   | 70                      |
| 20BC043              | 3     | 22        | 18.5 | 4         | 50        | 47.5             |             | 43     | 56     | 74   | 90                      |
| 20BC056              | 3     | 30        | 22   | 4         | 50        | 61.9             |             | 56     | 64     | 86   | 100                     |
| 20BC072              | 3     | 37        | 30   | 4         | 50 (7)    | 80.5             |             | 72     | 84     | 112  | 125                     |
| 20BC085 (3)(5)       | 4     | 45        | —    | 4         | 45        | 95.1             |             | 85     | 94     | 128  | 150                     |
|                      |       | —         | 37   | 4         | 45        | 80.5             |             | 72     | 108    | 144  | 175                     |
| 20BH105 (3)(5)       | 5     | 55        | —    | 4         | 50 (4)    | 120.2            |             | 105    | 116    | 158  | 175                     |
|                      |       | —         | 45   | 4         | 50 (4)    | 95.1             |             | 85     | 128    | 170  | 200                     |
| 20BH140 (3)(5)       | 5     | 75        | —    | 4         | 40 (4)    | 159              |             | 140    | 154    | 190  | 225                     |
|                      |       | —         | 55   | 4         | 40 (4)    | 120.2            |             | 105    | 158    | 190  | 225                     |
| 20BH170 (3)(5)       | 6     | 90        | —    | 4         | 50 (4)    | 192.3            |             | 170    | 187    | 255  | 300                     |
|                      |       | —         | 75   | 4         | 50 (4)    | 159              |             | 140    | 210    | 280  | 300                     |
| 20BH205 (3)(5)       | 6     | 110       | —    | 4         | 40 (4)    | 226              |             | 205    | 220    | 289  | 350                     |
|                      |       | —         | 90   | 4         | 40 (4)    | 192.3            |             | 170    | 255    | 313  | 350                     |
| 20BH260 (3)(5)       | 6     | 132       | —    | 2         | 45 (4)    | 298              |             | 260    | 286    | 390  | 500                     |
|                      |       | —         | 110  | 2         | 50 (4)    | 226              |             | 205    | 305    | 410  | 500                     |

Table K 650 Volt DC Input Protection Devices (See [page 41](#) for Notes)

| Drive Catalog Number | Frame | Hp Rating |      | PWM Freq. | Temp. (1) | DC Input Ratings | Output Amps |        |        | Fuse | Non-Time Delay Fuse (2) |
|----------------------|-------|-----------|------|-----------|-----------|------------------|-------------|--------|--------|------|-------------------------|
|                      |       | ND        | HD   | kHz       | °C        | Amps             | Cont.       | 1 Min. | 3 Sec. |      |                         |
| 650 Volt DC Input    |       |           |      |           |           |                  |             |        |        |      |                         |
| 20BD1P1              | 0     | 0.5       | 0.33 | 4         | 50        | 1                |             | 1.1    | 1.2    | 1.6  | 3                       |
| 20BD2P1              | 0     | 1         | 0.75 | 4         | 50        | 1.9              |             | 2.1    | 2.4    | 3.2  | 6                       |
| 20BD3P4              | 0     | 2         | 1.5  | 4         | 50        | 3                |             | 3.4    | 4.5    | 6    | 6                       |
| 20BD5P0              | 0     | 3         | 2    | 4         | 50        | 4.5              |             | 5      | 5.5    | 7.5  | 10                      |
| 20BD8P0              | 0     | 5         | 3    | 4         | 50        | 8.1              |             | 8      | 8.8    | 12   | 15                      |
| 20BD011              | 0     | 7.5       | 5    | 4         | 50        | 11.1             |             | 11     | 12.1   | 16.5 | 20                      |
| 20BD014              | 1     | 10        | 7.5  | 4         | 50        | 14.7             |             | 14     | 16.5   | 22   | 30                      |
| 20BD022              | 1     | 15        | 10   | 4         | 50        | 23.3             |             | 22     | 24.2   | 33   | 40                      |
| 20BD027              | 2     | 20        | 15   | 4         | 50        | 28.9             |             | 27     | 33     | 44   | 50                      |
| 20BD034              | 2     | 25        | 20   | 4         | 50        | 36.4             |             | 34     | 40.5   | 54   | 60                      |
| 20BD040              | 3     | 30        | 25   | 4         | 50        | 42.9             |             | 40     | 51     | 68   | 80                      |
| 20BD052              | 3     | 40        | 30   | 4         | 50        | 55.7             |             | 52     | 60     | 80   | 90                      |
| 20BD065              | 3     | 50        | 40   | 4         | 50        | 69.7             |             | 65     | 78     | 104  | 100                     |
| 20BD077(3)           | 4     | 60        | —    | 4         | 50        | 84.5             |             | 77     | 85     | 116  | 150                     |
|                      |       | —         | 50   | 4         | 50        | 69.7             |             | 65     | 98     | 130  | 150                     |
| 20BR096(3)(6)        | 5     | 75        | —    | 4         | 50(4)     | 105.3            |             | 96     | 106    | 144  | 175                     |
|                      |       | —         | 60   | 4         | 50(4)     | 84.5             |             | 77     | 116    | 154  | 175                     |
| 20BR125(3)(6)        | 5     | 100       | —    | 4         | 50(4)     | 137.1            |             | 125    | 138    | 163  | 200                     |
|                      |       | —         | 75   | 4         | 50(4)     | 105.3            |             | 96     | 144    | 168  | 200                     |
| 20BR156(3)(6)        | 6     | 125       | —    | 4         | 50(4)     | 171.2            |             | 156    | 172    | 234  | 300                     |
|                      |       | —         | 100  | 4         | 50(4)     | 137.1            |             | 125    | 188    | 250  | 300                     |
| 20BR180(3)(6)        | 6     | 150       | —    | 4         | 50(4)     | 204              |             | 180    | 198    | 270  | 350                     |
|                      |       | —         | 125  | 4         | 50(4)     | 171.2            |             | 156    | 234    | 312  | 350                     |
| 20BR248(3)(6)        | 6     | 200       | —    | 2         | 45(4)     | 272              |             | 248    | 273    | 372  | 400                     |
|                      |       | —         | 150  | 2         | 50(4)     | 204              |             | 180    | 270    | 360  | 400                     |

Table L 810 Volt DC Input Protection Devices (See [page 41](#) for Notes)

| Drive Catalog Number | Frame | Hp Rating |      | PWM Freq. | Temp. (1) | DC Input Ratings | Output Amps |        |        | Fuse | Non-Time Delay Fuse (2) |
|----------------------|-------|-----------|------|-----------|-----------|------------------|-------------|--------|--------|------|-------------------------|
|                      |       | ND        | HD   | kHz       | °C        | Amps             | Cont.       | 1 Min. | 3 Sec. |      |                         |
| 810 Volt DC Input    |       |           |      |           |           |                  |             |        |        |      |                         |
| 20BE1P7              | 0     | 1         | 0.75 | 4         | 50        | 1.5              | 1.7         | 2      | 2.6    | 3    | JKS-3                   |
| 20BE2P7              | 0     | 2         | 1.5  | 4         | 50        | 2.4              | 2.7         | 3.6    | 4.8    | 6    | JKS-6                   |
| 20BE3P9              | 0     | 3         | 2    | 4         | 50        | 3.5              | 3.9         | 4.3    | 5.9    | 6    | JKS-6                   |
| 20BE6P1              | 0     | 5         | 3    | 4         | 50        | 6.2              | 6.1         | 6.7    | 9.2    | 10   | JKS-10                  |
| 20BE9P0              | 0     | 7.5       | 5    | 4         | 50        | 9.1              | 9           | 9.9    | 13.5   | 15   | HSJ15                   |
| 20BE011              | 0     | 10        | 7.5  | 4         | 50        | 11.5             | 11          | 13.5   | 18     | 20   | HSJ20                   |
| 20BE017              | 1     | 15        | 10   | 4         | 50        | 18               | 17          | 18.7   | 25.5   | 30   | HSJ30                   |
| 20BE022              | 2     | 20        | 15   | 4         | 50        | 23.6             | 22          | 25.5   | 34     | 40   | HSJ40                   |
| 20BE027              | 2     | 25        | 20   | 4         | 50        | 29               | 27          | 33     | 44     | 50   | HSJ50                   |
| 20BE032              | 3     | 30        | 25   | 4         | 50        | 34.3             | 32          | 40.5   | 54     | 60   | HSJ60                   |
| 20BE041              | 3     | 40        | 30   | 4         | 50        | 43.9             | 41          | 48     | 64     | 70   | HSJ70                   |
| 20BE052              | 3     | 50        | 40   | 4         | 50        | 55.7             | 52          | 61.5   | 82     | 90   | HSJ90                   |
| 20BE062              | 4     | 60        | 50   | 2         | 50        | 68               | 62          | 78     | 104    | 125  | HSJ125                  |
| 20BT099(3)           | 5     | 100       | —    | 2         | 40        | 108.6            | 99          | 109    | 126    | 150  | HSJ150                  |
|                      |       | —         | 75   | 2         | 40        | 84.5             | 77          | 116    | 138    | 150  | HSJ150                  |
| 20BT144(3)           | 6     | 150       | —    | 2         | 50        | 158              | 144         | 158    | 216    | 250  | HSJ250                  |
|                      |       | —         | 125  | 2         | 50        | 137.1            | 125         | 188    | 250    | 250  | HSJ250                  |

**Table M 932 Volt DC Input Protection Devices**

| Drive Catalog Number | Frame | kW Rating |      | PWM Freq. | Temp. (1) | DC Input Ratings | Output Amps |        |        | Fuse | Non-Time Delay Fuse (2) |
|----------------------|-------|-----------|------|-----------|-----------|------------------|-------------|--------|--------|------|-------------------------|
|                      |       | ND        | HD   | kHz       | °C        | Amps             | Cont.       | 1 Min. | 3 Sec. |      |                         |
| 932 Volt DC Input    |       |           |      |           |           |                  |             |        |        |      |                         |
| 20BW052(3)           | 5     | 45        | –    | 2         | 50(4)     | 58.2             | 52          | 57     | 78     | 100  | 170M3691                |
|                      |       | –         | 37.5 | 2         | 50(4)     | 46.9             | 46          | 69     | 92     | 100  | 170M3691                |
| 20BW098(3)           | 5     | 90        | –    | 2         | 50(4)     | 110.7            | 98          | 108    | 127    | 160  | 170M3693                |
|                      |       | –         | 75   | 2         | 50(4)     | 92.3             | 82          | 123    | 140    | 160  | 170M3693                |
| 20BW142(3)           | 6     | 132       | –    | 2         | 50(4)     | 162.2            | 142         | 156    | 213    | 250  | 170M3695                |
|                      |       | –         | 110  | 2         | 40(4)     | 134.9            | 119         | 179    | 238    | 315  | 170M3696                |

**Notes**

- (1) Drive frames 0...4 temperature rating is for NEMA/UL Type Open. The adhesive top label must be removed to operate drive at this temperature. Frames 5 & 6 do not have a top label.
- (2) The power source to common bus inverters must be derived from AC voltages 600V or less, as defined in NFPA70; Art 430-18 (NEC). Battery supplies or MG sets are not included. The following devices were validated to break current of the derived power DC Bus.  
Disconnects: Allen-Bradley Bulletin No. 1494, 30...400A; 194, 30...400A; or ABB OESA, 600 & 800A; OESL, all sizes.  
Fuses: Bussmann Type JKS, all sizes; Type 170M, Case Sizes 1, 2 and 3, or Ferraz Shawmut Type HSJ, all sizes. For any other devices, please contact the factory.
- (3) Drives have dual current ratings; one for normal duty applications, and one for heavy duty applications. The drive may be operated at either rating.
- (4) UL Type 12/IP54 (flange mount) heat sink ambient temperature rating is 40° C/ambient of unprotected drive portion (inside enclosure) is 55° C. The ambient temperature for the UL Type 12/IP54 stand-alone drives is 40°.
- (5) Also applies to "H" voltage class. Frame 5 & 6 NEMA/UL Type 12 enclosures (codes F & G) are not available in "H" and "J" voltage class.
- (6) Also applies to "J" voltage class. Frame 5 & 6 NEMA/UL Type 12 enclosures (codes F & G) are not available in "H" & "J" voltage class.
- (7) Must remove top label and vent plate, drive enclosure rating will be IP00, NEMA/UL Type Open.
- (8) Two 630A Bussmann 170M6608 can also be used.
- (9) Two 700A Bussmann 170M6611 can also be used.

## Using Input/Output Contactors

### Input Contactor Precautions

---



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



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

---

### Output Contactor Precaution

---



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

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### Bypass Contactor Precaution

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

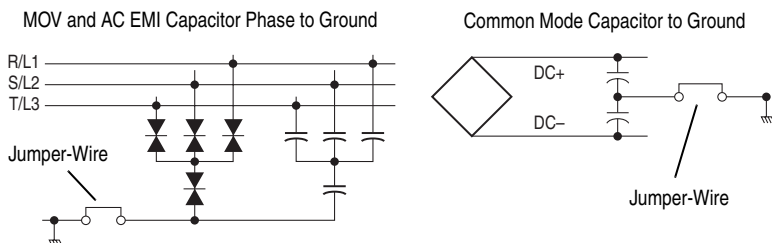
- Wiring AC line to drive output or control terminals.
- Improper bypass or output circuits not approved by Allen-Bradley.
- Output circuits which do not connect directly to the motor.

Contact Allen-Bradley for assistance with application or wiring.

---

## Disconnecting MOVs and Common Mode Capacitors

The Powerflex 700 drive contains protective MOVs and Common Mode Capacitors referenced to ground (see below). To guard against unstable operation and/or damage, the drive must be properly configured as shown in [Table N on page 44](#).



**Important:** All PowerFlex 700 drives are shipped with the DC bus common mode capacitors referenced to ground.

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



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



**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the following points (refer to pages [28](#) through [30](#) for locations):

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

The voltage must be zero for all three measurements.



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

Table N Recommended Power Jumper Configurations

| Power Source Type <sup>(1)</sup>                                                                                                                                                                                                                                                                 | MOV/Input Filter Caps <sup>(2)</sup> | DC Bus Common Mode Caps | Benefits Of Correct Configuration on Power Source Type                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Solid Ground</b> <ul style="list-style-type: none"><li>• AC fed, solidly grounded</li><li>• DC fed from passive rectifier which has an AC source and solid ground</li></ul>                                                                                                                   | Connected                            | Connected               | <ul style="list-style-type: none"><li>• UL compliance,</li><li>• Reduced electrical noise,</li><li>• Most stable operation,</li><li>• EMC compliance,</li><li>• Reduced voltage stress on components and motor bearings.</li></ul> |
| <b>Non-Solid Ground</b> <ul style="list-style-type: none"><li>• AC fed ungrounded</li><li>• Impedance grounded</li><li>• High resistive ground</li><li>• B phase ground</li><li>• Regenerative unit such as common DC bus supply &amp; brake</li><li>• DC fed from an active converter</li></ul> | Disconnected                         | Disconnected            | <ul style="list-style-type: none"><li>• Helps avoid severe equipment damage when ground fault occurs.</li></ul>                                                                                                                    |

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

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

To connect or disconnect these devices, refer to pages [46](#) through [54](#).

**Important:** Common mode capacitors are used to conform with the EMC directives. Removing these devices may withdraw the associated directive.

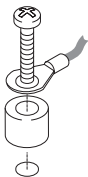
In addition, on an ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage, an isolation transformer should be installed. See *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001 for more information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

Jumper Installation, Removal and Storage

PowerFlex 700 drives utilize plug-in style jumpers/jumper wires. Most drives will have a jumper storage area inside the front cover. Extra jumpers or jumpers that have been removed should be stored in this location for use at a later time.

Insulating Jumper Wires

Some drives are designed to utilize nylon screws and spacers to insulate jumper wires from ground and secure them to the chassis. The components must be installed as shown.



Drive Identification

Refer to the drive nameplate and locate the “Voltage Code,” “Current Rating,” “Frame,” and “UL Type” (Frames 5...6). Use this information to locate the proper procedure in the following tables.

Voltage Code

UL Type

Current Rating

Cal No. 20B

D xxx x x xxxxxxx

400V

480V

UL TYPE 1/HP20

Series: B

Normal Duty Power

xxx kW

Heavy Duty Power

xxx kW

I/O: 24VAC/DC (Standard)

Original Firmware V.x.xxx

UL

US

Listed

Ind. Cont

Eq. 966X

Input: 3 Phase, 47-63Hz

AC Voltage Range

342-440

xxx

432-528

xxx

Output: 3 Phase, 0-400 Hz

AC Voltage Range

0-400

50 Hz

0-460

60 Hz

Continuous Amps

xxx

xxx

1 Min Overload Amps

xxx

xxx

3 Sec Overload Amps

xxx

xxx

Mid. In 2027 on Aug 1

AB

Allen-Bradley

Made in the USA (TMC 14)

Rockwell Automation, Milwaukee WI 53092-4400

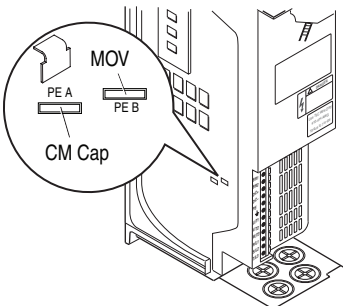
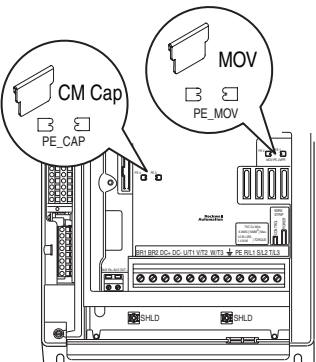
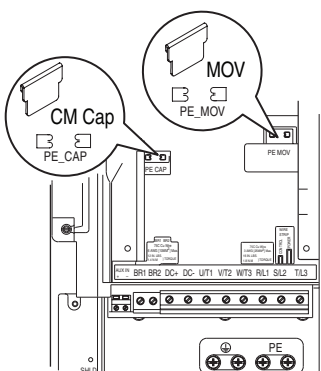
Frame: 3

Serial Number: xxxxxxx

Frame

Publication 20B-IN019C-EN-P

## Jumper Settings and Locations

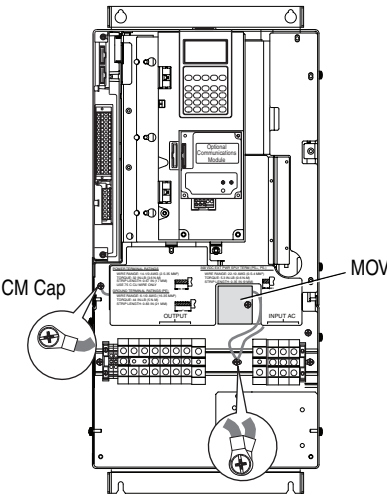
| Frame | Voltage Code | Current Rating | Factory Default Jumper Settings                                                     |                         | Power Source Type                                                                                                                                                                                                              |
|-------|--------------|----------------|-------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |              |                | MOV/Input Filter Caps                                                               | DC Bus Common Mode Caps |                                                                                                                                                                                                                                |
| 0...1 | B...E        | All            | PE_B Installed                                                                      | PE_A Installed          | <b>Solid Ground</b> <ul style="list-style-type: none"> <li>Remove the I/O Cassette (refer to the User Manual for details). Verify that jumpers are installed at the "PE_A" and "PE_B" locations on the Power Board.</li> </ul> |
|       |              |                |    |                         | <b>Non-Solid Ground</b> <ul style="list-style-type: none"> <li>Remove the I/O Cassette (refer to the User Manual for details). Remove jumpers at the "PE_A" and "PE_B" locations on the Power Board.</li> </ul>                |
| 2     | B...E        | All            | PE_MOV Installed                                                                    | PE_CAP Installed        | <b>Solid Ground</b> <ul style="list-style-type: none"> <li>Verify that jumpers are installed at the "PE_CAP" and "PE_MOV" locations.</li> </ul>                                                                                |
|       |              |                |   |                         | <b>Non-Solid Ground</b> <ul style="list-style-type: none"> <li>Remove jumpers at the "PE_CAP" and "PE_MOV" locations.</li> </ul>                                                                                               |
| 3...4 | B...E        | All            | PE_MOV Installed                                                                    | PE-CAP Installed        | <b>Solid Ground</b> <ul style="list-style-type: none"> <li>Verify that jumpers are installed at the "PE_CAP" and "PE_MOV" locations.</li> </ul>                                                                                |
|       |              |                |  |                         | <b>Non-Solid Ground</b> <ul style="list-style-type: none"> <li>Remove jumpers at the "PE_CAP" and "PE_MOV" locations.</li> </ul>                                                                                               |

| Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Voltage Code                         | Current Rating  | Factory Default Jumper Settings                                          |                                                 | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------|--------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                      |                 | MOV/ Input Filter Caps <sup>(1)(2)</sup>                                 | DC Bus Common Mode Caps                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | B<br>C<br>D<br>H<br>J<br>N<br>P<br>R | All except C140 | Two green/yellow wires <u>connected</u> to the Power Terminal Block rail | Green/yellow wire is <u>connected</u> to ground | <b>Solid Ground</b> <ol style="list-style-type: none"> <li>CM Cap jumper wire should be connected to ground with a metal screw. Verify. <ul style="list-style-type: none"> <li>Newer Drives - If necessary, remove the nylon screw/spacer and insert a metal M5 x 8 screw. Torque to 3.2 N•m (28 lb•in).</li> <li>Older Drives - Remove the I/O Cassette (see User Manual for details). The green/yellow CM Cap jumper wire is located on the back of chassis and should be connected to ground with a metal screw. If necessary, remove the insulation from the wire terminal and connect to chassis with a metal M5 x 12 screw. Torque screw to 3.2 N•m (28 lb•in).</li> </ul> </li> <li>MOV/ Input Filter Cap jumper wires should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 12 screw.</li> </ol> |
| <div style="text-align: center;"> <p>CM Cap - Newer Drives</p> <p>CM Cap - Older Drives</p> <p>MOV</p> <p>MOV / Input Filter Cap</p> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                 |                                                                          |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Non-Solid Ground</b> <ol style="list-style-type: none"> <li>CM Cap jumper wire should be insulated from ground. Verify. <ul style="list-style-type: none"> <li>Newer Drives - If necessary, remove the metal screw and insert a M5 x 15 nylon screw/spacer.</li> <li>Older Drives - Remove the I/O Cassette (see User Manual for details). If necessary, insulate/ secure jumper wire to guard against unintentional contact with chassis or components.</li> </ul> </li> <li>MOV/ Input Filter Cap jumper wires should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 20 nylon screw/ spacer.</li> </ol> |                                      |                 |                                                                          |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Frame 5 continued on next page

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

(2) When removing MOV's, the input filter capacitor must also be removed.

| Frame                                                                                                                                    | Voltage Code | Current Rating    | Factory Default Jumper Settings                                          |                                                                 | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                          |              |                   | MOV/ Input Filter Caps <sup>(1)(2)</sup>                                 | DC Bus Common Mode Caps                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 5                                                                                                                                        | C<br>F<br>W  | 140<br>052<br>060 | Two green/yellow wires <u>connected</u> to the Power Terminal Block rail | Green/yellow wire to CM Cap Board is <u>connected</u> to ground | <b>Solid Ground</b><br><br>1. CM Cap jumper wire should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 8 screw. Torque to 3.2 N•m (28 lb•in).<br><br>2. MOV/ Input Filter Cap jumper wires should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 12 screw.<br><br><b>Non-Solid Ground</b><br><br>1. CM Cap jumper wire should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 15 nylon screw/spacer.<br><br>2. MOV/ Input Filter Cap jumper wires should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 20 nylon screw/spacer. |
|  <p>CM Cap</p> <p>MOV</p> <p>MOV / Input Filter Cap</p> |              |                   |                                                                          |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

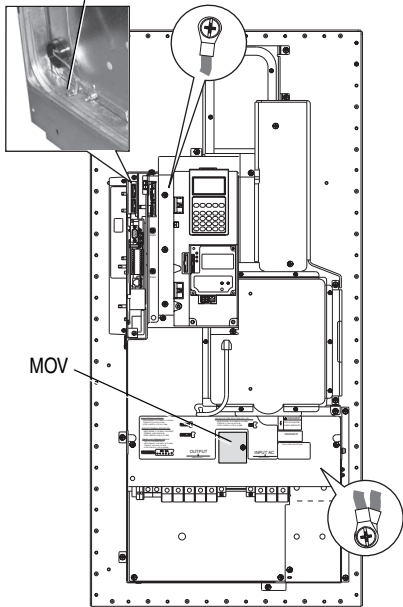
Frame 5 continued on next page

(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.  
(2) When removing MOV's, the input filter capacitor must also be removed.

| Frame | Voltage Code     | Current Rating           | Factory Default Jumper Settings                           |                                                                 | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------|------------------|--------------------------|-----------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                  |                          | MOV/Input Filter Caps <sup>(1)(2)</sup>                   | DC Bus Common Mode Caps                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5     | E<br>F<br>T<br>W | 077<br>082<br>099<br>098 | Two green/yellow wires <u>connected</u> to chassis ground | Green/yellow wire to CM Cap Board is <u>connected</u> to ground | <b>Solid Ground</b><br><br>1. CM Cap jumper wire should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 8 screw. Torque to 3.2 N•m (28 lb•in).<br><br>2. MOV jumper wire should be connected to ground with metal screws. Verify. If necessary, remove the nylon screw/spacers and insert a metal M5 x 12 screws.<br><br>3. Input Filter Cap jumper wire should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert metal M5 x 8 screw.<br><br><b>Non-Solid Ground</b><br><br>1. CM Cap jumper wire should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 15 nylon screw/spacer.<br><br>2. MOV jumper wire should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screws and insert a M5 x 20 nylon screw/spacer.<br><br>3. Input Filter Cap jumper wire should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screws and insert a M5 x 15 nylon screw/spacer. |
|       |                  |                          |                                                           |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

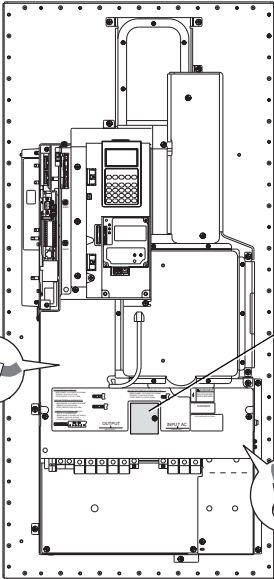
Frame 5 continued on next page

(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.  
(2) When removing MOV's, the input filter capacitor must also be removed.

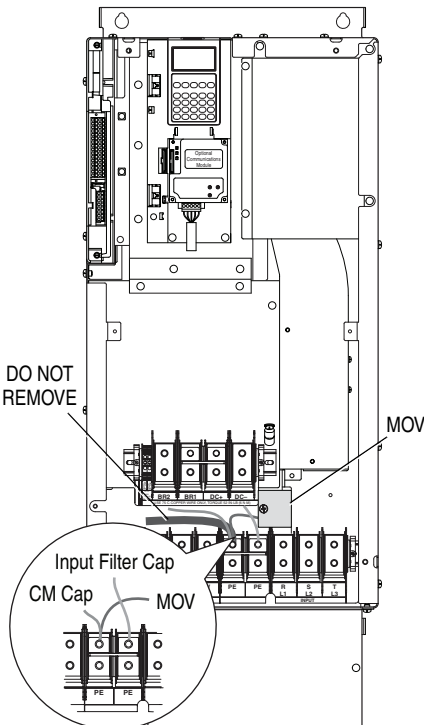
| Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Voltage Code           | Current Rating                                            | Factory Default Jumper Settings                 |                         | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------|-------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                                                           | MOV/Input Filter Caps <sup>(1)(2)</sup>         | DC Bus Common Mode Caps |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NEMA/UL Type 12 Drives |                                                           |                                                 |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| C<br>D<br>P<br>R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | All                    | Two green/yellow wires <u>connected</u> to chassis ground | Green/yellow wire is <u>connected</u> to ground |                         | <b>Solid Ground</b><br><br>1. CM Cap jumper wire should be connected to ground with a metal screw. Verify. <ul style="list-style-type: none"><li>• Newer Drives - If necessary, remove the nylon screw/spacer and insert a metal M5 x 8 screw. Torque to 3.2 N•m (28 lb•in).</li><li>• Older Drives - Remove the I/O Cassette (see User Manual for details). The green/yellow CM Cap jumper wire is located on the back of chassis and should be connected to ground with a metal screw. If necessary, remove the insulation from the wire terminal and connect to chassis with a metal M5 x 10 screw. Torque screw to 3.2 N•m (28 lb•in).</li></ul><br>2. MOV/Input Filter Cap jumper wires should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 12 screw. |
| <div><div>CM Cap - Older Drives</div><div>CM Cap - Newer Drives</div><div>MOV</div><div>MOV / Input Filter Cap</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |                                                           |                                                 |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Non-Solid Ground</b><br><br>1. CM Cap jumper wire should be insulated from ground. Verify. <ul style="list-style-type: none"><li>• Newer Drives - If necessary, remove the metal screw and insert a M5 x 15 nylon screw/spacer.</li><li>• Older Drives - Remove the I/O Cassette (see User Manual for details). If necessary, insulate/ secure jumper wire to guard against unintentional contact with chassis or components.</li></ul><br>2. MOV/Input Filter Cap jumper wires should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 20 nylon screw/spacer. |                        |                                                           |                                                 |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

Frame 5 continued on next page

(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.  
(2) When removing MOV's, the input filter capacitor must also be removed.

| Frame                                                                                                                                            | Voltage Code           | Current Rating | Factory Default Jumper Settings                           |                                                                 | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------|-----------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                  |                        |                | MOV /Input Filter Caps <sup>(1)(2)</sup>                  | DC Bus Common Mode Caps                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5                                                                                                                                                | NEMA/UL Type 12 Drives |                |                                                           |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                  | E<br>F<br>T<br>W       | All            | Two green/yellow wires <u>connected</u> to chassis ground | Green/yellow wire to CM Cap Board is <u>connected</u> to ground | <b>Solid Ground</b><br><br>1. CM Cap jumper wire should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 12 screw. Torque to 3.2 N•m (28 lb•in).<br><br>2. MOV/Input Filter Cap jumper wires should be connected to ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 12 screw.<br><br><b>Non-Solid Ground</b><br><br>1. CM Cap jumper wire should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 20 nylon screw/spacer.<br><br>2. MOV/Input Filter Cap jumper wires should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 20 nylon screw/spacer. |
| <div><p>CM Cap</p><p>MOV</p><p>MOV / Input Filter Cap</p></div> |                        |                |                                                           |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.  
(2) When removing MOV's, the input filter capacitor must also be removed.

| Frame                                                                              | Voltage Code                         | Current Rating | Factory Default Jumper Settings                                      |                                                                                    | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------|--------------------------------------|----------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                    |                                      |                | MOV/Input Filter Caps <sup>(1)(2)</sup>                              | DC Bus Common Mode Caps                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6                                                                                  | B<br>C<br>D<br>H<br>J<br>N<br>P<br>R | All            | Two green/yellow wires <u>connected</u> to Power Terminal Block "PE" | Green/yellow wire to CM Cap Board is <u>connected</u> to Power Terminal Block "PE" | <b>Solid Ground</b><br><br>1. The green/yellow CM Cap jumper wire should be connected to "PE."<br><br>2. The MOV/Input Filter Cap jumper wires should be connected to "PE."                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                    |                                      |                |                                                                      |                                                                                    | <b>Non-Solid Ground</b><br><br>1. The green/yellow CM Cap jumper wire should be insulated from ground. If necessary, remove the jumper wire from "PE" and insulate/ secure it to guard against unintentional contact with chassis or components. <b>Important: Do Not Remove/Disconnect the larger green/yellow wire.</b><br><br>2. The MOV/Input Filter Cap jumper wires should be insulated from ground. If necessary, remove the jumper wires from "PE" and individually insulate/ secure each jumper wire to guard against unintentional contact with chassis or components. |
|  |                                      |                |                                                                      |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Frame 6 continued on next page

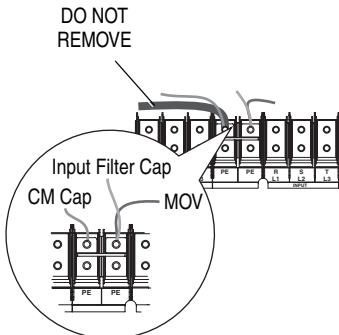
(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.  
(2) When removing MOV's, the input filter capacitor must also be removed.

| Frame | Voltage Code     | Current Rating | Factory Default Jumper Settings                                           |                                                                             | Power Source Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------|------------------|----------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                  |                | MOV/Input Filter Caps <sup>(1)(2)</sup>                                   | DC Bus Common Mode Caps                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 6     | E<br>F<br>T<br>W | All            | Two green/yellow wires connected to Power Terminal Block "PE" and chassis | Green/yellow wire to CM Cap Board is connected to Power Terminal Block "PE" | <b>Solid Ground</b><br><br>1. The green/yellow CM Cap and MOV jumper wires should be connected to "PE."<br><br>2. The Input Filter Cap jumper wire (top right) should be connected to chassis ground with a metal screw. Verify. If necessary, remove the nylon screw/spacer and insert a metal M5 x 10 screw. Torque to 3.2 N•m (28 lb•in).<br><br><b>Non-Solid Ground</b><br><br>1. The green/yellow CM Cap and MOV jumper wires should be insulated from ground. If necessary, remove them from "PE" and individually insulate/secure each jumper wire to guard against unintentional contact with chassis or components. <b>Important: Do Not Remove/ Disconnect the larger green/yellow wire.</b><br><br>2. The Input Filter Cap jumper wire (top right) should be insulated from ground with a nylon screw/spacer. Verify. If necessary, remove the metal screw and insert a M5 x 15 nylon screw/spacer. |

The diagram shows the internal layout of the drive's power section. At the top, there's a terminal block with various connections. Below it, a large capacitor (CM Cap) and a metal-oxide varistor (MOV) are mounted. To the right, an input filter capacitor is shown. A callout points to the 'DO NOT REMOVE' label near the terminal block. Another callout points to the 'Input Filter Cap' with a line indicating its connection point. A third callout points to the 'CM Cap' and 'MOV' components, showing their connection to the PE terminal.

Frame 6 continued on next page

- (1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.
- (2) When removing MOV's, the input filter capacitor must also be removed.

| Frame                                                                                                            | Voltage Code | Current Rating                                                       | Factory Default Jumper Settings                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Power Source Type |  |
|------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--|
|                                                                                                                  |              |                                                                      | MOV/Input Filter Caps <sup>(1)(2)</sup>                                            | DC Bus Common Mode Caps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |  |
| 6 NEMA/UL Type 12 Drives                                                                                         |              |                                                                      |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |  |
| C<br>D<br>E<br>F<br>P<br>R<br>T<br>W                                                                             | All          | Two green/yellow wires <u>connected</u> to Power Terminal Block "PE" | Green/yellow wire to CM Cap Board is <u>connected</u> to Power Terminal Block "PE" | <b>Solid Ground</b><br><br>1. The green/yellow CM Cap jumper wire should be connected to "PE."<br><br>2. The MOV/Input Filter Cap jumper wires should be connected to "PE."                                                                                                                                                                                                                                                                                                                                                                                    |                   |  |
| <div><p>DO NOT REMOVE</p></div> |              |                                                                      |                                                                                    | <b>Non-Solid Ground</b><br><br>1. The green/yellow CM Cap jumper wire should be insulated from ground. If necessary, remove the jumper wire from "PE" and insulate/secure it to guard against unintentional contact with chassis or components. <b>Important: Do Not Remove/Disconnect the larger green/yellow wire.</b><br><br>2. MOV/Input Filter Cap jumper wires should be insulated from ground. If necessary, remove the jumper wires from "PE" and individually insulate/secure them to guard against unintentional contact with chassis or components. |                   |  |

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

(2) When removing MOV's, the input filter capacitor must also be removed.

Step 4 I/O Wiring

Important points to remember about I/O wiring:

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

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



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



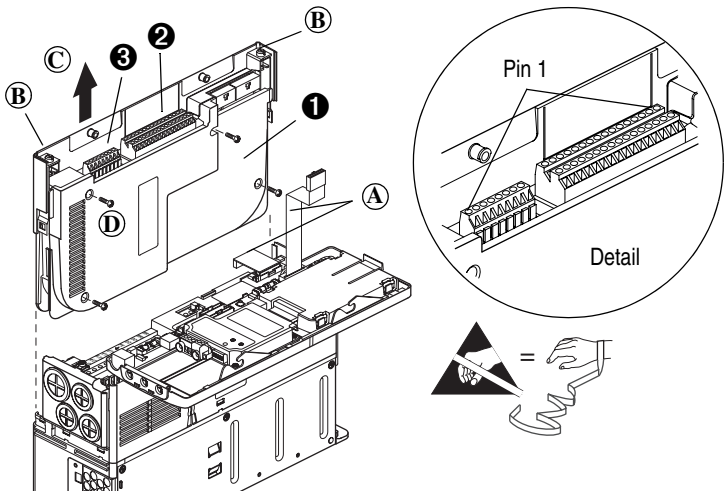
**ATTENTION:** Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

I/O Terminals

Figure 1 shows the I/O Control Cassette and terminal block locations. The cassette houses the main control board (including drive control firmware) with I/O terminal block and optional encoder board. To remove the cassette, follow the steps below. Cassette removal will be similar for all frames (Frame 0 drive shown).

| Step | Description                                                         |
|------|---------------------------------------------------------------------|
| (A)  | Disconnect the two cable connectors shown in Figure 1.              |
| (B)  | Loosen the two screw latches shown in Figure 1.                     |
| (C)  | Slide the cassette out.                                             |
| (D)  | Remove screws securing cassette cover to gain access to the boards. |

Figure 1 PowerFlex 700 Typical Cassette & I/O Terminal Blocks



I/O Terminal Block Specifications

| No. | Name                   | Description                        | Wire Size Range <sup>(1)</sup>   |                                   | Torque                 |                        |
|-----|------------------------|------------------------------------|----------------------------------|-----------------------------------|------------------------|------------------------|
|     |                        |                                    | Maximum                          | Minimum                           | Maximum                | Recommended            |
| 1   | I/O Cassette           | Removable I/O Cassette             |                                  |                                   |                        |                        |
| 2   | I/O Terminal Block     | Signal & control connections       | 2.5 mm <sup>2</sup><br>(14 AWG)  | 0.30 mm <sup>2</sup><br>(22 AWG)  | 0.6 N•m<br>(5.3 lb•in) | 0.6 N•m<br>(5.3 lb•in) |
| 3   | Encoder Terminal Block | Encoder power & signal connections | 0.75 mm <sup>2</sup><br>(18 AWG) | 0.196 mm <sup>2</sup><br>(24 AWG) | 0.6 N•m<br>(5.3 lb•in) | 0.6 N•m<br>(5.3 lb•in) |

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

Figure 2 Vector Control Option I/O Terminal Designations



| No. | Signal                                                   | Factory Default | Description                                                                                                                                                                                                                                                   | Related Param. |
|-----|----------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1   | Analog In 1 (-) <sup>(1)</sup>                           | (2)             | Isolated <sup>(3)</sup> , bipolar, differential, $\pm 10\text{V}/0\text{--}20\text{ mA}$ , 11 bit & sign. For 0-20 mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20). 88k ohm input impedance when configured for volt. & 95.3 ohm for current | 320 - 327      |
| 2   | Analog In 1 (+) <sup>(1)</sup>                           |                 |                                                                                                                                                                                                                                                               |                |
| 3   | Analog In 2 (-) <sup>(1)</sup>                           |                 |                                                                                                                                                                                                                                                               |                |
| 4   | Analog In 2 (+) <sup>(1)</sup>                           |                 |                                                                                                                                                                                                                                                               |                |
| 5   | Pot Common                                               | -               | For (+) and (-) 10V pot references.                                                                                                                                                                                                                           |                |
| 6   | Analog Out 1 (-)                                         | (2)             | Single-ended bipolar (current output is not bipolar), $\pm 10\text{V}/0\text{--}20\text{ mA}$ , 11 bit & sign, Voltage mode - limit current to 5 mA. Current mode - max. load is 400 ohms.                                                                    | 340 - 347      |
| 7   | Analog Out 1 (+)                                         |                 |                                                                                                                                                                                                                                                               |                |
| 8   | Analog Out 2 (-)                                         |                 |                                                                                                                                                                                                                                                               |                |
| 9   | Analog Out 2 (+)                                         |                 |                                                                                                                                                                                                                                                               |                |
| 10  | HW PTC Input 1                                           | -               | 1.8k ohm PTC, Internal 3.32k ohm pull-up resistor                                                                                                                                                                                                             | 238 - 259      |
| 11  | Digital Out 1 - N.C. <sup>(4)</sup>                      | Fault           | Max. Resistive Load:<br>240V AC/30V DC - 1200VA, 150W<br>Max. Current: 5A, Min. Load: 10 mA<br>Max. Inductive Load:<br>240V AC/30V DC - 840VA, 105W<br>Max. Current: 3.5A, Min. Load: 10 mA                                                                   | 380 - 391      |
| 12  | Digital Out 1 Common                                     |                 |                                                                                                                                                                                                                                                               |                |
| 13  | Digital Out 1 - N.O. <sup>(4)</sup>                      | NOT Fault       |                                                                                                                                                                                                                                                               |                |
| 14  | Digital Out 2 - N.C. <sup>(4)</sup>                      | NOT Run         |                                                                                                                                                                                                                                                               |                |
| 15  | Digital Out 2/3 Com.                                     |                 |                                                                                                                                                                                                                                                               |                |
| 16  | Digital Out 3 - N.O. <sup>(4)</sup>                      | Run             |                                                                                                                                                                                                                                                               |                |
| 17  | Current In Jumper <sup>(1)</sup> -                       |                 | Placing a jumper across terminals 17 & 18 (or 19 & 20) will configure that analog input for current.                                                                                                                                                          | 320 - 327      |
| 18  | Analog In 1                                              |                 |                                                                                                                                                                                                                                                               |                |
| 19  | Current In Jumper <sup>(1)</sup> -                       |                 |                                                                                                                                                                                                                                                               |                |
| 20  | Analog In 2                                              |                 |                                                                                                                                                                                                                                                               |                |
| 21  | -10VDC Pot Ref.                                          | -               | 2k ohm minimum load.                                                                                                                                                                                                                                          |                |
| 22  | +10VDC Pot Ref.                                          | -               |                                                                                                                                                                                                                                                               |                |
| 23  | HW PTC Input 2                                           | -               | See above                                                                                                                                                                                                                                                     |                |
| 24  | +24VDC <sup>(5)</sup>                                    | -               | Drive supplied logic input power. <sup>(5)</sup>                                                                                                                                                                                                              |                |
| 25  | Digital In Common                                        | -               |                                                                                                                                                                                                                                                               |                |
| 26  | 24V Common <sup>(5)</sup>                                | -               | Common for internal power supply.                                                                                                                                                                                                                             |                |
| 27  | Digital In 1 <sup>(6)</sup>                              | Stop - CF       | 115V AC, 50/60 Hz - Opto isolated<br>Low State: less than 30V AC<br>High State: greater than 100V AC, 5.7 mA<br>24V DC - Opto isolated<br>Low State: less than 5V DC<br>High State: greater than 20V DC, 10 mA<br>DC Digital Input Impedance: 21k ohm         | 361 - 366      |
| 28  | Digital In 2 <sup>(6)</sup>                              | Start           |                                                                                                                                                                                                                                                               |                |
| 29  | Digital In 3 <sup>(6)</sup>                              | Auto/Man.       |                                                                                                                                                                                                                                                               |                |
| 30  | Digital In 4 <sup>(6)</sup>                              | Speed Sel 1     |                                                                                                                                                                                                                                                               |                |
| 31  | Digital In 5 <sup>(6)</sup>                              | Speed Sel 2     |                                                                                                                                                                                                                                                               |                |
| 32  | Digital In 6/Hardware Enable <sup>(6)</sup> , see pg. 60 | Speed Sel 3     |                                                                                                                                                                                                                                                               |                |

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

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

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

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

(5) 150 mA maximum load designed to power digital inputs only. Not present on 115V versions.

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

Figure 3 Standard Control Option I/O Terminal Designations

| No. | Signal                              | Factory Default | Description                                                                                                                                                                               | Related Param. |
|-----|-------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1   | Anlg Volts In 1 (–)                 | (2)             | Isolated <sup>(3)</sup> , bipolar, differential, $\pm 10V$ , 11 bit & sign, 88k ohm input impedance.                                                                                      | 320 - 327      |
| 2   | Anlg Volts In 1 (+)                 |                 |                                                                                                                                                                                           |                |
| 3   | Anlg Volts In 2 (–)                 | (2)             | Isolated <sup>(4)</sup> , bipolar, differential, $\pm 10V$ , 11 bit & sign, 88k ohm input impedance.                                                                                      |                |
| 4   | Anlg Volts In 2 (+)                 |                 |                                                                                                                                                                                           |                |
| 5   | Pot Common                          | –               | For (+) and (–) 10V pot references.                                                                                                                                                       |                |
| 6   | Anlg Volts Out 1 (–)                | (2)             | Bipolar, $\pm 10V$ , 11 bit & sign, 2k ohm minimum load.                                                                                                                                  | 340 - 344      |
| 7   | Anlg Volts Out 1 (+)                |                 |                                                                                                                                                                                           |                |
| 8   | Anlg Current Out 1 (–)              | (2)             | 4-20mA, 11 bit & sign, 400 ohm maximum load.                                                                                                                                              |                |
| 9   | Anlg Current Out 1 (+)              |                 |                                                                                                                                                                                           |                |
| 10  | Reserved for Future Use             |                 |                                                                                                                                                                                           |                |
| 11  | Digital Out 1 – N.C. <sup>(1)</sup> | Fault           | Max. Resistive Load:<br>240V AC/30V DC – 1200VA, 150W<br>Max. Current: 5A, Min. Load: 10mA<br>Max. Inductive Load:<br>240V AC/30V DC – 840VA, 105W<br>Max. Current: 3.5A, Min. Load: 10mA | 380 - 387      |
| 12  | Digital Out 1 Common                |                 |                                                                                                                                                                                           |                |
| 13  | Digital Out 1 – N.O. <sup>(1)</sup> | NOT Fault       |                                                                                                                                                                                           |                |
| 14  | Digital Out 2 – N.C. <sup>(1)</sup> | NOT Run         |                                                                                                                                                                                           |                |
| 15  | Digital Out 2 Common                |                 |                                                                                                                                                                                           |                |
| 16  | Digital Out 2 – N.O. <sup>(1)</sup> | Run             |                                                                                                                                                                                           |                |
| 17  | Anlg Current In 1 (–)               | (2)             | Isolated <sup>(3)</sup> , 4-20 mA, 11 bit & sign, 124 ohm input impedance.                                                                                                                | 320 - 327      |
| 18  | Anlg Current In 1 (+)               |                 |                                                                                                                                                                                           |                |
| 19  | Anlg Current In 2 (–)               | (2)             | Isolated <sup>(4)</sup> , 4-20 mA, 11 bit & sign, 124 ohm input impedance.                                                                                                                |                |
| 20  | Anlg Current In 2 (+)               |                 |                                                                                                                                                                                           |                |
| 21  | –10VDC Pot Ref.                     | –               | 2k ohm minimum.                                                                                                                                                                           |                |
| 22  | +10VDC Pot Ref.                     | –               |                                                                                                                                                                                           |                |
| 23  | Reserved for Future Use             |                 |                                                                                                                                                                                           |                |
| 24  | +24VDC <sup>(5)</sup>               | –               | Drive supplied logic input power. <sup>(5)</sup>                                                                                                                                          |                |
| 25  | Digital In Common                   | –               |                                                                                                                                                                                           |                |
| 26  | 24V Common <sup>(5)</sup>           | –               | Common for internal power supply.                                                                                                                                                         |                |
| 27  | Digital In 1                        | Stop - CF       | 115V AC, 50/60 Hz - Opto isolated                                                                                                                                                         | 361 - 366      |
| 28  | Digital In 2                        | Start           | Low State: less than 30V AC                                                                                                                                                               |                |
| 29  | Digital In 3                        | Auto/Man.       | High State: greater than 100V AC, 5.0 mA                                                                                                                                                  |                |
| 30  | Digital In 4                        | Speed Sel 1     | 24V AC/DC, 50/60 Hz - Opto isolated                                                                                                                                                       |                |
| 31  | Digital In 5                        | Speed Sel 2     | Low State: less than 5V AC/DC                                                                                                                                                             |                |
| 32  | Digital In 6                        | Speed Sel 3     | High State: greater than 20V AC/DC<br>11.2 mA DC<br>Digital Input Impedance: 35k ohm                                                                                                      |                |

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

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

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

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

(5) 150 mA maximum load designed to power digital inputs only. Not present on 115V versions.

## I/O Wiring Examples

| Input/Output                                                                                                | Connection Example | Parameter Settings                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potentiometer Unipolar Speed Reference<sup>(1)</sup></b><br>10k Ohm Pot.<br>Recommended (2k Ohm Minimum) |                    | <ul style="list-style-type: none"> <li>Adjust Scaling:<br/>Parameters 91/92 and 325/326</li> <li>View Results:<br/>Parameter 002</li> </ul>                                                                                                            |
| <b>Analog Input Bipolar Speed Reference</b><br>±10V Input                                                   |                    | <ul style="list-style-type: none"> <li>Set Direction Mode:<br/>Parameter 190 = "1, Bipolar"</li> <li>Adjust Scaling:<br/>Parameters 91/92 and 325/326</li> <li>View Results:<br/>Parameter 002</li> </ul>                                              |
| <b>Analog Voltage Input Unipolar Speed Reference</b><br>0 to +10V Input                                     |                    | <ul style="list-style-type: none"> <li>Configure Input with parameter 320</li> <li>Adjust Scaling:<br/>Parameters 91/92 and 325/326</li> <li>View results:<br/>Parameter 002</li> </ul>                                                                |
| <b>Analog Current Input Unipolar Speed Reference</b><br><b>Vector</b><br>0...20 mA Input                    |                    | <ul style="list-style-type: none"> <li>Configure Input for Current:<br/>Parameter 320 and add jumper at appropriate terminals</li> <li>Adjust Scaling:<br/>Parameters 91/92 and 325/326</li> <li>View results:<br/>Parameter 002</li> </ul>            |
| <b>Analog Current Input Unipolar Speed Reference</b><br><b>Standard</b><br>4...20 mA Input                  |                    | <ul style="list-style-type: none"> <li>Configure Input for Current:<br/>Parameter 320, Bit 1 = "1, Current"</li> <li>Adjust Scaling:<br/>Parameters 91/92 and 325/326</li> <li>View Results:<br/>Parameter 002</li> </ul>                              |
| <b>Analog Input, PTC</b><br><b>Vector</b><br>PTC OT set > 5V<br>PTC OT cleared < 4V<br>PTC Short < 0.2V     |                    | <ul style="list-style-type: none"> <li>Set Fault Config 1:<br/>Parameter 238, bit 7 = "Enabled"</li> <li>Set Alarm Config 1:<br/>Parameter 259, bit 11 = "Enabled"</li> <li>View Status Drive Alarm 1:<br/>Parameter 211, bit 11 = "True"</li> </ul>   |
| <b>HW PTC Input<sup>(2)</sup></b><br>PTC OT set > 5V<br>PTC OT cleared < 4V<br>PTC Short < 0.2V             |                    | <ul style="list-style-type: none"> <li>Set Fault Config 1:<br/>Parameter 238, bit 13 = "Enabled"</li> <li>Set Alarm Config 1:<br/>Parameter 259, bit 18 = "Enabled"</li> <li>View Status: Drive Alarm 1:<br/>Parameter 211, bit 18 = "True"</li> </ul> |

(1) Refer to the Attention statement on [page 55](#) for important bipolar wiring information.

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

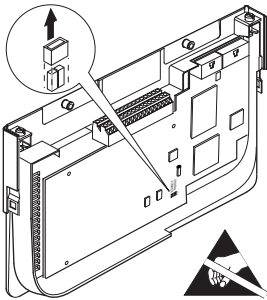
| Input/Output                                                                                                                                                                                                                                                                      | Connection Example | Parameter Settings                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2-Wire Control Non-Reversing<sup>(1)</sup></b><br>24V DC internal supply                                                                                                                                                                                                       |                    | <ul style="list-style-type: none"> <li>Disable Digital Input #1: Parameter 361 = "0, Unused"</li> <li>Set Digital Input #2: Parameter 362 = "7, Run"</li> <li>Set Direction Mode: Parameter 190 = "0, Unipolar"</li> </ul>                                   |
| <b>2-Wire Control Reversing<sup>(1)</sup></b><br>External supply<br>(I/O Board dependent)                                                                                                                                                                                         |                    | <ul style="list-style-type: none"> <li>Set Digital Input #1: Parameter 361 = "8, Run Forward"</li> <li>Set Digital Input #2: Parameter 362 = "9, Run Reverse"</li> </ul>                                                                                     |
| <b>3-Wire Control</b><br>Internal supply                                                                                                                                                                                                                                          |                    | <ul style="list-style-type: none"> <li>No changes required if parameters are at factory default settings</li> </ul>                                                                                                                                          |
| <b>3-Wire Control</b><br>External supply<br>(I/O Board dependent).<br>Requires 3-wire functions only ([Digital In1 Self]). Using 2-wire selections will cause a type 2 alarm.                                                                                                     |                    | <ul style="list-style-type: none"> <li>No changes required if parameters are at factory default settings</li> </ul>                                                                                                                                          |
| <b>Digital Input</b><br>PLC Output Card (Board dependent). Resistors are recommended to dissipate leakage current.                                                                                                                                                                |                    | <ul style="list-style-type: none"> <li>No changes required if parameters are at factory default settings</li> </ul>                                                                                                                                          |
| <b>Digital Output</b><br>Relays shown in powered state with drive faulted. See page 56.<br>Vector Control <ul style="list-style-type: none"> <li>2 relays at term. 14...16</li> </ul> Standard Control <ul style="list-style-type: none"> <li>1 relay at term. 14...16</li> </ul> |                    | Vector Control <ul style="list-style-type: none"> <li>Select Source to Activate: Parameters 380/384/388</li> </ul> Standard Control <ul style="list-style-type: none"> <li>Select Source to Activate: Parameters 380/384</li> </ul>                          |
| <b>Enable Input</b>                                                                                                                                                                                                                                                               |                    | Vector Control <ul style="list-style-type: none"> <li>Configure with parameter 366 For dedicated hardware Enable: Remove Jumper J10 (see page 60)</li> </ul> Standard Control <ul style="list-style-type: none"> <li>Configure with parameter 366</li> </ul> |

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

Hardware Enable Circuitry (Vector Control Only)

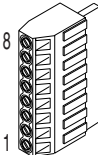
By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without software interpretation*, a “dedicated” hardware enable configuration can be utilized. This is done by removing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

- 1. Remove the I/O Control Cassette & cover as described on [page 55](#).
- 2. Locate & remove Jumper J10 on the Main Control Board (see diagram).
- 3. Re-assemble cassette.
- 4. Wire Enable to “Digital In 6” (see [page 56](#)).
- 5. Verify that [Digital In6 Sel], parameter 366 is set to “1, Enable.”



Encoder Interface Option (Vector Control Only)

Encoder Terminal Designations

| <div>See “Detail” on <a href="#">page 55</a></div>  | No. | Description                            |                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------|--------------------------------------------------------|
|                                                                                                                                       | 8   | +12V <sup>(1)</sup> DC Power           | Internal power source<br>250 mA.                       |
|                                                                                                                                       | 7   | +12V <sup>(1)</sup> DC Return (Common) |                                                        |
|                                                                                                                                       | 6   | Encoder Z (NOT)                        | Pulse, marker or registration<br>input. <sup>(2)</sup> |
|                                                                                                                                       | 5   | Encoder Z                              |                                                        |
|                                                                                                                                       | 4   | Encoder B (NOT)                        | Quadrature B input.                                    |
|                                                                                                                                       | 3   | Encoder B                              |                                                        |
|                                                                                                                                       | 2   | Encoder A (NOT)                        | Single channel or<br>quadrature A input.               |
|                                                                                                                                       | 1   | Encoder A                              |                                                        |

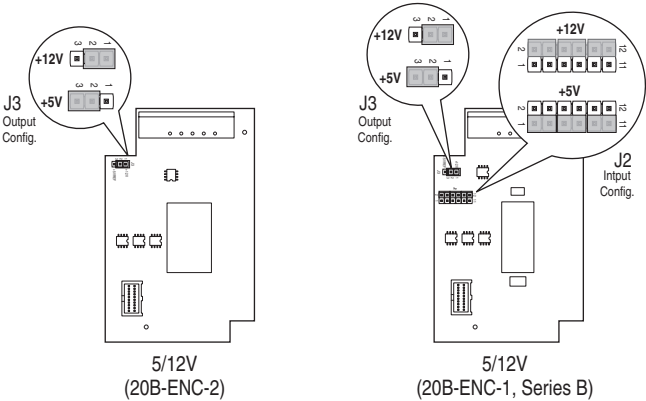
(1) Jumper selectable +5/12V is available on 20B-ENC-1 Encoder Boards.

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

### Encoder Specifications

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

### Encoder Board Jumper Settings



### Sample Encoder Wiring

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

(1) SHLD connection is on drive chassis (see [page 29](#)).

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

## Step 5 Start-Up Check List

- This check list supports the Basic Start-Up menu option. See [page 67](#) for information on other start-up routines.
- A Human Interface Module (HIM) is required to run the Basic Start-Up routine.
- The Basic Start-Up routine may modify parameter values for Analog and Digital I/O. Refer to Common I/O Programming Changes on [page 71](#).



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

### Prepare For Drive Start-Up

- ☐ 1. Confirm that all inputs are connected to the correct terminals and are secure.
- ☐ 2. Verify that AC line power at the disconnect device is within the rated value of the drive.
- ☐ 3. Verify that control power voltage is correct.
- ☐ 4. The remainder of this procedure requires that a HIM be installed. Connect a Human Interface Module (HIM) to Drive Peripheral Interface (DPI) Port 1 or 2. If an operator interface is not available, remote devices should be used to start up the drive.

**Important:** When power is first applied, the HIM may require approximately 5 seconds until commands are recognized (including the Stop key). An explanation of the LED indicators can be found on [page 70](#).



- ☐ 5. Apply AC power and control voltages to the drive.

If any of the six digital inputs are configured to “Stop – CF” (CF = Clear Fault) or “Enable,” verify that signals are present or reconfigure [Digital Inx Sel], parameters 361...366. If an I/O option is not installed (i.e. no I/O terminal block), verify that [Digital Inx Sel] is not configured to “Stop – CF” or “Enable.” If this is not done, the drive will not start. Refer to [Troubleshooting – Abbreviated Fault & Alarm Listing on page 72](#) for a list of potential digital input conflicts.

If the STS LED is not flashing green at this point, refer to [Drive Status Indicators on page 70](#).

- ☐ 6. When prompted, select a display language. The PowerFlex 700 Start-Up Screen will then display.
- ☐ 7. Press the Enter key to display the Start-Up Menu.
- ☐ 8. Use the Arrow keys to highlight “2. Basic”.
- ☐ 9. Press the Enter key. Follow the menu using the Enter key which will step you through the Start-Up routine.

The Basic Start-Up routine asks simple questions and prompts you to input required information. See also [Common I/O Programming Changes on page 71](#).

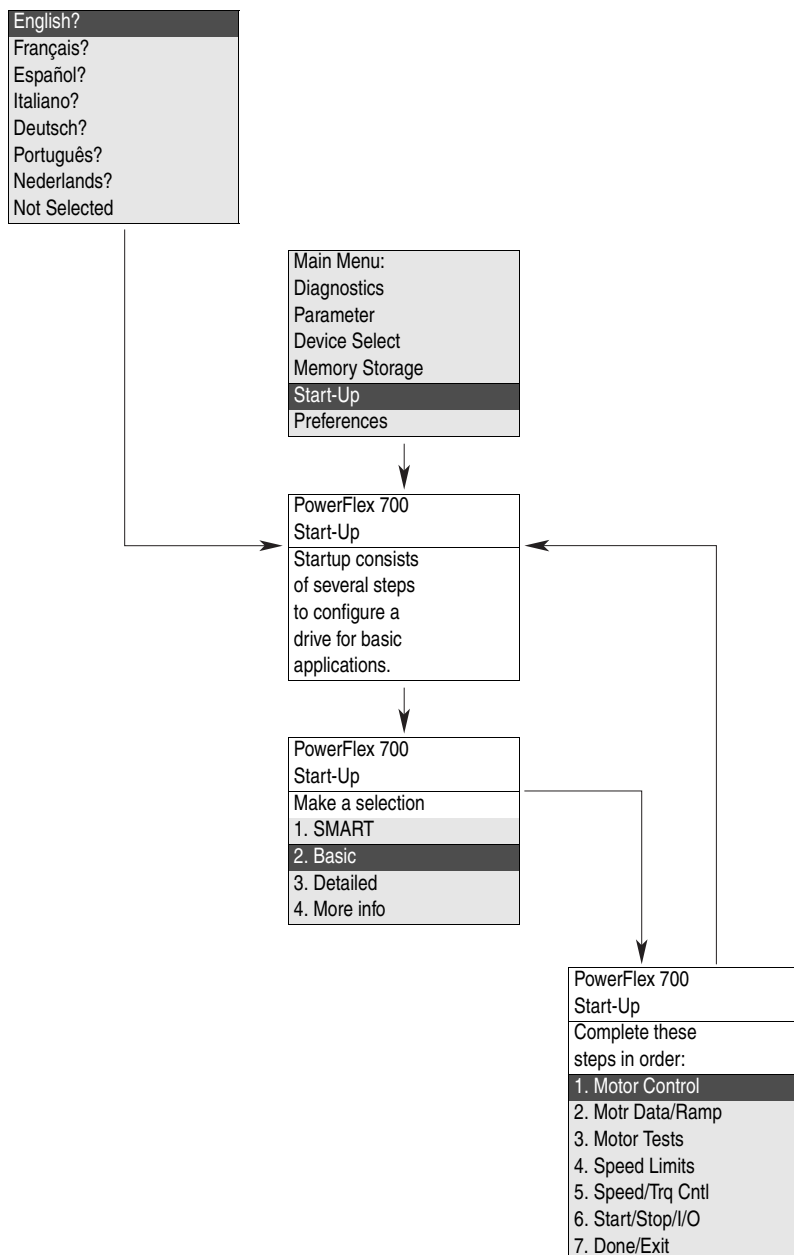
## Information About Start-Up Motor Tests

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

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

During motor tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361...366. If power is removed from the drive during the tests without aborting the auto-tune procedure, these parameters may not reset to their original value. If this situation occurs, reset the drive to factory defaults (see [page 71](#)) and repeat the Start Up procedure.

## First Powerup Menu Structure



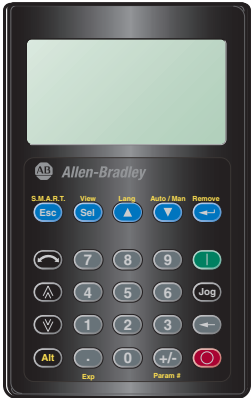
Human Interface Module (HIM) Overview

LCD Display Elements

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

Human Interface Module (HIM) Key Functions

| Key | Description                                                                                                            |
|-----|------------------------------------------------------------------------------------------------------------------------|
|     | Exit a menu, cancel a change to a parameter value, or acknowledge a fault/alarm.                                       |
|     | Select a digit, select a bit, or enter edit mode in a parameter screen.                                                |
|     | Scroll through options, increase a value, or toggle a bit.                                                             |
|     | Scroll through options, decrease a value, or toggle a bit.                                                             |
|     | Enter a menu, enter edit mode in a parameter screen, or save a change to a parameter value.                            |
|     | Access the function associated with a programming or numeric key. Refer to the drive user manual for more information. |
|     | Start the drive.                                                                                                       |
|     | Stop the drive or clear a fault.                                                                                       |
|     | Jog the drive.                                                                                                         |
|     | Change direction.                                                                                                      |
|     | Increase speed.                                                                                                        |
|     | Decrease speed.                                                                                                        |



Human Interface Module (HIM)

These keys are active only when the HIM is granted Manual Control or Param. 090 [Speed Ref A Sel] / 093 [Speed Ref B Sel] is set to:

Option 18 “DPI Port 1” for a HIM installed in the drive cover or

Option 19 “DPI Port 2” for a HIM connected by cable for handheld or remote installation option

Human Interface Module (HIM) Main Menu

| Main Menu Screen                                                                                                                 | Menu Selections                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <div><div>F-&gt;Power LossAuto</div><div>0.0 Hz</div><div>Main Menu:<br/>Diagnostics<br/>Parameter<br/>Device Select</div></div> | <div>Main Menu:<br/>Diagnostics<br/>Parameter<br/>Device Select<br/>Memory Storage<br/>Start-Up<br/>Preferences</div> |

ALT Functions

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

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

## Start-Up Routines

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

- **S.M.A.R.T. Start**

This routine is accessible by using the “ALT” function key on the LCD HIM. This keystroke brings up a list of parameters needed to program the eight most commonly adjusted drive functions. These include Start, Stop, Minimum Speed, Maximum Speed, Acceleration Time, Deceleration Time, Reference source (speed command) and Electronic Overload setting for the motor. No knowledge of parameter organization or access is required. S.M.A.R.T. Start can commission the drive in just a few minutes. See [page 69](#).

- **Assisted Start Up**

Three levels of Assisted Start Up (Basic, Detailed and Application) aid the user in commissioning the drive asking simple Yes/No or “Enter Data” questions. The user is guided through the Start Up to reduce the amount of time necessary to get the drive “up and running.” The following are included in startup:

- Input Voltage Ratings
- Motor Data
- Motor Tests & Auto-tuning
- Speed/Torque Control & Direction Limits
- Speed Reference
- Start & Stop Modes
- Ramp Setup
- Digital and Analog I/O
- Application Set-up (TorqProve, Oil Well Pumps, Positioning/Speed Profiling)

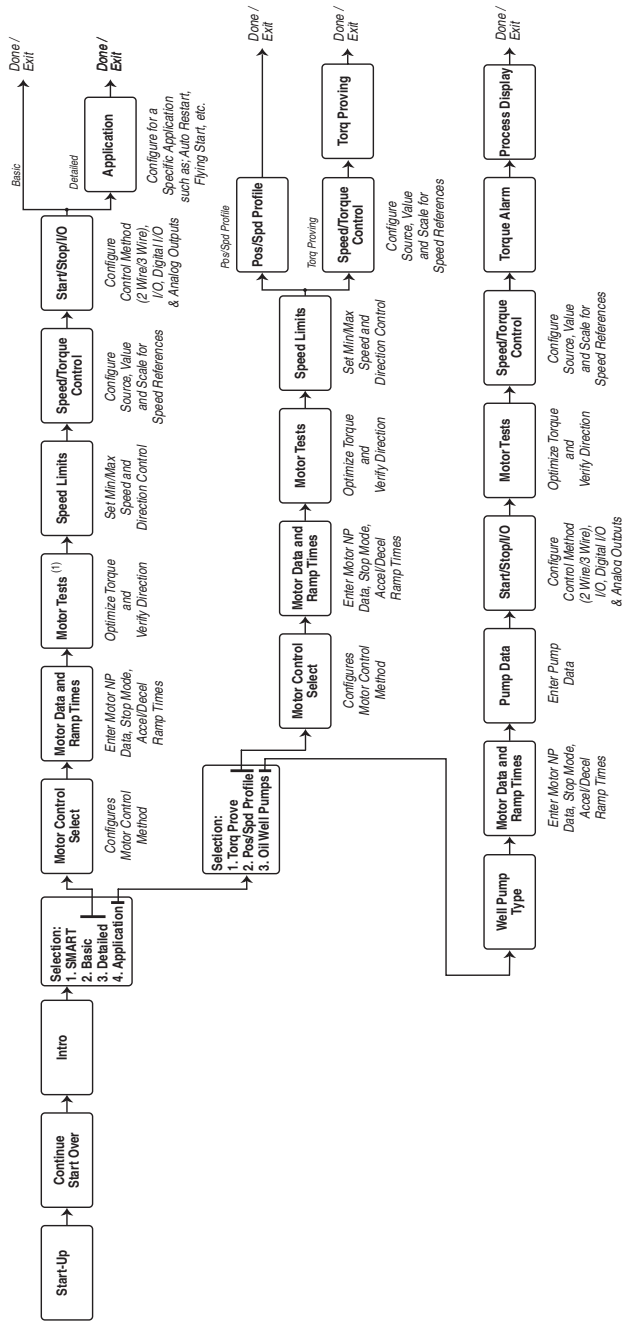
See [page 69](#) for details.

### **Important Information**

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

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

Figure 4 Start Up Menu



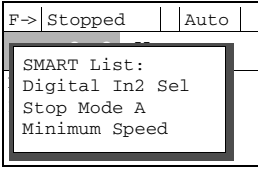
(1) During Motor Tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361...366. If power is removed from the drive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

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

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

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

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

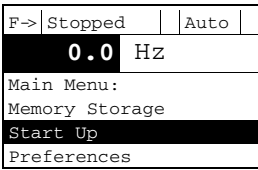
| Step                                                                                                    | Key(s)                                                                                                                                                              | Example LCD Displays                                                              |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 1. Press ALT and then Esc (S.M.A.R.T.). The S.M.A.R.T. start screen appears.                            |   |  |
| 2. View and change parameter values as desired. For HIM information, see Appendix B in the User Manual. |                                                                                                                                                                     |                                                                                   |
| 3. Press Esc to exit the S.M.A.R.T. start.                                                              |                                                                                    |                                                                                   |

Running an Assisted Start Up

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

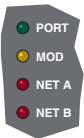
The Assisted start-up routine prompts you to input required information. Access Assisted Start Up by selecting “Start Up” from the Main Menu.

To perform an Assisted Start-Up

| Step                                                                           | Key(s)                                                                                                                                                                  | Example LCD Displays                                                                |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Start Up”. |   |  |
| 2. Press Enter.                                                                |                                                                                      |                                                                                     |

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

## Drive Status Indicators

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

## Common I/O Programming Changes

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

### Speed Reference A

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

1. Set Param. 090 [Speed Ref A Sel] to option 1 “Analog In 1”  
This sets the speed reference input to I/O terminals 1 & 2. For 4...20 mA operation, a jumper must be placed between terminals 17 & 18.
2. Set Param. 096 [TB Man Ref Sel] to option 9 “MOP Level”  
This eliminates a potential Conflict alarm condition. Analog In 2 is not a valid Speed Reference source if selected for any of the following:
  - 117 [Trim In Select]
  - 126 [PI Reference Sel]
  - 128 [PI Feedback Sel]
  - 147 [Current Lmt Sel]
  - 179 [Sleep-Wake Ref]
3. Set Param. 091 [Speed Ref A Hi] to the upper value of the desired speed reference range in Hz
4. Set Param. 092 [Speed Ref A Lo] to the lower value of the desired speed reference range in Hz

### Control Scheme

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

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

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

See I/O Wiring Examples beginning on [page 58](#).

### Restoring Factory Defaults

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

## Troubleshooting – Abbreviated Fault & Alarm Listing

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

| Fault            | No. | Type <sup>(1)</sup> | Description                                                                                                                                                                                                                      | Action                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------|-----|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Auxiliary Input  | 2   | ①                   | Auxiliary input interlock is open.                                                                                                                                                                                               | Check remote wiring.                                                                                                                                                                                                                                                                                                                                                                               |
| Decel Inhibit    | 24  | ③                   | The drive is not following a commanded deceleration because it is attempting to limit bus voltage.                                                                                                                               | <ol style="list-style-type: none"> <li>1. Verify input voltage is within drive specified limits.</li> <li>2. Verify system ground impedance follows proper grounding techniques.</li> <li>3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time. <b>Refer to <a href="#">page 6</a> for further info.</b></li> <li>4. Disable with parameter 238.</li> </ol> |
| FluxAmpsRef Rang | 78  |                     | The value for flux amps determined by the Autotune procedure exceeds the programmed [Motor NP FLA], parameter 042.                                                                                                               | <ol style="list-style-type: none"> <li>1. Reprogram [Motor NP FLA] with the correct motor nameplate value.</li> <li>2. Repeat Autotune.</li> </ol>                                                                                                                                                                                                                                                 |
| HW OverCurrent   | 12  | ①                   | The drive output current has exceeded the hardware current limit.                                                                                                                                                                | Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.                                                                                                                                                                                                                                                                |
| IR Volts Range   | 77  |                     | "Calculate" is the autotune default and the value determined by the autotune procedure for IR Drop Volts is not in the range of acceptable values.                                                                               | Re-enter motor nameplate data.                                                                                                                                                                                                                                                                                                                                                                     |
| Motor Overload   | 7   | ①<br>③              | <p>Internal electronic overload trip.</p> <p>Enable/Disable with [Fault Config 1].</p>                                                                                                                                           | An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA].                                                                                                                                                                                                                                                                             |
| OverSpeed Limit  | 25  | ①                   | Functions such as Slip Compensation or Bus Regulation have attempted to add an output frequency adjustment greater than that programmed in [Overspeed Limit], parameter 083.                                                     | Remove excessive load or overhauling conditions or increase [Overspeed Limit].                                                                                                                                                                                                                                                                                                                     |
| OverVoltage      | 5   | ①                   | DC bus voltage exceeded maximum value.                                                                                                                                                                                           | Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.                                                                                                                                                                                                                |
| SW OverCurrent   | 36  | ①                   | Drive output current has exceeded the 1ms current rating. This rating is greater than the 3 second current rating and less than the hardware overcurrent fault level. It is typically 200...250% of the drive continuous rating. | Check for excess load, improper DC boost setting. DC brake volts set too high.                                                                                                                                                                                                                                                                                                                     |

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

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

## Common Symptoms and Corrective Actions

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

| Cause(s)                                                                                                                                                                                                                                                                                                                                                                        | Indication                                                                                                       | Corrective Action                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drive is Faulted                                                                                                                                                                                                                                                                                                                                                                | Flashing red status light                                                                                        | Clear fault. <ul style="list-style-type: none"> <li>• Press Stop</li> <li>• Cycle power</li> <li>• Set [Fault Clear] to 1</li> <li>• "Clear Faults" on the HIM Diagnostic menu.</li> </ul> |
| Incorrect input wiring. Refer to the wiring examples starting on <a href="#">page 58</a> . <ul style="list-style-type: none"> <li>• 2 wire control requires Run, Run Forward, Run Reverse or Jog input.</li> <li>• 3 wire control requires Start and Stop inputs.</li> <li>• Jumper from terminal 25 to 26 is required.</li> </ul>                                              | None                                                                                                             | Wire inputs correctly and/or install jumper.                                                                                                                                               |
| Incorrect digital input programming. <ul style="list-style-type: none"> <li>• Mutually exclusive choices have been made (i.e., Jog and Jog Forward).</li> <li>• 2 wire and 3 wire programming may be conflicting.</li> <li>• Exclusive functions (i.e., direction control) may have multiple inputs configured.</li> <li>• Stop is factory default and is not wired.</li> </ul> | None                                                                                                             | Program [Digital Inx Sel], parameters 361...366 for correct inputs. Start or Run programming may be missing.                                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                 | Flashing yellow status light and "Dign CflctB" indication on LCD HIM.<br>[Drive Status 2] shows type 2 alarm(s). | Program [Digital Inx Sel] to resolve conflicts.<br>Remove multiple selections for the same function.<br>Install stop button to apply a signal at stop terminal.                            |

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

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

### Drive does not respond to changes in speed command.

| Cause(s)                                           | Indication                                                   | Corrective Action                                                                                                                                                                                                           |
|----------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No value is coming from the source of the command. | LCD HIM Status Line indicates "At Speed" and output is 0 Hz. | <ol style="list-style-type: none"> <li>1. If the source is an analog input, check wiring and use a meter to check for presence of signal.</li> <li>2. Check [Commanded Speed], parameter 002 for correct source.</li> </ol> |

| Cause(s)                                                                          | Indication | Corrective Action                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Incorrect reference source has been programmed.                                   | None       | <ol style="list-style-type: none"> <li>3. Check parameter 213, [Speed Ref Source] for the source of the speed reference.</li> <li>4. Reprogram parameter 090, [Speed Ref A Sel] for correct source.</li> </ol>                                                                                                           |
| Incorrect Reference source is being selected via remote device or digital inputs. | None       | <ol style="list-style-type: none"> <li>5. Check parameter 209, [Drive Status 1], bits 12 &amp; 13 for unexpected source selections.</li> <li>6. Check parameter 216 [Dig In Status] to see if inputs are selecting an alternate source.</li> <li>7. Reprogram digital inputs to correct "Speed Sel x" option.</li> </ol> |

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

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

### Motor operation is unstable.

| Cause(s)                                                          | Indication | Corrective Action                                                                                                                                       |
|-------------------------------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor data was incorrectly entered or Autotune was not performed. | None       | <ol style="list-style-type: none"> <li>1. Correctly enter motor nameplate data.</li> <li>2. Perform "Static" or "Rotate" Autotune procedure.</li> </ol> |

### Drive will not reverse motor direction.

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

### Stopping the drive results in a Decel Inhibit fault.

| Cause(s)                                                                                                                                                                                                                                          | Indication                                                          | Corrective Action                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation. | Decel Inhibit fault screen.<br>LCD Status Line indicates "Faulted". | <ol style="list-style-type: none"> <li>1. See Attention statement on <a href="#">page 6</a>.</li> <li>2. Reprogram parameters 161/162 to eliminate any "Adjust Freq" selection.</li> <li>3. Disable bus regulation (parameters 161 &amp; 162) and add a dynamic brake.</li> <li>4. Correct AC input line instability or add an isolation transformer.</li> <li>5. Reset drive.</li> </ol> |

## Manually Clearing Faults

| Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Key(s)                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the Human Interface Module (HIM).</li> <li>2. Address the condition that caused the fault.<br/>The cause must be corrected before the fault can be cleared.</li> <li>3. After corrective action has been taken, clear the fault by one of these methods: <ul style="list-style-type: none"> <li>• Press Stop</li> <li>• Cycle drive power</li> <li>• Set parameter 240 [Fault Clear] to "1."</li> <li>• "Clear Faults" on the Human Interface Module (HIM) Diagnostic menu.</li> </ul> </li> </ol> | <br><br><br><br><br><br><br><br><br><br> |

## Parameter List – Vector Control Option (v8.xxx)

| Number | Parameter Name               | Group             |
|--------|------------------------------|-------------------|
| 1      | Output Freq                  | Metering          |
| 2      | Commanded Freq               | Metering          |
| 3      | Output Current               | Metering          |
| 4      | Torque Current               | Metering          |
| 5      | Flux Current                 | Metering          |
| 6      | Output Voltage               | Metering          |
| 7      | Output Power                 | Metering          |
| 8      | Output Powr Fctr             | Metering          |
| 9      | Elapsed MWh                  | Metering          |
| 10     | Elapsed Run Time             | Metering          |
| 11     | MOP Reference                | Metering          |
| 12     | DC Bus Voltage               | Metering          |
| 13     | DC Bus Memory                | Metering          |
| 14     | Elapsed kWh                  | Metering          |
| 16     | Analog In1 Value             | Metering          |
| 17     | Analog In2 Value             | Metering          |
| 18     | PTC HW Value                 | Metering          |
| 21     | Spd Fdbk No Filt             | Metering          |
| 22     | Ramped Speed                 | Metering          |
| 23     | Speed Reference              | Metering          |
| 24     | Commanded Torque**           | Metering          |
| 25     | Speed Feedback               | Metering          |
| 26     | Rated kW                     | Drive Data        |
| 27     | Rated Volts                  | Drive Data        |
| 28     | Rated Amps                   | Drive Data        |
| 29     | Control SW Ver               | Drive Data        |
| 40     | Motor Type                   | Motor Data        |
| 41     | Motor NP Volts               | Motor Data        |
| 42     | Motor NP FLA                 | Motor Data        |
| 43     | Motor NP Hertz               | Motor Data        |
| 44     | Motor NP RPM                 | Motor Data        |
| 45     | Motor NP Power               | Motor Data        |
| 46     | Mtr NP Pwr Units             | Motor Data        |
| 47     | Motor OL Hertz               | Motor Data        |
| 48     | Motor OL Factor              | Motor Data        |
| 49     | Motor Poles                  | Motor Data        |
| 50     | Motor OL Mode <sup>6.x</sup> | Motor Data        |
| 53     | Motor Cntl Sel               | Torq Attributes   |
| 54     | Maximum Voltage              | Torq Attributes   |
| 55     | Maximum Freq                 | Torq Attributes   |
| 56     | Compensation                 | Torq Attributes   |
| 57     | Flux Up Mode                 | Torq Attributes   |
| 58     | Flux Up Time                 | Torq Attributes   |
| 59     | SV Boost Filter              | Torq Attributes   |
| 61     | Autotune                     | Torq Attributes   |
| 62     | IR Voltage Drop              | Torq Attributes   |
| 63     | Flux Current Ref             | Torq Attributes   |
| 64     | Ixo Voltage Drop             | Torq Attributes   |
| 66     | Autotune Torque**            | Torq Attributes   |
| 67     | Inertia Autotune**           | Torq Attributes   |
| 69     | Start/Acc Boost              | Volts per Hertz   |
| 70     | Run Boost*                   | Volts per Hertz   |
| 71     | Break Voltage*               | Volts per Hertz   |
| 72     | Break Frequency*             | Volts per Hertz   |
| 79     | Speed Units                  | Spd Mode & Limits |
| 80     | Feedback Select              | Spd Mode & Limits |
| 81     | Minimum Speed                | Spd Mode & Limits |
| 82     | Maximum Speed                | Spd Mode & Limits |
| 83     | Overspeed Limit              | Spd Mode & Limits |

| Number   | Parameter Name       | Group             |
|----------|----------------------|-------------------|
| 84-86    | Skip Frequency 1-3*  | Spd Mode & Limits |
| 87       | Skip Freq Band*      | Spd Mode & Limits |
| 88       | Speed/Torque Mod**   | Spd Mode & Limits |
| 90, 93   | Speed Ref X Sel      | Speed Reference   |
| 91, 94   | Speed Ref X Hi       | Speed Reference   |
| 92, 95   | Speed Ref X Lo       | Speed Reference   |
| 96       | TB Man Ref Sel       | Speed Reference   |
| 97       | TB Man Ref Hi        | Speed Reference   |
| 98       | TB Man Ref Lo        | Speed Reference   |
| 99       | Pulse Input Ref      | Speed Reference   |
| 100      | Jog Speed 1          | Discrete Speeds   |
| 101-107  | Preset Speed 1-7     | Discrete Speeds   |
| 108      | Jog Speed 2          | Discrete Speeds   |
| 116      | Trim % Setpoint      | Speed Trim        |
| 117      | Trim In Select       | Speed Trim        |
| 118      | Trim Out Select      | Speed Trim        |
| 119      | Trim Hi              | Speed Trim        |
| 120      | Trim Lo              | Speed Trim        |
| 121      | Slip RPM @ FLA       | Slip Comp         |
| 122      | Slip Comp Gain*      | Slip Comp         |
| 123      | Slip RPM Meter       | Slip Comp         |
| 124      | PI Configuration     | Process PI        |
| 125      | PI Control           | Process PI        |
| 126      | PI Reference Sel     | Process PI        |
| 127      | PI Setpoint          | Process PI        |
| 128      | PI Feedback Sel      | Process PI        |
| 129      | PI Integral Time     | Process PI        |
| 130      | PI Prop Gain         | Process PI        |
| 131      | PI Lower Limit       | Process PI        |
| 132      | PI Upper Limit       | Process PI        |
| 133      | PI Preload           | Process PI        |
| 134      | PI Status            | Process PI        |
| 135      | PI Ref Meter         | Process PI        |
| 136      | PI Fdbk Meter        | Process PI        |
| 137      | PI Error Meter       | Process PI        |
| 138      | PI Output Meter      | Process PI        |
| 139      | PI BW Filter         | Process PI        |
| 140, 141 | Accel Time X         | Ramp Rates        |
| 142, 143 | Decel Time X         | Ramp Rates        |
| 145      | DB While Stopped     | Stop/Brake Modes  |
| 146      | S Curve %            | Ramp Rates        |
| 147      | Current Lmt Sel      | Load Limits       |
| 148      | Current Lmt Val      | Load Limits       |
| 149      | Current Lmt Gain     | Load Limits       |
| 150      | Drive OL Mode        | Load Limits       |
| 151      | PWM Frequency        | Load Limits       |
| 152      | Droop RPM @ FLA      | Load Limits       |
| 153      | Regen Power Limit**  | Load Limits       |
| 154      | Current Rate Limit** | Load Limits       |
| 155, 156 | Stop Mode X          | Stop/Brake Modes  |
| 157      | DC Brk Lvl Sel       | Stop/Brake Modes  |
| 158      | DC Brake Level       | Stop/Brake Modes  |
| 159      | DC Brake Time        | Stop/Brake Modes  |
| 160      | Bus Reg Ki*          | Stop/Brake Modes  |
| 161, 162 | Bus Reg Mode X       | Stop/Brake Modes  |
| 163      | DB Resistor Type     | Stop/Brake Modes  |
| 164      | Bus Reg Kp*          | Stop/Brake Modes  |
| 165      | Bus Reg Kd*          | Stop/Brake Modes  |
| 166      | Flux Braking         | Stop/Brake Modes  |

| Number   | Parameter Name                  | Group            |
|----------|---------------------------------|------------------|
| 167      | Powerup Delay                   | Restart Modes    |
| 168      | Start At PowerUp                | Restart Modes    |
| 169      | Flying Start En                 | Restart Modes    |
| 170      | Flying StartGain                | Restart Modes    |
| 174      | Auto Rstrt Tries                | Restart Modes    |
| 175      | Auto Rstrt Delay                | Restart Modes    |
| 177      | Gnd Warn Level                  | Power Loss       |
| 178      | Sleep-Wake Mode                 | Restart Modes    |
| 179      | Sleep-Wake Ref                  | Restart Modes    |
| 180      | Wake Level                      | Restart Modes    |
| 181      | Wake Time                       | Restart Modes    |
| 182      | Sleep Level                     | Restart Modes    |
| 183      | Sleep Time                      | Restart Modes    |
| 184      | Power Loss Mode                 | Power Loss       |
| 185      | Power Loss Time                 | Power Loss       |
| 186      | Power Loss Level                | Power Loss       |
| 187      | Load Loss Level                 | Power Loss       |
| 188      | Load Loss Time                  | Power Loss       |
| 189      | Shear Pin Time                  | Power Loss       |
| 190      | Direction Mode                  | Direction Config |
| 192      | Save HIM Ref                    | HIM Ref Config   |
| 193      | Man Ref Preload                 | HIM Ref Config   |
| 194      | Save MOP Ref                    | MOP Config       |
| 195      | MOP Rate                        | MOP Config       |
| 196      | Param Access Lvl                | Drive Memory     |
| 197      | Reset To Defaults               | Drive Memory     |
| 198      | Load Frm Usr Set                | Drive Memory     |
| 199      | Save To User Set                | Drive Memory     |
| 200      | Reset Meters                    | Drive Memory     |
| 201      | Language                        | Drive Memory     |
| 202      | Voltage Class                   | Drive Memory     |
| 203      | Drive Checksum                  | Drive Memory     |
| 204      | Dyn UserSet Cnfg                | Drive Memory     |
| 205      | Dyn UserSet Sel                 | Drive Memory     |
| 206      | Dyn UserSet Actv                | Drive Memory     |
| 209, 210 | Drive Status X                  | Diagnostics      |
| 211, 212 | Drive Alarm X                   | Diagnostics      |
| 213      | Speed Ref Source                | Diagnostics      |
| 214      | Start Inhibits                  | Diagnostics      |
| 215      | Last Stop Source                | Diagnostics      |
| 216      | Dig In Status                   | Diagnostics      |
| 217      | Dig Out Status                  | Diagnostics      |
| 218      | Drive Temp                      | Diagnostics      |
| 219      | Drive OL Count                  | Diagnostics      |
| 220      | Motor OL Count                  | Diagnostics      |
| 221      | Mtr OL Trip Time                | Diagnostics      |
| 222      | Drive Status 3 <sup>6,x</sup>   | Diagnostics      |
| 223      | Status 3 @ Fault <sup>6,x</sup> | Diagnostics      |
| 224      | Fault Speed                     | Diagnostics      |
| 225      | Fault Amps                      | Diagnostics      |
| 226      | Fault Bus Volts                 | Diagnostics      |
| 227, 228 | Status X @ Fault                | Diagnostics      |
| 229, 230 | Alarm X @ Fault                 | Diagnostics      |
| 234, 236 | Testpoint X Sel                 | Diagnostics      |
| 235, 237 | Testpoint X Data                | Diagnostics      |
| 238      | Fault Config 1                  | Faults           |
| 240      | Fault Clear                     | Faults           |
| 241      | Fault Clear Mode                | Faults           |
| 242      | Power Up Marker                 | Faults           |
| 243      | Fault 1 Code                    | Faults           |
| 244      | Fault 1 Time                    | Faults           |
| 245      | Fault 2 Code                    | Faults           |
| 246      | Fault 2 Time                    | Faults           |

| Number        | Parameter Name             | Group                      |
|---------------|----------------------------|----------------------------|
| 247           | Fault 3 Code               | Faults                     |
| 248           | Fault 3 Time               | Faults                     |
| 249           | Fault 4 Code               | Faults                     |
| 250           | Fault 4 Time               | Faults                     |
| 251           | Fault 5 Code               | Faults                     |
| 252           | Fault 5 Time               | Faults                     |
| 253           | Fault 6 Code               | Faults                     |
| 254           | Fault 6 Time               | Faults                     |
| 255           | Fault 7 Code               | Faults                     |
| 256           | Fault 7 Time               | Faults                     |
| 257           | Fault 8 Code               | Faults                     |
| 258           | Fault 8 Time               | Faults                     |
| 259           | Alarm Config 1             | Alarms                     |
| 261           | Alarm Clear                | Alarms                     |
| 262-269       | Alarm X Code               | Alarms                     |
| 270           | DPI Baud Rate              | Comm Control               |
| 271           | Drive Logic Rslt           | Comm Control               |
| 272           | Drive Ref Rslt             | Comm Control               |
| 273           | Drive Ramp Rslt            | Comm Control               |
| 274           | DPI Port Sel               | Comm Control               |
| 275           | DPI Port Value             | Comm Control               |
| 276           | Logic Mask                 | Masks & Owners<br>Security |
| 277           | Start Mask                 | Masks & Owners             |
| 278           | Jog Mask                   | Masks & Owners             |
| 279           | Direction Mask             | Masks & Owners             |
| 280           | Reference Mask             | Masks & Owners             |
| 281           | Accel Mask                 | Masks & Owners             |
| 282           | Decel Mask                 | Masks & Owners             |
| 283           | Fault Clr Mask             | Masks & Owners             |
| 284           | MOP Mask                   | Masks & Owners             |
| 285           | Local Mask                 | Masks & Owners             |
| 288           | Stop Owner                 | Masks & Owners             |
| 289           | Start Owner                | Masks & Owners             |
| 290           | Jog Owner                  | Masks & Owners             |
| 291           | Direction Owner            | Masks & Owners             |
| 292           | Reference Owner            | Masks & Owners             |
| 293           | Accel Owner                | Masks & Owners             |
| 294           | Decel Owner                | Masks & Owners             |
| 295           | Fault Clr Owner            | Masks & Owners             |
| 296           | MOP Owner                  | Masks & Owners             |
| 297           | Local Owner                | Masks & Owners             |
| 298           | DPI Ref Select             | Comm Control               |
| 299           | DPI Fdbk Select            | Comm Control               |
| 300-307       | Data In XX                 | Datalinks                  |
| 308           | HighRes Ref <sup>6,x</sup> | Datalinks                  |
| 310-317       | Data Out XX                | Datalinks                  |
| 320           | Anlg In Config             | Analog Inputs              |
| 321           | Anlg In Sqr Root           | Analog Inputs              |
| 322, 325      | Analog In X Hi             | Analog Inputs              |
| 323, 326      | Analog In X Lo             | Analog Inputs              |
| 324, 327      | Analog In X Loss           | Analog Inputs              |
| 340           | Anlg Out Config            | Analog Outputs             |
| 341           | Anlg Out Absolut           | Analog Outputs             |
| 342, 345      | Analog OutX Sel            | Analog Outputs             |
| 343, 346      | Analog OutX Hi             | Analog Outputs             |
| 344, 347      | Analog OutX Lo             | Analog Outputs             |
| 354, 355      | Anlg OutX Scale            | Analog Outputs             |
| 361-366       | Digital InX Sel            | Digital Inputs             |
| 377, 378      | Anlg OutX Setpt            | Analog Outputs             |
| 379           | Dig Out Setpt              | Digital Outputs            |
| 380, 384, 388 | Digital OutX Sel           | Digital Outputs            |

| Number        | Parameter Name                 | Group           |
|---------------|--------------------------------|-----------------|
| 381, 385, 389 | Dig OutX Level                 | Digital Outputs |
| 382, 386, 390 | Dig OutX OnTime                | Digital Outputs |
| 383, 387, 391 | Dig OutX OffTime               | Digital Outputs |
| 392           | Dig Out Invert                 | Digital Outputs |
| 393           | Dig Out Param                  | Digital Outputs |
| 394           | Dig Out Mask                   | Digital Outputs |
| 411           | DigIn DataLogic <sup>6.x</sup> | Digital Inputs  |
| 412           | Motor Fdbk Type                | Speed Feedback  |
| 413           | Encoder PPR                    | Speed Feedback  |
| 414           | Enc Position Fdbk              | Speed Feedback  |
| 415           | Encoder Speed                  | Speed Feedback  |
| 416           | Fdbk Filter Sel                | Speed Feedback  |
| 419           | Notch Filter Freq**            | Speed Feedback  |
| 420           | Notch Filter K**               | Speed Feedback  |
| 421           | Marker Pulse                   | Speed Feedback  |
| 422           | Pulse In Scale                 | Speed Feedback  |
| 423           | Encoder Z Chan                 | Speed Feedback  |
| 427, 431      | Torque Ref X Sel**             | Torq Attributes |
| 428, 432      | Torque Ref X Hi**              | Torq Attributes |
| 429, 433      | Torque Ref X Lo**              | Torq Attributes |
| 430           | Torq Ref A Div**               | Torq Attributes |
| 434           | Torque Ref B Mult**            | Torq Attributes |
| 435           | Torque Setpoint**              | Torq Attributes |
| 436           | Pos Torque Limit**             | Torq Attributes |
| 437           | Neg Torque Limit**             | Torq Attributes |
| 438           | Torque Setpoint2**             | Torq Attributes |
| 440           | Control Status**               | Torq Attributes |
| 441           | Mtr Tor Cur Ref**              | Torq Attributes |
| 445           | Ki Speed Loop**                | Speed Regulator |
| 446           | Kp Speed Loop**                | Speed Regulator |
| 447           | Kf Speed Loop**                | Speed Regulator |
| 448           | Spd Err Filt BW <sup>6.x</sup> | Speed Regulator |
| 449           | Speed Desired BW**             | Speed Regulator |
| 450           | Total Inertia**                | Speed Regulator |
| 451           | Speed Loop Meter**             | Speed Regulator |
| 454           | Rev Speed Limit**              | Speed Regulator |
| 459           | PI Deriv Time                  | Process PI      |
| 460           | PI Reference Hi                | Process PI      |
| 461           | PI Reference Lo                | Process PI      |
| 462           | PI Feedback Hi                 | Process PI      |
| 463           | PI Feedback Lo                 | Process PI      |
| 464           | PI Output Gain                 | Process PI      |
| 476-494       | ScaleX In Value                | Scaled Blocks   |
| 477-495       | ScaleX In Hi                   | Scaled Blocks   |
| 478-496       | ScaleX In Lo                   | Scaled Blocks   |
| 479-497       | ScaleX Out Hi                  | Scaled Blocks   |
| 480-498       | ScaleX Out Lo                  | Scaled Blocks   |
| 481-499       | ScaleX Out Value               | Scaled Blocks   |
| 595           | Port Mask Act                  | Security        |
| 596           | Write Mask Cfg                 | Security        |
| 597           | Write Mask Act                 | Security        |
| 598           | Logic Mask Act                 | Security        |
| 600           | TorqProve Cnfg                 | Torq Proving    |
| 601           | TorqProve Setup                | Torq Proving    |
| 602           | Spd Dev Band                   | Torq Proving    |
| 603           | SpdBand Integrat               | Torq Proving    |
| 604           | Brk Release Time               | Torq Proving    |
| 605           | ZeroSpdFloatTime               | Torq Proving    |
| 606           | Float Tolerance                | Torq Proving    |
| 607           | Brk Set Time                   | Torq Proving    |

| Number  | Parameter Name                 | Group            |
|---------|--------------------------------|------------------|
| 608     | TorqLim SlewRate               | Torq Proving     |
| 609     | BrkSlip Count                  | Torq Proving     |
| 610     | Brk Alarm Travel               | Torq Proving     |
| 611     | MicroPos Scale%                | Torq Proving     |
| 612     | TorqProve Status               | Torq Proving     |
| 613     | Brake Test Torq <sup>6.x</sup> | Torq Proving     |
| 631     | Rod Load Torque                | Oil Well Pump    |
| 632     | TorqAlarm Level                | Oil Well Pump    |
| 633     | TorqAlarm Action               | Oil Well Pump    |
| 634     | TorqAlarm Dwell                | Oil Well Pump    |
| 635     | TorqAlrm Timeout               | Oil Well Pump    |
| 636     | TorqAlrm TO Act                | Oil Well Pump    |
| 637     | PCP Pump Sheave                | Oil Well Pump    |
| 638     | Max Rod Torque                 | Oil Well Pump    |
| 639     | Min Rod Speed                  | Oil Well Pump    |
| 640     | Max Rod Speed                  | Oil Well Pump    |
| 641     | OilWell Pump Sel               | Oil Well Pump    |
| 642     | Gearbox Rating                 | Oil Well Pump    |
| 643     | Gearbox Sheave                 | Oil Well Pump    |
| 644     | Gearbox Ratio                  | Oil Well Pump    |
| 645     | Motor Sheave                   | Oil Well Pump    |
| 646     | Total Gear Ratio               | Oil Well Pump    |
| 647     | DB Resistor                    | Oil Well Pump    |
| 648     | Gearbox Limit                  | Oil Well Pump    |
| 650     | Adj Volt Phase                 | Adjust Voltage   |
| 651     | Adj Volt Select                | Adjust Voltage   |
| 652     | Adj Volt Ref Hi                | Adjust Voltage   |
| 653     | Adj Volt Ref Lo                | Adjust Voltage   |
| 654-660 | Adj Volt Preset1-7             | Adjust Voltage   |
| 661     | Min Adj Voltage                | Adjust Voltage   |
| 662     | Adj Volt Command               | Adjust Voltage   |
| 663     | MOP Adj VoltRate               | Adjust Voltage   |
| 669     | Adj Volt TrimSel               | Adjust Voltage   |
| 670     | Adj Volt Trim Hi               | Adjust Voltage   |
| 671     | Adj Volt Trim Lo               | Adjust Voltage   |
| 672     | Adj Volt Trim %                | Adjust Voltage   |
| 675     | Adj Volt AccTime               | Adjust Voltage   |
| 676     | Adj Volt DecTime               | Adjust Voltage   |
| 677     | Adj Volt S Curve               | Adjust Voltage   |
| 700     | Pos/Spd Prof Sts               | ProfSetup/Status |
| 701     | Units Traveled                 | ProfSetup/Status |
| 702     | Home Position <sup>6.x</sup>   | ProfSetup/Status |
| 705     | Pos/Spd Prof Cmd               | ProfSetup/Status |
| 707     | Encoder Pos Tol                | ProfSetup/Status |
| 708     | Counts Per Unit                | ProfSetup/Status |
| 711     | Vel Override                   | ProfSetup/Status |
| 713     | Find Home Speed                | ProfSetup/Status |
| 714     | Find Home Ramp                 | ProfSetup/Status |
| 718     | Pos Reg Filter                 | ProfSetup/Status |
| 719     | Pos Reg Gain                   | ProfSetup/Status |
| 720...  | Step x Type                    | Profile Setup    |
| 721...  | Step x Velocity                | Profile Setup    |
| 722...  | Step x AccelTime               | Profile Setup    |
| 723...  | Step x DecelTime               | Profile Setup    |
| 724...  | Step x Value                   | Profile Setup    |
| 725...  | Step x Dwell                   | Profile Setup    |
| 726...  | Step x Batch                   | Profile Setup    |
| 727...  | Step x Next                    | Profile Setup    |

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

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

<sup>6.x</sup> Firmware 6.002 and later.

## Parameter List – Standard Control Option (v3.xxx)

| Number | Parameter Name   | Group             |
|--------|------------------|-------------------|
| 1      | Output Freq      | Metering          |
| 2      | Commanded Freq   | Metering          |
|        | Commanded Speed  | Metering          |
| 3      | Output Current   | Metering          |
| 4      | Torque Current   | Metering          |
| 5      | Flux Current     | Metering          |
| 6      | Output Voltage   | Metering          |
| 7      | Output Power     | Metering          |
| 8      | Output Pwr Fctr  | Metering          |
| 9      | Elapsed MWh      | Metering          |
| 10     | Elapsed Run Time | Metering          |
| 11     | MOP Frequency    | Metering          |
|        | MOP Reference    | Metering          |
| 12     | DC Bus Voltage   | Metering          |
| 014    | Elapsed kWh      | Metering          |
| 13     | DC Bus Memory    | Metering          |
| 16     | Analog In1 Value | Metering          |
| 17     | Analog In2 Value | Metering          |
| 22     | Ramped Speed     | Metering          |
| 23     | Speed Reference  | Metering          |
| 24     | Commanded Torque | Metering          |
| 25     | Speed Feedback   | Metering          |
| 26     | Rated kW         | Drive Data        |
| 27     | Rated Volts      | Drive Data        |
| 28     | Rated Amps       | Drive Data        |
| 29     | Control SW Ver   | Drive Data        |
| 40     | Motor Type       | Motor Data        |
| 41     | Motor NP Volts   | Motor Data        |
| 42     | Motor NP FLA     | Motor Data        |
| 43     | Motor NP Hertz   | Motor Data        |
| 44     | Motor NP RPM     | Motor Data        |
| 45     | Motor NP Power   | Motor Data        |
| 46     | Mtr NP Pwr Units | Motor Data        |
| 47     | Motor OL Hertz   | Motor Data        |
| 48     | Motor OL Factor  | Motor Data        |
| 49     | Motor Poles      | Motor Data        |
| 53     | Motor Cntl Sel   | Torq Attributes   |
|        | Torque Perf Mode | Torq Attributes   |
| 54     | Maximum Voltage  | Torq Attributes   |
| 55     | Maximum Freq     | Torq Attributes   |
| 56     | Compensation     | Torq Attributes   |
| 57     | Flux Up Mode     | Torq Attributes   |
| 58     | Flux Up Time     | Torq Attributes   |
| 59     | SV Boost Filter  | Torq Attributes   |
| 61     | Autotune         | Torq Attributes   |
| 62     | IR Voltage Drop  | Torq Attributes   |
| 63     | Flux Current Ref | Torq Attributes   |
| 64     | Ixo Voltage Drop | Torq Attributes   |
| 66     | Autotune Torque  | Torq Attributes   |
| 67     | Inertia Autotune | Torq Attributes   |
| 69     | Start/Acc Boost  | Volts per Hertz   |
| 70     | Run Boost        | Volts per Hertz   |
| 71     | Break Voltage    | Volts per Hertz   |
| 72     | Break Frequency  | Volts per Hertz   |
| 79     | Speed Units      | Spd Mode & Limits |

| Number   | Parameter Name     | Group             |
|----------|--------------------|-------------------|
| 80       | Feedback Select    | Spd Mode & Limits |
|          | Speed Mode         | Spd Mode & Limits |
| 81       | Minimum Speed      | Spd Mode & Limits |
| 82       | Maximum Speed      | Spd Mode & Limits |
| 83       | Overspeed Limit    | Spd Mode & Limits |
| 84-86    | Skip Frequency X   | Spd Mode & Limits |
| 87       | Skip Freq Band     | Spd Mode & Limits |
| 88       | Speed/Torque Mod   | Spd Mode & Limits |
| 90, 93   | Speed Ref X Sel    | Speed Reference   |
| 91, 94   | Speed Ref X Hi     | Speed Reference   |
| 92, 95   | Speed Ref X Lo     | Speed Reference   |
| 96       | TB Man Ref Sel     | Speed Reference   |
| 97       | TB Man Ref Hi      | Speed Reference   |
| 98       | TB Man Ref Lo      | Speed Reference   |
| 99       | Pulse Input Ref    | Speed Reference   |
| 100      | Jog Speed          | Discrete Speeds   |
|          | Jog Speed 1        | Discrete Speeds   |
| 101-107  | Preset Speed X     | Discrete Speeds   |
| 108      | Jog Speed 2        | Discrete Speeds   |
| 116      | Trim % Setpoint    | Speed Trim        |
| 117      | Trim In Select     | Speed Trim        |
| 118      | Trim Out Select    | Speed Trim        |
| 119      | Trim Hi            | Speed Trim        |
| 120      | Trim Lo            | Speed Trim        |
| 121      | Slip RPM @ FLA     | Slip Comp         |
| 122      | Slip Comp Gain     | Slip Comp         |
| 123      | Slip RPM Meter     | Slip Comp         |
| 124      | PI Configuration   | Process PI        |
| 125      | PI Control         | Process PI        |
| 126      | PI Reference Sel   | Process PI        |
| 127      | PI Setpoint        | Process PI        |
| 128      | PI Feedback Sel    | Process PI        |
| 129      | PI Integral Time   | Process PI        |
| 130      | PI Prop Gain       | Process PI        |
| 131      | PI Lower Limit     | Process PI        |
| 132      | PI Upper Limit     | Process PI        |
| 133      | PI Preload         | Process PI        |
| 134      | PI Status          | Process PI        |
| 135      | PI Ref Meter       | Process PI        |
| 136      | PI Fdbck Meter     | Process PI        |
| 137      | PI Error Meter     | Process PI        |
| 138      | PI Output Meter    | Process PI        |
| 139      | PI BW Filter       | Process PI        |
| 140, 141 | Accel Time X       | Ramp Rates        |
| 142, 143 | Decel Time X       | Ramp Rates        |
| 145      | DB While Stopped   | Stop/Brake Modes  |
| 146      | S Curve %          | Ramp Rates        |
| 147      | Current Lmt Sel    | Load Limits       |
| 148      | Current Lmt Val    | Load Limits       |
| 149      | Current Lmt Gain   | Load Limits       |
| 150      | Drive OL Mode      | Load Limits       |
| 151      | PWM Frequency      | Load Limits       |
| 152      | Droop RPM @ FLA    | Load Limits       |
| 153      | Regen Power Limit  | Load Limits       |
| 154      | Current Rate Limit | Load Limits       |

| Number   | Parameter Name    | Group            |
|----------|-------------------|------------------|
| 155, 156 | Stop Mode X       | Stop/Brake Modes |
|          | Stop/BRK Mode X   | Stop/Brake Modes |
| 157      | DC Brk Lvl Sel    | Stop/Brake Modes |
| 158      | DC Brake Level    | Stop/Brake Modes |
| 159      | DC Brake Time     | Stop/Brake Modes |
| 160      | Bus Reg Ki        | Stop/Brake Modes |
| 161, 162 | Bus Reg Mode X    | Stop/Brake Modes |
| 163      | DB Resistor Type  | Stop/Brake Modes |
| 164      | Bus Reg Kp        | Stop/Brake Modes |
| 165      | Bus Reg Kd        | Stop/Brake Modes |
| 166      | Flux Braking      | Stop/Brake Modes |
| 167      | Powerup Delay     | Restart Modes    |
| 168      | Start At PowerUp  | Restart Modes    |
| 169      | Flying Start En   | Restart Modes    |
| 170      | Flying StartGain  | Restart Modes    |
| 174      | Auto Rstrt Tries  | Restart Modes    |
| 175      | Auto Rstrt Delay  | Restart Modes    |
| 177      | Gnd Warn Level    | Power Loss       |
| 178      | Sleep-Wake Mode   | Restart Modes    |
| 179      | Sleep-Wake Ref    | Restart Modes    |
| 180      | Wake Level        | Restart Modes    |
| 181      | Wake Time         | Restart Modes    |
| 182      | Sleep Level       | Restart Modes    |
| 183      | Sleep Time        | Restart Modes    |
| 184      | Power Loss Mode   | Power Loss       |
| 185      | Power Loss Time   | Power Loss       |
| 186      | Power Loss Level  | Power Loss       |
| 187      | Load Loss Level   | Power Loss       |
| 188      | Load Loss Time    | Power Loss       |
| 189      | Shear Pin Time    | Power Loss       |
| 190      | Direction Mode    | Direction Config |
| 192      | Save HIM Ref      | HIM Ref Config   |
| 193      | Man Ref Preload   | HIM Ref Config   |
| 194      | Save MOP Ref      | MOP Config       |
| 195      | MOP Rate          | MOP Config       |
| 196      | Param Access Lvl  | Drive Memory     |
| 197      | Reset To Defaults | Drive Memory     |
| 198      | Load Frm Usr Set  | Drive Memory     |
| 199      | Save To User Set  | Drive Memory     |
| 200      | Reset Meters      | Drive Memory     |
| 201      | Language          | Drive Memory     |
| 202      | Voltage Class     | Drive Memory     |
| 203      | Drive Checksum    | Drive Memory     |
| 209, 210 | Drive Status X    | Diagnostics      |
| 211, 212 | Drive Alarm X     | Diagnostics      |
| 213      | Speed Ref Source  | Diagnostics      |
| 214      | Start Inhibits    | Diagnostics      |
| 215      | Last Stop Source  | Diagnostics      |
| 216      | Dig In Status     | Diagnostics      |
| 217      | Dig Out Status    | Diagnostics      |
| 218      | Drive Temp        | Diagnostics      |
| 219      | Drive OL Count    | Diagnostics      |
| 220      | Motor OL Count    | Diagnostics      |
| 224      | Fault Frequency   | Diagnostics      |
|          | Fault Speed       | Diagnostics      |
| 225      | Fault Amps        | Diagnostics      |
| 226      | Fault Bus Volts   | Diagnostics      |
| 227, 228 | Status X @ Fault  | Diagnostics      |
| 229, 230 | Alarm X @ Fault   | Diagnostics      |

| Number   | Parameter Name   | Group          |
|----------|------------------|----------------|
| 234, 236 | Testpoint X Sel  | Diagnostics    |
| 235, 237 | Testpoint X Data | Diagnostics    |
| 238      | Fault Config 1   | Faults         |
| 240      | Fault Clear      | Faults         |
| 241      | Fault Clear Mode | Faults         |
| 242      | Power Up Marker  | Faults         |
| 243      | Fault 1 Code     | Faults         |
| 244      | Fault 1 Time     | Faults         |
| 245      | Fault 2 Code     | Faults         |
| 246      | Fault 2 Time     | Faults         |
| 247      | Fault 3 Code     | Faults         |
| 248      | Fault 3 Time     | Faults         |
| 249      | Fault 4 Code     | Faults         |
| 250      | Fault 4 Time     | Faults         |
| 251      | Fault 5 Code     | Faults         |
| 252      | Fault 5 Time     | Faults         |
| 253      | Fault 6 Code     | Faults         |
| 254      | Fault 6 Time     | Faults         |
| 255      | Fault 7 Code     | Faults         |
| 256      | Fault 7 Time     | Faults         |
| 257      | Fault 8 Code     | Faults         |
| 258      | Fault 8 Time     | Faults         |
| 259      | Alarm Config 1   | Alarms         |
| 261      | Alarm Clear      | Alarms         |
| 262-269  | Alarm X Code     | Alarms         |
| 270      | DPI Baud Rate    | Comm Control   |
|          | DPI Data Rate    | Comm Control   |
| 271      | Drive Logic Rslt | Comm Control   |
| 272      | Drive Ref Rslt   | Comm Control   |
| 273      | Drive Ramp Rslt  | Comm Control   |
| 274      | DPI Port Sel     | Comm Control   |
| 275      | DPI Port Value   | Comm Control   |
| 276      | Logic Mask       | Masks & Owners |
| 277      | Start Mask       | Masks & Owners |
| 278      | Jog Mask         | Masks & Owners |
| 279      | Direction Mask   | Masks & Owners |
| 280      | Reference Mask   | Masks & Owners |
| 281      | Accel Mask       | Masks & Owners |
| 282      | Decel Mask       | Masks & Owners |
| 283      | Fault Clr Mask   | Masks & Owners |
| 284      | MOP Mask         | Masks & Owners |
| 285      | Local Mask       | Masks & Owners |
| 288      | Stop Owner       | Masks & Owners |
| 289      | Start Owner      | Masks & Owners |
| 290      | Jog Owner        | Masks & Owners |
| 291      | Direction Owner  | Masks & Owners |
| 292      | Reference Owner  | Masks & Owners |
| 293      | Accel Owner      | Masks & Owners |
| 294      | Decel Owner      | Masks & Owners |
| 295      | Fault Clr Owner  | Masks & Owners |
| 296      | MOP Owner        | Masks & Owners |
| 297      | Local Owner      | Masks & Owners |
| 298      | DPI Ref Select   | Comm Control   |
| 299      | DPI Fdbk Select  | Comm Control   |
| 300-307  | Data In XX       | Datalinks      |
| 310-317  | Data Out XX      | Datalinks      |
| 320      | Anlg In Config   | Analog Inputs  |
| 321      | Anlg In Sqr Root | Analog Inputs  |
| 322, 325 | Analog In X Hi   | Analog Inputs  |

| Number        | Parameter Name    | Group           |
|---------------|-------------------|-----------------|
| 323, 326      | Analog In X Lo    | Analog Inputs   |
| 324, 327      | Analog In X Loss  | Analog Inputs   |
| 340           | Anlg Out Config   | Analog Outputs  |
| 341           | Anlg Out Absolut  | Analog Outputs  |
| 342, 345      | Analog OutX Sel   | Analog Outputs  |
| 343, 346      | Analog OutX Hi    | Analog Outputs  |
| 344, 347      | Analog OutX Lo    | Analog Outputs  |
| 354, 355      | Anlg OutX Scale   | Analog Outputs  |
| 361-366       | Digital InX Sel   | Digital Inputs  |
| 377, 378      | Anlg OutX Setpt   | Analog Outputs  |
| 379           | Dig Out Setpt     | Digital Outputs |
| 380, 384, 388 | Digital OutX Sel  | Digital Outputs |
| 381, 385, 389 | Dig OutX Level    | Digital Outputs |
| 382, 386, 390 | Dig OutX OnTime   | Digital Outputs |
| 383, 387, 391 | Dig OutX OffTime  | Digital Outputs |
| 412           | Motor Fdbk Type   | Speed Feedback  |
| 413           | Encoder PPR       | Speed Feedback  |
| 414           | Enc Position Fdbk | Speed Feedback  |
| 415           | Encoder Speed     | Speed Feedback  |
| 416           | Fdbk Filter Sel   | Speed Feedback  |
| 419           | Notch Filter Freq | Speed Feedback  |
| 420           | Notch Filter K    | Speed Feedback  |
| 421           | Marker Pulse      | Speed Feedback  |
| 422           | Pulse In Scale    | Speed Feedback  |
| 423           | Encoder Z Chan    | Speed Feedback  |
| 427, 431      | Torque Ref X Sel  | Torq Attributes |
| 428, 432      | Torque Ref X Hi   | Torq Attributes |
| 429, 433      | Torque Ref X Lo   | Torq Attributes |
| 430           | Torq Ref A Div    | Torq Attributes |
| 434           | Torque Ref B Mult | Torq Attributes |
| 435           | Torque Setpoint   | Torq Attributes |
| 436           | Pos Torque Limit  | Torq Attributes |
| 437           | Neg Torque Limit  | Torq Attributes |
| 438           | Torque Setpoint2  | Torq Attributes |
| 440           | Control Status    | Torq Attributes |
| 441           | Mtr Tor Cur Ref   | Torq Attributes |
| 445           | Ki Speed Loop     | Speed Regulator |
| 446           | Kp Speed Loop     | Speed Regulator |

| Number  | Parameter Name   | Group           |
|---------|------------------|-----------------|
| 447     | Kf Speed Loop    | Speed Regulator |
| 449     | Speed Desired BW | Speed Regulator |
| 450     | Total Inertia    | Speed Regulator |
| 451     | Speed Loop Meter | Speed Regulator |
| 454     | Rev Speed Limit  | Speed Regulator |
| 459     | PI Deriv Time    | Process PI      |
| 460     | PI Reference Hi  | Process PI      |
| 461     | PI Reference Lo  | Process PI      |
| 462     | PI Feedback Hi   | Process PI      |
| 463     | PI Feedback Lo   | Process PI      |
| 476-494 | ScaleX In Value  | Scaled Blocks   |
| 477-495 | ScaleX In Hi     | Scaled Blocks   |
| 478-496 | ScaleX In Lo     | Scaled Blocks   |
| 479-497 | ScaleX Out Hi    | Scaled Blocks   |
| 480-498 | ScaleX Out Lo    | Scaled Blocks   |
| 481-499 | ScaleX Out Value | Scaled Blocks   |
| 600     | TorqProve Cnfg   | Torq Proving    |
| 601     | TorqProve Setup  | Torq Proving    |
| 602     | Spd Dev Band     | Torq Proving    |
| 603     | SpdBand Integrat | Torq Proving    |
| 604     | Brk Release Time | Torq Proving    |
| 605     | ZeroSpdFloatTime | Torq Proving    |
| 606     | Float Tolerance  | Torq Proving    |
| 607     | Brk Set Time     | Torq Proving    |
| 608     | TorqLim SlewRate | Torq Proving    |
| 609     | BrkSlip Count    | Torq Proving    |
| 610     | Brk Alarm Travel | Torq Proving    |
| 611     | MicroPos Scale%  | Torq Proving    |



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