## Catalog Number Explanation

| 1-3 | 4 | 5 | 6-8 | 9 | 10 | 11 | 12 (1) | 13-14 |
|---|---|---|---|---|---|---|---|---|
| **22B** | **-** | **A** | **1P5** | **N** | **1** | **1** | **4** | **AA** |
| Drive | Dash | Voltage Rating | Rating | Enclosure | HIM | Emission Class | Type | Optional |

| Code | |
|---|---|
| 22B | PowerFlex 40 |

| Code | Version |
|---|---|
| 3 | No Brake IGBT |
| 4 | Standard |

| Code | Rating |
|---|---|
| 0 | Not Filtered |
| 1 | Filtered |

| Code | Voltage | Ph. |
|---|---|---|
| V | 120V AC | 1 |
| A | 240V AC | 1 |
| B | 240V AC | 3 |
| D | 480V AC | 3 |
| E | 600V AC | 3 |

| Code | Interface Module |
|---|---|
| 1 | Fixed Keypad |

| Code | Purpose |
|---|---|
| AA thru ZZ | Reserved for custom firmware |

| Code | Enclosure |
|---|---|
| N | Panel Mount - IP 20 (NEMA Type Open) |
| F | Flange Mount - IP 20 (NEMA Type Open) |
| H | Replacement Plate Drive - IP 20 (NEMA Type Open) *- Contact factory for ordering information.* |

Output Current @ 100-120V Input

| Code | Amps | kW (HP) |
|---|---|---|
| 2P3 | 2.3 | 0.4 (0.5) |
| 5P0 | 5.0 | 0.75 (1.0) |
| 6P0 | 6.0 | 1.1 (1.5) |

Output Current @ 200-240V Input

| Code | Amps | kW (HP) |
|---|---|---|
| 2P3 | 2.3 | 0.4 (0.5) |
| 5P0 | 5.0 | 0.75 (1.0) |
| 8P0 | 8.0 | 1.5 (2.0) |
| 012 | 12 | 2.2 (3.0) |
| 017 | 17.5 | 3.7 (5.0) |
| 024 | 24 | 5.5 (7.5) |
| 033 | 33 | 7.5 (10) |

Output Current @ 380-480V Input

| Code | Amps | kW (HP) |
|---|---|---|
| 1P4 | 1.4 | 0.4 (0.5) |
| 2P3 | 2.3 | 0.75 (1.0) |
| 4P0 | 4.0 | 1.5 (2.0) |
| 6P0 | 6.0 | 2.2 (3.0) |
| 010 | 10.5 | 4.0 (5.0) |
| 012 | 12 | 5.5 (7.5) |
| 017 | 17 | 7.5 (10) |
| 024 | 24 | 11 (15) |

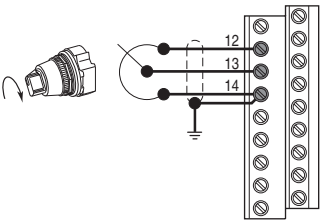
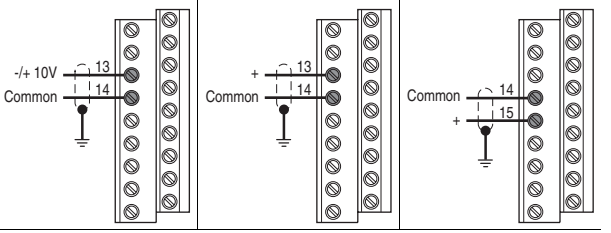
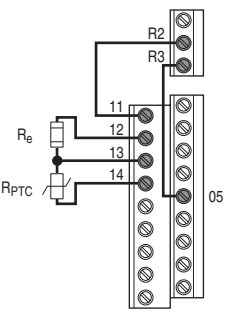
Output Current @ 500-600V Input

| Code | Amps | kW (HP) |
|---|---|---|
| 1P7 | 1.7 | 0.75 (1.0) |
| 3P0 | 3.0 | 1.5 (2.0) |
| 4P2 | 4.2 | 2.2 (3.0) |
| 6P6 | 6.6 | 4.0 (5.0) |
| 9P9 | 9.9 | 5.5 (7.5) |
| 012 | 12.2 | 7.5 (10) |
| 019 | 19 | 11 (15) |

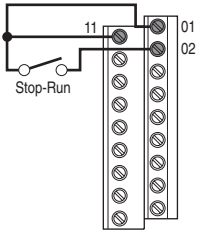
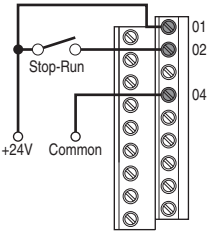
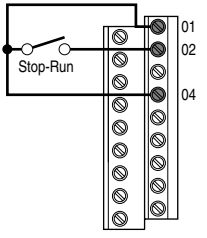
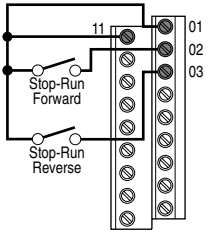
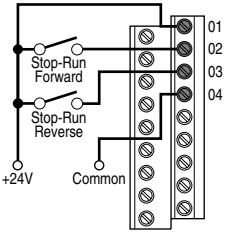
(1) Position 12 of the Catalog Number now indicates drive type. All PowerFlex 40 drives are equipped with RS485 communication.

Additional accessories, options and adapters are available. See Appendix B for details.

## I/O Wiring Examples

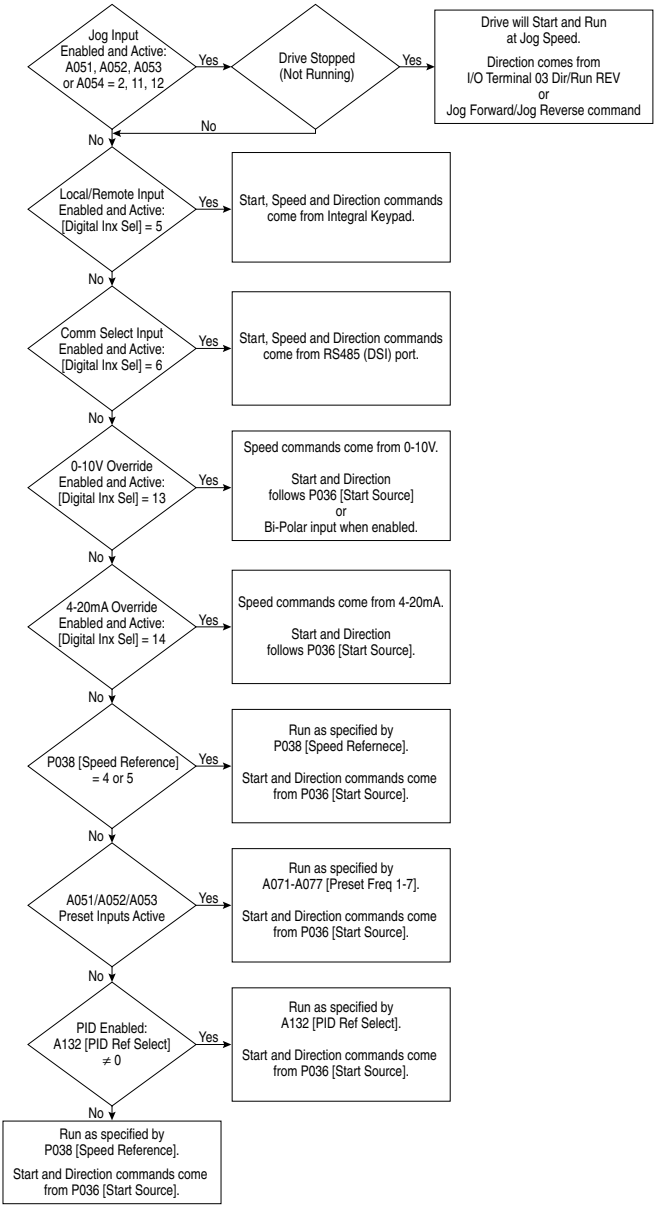
<table>
<tr><th>Input/Output</th><th colspan="3">Connection Example</th></tr>
<tr><td>Potentiometer<br>1-10k Ohm Pot. Recommended<br>(2 Watt minimum)</td><td colspan="3">P038 [Speed Reference] = 2 “0-10V Input”<br>
</td></tr>
<tr><td rowspan="2">Analog Input<br>0 to +10V, 100k ohm impedance<br>4-20 mA, 250 ohm impedance</td><td>Bipolar<br>P038 [Speed Reference] = 2 “0-10V Input” and A123 [10V Bipolar Enbl] = 1 “Bi-Polar In”</td><td>Unipolar (Voltage)<br>P038 [Speed Reference] = 2 “0-10V Input”</td><td>Unipolar (Current)<br>P038 [Speed Reference] = 3 “4-20mA Input”</td></tr>
<tr><td>
</td></tr>
<tr><td>Analog Input, PTC<br>For Drive Fault</td><td colspan="3">Wire the PTC and External Resistor (typically matched to the PTC Hot Resistance) to I/O Terminals 12, 13, 14.<br>Wire R2/R3 Relay Output (SRC) to I/O Terminals 5 & 11.<br>A051 [Digital In1 Sel] = 3 “Aux Fault”<br>A055 [Relay Out Sel] = 10 “Above Anlg V”<br>A056 [Relay Out Level] = % Voltage Trip<br>

$$V_{Trip} = \frac{R_{PTC\ (hot)}}{R_{PTC\ (hot)} + R_e} \times 100$$</td></tr>
</table>

<table>
<tr><th>Input/Output</th><th colspan="2">Connection Example</th></tr>
<tr><td rowspan="2">2 Wire SRC Control - Non-Reversing<br>P036 [Start Source] = 2, 3 or 4<br>Input must be active for the drive to run. When input is opened, the drive will stop as specified by P037 [Stop Mode].<br>If desired, a User Supplied 24V DC power source can be used. Refer to the “External Supply (SRC)” example.</td><td>Internal Supply (SRC)<br>
</td><td>External Supply (SRC)<br>
<br>Each digital input draws 6 mA.</td></tr>
<tr><td colspan="2">2 Wire SNK Control - Non-Reversing</td></tr>
<tr><td></td><td colspan="2">Internal Supply (SNK)<br>
</td></tr>
<tr><td rowspan="2">2 Wire SRC Control - Run FWD/Run REV<br>P036 [Start Source] = 2, 3 or 4<br>Input must be active for the drive to run. When input is opened, the drive will stop as specified by P037 [Stop Mode].<br>If both Run Forward and Run Reverse inputs are closed at the same time, an undetermined state could occur.</td><td>Internal Supply (SRC)<br>
</td><td>External Supply (SRC)<br>
<br>Each digital input draws 6 mA.</td></tr>
</table>

## Start and Speed Reference Control

The drive speed command can be obtained from a number of different sources. The source is normally determined by P038 [Speed Reference]. However, when A051 - A054 [Digital Inx Sel] is set to option 2, 4, 5, 6, 11, 12, 13, 14, 15 and the digital input is active, or if A132 is not set to option 0, the speed reference commanded by P038 [Speed Reference] will be overridden. See the chart below for the override priority.



## Basic Program Group

### P031 [Motor NP Volts]

Related Parameter(s): d004, A084, A085, A086, A087

Stop drive before changing this parameter.

Set to the motor nameplate rated volts.

| | | |
|---|---|---|
| **Values** | Default: | Based on Drive Rating |
| | Min/Max: | 20/Drive Rated Volts |
| | Display: | 1 VAC |

### P032 [Motor NP Hertz]

Related Parameter(s): A084, A085, A086, A087, A090

Stop drive before changing this parameter.

Set to the motor nameplate rated frequency.

| | | |
|---|---|---|
| **Values** | Default: | 60 Hz |
| | Min/Max: | 15/400 Hz |
| | Display: | 1 Hz |

### P033 [Motor OL Current]

Related Parameter(s): A055, A058, A061, A089, A090, A098, A114, A118

Set to the maximum allowable motor current.

The drive will fault on an F7 Motor Overload if the value of this parameter is exceeded by 150% for 60 seconds.

| | | |
|---|---|---|
| **Values** | Default: | Based on Drive Rating |
| | Min/Max: | 0.0/(Drive Rated Amps × 2) |
| | Display: | 0.1 Amps |

### P034 [Minimum Freq]

Related Parameter(s): d001, d002, d013, P035, A085, A086, A087, A110, A112

Sets the lowest frequency the drive will output continuously.

| | | |
|---|---|---|
| **Values** | Default: | 0.0 Hz |
| | Min/Max: | 0.0/400.0 Hz |
| | Display: | 0.1 Hz |

### P035 [Maximum Freq]

Related Parameter(s): d001, d002, d013, P034, A065, A078, A085, A086, A087, A111, A113

Stop drive before changing this parameter.

Sets the highest frequency the drive will output.

| | | |
|---|---|---|
| **Values** | Default: | 60 Hz |
| | Min/Max: | 0/400 Hz |
| | Display: | 1 Hz |

## Basic Program Group *(continued)*

### P036 [Start Source]

Related Parameter(s): d012, P037

Stop drive before changing this parameter.

Sets the control scheme used to start the drive.

Refer to Start and Speed Reference Control on page 1-21 for details about how other drive settings can override the setting of this parameter.

**Important:** For all settings except option 3, the drive must receive a leading edge from the start input for the drive to start after a stop input, loss of power or fault condition.

| | | | |
|---|---|---|---|
| **Options** | **0** | "Keypad" (Default) | • Integral keypad controls drive operation.<br>• I/O Terminal 1 "Stop" = coast to stop.<br>• When active, the Reverse key is also active unless disabled by A095 [Reverse Disable]. |
| | **1** | "3-Wire" | I/O Terminal 1 "Stop" = stop according to the value set in P037 [Stop Mode]. |
| | **2** | "2-Wire" | I/O Terminal 1 "Stop" = coast to stop. |
| | **3** | "2-W Lvl Sens" | Drive will restart after a "Stop" command when:<br>• Stop is removed<br>and<br>• Start is held active |

**ATTENTION:** Hazard of injury exists due to unintended operation. When P036 [Start Source] is set to option 3, and the Run input is maintained, the Run inputs do not need to be toggled after a Stop input for the drive to run again. A Stop function is provided only when the Stop input is active (open).

| | | |
|---|---|---|
| **4** | "2-W Hi Speed" | **Important:** There is greater potential voltage on the output terminals when using this option.<br>• Outputs are kept in a ready-to-run state. The drive will respond to a "Start" command within 10 ms.<br>• I/O Terminal 1 "Stop" = coast to stop. |
| **5** | "Comm Port" | • Remote communications. Refer to Appendix C for details.<br>• I/O Terminal 1 "Stop" = coast to stop. |
| **6** | "Momt FWD/REV" | • Drive will start after a momentary input from either the Run FWD Input (I/O Terminal 02) or the Run REV Input (I/O Terminal 03).<br>• I/O Terminal 1 "Stop" = stop according to the value set in P037 [Stop Mode]. |

## Fault Descriptions

**Table 4.A Fault Types, Descriptions and Actions**

| No. | Fault | Type[1] | Description | Action |
|---|---|---|---|---|
| F2 | Auxiliary Input | ① | Auxiliary input interlock is open. | 1. Check remote wiring.<br>2. Verify communications programming for intentional fault. |
| F3 | Power Loss | ② | DC bus voltage remained below 85% of nominal. | 1. Monitor the incoming AC line for low voltage or line power interruption.<br>2. Check input fuses. |
| F4 | UnderVoltage | ① | DC bus voltage fell below the minimum value. | Monitor the incoming AC line for low voltage or line power interruption. |
| F5 | OverVoltage | 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. |
| F6 | Motor Stalled | ① | Drive is unable to accelerate motor. | Increase P039 - A067 [Accel Time x] or reduce load so drive output current does not exceed the current set by parameter A089 [Current Limit 1]. |
| F7 | Motor Overload | ① | Internal electronic overload trip. | 1. An excessive motor load exists. Reduce load so drive output current does not exceed the current set by parameter P033 [Motor OL Current].<br>2. Verify A084 [Boost Select] setting |
| F8 | Heatsink OvrTmp | ① | Heatsink temperature exceeds a predefined value. | 1. Check for blocked or dirty heat sink fins. Verify that ambient temperature has not exceeded 40°C (104°F) for IP 30/NEMA 1/UL Type 1 installations or 50°C (122°F) for IP20/Open type installations.<br>2. Check fan. |
| F12 | HW OverCurrent | ② | The drive output current has exceeded the hardware current limit. | Check programming. Check for excess load, improper A084 [Boost Select] setting, DC brake volts set too high or other causes of excess current. |
| F13 | Ground Fault | ② | A current path to earth ground has been detected at one or more of the drive output terminals. | Check the motor and external wiring to the drive output terminals for a grounded condition. |
| F29 | Analog Input Loss | ① | An analog input is configured to fault on signal loss. A signal loss has occurred.<br>Configure with A122 [Analog In Loss]. | 1. Check parameters.<br>2. Check for broken/loose connections at inputs. |

(1) See page 4-1 for a description of fault types.

# Specifications

**Drive Ratings**

| Catalog Number | Output Ratings | | Input Ratings | | | Branch Circuit Protection | | |
|---|---|---|---|---|---|---|---|---|
| | *kW (HP)* | *Amps* | *Voltage Range* | *kVA* | *Amps* | *Fuses* | *140M Motor Protectors*[2] | *Contactors* |
| **100 - 120V AC (±10%) – 1-Phase Input, 0 - 230V 3-Phase Output** | | | | | | | | |
| 22B-V2P3N104 | 0.4 (0.5) | 2.3 | 90-132 | 1.15 | 9.0 | 15 | 140M-C2E-C16 | 100-C12 |
| 22B-V5P0N104 | 0.75 (1.0) | 5.0 | 90-132 | 2.45 | 20.3 | 35 | 140M-D8E-C20 | 100-C23 |
| 22B-V6P0N104 | 1.1 (1.5) | 6.0 | 90-132 | 3.0 | 24.0 | 40 | 140M-F8E-C32 | 100-C37 |
| **200 - 240V AC (±10%) – 1-Phase[1] Input, 0 - 230V 3-Phase Output** | | | | | | | | |
| 22B-A2P3N104 | 0.4 (0.5) | 2.3 | 180-264 | 1.15 | 6.0 | 10 | 140M-C2E-B63 | 100-C09 |
| 22B-A5P0N104 | 0.75 (1.0) | 5.0 | 180-264 | 2.45 | 12.0 | 20 | 140M-C2E-C16 | 100-C12 |
| 22B-A8P0N104 | 1.5 (2.0) | 8.0 | 180-264 | 4.0 | 18.0 | 30 | 140M-D8E-C20 | 100-C23 |
| 22B-A012N104 | 2.2 (3.0) | 12.0 | 180-264 | 5.5 | 25.0 | 40 | 140M-F8E-C32 | 100-C37 |
| **200 - 240V AC (±10%) – 3-Phase Input, 0 - 230V 3-Phase Output** | | | | | | | | |
| 22B-B2P3N104 | 0.4 (0.5) | 2.3 | 180-264 | 1.15 | 2.5 | 6 | 140M-C2E-B40 | 100-C07 |
| 22B-B5P0N104 | 0.75 (1.0) | 5.0 | 180-264 | 2.45 | 5.7 | 10 | 140M-C2E-C10 | 100-C09 |
| 22B-B8P0N104 | 1.5 (2.0) | 8.0 | 180-264 | 4.0 | 9.5 | 15 | 140M-C2E-C16 | 100-C12 |
| 22B-B012N104 | 2.2 (3.0) | 12.0 | 180-264 | 5.5 | 15.5 | 25 | 140M-C2E-C16 | 100-C23 |
| 22B-B017N104 | 3.7 (5.0) | 17.5 | 180-264 | 8.6 | 21.0 | 30 | 140M-F8E-C25 | 100-C23 |
| 22B-B024N104 | 5.5 (7.5) | 24.0 | 180-264 | 11.8 | 26.1 | 40 | 140M-F8E-C32 | 100-C37 |
| 22B-B033N104 | 7.5 (10.0) | 33.0 | 180-264 | 16.3 | 34.6 | 60 | 140M-G8E-C45 | 100-C60 |
| **380 - 480V AC (±10%) – 3-Phase Input, 0 - 460V 3-Phase Output** | | | | | | | | |
| 22B-D1P4N104 | 0.4 (0.5) | 1.4 | 342-528 | 1.4 | 1.8 | 3 | 140M-C2E-B25 | 100-C07 |
| 22B-D2P3N104 | 0.75 (1.0) | 2.3 | 342-528 | 2.3 | 3.2 | 6 | 140M-C2E-B40 | 100-C07 |
| 22B-D4P0N104 | 1.5 (2.0) | 4.0 | 342-528 | 4.0 | 5.7 | 10 | 140M-C2E-B63 | 100-C09 |
| 22B-D6P0N104 | 2.2 (3.0) | 6.0 | 342-528 | 5.9 | 7.5 | 15 | 140M-C2E-C10 | 100-C09 |
| 22B-D010N104 | 4.0 (5.0) | 10.5 | 342-528 | 10.3 | 13.0 | 20 | 140M-C2E-C16 | 100-C23 |
| 22B-D012N104 | 5.5 (7.5) | 12.0 | 342-528 | 11.8 | 14.2 | 25 | 140M-D8E-C20 | 100-C23 |
| 22B-D017N104 | 7.5 (10.0) | 17.0 | 342-528 | 16.8 | 18.4 | 30 | 140M-D8E-C20 | 100-C23 |
| 22B-D024N104 | 11.0 (15.0) | 24.0 | 342-528 | 23.4 | 26.0 | 50 | 140M-F8E-C32 | 100-C43 |
| **460 - 600V AC (±10%) – 3-Phase Input, 0 - 575V 3-Phase Output** | | | | | | | | |
| 22B-E1P7N104 | 0.75 (1.0) | 1.7 | 414-660 | 2.1 | 2.3 | 6 | 140M-C2E-B25 | 100-C09 |
| 22B-E3P0N104 | 1.5 (2.0) | 3.0 | 414-660 | 3.65 | 3.8 | 6 | 140M-C2E-B40 | 100-C09 |
| 22B-E4P2N104 | 2.2 (3.0) | 4.2 | 414-660 | 5.2 | 5.3 | 10 | 140M-C2E-B63 | 100-C09 |
| 22B-E6P6N104 | 4.0 (5.0) | 6.6 | 414-660 | 8.1 | 8.3 | 15 | 140M-C2E-C10 | 100-C09 |
| 22B-E9P9N104 | 5.5 (7.5) | 9.9 | 414-660 | 12.1 | 11.2 | 20 | 140M-C2E-C16 | 100-C16 |
| 22B-E012N104 | 7.5 (10.0) | 12.2 | 414-660 | 14.9 | 13.7 | 25 | 140M-C2E-C16 | 100-C23 |
| 22B-E019N104 | 11.0 (15.0) | 19.0 | 414-660 | 23.1 | 24.1 | 40 | 140M-D8E-C25 | 100-C30 |

(1) 200-240V AC - 1-Phase drives are also available with an integral EMC filter. Catalog suffix changes from N104 to N114.

(2) Refer to the Bulletin 140M Motor Protectors *Selection Guide*, publication 140M-SG001… to determine the frame and breaking capacity required for your application.

## Input/Output Ratings

*Output Frequency:* 0-400 Hz (Programmable)
*Efficiency:* 97.5% (Typical)

## Approvals

UL508C c UL CSA 22.2

EMC Directive 89/336
LV: EN 50178, EN 60204
EMC: EN 61800-3, EN 50081-1, EN 50082-2

## Digital Control Inputs (Input Current = 6mA)

| SRC (Source) Mode: | SNK (Sink) Mode: |
|---|---|
| 18-24V = ON | 0-6V = ON |
| 0-6V = OFF | 18-24V = OFF |

## Analog Control Inputs

*4-20mA Analog:* 250 ohm input impedance
*0-10V DC Analog:* 100k ohm input impedance
*External Pot:* 1-10k ohms, 2 Watt minimum

## Control Output

| *Programmable Output (form C relay)* | *Opto Outputs* | *Analog Outputs (10 bit)* |
|---|---|---|
| Resistive Rating: 3.0A at 30V DC, 3.0A at 125V AC, 3.0A at 240V AC | 30V DC, 50mA | 0-10V, 1k ohm Min. |
| Inductive Rating: 0.5A at 30V DC, 0.5A at 125V AC, 0.5A at 240V AC | Non-inductive | 4-20mA, 525 ohm Max. |

## Fuses and Circuit Breakers

*Recommended Fuse Type:* UL Class J, CC, T or Type BS88; 600V (550V) or equivalent.
*Recommended Circuit Breakers:* HMCP circuit breakers or equivalent.

## Protective Features

*Motor Protection:* $I^2t$ overload protection - 150% for 60 Secs, 200% for 3 Secs (Provides Class 10 protection)

*Overcurrent:* 200% hardware limit, 300% instantaneous fault

*Over Voltage:*
100-120V AC Input – Trip occurs at 405V DC bus voltage (equivalent to 150V AC incoming line)
200-240V AC Input – Trip occurs at 405V DC bus voltage (equivalent to 290V AC incoming line)
380-460V AC Input – Trip occurs at 810V DC bus voltage (equivalent to 575V AC incoming line)
460-600V AC Input – Trip occurs at 1005V DC bus voltage (equivalent to 711V AC incoming line)

*Under Voltage:*
100-120V AC Input – Trip occurs at 210V DC bus voltage (equivalent to 75V AC incoming line)
200-240V AC Input – Trip occurs at 210V DC bus voltage (equivalent to 150V AC incoming line)
380-480V AC Input – Trip occurs at 390V DC bus voltage (equivalent to 275V AC incoming line)
460-600V AC Input – If P042 = 3 "High Voltage" trip occurs at 487V DC bus voltage (344V AC incoming line);
If P042 = 2 "Low Voltage" trip occurs at 390V DC bus voltage (275V AC incoming line)

*Control Ride Through:* Minimum ride through is 0.5 Secs - typical value 2 Secs

*Faultless Power Ride Through:* 100 milliseconds

## Dynamic Braking

Internal brake IGBT included with all ratings except when no brake is specified.
Refer to Appendix B for DB resistor ordering information.

| Category | Specification | |
|---|---|---|
| **Environment** | Altitude: | 1000 m (3300 ft) max. without derating |
| | Maximum Surronding Air Temperature without derating: | |
| | Open Type, IP20: | –10 to 50° C (14 to 122° F) |
| | NEMA Type 1, IP30, UL Type 1: | –10 to 40° C (14 to 104° F) |
| | Flange Mount: | Heatsink: –10 to 40° C (14 to 104° F)<br>Drive: –10 to 50° C (14 to 122° F) |
| | Cooling Method | |
| | Convection: | 0.4 kW (0.5 HP) drives |
| | Fan: | All other drive ratings and 0.4 kW (0.5 HP) 1-Phase drives with Integral “S Type” EMC Filter |
| | Storage Temperature: | –40 to 85 degrees C (–40 to 185 degrees F) |
| | Atmosphere: | **Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere. |
| | Relative Humidity: | 0 to 95% non-condensing |
| | Shock (operating): | 15G peak for 11ms duration (±1.0ms) |
| | Vibration (operating): | 1G peak, 5 to 2000 Hz |
| **Control** | Carrier Frequency | 2-16 kHz. Drive rating based on 4 kHz. |
| | Frequency Accuracy | |
| | Digital Input: | Within ±0.05% of set output frequency. |
| | Analog Input: | Within 0.5% of maximum output frequency, 10-Bit resolution |
| | Analog Output: | ±2% of full scale, 10-Bit resolution |
| | Speed Regulation - Open Loop with Slip Compensation: | ±1% of base speed across a 60:1 speed range. |
| | Stop Modes: | Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S Curve. |
| | Accel/Decel: | Two independently programmable accel and decel times. Each time may be programmed from 0 - 600 seconds in 0.1 second increments. |
| | Intermittent Overload: | 150% Overload capability for up to 1 minute<br>200% Overload capability for up to 3 seconds |
| | Electronic Motor Overload Protection: | Class 10 protection with speed sensitive response and power-down overload retention function. |