User Manual

Allen-Bradley

PowerFlex® 700 AC Drives

Vector Control Firmware 4.001 & Up, Frames 0…10

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **http://www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.

Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

Summary of Changes

The information below summarizes the changes to the PowerFlex 700 User Manual, publication 20B-UM002 since the last release.

Manual Updates

Change	Page(s)
Added Frame 7…10 information	Throughout Manual
Updated content for firmware version 8.002	Throughout Manual
Updated MOV and Common Mode Cap info	Chapter 1

Notes:

Table of Contents

Overview

The purpose of this manual is to provide you with the basic information needed to install, start-up and troubleshoot the PowerFlex 700 Adjustable Frequency AC Drive with Vector Control.

Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to program and operate Adjustable Frequency AC Drive devices. In addition, you must have an understanding of the parameter settings and functions.

What Is Not in this Manual

The *PowerFlex 700 Series B User Manual* is designed to provide only basic start-up information for the Vector Control drive, Frames 0…10.

For detailed drive information, refer to the *PowerFlex Reference Manual,* publication PFLEX-RM004.

Refer to the *PowerFlex 700 Series A User Manual* (publication 20B-UM001) for Standard Control information.

Literature is available online at **http://www.rockwellautomation.com/literature.** Refer to Reference Materials on the next page.

ATEX Approved Drives & Motors

For detailed information on using ATEX approved drives and motors, refer to Appendix D.

Reference Materials

For additional drive information, refer to the following publications online at **www.rockwellautomation.com/literature**:

Title	Publication
PowerFlex 700 Standard Control User Manual	20B-UM001
PowerFlex 70 and PowerFlex 700 Reference Manual	PFLEX-RM001
PowerFlex 70 Enhanced and PowerFlex 700 Vector Control Reference Manual	PFLEX-RM004
PowerFlex Comm Adapter Manuals	20COMM-UM
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives	DRIVES-IN001
Preventive Maintenance of Industrial Control and Drive System Equipment	DRIVES-TD001
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1
A Global Reference Guide for Reading Schematic Diagrams	100-2.10
Guarding Against Electrostatic Damage	8000-4.5.2

To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative. To locate your local Rockwell Automation distributor, visit **www.rockwellautomation.com/locations**

Use the contacts below for PowerFlex 700 technical support.

Online at…	By Email at…	By Telephone at…
www.ab.com/support/abdrives	support@drives.ra.rockwell.com	262-512-8176

Manual Conventions

- In this manual we refer to the PowerFlex 700 Adjustable Frequency AC Drive as; drive, PowerFlex 700 or PowerFlex 700 Drive.
- To help differentiate parameter names and LCD display text from other text, the following conventions will be used:
  - Parameter Names will appear in [brackets]. For example: [DC Bus Voltage].
  - Display Text will appear in "quotes." For example: "Enabled."
- The following words are used throughout the manual to describe an action:

Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

Drive Frame Sizes

Similar PowerFlex 700 drive sizes are grouped into frame sizes to simplify spare parts ordering, dimensioning, etc. A cross reference of drive catalog numbers and their respective frame size is provided in Appendix A.

General Precautions

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 A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

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: 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.

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 +DC & –DC terminals of the Power Terminal Block (refer to Chapter 1 for location). The voltage must be zero.

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: 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.

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.

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.

Catalog Number Explanation

Position

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

a

Drive

Code	Type
20B	PowerFlex 700

b

Voltage Rating

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

c1

ND Rating

208/240V, 60 Hz Input

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

c2

ND Rating

400V, 50 Hz Input

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

c3

ND Rating

480V, 60 Hz Input

Code	Amps	Hp	Frame
1P1	1.1	0.5	0
2P1	2.1	1.0	0
3P4	3.4	2.0	0
5P0	5.0	3.0	0
8P0	8.0	5.0	0
011	11	7.5	0
014	14	10	1
022	22	15	1
027	27	20	2
034	34	25	2
040	40	30	3
052	52	40	3
065	65	50	3
077	77	60	4
096	96	75	5
125	125	100	5
156	156	125	6
180	180	150	6
248	248	200	6
292	292	250	7
325	325	250	7
365	365	300	8
415	415	350	8
481	481	400	8
535	535	450	8
600	600	500	8
730	730	600	9
875	875	700	10

Position

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

c4

ND Rating

600V, 60 Hz Input

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

c5

ND Rating

690V, 50 Hz Input

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

d

Enclosure

Code	Enclosure
A	IP20, NEMA/UL Type 1
F ⌘	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA Type 12
N §	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12
G ⌘	Stand-Alone/Wall Mount IP54, NEMA/UL Type 12
J	IP00, NEMA/UL Type Open with Conformal Coat
M ❖	IP20, NEMA/UL Type 1 with Conformal Coat
U	Roll-In Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12 Frames 8 & 9 Only
V	Roll-In with Conformal Coat Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12 Frames 8 & 9 Only

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

§ Only available for Frames 7…10.

❖ Only available with Vector Control option.

e

HIM

Code	Operator Interface
0	Blank Cover
3	Full Numeric LCD
5	Prog. Only 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").

f

Documentation

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

g

Brake

Code	w/Brake IGBT ❄
Y	Yes
N	No

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

h

Internal Braking Resistor

Code	w/Resistor
Y	Yes ✶
N	No

✶ Not available for Frame 3 drives or larger.

i ✦

Emission

Code	CE Filter ‡	CM Choke
A	Yes	Yes
B ♠	Yes	No
N	No	No

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

✦ Refer to *Internal EMC Filter* for details on selecting this option for each frame size.

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

j

Comm Slot

Code	Network Type
B	BACnet MS/TP
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
R	Remote I/O
S	RS485 DF1
N	None

k

Control & I/O

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

♣ Vector Control Option utilizes DPI Only. Frame 7…10 drives only accept Vector Control.

l

Feedback

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

m

Future Use

n

Special Firmware (Frames 0…6 Only)

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

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

Chapter 1

Installation/Wiring

This chapter provides information on mounting and wiring the PowerFlex 700.

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. The Allen-Bradley Company 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.

Opening the Cover – Frames 0…7

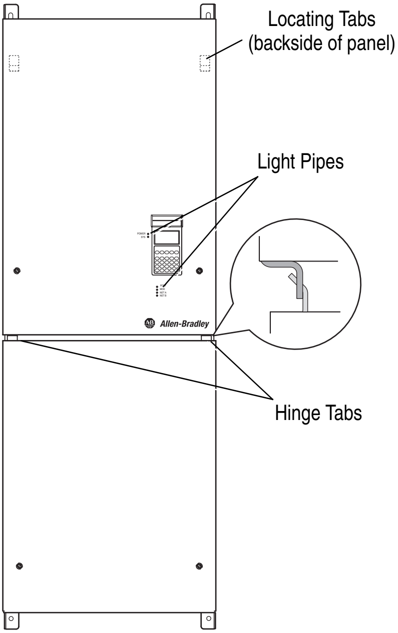
Frames 0…4
Locate the slot in the upper left corner. Slide the locking tab up and swing the cover open. Special hinges allow cover to move away from drive and lay on top of adjacent drive (if present). See page 1-8 for frame 4 access panel removal.

Frame 5
Slide the locking tab up, loosen the right-hand cover screw and remove. See page 1-8 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.

Frame 7

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



Mounting Considerations

Operating Temperatures

PowerFlex 700 drives are designed to operate at 0…40 °C ambient. To operate the drive in installations between 41…50 °C, see the information below and refer to pages A-12 through A-24 for exceptions.

Table 1.A Acceptable Surrounding Air Temperature & Required Actions

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

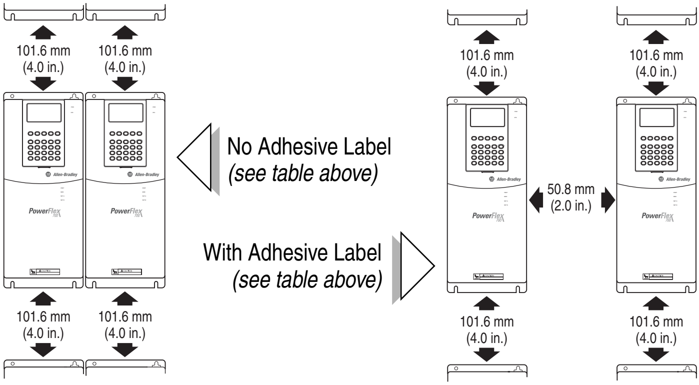
[1] Removing the adhesive top label from the drive changes the NEMA/UL enclosure rating from Type 1 to Open. Frames 5 and 6 do not have a top label.

[2] Refer to pages A-12 through A-24 for exceptions.

[3] To remove vent plate (see page A-30 for location), lift top edge of plate from the chassis. Rotate the plate out from the back plate.

Minimum Mounting Clearances

Frames 0…6



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.

Frames 7…10

The drive must be mounted with sufficient space at the top, sides, and front of the cabinet to allow for proper heat dissipation.

Frame	Recommendations
7	Allow a minimum of 152 mm (6.0 in.) at the top and bottom of the enclosure and 102 mm (4.0 in.) on the sides. Flange Mount - Allow a minimum of 152 mm (6.0 in.) at the back of the enclosure (from flange mount surface to wall).
8…10	Allow a minimum of 152 mm (6.0 in.) at the top of the enclosure. Additionally, allow a minimum of 102 mm (4.0 in.) on each side OR 152 mm (6.0 in.) in the back.

AC Supply Source 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 in Appendix A.

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

Unbalanced, Ungrounded, Resistive or B Phase Grounded Distribution Systems

If phase to ground voltage will exceed 125% of normal line to line voltage or the supply system is ungrounded, refer to the *Wiring and Grounding Guidelines for PWM AC Drives* (publication DRIVES-IN001).

ATTENTION: To guard against drive damage, PowerFlex 700 drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices must be disconnected if the drive is not installed on a solidly grounded system. See page 1-24 for details.

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

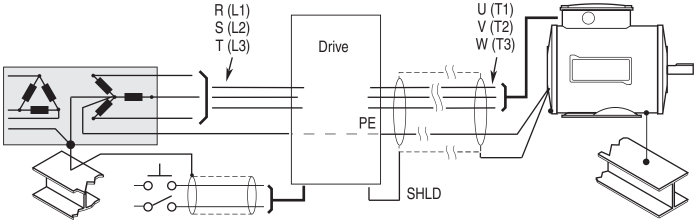
If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance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

General Grounding Requirements

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

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

Typical Grounding



Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar (see above). Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Shield Termination

Shield termination at “SHLD” (Frames 0…6) or “PE” (Frames 7…10) provides a grounding point for the motor cable shield. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

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

RFI Filter Grounding

Using an optional RFI filter may result in relatively high ground leakage currents. Therefore, the **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground. Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

Fuses and Circuit Breakers

The PowerFlex 700 can be installed with input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to Appendix A for recommended fuses/circuit breakers.

ATTENTION: The PowerFlex 700 does not provide branch short circuit protection. Specifications for the recommended fuse or circuit breaker to provide protection against short circuits are provided in Appendix A.

Power Wiring

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

Cable Types Acceptable for 200...600 Volt Installations

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

Unshielded

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

Shielded/Armored Cable

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

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks. Refer to Reflected Wave in *Wiring and Grounding Guidelines for PWM AC Drives*, pub. DRIVES-IN001.

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

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

Other types of shielded cable are available, but the selection of these types may limit the allowable cable length. Particularly, some of the newer cables bundle 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known. See Table 1.B.

Table 1.B Recommended Shielded Wire

Location	Rating/Type	Description
Standard (Option 1)	600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

EMC Compliance

Frames 0…6 – refer to page 1-52 for details.

Frames 7…10 – drives are CE Certified for use with 400V AC and 480V AC center grounded neutral power supply systems only. Refer to page 1-52 for details.

Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to the guidelines presented in the *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001.

ATTENTION: To avoid a possible shock hazard caused by induced voltages, unused wires in the conduit must be grounded at both ends. For the same reason, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled. This will help minimize the possible shock hazard from “cross coupled” motor leads.

Motor Cable Lengths

Typically, motor lead lengths less than 30 meters (100 feet) are acceptable. However, if your application dictates longer lengths, refer to the *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001 or the *PowerFlex 700 Technical Data*, publication 20B-TD001.

Cable Entry Plate Removal

If additional wiring access is needed, the Cable Entry Plate on Frame 0…3 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 – Frames 0…5

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

Single-Phase Input Power

The PowerFlex 700 drive is typically used with a three-phase input supply. However, single-phase operation is possible for certain frames as explained below:

Frame	Condition
0…7	Listed by UL to operate on single-phase input power with the requirement that the output current is derated by 50% of the three-phase ratings (see pages A-10 & A-11).
8…10	Not designed for single-phase operation.

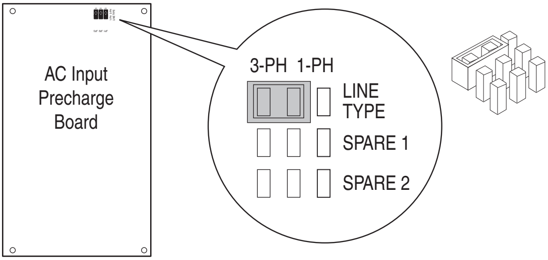
AC Input Phase Selection (Frames 5…7 Only)

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

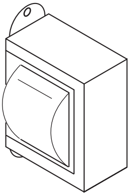


Fan Circuit Power Supply

ATTENTION: To avoid a shock hazard, ensure that all power to the drive has been removed before changing/connecting the fan supply.

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

Frames 5 & 6 Fan Connections

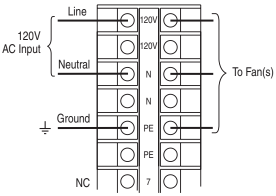
Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/ UL Type Open	100 VA (Frame 5) 138 VA (Frame 6)	1	Power Terminal Block Requires user supplied 120 or 240V AC. See pages 1-16 and 1-21 for TB locations and terminal designations.
	IP20, NEMA/ UL Type 1 IP54, NEMA/ UL Type 12	100 VA (Frame 5) 138 VA (Frame 6)	1	
AC Input	IP00, NEMA/ UL Type Open	100 VA (Frame 5) 138 VA (Frame 6)	1	N/A (Connected internally) A transformer matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps. The transformer is located behind the Power Terminal Block on the right-side of the drive. 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.
	IP20, NEMA/ UL Type 1 IP54, NEMA/ UL Type 12	100 VA (Frame 5) 138 VA (Frame 6)	1	
				

Frame 7 Fan Connections

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/ UL Type Open	250 VA	1	Power Terminal Block Requires user supplied 120V AC. See page 1-22 for location.
	IP20, NEMA/ UL Type 1	250 VA	1	
AC Input	IP00, NEMA/ UL Type Open	250 VA	1	N/A (Connected internally)
	IP20, NEMA/ UL Type 1	250 VA	1	

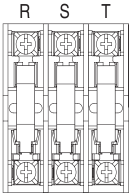
Fan/Blower Terminal Blocks - Frames 8…10

TB9, TB10



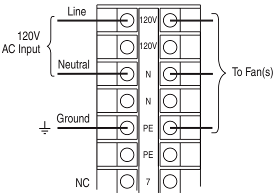
Frames 8…10

Blower TB



Frame 9 Only

TB12



Frame 10, AC Input, IP20 Only

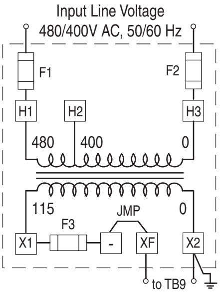
Fan Transformer Specifications/Fusing

		Recommended Fuses	
Frame	**Rating**	**Primary (Quantity 2)**	**Secondary (Quantity 1)**
8 & 9	500 VA	2.8A, 600V AC, KLDR/ATQR Type	6.25A, 250V AC, Time Delay
10	1000 VA	6A, 600V AC, KLDR/ATQR Type	9A, 250V AC, Time Delay

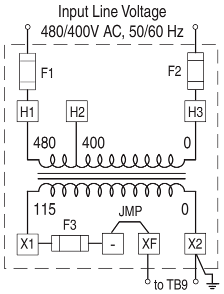
Three-Phase Blower Fusing

Frame	Recommended Fuses (Quantity 3)
9	5A, 600V AC, Time Delay

Frame 8 Fan Connections

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/ UL Type Open	500 VA	1	TB9 Requires user supplied 120V AC. See page 1-18 for TB location and page 1-11 for terminal designations.
	IP20, NEMA/ UL Type 1	500 VA	1	
AC Input	IP00, NEMA/ UL Type Open	500 VA	1	TB9 A transformer matches the input line voltage to the internal fan voltage. If line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps (see below).
	IP20, NEMA/ UL Type 1	500 VA	1	
				

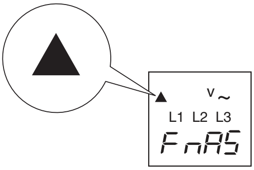
Frame 9 Fan Connections

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/ UL Type Open	500 VA	2	**TB9** Requires user supplied 120V AC for cap. bank fan and phase monitor. **Blower Terminal Block** Three-phase power must be supplied to the Blower TB. See page 1-18 for TB locations and page 1-11 for terminal designations.
	IP20, NEMA/ UL Type 1	500 VA	2	
AC Input	IP00, NEMA/ UL Type Open	500 VA	2	**TB9** A transformer (see page 1-18 for location) matches the input line voltage to the internal voltage used for the capacitor fan and phase detector module. If the line voltage is different than the voltage class specified on the drive nameplate, it may be necessary to change transformer taps (as shown).
	IP20, NEMA/ UL Type 1	500 VA	2	
				

Frame 9 Blower Operation

Frame 9 drives use a single-phase capacitor bank fan and a three-phase blower for cooling. Proper phasing must be supplied to terminals R, S, and T of the Power Terminal Block (AC drives) or the Blower Terminal Block (DC drives) to assure correct blower rotation. To verify this, a Phase Monitor (see page 1-18 for location) is used.

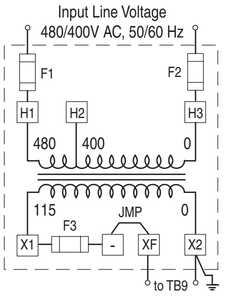
When wiring is complete, apply drive power. If phasing is correct, a solid triangle will be displayed on the Phase Monitor.



If the blower does not operate:

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

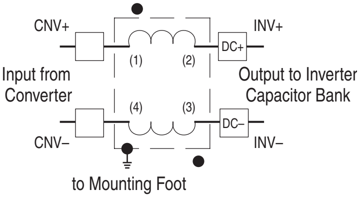
Frame 10 Fan Connections

Drive Type	Enclosure	Rating *(120VAC)*	No. of Fans	Connect at …
DC Input	IP00, NEMA/ UL Type Open	1000 VA	2	TB9 & 10 Requires user supplied 120V AC. See page 1-20 for TB locations and the diagram above for terminal designations.
	IP20, NEMA/ UL Type 1	1000 VA	2	
AC Input	IP00, NEMA/ UL Type Open	1000 VA	3	TB9, 10 & 12 Requires user supplied 120V AC. See page 1-20 for TB locations and and the diagram above for terminal designations.
	IP20, NEMA/ UL Type 1	1000 VA	3	TB9, 10 & 12 A transformer (see page 1-20) 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.
				

Additional Frame 10 Wiring Requirement for IP00 AC Input Drives

The Inverter and Converter sections of Frame 10 AC Input IP00, NEMA/ UL Type Open drives are shipped separately. Once installed, the following connections will be required.

1. DC Link Choke Wiring
   DC link chokes are supplied loose for customer mounting and wiring in IP00 drives. See diagram for connection information and page A-12 through A-19 for drive ratings.



2. Thermistor Wiring
   Thermistor wiring will be coiled loose in the Converter section for shipping. Locate the wire (labeled "To INV") and route through the enclosure wall. Connect it to the mating connector located above the HIM cradle.
3. Ground the drive chassis.

ATTENTION: To avoid possible drive damage, ensure that the thermistor wiring described above has been properly performed.

Auxiliary Control Power Supply

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

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

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

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

Refer to pages 1-16 through 1-21 for terminal block location.

Power supply must provide		
UL Installation	300V DC, ±10%	Frames 0…3: 40 W, 165 mA, Frame 5: 80 W, 90 mA
Non UL Installation	270…600V DC, ±10%	

Power Terminal Block

Refer to pages 1-16 through 1-20 for typical locations.

Table 1.C Power Terminal Block Specifications

No.	Name	Frame	Description	Wire Size Range *see Note* (2)		Torque	
				Maximum	Minimum	Maximum	Recommended
❶	Power Terminal Block	0 & 1	Input power and motor connections	4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	1.7 N•m (15 lb•in)	0.8 N•m (7 lb•in)
		2	Input power and motor connections	10.0 mm^2 (8 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb•in)	1.4 N•m (12 lb•in)
		3	Input power and motor connections	25.0 mm^2 (3 AWG)	2.5 mm^2 (14 AWG)	3.6 N•m (32 lb•in)	1.8 N•m (16 lb•in)
			BR1, 2 terminals	10.0 mm^2 (8 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb•in)	1.4 N•m (12 lb•in)
		4	Input power and motor connections	35.0 mm^2 (1 AWG)	10.0 mm^2 (8 AWG)	4.0 N•m (35 lb•in)	4.0 N•m (35 lb•in)
		5 *75 Hp, 480V* *100 Hp, 600V*	Input power, DC+, DC–, BR1, 2, PE, motor connections	50.0 mm^2 (1/0 AWG)	4.0 mm^2 (12 AWG)	See Note (4)	
		5 *100 Hp*	Input power, DC+, DC– and motor	70.0 mm^2 (2/0 AWG)	10.0 mm^2 (8 AWG)		
			BR1, 2, PE terminals	50.0 mm^2 (1/0 AWG)	4.0 mm^2 (12 AWG)		
		6	Input power, DC+, DC–, BR1, 2, PE, motor connections	150.0 mm^2 (300 MCM) *see Note* (3)	2.5 mm^2 (14 AWG)	6.0 N•m (52 lb•in)	6.0 N•m (52 lb•in)
		7	Input power, DC+, DC–, PE, motor connections	150.0 mm^2 (300 MCM) *see Note* (3)	2.5 mm^2 (14 AWG)	2.7 N-m (24 lb.-in.)	2.7 N-m (24 lb.-in.)
		8…10	Input power, DC+, DC–, PE, motor connections	300.0 mm^2 (600 MCM) *see Note* (3)	2.5 mm^2 (14 AWG)	10.0 N•m (87 lb•in)	10.0 N•m (87 lb•in)
❷	SHLD Terminal	0…6	Terminating point for wiring shields	—	—	1.6 N•m (14 lb•in)	1.6 N•m (14 lb•in)
❸	AUX Terminal Block (1)	0…4	Auxiliary Control Voltage PS+, PS– (1)	1.5 mm^2 (16 AWG)	0.2 mm^2 (24 AWG)	—	—
		5…6		4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
		7…10		4.0 mm^2 (12 AWG)	0.049 mm^2 (30 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
❹	Fan Terminal Block	5…6	User Supplied Fan Voltage	4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
		7		4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.9 N•m (8.0 lb•in)	0.6 N•m (5.3 lb•in)
		8…10		4.0 mm^2 (12 AWG)	0.5 mm^2 (22 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)

(1) External control power - select drives only, see Auxiliary Control Power Supply on page 1-14 for details.

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

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

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

Figure 1.1 Component Locations - Frames 0…6

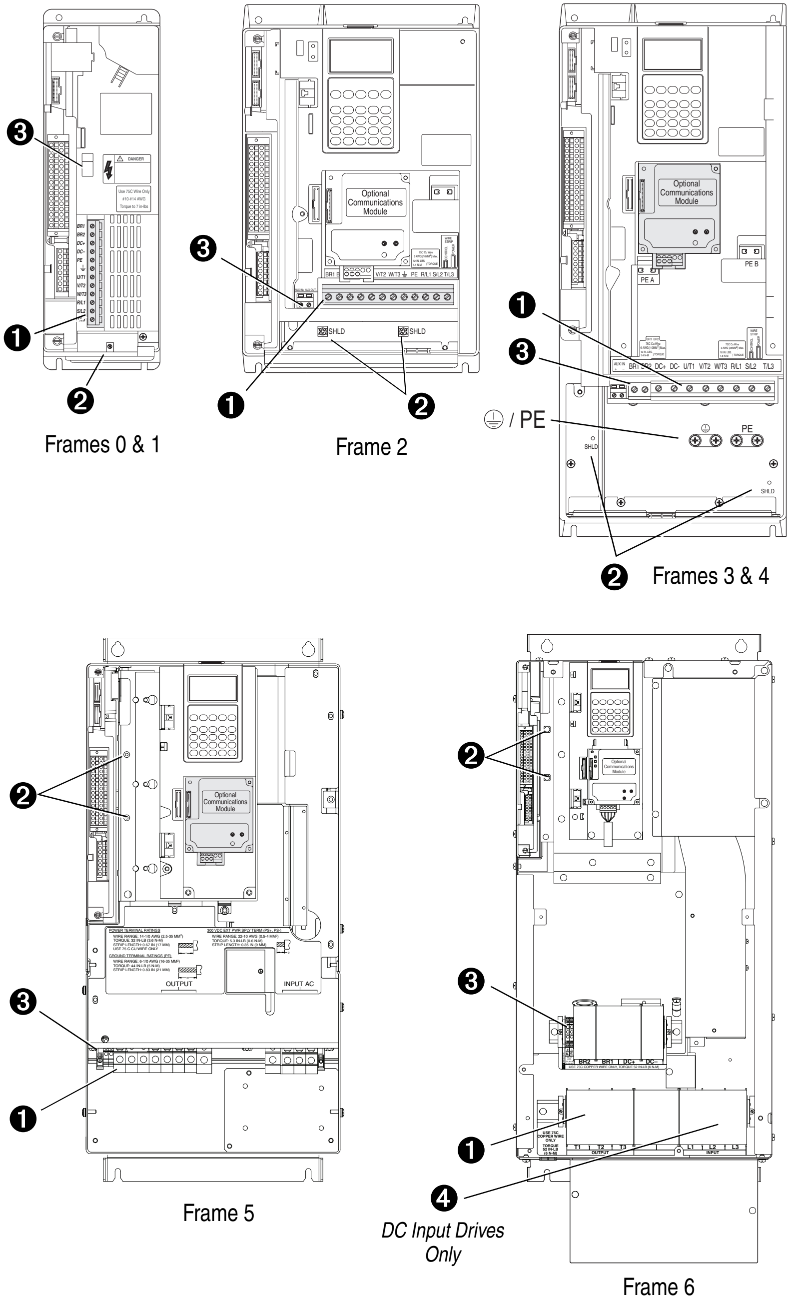
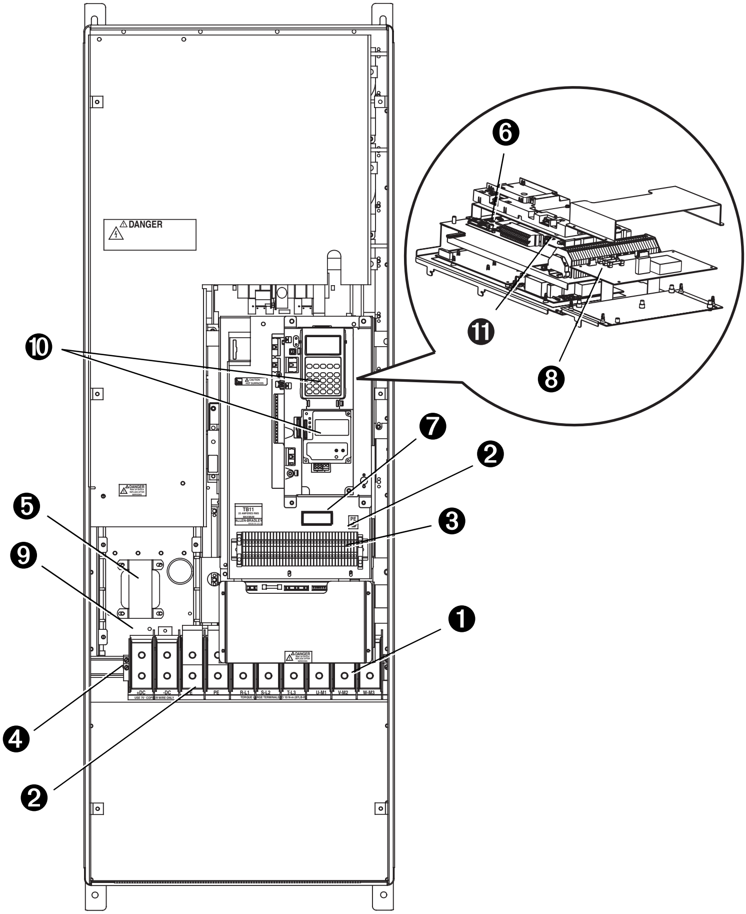


Figure 1.2 Component Locations - Frame 7

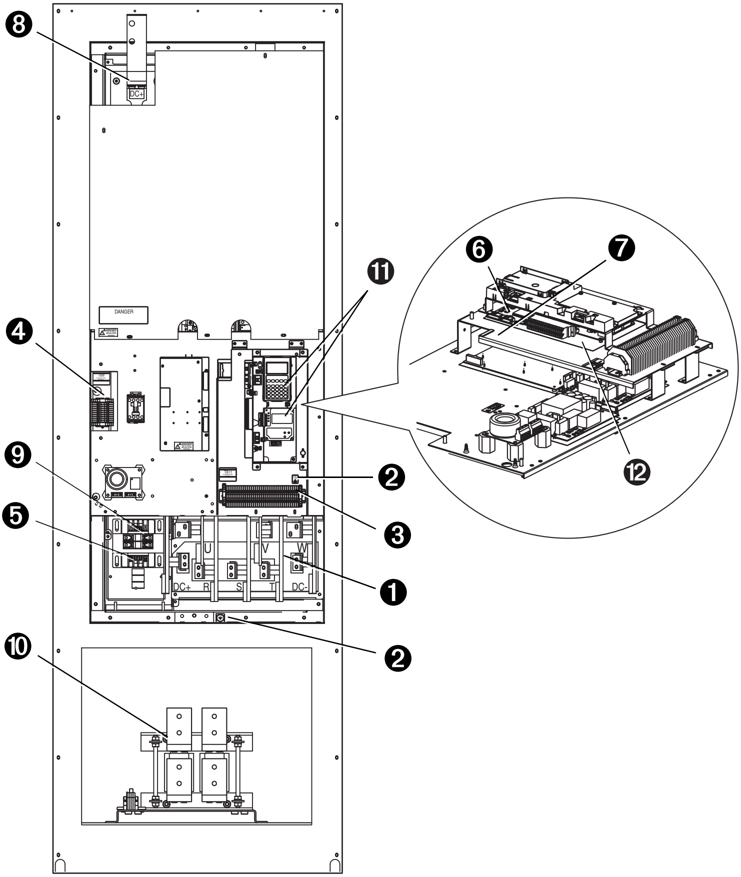


Refer to page 1-15 for TB specifications.

No.	Component
❶	Power Terminal Block
❷	PE Ground
❸	I/O & Auxiliary Control Voltage - TB11
❹	Fan Terminal Block (DC input only)
❺	Fan Transformer (AC input only)
❻	Main Control Board

No.	Component
❼	Nameplate
❽	Precharge Board
❾	MOV
❿	HIM/Comm Module (Optional)
⓫	Encoder Feedback Board (Optional)

Figure 1.3 Component Locations - Frame 8

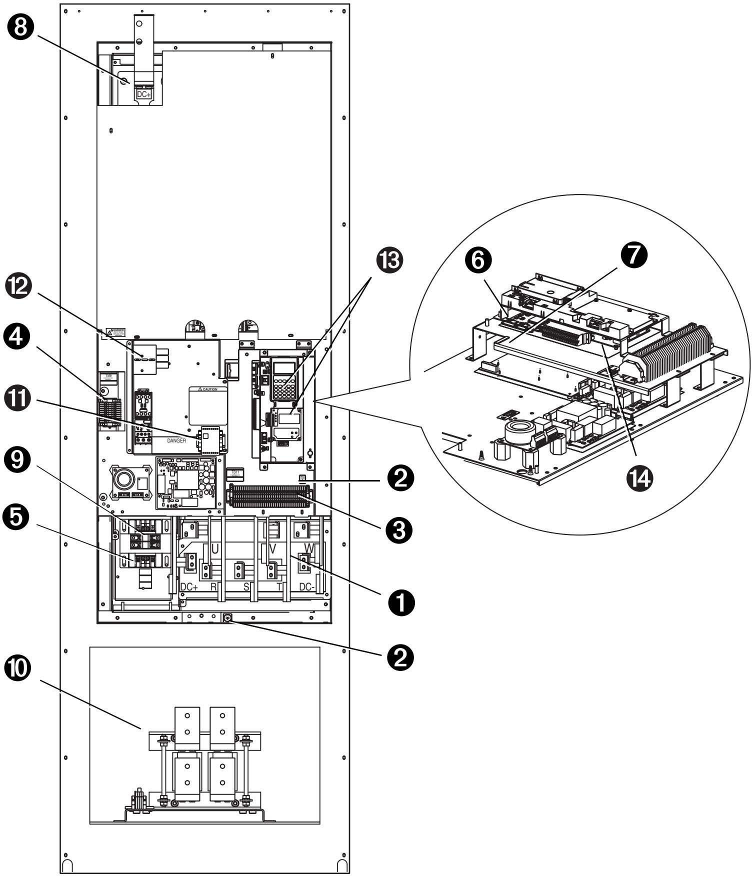


Refer to page 1-15 for TB specifications.

No.	Component
❶	Power Terminals
❷	PE Ground (and MOV wire)
❸	I/O & Auxiliary Control Voltage - TB11
❹	Fan Terminal Block - TB9
❺	Fan Transformer (AC input only)
❻	Main Control Board

No.	Component
❼	Nameplate
❽	DC Bus/Brake Terminals
❾	MOV (located under boards)
❿	DC Link Choke (AC input only)
⓫	HIM/Comm Module (Optional)
⓬	Encoder Feedback Board (Optional)

Figure 1.4 Component Locations - Frame 9

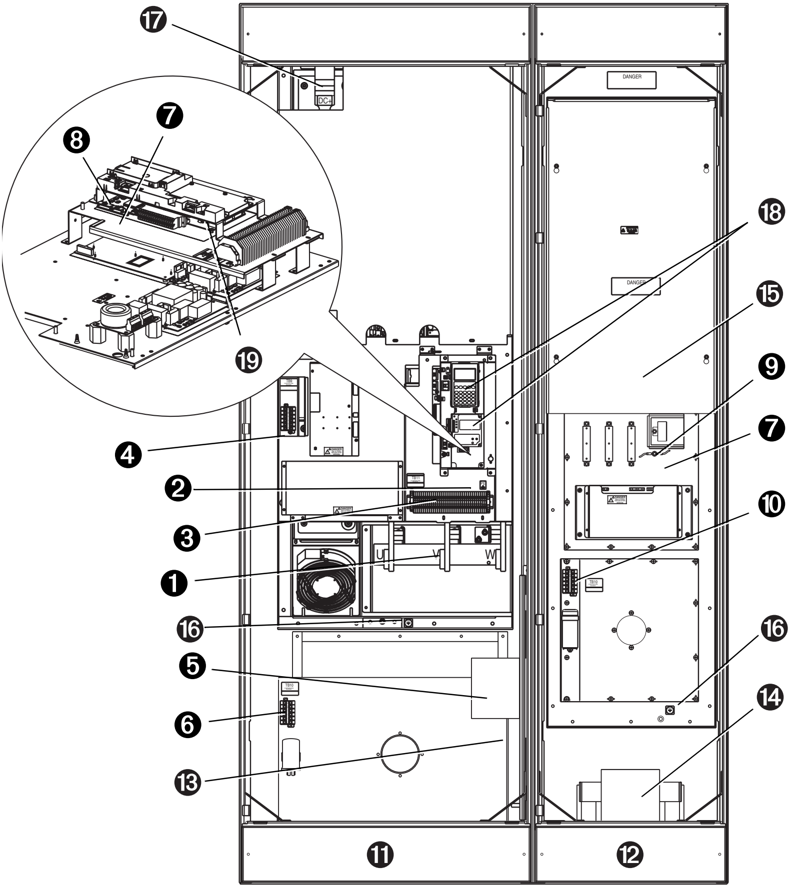


Refer to page 1-15 for TB specifications.

No.	Component
❶	Power Terminals
❷	PE Ground (and MOV wire)
❸	I/O & Auxiliary Control Voltage - TB11
❹	Fan Terminal Block (cap. fan) - TB9
❺	Fan Transformer (cap. fan) - AC input only
❻	Main Control Board
❼	Nameplate

No.	Component
❽	DC Bus/Brake Terminals
❾	MOV (located under boards)
❿	DC Link Choke (AC input only)
⓫	Phase Monitor
⓬	Blower Terminal Block (three-phase)
⓭	HIM/Comm Module (Optional)
⓮	Encoder Feedback Board (Optional)

Figure 1.5 Component Locations - Frame 10 *(AC Input shown)*



For DC Input drives, reference the left Inverter section. See page 1-15 for TB specifications.

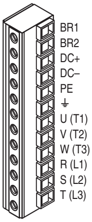
No.	Component
❶	Motor Terminal Block
❷	PE Ground
❸	I/O & Auxiliary Control Voltage - TB11
❹	Fan Terminal Block - TB9 (Capacitor Assembly Fan)
❺	Fan Transformer (IP20 Only)
❻	Fan Terminal Block - TB10 (Heatsink Fan)
❼	Nameplate
❽	Main Control Board
❾	MOV Jumper
❿	Fan Terminal Block - TB12 (Heatsink Fan)

No.	Component
⓫	Inverter Section
⓬	Converter Section
⓭	PE Bus Bar (IP20 Only)
⓮	DC Link Choke (AC input only, supplied loose for IP00)
⓯	AC Input Terminals (Behind Shield)
⓰	PE Connection Point (IP00)
⓱	DC Bus/Brake Terminals
⓲	HIM/Comm Module (Optional)
⓳	Encoder Feedback Board (Optional)

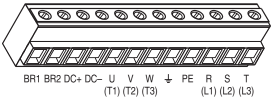
Figure 1.6 Power Terminal Block

Frame | **Terminal Block**

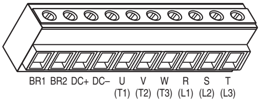
0 & 1



2



3 & 4



Notes:
Shaded BR1 & BR2 Terminals will only be present on drives ordered with the Brake Option.

❶ Precharge Resistor Fuse – DCT12-2
(DC input drives w/precharge only)

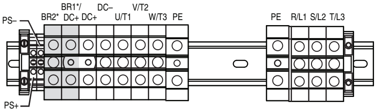
❷ M8 Stud (All Terminals)
Max. Lug Width = 25.4 mm (1 in.)

❸ M8 Stud (All Terminals)
Max. Lug Width = 31.8 mm (1.25 in.)

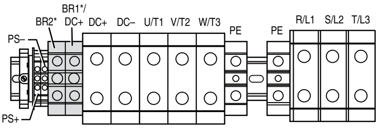
AC Input *(Ratings are Normal Duty)*

5

240V, 40 Hp 480V, 75 Hp 690V, 45-90 kW
400V, 55 kW 600V, 75 Hp

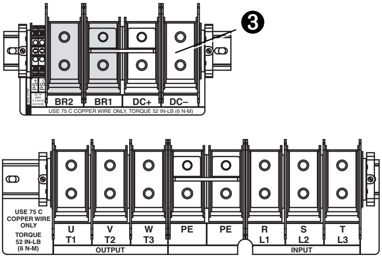


240V, 50 Hp 480V, 100 Hp
400V, 75 kW 600V, 100 Hp



6

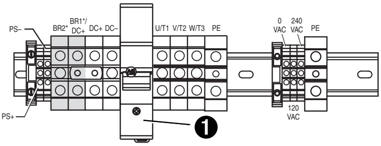
125…200 Hp



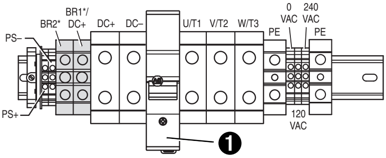
DC Input *(Ratings are Normal Duty)*

5

240V, 40 Hp 480V, 75 Hp 690V, 45…90 kW
400V, 55 kW 600V, 75 Hp

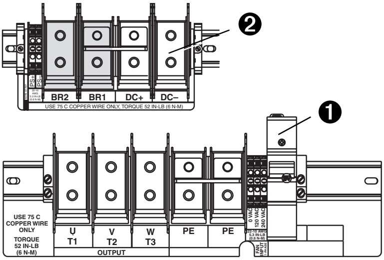


240V, 50 Hp 480V, 100 Hp
400V, 75 kW 600V, 100 Hp

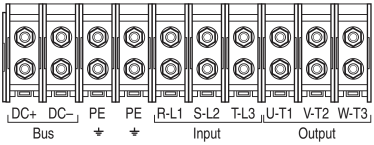
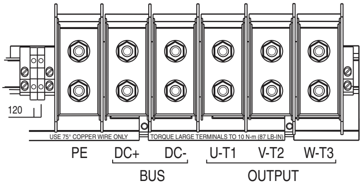
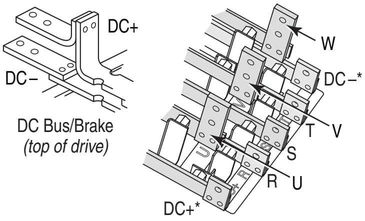
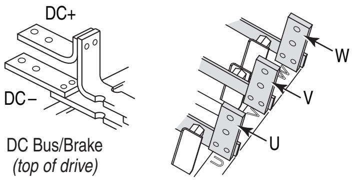
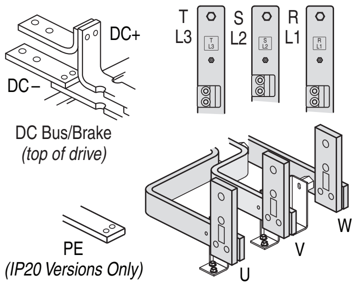
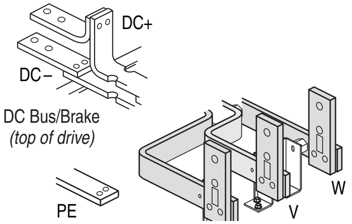


6

125…200 Hp



Power Terminal Blocks *(continued)*

Frame	Terminal Block AC Input	DC Input
7		
8 & 9	 * for DC link choke wiring	
10		

Terminal	Description	Notes
BR1 BR2	DC Brake (+) DC Brake (–)	DB Resistor Connection - **Important:** Only one DB resistor can be used with Frames 0…3. Connecting an internal & external resistor could cause damage.
DC+ DC–	DC Bus (+) DC Bus (–)	DC Input/Brake Connections
PE	PE Ground	
PS+ PS–	AUX (+) AUX (–)	Auxiliary Control Voltage (see page 1-14) for details.
⏚	Motor Ground	
U V W	U (T1) V (T2) W (T3)	To Motor
R S T	R (L1) S (L2) T (L3)	AC Line Input Power Three-Phase = R, S & T Single-Phase = R & S Only

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.

Bypass Contactor Precaution

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

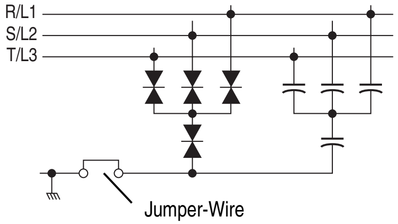
- Wiring AC line to drive output or control terminals.
- Improper bypass or output circuits not approved by Allen-Bradley.
- Output circuits which do not connect directly to the motor.

Contact Allen-Bradley for assistance with application or wiring.

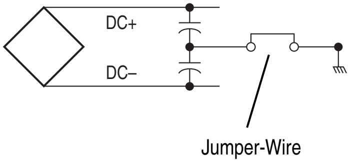
Disconnecting MOVs and Common Mode Caps

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 1.D on page 1-25.

MOV and AC EMI Capacitor Phase to Ground



Common Mode Capacitor to Ground
(Frames 0…6 Only)



Important: 325, 650 & 810V PowerFlex 700 DC input (common bus) drives and 240, 480 & 600V AC input drives **are shipped without the DC bus common mode capacitors referenced to ground**. Specific drive catalog numbers are listed below:

Type	Voltage	Cat. No.
AC Input	240	20BB…
	480	20BD…
	600	20BE…
DC Input (Common Bus)	325	20BN…
	650	20BJ…, 20BR…
	810	20BT…

See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for information on ungrounded systems.

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 +DC & –DC terminals of the Power Terminal Block (refer to the User Manual for location). The voltage must be zero.

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 1.D Recommended Power Jumper Configurations

Power Source Type (1)	MOV/Input Filter Caps (2)	DC Bus Common Mode Caps	Benefits Of Correct Configuration
Unknown	Connected	Disconnected	See Solid & Non-Solid Ground points below
Solid Ground • AC fed, solidly grounded • DC fed from passive rectifier which has an AC source and solid ground	Connected	Connected	• UL compliance, • Reduced electrical noise, • Most stable operation, • EMC compliance, • Reduced voltage stress on components and motor bearings
Non-Solid Ground • AC fed ungrounded • Impedance grounded • High resistive ground • B phase ground • Regenerative unit such as common DC bus supply & brake • DC fed from an active converter	Disconnected	Disconnected	• Helps avoid severe equipment damage when ground fault occurs

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

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

To connect or disconnect these devices, refer to pages 1-27 through 1-37.

Important: Frame 0…6 drives contain common mode capacitors which must be connected (jumper installed) in order to conform with the EMC directive. Additionally, MOVs are required to meet UL certification. Removing these devices will withdraw the associated directive.

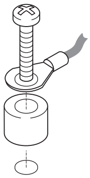
In addition, on an ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage, an isolation transformer should be installed. See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on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

Jumper Installation, Removal and Storage

PowerFlex 700 drives utilize plug-in style jumpers and 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.

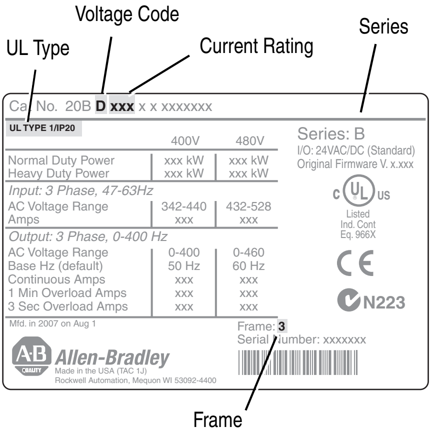
Insulating Jumper Wires

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

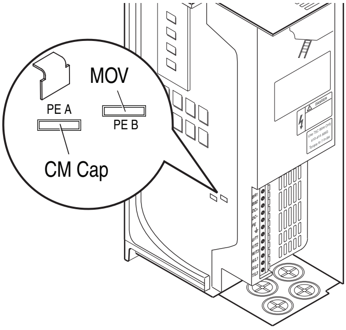
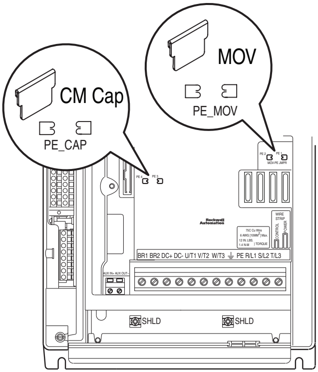


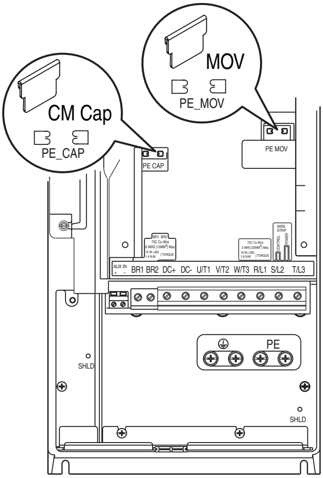
Drive Identification

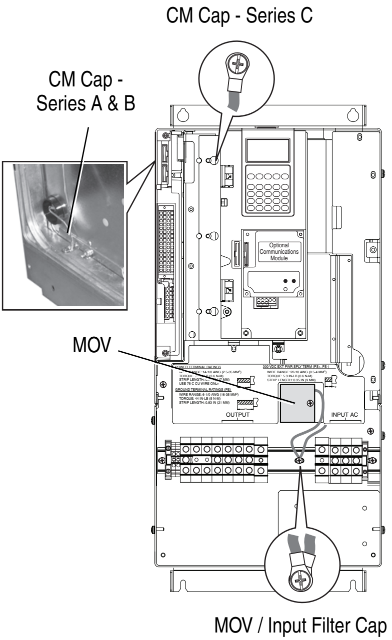
Refer to the drive nameplate and locate the "Voltage Code," "Current Rating," "Frame," "Series" and "UL Type" (Frames 5…6). Use this information to locate the proper procedure in the following tables.



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 D E	All	PE_B Installed	PE_A Not installed	**Solid Ground** • Remove the I/O Cassette (refer to the User Manual for details). Insert jumper at the “PE_A” location on the Power Board. Verify that “PE_B” is installed.
	C	All	PE_B Installed	PE_A Installed	
					**Non-Solid Ground** • Remove the I/O Cassette (refer to the User Manual for details). Remove jumper at the “PE_B” location on the Power Board. Verify that “PE_A” is also removed.
2	B D E	All	PE_MOV Installed	PE_CAP Not Installed	**Solid Ground** • Insert jumper at the “PE_CAP” location. Verify that the “PE_MOV” jumper is installed.
	C	All	PE_MOV Installed	PE_CAP Installed	
					**Non-Solid Ground** • Remove jumper at the “PE_MOV” location. Verify that the “PE_CAP” jumper is also removed.

Frame	**Voltage Code**	**Current Rating**	**Factory Default Jumper Settings**		**Power Source Type**
			MOV/Input Filter Caps	*DC Bus Common Mode Caps*	
3…4	B D E	All	PE_MOV Installed	PE-CAP Not installed	**Solid Ground** • Insert jumper at the "PE_CAP" location shown. Verify that the "PE_MOV" jumper is installed. **Non-Solid Ground** • Remove jumper at the "PE_MOV" location. Verify that the "PE_CAP" jumper is also removed.
	C	All	PE_MOV Installed	PE-CAP Installed	
					

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings		Power Source Type
			MOV/Input Filter Caps[1][2]	*DC Bus Common Mode Caps*	
5	B D J N R	All	Two green/ yellow wires connected to the Power Terminal Block rail	Green/yellow wire is insulated from ground	**Solid Ground** 1. CM Cap jumper wire should be connected to ground with a metal screw. Verify. • Series C 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). • Series A & B 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). 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. **Non-Solid Ground** 1. CM Cap jumper wire should be insulated from ground. Verify. • Series C Drives - If necessary, remove the metal screw and insert a M5 x 15 nylon screw/ spacer. • Series A & B 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. 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.
	C H P	All except C140	Two green/ yellow wires connected to the Power Terminal Block rail	Green/yellow wire is connected to ground	
					

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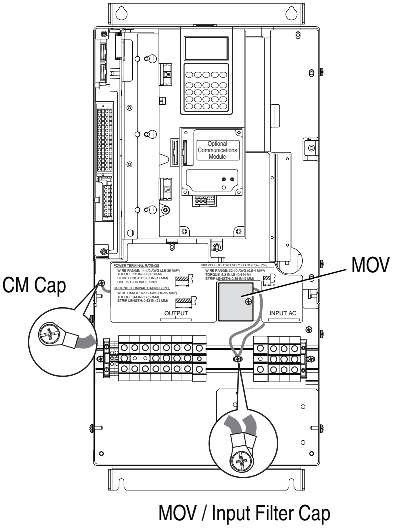
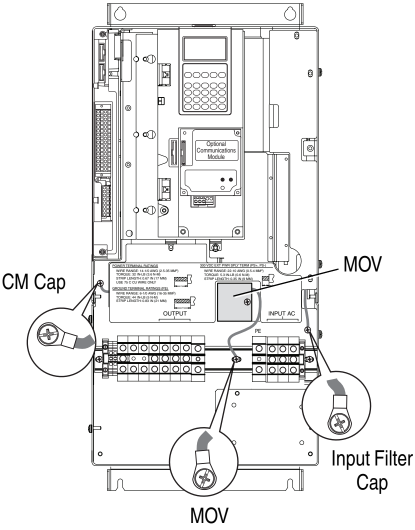
[1] AC input drives only. MOV's and input filter caps do not exist on DC input drives.

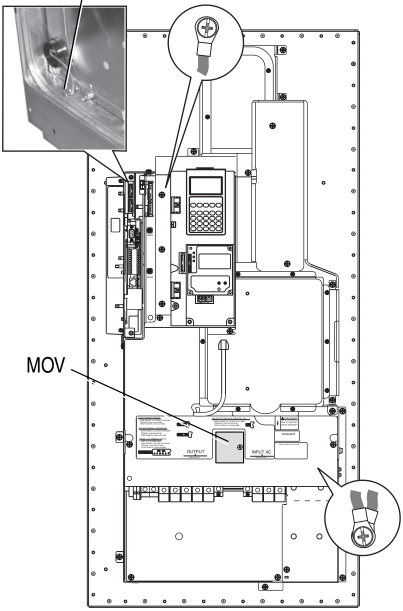
[2] When removing MOV's, the input filter capacitor must also be removed.

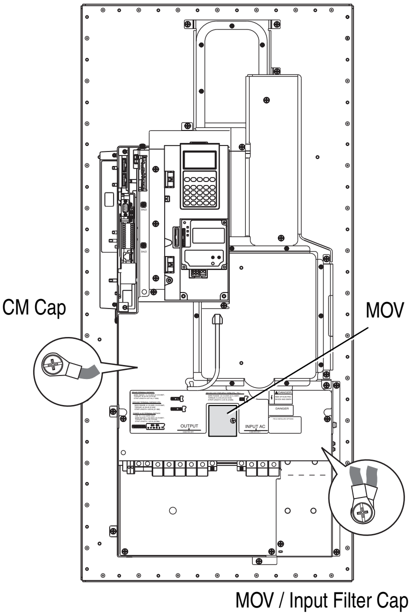
<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th rowspan="2">Current Rating</th><th colspan="2">Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th><i>MOV/Input Filter Caps</i> (1)(2)</th><th><i>DC Bus Common Mode Caps</i></th></tr>
<tr><td rowspan="3">5</td><td>C</td><td>140</td><td>Two green/ yellow wires connected to the Power Terminal Block rail</td><td>Green/yellow wire to CM Cap Board is connected to ground</td><td rowspan="3">Solid Ground
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).
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.
Non-Solid Ground
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.
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.</td></tr>
<tr><td>F
W</td><td>052
060</td><td>Two green/ yellow wires connected to the Power Terminal Block rail</td><td>Green/yellow wire to CM Cap Board is connected to ground</td></tr>
<tr><td colspan="4"> </td></tr>
</table>

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings		Power Source Type
			MOV/Input Filter Caps(1)(2)	*DC Bus Common Mode Caps*	
5	E T	077 099	Two green/ yellow wires connected to chassis ground	Green/yellow wire to CM Cap Board is insulated from ground	**Solid Ground** 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). 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. 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.
	F W	082 098	Two green/ yellow wires connected to chassis ground	Green/yellow wire to CM Cap Board is connected to ground	
					**Non-Solid Ground** 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. 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. 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.

(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.

<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th rowspan="2">Current Rating</th><th colspan="2">Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th>MOV/Input Filter Caps(1)(2)</th><th>DC Bus Common Mode Caps</th></tr>
<tr><td>5</td><td colspan="5">NEMA/UL Type 12 Drives</td></tr>
<tr><td></td><td>D
R</td><td>All</td><td>Two green/ yellow wires connected to chassis ground</td><td>Green/yellow wire is insulated from ground</td><td rowspan="3">Solid Ground
1. CM Cap jumper wire should be connected to ground with a metal screw. Verify.
• Series C 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).
• Series A & B 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).
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.
Non-Solid Ground
1. CM Cap jumper wire should be insulated from ground. Verify.
• Series C Drives - If necessary, remove the metal screw and insert a M5 x 15 nylon screw/ spacer.
• Series A & B 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.
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.</td></tr>
<tr><td></td><td>C
P</td><td>All</td><td>Two green/ yellow wires connected to chassis ground</td><td>Green/yellow wire is connected to ground</td></tr>
<tr><td></td><td colspan="4"> </td></tr>
</table>

Frame	Voltage Code	Current Rating	Factory Default Jumper Settings		Power Source Type
			MOV/Input Filter Caps(1)(2)	*DC Bus Common Mode Caps*	
5	**NEMA/UL Type 12 Drives**				
	E T	All	Two green/ yellow wires connected to chassis ground	Green/yellow wire to CM Cap Board is insulated from ground	**Solid Ground** 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). 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. **Non-Solid Ground** 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. 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.
	F W	All	Two green/ yellow wires connected to chassis ground	Green/yellow wire to CM Cap Board is connected to ground	
					

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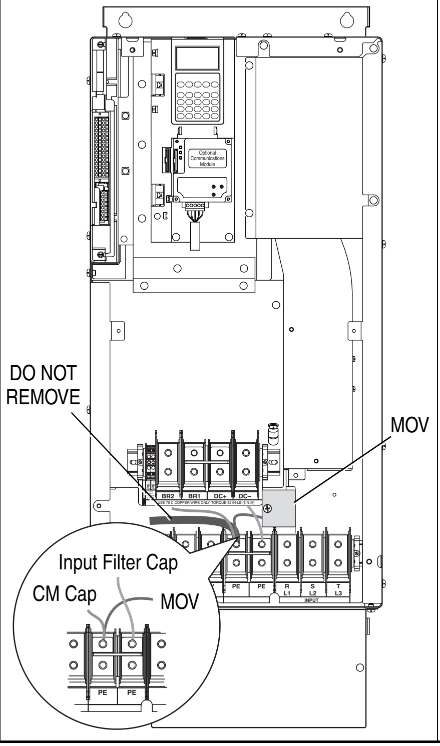
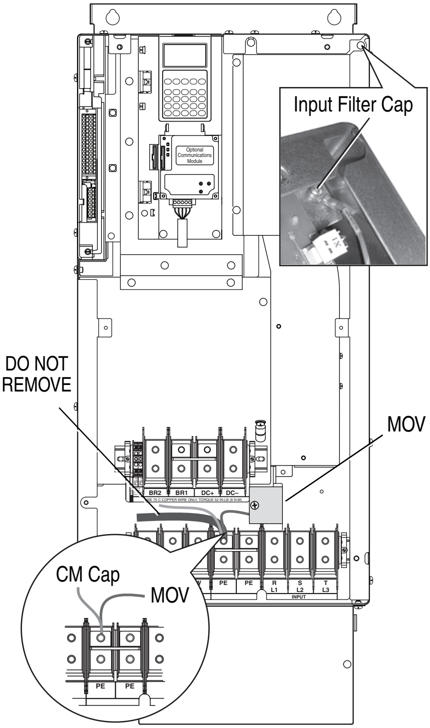
(1) AC input drives only. MOV's and input filter caps do not exist on DC input drives.

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

<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th rowspan="2">Current Rating</th><th colspan="2">Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th><i>MOV/Input Filter Caps(1)(2)</i></th><th><i>DC Bus Common Mode Caps</i></th></tr>
<tr><td rowspan="3">6</td><td>B
D
J
N
R</td><td>All</td><td>Two green/ yellow wires connected to Power Terminal Block “PE”</td><td>Green/yellow wire to CM Cap Board is disconnected</td><td rowspan="3">Solid Ground
1. The green/yellow CM Cap jumper wire should be connected to “PE.”
2. The MOV/Input Filter Cap jumper wires should be connected to “PE.”

Non-Solid Ground
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. Important: Do Not Remove/Disconnect the larger green/yellow wire.
2. 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.</td></tr>
<tr><td>C
H
P</td><td>All</td><td>Two green/ yellow wires connected to Power Terminal Block “PE”</td><td>Green/yellow wire to CM Cap Board is connected to Power Terminal Block “PE”</td></tr>
<tr><td colspan="4"> </td></tr>
</table>

Frame	**Voltage Code**	**Current Rating**	**Factory Default Jumper Settings**		**Power Source Type**
			MOV/Input Filter Caps[1][2]	*DC Bus Common Mode Caps*	
6	E T	All	Two green/ yellow wires connected to Power Terminal Block "PE" and chassis	Green/yellow wire to CM Cap Board is disconnected	**Solid Ground** 1. The green/yellow CM Cap and MOV jumper wires should be connected to "PE." 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).
	F 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"	
					**Non-Solid Ground** 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. **Important: Do Not Remove/ Disconnect the larger green/ yellow wire**. 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.

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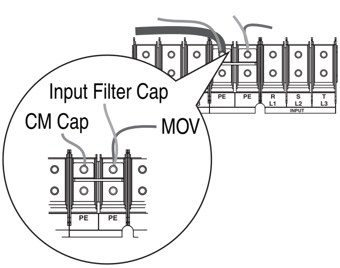
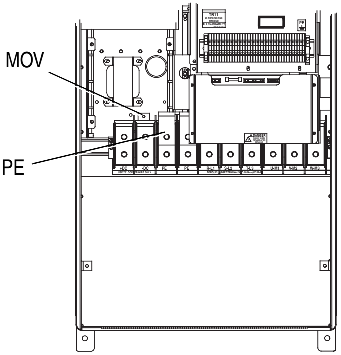
[1] AC input drives only. MOV's and input filter caps do not exist on DC input drives.

[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(1)(2)	*DC Bus Common Mode Caps*	
6	**NEMA/UL Type 12 Drives**				
	D E R T	All	Two green/yellow wires connected to Power Terminal Block "PE"	Green/yellow wire to CM Cap Board is disconnected	**Solid Ground** 1. The green/yellow CM Cap jumper wire should be connected to "PE." 2. The MOV/Input Filter Cap jumper wires should be connected to "PE." **Non-Solid Ground** 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. **Important: Do Not Remove/Disconnect the larger green/yellow wire**. 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.
	C F P W	All	Two green/yellow wires connected to Power Terminal Block "PE"	Green/yellow wire to CM Cap Board is connected to Power Terminal Block "PE"	
					

(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(1)(2)	
7	All	All	A green/yellow wire connected to Power Terminal Block "PE"	**Solid Ground** - The green/yellow MOV jumper wire should be connected to "PE." **Non-Solid Ground** - The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire from "PE" and insulate/secure it to guard against unintentional contact with chassis or components.
				

<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th rowspan="2">Current Rating</th><th>Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th>MOV (1) (2)</th></tr>
<tr><td rowspan="2">8…9</td><td>All</td><td>All</td><td>A green/yellow wire <u>connected</u> to the “PE” bus bar</td><td rowspan="2">

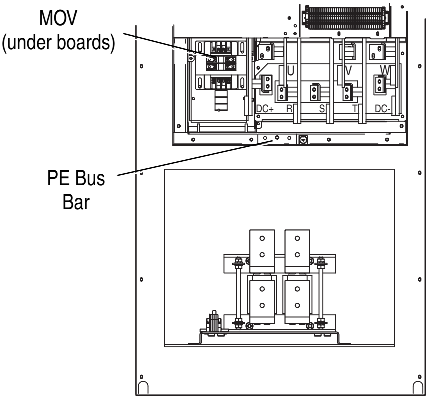
Solid Ground

- The green/yellow MOV jumper wire should be connected to “PE.”

Non-Solid Ground

- The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire from the “PE” bus bar and insulate/secure it to guard against unintentional contact with chassis or components.

</td></tr>
<tr><td colspan="3">



</td></tr>
<tr><td rowspan="2">10</td><td>All</td><td>All</td><td>A green/yellow wire <u>connected</u> to chassis</td><td rowspan="2">

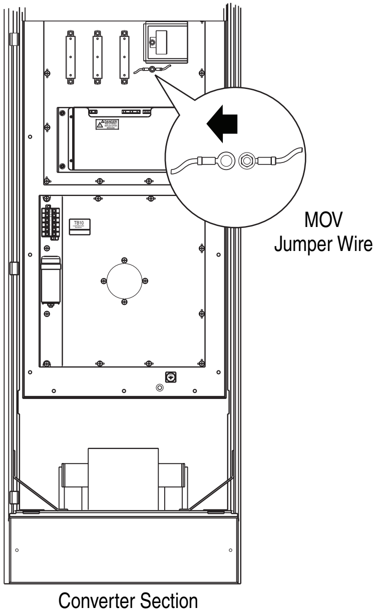
Solid Ground

- The green/yellow MOV jumper wire should be connected to the chassis.

Non-Solid Ground

- The green/yellow MOV jumper wire should be insulated from ground. If necessary, remove the wire and insulate/secure both ends to guard against unintentional contact with chassis or components.

</td></tr>
<tr><td colspan="3">



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

---

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

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

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 0-20mA 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.

Signal and Control Wire Types

Table 1.E Recommended Signal Wire

Signal Type/ Where Used	Belden Wire Type(s) *(or equivalent)*		Description	Min. Insulation Rating
Analog I/O & PTC	8760/9460		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (5)	300V, 75…90 °C (167…194 °F)
Remote Pot	8770		0.750 mm^2 (18 AWG), 3 cond., shielded	
Encoder/Pulse I/O <30 m (100 ft.)	Combined:	9730 (1)	0.196 mm^2 (24 AWG), individually shielded	
Encoder/Pulse I/O 30 to 152 m (100 to 500 ft.)	Signal:	9730/9728 (1)	0.196 mm^2 (24 AWG), indiv. shielded	
	Power:	8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	9892 (3)	0.330 mm^2 or 0.500 mm^2 (3)	
Encoder/Pulse I/O 152 to 259 m (500 to 850 ft.)	Signal:	9730/9728 (1)	0.196 mm^2 (24 AWG), indiv. shielded	
	Power:	8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	9773/9774 (4)	0.750 mm^2 (18 AWG), indiv. shielded pair	

(1) 9730 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9728.

(2) 8790 is 1 shielded pair.

(3) 9892 is 3 individually shielded pairs (3 channel), 0.33 mm^2 (22 AWG) + 1 shielded pair 0.5 mm^2 (20 AWG) for power.

(4) 9773 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9774.

(5) 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.

Table 1.F Recommended Control Wire for Digital I/O

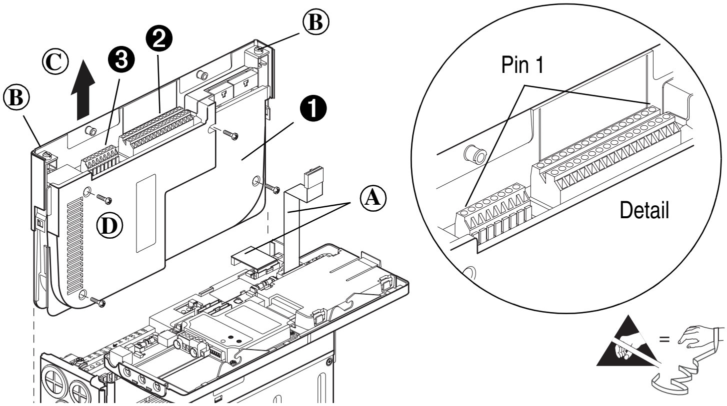
Type	Wire Type(s)	Description	Min. Insulation Rating
Unshielded	Per US NEC or applicable national or local code	–	300V, 60 °C (140 °F)
Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

The I/O Control Cassette – Frames 0…6

Figure 1.7 shows the I/O Control Cassette and terminal block locations. The cassette provides a mounting point for the various PowerFlex 700 I/O options. To remove the cassette, follow the steps below. Cassette removal will be similar for all frames (Frame 0 drive shown).

Step	Description
Ⓐ	Disconnect the two cable connectors shown below.
Ⓑ	Loosen the two screw latches shown below.
Ⓒ	Slide the cassette out.
Ⓓ	Remove screws securing cassette cover to gain access to the boards.

Figure 1.7 PowerFlex 700 Cassette & I/O Terminal Blocks - Frames 0…6



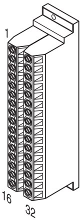
I/O Terminal Blocks

Table 1.G I/O Terminal Block Specifications

				Wire Size Range (1)		Torque	
No.	**Name**	**Frames**	**Description**	Maximum	Minimum	Maximum	Recommended
❶	I/O Cassette	0…6	Removable I/O Cassette				
❷	I/O Terminal Block	0…6	Signal & control connections	2.5 mm^2 (14 AWG)	0.30 mm^2 (22 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
		7…10		4.0 mm^2 (12 AWG)	0.049 mm^2 (30 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)
❸	Encoder Terminal Block	0…10	Encoder power & signal connections	0.75 mm^2 (18 AWG)	0.196 mm^2 (24 AWG)	0.6 N•m (5.3 lb•in)	0.6 N•m (5.3 lb•in)

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

Table 1.H I/O Terminal Designations – Frames 0…6

	No.	Signal	Factory Default	Description	Related Param.
	1	Analog In 1 (–)(1)	(2)	Isolated(3), bipolar, differential, ±10V/0-20 mA, 11 bit & sign. For 0-20 mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20). 88k ohm input impedance when configured for volt. & 95.3 ohm for current	320-327
	2	Analog In 1 (+)(1)			
	3	Analog In 2 (–)(1)			
	4	Analog In 2 (+)(1)			
	5	Pot Common	–	For (+) and (–) 10V pot references.	
	6	Analog Out 1 (–)	(2)	Single-ended bipolar (current output is not bipolar), ±10V/0-20mA, 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.(4)	Fault	Max. Resistive Load: 240V AC/30V DC – 1200VA, 150W Max. Current: 5A, Min. Load: 10 mA Max. Inductive Load: 240V AC/30V DC – 840VA, 105W Max. Current: 3.5A, Min. Load: 10 mA	380-391
	12	Digital Out 1 Common			
	13	Digital Out 1 – N.O.(4)	NOT Fault		
	14	Digital Out 2 – N.C.(4)	NOT Run		
	15	Digital Out 2/3 Com.			
	16	Digital Out 3 – N.O.(4)	Run		
	17	Current In Jumper(1) – Analog In 1		Placing a jumper across terminals 17 & 18 (or 19 & 20) will configure that analog input for current.	
	18				
	19	Current In Jumper(1) – Analog In 2			
	20				
	21	–10V Pot Reference	–	2k ohm minimum load.	
	22	+10V Pot Reference	–		
	23	HW PTC Input 2	–	See above	
	24	+24VDC(5)	–	Drive supplied logic input power. (5)	
	25	Digital In Common	–		
	26	24V Common(5)	–	Common for internal power supply.	
	27	Digital In 1(6)	Stop - CF	115V AC, 50/60 Hz - Opto isolated Low State: less than 30V AC High State: greater than 100V AC, 5.7 mA 24V DC - Opto isolated Low State: less than 5V DC High State: greater than 20V DC, 10 mA DC Digital Input Impedance: 21k ohm	361-366
	28	Digital In 2(6)	Start		
	29	Digital In 3(6)	Auto/Man.		
	30	Digital In 4(6)	Speed Sel 1		
	31	Digital In 5(6)	Speed Sel 2		
	32	Digital In 6/Hardware Enable(6), see pg. 1-43	Speed Sel 3		

(1) **Important:** 0-20mA 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").

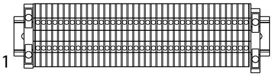
(3) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

(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. 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.

Table 1.I I/O Terminal Designations – Frames 7…10



No.	Signal	Factory Default	Description	Related Param.
1	Analog In 1 (–)(1)	(2)	Isolated(3), bipolar, differential, ±10V/4-20mA, 11 bit & sign, 88k ohm input impedance. For 4-20mA, a jumper must be installed at terminals 17 & 18 (or 19 & 20).	320-327
2	Analog In 1 (+)(1)			
3	Analog In 2 (–)(1)			
4	Analog In 2 (+)(1)			
5	Pot Common	–	For (+) and (–) 10V pot references.	
6	Analog Out 1 (–)	(2)	Bipolar (current output is not bipolar), ±10V/4-20mA, 11 bit & sign, voltage mode - limit current to 5 mA. Current mode - max. load resistance is 400 ohms.	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.(4)	Fault	Max. Resistive Load: 240V AC/30V DC – 1200VA, 150W Max. Current: 5A, Min. Load: 10mA Max. Inductive Load: 240V AC/30V DC – 840VA, 105W Max. Current: 3.5A, Min. Load: 10mA	380-391
12	Digital Out 1 Common			
13	Digital Out 1 – N.O.(4)	NOT Fault		
14	Digital Out 2 – N.C.(4)	NOT Run		
15	Digital Out 2/3 Com.			
16	Digital Out 3 – N.O.(4)	Run		
17	Current In Jumper(1) – Analog In 1		Placing a jumper across terminals 17 & 18 (or 19 & 20) will configure that analog input for current.	
18				
19	Current In Jumper(1) – Analog In 2			
20				
21	–10V Pot Reference	–	2k ohm minimum load.	
22	+10V Pot Reference	–		
23	HW PTC Input 2	–	See above	
24	+24VDC(5)	–	Drive supplied logic input power. (5)	
25	Digital In Common	–		
26	24V Common(5)	–	Common for internal power supply.	
27	Digital In 1	Stop - CF	115V AC, 50/60 Hz - Opto isolated Low State: less than 30V AC High State: greater than 100V AC 24V DC - Opto isolated Low State: less than 5V DC High State: greater than 20V DC 11.2 mA DC	361-366
28	Digital In 2	Start		
29	Digital In 3	Auto/Man.		
30	Digital In 4	Speed Sel 1		
31	Digital In 5	Speed Sel 2		
32	Digital In 6/Hardware Enable, see pg. 1-43	Speed Sel 3		
33	Digital Out 4 – N.C.	Fault	Dedicated fault output - Not user configurable. Relay will energize (pick up) when power is applied to drive and deenergize (drop out) when a fault exists. See Terminals 11…16 for specs.	
34	Digital Out 4 Common			
35	Digital Out 4 – N.O.	NOT Fault		
PS+	Aux. Control Power (+)		Refer to page 1-14.	
PS-	Aux. Control Power (–)		Refer to page 1-14.	
PE	PE Ground		PE Ground	
PE	PE Ground		PE Ground	

See page 1-42 for notes

(1) **Important:** 0-20mA 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”).

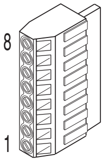
(3) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

(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) 150mA maximum Load. Not present on 115V versions.

Encoder Terminal Block

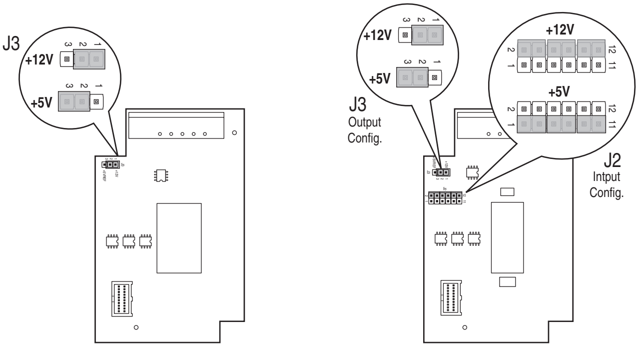
Table 1.J Encoder Terminal Designations

	No.	**Description** (refer to page A-4 for encoder specifications)	
See “Detail” on page 1-39  	8	+12V(1) DC Power	Internal power source 250 mA.
	7	+12V(1) DC Return (Common)	
	6	Encoder Z (NOT)	Pulse, marker or registration input. (2)
	5	Encoder Z	
	4	Encoder B (NOT)	Quadrature B input.
	3	Encoder B	
	2	Encoder A (NOT)	Single channel or quadrature A input.
	1	Encoder A	

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

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

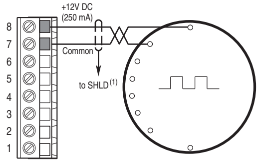
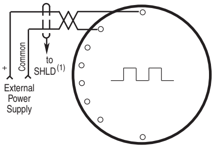
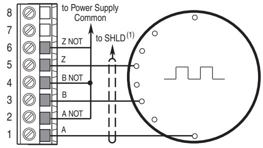
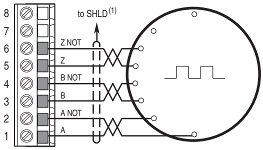
Figure 1.8 Encoder Board Jumper Settings



5/12V
(20B-ENC-2)

5/12V
(20B-ENC-1, Series B)

Figure 1.9 Sample Encoder Wiring

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

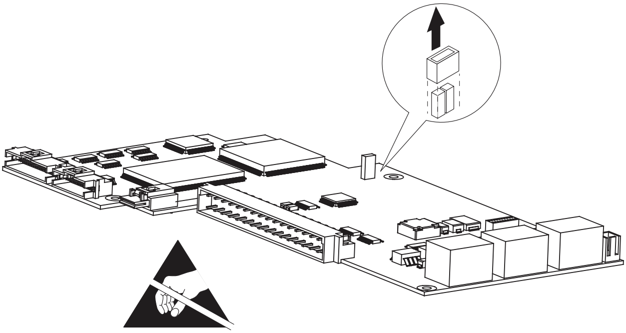
(1) SHLD connection is on drive chassis (see page 1-16).

Hardware Enable Circuitry *(Vector Control Option Only)*

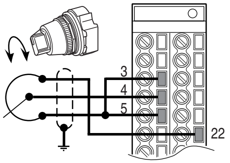
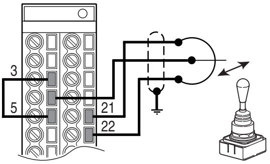
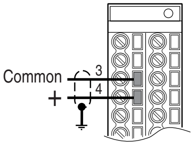
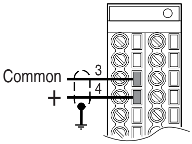
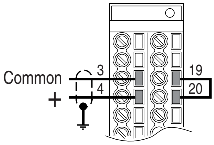
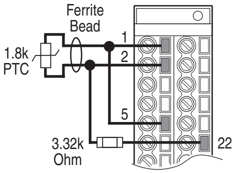
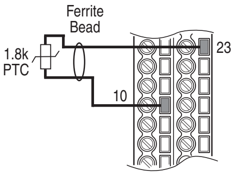
By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a “dedicated” hardware enable configuration can be utilized. This is done by removing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

1. Frames 0…6 – Remove the I/O Control Cassette & cover as described on page 1-39.

   Frames 7…10 – Remove HIM support plate to gain access to the Main Control Board.
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 1-40 or 1-41).
5. Verify that [Digital In6 Sel], parameter 366 is set to “1, Enable.”



I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Speed Reference (1) 10k Ohm Pot. Recommended (2k Ohm Minimum)		- Adjust Scaling: Parameters 91/92 and 325/326 - View Results: Parameter 002
Joystick Bipolar Speed Reference (1) ±10V Input		- Set Direction Mode: Parameter 190 = "1, Bipolar" - Adjust Scaling: Parameters 91/92 and 325/326 - View Results: Parameter 002
Analog Input Bipolar Speed Reference ±10V Input		- Set Direction Mode: Parameter 190 = "1, Bipolar" - Adjust Scaling: Parameters 91/92 and 325/326 - View Results: Parameter 002
Analog Voltage Input Unipolar Speed Reference 0 to +10V Input		- Configure Input with parameter 320 - Adjust Scaling: Parameters 91/92 and 325/326 - View results: Parameter 002
Analog Current Input Unipolar Speed Reference 0-20 mA Input		- Configure Input for Current: Parameter 320 and add jumper at appropriate terminals - Adjust Scaling: Parameters 91/92 and 325/326 - View results: Parameter 002
Analog Input, PTC PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V		- Set Fault Config 1: Parameter 238, bit 7 = "Enabled" - Set Alarm Config 1: Parameter 259, bit 11 = "Enabled" - View Status Drive Alarm 1: Parameter 211, bit 11 = "True"
HW PTC Input PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V		- Set Fault Config 1: Parameter 238, bit 13 = "Enabled" - Set Alarm Config 1: Parameter 259, bit 18 = "Enabled" - View Status: Drive Alarm 1: Parameter 211, bit 18 = "True"

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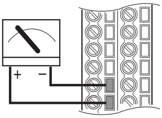
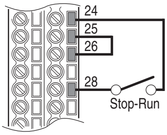
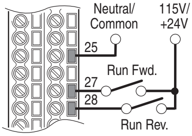
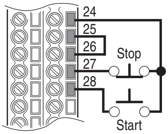
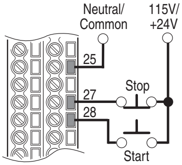
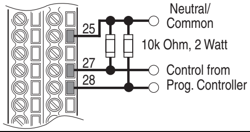
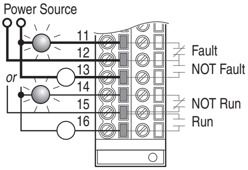
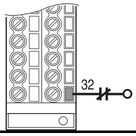
(1) Refer to the Attention statement on page 1-38 for important bipolar wiring information.

I/O Wiring Examples (continued)

<table>
<tr><th>Input/Output</th><th>Connection Example</th><th>Required Parameter Changes</th></tr>
<tr><td>Analog Output
±10V, 0-20 mA Bipolar
+10V Unipolar <i>(shown)</i></td><td>
</td><td>
- Configure with Parameter 340
- Select Source Value:
Parameter 380, [Digital Out1 Sel]
- Adjust Scaling:
Parameters 343/344
</td></tr>
<tr><td>2-Wire Control Non-Reversing[1]
24V DC internal supply</td><td>
</td><td>
- Disable Digital Input:#1:
Parameter 361 = “0, Unused”
- Set Digital Input #2:
Parameter 362 = “7, Run”
- Set Direction Mode:
Parameter 190 = “0, Unipolar”
</td></tr>
<tr><td>2-Wire Control Reversing[1]
External supply
(I/O Board dependent)</td><td>
</td><td>
- Set Digital Input:#1:
Parameter 361 = “8, Run Forward”
- Set Digital Input #2:
Parameter 362 = “9, Run Reverse”
</td></tr>
<tr><td>3-Wire Control
Internal supply</td><td>
</td><td>
- No Changes Required
</td></tr>
<tr><td>3-Wire Control
External supply (I/O Board dependent). Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections will cause a type 2 alarm (page 4-11).</td><td>
</td><td>
- No Changes Required
</td></tr>
<tr><td>Digital Input
PLC Output Card (Board dependent).</td><td>
</td><td>
- No Changes Required
</td></tr>
<tr><td>Digital Output
Relays (two at terminals 14…16) shown in powered state with drive faulted. See pages 1-40 and 1-41.</td><td>
</td><td>
- Select Source to Activate:
Parameters 380/384
</td></tr>
<tr><td>Enable Input</td><td>
</td><td>
- Configure with parameter 366
For dedicated hardware Enable:
Remove Jumper J10 (see 1-43)
</td></tr>
</table>

---

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

Reference Control

"Auto" Speed Sources

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

The default source for a command reference (all speed select inputs open or not programmed) is the selection programmed in [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive will use other parameters as the speed command source.

"Manual" Speed Sources

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

- The HIM can provide the manual source when:
  - manual control is requested from the HIM (see ALT Functions on page B-3)
    or …
  - the I/O terminal block requests manual control through a digital input programmed for "Auto/Manual." [TB Man Ref Sel] is then set to one of the DPI ports with a HIM connected to it.(1)
- the I/O terminal block analog input can provide the manual source when a digital input is programmed for "Auto/Manual." [TB Man Ref Sel] is set to "Analog Input."

Changing Speed Sources

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

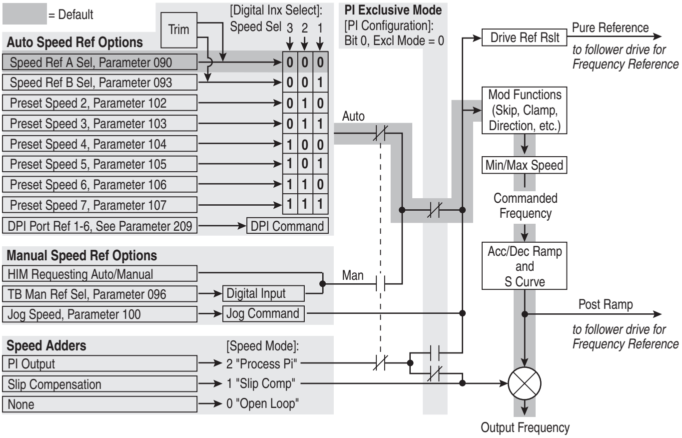
Torque Reference Source

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

---

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

Figure 1.10 Speed Reference Selection Chart(1)



Auto/Manual Examples

PLC = Auto, HIM = Manual

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

Attain Manual Control

- Press ALT then Auto/Man on the HIM. When the HIM attains manual control, the drive speed command comes from the HIM speed control keys.

Release to Auto Control

- Press ALT then Auto/Man on the HIM again. When the HIM releases manual control, the drive speed command returns to the PLC.

---

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

PLC = Auto, Terminal Block = Manual

A process is run by a PLC when in Auto mode and requires manual control from an analog potentiometer wired to the drive terminal block. The auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to “DPI Port 5” with the drive running from the Auto source. Since the Manual speed reference is issued by an analog input (“Analog In 1 or 2”), [TB Man Ref Sel] is set to the same input. To switch between Auto and Manual, [Digital In4 Sel] is set to “Auto/Manual.”

Attain Manual Control

- Close the digital input.
  With the input closed, the speed command comes from the pot.

Release to Auto Control

- Open the digital input.
  With the input open, the speed command returns to the PLC.

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

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

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

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

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

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

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

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

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

Attain Manual Control

- Close the digital input.
  With the input closed, the speed command comes from the HIM.

Release to Auto Control

- Open the digital input.
  With the input open, the speed command returns to the PLC.

Auto/Manual Notes

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

Lifting/Torque Proving

For Lifting/Torque Proving details, refer to page C-4.

Using PowerFlex Drives with Regenerative Units

If a Regenerative unit (i.e. 1336 REGEN) is used as a bus supply or brake, the common mode capacitors should be disconnected as described on page 1-24.

Connections to the 1336 REGEN

Regen Brake Mode

	Terminals	
Frame(s)	**1336 REGEN**	**PowerFlex 700**
0…4	DC+	BR1
	DC–	DC–
5…6	DC+	DC+
	DC–	DC–

Regenerative Bus Supply Mode

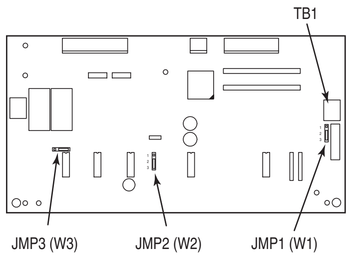
	Terminals	
Frame(s)	**1336 REGEN**	**PowerFlex 700**
0…4	DC+	DC+
	DC–	DC–
5…6	DC+	DC+ of Common Bus Drives
	DC–	DC– of Common Bus Drives

DC Input (Common Bus) and Precharge Notes

The following notes must be read and understood.

Important Application Notes

1. If drives without internal precharge are used (Frames 5, 6 and 10 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.
3. If drives with internal precharge (Frames 7…9) are used with a disconnect switch to the common bus, then:
   - **a)** an auxiliary contact on the disconnect must be connected to a digital input of the drive. The corresponding input (parameter 361…366) must be set to option 30, "Precharge Enable." This provides the proper precharge interlock, guarding against possible damage to the drive when connected to a common DC bus, and…
   - **b)** an auxiliary contact on the disconnect must also be connected to TB1 on the Precharge Board. Set JMP1 to the voltage being used and JMP2 to "Interlock."
   - **c)** Set jumpers on the Precharge Board as shown below:

Jumper	Setting	Description	
JMP1	1-2	24V DC input	
	2-3(1)	120V AC Input	
JMP2	1-2	Interlock	
	2-3(1)	Bypass	
JMP3	1-2	Do Not Use	
	2-3(1)	Bypass	

(1) Default setting.

EMC Instructions - Frames 0…6

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(1) comply with the EN standards listed below when installed according to this *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.

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.

(1) 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.

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 before installing the drive.
3. Grounding as described in this publication. Frame 7…10, 400/480V AC drives are certified for AC center grounded neutral power supply systems only.
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.
   - Refer to the *Wiring and Grounding Guidelines for PWM AC Drives* (publication DRIVES-IN001) for additional information.

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 1.K and **http://www.deltron-emcon.com** and **http://www.mtecorp.com** (USA) or **http://www.schaffner.com**, respectively.

Table 1.K PowerFlex 700 Recommended Filters

Manufacturer	**Frame**	**Manufacturer Part Number**[1]	**Class**		**Manufacturer Part Number**[1]	**Class**	
			A *(Meters)*	**B** *(Meters)*		**A** *(Meters)*	**B** *(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	–	–	–

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

Chapter 2

Start Up

This chapter describes how you start up the PowerFlex 700 Drive. Refer to Appendix B for a brief description of the LCD HIM (Human Interface Module).

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. If an event does not occur while performing this procedure, **Do Not Proceed**. **Remove Power** including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to then drive. Correct the malfunction before continuing.

Prepare For Drive Start-Up

Before Applying Power to the Drive

☐ **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.

The remainder of this procedure requires that a HIM be installed. 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).

Applying Power to the Drive

☐ **4.** Apply AC power and control voltages to the drive.

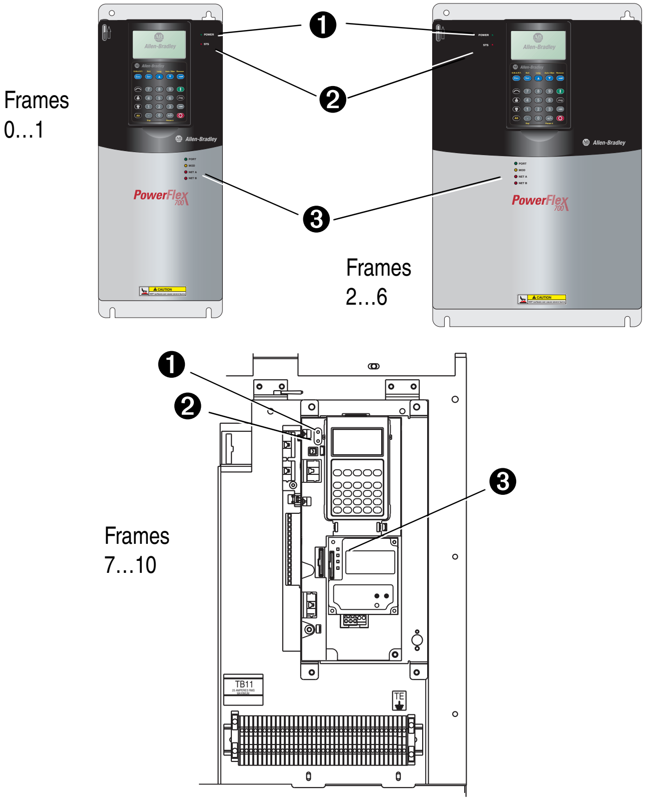
If any of the six digital inputs are configured to “Stop – CF” (CF = Clear Fault) or “Enable,” verify that signals are present or reconfigure [Digital Inx Sel]. If an I/O option is not installed (i.e. no I/O terminal block), verify that [Digital Inx Sel] is not configured to “Stop – CF” or “Enable.” If this is not done, the drive will not start. Refer to Alarm Descriptions on page 4-11 for a list of potential digital input conflicts. If a fault code appears, refer to Chapter 4.

If the STS LED is not flashing green at this point, refer to Status Indicators below.

☐ **5.** Proceed to Start-Up Routines.

Status Indicators

Figure 2.1 Drive Status Indicators



#	Name	Color	State	Description
❶	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
❷	STS (Status)	Green	Flashing	Drive ready, but not running and no faults are present.
			Steady	Drive running, no faults are present.
		Yellow See page 4-11	Flashing, Drive Stopped	A start inhibit condition exists, the drive cannot be started. Check parameter 214 [Start Inhibits].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
		Red See page 4-5	Flashing	Fault has occurred. Check [Fault x Code] or Fault Queue.
			Steady	A non-resettable fault has occurred.
❸	PORT	Refer to the Communication Adapter User Manual.		Status of DPI port internal communications (if present).
	MOD			Status of communications module (when installed).
	NET A			Status of network (if connected).
	NET B			Status of secondary network (if connected).

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 2-6.

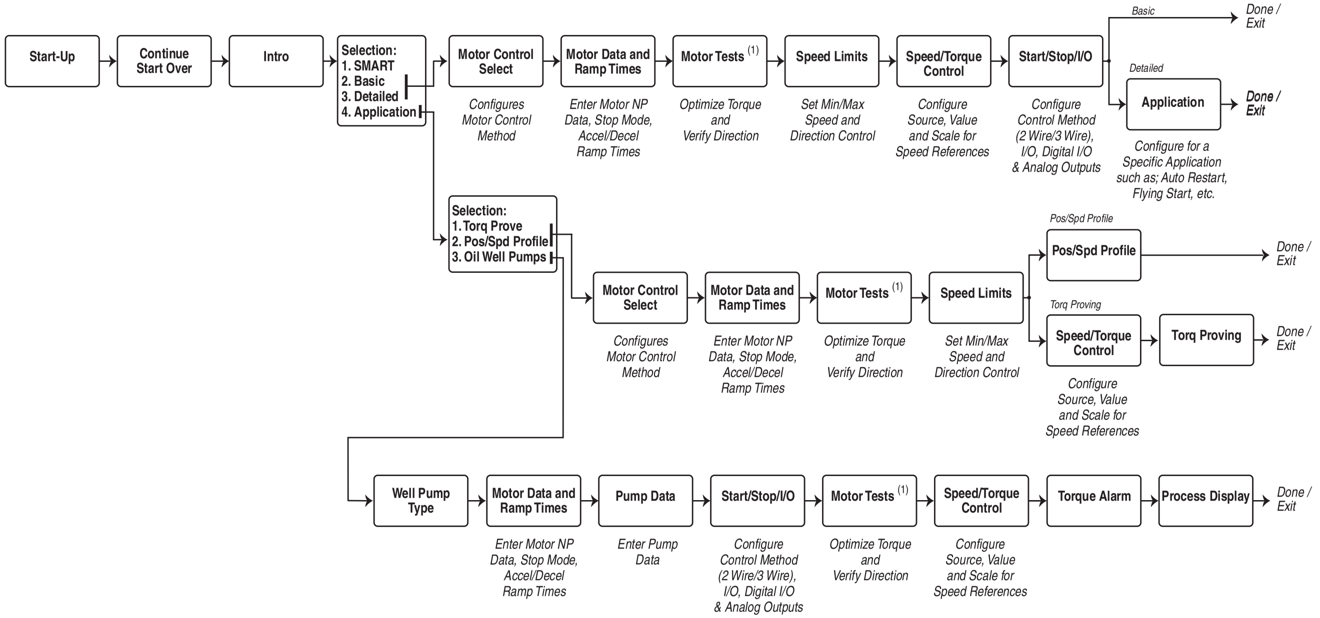
- **Assisted Start Up**
  Three levels of Assisted Start Up (Basic, Detailed and Application) aid the user in commissioning the drive asking simple Yes/No or "Enter Data" questions. The user is guided through the Start Up to reduce the amount of time necessary to get the drive "up and running." The following 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 2-6 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 on page C-4.

Figure 2.2 Start Up Menu



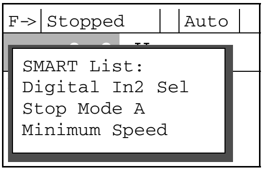
(1) During Motor Tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361-366. If power is removed from the drive during 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:

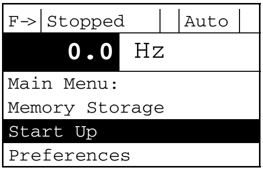
Step	Key(s)	Example LCD Displays
1. Press ALT and then Esc (S.M.A.R.T). The S.M.A.R.T. start screen appears.	ALT Esc	 F-> Stopped Auto SMART List: Digital In2 Sel Stop Mode A Minimum Speed
2. View and change parameter values as desired. For HIM information, see Appendix B.		
3. Press Esc to exit the S.M.A.R.T. start.	Esc	

Running an Assisted Start Up

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

The Assisted start-up routine asks simple yes/no or "enter data" questions. 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".	▲ ▼	 F-> Stopped Auto 0.0 Hz Main Menu: Memory Storage Start Up Preferences
2. Press Enter.	↵	

Programming and Parameters

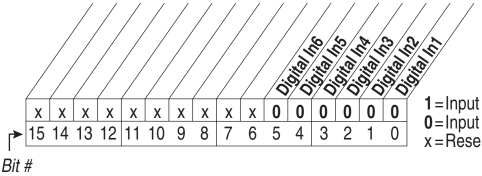
Chapter 3 provides a complete listing and description of the PowerFlex 700 parameters. The parameters can be programmed (viewed/edited) using an LCD HIM (Human Interface Module). As an alternative, programming can also be performed using DriveExplorer™ or DriveExecutive™ software and a personal computer. Refer to Appendix B for a brief description of the LCD HIM.

About Parameters

To configure a drive to operate in a specific way, drive parameters may have to be set. Three types of parameters exist:

- **ENUM Parameters**
  ENUM parameters allow a selection from 2 or more items. The LCD HIM will display a text message for each item.
- **Bit Parameters**
  Bit parameters have individual bits associated with features or conditions. If the bit is 0, the feature is off or the condition is false. If the bit is 1, the feature is on or the condition is true.
- **Numeric Parameters**
  These parameters have a single numerical value (i.e. 0.1 Volts).

The example on the following page shows how each parameter type is presented in this manual.

❶	❷	❸	❹	❺	❻
File	**Group**	**No.**	**Parameter Name & Description**	**Values**	**Related**
UTILITY	Drive . . .	198 ○	**[Load Frm Usr Set]** Loads a previously saved set of parameter values from a selected user set location in drive nonvolatile memory to active drive memory.	Default: 0 "Ready" Options: 0 "Ready" 1 "User Set 1" 2 "User Set 2" 3 "User Set 3"	199 ℹ
UTILITY	Diagnostics	216	**[Dig In Status]** Status of the digital inputs. 	Read Only **1** = Input Present **0** = Input Not Present x = Reserved	361 thru 366
MOTOR . . .	Torq . . .	434 FV	**[Torque Ref B Mult]** Defines the value of the multiplier for the [Torque Ref B Sel] selection.	Default: 1.0 Min/Max: –/+32767.0 Units: 0.1	053

No.	Description		
❶	**File** – Lists the major parameter file category.		
❷	**Group** – Lists the parameter group within a file.		
❸	**No.** – Parameter number. Note that all parameters in the PowerFlex 700VC are 32 bit. ○ = Parameter value cannot be changed until drive is stopped. FV = Parameter only displayed when [Motor Cntl Sel] is set to "4." v6 = This parameter only available with firmware version 6.002 and later.		
❹	**Parameter Name & Description** – Parameter name as it appears on an LCD HIM, with a brief description of the parameter's function.		
❺	**Values** – Defines the various operating characteristics of the parameter. Three types exist.		
	ENUM	Default: Options:	Lists the value assigned at the factory. "Read Only" = no default. Displays the programming selections available.
	Bit	Bit:	Lists the bit place holder and definition for each bit.
	Numeric	Default: Min/Max: Units:	Lists the value assigned at the factory. "Read Only" = no default. The range (lowest and highest setting) possible for the parameter. Unit of measure and resolution as shown on the LCD HIM.
		Important: Some parameters will have two unit values: • Analog inputs can be set for current or voltage with [Anlg In Config], param. 320. • Setting [Speed Units], parameter 79 selects Hz or RPM.	
		Important: When sending values through DPI ports, simply remove the decimal point to arrive at the correct value (i.e. to send "5.00 Hz," use "500").	
❻	**Related** – Lists parameters (if any) that interact with the selected parameter. The symbol "ℹ" indicates that additional parameter information is available in Appendix C.		

How Parameters are Organized

The LCD HIM displays parameters in a **File-Group-Parameter** or **Numbered List** view order. To switch display mode, access the Main Menu, press ALT, then Sel while cursor is on the parameter selection. In addition, using [Param Access Lvl], the user has the option to display the full parameter set (Advanced), commonly used parameters (Basic) or diagnostic/advanced tuning parameters (Reserved).

To simplify programming, the displayed parameters will change according to the selection made with [Motor Cntl Sel]. For example, if “FVC Vector” is selected, the parameters associated solely with other operations such as Volts per Hertz or Sensorless Vector will be hidden. Refer to pages 3-4 and 3-5.

File-Group-Parameter Order

This simplifies programming by grouping parameters that are used for similar functions. The parameters are organized into files. Each file is divided into groups, and each parameter is an element in a group. By default, the LCD HIM displays parameters by File-Group-Parameter view.

Numbered List View

All parameters are in numerical order.

Basic Parameter View

Parameter 196 [Param Access Lvl] set to option 0 “Basic.”

File	Group	Parameters					
Monitor	Metering	Output Freq Commanded Speed Commanded Torque** Output Current Torque Current DC Bus Voltage	001 002 024 003 004 012				
Motor Control	Motor Data	Motor NP Volts Motor NP FLA Motor NP Hertz	041 042 043	Motor NP RPM Motor NP Power Mtr NP Pwr Units	044 045 046	Motor OL Hertz Motor Poles	047 049
	Torq Attributes	Motor Cntl Sel Maximum Voltage Maximum Freq Autotune	053 054 055 061	Autotune Torque** Inertia Autotune** Torque Ref A Sel** Torque Ref A Hi**	066 067 427 428	Torque Ref A Lo** Pos Torque Limit** Neg Torque Limit**	429 436 437
	Speed Feedback	Motor Fdbk Type	412	Encoder PPR	413		
Speed Command	Spd Mode & Limits	Speed Units Feedback Select	079 080	Minimum Speed Maximum Speed	081 082	Rev Speed Limit**	454
	Speed References	Speed Ref A Sel Speed Ref A Hi Speed Ref A Lo Speed Ref B Sel	090 091 092 093	Speed Ref B Hi Speed Ref B Lo TB Man Ref Sel TB Man Ref Hi	094 095 096 097	TB Man Ref Lo Pulse Input Ref	098 099
	Discrete Speeds	Jog Speed 1 Preset Speed 1-7	100 101-107	Jog Speed 2	108		
Dynamic Control	Ramp Rates	Accel Time 1 Accel Time 2	140 141	Decel Time 1 Decel Time 2	142 143	S-Curve %	146
	Load Limits	Current Lmt Sel	147	Current Lmt Val	148		
	Stop/Brake Modes	Stop/Brk Mode A Stop/Brk Mode B	155 156	DC Brk Lvl Sel DC Brake Level DC Brake Time	157 158 159	Bus Reg Mode A Bus Reg Mode B DB Resistor Type	161 162 163
	Restart Modes	Start At PowerUp	168	Auto Rstrt Tries	174	Auto Rstrt Delay	175
	Power Loss	Power Loss Mode	184	Power Loss Time	185	Power Loss Level	186
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	Drive Memory	Param Access Lvl Reset To Defalts	196 197	Load Frm Usr Set Save To User Set	198 199	Language	201
	Diagnostics	Start Inhibits	214	Dig In Status	216	Dig Out Status	217
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	Alarms	Alarm Config 1	259				
Inputs & Outputs	Analog Inputs	Anlg In Config Analog In1 Hi Analog In1 Lo	320 322 323	Analog In2 Hi Analog In2 Lo	325 326		
	Analog Outputs	Analog Out1, 2 Sel Analog Out1 Hi	342 343	Analog Out1, 2 Lo Analog Out1, 2 Sel	344 345	Analog Out2 Hi Analog Out1, 2 Lo	346 347
	Digital Inputs	Digital In1-6 Sel	361-366				
	Digital Outputs	Digital Out1-3 Sel	380-388	Dig Out1-3 Level	381-389		

* These parameters will <u>only</u> be displayed when parameter 053 [Motor Cntl Sel] is set to option “2 or 3.”

** These parameters will <u>only</u> be displayed when parameter 053 [Motor Cntl Sel] is set to option “4.”

6.x Firmware version 6.002 and later.

Advanced Parameter View

Parameter 196 [Param Access Lvl] set to option 1 “Advanced.”

File	Group	Parameters					
Monitor	Metering	Output Freq	001	Flux Current	005	DC Bus Memory	013
		Commanded Speed	002	Output Voltage	006	Analog In1 Value	016
		Ramped Speed	022	Output Power	007	Analog In2 Value	017
		Speed Reference	023	Output Powr Fctr	008	Elapsed kWh	014
		Commanded Torque**	024	Elapsed MWh	009	PTC HW Value	018
		Speed Feedback	025	Elapsed Run Time	010	Spd Fdbk No Filt	021
		Output Current	003	MOP Reference	011		
		Torque Current	004	DC Bus Voltage	012		
	Drive Data	Rated kW	026	Rated Amps	028		
		Rated Volts	027	Control SW Ver	029		
Motor Control	Motor Data	Motor Type	040	Motor NP RPM	044	Motor OL Factor	048
		Motor NP Volts	041	Motor NP Power	045	Motor OL Mode$^{6.x}$	050
		Motor NP FLA	042	Mtr NP Pwr Units	046	Motor Poles	049
		Motor NP Hertz	043	Motor OL Hertz	047		
	Torq Attributes	Motor Cntl Sel	053	Flux Current Ref	063	Torque Ref B Hi**	432
		Maximum Voltage	054	IXo Voltage Drop	064	Torque Ref B Lo**	433
		Maximum Freq	055	Autotune Torque**	066	Torq Ref B Mult**	434
		Compensation	056	Inertia Autotune**	067	Torque Setpoint 1**	435
		Flux Up Mode	057	Torque Ref A Sel**	427	Torque Setpoint 2**	438
		Flux Up Time	058	Torque Ref A Hi**	428	Pos Torque Limit**	436
		SV Boost Filter	059	Torque Ref A Lo**	429	Neg Torque Limit**	437
		Autotune	061	Torq Ref A Div**	430	Control Status**	440
		IR Voltage Drop	062	Torque Ref B Sel**	431	Mtr Tor Cur Ref**	441
	Volts per Hertz	Start/Acc Boost	069	Break Voltage*	071		
		Run Boost*	070	Break Frequency*	072		
	Speed Feedback	Motor Fdbk Type	412	Fdbk Filter Sel	416	Marker Pulse	421
		Encoder PPR	413	Notch Filter Freq**	419	Pulse In Scale	422
		Enc Position Fdbk	414	Notch Filter K**	420	Encoder Z Chan	423
		Encoder Speed	415				
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		Feedback Select	080	Skip Frequency 1*	084	Speed/Torque Mod**	088
		Minimum Speed	081	Skip Frequency 2*	085	Rev Speed Limit**	454
		Maximum Speed	082	Skip Frequency 3*	086		
	Speed References	Speed Ref A Sel	090	Speed Ref B Hi	094	TB Man Ref Hi	097
		Speed Ref A Hi	091	Speed Ref B Lo	095	TB Man Ref Lo	098
		Speed Ref A Lo	092	TB Man Ref Sel	096	Pulse Input Ref	099
		Speed Ref B Sel	093				
	Discrete Speeds	Jog Speed 1	100	Preset Speed 1-7	101-107	Jog Speed 2	108
	Speed Trim	Trim In Select	117	Trim Hi	119	Trim % Setpoint	116
		Trim Out Select	118	Trim Lo	120		
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	Process PI	PI Configuration	124	PI Upper Limit	132	PI Reference Lo	461
		PI Control	125	PI Preload	133	PI Feedback Hi	462
		PI Reference Sel	126	PI Status	134	PI Feedback Lo	463
		PI Setpoint	127	PI Ref Meter	135	PI BW Filter	139
		PI Feedback Sel	128	PI Fdback Meter	136	PI Deriv Time	459
		PI Integral Time	129	PI Error Meter	137	PI Output Gain	464
		PI Prop Gain	130	PI Output Meter	138		
		PI Lower Limit	131	PI Reference Hi	460		
	Speed Regulator	Ki Speed Loop**	445	Spd Err Filt BW$^{6.x}$	448	Speed Loop Meter**	451
		Kp Speed Loop**	446	Speed Desired BW**	449		
		Kf Speed Loop**	447	Total Inertia**	450		
Dynamic Control	Ramp Rates	Accel Time 1, 2	140,141	Decel Time 1, 2	142,143	S Curve %	146
	Load Limits	Current Lmt Sel	147	Drive OL Mode	150	Regen Power Limit**	153
		Current Lmt Val	148	PWM Frequency	151	Current Rate Limit **	154
		Current Lmt Gain	149	Droop RPM @ FLA	152		
	Stop/Brake Modes	Stop Mode	155,156	Bus Reg Ki*	160	Bus Reg Kd*	165
		DC Brk Lvl Sel	157	Bus Reg Mode	161,162	Flux Braking	166
		DC Brake Level	158	DB Resistor Type	163	DB While Stopped	145
		DC Brake Time	159	Bus Reg Kp*	164		
	Restart Modes	Start At PowerUp	168	Auto Rstrt Delay	175	Wake Time	181
		Flying Start En	169	Sleep-Wake Mode	178	Sleep Level	182
		Flying StartGain	170	Sleep-Wake Ref	179	Sleep Time	183
		Auto Rstrt Tries	174	Wake Level	180	Powerup Delay	167
	Power Loss	Power Loss Mode	184	Load Loss Level	187	Gnd Warn Level	177
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		Reset To Defalts	197	Language	201	Dyn UserSet Sel	205
		Load Frm Usr Set	198	Voltage Class	202	Dyn UserSet Actv	206
		Save To User Set	199	Drive Checksum	203		
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		Speed Ref Source	213	Motor OL Count	220	Testpoint 1,2 Sel	234,236
		Start Inhibits	214	Fault Speed	224	Testpoint 1,2 Data	235,237
		Last Stop Source	215	Fault Amps	225	Mtr OL Trip Time	221
		Dig In Status	216	Fault Bus Volts	226		
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		Scale1, 2 In Hi	477,483	Scale1,2 Out Val	481,487	Scale3, 4 Out Hi	491,497
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		Jog Mask	278	Local Mask	285	Decel Owner	294
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		Reference Mask	280	Start Owner	289	MOP Owner	296
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		Anlg In Sqr Root	321	Analog In1, 2 Lo	323,326		
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		Anlg Out Absolut	341	Analog Out1, 2 Lo	344,347	Anlg1 Out Setpt	377,378
		Analog Out1, 2 Sel	342,345				
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		Spd Dev Band	602	Brk Set Time	607	Torq Prove Sts	612
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		TorqAlarm Action	633	Min Rod Speed	639	Motor Sheave	645
		TorqAlarm Dwell	634	Max Rod Speed	640	Total Gear Ratio	646
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		Step x Velocity	721…	Step x Value	724…	Step x Next	727…
		Step x AccelTime	722…	Step x Dwell	725…		

* These parameters will <u>only</u> be displayed when parameter 053 [Motor Cntl Sel] is set to option “2 or 3.”

** These parameters will <u>only</u> be displayed when parameter 053 [Motor Cntl Sel] is set to option “4.”

[6.x] Firmware version 6.002 and later.

Monitor File

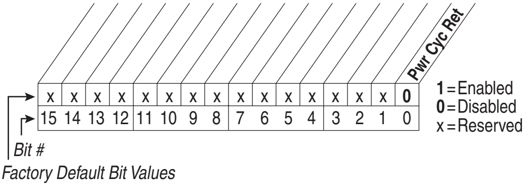
File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values		Related
MONITOR	Metering	001	**[Output Freq]** Output frequency present at T1, T2 & T3 (U, V & W)	Default: Min/Max: Units:	Read Only –/+[Maximum Freq] 0.1 Hz	
		002	**[Commanded Speed]** Value of the active Speed/Frequency Reference. Displayed in Hz or RPM, depending on value of [Speed Units].	Default: Min/Max: Units:	Read Only –/+[Maximum Speed] 0.1 Hz 0.1 RPM	079
		003	**[Output Current]** The total output current present at T1, T2 & T3 (U, V & W).	Default: Min/Max: Units:	Read Only 0.0/Drive Rated Amps × 2 0.1 Amps	
		004	**[Torque Current]** Based on the motor, the amount of current that is in phase with the fundamental voltage component.	Default: Min/Max: Units:	Read Only Drive Rating × –2/+2 0.1 Amps	
		005	**[Flux Current]** Amount of current that is out of phase with the fundamental voltage component.	Default: Min/Max: Units:	Read Only Drive Rating × –2/+2 0.1 Amps	
		006	**[Output Voltage]** Output voltage present at terminals T1, T2 & T3 (U, V & W).	Default: Min/Max: Units:	Read Only 0.0/Drive Rated Volts 0.1 VAC	
		007	**[Output Power]** Output power present at T1, T2 & T3 (U, V & W). [Output Power] = SQRT (3) x [Output Voltage] x [Output Current] x [Output Powr Fctr]	Default: Min/Max: Units:	Read Only 0.0/Drive Rated kW × 2 0.1 kW	
		008	**[Output Powr Fctr]** Output Power Factor = ABS (SIN (Commanded Voltage Vector Angle - Measured Current Vector Angle))	Default: Min/Max: Units:	Read Only 0.00/1.00 0.01	
		009	**[Elapsed MWh]** Accumulated output energy of the drive.	Default: Min/Max: Units:	Read Only 0.0/214748352.0 MWh 0.1 MWh	
		010	**[Elapsed Run Time]** Accumulated time drive is outputting power.	Default: Min/Max: Units:	Read Only 0.0/214748352.0 Hrs 0.1 Hrs	
		011	**[MOP Reference]** Value of the signal at MOP (Motor Operated Potentiometer).	Default: Min/Max: Units:	Read Only –/+[Maximum Speed] 0.1 Hz 0.1 RPM	079
		012	**[DC Bus Voltage]** Present DC bus voltage level.	Default: Min/Max: Units:	Read Only 0.0/Based on Drive Rating 0.1 VDC	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values		Related
MONITOR	Metering	013	**[DC Bus Memory]** 6 minute average of DC bus voltage level.	Default: Min/Max: Units:	Read Only 0.0/Based on Drive Rating 0.1 VDC	
		014	**[Elapsed kWh]** Accumulated output energy of the drive.	Default: Min/Max: Units:	Read Only 0.0/429496729.5 kWh 0.1 kWh	
		016 017	**[Analog In1 Value]** **[Analog In2 Value]** Value of the signal at the analog inputs.	Default: Min/Max: Units:	Read Only 0.000/20.000 mA –/+10.000V 0.001 mA 0.001 Volt	
		018	**[PTC HW Value]** Value present at the drive's PTC input terminals.	Default: Min/Max: Units:	Read Only –/+5.00 Volts 0.01 Volts	
		021	**[Spd Fdbk No Filt]** Displays the unfiltered value of the actual motor speed, whether measured by encoder feedback or estimated.	Default: Min/Max: Units:	Read Only –/+400.0 Hz –/+24000.0 RPM 0.1 Hz 0.1 RPM	
		022	**[Ramped Speed]** Value of commanded speed after Accel/Decel, and S-Curve are applied.	Default: Min/Max: Units:	Read Only –/+400.0 Hz –/+24000.0 RPM 0.1 Hz 0.1 RPM	079
		023	**[Speed Reference]** Summed value of ramped speed, process PI and droop. When FVC Vector mode is selected, droop will not be added.	Default: Min/Max: Units:	Read Only –/+400.0 Hz –/+24000.0 RPM 0.1 Hz 0.1 RPM	079
		024 FV	**[Commanded Torque]** Final torque reference value after limits and filtering are applied. Percent of motor rated torque.	Default: Min/Max: Units:	Read Only –/+800.0% 0.1%	053
		025	**[Speed Feedback]** Displays the lightly filtered value of the actual motor speed, whether measured by encoder feedback, or estimated.	Default: Min/Max: Units:	Read Only –/+400.0 Hz –/+24000.0 RPM 0.1 Hz 0.1 RPM	
	Drive Data	026	**[Rated kW]** Drive power rating.	Default: Min/Max: Units:	Read Only 0.00/3000.00 kW 0.01 kW	
		027	**[Rated Volts]** The drive input voltage class (208, 240, 400 etc.).	Default: Min/Max: Units:	Read Only 0.0/65535.0 VAC 0.1 VAC	

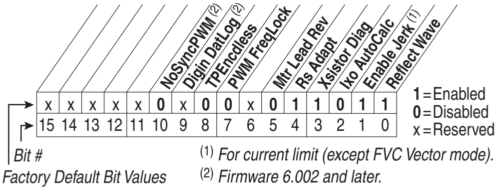
File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
MONITOR	Drive Data	028	**[Rated Amps]** The drive rated output current.	Default: Read Only Min/Max: 0.0/65535.0 Amps Units: 0.1 Amps	
		029	**[Control SW Ver]** Main Control Board software version.	Default: Read Only Min/Max: 0.000/65535.000 Units: 0.001	196

Motor Control File

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
MOTOR CONTROL	Motor Data	040 ○	**[Motor Type]** Set to match the type of motor connected. (1) **Important:** Selecting option 1 or 2 also requires selection of “Custom V/Hz,” option 2 in parameter 53.	Default: 0 “Induction” Options: 0 “Induction” 1 “Synchr Reluc” (1) 2 “Synchr PM” (1)	053
		041 ○	**[Motor NP Volts]** Set to the motor nameplate rated volts.	Default: Based on Drive Rating Min/Max: 0.0/[Rated Volts] Units: 0.1 VAC	
		042 ○	**[Motor NP FLA]** Set to the motor nameplate rated full load amps.	Default: Based on Drive Rating Min/Max: 0.0/[Rated Amps] × 2 Units: 0.1 Amps	047 048
		043 ○	**[Motor NP Hertz]** Set to the motor nameplate rated frequency.	Default: Based on Drive Cat. No. Min/Max: 5.0/400.0 Hz Units: 0.1 Hz	
		044 ○	**[Motor NP RPM]** Set to the motor nameplate rated RPM.	Default: 1750.0 RPM Min/Max: 60.0/24000.0 RPM Units: 1.0 RPM	
		045 ○	**[Motor NP Power]** Set to the motor nameplate rated power.	Default: Based on Drive Rating Min/Max: 0.00/1000.00 Units: 0.01 kW/HP See [Mtr NP Pwr Units]	046
		046 ○	**[Mtr NP Pwr Units]** Selects the motor power units to be used. This parameter is not reset when “Reset to Defaults” is selected. “Convert HP” = converts all power units to Horsepower. “Convert kW” = converts all power units to kilowatts.	Default: Drive Rating Based Options: 0 “Horsepower” 1 “kiloWatts” 2 “Convert HP” 3 “Convert kW”	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
MOTOR CONTROL	Motor Data	047 ●	**[Motor OL Hertz]** Selects the output frequency below which the motor operating current is derated. The motor thermal overload will generate a fault at lower levels of current.	Default: Motor NP Hz/3 Min/Max: 0.0/Motor NP Hz Units: 0.1 Hz	042 220 ℹ
		048 ●	**[Motor OL Factor]** Sets the operating level for the motor overload. Motor FLA x OL Factor = Operating Level	Default: 1.00 Min/Max: 0.20/2.00 Units: 0.01	042 220 ℹ
		049 ●	**[Motor Poles]** Defines the number of poles in the motor.	Default: 4 Min/Max: 2/40 Units: 1 Pole	
		050	v6 **[Motor OL Mode]** Provides the ability to preserve the [Motor OL Count] value through a power cycle or drive reset.  Option Descriptions Pwr Cyc Ret — If bit 0 is set to “0” (Disabled) the value of [Motor OL Count], parameter 220 is reset to zero by a drive reset or power cycle. A “1” (Enabled) will maintain the value. A transition from “1” to “0” resets [Motor OL Count] to zero.		
	Torq Attributes	053 ●	**[Motor Cntl Sel]** Sets the method of motor control used in the drive. When “Adj Voltage” is selected, voltage control is independent from frequency control. The voltage and frequency components have independent references and accel/decel rates. Typical applications include non-motor loads or power supplies. **Important:** “FVC Vector” mode requires autotuning of the motor. Being coupled to the load will determine inertia (preferably lightly-loaded). Total Inertia (parameter 450) will have to be estimated if uncoupled for tuning of the speed loop or separately adjust Ki and Kp (parameters 445 & 446).	Default: 0 “Sensrls Vect” Options: 0 “Sensrls Vect” 1 “SV Economize” 2 “Custom V/Hz” 3 “Fan/Pmp V/Hz” 4 “FVC Vector” 5 “Adj Voltage”	ℹ

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
MOTOR CONTROL	Torq Attributes	054	**[Maximum Voltage]** Sets the highest voltage the drive will output. Based on [Voltage Class], parameter 202.	Default: Drive Rated Volts Min/Max: Rated Volts x 0.25/Rated Volts Units: 0.1 VAC	202
		055 ○	**[Maximum Freq]** Sets the highest frequency the drive will output. Based on [Voltage Class], parameter 202. Also refer to [Overspeed Limit], parameter 083.	Default: 110.0 or 130.0 Hz Min/Max: 5.0/420.0 Hz Units: 0.1 Hz	083 202
		056	**[Compensation]** Enables/disables correction options.		



(1) *For current limit (except FVC Vector mode).*

(2) *Firmware 6.002 and later.*

Option Descriptions

Reflect Wave	Disables reflected wave overvoltage protection for long cable lengths. (typically enabled).
Enable Jerk	In non-FVC Vector modes, disabling jerk removes a short S-curve at the start of the accel/decel ramp.
Ixo AutoCalc	Not functional – reserved for future enhancements.
Xsistor Diag	“0” disables power transistor power diagnostic tests which run at each start command. “1” enables transistor diagnostic tests.
Rs Adapt	FVC w/Encoder Only - Disabling may improve torque regulation at lower speeds (typically not needed).
Mtr Lead Rev	Reverses the phase rotation of the applied voltage, effectively reversing the motor leads. Note: This bit is reset to “0” when parameters are reset to factory defaults.
PWM Freq Lock	Keeps the PWM frequency from decreasing to 2 kHz at low operating frequencies in FVC Vector mode without encoder.
DigIn DatLog	Enable [DigIn DataLogic], parameter 411.
NoSyncPWM	Disables synchronous PWM.

File	Group	No.	**Parameter Name & Description**	**Values**	**Related**
MOTOR CONTROL	Torq Attributes	057	**[Flux Up Mode]** Auto = Flux is established for a calculated time period based on motor nameplate data. [Flux Up Time] is not used. Manual = Flux is established for [Flux Up Time] before acceleration.	Default: 0 “Manual” Options: 0 “Manual” 1 “Automatic”	053 058
		058	**[Flux Up Time]** Sets the amount of time the drive will use to try and achieve full motor stator flux. When a Start command is issued, DC current at current limit level is used to build stator flux before accelerating.	Default: 0.000 Secs Min/Max: 0.000/5.000 Secs Units: 0.001 Secs	053 058

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL	Torq Attributes	059	**[SV Boost Filter]** Sets the amount of filtering used to boost voltage during Sensorless Vector and FVC Vector (encoderless) operation.	Default: 500 Min/Max: 0/32767 Units: 1	
		061 ○	**[Autotune]** Provides a manual or automatic method for setting [IR Voltage Drop], [Flux Current Ref] and [Ixo Voltage Drop]. Valid only when parameter 53 is set to "Sensrls Vect," "SV Economize" or "FVC Vector."	Default: 3 "Calculate" Options: 0 "Ready" 1 "Static Tune" 2 "Rotate Tune" 3 "Calculate"	053 062
			"Ready" (0) = Parameter returns to this setting following a "Static Tune" or "Rotate Tune." It also permits manually setting [IR Voltage Drop], [Ixo Voltage Drop] and [Flux Current Ref]. "Static Tune" (1) = A temporary command that initiates a non-rotational motor stator resistance test for the best possible automatic setting of [IR Voltage Drop] in all valid modes and a non-rotational motor leakage inductance test for the best possible automatic setting of [Ixo Voltage Drop] in "FVC Vector" mode. A start command is required following initiation of this setting. The parameter returns to "Ready" (0) following the test, at which time another start transition is required to operate the drive in normal mode. Used when motor cannot be rotated. "Rotate Tune" (2) = A temporary command that initiates a "Static Tune" followed by a rotational test for the best possible automatic setting of [Flux Current Ref]. In "FVC Vector" mode, with encoder feedback, a test for the best possible automatic setting of [Slip RPM @ FLA] is also run. A start command is required following initiation of this setting. The parameter returns to "Ready" (0) following the test, at which time another start transition is required to operate the drive in normal mode. **Important:** If using rotate tune for "Sensrls Vect" mode, the motor should be uncoupled from the load or results may not be valid. With "FVC Vector," either a coupled or uncoupled load will produce valid results. ⚠ **ATTENTION:** Rotation of the motor in an undesired direction can occur during this procedure. To guard against possible injury and/or equipment damage, it is recommended that the motor be disconnected from the load before proceeding. "Calculate" (3) = This setting uses motor nameplate data to automatically set [IR Voltage Drop], [Ixo Voltage Drop], [Flux Current Ref] and [Slip RPM @ FLA].		
		062	**[IR Voltage Drop]** Value of voltage drop across the resistance of the motor stator at rated motor current. Used only when parameter 53 is set to "Sensrls Vect," "SV Economize" or "FVC Vector."	Default: Based on Drive Rating Min/Max: 0.0/[Motor NP Volts]×0.25 Units: 0.1 VAC	053 061
		063	**[Flux Current Ref]** Value of amps for full motor flux. Used only when parameter 53 is set to "Sensrls Vect," "SV Economize or "FVC Vector."	Default: Based on Drive Rating Min/Max: 0.00/[Motor NP FLA] Units: 0.01 Amps	053 061

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
MOTOR CONTROL	Torq Attributes	064 ○	**[Ixo Voltage Drop]** Value of voltage drop across the leakage inductance of the motor at rated motor current. Used only when parameter 53 is set to “Sensrls Vect,” “SV Economize or “FVC Vector.”	Default: Based on Drive Rating Min/Max: 0.0/230.0, 480.0, 575 VAC Units: 0.1 VAC	
		066 ○ FV	**[Autotune Torque]** Specifies motor torque applied to the motor during the flux current and inertia tests performed during an autotune.	Default: 50.0% Min/Max: 0.0/150.0% Units: 0.1%	053
		067 ○ FV	**[Inertia Autotune]** Provides an automatic method of setting [Total Inertia]. This test is automatically run during Start-Up motor tests. **Important:** If using rotate tune for “Sensrls Vect” mode, the motor should be uncoupled from the load or results may not be valid. With “FVC Vector,” either a coupled or uncoupled load will produce valid result. “Ready” = Parameter returns to this setting following a completed inertia tune. “Inertia Tune” = A temporary command that initiates an inertia test of the motor/load combination. The motor will ramp up and down, while the drive measures the amount of inertia.	Default: 0 “Ready” Options: 0 “Ready” 1 “Inertia Tune”	053 450
		427 431 ○ FV	**[Torque Ref A Sel]** **[Torque Ref B Sel]** Selects the source of the external torque reference to the drive. How this reference is used is dependent upon [Speed/Torque Mod]. (1) See *Appendix B* for DPI port locations.	Default: 0 “Torque Stpt1” 24 “Disabled” Options: 0 “Torque Stpt1” 1 “Analog In 1” 2 “Analog In 2” 3-17 “Reserved” 18-22 “DPI Port 1-5”(1) 23 “Reserved” 24 “Disabled” 25-28 “Scale Block1-4” 29 “Torque Stpt2”	053
		428 432 FV	**[Torque Ref A Hi]** **[Torque Ref B Hi]** Scales the upper value of the [Torque Ref x Sel] selection when the source is an analog input.	Default: 100.0% 100.0% Min/Max: –/+800.0% Units: 0.1%	053
		429 433 FV	**[Torque Ref A Lo]** **[Torque Ref B Lo]** Scales the lower value of the [Torque Ref x Sel] selection when the source is an analog input.	Default: 0.0% 0.0% Min/Max: –/+800.0% Units: 0.1%	053

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL	Torq Attributes	430 FV	**[Torq Ref A Div]** Defines the value of the divisor for the [Torque Ref A Sel] selection.	Default: 1.0 Min/Max: 0.1/3276.7 Units: 0.1	053
		434 FV	**[Torque Ref B Mult]** Defines the value of the multiplier for the [Torque Ref B Sel] selection.	Default: 1.0 Min/Max: –/+32767.0 Units: 0.1	053
		435 FV	**[Torque Setpoint1]** Provides an internal fixed value for Torque Setpoint when [Torque Ref x Sel] is set to "Torque Setpt."	Default: 0.0% Min/Max: –/+800.0% Units: 0.1%	053
		436 FV	**[Pos Torque Limit]** Defines the torque limit for the positive torque reference value. The reference will not be allowed to exceed this value.	Default: 200.0% Min/Max: 0.0/800.0% Units: 0.1%	053
		437 FV	**[Neg Torque Limit]** Defines the torque limit for the negative torque reference value. The reference will not be allowed to exceed this value.	Default: –200.0% Min/Max: –800.0/0.0% Units: 0.1%	053
		438 FV	**[Torque Setpoint2]** Provides an internal fixed value for Torque Setpoint when [Torque Ref x Sel] is set to "Torque Setpt 2."	Default: 0.0% Min/Max: –/+800.0% Units: 0.1%	
		440 FV	**[Control Status]** Displays a summary status of any condition that may be limiting either the current or the torque reference.	Read Only	053

	VltLimLeakag	Observe Sts	FldWeakSts	TorqRef	VelTrqRef	MinTrqCurLim	Max Slip Lim	Min Slip Lim	PosPwrTrqLim	NegPwrTrqLim	PosTrqLimit	NegTrqLimit	PosFlxCurLim	NegFlxCurLim	PosTrqCurLim	NegTrqCurLim
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

												RevPhaseMot	Economize	FluxBrake	DrvVoltLim	VltLimStator
	x	x	x	x	x	x	x	x	x	x	x	0	0	0	0	0
Bit #	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

1 = Condition True
0 = Condition False
x = Reserved

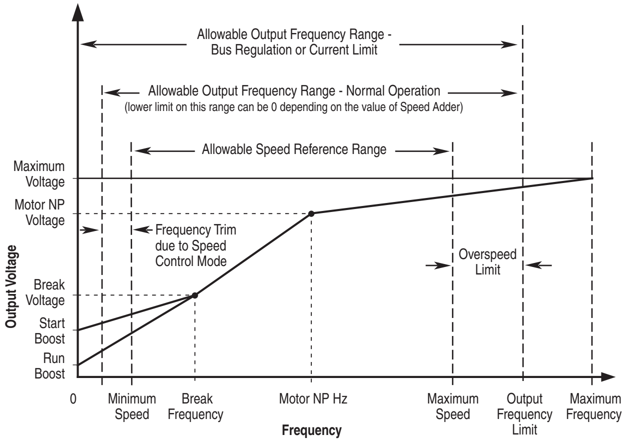
		441 FV	**[Mtr Tor Cur Ref]** Displays the torque current reference value that is present at the output of the current rate limiter (parameter 154).	Default: Read Only Min/Max: –/+32767.0 Amps Units: 0.01 Amps	053

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL	Volts per Hertz	069	**[Start/Acc Boost]** Sets the voltage boost level for starting and acceleration when "Custom V/Hz" mode is selected. Refer to parameter 083 [Overspeed Limit].	Default: Based on Drive Rating Min/Max: 0.0/[Motor NP Volts] x 0.25 Units: 0.1 VAC	053 070
		070	**[Run Boost]** Sets the boost level for steady state or deceleration when "Fan/Pmp V/Hz" or "Custom V/Hz" modes are selected. See parameter 083 [Overspeed Limit].	Default: Based on Drive Rating Min/Max: 0.0/[Motor NP Volts] x 0.25 Units: 0.1 VAC	053 069
		071	**[Break Voltage]** Sets the voltage the drive will output at [Break Frequency]. Refer to parameter 083 [Overspeed Limit].	Default: [Motor NP Volts] × 0.25 Min/Max: 0.0/[Motor NP Volts] Units: 0.1 VAC	053 072
		072	**[Break Frequency]** Sets the frequency the drive will output at [Break Voltage]. Refer to parameter 083.	Default: [Motor NP Hz] × 0.25 Min/Max: 0.0/[Maximum Freq] Units: 0.1 Hz	053 071
	Speed Feedback	412	**[Motor Fdbk Type]** Selects the encoder type; single channel or quadrature. Options 1 & 3 detect a loss of encoder signal (when using differential inputs) regardless of the [Feedback Select], param. 080 setting. For FVC Vector mode, use a quadrature encoder only (option 0/1). If a single channel encoder is used (option 2/3) in sensorless vector or V/Hz mode, select "Reverse Dis" (option 2) in param. 190.	Default: 0 "Quadrature" Options: 0 "Quadrature" 1 "Quad Check" 2 "Single Chan" 3 "Single Check"	
		413 ○	**[Encoder PPR]** Contains the encoder pulses per revolution. For improved operation in FVC Vector mode, PPR should be ≥ (64 x motor poles).	Default: 1024 PPR Min/Max: 2/20000 PPR Units: 1 PPR	
		414	**[Enc Position Fdbk]** Displays raw encoder pulse count. For single channel encoders, this count will increase (per rev.) by the amount in [Encoder PPR]. For quadrature encoders this count will increase by 4 times the amount defined in [Encoder PPR].	Default: Read Only Min/Max: –/+2147483647 Units: 1	
		415	**[Encoder Speed]** Provides a monitoring point that reflects speed as seen from the feedback device.	Default: Read Only Min/Max: –/+420.0 Hz –/+25200.0 RPM Units: 0.1 Hz 0.1 RPM	079

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
MOTOR CONTROL	Speed Feedback	416	**[Fdbk Filter Sel]** Selects the type of feedback filter desired. “Light” uses a 35/49 radian feedback filter. “Heavy” uses a 20/40 radian feedback filter.	Default: 0 “None” Options: 0 “None” 1 “Light” 2 “Heavy”	
		419 FV	**[Notch FilterFreq]** Sets the center frequency for an optional 2-pole notch filter. Filter is applied to the torque command. “0” disables this filter.	Default: 0.0 Hz Min/Max: 0.0/500.0 Hz Units: 0.1 Hz	053
		420 FV	**[Notch Filter K]** Sets the gain for the 2-pole notch filter.	Default: 0.3 Hz Min/Max: 0.1/0.9 Hz Units: 0.1 Hz	053
		421 ○	**[Marker Pulse]** Latches the raw encoder count at each marker pulse.	Default: Read Only Min/Max: –/+2147483647 Units: 1	
		422 ○	**[Pulse In Scale]** Sets the scale factor/gain for the Pulse Input when P423 is set to “Pulse Input.” Calculate for the desired speed command as follows: for Hz, [Pulse In Scale] = $\frac{\text{Input Pulse Rate (Hz)}}{\text{Desired Cmd. (Hz)}}$ for RPM, [Pulse In Scale] = $\frac{\text{Input Pulse Rate (Hz)}}{\text{Desired Cmd. (RPM)}} \text{ x } \frac{120}{\text{[Motor Poles]}}$	Default: 64 Min/Max: 2/20000 Units: 1	
		423 ○	**[Encoder Z Chan]** Defines if the input wired to terminals 5 & 6 of the Encoder Terminal Block will be used as a Pulse or Marker input. Options 1 & 3 detect a loss of signal (when using differential inputs) regardless of the [Feedback Select], param. 080 setting. When option 2 or 3 is used with Profile/ Indexer mode, the “homing” routine will position to the nearest marker pulse off of the home limit switch.	Default: 0 “Pulse Input” Options: 0 “Pulse Input” 1 “Pulse Check” 2 “Marker Input” 3 “Marker Check”	

Speed Command File

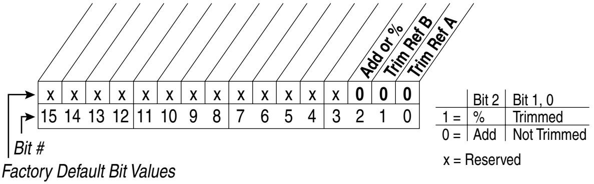
File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	**Spd Mode & Limits**	079 ○	**[Speed Units]** Selects the units to be used for all speed related parameters. Options 0 & 1 indicate status only. 2 & 3 will convert/ configure the drive for that selection. "Convert Hz" (2) - converts all speed based parameters to Hz, and changes the value proportionately (i.e. 1800 RPM = 60 Hz). "Convert RPM" (3) - converts all speed based parameters to RPM, and changes the value proportionately. This parameter is not reset when "Reset to Defaults" is selected.	Default: 0 "Hz" Options: 0 "Hz" 1 "RPM" 2 "Convert Hz" 3 "Convert RPM"	
		080 ○	**[Feedback Select]** Selects the source for motor speed feedback. Note that all selections are available when using Process PI. "Open Loop" (0) - no encoder is present, and slip compensation is not needed. "Slip Comp" (1) - tight speed control is needed, and encoder is not present. "Encoder" (3) - an encoder is present. "Simulator" (5) - Simulates a motor for testing drive operation & interface check.	Default: 0 "Open Loop" Options: 0 "Open Loop" 1 "Slip Comp" 2 "Reserved" 3 "Encoder" 4 "Reserved" 5 "Simulator"	412 152
		081 ○	**[Minimum Speed]** Sets the low limit for speed reference after scaling is applied. Refer to parameter 083 [Overspeed Limit].	Default: 0.0 Min/Max: 0.0/[Maximum Speed] Units: 0.1 Hz 0.1 RPM	079 083 092 095
		082 ○	**[Maximum Speed]** Sets the high limit for speed reference after scaling is applied. Refer to parameter 083 [Overspeed Limit].	Default: 50.0 or 60.0 Hz (volt class) [Motor NP RPM] Min/Max: 5.0/400.0 Hz 75.0/24000.0 RPM Units: 0.1 Hz 0.1 RPM	055 079 083 091 094 202

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
SPEED COMMAND	Spd Mode & Limits	083 ○	**[Overspeed Limit]** Sets the incremental amount of the output frequency (above [Maximum Speed]) allowable for functions such as slip compensation. [Maximum Speed] + [Overspeed Limit] must be ≤ [Maximum Freq]  	Default: 10.0 Hz 300.0 RPM Min/Max: 0.0/20.0 Hz 0.0/600.0 RPM Units: 0.1 Hz 0.1 RPM	055 079 082 ℹ
		084 085 086	**[Skip Frequency 1]** **[Skip Frequency 2]** **[Skip Frequency 3]** Sets a frequency at which the drive will not operate.	Default: 0.0 Hz Default: 0.0 Hz Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	087 ℹ
		087	**[Skip Freq Band]** Determines the bandwidth around a skip frequency. [Skip Freq Band] is split, applying 1/2 above and 1/2 below the actual skip frequency. The same bandwidth applies to all skip frequencies.	Default: 0.0 Hz Min/Max: 0.0/30.0 Hz Units: 0.1 Hz	084 085 086

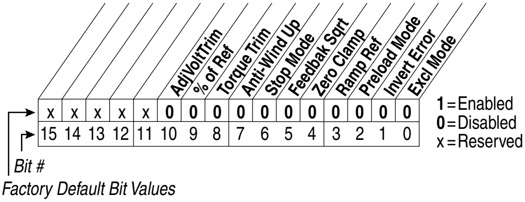
File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	Spd Mode & Limits	088 FV	**[Speed/Torque Mod]** Selects the torque reference source. “Zero Torque” (0) - torque command = 0. “Speed Reg” (1) - drive operates as a speed regulator. “Torque Reg” (2) - an external torque reference is used for the torque command. “Min Torq/Spd” (3) - selects the smallest algebraic value to regulate to when the torque reference and torque generated from the speed regulator are compared. “Max Torq/Spd” (4) - selects the largest algebraic value when the torque reference and the torque generated from the speed regulator are compared. “Sum Torq/Spd” (5) - selects the sum of the torque reference and the torque generated from the speed regulator. “Absolute Min” (6) - selects the smallest absolute algebraic value to regulate to when the torque reference and torque generated from the speed regulator are compared. “Pos/Spd Prof” (7) - drive operates as a speed or position regulator as determined by the Profile Step parameters (720-877) and Setup parameters (705-719). **ATTENTION:** The speed of the drive could reach [Maximum Speed] + [Overspeed Limit] to meet required torque when any of the torque modes have been selected. Equipment damage and/or personal injury may result.	Default: 1 “Speed Reg” Options: 0 “Zero Torque” 1 “Speed Reg” 2 “Torque Reg” 3 “Min Torq/Spd” 4 “Max Torq/Spd” 5 “Sum Torq/Spd” 6 “Absolute Min” 7 “Pos/Spd Prof”	053
		454 FV	**[Rev Speed Limit]** Sets a limit on speed in the negative direction, when in FVC Vector mode. Used in bipolar mode only. A value of zero disables this parameter and uses [Maximum Speed] for reverse speed limit.	Default: 0.0 RPM Min/Max: –[Max Speed]/0.0 Hz –[Max Speed]/0.0 RPM Units: 0.0 Hz 0.0 RPM	ℹ

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND	Speed References	090 ○	**[Speed Ref A Sel]** Selects the source of the speed reference to the drive unless [Speed Ref B Sel] or [Preset Speed 1-7] is selected. (1) See Appendix B for DPI port locations.	Default: 2 “Analog In 2” Options: 1 “Analog In 1” 2 “Analog In 2” 3-6 “Reserved” 7 “Pulse In” 8 “Encoder” 9 “MOP Level” 10 “Reserved” 11 “Preset Spd1” 12 “Preset Spd2” 13 “Preset Spd3” 14 “Preset Spd4” 15 “Preset Spd5” 16 “Preset Spd6” 17 “Preset Spd7” 18 “DPI Port 1” (1) 19 “DPI Port 2” (1) 20 “DPI Port 3” (1) 21 “DPI Port 4” (1) 22 “DPI Port 5” (1) 23-24 “Reserved” 25 “Scale Block1” 26 “Scale Block2” 27 “Scale Block3” 28 “Scale Block4” 29 “Reserved” 30 “HighRes Ref”	002 091 thru 093 101 thru 107 117 thru 120 192 thru 194 213 272 273 320 361 thru 366
		091	**[Speed Ref A Hi]** Scales the upper value of the [Speed Ref A Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 082
		092	**[Speed Ref A Lo]** Scales the lower value of the [Speed Ref A Sel] selection when the source is an analog input.	Default: 0.0 Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 081
		093 ○	**[Speed Ref B Sel]** See [Speed Ref A Sel].	Default: 11 “Preset Spd1” Options: See [Speed Ref A Sel]	See 090
		094	**[Speed Ref B Hi]** Scales the upper value of the [Speed Ref B Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 093
		095	**[Speed Ref B Lo]** Scales the lower value of the [Speed Ref B Sel] selection when the source is an analog input.	Default: 0.0 Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 090 093

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND	Speed References	096 ○	**[TB Man Ref Sel]** Sets the manual speed reference source when a digital input (parameter 361…366) is configured for “Auto/ Manual” or “Manual/Auto” (v7.002 & later). (1) “Analog In 2” is not a valid selection if it was selected for any of the following: - [Trim In Select] - [PI Feedback Sel] - [PI Reference Sel] - [Current Lmt Sel] - [Sleep-Wake Ref] (2) Requires a Series B HIM with firmware v5.004 or greater. Selects the HIM to provide the manual speed reference when a digital input is configured for “Auto/Manual” or “Manual/Auto.” Additionally, if [Man Ref Preload], parameter 193 is set to “Enabled,” the automatic speed reference will be preloaded into the HIM when the drive switches to Manual mode from Automatic mode (or to Automatic mode from Manual mode). • Set [Save HIM Ref], parameter 192, bit 1 (Manual Mode) as desired. • Set [TB Man Ref Sel] to the desired drive reference when in Manual Mode. If set to one of the DPI Ports, then [Man Ref Preload] must be set to enable or disable reference preload of the current speed. Connect a HIM to the DPI Port selected. • When Manual mode is requested through the terminal block digital input, the drive evaluates if Manual mode can be granted. • If [TB Man Ref Sel] is set to a DPI Port and [Man Ref Preload] is enabled, the drive transfers the last value of the automatic speed reference to the HIM. The HIM is now the speed reference source. The terminal block has exclusive control based on [Save HIM Ref], bit 1 (Manual Mode). If [Man Ref Preload] is disabled, the HIM is now the speed reference source. The terminal block has exclusive control based on [Save HIM Ref], bit 1 (Manual Mode). **Important:** the HIM does not enter Manual mode, it is only the reference source for the terminal block. When Auto mode is requested through the terminal block, the drive changes to Auto mode and returns control and reference to the previous state before Manual mode was requested.	Default: 1 “Analog In 1” Options: 1 “Analog In 1” 2 “Analog In 2”(1) 3-8 “Reserved” 9 “MOP Level” 10-17 “Reserved” 18 “DPI Port 1”(2) 19 “DPI Port 2”(2) 20 “DPI Port 3”(2)	097 098
		097	**[TB Man Ref Hi]** Scales the upper value of the [TB Man Ref Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 096
		098	**[TB Man Ref Lo]** Scales the lower value of the [TB Man Ref Sel] selection when the source is an analog input.	Default: 0.0 Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 0.01 RPM	079 096
		099	**[Pulse Input Ref]** Displays the pulse input value as seen at terminals 5 and 6 of the Encoder Terminal Block, if [Encoder Z Chan], parameter 423 is set to “Pulse Input.”	Default: Read Only Min/Max: –/+420.0 Hz –/+25200.0 RPM Units: 0.1 Hz 0.1 RPM	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	Discrete Speeds	100	**[Jog Speed 1]** Sets the output frequency when Jog Speed 1 is selected.	Default: 10.0 Hz 300.0 RPM Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 1 RPM	079
		101 102 103 104 105 106 107	**[Preset Speed 1]** **[Preset Speed 2]** **[Preset Speed 3]** **[Preset Speed 4]** **[Preset Speed 5]** **[Preset Speed 6]** **[Preset Speed 7]** Provides an internal fixed speed command value. In bipolar mode direction is commanded by the sign of the reference.	Default: 5.0 Hz/150 RPM 10.0 Hz/300 RPM 20.0 Hz/600 RPM 30.0 Hz/900 RPM 40.0 Hz/1200 RPM 50.0 Hz/1500 RPM 60.0 Hz/1800 RPM Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 1 RPM	079 090 093
		108	**[Jog Speed 2]** Sets the output frequency when Jog Speed 2 is selected.	Default: 10.0 Hz 300.0 RPM Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 1 RPM	
	Speed Trim	116 ○	**[Trim % Setpoint]** Adds or subtracts a percentage of the speed reference or maximum speed. Dependent on the setting of [Trim Out Select], parameter 118.	Default: 0.0% Min/Max: –/+200.0% Units: 0.1%	118
		117 ○	**[Trim In Select]** Specifies which analog input signal is being used as a trim input.	Default: 2 “Analog In 2” Options: See [Speed Ref A Sel]	090 093
		118 ○	**[Trim Out Select]** Specifies which speed references are to be trimmed.  		117 119 120
		119	**[Trim Hi]** Scales the upper value of the [Trim In Select] selection when the source is an analog input.	Default: 60.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 1 RPM/%	079 082 117
		120	**[Trim Lo]** Scales the lower value of the [Trim In Select] selection when the source is an analog input.	Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz 1 RPM/%	079 117

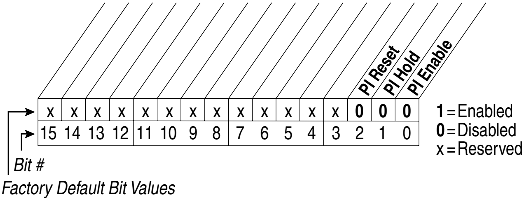
File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND	Slip Comp		**Important:** Parameters in the Slip Comp Group are used to enable and tune the Slip Compensation Regulator. In order to allow the regulator to control drive operation, parameter 080 [Speed Mode] must be set to 1 "Slip Comp".		
		121	**[Slip RPM @ FLA]** Sets the amount of compensation to drive output at motor FLA. If the value of parameter 061 [Autotune] = 3 "Calculate" changes made to this parameter will not be accepted. Value may be changed by [Autotune] when "Encoder" is selected in [Feedback Select], parameter 080.	Default: Based on [Motor NP RPM] Min/Max: 0.0/1200.0 RPM Units: 0.1 RPM	061 080 122 123
		122	**[Slip Comp Gain]** Sets the response time of slip compensation.	Default: 40.0 Min/Max: 1.0/100.0 Units: 0.1	080 121 122
		123	**[Slip RPM Meter]** Displays the present amount of adjustment being applied as slip compensation.	Default: Read Only Min/Max: –/+300.0 RPM Units: 0.1 RPM	080 121 122
	Process PI	124 ○	**[PI Configuration]** Sets configuration of the PI regulator.		124 thru 138 ⓘ



Option Description

AdjVoltTrim (10) Configures the PI regulator output to trim the voltage reference, rather than the torque or speed references. The trim can be configured to be exclusive by setting "Excl Mode" (bit 0). Trimming the voltage reference is not compatible with trimming the torque reference, thus if bits 8 & 10 are set, a type II alarm will occur, setting "PI Cfg Cflct" (bit 19) in [Drive Alarm 2].

No.	Parameter Name & Description	Related
125	**[PI Control]** Controls the PI regulator.	080 ⓘ



File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	**Process PI**	126 ○	**[PI Reference Sel]** Selects the source of the PI reference. (1) Adjustable Voltage Mode.	Default: 0 "PI Setpoint" Options: 0 "PI Setpoint" 1 "Analog In 1" 2 "Analog In 2" 3-6 "Reserved" 7 "Pulse In" 8 "Encoder" 9 "MOP Level" 10 "Master Ref" 11-17 "Preset Spd1-7" 18-22 "DPI Port 1-5" 23-24 "Reserved" 25-28 "Scale Block 1-4" 29 "Preset1-7 Volt" (1) 36 "Voltage Cmd" (1)	024 124 thru 138 ℹ
		127	**[PI Setpoint]** Provides an internal fixed value for process setpoint when [PI Reference Sel] is set to "PI Setpoint."	Default: 50.00% Min/Max: –/+100.00% of Maximum Process Value Units: 0.01%	124 thru 138
		128 ○	**[PI Feedback Sel]** Selects the source of the PI feedback. (1) Adjustable Voltage Mode.	Default: 0 "PI Setpoint" Options: 0 "PI Setpoint" 1 "Analog In 1" 2 "Analog In 2" 3-6 "Reserved" 7 "Pulse In" 8 "Encoder" 9 "MOP Level" 10 "Master Ref" 11-17 "Preset Spd1-7" 18-22 "DPI Port 1-5" 23-24 "Reserved" 25-28 "Scale Block 1-4" 29 "Preset1-7 Volt" (1) 36 "Voltage Cmd" (1) 37 "Output Power" (1) 38 "Output Cur" (1)	124 thru 138
		129	**[PI Integral Time]** Time required for the integral component to reach 100% of [PI Error Meter]. Not functional when the PI Hold bit of [PI Control] = "1" (enabled).	Default: 2.00 Secs Min/Max: 0.00/100.00 Secs Units: 0.01 Secs	124 thru 138
		130	**[PI Prop Gain]** Sets the value for the PI proportional component. PI Error x PI Prop Gain = PI Output	Default: 1.0 Min/Max: 0.00/100.00 Units: 0.01	124 thru 138

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	Process PI	131	**[PI Lower Limit]** Sets the lower limit of the PI output.	Default: –[Maximum Freq] –100% Min/Max: –/+400.0 Hz –/+800.0% Units: 0.1 Hz 0.1%	079 124 thru 138
		132	**[PI Upper Limit]** Sets the upper limit of the PI output.	Default: +[Maximum Freq] 100% Min/Max: –/+400.0 Hz –/+800.0% Units: 0.1 Hz 0.1%	079 124 thru 138
		133	**[PI Preload]** Sets the value used to preload the integral component on start or enable.	Default: 0.0 Hz 100.0% Min/Max: [PI Lower Limit]/ [PI Upper Limit] Units: 0.1 Hz 0.1%	079 124 thru 138
		134	**[PI Status]** Status of the Process PI regulator. PI InLimit PI Reset PI Hold PI Enabled x x x x x x x x x x x x **0 0 0 0** 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 *Bit #*	Read Only **1** =Condition True **0** =Condition False x =Reserved	124 thru 138
		135	**[PI Ref Meter]** Present value of the PI reference signal.	Default: Read Only Min/Max: –/+100.0% Units: 0.1%	124 thru 138
		136	**[PI Fdback Meter]** Present value of the PI feedback signal.	Default: Read Only Min/Max: –/+100.0% Units: 0.1%	124 thru 138
		137	**[PI Error Meter]** Present value of the PI error.	Default: Read Only Min/Max: –/+200.0% Units: 0.1%	124 thru 138
		138	**[PI Output Meter]** Present value of the PI output.	Default: Read Only Min/Max: –/+800.0% Units: 0.1%	124 thru 138
		139	**[PI BW Filter]** Provides filter for Process PI error signal. The output of this filter is displayed in [PI Error Meter]. Zero will disable the filter.	Default: 0.0 Radians Min/Max: 0.0/240.0 Radians Units: 0.1 Radians	137

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
SPEED COMMAND	**Process PI**	459 ○	**[PI Deriv Time]** Refer to formula below: $PI_{Out} = KD\ (Sec) \times \frac{d_{PI\ Error}\ (\%)}{d_t\ (Sec)}$	Default: 0.00 Secs Min/Max: 0.00/100.00 Secs Units: 0.01 Secs	
		460	**[PI Reference Hi]** Scales the upper value of [PI Reference Sel].	Default: 100.0% Min/Max: –/+100.0% Units: 0.1%	
		461	**[PI Reference Lo]** Scales the lower value of [PI Reference Sel].	Default: –100.0% Min/Max: –/+100.0% Units: 0.1%	
		462	**[PI Feedback Hi]** Scales the upper value of [PI Feedback Sel].	Default: 100.0% Min/Max: –/+100.0% Units: 0.1%	
		463	**[PI Feedback Lo]** Scales the lower value of [PI Feedback Sel].	Default: 0.0% Min/Max: –/+100.0% Units: 0.1%	
		464	**[PI Output Gain]** Sets the gain factor for [PI Output Meter].	Default: 1.000 Min/Max: –/+8.000 Units: 0.001	
	Speed Regulator	445 FV	**[Ki Speed Loop]** Controls the integral error gain of the speed regulator. The drive automatically adjusts [Ki Speed Loop] when a non-zero value is entered for [Speed Desired BW] or an autotune is performed. Typically, manual adjustment of this parameter is needed only if system inertia cannot be determined through an autotune. [Speed Desired BW] is set to “0” when a manual adjustment is made to this parameter.	Default: 7.0 Min/Max: 0.0/4000.0 Units: 0.1	053
		446 FV	**[Kp Speed Loop]** Controls the proportional error gain of the speed regulator. The drive automatically adjusts [Kp Speed Loop] when a non-zero value is entered for [Speed Desired BW] or an auto-tune is performed. Typically, manual adjustment of this parameter is needed only if system inertia cannot be determined through an autotune. [Speed Desired BW] is set to “0” when a manual adjustment is made to this parameter. An internal Error Filter BW is active when Kp or [Speed Desired BW] is changed. It is set to Kp times [Total Inertia] with a minimum of 25 radians.	Default: 6.3 Min/Max: 0.0/200.0 Units: 0.1	053

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
SPEED COMMAND	**Speed Regulator**	447 FV	**[Kf Speed Loop]** Controls the feed forward gain of the speed regulator. Setting the Kf gain greater than zero reduces speed feedback overshoot in response to a step change in speed reference.	Default: 0.0 Min/Max: 0.0/0.5 Units: 0.1	053
		448 FV	v6 **[Spd Err Filt BW]** Sets the bandwidth of a speed error filter used in FVC Vector mode. A setting of “0.0” disables the filter.	Default: 200.0 R/s Min/Max: 0.0/2000.0 R/s Units: 0.1 R/s	053
		449 FV	**[Speed Desired BW]** Sets the speed loop bandwidth and determines the dynamic behavior of the speed loop. As bandwidth increases, the speed loop becomes more responsive and can track a faster changing speed reference. Adjusting this parameter will cause the drive to calculate and change [Ki Speed Loop] and [Kp Speed Loop] gains.	Default: 0.0 Radians/Sec Min/Max: 0.0/250.0 Radians/Sec Units: 0.1 Radians/Sec	053
		450 FV	**[Total Inertia]** Represents the time in seconds, for a motor coupled to a load to accelerate from zero to base speed, at rated motor torque. The drive calculates Total Inertia during the autotune inertia procedure. Adjusting this parameter will cause the drive to calculate and change [Ki Speed Loop] and [Kp Speed Loop] gains.	Default: 0.10 Secs Min/Max: 0.01/600.00 Units: 0.01 Secs	053
		451 FV	**[Speed Loop Meter]** Value of the speed regulator output. (1) “%” if [Motor Cntl Sel] = “FVC Vector.”	Default: Read Only Min/Max: –/+800.0% (1) –/+800.0 Hz –/+800.0 RPM Units: 0.1%/Hz/RPM	053 121 079

Dynamic Control File

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
DYNAMIC CONTROL	Ramp Rates	140 141	**[Accel Time 1]** **[Accel Time 2]** Sets the rate of accel for all speed increases. $\frac{\text{Max Speed}}{\text{Accel Time}} = \text{Accel Rate}$	Default: 10.0 Secs 10.0 Secs Min/Max: 0.0/3600.0 Secs 0.1 Secs Units:	142 143 146 361
		142 143	**[Decel Time 1]** **[Decel Time 2]** Sets the rate of decel for all speed decreases. $\frac{\text{Max Speed}}{\text{Decel Time}} = \text{Decel Rate}$	Default: 10.0 Secs 10.0 Secs Min/Max: 0.0/3600.0 Secs 0.1 Secs Units:	140 141 146 361
		146	**[S Curve %]** Sets the percentage of accel or decel time that is applied to the ramp as S Curve. Time is added, 1/2 at the beginning and 1/2 at the end of the ramp.	Default: 0% Min/Max: 0/100% Units: 1%	140 thru 143
	Load Limits	147 ○	**[Current Lmt Sel]** Selects the source for the adjustment of current limit (i.e. parameter, analog input, etc.).	Default: 0 "Cur Lim Val" Options: 0 "Cur Lim Val" 1 "Analog In 1" 2 "Analog In 2"	146 149
		148	**[Current Lmt Val]** Defines the current limit value when [Current Lmt Sel] = "Cur Lim Val." When in "Adj Voltage" mode, the output voltage will not be allowed to exceed this value.	Default: [Rated Amps] × 1.5 (Equation yields approximate default value.) Min/Max: Based on Drive Rating Units: 0.1 Amps	147 149
		149	**[Current Lmt Gain]** Sets the responsiveness of the current limit.	Default: 250 Min/Max: 0/5000 Units: 1	147 148
		150	**[Drive OL Mode]** Selects the drives response to increasing drive temperature and may reduce the current limit value as well as the PWM frequency. If the drive is being used with a sine wave filter, the filter is likely tuned to a specific carrier frequency. To ensure stable operation it is recommended to set this parameter to "Reduce CLim"	Default: 3 "Both–PWM 1st" Options: 0 "Disabled" 1 "Reduce CLim" 2 "Reduce PWM" 3 "Both–PWM 1st"	219

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL	Load Limits	151	**[PWM Frequency]** Sets the carrier frequency for the PWM output. Drive derating may occur at higher carrier frequencies. For derating information, refer to the *PowerFlex Reference Manual*. **Important:** If parameter 053 [Motor Cntl Sel] is set to “FVC Vector,” the drive will run at 2 kHz when operating below 6 Hz.	Default: 4 kHz or 2 kHz (Refer to Appendix A) Min/Max: 2/10 kHz Units: 2/4/8/10 kHz	
		152	**[Droop RPM @ FLA]** Selects amount of droop that the speed reference is reduced when at full load torque. Zero disables the droop function. **Important:** Selecting “Slip Comp” with parameter 080 in conjunction with parameter 152, may produce undesirable results.	Default: 0.0 RPM Min/Max: 0.0/200.0 RPM Units: 0.1 RPM	
		153 FV	**[Regen Power Limit]** Sets the maximum power limit allowed to transfer from the motor to the DC bus. When using an external dynamic brake, set this parameter to its maximum value.	Default: –50.0% Min/Max: –800.0/0.0% Units: 0.1%	053
		154 FV	**[Current Rate Limit]** Sets the largest allowable rate of change for the current reference signal. This number is scaled in percent of maximum motor current every 250 microseconds.	Default: 400.0% Min/Max: 1.0/800.0% Units: 0.1%	053
	Stop/Brake Modes	145 ○	**[DB While Stopped]** Enables/disables dynamic brake operation when drive is stopped. DB may operate if input voltage becomes too high. Disabled = DB will only operate when drive is running. Enable = DB may operate whenever drive is energized.	Default: 0 “Disabled” Options: 0 “Disabled” 1 “Enabled”	161 162
		155 156	**[Stop Mode A]** **[Stop Mode B]** Active stop mode. [Stop Mode A] is active unless [Stop Mode B] is selected by inputs. (1) When using options 1, 2 or 4, refer to parameter 158 Attention statements.	Default: 1 “Ramp” Default: 0 “Coast” Options: 0 “Coast” 1 “Ramp”(1) 2 “Ramp to Hold”(1) 3 “DC Brake” 4 “Fast Brake”(1)	157 158 159 ℹ

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL	Stop/Brake Modes	157	**[DC Brake Lvl Sel]** Selects the source for [DC Brake Level].	Default: 0 "DC Brake Lvl" Options: 0 "DC Brake Lvl" 1 "Analog In 1" 2 "Analog In 2"	155 156 158 159
		158	**[DC Brake Level]** Defines the DC brake current level injected into the motor when "DC Brake" is selected as a stop mode. This also sets the braking current level when "Fast Stop" is selected. The DC braking voltage used in this function is created by a PWM algorithm and may not generate the smooth holding force needed for some applications. Refer to the *PowerFlex Reference Manual*. **ATTENTION:** If a hazard of injury due to movement of equipment or material exists, an auxiliary mechanical braking device must be used. **ATTENTION:** This feature should not be used with synchronous or permanent magnet motors. Motors may be demagnetized during braking.	Default: [Rated Amps] Min/Max: 0/[Rated Amps] × 1.5 (Equation yields approximate maximum value.) Units: 0.1 Amps	
		159	**[DC Brake Time]** Sets the amount of time DC brake current is "injected" into the motor. Not used for "Ramp to Hold" which will apply DC braking continuously. See page C-42.	Default: 0.0 Secs Min/Max: 0.0/90.0 Secs Units: 0.1 Secs	155 thru 158 ℹ
		160	**[Bus Reg Ki]** Sets the responsiveness of the bus regulator.	Default: 450 Min/Max: 0/5000 Units: 1	161 162

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
DYNAMIC CONTROL	Stop/Brake Modes	161 162 ○	**[Bus Reg Mode A]** **[Bus Reg Mode B]** Sets the method and sequence of the DC bus regulator voltage. Choices are dynamic brake, frequency adjust or both. Sequence is determined by programming or digital input to the terminal block. Dynamic Brake Setup If a dynamic brake resistor is connected to the drive, both of these parameters must be set to either option 2, 3 or 4. Refer to the Attention statement on page P-4 for important information on bus regulation.	Default: 1 "Adjust Freq" 4 "Both-Frq 1st" Options: 0 "Disabled" 1 "Adjust Freq" 2 "Dynamic Brak" 3 "Both-DB 1st" 4 "Both-Frq 1st"	160 163 ℹ
			⚠ **ATTENTION:** The drive does not offer protection for externally mounted brake resistors. A risk of fire exists if external braking resistors are not protected. External resistor packages must be self-protected from over temperature or the protective circuit shown in Figure C.1 on page C-3 (or equivalent) must be supplied.		
		163	**[DB Resistor Type]** Selects whether the internal or an external DB resistor will be used. **Important:** In Frame 0…2 drives, only one DB resistor can be connected to the drive. Connecting both an internal & external resistor could cause damage. If a dynamic brake resistor is connected to the drive, [Bus Reg Mode A & B] must be set to either option 2, 3 or 4.	Default: 2 "None" Options: 0 "Internal Res" 1 "External Res" 2 "None"	161 162
			⚠ **ATTENTION:** Equipment damage may result if a drive mounted (internal) resistor is installed and this parameter is set to "External Res" or "None." Thermal protection for the internal resistor will be disabled, resulting in possible device damage. Also see ATTENTION above.		
		164	**[Bus Reg Kp]** Proportional gain for the bus regulator. Used to adjust regulator response.	Default: 1500 Min/Max: 0/10000 Units: 1	
		165	**[Bus Reg Kd]** Derivative gain for the bus regulator. Used to control regulator overshoot.	Default: 1000 Min/Max: 0/10000 Units: 1	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
DYNAMIC CONTROL	Stop/Brake Modes	166	**[Flux Braking]** Set to use an increase in the motor flux current to increase the motor losses, and allow a faster deceleration time when a chopper brake or regenerative capability is not available. Can be used as a stopping or fast deceleration method.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	ℹ
	Restart Modes	167	**[Powerup Delay]** Defines the programmed delay time, in seconds, before a start command is accepted after a power up.	Default: 0.0 Secs Min/Max: 0.0/10800.0 Secs Units: 0.1 Secs	
		168	**[Start At PowerUp]** Enables/disables a feature to issue a Start or Run command and automatically resume running at commanded speed after drive input power is restored. Requires a digital input configured for Run or Start and a valid start contact. **ATTENTION:** Equipment damage and/or personal injury may result if this parameter is used in an inappropriate application. Do not use this function without considering applicable local, national and international codes, standards, regulations or industry guidelines.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	ℹ
		169	**[Flying Start En]** Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued. Not required in FVC Vector mode when using an encoder.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	170
		170	**[Flying StartGain]** Sets the response of the flying start function. **Important:** Lower gain may be required for permanent magnet motors.	Default: 4000 Min/Max: 20/32767 Units: 1	169
		174	**[Auto Rstrt Tries]** Sets the maximum number of times the drive attempts to reset a fault and restart. **ATTENTION:** Equipment damage and/or personal injury may result if this parameter is used in an inappropriate application. Do Not use this function without considering applicable local, national and international codes, standards, regulations or industry guidelines.	Default: 0 Min/Max: 0/9 Units: 1	175
		175	**[Auto Rstrt Delay]** Sets the time between restart attempts when [Auto Rstrt Tries] is set to a value other than zero.	Default: 1.0 Secs Min/Max: 0.5/10800.0 Secs Units: 0.1 Secs	174

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
DYNAMIC CONTROL	Restart Modes	178 ○	**[Sleep-Wake Mode]** Enables/disables the Sleep/Wake function. **Important:** When enabled, the following conditions must be met: • A proper value must be programmed for [Sleep Level] & [Wake Level]. • A speed reference must be selected in [Speed Ref A Sel]. • At least one of the following must be programmed (and input closed) in [Digital Inx Sel]; "Enable," "Stop=CF," "Run," "Run Forward," "Run Reverse."	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Direct" (Enabled) 2 "Invert" (Enabled)(7)	ⓘ

⚠ **ATTENTION:** Enabling the Sleep-Wake function can cause unexpected machine operation during the Wake mode. Equipment damage and/or personal injury can result if this parameter is used in an inappropriate application. Do Not use this function without considering the information below and in Appendix C. In addition, all applicable local, national & international codes, standards, regulations or industry guidelines must be considered

Conditions Required to Start Drive (1)(2)(3)

	After Power-Up	**After a Drive Fault**		**After a Stop Command**
Input		*Reset by Stop-CF, HIM or TB*	*Reset by Clear Faults (TB)*	*HIM or TB*
Stop	Stop Closed Wake Signal	Stop Closed Wake Signal New Start or Run Cmd.(4)	Stop Closed Wake Signal	Stop Closed <u>Direct Mode</u> Analog Sig. > Sleep Level(6) <u>Invert Mode</u> Analog Sig. < Sleep Level(6) New Start or Run Cmd.(4)
Enable	Enable Closed Wake Signal(4)	Enable Closed Wake Signal New Start or Run Cmd.(4)	Enable Closed Wake Signal	Enable Closed <u>Direct Mode</u> Analog Sig. > Sleep Level(6) <u>Invert Mode</u> Analog Sig. < Sleep Level(6) New Start or Run Cmd.(4)
Run Run For. Run Rev.	Run Closed Wake Signal	New Run Cmd.(5) Wake Signal	Run Closed Wake Signal	New Run Cmd.(5) Wake Signal

(1) When power is cycled, if all of the above conditions are present after power is restored, restart will occur.

(2) If all of the above conditions are present when [Sleep-Wake Mode] is "enabled," the drive will start.

(3) The active speed reference is determined as explained in Reference Control on page 1-46. The Sleep/Wake function and the speed reference may be assigned to the same input.

(4) Command must be issued from HIM, TB or network.

(5) Run Command must be cycled.

(6) Signal does not need to be greater than wake level.

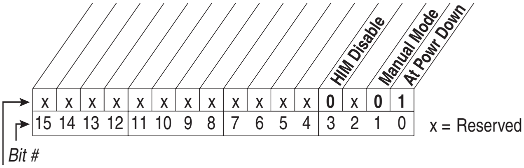
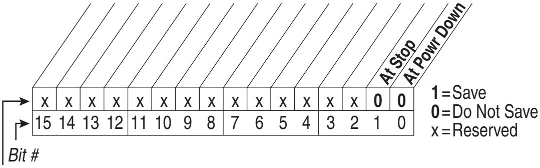
(7) For Invert function, refer to [Analog In x Loss].

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
DYNAMIC CONTROL	**Restart Modes**	179 ⭕	**[Sleep-Wake Ref]** Selects the source of the input controlling the Sleep-Wake function.	Default: 2 "Analog In 2" Options: 1 "Analog In 1" 2 "Analog In 2"	
		180	**[Wake Level]** Defines the analog input level that will start the drive.	Default: 6.000 mA, 6.000 Volts Min/Max: [Sleep Level]/20.000 mA 10.000 Volts Units: 0.001 mA 0.001 Volts	181
		181	**[Wake Time]** Defines the amount of time at or above [Wake Level] before a Start is issued.	Default: 0.0 Secs Min/Max: 0.0/1000.0 Secs Units: 0.1 Secs	180
		182	**[Sleep Level]** Defines the analog input level that will stop the drive.	Default: 5.000 mA, 5.000 Volts Min/Max: 4.000 mA/[Wake Level] 0.000 Volts/[Wake Level] Units: 0.001 mA 0.001 Volts	183
		183	**[Sleep Time]** Defines the amount of time at or below [Sleep Level] before a Stop is issued.	Default: 0.0 Secs Min/Max: 0.0/1000.0 Secs Units: 0.1 Secs	182
	Power Loss	177 ⭕	**[Gnd Warn Level]** Sets the level at which a ground warning fault will occur. Configure with [Alarm Config 1].	Default: 3.0 Amps Min/Max: 1.0/5.0 Amps Units: 0.1 Amps	259
		184	**[Power Loss Mode]** Sets the reaction to a loss of input power. Power loss is recognized when: • DC bus voltage is ≤ 73% of [DC Bus Memory] and [Power Loss Mode] is set to "Coast". • DC bus voltage is ≤ 82% of [DC Bus Memory] and [Power Loss Mode] is set to "Decel".	Default: 0 "Coast" Options: 0 "Coast" 1 "Decel" 2 "Continue" 3 "Coast Input" 4 "Decel Input" 5 "Decel 2 Stop" **v6**	013 185
		185	**[Power Loss Time]** Sets the time that the drive will remain in power loss mode before a fault is issued.	Default: 0.5 Secs Min/Max: 0.0/60.0 Secs Units: 0.1 Secs	184

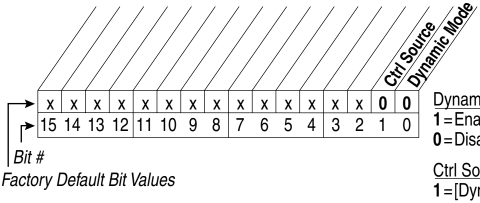
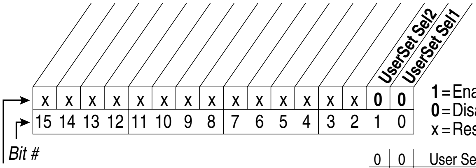
File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
DYNAMIC CONTROL	**Power Loss**	186	**[Power Loss Level]** Sets the level at which the [Power Loss Mode] selection will occur. The drive can use the percentages referenced in [Power Loss Mode] or a trigger point can be set for line loss detection as follows: $V_{trigger}$ = [DC Bus Memory] – [Power Loss Level] A digital input (programmed to “29, Pwr Loss Lvl”) is used to toggle between fixed percentages and the detection level. ⚠ **ATTENTION:** Drive damage can occur if proper input impedance is not provided as explained below. If the value for [Power Loss Level] is greater than 18% of [DC Bus Memory], the user must provide a minimum line impedance to limit inrush current when the power line recovers. The input impedance should be equal to or greater than the equivalent of a 5% transformer with a VA rating 5 times the drives input VA rating.	Default: Drive Rated Volts Min/Max: 0.0/999.9 VDC Units: 0.1 VDC	ⓘ
		187	**[Load Loss Level]** Sets the percentage of motor nameplate torque (absolute value) at which a load loss alarm will occur.	Default: 200.0% Min/Max: 0.0/800.0% Units: 0.1%	211 259
		188	**[Load Loss Time]** Sets the time that current is below the level set in [Load Loss Level] before a fault occurs.	Default: 0.0 Secs Min/Max: 0.0/300.0 Secs Units: 0.1 Secs	187
		189	**[Shear Pin Time]** Sets the time that the drive is at or above current limit before a fault occurs. Zero disables this feature.	Default: 0.0 Secs Min/Max: 0.0/30.0 Secs Units: 0.1 Secs	238

Utility File

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
<i>See page 3-2 for symbol descriptions</i></th><th>Values</th><th>Related</th></tr>
<tr><td>UTILITY</td><td>Direction Config</td><td>190
◉</td><td>[Direction Mode]
Selects method for changing direction.
<table>
<tr><th>Mode</th><th>Direction Change</th></tr>
<tr><td>Unipolar</td><td>Drive Logic</td></tr>
<tr><td>Bipolar</td><td>Sign of Reference</td></tr>
<tr><td>Reverse Dis</td><td>Not Changeable</td></tr>
</table></td><td>Default: 0 “Unipolar”
Options: 0 “Unipolar”
1 “Bipolar”
2 “Reverse Dis”</td><td>320
thru
327
361
thru
366</td></tr>
</table>

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
UTILITY	HIM Ref Config	192	**[Save HIM Ref]** Enables HIM to control Speed Reference only or Reference, Start and Jog in Manual mode including two-wire control. Also enables a feature to save the present frequency reference value issued by the HIM to drive memory on power loss. Value is restored to the HIM on power up.  *Factory Default Bit Values* At Powr Down **1** = Save at Power Down **0** = Do Not Save Manual Mode **1** = HIM controls Reference, Start, Jog, Direction & Clear Faults. Start & Jog Disabled from all other Sources regardless of 2-Wire/3-Wire control selection. Must select Manual Mode on the HIM prior to setting this bit. **0** = HIM controls only the Reference. HIM Disable **1** = Start & Jog on HIM Do Not Function in 3-Wire mode. **0** = Start & Jog on HIM will Function in 3-Wire mode.		
		193	**[Man Ref Preload]** Enables/disables a feature to automatically load the present "Auto" frequency reference value into the HIM when "Manual" is selected. Allows smooth speed transition from "Auto" to "Manual."	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	
	MOP Config	194	**[Save MOP Ref]** Enables/disables the feature that saves the present MOP frequency reference at power down or at stop.  *Factory Default Bit Values*		
		195	**[MOP Rate]** Sets rate of change of the MOP reference in response to a digital input.	Default: 1.0 Hz/s 30.0 RPM/s Min/Max: 0.2/[Maximum Freq] 6.0/[Maximum Freq] Units: 0.1 Hz/s 0.1 RPM/s	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Drive Memory	196	**[Param Access Lvl]** Selects the parameter display level viewable on the HIM. • Basic = Reduced parameter set • Advanced = Full parameter set • Reserved = Full parameter set and Engineering parameters (refer to the *PowerFlex Reference Manual*). This parameter is not reset when “Reset to Defaults” is selected.	Default: 0 “Basic” Options: 0 “Basic” 1 “Advanced” 2 “Reserved”	
		197 ○	**[Reset To Defalts]** Resets parameters to factory defaults except [Mtr NP Pwr Units], [Speed Units], [Param Access Lvl], [Language], [Voltage Class] & [TorqProve Cnfg] (params 46, 79, 196, 201, 202 & 600). • Option 1 resets parameters to factory defaults based on [Voltage Class]. • Options 2 & 3 will set [Voltage Class] to low or high settings and reset parameters to corresponding factory defaults. **Important:** Frames 5 & 6 - the internal fan voltage may have to be changed when using Option 2 or 3. See “Selecting /Verifying Fan Voltage” on page 1-14.	Default: 0 “Ready” Options: 0 “Ready” 1 “Factory” 2 “Low Voltage” 3 “High Voltage”	041 thru 047 054 055 062 063 069 thru 072 082 148 158
		198 ○	**[Load Frm Usr Set]** Loads a previously saved set of parameter values from a selected user set location in drive nonvolatile memory to active drive memory.	Default: 0 “Ready” Options: 0 “Ready” 1 “User Set 1” 2 “User Set 2” 3 “User Set 3”	199
		199	**[Save To User Set]** Saves the parameter values in active drive memory to a user set in drive nonvolatile memory.	Default: 0 “Ready” Options: 0 “Ready” 1 “User Set 1” 2 “User Set 2” 3 “User Set 3”	198
		200	**[Reset Meters]** Resets selected meters to zero.	Default: 0 “Ready” Options: 0 “Ready” 1 “MWh” 2 “Elapsed Time”	
		201	**[Language]** Selects the display language when using an LCD HIM. This parameter is not functional with an LED HIM. Options 6, 8 and 9 are “Reserved.” This parameter is not reset when “Reset to Defaults” is selected.	Default: 0 “Not Selected” Options: 0 “Not Selected” 1 “English” 2 “Francais” 3 “Español” 4 “Italiano” 5 “Deutsch” 7 “Português” 10 “Nederlands”	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
UTILITY	Drive Memory	202 ○	**[Voltage Class]** Configures the drive current rating and associates it with the selected voltage (i.e. 400 or 480V). Normally used when downloading parameter sets. Min/Max & Default values will be changed for parameters; 41-47, 54, 55, 62, 63, 69, 70-72, 82, 148, 158. This parameter is not reset when "Reset to Defaults" is selected.	Default: Based on Drive Cat. No. Options: 2 "Low Voltage" 3 "High Voltage" 4 "Reserved" 5 "Reserved"	041 thru 047 054 055 062 063 069 thru 072 082 148 158
		203	**[Drive Checksum]** Provides a checksum value that indicates whether or not a change in drive programming has occurred.	Default: Read Only Min/Max: 0/65535 Units: 1	
		204 ○	**[Dyn UsrSet Cnfg]** Enables/Disables dynamic selection of user parameter sets. **Important:** In dynamic mode, changes to the parameters are not saved to nonvolatile storage. Switching user sets restores the values last saved before enabling dynamic mode.  Dynamic Mode **1** = Enabled **0** = Disabled Ctrl Source **1** = [Dyn UserSet Sel] **0** = Digital Inputs x = Reserved		
		205 ○	**[Dyn UsrSet Sel]** Selects user set if [Dyn UsrSet Cnfg] = xxxx xx11. **Important:** All digital input selections (parameters 361-366) must be identical in all three user sets for proper Dynamic User Set operation (even if only two sets are used).  **1** = Enabled **0** = Disabled x = Reserved 0 0 User Set 1 0 1 User Set 2 1 0 User Set 3 1 1 User Set 3		

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Drive Memory	206	**[Dyn UserSet Actv]** Indicates the active user set and if the operation is dynamic or normal.	Read Only	
UTILITY	Diagnostics	209	**[Drive Status 1]** Present operating condition of the drive.	Read Only	210
UTILITY	Diagnostics	210	**[Drive Status 2]** Present operating condition of the drive.	Read Only	209

206 [Dyn UserSet Actv]

													User Set 3	User Set 2	User Set 1	Dynamic Mode
	x	x	x	x	x	x	x	x	x	x	x	x	**0**	**0**	**0**	**0**
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

209 [Drive Status 1]

	Spd Ref ID 3 (2)	Spd Ref ID 2 (2)	Spd Ref ID 1 (2)	Spd Ref ID 0 (2)	Local ID 2 (1)	Local ID 1 (1)	Local ID 0 (1)	At Speed	Faulted	Alarm	Decelerating	Accelerating	Actual Dir	Command Dir	Active	Ready
	0	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

Bits (2)				
15	14	13	12	Description
0	0	0	0	Ref A Auto
0	0	0	1	Ref B Auto
0	0	1	0	Preset 2 Auto
0	0	1	1	Preset 3 Auto
0	1	0	0	Preset 4 Auto
0	1	0	1	Preset 5 Auto
0	1	1	0	Preset 6 Auto
0	1	1	1	Preset 7 Auto
1	0	0	0	TB Manual
1	0	0	1	Port 1 Manual
1	0	1	0	Port 2 Manual
1	0	1	1	Port 3 Manual
1	1	0	0	Port 4 Manual
1	1	0	1	Port 5 Manual
1	1	1	0	Port 6 Manual
1	1	1	1	Jog Ref

Bits (1)			
11	10	9	Description
0	0	0	Port 0 (TB)
0	0	1	Port 1
0	1	0	Port 2
0	1	1	Port 3
1	0	0	Port 4
1	0	1	Port 5
1	1	0	Port 6
1	1	1	No Local Control

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Diagnostics	211	**[Drive Alarm 1]** Alarm conditions that currently exist in the drive. “Prof SetHome” will be set if the alarm is configured in [Alarm Config 1], “Prof/Indexer” is configured in [Speed/Torque Mod] and the homing routine has not been successfully completed.	Read Only	212

	Brk Slipped	Ground Warn	Underload	In PhaseLoss	MotorTherm	Waking	Decel Inhibt	Drv OL Lvl 2	Drv OL Lvl 1		IntDBRes OH	Anlg in Loss	Str At PwrUp	Power Loss	UnderVoltage	Prechrg Actv
	0	0	0	0	0	0	0	0	0	x	0	0	0	0	0	0
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

												Active Cnvtr (1)		PTC HW	Prof SetHome	Adj Volt Ref
	x	x	x	x	x	x	x	x	x	x	x	0	x	0	0	0
Bit #	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

1 = Condition True
0 = Condition False
x = Reserved

(1) *Firmware 6.002 and later.*

File	Group	No.	Parameter Name & Description	Values	Related
UTILITY	Diagnostics	212	**[Drive Alarm 2]** Alarm conditions that currently exist in the drive.	Read Only	211

	Brk Slipped	PTC Conflict	TB Ref Cflct	Sleep Config	Ixo Vlt Rang	SpdRef Cflct	FlxAmps Rang	IR Vlts Rang	VHz NegSlope	MaxFrq Cflct	NP Hz Cflct	MtrTyp Cflct	Bipolr Cflct	DigIn CflctC	DigIn CflctB	DigIn CflctA
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

													PICfgCflct	UserSetCflct	ProfStpCflct	TrqPrv Cflct
	x	x	x	x	x	x	x	x	x	x	x	x	0	0	0	0
Bit #	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

1 = Condition True
0 = Condition False
x = Reserved

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Diagnostics	213	**[Speed Ref Source]** Displays the source of the speed reference to the drive. (1) Options not listed are reserved for future use.	Default: Read Only Options: (1) 0 “PI Output” 1 “Analog In 1” 2 “Analog In 2” 7 “Pulse In” 8 “Encoder” 9 “MOP Level” 10 “Jog Speed 1” 11-17 “Preset Spd1-7” 18-22 “DPI Port 1-5” 24 “Autotune” 25 “Jog Speed 2” 26-29 “Scale Block 1-4” 30 “Pos/Spd Prof“ 31 “Position Reg“ 32 “Micro Pos“ 33 “Homing“ 34 “Decel Switch“ 35 “End Switch“ 36 “Unipolar Lim“ 37 “Rev Dis Lim“ 38 “Max Spd Lim“ 39 “Min Spd Lim“ 40 “Rev Spd Lim“ 41 “Load Trq Lim“ 43 “HighRes Ref”	090 093 096 101
		214	**[Start Inhibits]** Displays the inputs currently preventing the drive from starting.	Read Only	

		DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In	Fast Stop	Startup Actv	Params Reset	Stop Assertd	DC Bus Pchrg	Enable	Type 2 Alarm	Fault
x	x	0	0	0	0	0	1	0	0	0	1	0	0	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit #

1 = Inhibit True
0 = Inhibit False
x = Reserved

Description

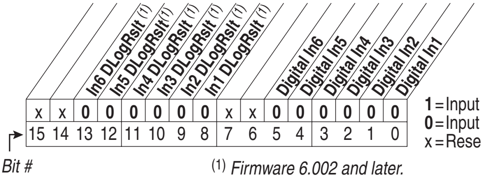
Fast Brake, bit 7	Either a digital input is configured for Fast Stop and is enabled or [TorqProve Setup], parameter 601, bit 0 is enabled.

File	Group	No.	Parameter Name & Description	Values	Related
UTILITY	Diagnostics	215	**[Last Stop Source]** Displays the source that initiated the most recent stop sequence. It will be cleared (set to 0) during the next start sequence. (1) Options not listed are reserved for future use.	Default: Read Only Options: (1) 0 “Pwr Removed” 1-5 “DPI Port 1-5” 7 “Digital In” 8 “Fault” 9 “Not Enabled” 10 “Sleep” 11 “Jog” 12 “Autotune” 13 “Precharge”	361 362 363 364 365 366

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 3-2 for symbol descriptions</th><th>Values</th><th>Related</th></tr>
<tr><td rowspan="6">UTILITY</td><td rowspan="6">Diagnostics</td><td>216</td><td>

[Dig In Status]

Status of the digital inputs.



<table>
<tr><td>x</td><td>x</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>x</td><td>x</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table>

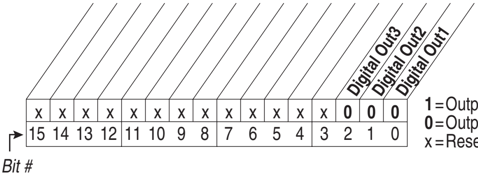
1 = Input Present
0 = Input Not Present
x = Reserved

(1) *Firmware 6.002 and later.*

</td><td>Read Only</td><td>361
thru
366</td></tr>
<tr><td>217</td><td>

[Dig Out Status]

Status of the digital outputs.



<table>
<tr><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table>

1 = Output Energized
0 = Output De-energized
x = Reserved

</td><td>Read Only</td><td>380
thru
384</td></tr>
<tr><td>218</td><td>

[Drive Temp]

Present operating temperature of the drive power section.

</td><td>Default: Read Only
Min/Max: 0.0/100.0%
Units: 0.1%</td><td></td></tr>
<tr><td>219</td><td>

[Drive OL Count]

Accumulated percentage of drive overload. Continuously operating the drive over 100% of its rating will increase this value to 100% and cause a drive fault or foldback depending on the setting of [Drive OL Mode].

</td><td>Default: Read Only
Min/Max: 0.0/100.0%
Units: 0.1%</td><td>150</td></tr>
<tr><td>220</td><td>

[Motor OL Count]

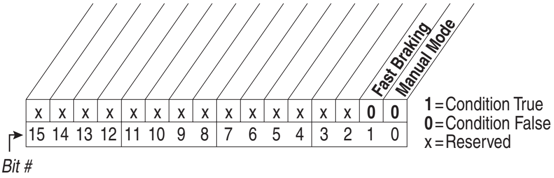
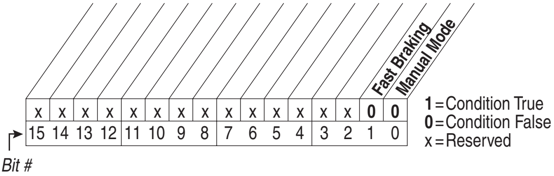
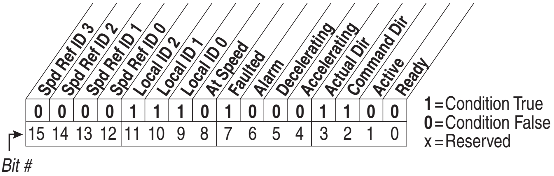
Accumulated percentage of motor overload. Continuously operating the motor over 100% of the motor overload setting will increase this value to 100% and cause a drive fault. Refer to page C-16.

</td><td>Default: Read Only
Min/Max: 0.0/100.0%
Units: 0.1%</td><td>047
048</td></tr>
<tr><td>221</td><td>

[Mtr OL Trip Time]

Amount of time before a Drive Overload fault (F64) occurs if the load condition remains constant. A value of 99999 means that the drive is operating under the overload level.

</td><td>Default: Read Only
Min/Max: 0/99999
Units: 1</td><td>220</td></tr>
</table>

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Diagnostics	222	v6 **[Drive Status 3]** Indicates if a device has manual control of the speed reference or if a "Fast Brake" is in progress.  Option Descriptions Manual Mode Refer to *"Manual" Speed Sources* in Chapter 1 of the User Manual. Fast Braking Fast braking active, see [Stop/Brk Mode A].	Read Only	
		223	v6 **[Status 3 @ Fault]** Captures and displays [Drive Status 3] bit pattern at the time of the last fault. 	Read Only	222
		224	**[Fault Speed]** Captures and displays the output speed of the drive at the time of the last fault.	Default: Read Only Min/Max: 0.0/+[Maximum Freq] 0.0/+[Maximum Speed] Units: 0.1 Hz 0.1 RPM	079 225 thru 230
		225	**[Fault Amps]** Captures and displays motor amps at the time of the last fault.	Default: Read Only Min/Max: 0.0/[Rated Amps] × 2 Units: 0.1 Amps	224 thru 230
		226	**[Fault Bus Volts]** Captures and displays the DC bus voltage of the drive at the time of the last fault.	Default: Read Only Min/Max: 0.0/Max Bus Volts Units: 0.1 VDC	224 thru 230
		227	**[Status 1 @ Fault]** Captures and displays [Drive Status 1] bit pattern at the time of the last fault. 	Read Only	209 224 thru 230

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Diagnostics	228	**[Status 2 @ Fault]** Captures and displays [Drive Status 2] bit pattern at the time of the last fault.	Read Only	210 224 thru 230

PTC HW	AdjVltAutoTn	DPI at 500 k	Motor Overld	Bus Freq Reg	Curr Limit	AutoRst Act	AutoRst Ctdn	DB Active	AutoTuning	DC Braking	Stopping	Jogging	Running	Active	Ready
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit #

1 = Condition True
0 = Condition False
x = Reserved

File	Group	No.	Parameter Name & Description	Values	Related
UTILITY	Diagnostics	229	**[Alarm 1 @ Fault]** Captures and displays [Drive Alarm 1] at the time of the last fault.	Read Only	211 224 thru 230

Brk Slipped	Ground Warn	Underload	In PhaseLoss	Motor Therm	Waking	Decel Inhibt	Drv OL Lvl 2	Drv OL Lvl 1		IntDBRes OH	Anlg in Loss	Str At PwrUp	Power Loss	UnderVoltage	Prechrg Actv
0	0	0	0	0	0	0	0	0	x	0	0	0	0	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit #

1 = Condition True
0 = Condition False
x = Reserved

											Active Cnvtr (1)		PTC HW	Prof SetHome	Adj Volt Ref
x	x	x	x	x	x	x	x	x	x	x	0	x	0	0	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Bit #

1 = Condition True
0 = Condition False
x = Reserved

(1) *Firmware 6.002 and later.*

File	Group	No.	Parameter Name & Description	Values	Related
UTILITY	Diagnostics	230	**[Alarm 2 @ Fault]** Captures and displays [Drive Alarm 2] at the time of the last fault.	Read Only	212 224 thru 230

Brk Slipped	PTC Conflict	TB Ref Cflct	Sleep Config	Ixo Vlt Rang	SpdRef Cflct	FlxAmps Rang	IR Vlts Rang	VHz NegSlope	MaxFrq Cflct	NP Hz Cflct	MtrTyp Cflct	Bipolr Cflct	DigIn CflctC	DigIn CflctB	DigIn CflctA
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit #

1 = Condition True
0 = Condition False
x = Reserved

												PICfgCflct	UserSetCflct	ProfStpCflct	TrqPrv Cflct
x	x	x	x	x	x	x	x	x	x	x	x	0	0	0	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Bit #

1 = Condition True
0 = Condition False
x = Reserved

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Diagnostics	234 236	**[Testpoint 1 Sel]** **[Testpoint 2 Sel]** Selects the function whose value is displayed value in [Testpoint x Data]. These are internal values that are not accessible through parameters. See Testpoint Codes and Functions on page 4-18 for a listing of available codes and functions.	Default: 499 Min/Max: 0/65535 Units: 1	
		235 237	**[Testpoint 1 Data]** **[Testpoint 2 Data]** The present value of the function selected in [Testpoint x Sel].	Default: Read Only Min/Max: –/+2147483648 Units: 1	
	Faults	238	**[Fault Config 1]** Enables/disables annunciation of the listed faults.		

			PTC HW	Out PhaseLoss (4)	ShearPNo Acc (2)		Underload	In PhaseLoss (1)	Motor Therm	Decel Inhibt	AutRst Tries	Shear Pin	Motor OverLd	HS Low Temp (3)	UnderVoltage	Power Loss
Factory Default Bit Values	x	x	0	0	0	x	0	0	0	1	0	0	1	1	1	0
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Enabled
0 = Disabled
x = Reserved

(1) *Default is "1" for Frames 8-10.*

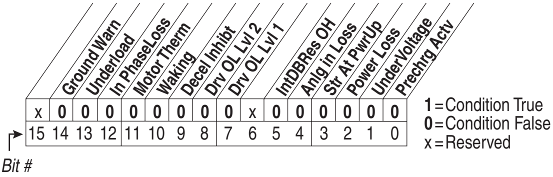
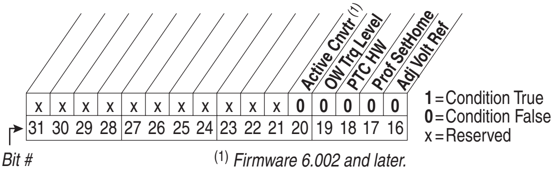
(2) *When enabled, the drive ignores the shear pin fault during any accel / decel.*

(3) *Firmware 6.002 and later.*

(4) *If Torque Prove is enabled, Output Phase Loss will always be performed.*

File	Group	No.	Parameter Name & Description	Values	Related
UTILITY	Faults	240	**[Fault Clear]** Resets a fault and clears the fault queue.	Default: 0 "Ready" Options: 0 "Ready" 1 "Clear Faults" 2 "Clr Flt Que"	
		241	**[Fault Clear Mode]** Enables/disables a fault reset (clear faults) attempt from any source. This does not apply to fault codes which are cleared indirectly via other actions.	Default: 1 "Enabled" Options: 0 "Disabled" 1 "Enabled"	
		242	**[Power Up Marker]** Elapsed hours since initial drive power up. This value will rollover to 0 after the drive has been powered on for more than the max value shown. For relevance to most recent power up see [Fault x Time].	Default: Read Only Min/Max: 0.0000/214748.3647 Hr Units: 0.1 Hr	244 246 248 250 252 254 256 258

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Faults	243 245 247 249 251 253 255 257	**[Fault 1 Code]** **[Fault 2 Code]** **[Fault 3 Code]** **[Fault 4 Code]** **[Fault 5 Code]** **[Fault 6 Code]** **[Fault 7 Code]** **[Fault 8 Code]** A code that represents the fault that tripped the drive. The codes will appear in these parameters in the order they occur ([Fault 1 Code] = the most recent fault).	Default: Read Only Min/Max: 0/65535 Units: 0	
		244 246 248 250 252 254 256 258	**[Fault 1 Time]** **[Fault 2 Time]** **[Fault 3 Time]** **[Fault 4 Time]** **[Fault 5 Time]** **[Fault 6 Time]** **[Fault 7 Time]** **[Fault 8 Time]** The time between **initial** drive power up and the occurrence of the associated trip fault. Can be compared to [Power Up Marker] for the time from the most recent power up. [Fault x Time] – [Power Up Marker] = Time difference to the most recent power up. A negative value indicates fault occurred before most recent power up. A positive value indicates fault occurred after most recent power up. To convert this value to the number days, hours, minutes and seconds, the following formula may be used: Fault x Time/24 hours = (# of days).(remaining time) Remaining Time x 24 hours = (# of hours) Remaining Time x 60 minutes = (# of minutes).(remaining time) Remaining Time x 60 seconds = (# of seconds) Result = (# of days).(# of hours).(# of minutes).(# of seconds) Example: 1909.2390 Hrs / 1 Day/24 Hrs = 79.551625 Days 0.551625 Days x 24 Hrs/Day = 13.239 Hrs 0.239 Hrs x 60 Min/Hr = 14.34 Min 0.34 Min x 60 Sec/Min = 20.4 Secs	Default: Read Only Min/Max: 0.0000/214748.3647 Hr Units: 0.0001 Hr	242

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Alarms	259	**[Alarm Config 1]** Enables/disables alarm conditions that will initiate an active drive alarm.   (1) *Firmware 6.002 and later.* Description OW Trq Level, bit 19 For the Rod Torque Process Display to work, the Oil Well Torque Level must be enabled.		
		261	**[Alarm Clear]** Resets all [Alarm 1-8 Code] parameters to zero.	Default: 0 "Ready" Options: 0 "Ready" 1 "Clr Alrm Que"	262 263 264 265 266 267 268 269
		262 263 264 265 266 267 268 269	**[Alarm 1 Code]** **[Alarm 2 Code]** **[Alarm 3 Code]** **[Alarm 4 Code]** **[Alarm 5 Code]** **[Alarm 6 Code]** **[Alarm 7 Code]** **[Alarm 8 Code]** A code that represents a drive alarm. The codes will appear in the order they occur (first 4 alarms in – first 4 out alarm queue). A time stamp is not available with alarms.	Default: Read Only Min/Max: 0/65535 Units: 1	261

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY	Scaled Blocks	476 482 488 494	**[Scale1 In Value]** **[Scale2 In Value]** **[Scale3 In Value]** **[Scale4 In Value]** Displays the value of the signal being sent to [ScaleX In Value] using a link.	Default: 0.0 Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	
		477 483 489 495	**[Scale1 In Hi]** **[Scale2 In Hi]** **[Scale3 In Hi]** **[Scale4 In Hi]** Scales the upper value of [ScaleX In Value].	Default: 0.0 Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	
		478 484 490 496	**[Scale1 In Lo]** **[Scale2 In Lo]** **[Scale3 In Lo]** **[Scale4 In Lo]** Scales the lower value of [ScaleX In Value].	Default: 0.0 Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	
		479 485 491 497	**[Scale1 Out Hi]** **[Scale2 Out Hi]** **[Scale3 Out Hi]** **[Scale4 Out Hi]** Scales the upper value of [ScaleX Out Value].	Default: 0.0 Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	
		480 486 492 498	**[Scale1 Out Lo]** **[Scale2 Out Lo]** **[Scale3 Out Lo]** **[Scale4 Out Lo]** Scales the lower value of [ScaleX Out Value].	Default: 0.0 Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	
		481 487 493 499	**[Scale1 Out Value]** **[Scale2 Out Value]** **[Scale3 Out Value]** **[Scale4 Out Value]** Value of the signal being sent out of the Universal Scale block. Typically this value is used as the source of information and will be linked to another parameter.	Default: Read Only Min/Max: –/+32767.000 Units: 0.1 (Scale 1 & 2) 0.001 (Scale 3 & 4)	

Communication File

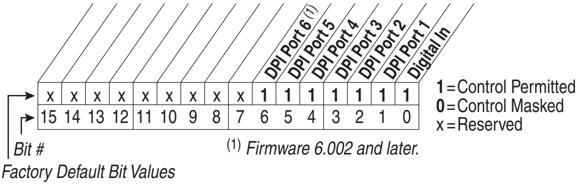
File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION	Comm Control	270 ○	**[DPI Baud Rate]** Sets the baud rate for attached drive peripherals. When changing this value the drive must be reset for the change to take affect.	Default: 1 "500 kbps" Options: 0 "125 kbps" 1 "500 kbps"	
		271	**[Drive Logic Rslt]** The final logic command resulting from the combination of all DPI and discrete inputs. This parameter has the same structure as the product-specific logic command received via DPI and is used in peer to peer communications.	Read Only	
		272	**[Drive Ref Rslt]** Present frequency reference scaled as a DPI reference for peer to peer communications. The value shown is the value prior to the accel/decel ramp and the corrections supplied by slip comp, PI, etc.	Default: Read Only Min/Max: –/+2147483647 Units: 1	
		273	**[Drive Ramp Rslt]** Present frequency reference scaled as a DPI reference for peer to peer communications. The value shown is the value after the accel/decel ramp, but prior to any corrections supplied by slip comp, PI, etc.	Default: Read Only Min/Max: –/+2147483647 Units: 1	

Parameter 271 [Drive Logic Rslt]:

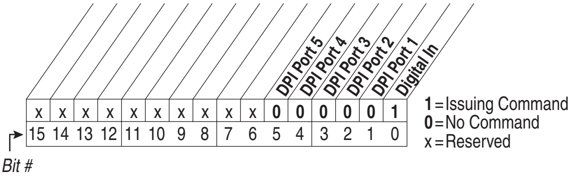
	MOP Dec	Spd Ref ID 2 (1)	Spd Ref ID 1 (1)	Spd Ref ID 0 (1)	Decel 2	Decel 1	Accel 2	Accel 1	Mop Inc	Local Contrl	Reverse	Forward	Clear Fault	Jog	Start	Stop
	0	0	0	0	1	1	1	0	1	0	0	0	1	1	0	0
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Condition True
0 = Condition False
x = Reserved

Bits(1)			
14	13	12	Description
0	0	0	No Command - Man. Mode
0	0	1	Ref A Auto
0	1	0	Ref B Auto
0	1	1	Preset 3 Auto
1	0	0	Preset 4 Auto
1	0	1	Preset 5 Auto
1	1	0	Preset 6 Auto
1	1	1	Preset 7 Auto

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
COMMUNICATION	Comm Control	274	**[DPI Port Sel]** Selects which DPI port reference value will appear in [DPI Port Value].	Default: “DPI Port 1” Options: 1-5 “DPI Port 1-5”	
		275	**[DPI Port Value]** Value of the DPI reference selected in [DPI Port Sel].	Default: Read Only Min/Max: –/+32767 Units: 1	
		298 ○	**[DPI Ref Select]** Scales DPI on maximum frequency or maximum speed.	Default: 0 “Max Freq” Options: 0 “Max Freq” 1 “Max Speed”	
		299	**[DPI Fdbk Select]** Selects the DPI units displayed on the first line of the HIM and the feedback word through any connected DPI peripheral (20-COMM-x, 1203-USB, etc.). (1) Refer to Input/Output Definitions on page 3-57. (2) “Speed Fdbk” is a filtered value. Choose “25, SpdFb NoFilt” if your process requires speed feedback via a communication network.	Default: 17 “Speed Fdbk” (2) Options: 0 “Output Freq” 1 “Command Spd” 2 “Output Amps” 3 “Torque Amps” 4 “Flux Amps” 5 “Output Power” 6 “Output Volts” 7 “DC Bus Volts” 8 “PI Reference” (1) 9 “PI Feedback” 10 “PI Error” 11 “PI Output” 12 “%Motor OL” 13 “%Drive OL” 14 “CommandedTrq” 15 “MtrTrqCurRef” (1) 16 “Speed Ref” 17 “Speed Fdbk” (2) 18 “Pulse In Ref” (1) 19 “Reserved” 20-23 “Scale Block1-4 (1) 24 “Param Cntl” 25 “SpdFb NoFilt”	
	Masks & Owners	276 ○	**[Logic Mask]** Determines which ports can control the drive when [Write Mask Act], bit 15 is set to “1.” If the bit for a port is set to “0,” the port will have no control functions except for stop.  1 = Control Permitted 0 = Control Masked x = Reserved (1) *Firmware 6.002 and later.*		288 thru 297
		277 ○	**[Start Mask]** Controls which adapters can issue start commands.	See [Logic Mask].	288 thru 297

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
COMMUNICATIONS	Masks & Owners	278 ○	**[Jog Mask]** Controls which adapters can issue jog commands.	See [Logic Mask].	288 thru 297
		279 ○	**[Direction Mask]** Controls which adapters can issue forward/reverse direction commands.	See [Logic Mask].	288 thru 297
		280 ○	**[Reference Mask]** Controls which adapters can select an alternate reference; [Speed Ref A, B Sel] or [Preset Speed 1-7].	See [Logic Mask].	288 thru 297
		281 ○	**[Accel Mask]** Controls which adapters can select [Accel Time 1, 2].	See [Logic Mask].	288 thru 297
		282 ○	**[Decel Mask]** Controls which adapters can select [Decel Time 1, 2].	See [Logic Mask].	288 thru 297
		283 ○	**[Fault Clr Mask]** Controls which adapters can clear a fault.	See [Logic Mask].	288 thru 297
		284 ○	**[MOP Mask]** Controls which adapters can issue MOP commands to the drive.	See [Logic Mask].	288 thru 297
		285 ○	**[Local Mask]** Controls which adapters are allowed to take exclusive control of drive logic commands (except stop). Exclusive "local" control can only be taken while the drive is stopped.	See [Logic Mask].	288 thru 297
		288	**[Stop Owner]** Adapters that are presently issuing a valid stop command.	Read Only	276 thru 285



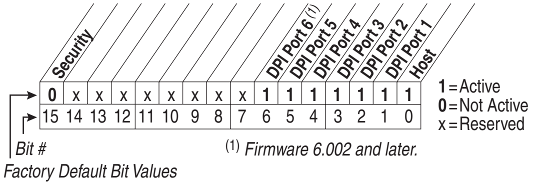
	x	x	x	x	x	x	x	x	x	x	0	0	0	0	0	1
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Issuing Command
0 = No Command
x = Reserved

File	Group	No.	**Parameter Name & Description**	**Values**	Related
COMMUNICATIONS	Masks & Owners	289	**[Start Owner]** Adapters that are presently issuing a valid start command.	See [Stop Owner].	276 thru 285
		290	**[Jog Owner]** Adapters that are presently issuing a valid jog command.	See [Stop Owner].	276 thru 285

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATIONS	Masks & Owners	291	**[Direction Owner]** Adapter that currently has exclusive control of direction changes.	See [Stop Owner].	276 thru 285
		292	**[Reference Owner]** Adapter that has the exclusive control of the command frequency source selection.	See [Stop Owner].	276 thru 285
		293	**[Accel Owner]** Adapter that has exclusive control of selecting [Accel Time 1, 2].	See [Stop Owner].	140 276 thru 285
		294	**[Decel Owner]** Adapter that has exclusive control of selecting [Decel Time 1, 2].	See [Stop Owner].	142 276 thru 285
		295	**[Fault Clr Owner]** Adapter that is presently clearing a fault.	See [Stop Owner].	276 thru 285
		296	**[MOP Owner]** Adapters that are currently issuing increases or decreases in MOP command frequency.	See [Stop Owner].	276 thru 285
		297	**[Local Owner]** Adapter that has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non-functional. Local control can only be obtained when the drive is not running.	See [Stop Owner].	276 thru 285
	Datalinks	300 301 ○	**[Data In A1] - Link A Word 1** **[Data In A2] - Link A Word 2** Parameter number whose value will be written from a communications device data table. Value will not be updated until drive is stopped. Refer to your communications option manual for datalink information.	Default: 0 (0 = "Disabled") Min/Max: 0/611 Units: 1	
		302 303 ○	**[Data In B1] - Link B Word 1** **[Data In B2] - Link B Word 2**	See [Data In A1] - Link A Word 1 [Data In A2] - Link A Word 2.	
		304 305 ○	**[Data In C1] - Link C Word 1** **[Data In C2] - Link C Word 2**	See [Data In A1] - Link A Word 1 [Data In A2] - Link A Word 2.	
		306 307 ○	**[Data In D1] - Link D Word 1** **[Data In D2] - Link D Word 2** Not available with Liquid-Cooled drives.	See [Data In A1] - Link A Word 1 [Data In A2] - Link A Word 2.	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATIONS	Datalinks	308	**v6 [HighRes Ref]** Used as a high resolution, 32 bit reference with Datalinks. –/+[Maximum Freq] or –/+[Maximum Speed] = 32767 x 65536	Default: 0 Min/Max: –/+2147418112 Units: 1	090 093 126 128 213 298
		310 311	**[Data Out A1] - Link A Word 1** **[Data Out A2] - Link A Word 2** Parameter whose value will be written to a communications device data table.	Default: 0 (0 = "Disabled") Min/Max: 0/611 Units: 1	
		312 313	**[Data Out B1] - Link B Word 1** **[Data Out B2] - Link B Word 2**	See [Data Out A1] - Link A Word 1 [Data Out A2] - Link A Word 2.	
		314 315	**[Data Out C1] - Link C Word 1** **[Data Out C2] - Link C Word 2**	See [Data Out A1] - Link A Word 1 [Data Out A2] - Link A Word 2.	
		316 317	**[Data Out D1] - Link D Word 1** **[Data Out D2] - Link D Word 2**	See [Data Out A1] - Link A Word 1 [Data Out A2] - Link A Word 2.	
	Security	595	**[Port Mask Act]** Bits 0-5 indicate status for DPI port communication. Bit 15 indicates when security software is controlling the parameter.	Read Only	

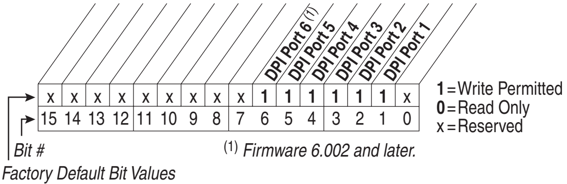


	Security									DPI Port 6 (1)	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Host
Factory Default Bit Values	0	x	x	x	x	x	x	x	x	1	1	1	1	1	1	1
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Active
0 = Not Active
x = Reserved

(1) *Firmware 6.002 and later.*

File	Group	No.	Parameter Name & Description	Values	Related
COMMUNICATIONS	Security	596 ○	**[Write Mask Cfg]** Enables/disables write access (parameters, links, etc.) for DPI ports. Changes to this parameter only become effective when power is cycled, the drive is reset or bit 15 of [Write Mask Actv], transitions from "1" to "0."		

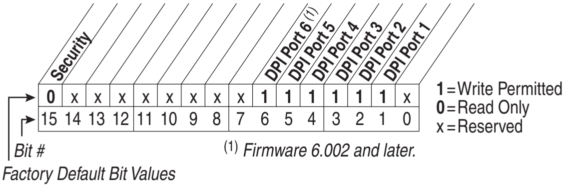


										DPI Port 6 (1)	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	
Factory Default Bit Values	x	x	x	x	x	x	x	x	x	1	1	1	1	1	1	x
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Write Permitted
0 = Read Only
x = Reserved

(1) *Firmware 6.002 and later.*

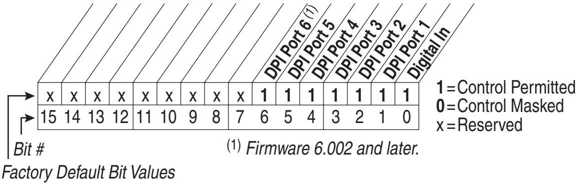
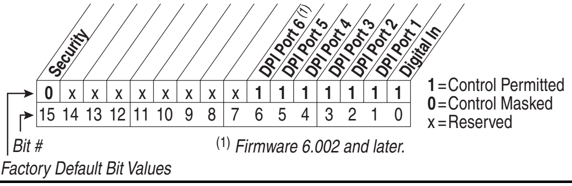
File	Group	No.	Parameter Name & Description	Values	Related
COMMUNICATIONS	Security	597	**[Write Mask Act]** Status of write access for DPI ports. When bit 15 is set, network security is controlling the write mask instead of [Write Mask Cfg].	Read Only	



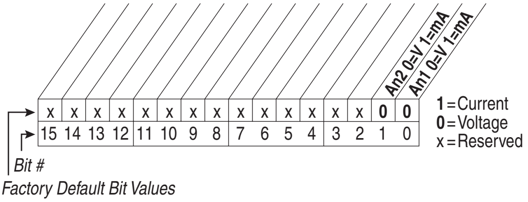
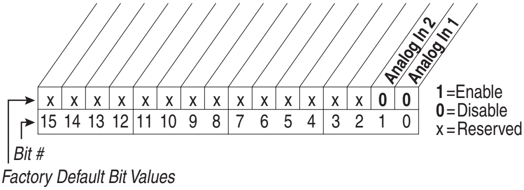
	Security									DPI Port 6 (1)	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	
Factory Default Bit Values	0	x	x	x	x	x	x	x	x	1	1	1	1	1	1	x
Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

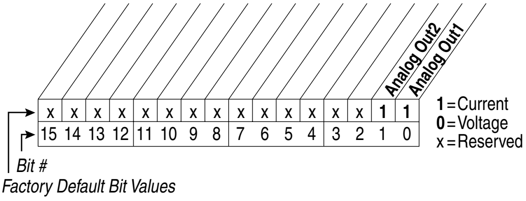
1 = Write Permitted
0 = Read Only
x = Reserved

(1) *Firmware 6.002 and later.*

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATIONS	Security	276 ○	**[Logic Mask]** Determines which ports can control the drive. If the bit for a port is set to "0," the port will have no control functions except for stop. 		288 thru 297
		598	**[Logic Mask Act]** Indicates status of the logic mask for DPI ports. When bit 15 is set, network security is controlling the logic mask instead of [Logic Mask]. 	Read Only	276

Inputs & Outputs File

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS	Analog Inputs	320 ○	**[Anlg In Config]** Selects the mode for the analog inputs. 		322 325 323 326
		321	**[Anlg In Sqr Root]** Enables/disables the square root function for each input. 		

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
<i>See page 3-2 for symbol descriptions</i></th><th>Values</th><th>Related</th></tr>
<tr><td rowspan="5">INPUTS & OUTPUTS</td><td rowspan="3">Analog Inputs</td><td>322
325</td><td>[Analog In 1 Hi]
[Analog In 2 Hi]
Sets the highest input value to the analog input x scaling block.
[Anlg In Config], parameter 320 defines if this input will be –/+10V or 0-20 mA.</td><td>Default: 10.000 Volt
10.000 Volt
Min/Max: 0.000/20.000mA
–/+10.000V
0.000/10.000V
Units: 0.001 mA
0.001 Volt</td><td>091
092</td></tr>
<tr><td>323
326</td><td>[Analog In 1 Lo]
[Analog In 2 Lo]
Sets the lowest input value to the analog input x scaling block.
[Anlg In Config], parameter 320 defines if this input will be –/+10V or 0-20 mA.
If set below 4 mA, [Analog In x Loss] should be “Disabled.”</td><td>Default: 0.000 Volt
0.000 Volt
Min/Max: 0.000/20.000mA
–/+10.000V
0.000/10.000V
Units: 0.001 mA
0.001 Volt</td><td>091
092</td></tr>
<tr><td>324
327</td><td>[Analog In 1 Loss]
[Analog In 2 Loss]
Selects drive action when an analog signal loss is detected. Signal loss is defined as an analog signal less than 1V or 2mA. The signal loss event ends and normal operation resumes when the input signal level is greater than or equal to 1.5V or 3mA.</td><td>Default: 0 “Disabled”
0 “Disabled”
Options: 0 “Disabled”
1 “Fault”
2 “Hold Input”
3 “Set Input Lo”
4 “Set Input Hi”
5 “Goto Preset1”
6 “Hold OutFreq”</td><td>091
092</td></tr>
<tr><td rowspan="2">Analog Outputs</td><td>340</td><td colspan="2">[Anlg Out Config]
Selects the mode for the analog outputs. .

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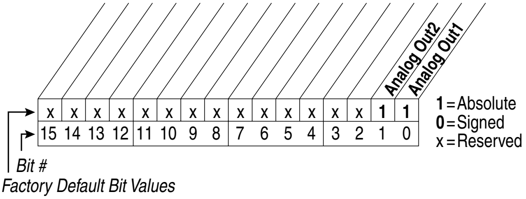
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table></td><td></td></tr>
<tr><td>341</td><td colspan="2">[Anlg Out Absolut]
Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the analog output.

<table>
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<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table></td><td></td></tr>
</table>

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
INPUTS & OUTPUTS	**Analog Outputs**	342 345	**[Analog Out1 Sel]** **[Analog Out2 Sel]** Selects the source of the value that drives the analog output.	Default: 0 “Output Freq” Options: See Table	001 002 003 004 005 007 006 012 135 136 137 138 220 219 377 378

Options		**[Analog Out1 Lo] Value**		**[Analog Out1 Hi] Value**
		Param. 341 = Signed	*Param. 341 = Absolute*	
0	“Output Freq”	–[Maximum Speed]	0 Hz	+[Maximum Speed]
1	“Command Spd”	–[Maximum Speed]	0 Hz/RPM	+[Maximum Speed]
2	“Output Amps”	0 Amps	0 Amps	200% Rated
3	“Torque Amps”	–200% Rated	0 Amps	200% Rated
4	“Flux Amps”	0 Amps	0 Amps	200% Rated
5	“Output Power”	0 kW	0 kW	200% Rated
6	“Output Volts”	0 Volts	0 Volts	120% Rated Input Volts
7	“DC Bus Volts”	0 Volts	0 Volts	200% Rated Input Volts
8	“PI Reference”(1)	–100%	0%	100%
9	“PI Feedback”	–100%	0%	100%
10	“PI Error”	–100%	0%	100%
11	“PI Output”	–100%	0%	100%
12	“%Motor OL”	0%	0%	100%
13	“%Drive OL”	0%	0%	100%
14	“CommandedTrq”	–800% Rated	0%	800% Rated
15	“MtrTrqCurRef”(1)	–200% Rated	0%	200% Rated
16	“Speed Ref”	–[Maximum Speed]	0 Hz/RPM	+[Maximum Speed]
17	“Speed Fdbk”	–[Maximum Speed]	0 Hz/RPM	+[Maximum Speed]
18	“Pulse In Ref”(1)	–25200.0 RPM	0 Hz/RPM	+[Maximum Speed]
19	“Torque Est”(1)	–800%	0%	+800%
20-23	“Scale Block1-4”(1)			
24	“Param Cntl”(1)			
25	“SpdFb NoFilt			

(1) Refer to Option Definitions on page 3-57.

File	Group	No.	**Parameter Name & Description**	**Values**	**Related**
INPUTS & OUTPUTS	**Analog Outputs**	343 346	**[Analog Out1 Hi]** **[Analog Out2 Hi]** Sets the analog output value when the source value is at maximum.	Default: 20.000 mA, 10.000 Volts Min/Max: 0.000/20.000mA –/+10.000V Units: 0.001 mA 0.001 Volt	340 342
		344 347	**[Analog Out1 Lo]** **[Analog Out2 Lo]** Sets the analog output value when the source value is at minimum.	Default: 0.000 mA, 0.000 Volts Min/Max: 0.000/20.000mA –/+10.000V Units: 0.001 mA 0.001 Volt	340 342
		354 355	**[Anlg Out1 Scale]** **[Anlg Out2 Scale]** Sets the high value for the range of analog out scale. Entering 0.0 will disable this scale and max scale will be used. Example: If [Analog Out Sel] = “Commanded Trq,” a value of 150 = 150% scale in place of the default 800%.	Default: 0.0 Min/Max: [Analog Out1 Sel] Units: 0.1	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**		Related
INPUTS & OUTPUTS	Analog Outputs	377 378	**[Anlg1 Out Setpt]** **[Anlg2 Out Setpt]** Controls the analog output value from a communication device. Example: Set [Data In Ax] to "377" (value from communication device). Then set [Analog Outx Sel] to "Param Cntl."	Default:	20.000 mA, 10.000 Volts	
				Min/Max:	0.000/20.000mA –/+10.000V	
				Units:	0.001 mA 0.001 Volt	

Selected Option Definitions – [Analog Outx Sel], [Digital Inx Sel], [Digital Outx Sel]

Option	Description	Related
At Speed	Relay changes state when drive has reached commanded speed.	380
Fast Stop	When open, the drive will stop with a 0.1 second decel time. (If Torque Proving is being used, float will be ignored at end of ramp and the mechanical brake will be set).	361 ℹ
Excl Link	Links digital input to a digital output if the output is set to "Input 1-6 Link." This does not need to be selected in the Vector option.	361
Find Home	Starts the commissioning procedure when a start command is issued to automatically position the motor to a home position established by a limit switch.	
Hold Step	Inhibits profile from transitioning to next step when active.	
Home Limit	This input is used for the "home" position.	
Input 1-6 Link	When Digital Output 1 is set to one of these (i.e. Input 3 Link) in conjunction with Digital Input 3 set to "Excl Link," the Digital Input 3 state (on/off) is echoed in the Digital Output 1.	380
Micro Pos	Micropostion input. When closed, the command frequency is set to a percentage speed reference as defined in [MicroPos Scale%], parameter 611.	361
MOP Dec	Decrements speed reference as long as input is closed.	361
MOP Inc	Increments speed reference as long as input is closed.	361
MtrTrqCurRef	Torque producing current reference.	342
Param Cntl	Parameter controlled analog output allows PLC to control analog outputs through data links. Set in [AnlgX Out Setpt], parameters 377-378.	342
Param Cntl	Parameter controlled digital output allows PLC to control digital outputs through data links. Set in [Dig Out Setpt], parameter 379.	380
PI Reference	Reference for PI block (see Process PID on page C-29).	342
Pos Redefine	Redefines the "home" position for the drive by latching encoder position.	
Pos Sel 1-5	Binary value of these inputs is used to select the starting step number for the profile.	
Precharge En	Forces drive into precharge state. Typically controlled by auxiliary contact on the disconnect at the DC input to the drive.	361
Profile Input	Must be chosen if [Step X Type] is set to "Dig Input" and the digital input value that is entered in [Step X Value] is the value of this digital input selector.	
Pulse In Ref	Reference of the pulse input (Z channel of encoder - can be used while A & B channels are encoder inputs).	342
RunFwd Level RunRev Level Run Level	Provides a run level input. They do not require a transition for enable or fault, but a transition is still required for a stop.	
Run w/Comm	Allows the comms start bit to operate like a run with the run input on the terminal block. Ownership rules apply.	
Scale Block 1-4	Output of scale blocks, parameters 354-355.	342
SpdFb NoFilt	Provides an unfiltered value to an analog output. The filtered version "Speed Fdbk" includes a 125 ms filter.	
Torque Est	Calculated percentage of rated motor torque.	342
Torque Setpt 1	Selects "Torque Stpt1" for [Torque Ref A Sel] when set, otherwise uses value selected in [Torque Ref A Sel].	361
Vel Override	When active, multiplies value of [Step X Velocity] by % value in [Vel Override].	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values			Related
INPUTS & OUTPUTS	Digital Inputs	361	**[Digital In1 Sel]**	Default:	4	“Stop – CF”	
		362	**[Digital In2 Sel]**	Default:	5	“Start”	
		363	**[Digital In3 Sel]**	Default:	18	“Auto/ Manual”	
		364	**[Digital In4 Sel]**	Default:	15	“Speed Sel 1”	
		365	**[Digital In5 Sel]**	Default:	16	“Speed Sel 2”	
		366	**[Digital In6 Sel]** (10)	Default:	17	“Speed Sel 3”	

○ Selects the function for the digital inputs.

(1) Speed Select Inputs.

3	2	1	Auto Reference Source
0	0	0	Reference A
0	0	1	Reference B
0	1	0	Preset Speed 2
0	1	1	Preset Speed 3
1	0	0	Preset Speed 4
1	0	1	Preset Speed 5
1	1	0	Preset Speed 6
1	1	1	Preset Speed 7

To access Preset Speed 1, set [Speed Ref x Sel] to “Preset Speed 1”.

Type 2 Alarms - Some digital input programming may cause conflicts that will result in a Type 2 alarm. Example: [Digital In1 Sel] set to “5, Start” in 3-wire control and [Digital In2 Sel] set to 7 “Run” in2-wire. See Table 4.C for info on resolving this type of conflict.

(2)

3	2	1	Spd/Trq Mode
0	0	0	Zero Torque
0	0	1	Spd Reg
0	1	0	Torque Reg
0	1	1	Min Spd/Trq
1	0	0	Max Spd/Trq
1	0	1	Sum Spd/Trq
1	1	0	Absolute
1	1	1	Pos/Spd Prof

(3) When [Digital Inx Sel] is set to option 2 “Clear Faults” the Stop button cannot be used to clear a fault condition.

(4) Typical 3-Wire Inputs - Only 3-wire functions are allowed. Including 2-wire selections will cause a type 2 alarm.

(5) Typical 2-Wire Inputs - Only 2-wire functions can be chosen. Including 3-wire selections will cause a type 2 alarm. See Table 4.C for conflicts.

(6) Configures the input to command a transition between the Manual/Auto or Auto/Manual speed references. Refer to pages 1-46…1-49 for details. “Manual/ Auto” (68) is similar to “Auto/Manual” (18) except that the polarity is opposite.

Input State	“Auto/Manual” (18)	“Manual/Auto” (68)
Lo	Auto	Manual
Hi	Manual	Auto

continued

Options:		
Options:	0	“Not Used”
	1	“Enable” (7, 9)
	2	“Clear Faults”(CF) (3)
	3	“Aux Fault”
	4	“Stop – CF” (9)
	5	“Start” (4, 8)
	6	“Fwd/ Reverse” (4)
	7	“Run” (5, 9)
	8	“Run Forward” (5)
	9	“Run Reverse” (5)
	10	“Jog1”
	11	“Jog Forward” (5)
	12	“Jog Reverse” (5)
	13	“Stop Mode B”
	14	“Bus Reg Md B”
	15-17	“Speed Sel 1-3” (1)
	18	“Auto/ Manual” (6)
	19	“Local”
	20	“Acc2 & Dec2”
	21	“Accel 2”
	22	“Decel 2”
	23	“MOP Inc” (12)
	24	“MOP Dec” (12)
	25	“Excl Link” (12)
	26	“PI Enable”
	27	“PI Hold”
	28	“PI Reset”
	29	“Pwr Loss Lvl”
	30	“Precharge En” (12)
	31-33	“Spd/Trq Sel1-3” (2)
	34	“Jog 2”
	35	“PI Invert”
	36	“Torque Setpt 1” (12)
	37	“Flt/MicroPos” (11, 12)
	38	“Fast Stop” (12)
	39	“Decel Limit”
	40	“End Limit”
	41-42	“UserSet Sel1-2” (13)
	43	“Run Level”
	44	“RunFwd Level”
	45	“RunRev Level” (12)
	46	“Run w/Comm” (12)
	47	“Hold Step” (12)
	48	“Redefine Pos” (12)
	49	“Find Home” (12)
	50	“Home Limit” (12)
	51	“Vel Override” (12)
	52-56	“Pos Sel 1-5” (12)
	57	“Prof Input” (12)

Related: 100, 156, 162, 096, 141, 143, 195, 194, 380, 124

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS	Digital Inputs		(continued below)	(continued below)	

(7) Opening an “Enable” input will cause the motor to coast-to-stop, ignoring any programmed Stop modes.

(8) “Dig In ConflictB” alarm will occur if a “Start” input is prog. without a “Stop” input.

(9) Refer to the Sleep-Wake Mode Attention statement on page 3-33.

(10) A dedicated hardware enable input is available via a jumper selection. Refer to page 1-43 for further information.

(11) Only available when “Torque Proving” function is selected.

(12) Refer to Option Definitions on page 3-57.

(13) Refer to [Dyn UsrSet Sel] on page 3-38 for selection information.

(14) Firmware v6.002 and later.

(15) Adjust Voltage Select Inputs

3	2	1	AdjV Sel
0	0	0	Adj Volt Sel
0	0	1	Adj Volt Preset1
0	1	0	Adj Volt Preset2
0	1	1	Adj Volt Preset3
1	0	0	Adj Volt Preset4
1	0	1	Adj Volt Preset5
1	1	0	Adj Volt Preset6
1	1	1	Adj Volt Preset7

(16)

3	2	1	AdjV Sel
0	0	0	Adj Volt Sel & Speed ref A Sel
0	0	1	Adj Volt Preset1 & Speed Ref B Sel
0	1	0	Adj Volt Preset2 & Speed Preset 2
0	1	1	Adj Volt Preset3 & Speed Preset 3
1	0	0	Adj Volt Preset4 & Speed Preset 4
1	0	1	Adj Volt Preset5 & Speed Preset 5
1	1	0	Adj Volt Preset6 & Speed Preset 6
1	1	1	Adj Volt Preset7 & Speed Preset 7

Mixing selections 63-65 with 60-62 or 15-17 will cause a type 2 alarm.

Values:

58-59	“Reserved”
60-62	“AdjV Sel 1-3 (14, 15)
63-65	“AdjV/Hz Sel1-3 (14, 16)
66	“Abort Step” (14)
67	“Abort Prof” (14)
68	“Manual/Auto” (6)

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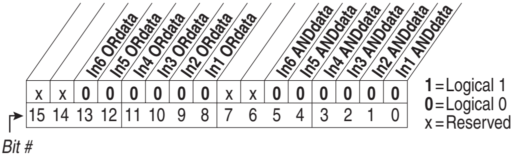
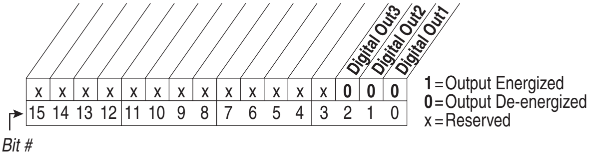
411 **v6** **[DigIn DataLogic]** — Related: 056

Provides data to the logical operations that will be done with the digital inputs when parameter 056 is set to option 9, “DigIn DatLog.”



		In6 ORdata	In5 ORdata	In4 ORdata	In3 ORdata	In2 ORdata	In1 ORdata			In6 ANDdata	In5 ANDdata	In4 ANDdata	In3 ANDdata	In2 ANDdata	In1 ANDdata
x	x	**0**	**0**	**0**	**0**	**0**	**0**	x	x	**0**	**0**	**0**	**0**	**0**	**0**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Logical 1
0 = Logical 0
x = Reserved

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**			Related
INPUTS & OUTPUTS	Digital Outputs	379	**[Dig Out Setpt]** Sets the digital output value from a communication device. Example: Set [Data In B1] to “379.” The first three bits of this value will determine the setting of [Digital Outx Sel] which should be set to “30, Param Cntl.”  				380
		380	**[Digital Out1 Sel]**(4)	Default:	1	“Fault”	381
		384	**[Digital Out2 Sel]**		4	“Run”	385
		388	**[Digital Out3 Sel]**		4	“Run”	389
			Selects the drive status that will energize a (CRx) output relay.	Options:	1	“Fault”(1)	382
					2	“Alarm”(1)	386
					3	“Ready”	390
					4	“Run”	383
					5	“Forward Run”	
					6	“Reverse Run”	
					7	“Auto Restart”	
					8	“Powerup Run”	
					9	“At Speed”(2)	
					10	“At Freq”(3)	002
					11	“At Current”(3)	001
					12	“At Torque”(3)	003
					13	“At Temp”(3)	004
					14	“At Bus Volts”(3)	218
					15	“At PI Error”(3)	012
					16	“DC Braking”	137
					17	“Curr Limit”	157
					18	“Economize”	147
					19	“Motor Overld”	053
					20	“Power Loss”	048
					21-26	“Input 1-6 Link”	184
					27	“PI Enable”	
					28	“PI Hold”	
					29	“Drive Overload”	
					30	“Param Cntl”(2)	379
					31	”Mask 1 AND”	
					32	”Mask 1 OR”	
					33	”Prof At Pos”	
					34	”Prof Enabled”	
					35	”Prof Running”	
					36	”Prof Holding”	
					37	”Prof At Home”	
					38	”ProfComplete”	
					39	”Prof Homing”	
					40	”Prof Dwell”	
					41	”Prof Batch”	
					42-57	”Prof @ Step1-16”	
					58	“Manual Mode”(5)	222
					59	“Fast Braking”(5)	222
					60	“TrqPrv Brake”(5)	600
					61	“Speed Fdbk”(5)	

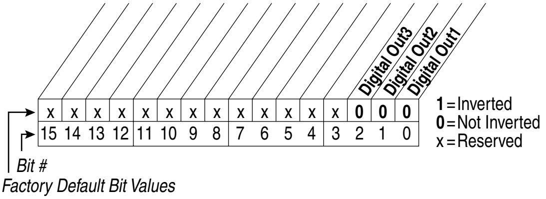
(1) Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and deenergize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will deenergize when condition is removed. Refer to pages 1-40.

(2) Refer to Option Definitions on page 3-57.

(3) Activation level is defined in [Dig Outx Level] below.

(4) When [TorqProve Cnfg] is set to “Enable,” [Digital Out1 Sel] becomes the brake control and any other selection will be ignored.

(5) Firmware 6.002 & Later.

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS	Digital Outputs	381 385 389	**[Dig Out1 Level]** **[Dig Out2 Level]** **[Dig Out3 Level]** Sets the relay activation level for options 10-15 in [Digital Outx Sel]. Units are assumed to match the above selection (i.e. "At Freq" = Hz, "At Torque" = Amps).	Default: 0.0 0.0 0.0 Min/Max: 0.0/819.2 Units: 0.1	380
		382 386 390	**[Dig Out1 OnTime]** **[Dig Out2 OnTime]** **[Dig Out3 OnTime]** Sets the "ON Delay" time for the digital outputs. This is the time between the occurrence of a condition and activation of the relay.	Default: 0.00 Secs 0.00 Secs Min/Max: 0.00/600.00 Secs Units: 0.01 Secs	380
		383 387 391	**[Dig Out1 OffTime]** **[Dig Out2 OffTime]** **[Dig Out3 OffTime]** Sets the "OFF Delay" time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.	Default: 0.00 Secs 0.00 Secs Min/Max: 0.00/600.00 Secs Units: 0.01 Secs	380
		392	**[Dig Out Invert]** Inverts the selected digital output. 		

x	x	x	x	x	x	x	x	x	x	x	x	x	**0**	**0**	**0**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS	Digital Outputs	393	**[Dig Out Param]** Selects the value that the mask ([Dig Out Mask]) will be applied to.	Default: 0 “PI Config” Options: 0 “PI Config” 1 “PI Status” 2-3 “Drive Sts 1-2” 4-5 “DriveAlarm1-2“ 6 “StartInhibit“ 7 “DigIn Status“ 8-9 “DrvSts1/2Flt“ 10 “AlrmSts1/2Flt“ 12 “LogicCmdRslt“ 13 “Stop Owner“ 14 “Start Owner“ 15 “Jog Owner“ 16 “Dir Owner“ 17 “Ref Owner“ 18 “Accel Owner“ 19 “Decel Owner“ 20 “FltRst Owner“ 21 “MOP Owner“ 22 “Local Owner“ 23 “Limit Status“ 24 “PortMaskAct“ 25 “WriteMaskAct“ 26 “LogicMaskAct“ 27 “TorqProvCnfg“ 28 “TorqProvSet“ 29 “TorqProvSts“ 30 “Profile Sts“ 31 “Profile Cmd“	
		394	**[Dig Out Mask]** Sets the mask that is applied to the selected value in [Dig Out Param]. A bit (AND/OR) is applied, which is selected by the [Digital Outx Sel]. All bits with zeros in the mask are ignored.		

0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1 = Bit selected
0 = Bit Masked
x = Reserved

Bit #

Factory Default Bit Values

Example:

Mask OR: If Any bits in the value are set in the mask, then the output is On.

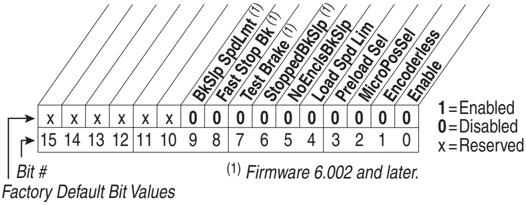
Selected Value	0	0	0	0	1	1	0	0	**1**	1	1	1	0	**0**	0	0
Mask	0	0	0	0	0	0	0	0	**1**	0	0	0	0	**1**	0	0
Result	Output On															

Mask AND: If All bits in the value are set in the mask then the output is On.

Selected Value	0	0	0	0	1	1	0	0	**1**	1	1	1	0	**0**	0	0
Mask	0	0	0	0	0	0	0	0	**1**	0	0	0	0	**1**	0	0
Result	Output Off															

Applications File

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
APPLICATIONS	Torque Proving	600	**[TorqProve Cnfg]** Enables/disables torque/brake proving feature. When “Enabled,” [Digital Out1 Sel] becomes the brake control. Note: this value is not changed when parameters are reset to factory defaults.		

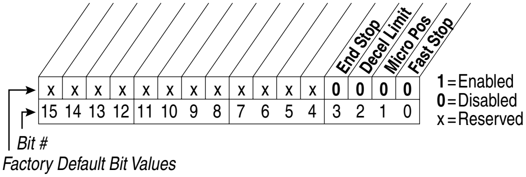


(1) *Firmware 6.002 and later.*

Option Descriptions

Enable	Enables TorqProve features.
Encoderless	Enables encoderless operation – bit 0 must also be enabled.
MicroPosSel	A “1” allows the Micro Position digital input to change the speed command while the drive is running.
Preload Sel	“0” uses the last torque for preload. “1” uses “TorqRef A” if commanded direction is forward and “TorqRef B” for reverse.
Load Spd Lim	Enables drive to perform load calculation at base speed. Drive will then limit operation above base speed depending on load.
NoEnclsBkSlp	A “1” Disables the partial Brake Slip routine from the drive when encoderless is selected.
StoppedBkSlp	Check for brake slip while stopped.
Test Brake	Before releasing brake, test for slip using [Brake Test Torque].
Fast Stop Bk	Immediately apply brake when a Fast Stop is initiated.

File	Group	No.	Parameter Name & Description	Values	Related
APPLICATIONS	Torque Proving	601	**[TorqProve Setup]** Allows control of specific torque proving functions through a communication device.		



File	Group	No.	Parameter Name & Description	Values	Related
APPLICATIONS	Torque Proving	602	**[Spd Dev Band]** Defines the allowable difference between the commanded frequency and encoder feedback value. A fault will occur when the difference exceeds this value for a period of time.	Default: 2.0 Hz 60.0 RPM Min/Max: 0.1/15.0 Hz 3.0/450.0 RPM Units: 0.1 Hz 0.1 RPM	603

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values		Related
APPLICATIONS	Torque Proving	603	**[SpdBand Integrat]** Sets the amount of time before a fault is issued when [Spd Dev Band] is outside its threshold.	Default: Min/Max: Units:	60 mSec 1/200 mSec 1 mSec	602
		604	**[Brk Release Time]** Sets the time between the brake release command and when the drive begins to accelerate. In Encoderless mode, this parameter sets the time to release the brake after drive starts.	Default: Min/Max: Units:	0.10 Secs 0.00/10.00 Secs 0.01 Secs	
		605	**[ZeroSpdFloatTime]** Sets the amount of time the drive is below [Float Tolerance] before the brake is set. Not used in Encoderless TorqProve mode.	Default: Min/Max: Units:	5.0 Secs 0.1/500.0 Secs 0.1 Secs	
		606	**[Float Tolerance]** Sets the frequency level where the float timer starts. Also sets the frequency level where the brake will be closed in Encoderless TorqProve mode.	Default: Min/Max: Units:	0.2 Hz 6.0 RPM 0.1/5.0 Hz 3.0/150.0 RPM 0.1 Hz 0.1 RPM	
		607	**[Brk Set Time]** Defines the amount of delay time between commanding the brake to be set and the start of brake proving.	Default: Min/Max: Units:	0.10 Secs 0.00/10.00 Secs 0.01 Secs	
		608	**[TorqLim SlewRate]** Sets the rate to ramp the torque limits to zero during brake proving.	Default: Min/Max: Units:	10.0 Secs 0.5/300.0 Secs 0.1 Secs	
		609	**[BrkSlip Count]** Sets the number of encoder counts to define a brake slippage condition. Not used in encoderless operation.	Default: Min/Max: Units:	250 0/65535 1	
		610	**[Brk Alarm Travel]** Sets the number of motor shaft revolutions allowed during the brake slippage test. Drive torque is reduced to check for brake slippage. When slippage occurs, the drive allows this number of motor shaft revolutions before regaining control. Not used in Encoderless TorqProve mode.	Default: Min/Max: Units:	1.0 Revs 0.0/1000.0 Revs 0.1 Revs	
		611 ○	**[MicroPos Scale%]** Sets the percent of speed reference to be used when micropositioning has been selected in [TorqProve Cnfg]. Bit 2 of [TorqProve Cnfg], parameter 600 determines if the motor needs to come to a stop before this setting will take effect.	Default: Min/Max: Units:	10.0% 0.1/100.0% 0.1%	361 thru 366 600

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
APPLICATIONS	Torque Proving	612	**[Torq Prove Sts]** Displays the status bits for TorqProve.	Read Only	

									RefLoadLimtd	LoadTestActv	Brake Set	BrkSlipAlarm	MicroPosActv	DecelLimActv	EndLimitActv
x	x	x	x	x	x	x	x	x	0	0	0	0	0	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit #

1 = Enabled
0 = Disabled
x = Reserved

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
APPLICATIONS	Torque Proving	613	v6 **[Brake Test Torq]** Sets test torque to use when [Brake Test] is enabled in [TorqProv Cnfg].	Default: 50.0% Min/Max: 0.0/150.0% Units: 0.1%	600
	Oil Well Pump	631	**[Rod Load Torque]** Displays the load side torque. [Alarm Config 1], parameter 259, bit 19 must be enabled to activate this display.	Default: Read Only Min/Max: 0.00/32000.00 FtLb Units: 0.01 FtLb	
		632	**[TorqAlarm Level]** Sets the level at which the Torque Alarm becomes active. Note: only active with PC pump applications (see param. 641).	Default: 0.00 FtLb Min/Max: 0.00/5000.00 FtLb Units: 0.01 FtLb	
		633	**[TorqAlarm Action]** Sets the drive action when the Torque Alarm is exceeded. Note: only active with PC pump applications (see param. 641).	Default: 0 "No Action" Options: 0 "No Action" 1 "Goto Preset1"	
		634	**[TorqAlarm Dwell]** Sets the time that the torque must exceed [TorqAlarm Level] before [TorqAlarm Action] takes place. Note: only active with PC pump applications (see param. 641).	Default: 0.0 Secs Min/Max: 0.0/60.0 Secs Units: 0.1 Secs	
		635	**[TorqAlrm Timeout]** Sets the amount of time a Torque Alarm can be active until timeout action begins. Note: only active with PC pump applications (see param. 641).	Default: 0.0 Secs Min/Max: 0.0/600.0 Secs Units: 0.1 Secs	
		636 ○	**[TorqAlrm TO Act]** Sets the drive action when [TorqAlrm Timeout] is exceeded. Note: only active with PC pump applications (see p. 641).	Default: 0 "Resume" Options: 0 "Resume" 1 "Fault Drive"	
		637 ○	**[PCP Pump Sheave]** Specifies the pump sheave diameter.	Default: 20.00 Inch Min/Max: 0.25/200.00 Inch Units: 0.01 Inch	
		638 ○	**[Max Rod Torque]** Sets the desired maximum torque on the polished rod in a PCP oil well application	Default: 500.0 FtLb Min/Max: 0.0/3000.0 FtLb Units: 0.1 FtLb	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
APPLICATIONS	**Oil Well Pump**	639 ○	**[Min Rod Speed]** Sets the minimum speed for the polished rod in a PCP oil well application.	Default: 0.0 RPM Min/Max: 0.0/199.0 RPM Units: 0.1 RPM	081 646
		640 ○	**[Max Rod Speed]** Sets the maximum speed for the polished rod in a PCP oil well application.	Default: 300.0 RPM Min/Max: 200.0/600.0 RPM Units: 0.1 RPM	082 646
		641 ○	**[OilWell Pump Sel]** Selects the type of oil well application. "Disable" (0) - Disables oil well parameters. "Pump Jack" (1) - Sets parameters based on Pump Jack type oil well. "PC Oil Well" (2) - Sets parameters based on Progressive Cavity type Pumps.	Default: 0 "Disable" Options: 0 "Disable" 1 "Pump Jack" 2 "PC Oil Well"	190 279
		642 ○	**[Gearbox Rating]** Sets the gearbox rating.	Default: 640.0 Kin# Min/Max: 16.0/2560.0 Kin# Units: 0.1 Kin#	
		643 ○	**[Gearbox Sheave]** Sets the Sheave diameter on the Gearbox.	Default: 0.25 Inch Min/Max: 0.25/100.00 Inch Units: 0.01 Inch	
		644 ○	**[Gearbox Ratio]** Specifies the nameplate gear ratio.	Default: 1.00 Min/Max: 1.00/40.00 Units: 0.01	
		645 ○	**[Motor Sheave]** Sets the sheave diameter on the motor.	Default: 10.00 Inch Min/Max: 0.25/25.00 Inch Units: 0.01 Inch	
		646 ○	**[Total Gear Ratio]** Displays the calculated total gear ratio as follows: $\frac{[\text{Gearbox Sheave}] \text{ x } [\text{Gearbox Ratio}]}{[\text{Motor Sheave}]}$	Default: Read Only Min/Max: 0.00/32000.00 Units: 0.01	
		647 ○	**[DB Resistor]** Calculates the negative torque maximum available from the dynamic brake resistor.	Default: 10.4 Ohms Min/Max: 0.0/100.0 Ohms Units: 0.1 Ohms	
		648 ○	**[Gearbox Limit]** Sets the gearbox torque limit. This value is used in determining the [Pos Torque Limit] & [Neg Torque Limit].	Default: 100.0% Min/Max: 0.0/200.0% Units: 0.1%	

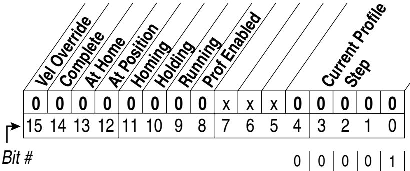
File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
APPLICATIONS	**Adjust Voltage**	650 ○	**[Adj Volt Phase]** "1 Phase" (0) - Select to operate single phase loads connected to the U & V phases. Not designed to operate single phase motors. "3 Phase" (1) - Select to operate three phase loads.	Default: 1 "3 Phase" Options: 0 "1 Phase" 1 "3 Phase"	
		651 ○	**[Adj Volt Select]** Selects the source of the voltage reference to the drive.	Default: 2 "Analog In 2" Options: 0 "Reserved" 1 "Analog In 1" 2 "Analog In 2" 3-6 "Reserved" 7-8 "Not Used 9 "MOP Level" 10 "Reserved" 11-17 "Preset Volt1-7" 18-22 "DPI Port 1-5"	
		652 ○	**[Adj Volt Ref Hi]** Scales the upper value of the [Adj Volt Select] selection when the source is an analog input.	Default: 100.0% Min/Max: –/+100.0% of Drive Rated Volts Units: 0.1%	
		653 ○	**[Adj Volt Ref Lo]** Scales the lower value of the [Adj Volt Select] selection when the source is an analog input.	Default: 0.0% Min/Max: –/+100.0% of Drive Rated Volts Units: 0.1%	
		654 655 656 657 658 659 660	**[Adj Volt Preset1]** **[Adj Volt Preset2]** **[Adj Volt Preset3]** **[Adj Volt Preset4]** **[Adj Volt Preset5]** **[Adj Volt Preset6]** **[Adj Volt Preset7]** Provides an internal fixed voltage command value that is available as a selection for [Adj Volt Select].	Default: 0.0 VAC Min/Max: 0.0/Drive Rated Volts Units: 0.1 VAC	
		661	**[Min Adj Voltage]** Sets the low limit for the voltage reference when [Motor Cntrl Sel] is set to "Adj Voltage."	Default: 0.0 VAC Min/Max: 0.0/Drive Rated Volts Units: 0.1 VAC	
		662	**[Adj Volt Command]** Displays the voltage value of the reference specified in [Adj Volt Select].	Default: Read Only Min/Max: 0.0/Drive Rated Volts Units: 0.1 VAC	
		663	**[MOP Adj VoltRate]** Sets the rate for the MOP.	Default: 1.0 V/s Min/Max: 0.1/100.0 V/s Units: 0.1 V/s	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	Related
APPLICATIONS	Adjust Voltage	669 ○	**[Adj Volt TrimSel]** Selects the source of the voltage trim that is added to or subtracted from the voltage reference.	Default: 2 “Analog In 2” Options: 0 “Reserved” 1 “Analog In 1” 2 “Analog In 2” 3-6 “Reserved” 7-8 “Not Used 9 “MOP Level” 10 “Reserved” 11-17 “Preset Volt1-7” 18-22 “DPI Port 1-5”	
		670 ○	**[Adj Volt Trim Hi]** Scales the upper value of the [Adj Volt TrimSel] selection when the source is an analog input.	Default: 100.0% Min/Max: 0.0/100.0% of Drive Rated Volts Units: 0.1%	
		671 ○	**[Adj Volt Trim Lo]** Scales the lower value of the [Adj Volt TrimSel] selection when the source is an analog input.	Default: 0.0% Min/Max: 0.0/100.0% of Drive Rated Volts Units: 0.1%	
		672	**[Adj Volt Trim %]** Scales the total voltage trim value from all sources. Analog In 1 & 2 are scaled separately with [Adj Volt Trim Hi] & [Adj Volt Trim Lo] then [Adj Volt Trim %] sets the trim value. The sign of this value will determine if trim is added or subtracted from the reference.	Default: 0.0% Min/Max: –/+100.0% of Drive Rated Volts Units: 0.1%	
		675	**[Adj Volt AccTime]** Sets the rate of voltage increase. The value will be the time it takes to ramp the voltage from [Min Adj Voltage] to [Maximum Voltage]. An “S” curve can be applied to the ramp using parameter 677.	Default: 0.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	
		676	**[Adj Volt DecTime]** Sets the rate of voltage decrease. The value will be the time it takes to ramp the voltage from [Maximum Voltage] to [Min Adj Voltage]. An “S” curve can be applied to the ramp using [Adj Volt Scurve]. **Important:** This ramp and [Decel Time 1/2] (parameters 142/143) must ramp to zero for drive to Stop.	Default: 0.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	
		677	**[Adj Volt S Curve]** Sets the percentage of accel or decel time to be applied to the voltage ramp as “S” curve. Time is added 1/2 at the beginning and 1/2 at the end.	Default: 0.0% Min/Max: 0.0/100.0% Units: 0.1%	

Pos/Spd Profile File

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	ProfSetup/Status	700	**[Pos/Spd Prof Sts]** Provides status of the profile/indexer. Bits 0-4 are a binary value.	Read Only	
		701	**[Units Traveled]** Number of units traveled from the home position.	Default: Read Only Min/Max: –/+ 21474836.47 Units: 0.01	
		702	**v6** **[Home Position]** A “Find Home” or a “Redefine Pos” sets [Units Traveled] to this value.	Default: 0.00 Min/Max: –/+ 21474836.47 Units: 0.01	701
		705	**[Pos/Spd Prof Cmd]** Control word for the profile/indexer. The control functions are the same as those in the digital input section. If a digital input is configured to provide the starting step (bits 0-4), then its starting step value takes priority over [Pos/Spd Prof Cmd]. If a digital input is configured for any of bits 8-12, the corresponding functions will respond to the digital input status or the status of [Pos/Spd Prof Cmd].		

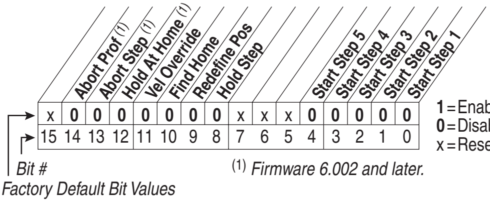
700 [Pos/Spd Prof Sts]



1 = Enabled
0 = Disabled
x = Reserved

0	0	0	0	1	Step 1
0	0	0	1	0	Step 2
0	0	0	1	1	Step 3
0	0	1	0	0	Step 4
0	0	1	0	1	Step 5
0	0	1	1	0	Step 6
0	0	1	1	1	Step 7
0	1	0	0	0	Step 8
0	1	0	0	1	Step 9
0	1	0	1	0	Step 10
0	1	0	1	1	Step 11
0	1	1	0	0	Step 12
0	1	1	0	1	Step 13
0	1	1	1	0	Step 14
0	1	1	1	1	Step 15
1	0	0	0	0	Step 16

705 [Pos/Spd Prof Cmd]



1 = Enabled
0 = Disabled
x = Reserved

(1) *Firmware 6.002 and later.*

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	ProfSetup/Status	707	**[Encoder Pos Tol]** Sets the “At Position” tolerance window (see [Pos/Spd Prof Sts], bit 12) around the encoder count. The value is subtracted from and added to the encoder unit value. It is applied to all steps using encoder units.	Default: 10 Min/Max: 1/50000 Units: 1	
		708	**[Counts per Unit]** Sets the number of encoder counts equal to one unit. A 1024 PPR quadrature encoder has 4096 pulses (counts) in one revolution.	Default: 4096 Min/Max: 1/1000000 Units: 1	
		711 ○	**[Vel Override]** This value is a multiplier to the [Step x Velocity] value when “Vel Override” bit of [Pos/Spd Prof Cmd] is set to “1”. This is applicable to all step types.	Default: 100.0% Min/Max: 10.0/150.0% Units: 0.1%	
		713 ○	**[Find Home Speed]** Sets the speed and direction that are active when “Find Home” of [Pos/Spd Prof Cmd] is active. The sign of the value defines direction (“+” = Forward, “–” = Reverse).	Default: +10.0% of [Maximum Speed] Min/Max: –/+50.0% of [Maximum Speed] Units: 0.1 Hz 0.1 RPM	
		714 ○	**[Find Home Ramp]** Sets the rate of acceleration and deceleration of the Find Home moves.	Default: 10.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	
		718	**[Pos Reg Filter]** Sets the error signal filter in the position regulator.	Default: 25.0 Min/Max: 0.0/500.0 Units: 0.1	
		719	**[Pos Reg Gain]** Sets the gain adjustment for the position regulator.	Default: 4.0 Min/Max: 0.0/200.0 Units: 0.1	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	**Values**	**Related**
POS/SPD PROFILE	**Profile Step 1-16**	720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870	**[Step 1 Type]** **[Step 2 Type]** **[Step 3 Type]** **[Step 4 Type]** **[Step 5 Type]** **[Step 6 Type]** **[Step 7 Type]** **[Step 8 Type]** **[Step 9 Type]** **[Step 10 Type]** **[Step 11 Type]** **[Step 12 Type]** **[Step 13 Type]** **[Step 14 Type]** **[Step 15 Type]** **[Step 16 Type]** Selects the type of move for a particular step.	Default: 1 "Time" Options: 0 "End" 1 "Time" 2 "Time Blend" 3 "Dig Input" 4 "Encoder Incr" 5 "EncIncrBlend" 6 "Encoder Abs" 7 "End Hold Pos" 8 "Param Level"	
			The following step types use the velocity regulator only: "End" (0) - drive ramps to zero speed and stops the profile after the programmed dwell time. "Time" (1) - drive ramps to [Step x Velocity], holds speed and decels to zero in specified [Step x Value] time. "Time Blend" (2) - drive ramps to [Step x Velocity], and holds speed until [Step x Value] time completes, then transitions to step defined in [Step x Next]. "Dig Input" (3) - drive ramps to [Step x Velocity], holds speed until input specified in [Step x Value] transitions in the direction defined by sign of [Step x Value]. "EncIncrBlend" (5) - drive ramps to [Step x Velocity], holds speed, when at encoder position defined by [Step x Value] within tolerance window transition to [Step x Next]. "Param Level" (8) - drive ramps to [Step x Velocity], holds speed, and compares [Step x Value] to [Step x Dwell]. The sign of [Step x Value] ("+"= >, "-" = <) determines when to transition [Step x Next] and compares [Step x Dwell] to the value specified by the parameter number in [Step x Value]. The following step types use the point-to-point position regulator: "Encoder Incr" (4) - drive ramps to [Step x Velocity], holds speed then ramps to zero at encoder position defined by [Step x Value] within position tolerance window. "Encoder Abs" (6) - drive ramps to [Step x Velocity], in direction required, holds speed, then ramps to zero at position within tolerance window. "End Hold Pos" (7) - drive holds last position for [Step x Dwell] time then stops. The drive must have [Direction Mode] set to "Bipolar" for the position regulator to function properly. Current, Torque and Regen Power Limits must be set so as not to limit the programmed deceleration time. If one of the limits occur, the position regulator may overshoot the position set point. Sleep Mode must be turned off.		

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	Profile Step 1-16	721 731 741 751 761 771 781 791 801 811 821 831 841 851 861 871	**[Step 1 Velocity]** **[Step 2 Velocity]** **[Step 3 Velocity]** **[Step 4 Velocity]** **[Step 5 Velocity]** **[Step 6 Velocity]** **[Step 7 Velocity]** **[Step 8 Velocity]** **[Step 9 Velocity]** **[Step 10 Velocity]** **[Step 11 Velocity]** **[Step 12 Velocity]** **[Step 13 Velocity]** **[Step 14 Velocity]** **[Step 15 Velocity]** **[Step 16 Velocity]** Step Speed – Sign of this value is used to determine direction for Time, Time Blended, Digital Input & Parameter Level step types. The value is an absolute number for all encoder step types	Default: 0.0 Min/Max: –/+ [Maximum Speed] Units: 0.1 Hz 0.1 RPM	
		722 732 742 752 762 772 782 792 802 812 822 832 842 852 862 872	**[Step 1 AccelTime]** **[Step 2 AccelTime]** **[Step 3 AccelTime]** **[Step 4 AccelTime]** **[Step 5 AccelTime]** **[Step 6 AccelTime]** **[Step 7 AccelTime]** **[Step 8 AccelTime]** **[Step 9 AccelTime]** **[Step 10 AccelTime]** **[Step 11 AccelTime]** **[Step 12 AccelTime]** **[Step 13 AccelTime]** **[Step 14 AccelTime]** **[Step 15 AccelTime]** **[Step 16 AccelTime]** This is the acceleration rate for the step. Sets the time to ramp from zero to [Maximum Speed].	Default: 10.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	Profile Step 1-16	723 733 743 753 763 773 783 793 803 813 823 833 843 853 863 873	**[Step 1 DecelTime]** **[Step 2 DecelTime]** **[Step 3 DecelTime]** **[Step 4 DecelTime]** **[Step 5 DecelTime]** **[Step 6 DecelTime]** **[Step 7 DecelTime]** **[Step 8 DecelTime]** **[Step 9 DecelTime]** **[Step 10 DecelTime]** **[Step 11 DecelTime]** **[Step 12 DecelTime]** **[Step 13 DecelTime]** **[Step 14 DecelTime]** **[Step 15 DecelTime]** **[Step 16 DecelTime]** This is the deceleration rate for the step. Sets the time to ramp from [Maximum Speed] to zero.	Default: 10.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	
		724 734 744 754 764 774 784 794 804 814 824 834 844 854 864 874	**[Step 1 Value]** **[Step 2 Value]** **[Step 3 Value]** **[Step 4 Value]** **[Step 5 Value]** **[Step 6 Value]** **[Step 7 Value]** **[Step 8 Value]** **[Step 9 Value]** **[Step 10 Value]** **[Step 11 Value]** **[Step 12 Value]** **[Step 13 Value]** **[Step 14 Value]** **[Step 15 Value]** **[Step 16 Value]** Sets the step value used for time, time blend, digital input number, parameter level and encoder based units. Also determines the condition to move to the next step. Time/Time Blend: 0.00-3600.00 seconds Digital Input: 1 to 6 (decimal ignored) The sign value “+” makes inputs “active high” and a “–”makes them “active low”. Parameter Level: parameter number Encoder Absolute/Encoder Incremental/ Encoder Incremental Blend:99,999.00 units (see [Counts per Unit]).	Default: 6.0 Min/Max: Based on [Step x Type] Units: 0.01 Units dependent on [Step[x Type]	

File	Group	No.	**Parameter Name & Description** *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	**Profile Step 1-16**	725 735 745 755 765 775 785 795 805 815 825 835 845 855 865 875	**[Step 1 Dwell]** **[Step 2 Dwell]** **[Step 3 Dwell]** **[Step 4 Dwell]** **[Step 5 Dwell]** **[Step 6 Dwell]** **[Step 7 Dwell]** **[Step 8 Dwell]** **[Step 9 Dwell]** **[Step 10 Dwell]** **[Step 11 Dwell]** **[Step 12 Dwell]** **[Step 13 Dwell]** **[Step 14 Dwell]** **[Step 15 Dwell]** **[Step 16 Dwell]** After the condition to move to the next step has been satisfied, the drive continues at its present velocity or position until the dwell time expires. At that point the next step is executed. Not applicable for blend-type moves.	Default: 10.0 Min/Max: Based on [Step x Type] Units: 0.01 Secs If [Step x Type] = "Param Level," units are the same as the parameter number specified in [Step x Value]	
		726 736 746 756 766 776 786 796 806 816 826 836 846 856 866 876	**[Step 1 Batch]** **[Step 2 Batch]** **[Step 3 Batch]** **[Step 4 Batch]** **[Step 5 Batch]** **[Step 6 Batch]** **[Step 7 Batch]** **[Step 8 Batch]** **[Step 9 Batch]** **[Step 10 Batch]** **[Step 11 Batch]** **[Step 12 Batch]** **[Step 13 Batch]** **[Step 14 Batch]** **[Step 15 Batch]** **[Step 16 Batch]** Sets the number of times to run this step. "0" = continuously run this step.	Default: 1 Min/Max: 0/1000000 Units: 1	

File	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
POS/SPD PROFILE	Profile Step 1-16	727 737 747 757 767 777 787 797 807 817 827 837 847 857 867 877	**[Step 1 Next]** **[Step 2 Next]** **[Step 3 Next]** **[Step 4 Next]** **[Step 5 Next]** **[Step 6 Next]** **[Step 7 Next]** **[Step 8 Next]** **[Step 9 Next]** **[Step 10 Next]** **[Step 11 Next]** **[Step 12 Next]** **[Step 13 Next]** **[Step 14 Next]** **[Step 15 Next]** **[Step 16 Next]** Sets the step number to execute after this step is complete (including [Step x Batch]).	Default: 2 Min/Max: 1/16 Units: 1	

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Notes:

Troubleshooting

Chapter 4 provides information to guide you in troubleshooting the PowerFlex 700. Included is a listing and description of drive faults (with possible solutions, when applicable) and alarms.

Faults and Alarms

A fault is a condition that stops the drive. There are three fault types.

Type	Fault Description	
①	Auto-Reset Run	When this type of fault occurs, and [Auto Rstrt Tries] (see page 3-32) is set to a value greater than “0,” a user-configurable timer, [Auto Rstrt Delay] (see page 3-32) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will be restarted.
②	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
③	User Configurable	These faults can be enabled/disabled to annunciate or ignore a fault condition.

An alarm is a condition that, if left untreated, may stop the drive. There are two alarm types.

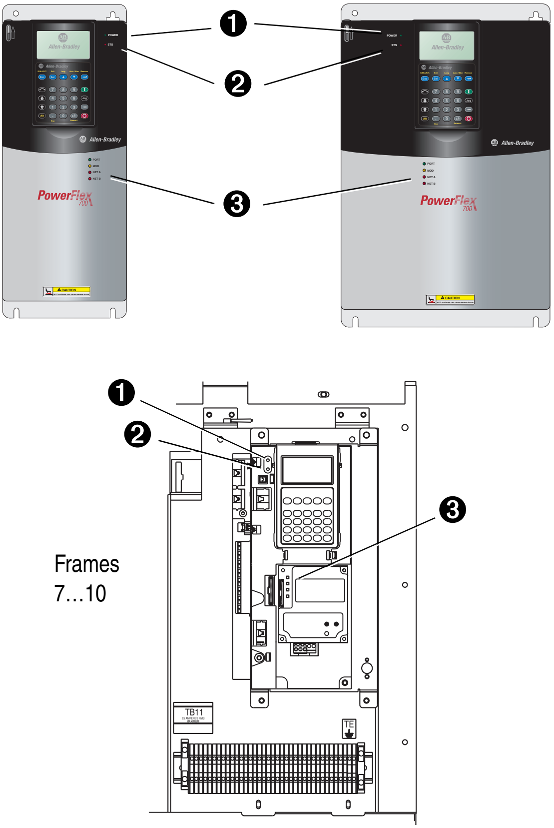
Type	Alarm Description	
①	User Configurable	These alarms can be enabled or disabled through [Alarm Config 1] on page 3-47.
②	Non-Configurable	These alarms are always enabled.

Drive Status

The condition or state of your drive is constantly monitored. Any changes will be indicated through the LEDs and/or the HIM (if present).

Front Panel LED Indications

Figure 4.1 Typical Drive Status Indicators



#	Name	Color	State	Description
❶	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
❷	STS (Status)	Green	Flashing	Drive ready, but not running & no faults are present.
			Steady	Drive running, no faults are present.
		Yellow See page 4-11	Flashing, Drive Stopped	A start inhibit condition exists, the drive cannot be started. Check parameter 214 [Start Inhibits].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
		Red See page 4-5	Flashing	Fault has occurred. Check [Fault x Code] or Fault Queue.
			Steady	A non-resettable fault has occurred.
❸	PORT	Green	–	Status of DPI port internal communications (if present).
	MOD	Yellow	–	Status of communications module (when installed).
	NET A	Red	–	Status of network (if connected).
	NET B	Red	–	Status of secondary network (if connected).

Precharge Board LED Indications

Precharge Board LED indicators are found on AC input drives, Frames 5…10.

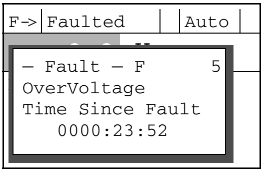
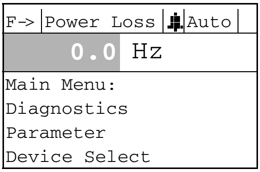
Name	Color	State	Description
Power	Green	Steady	Indicates when precharge board power supply is operational
Alarm	Yellow	Flashing	Number in "[ ]" indicates flashes and associated alarm(1):
		[1]	Low line voltage (<90%).
		[2]	Very low line voltage (<50%).
		[3]	Low phase (one phase <80% of line voltage).
		[4]	Frequency out of range or asymmetry (line sync failed).
		[5]	Low DC bus voltage (triggers ride-through operation).
		[6]	Input frequency momentarily out of range (40-65 Hz).
		[7]	DC bus short circuit detection active.
Fault	Red	Flashing	Number in "[ ]" indicates flashes and associated fault(2):
		[2]	DC bus short (Udc <2% after 20 ms).
		[4]	Line sync failed or low line (Uac <50% Unom).

(1) An alarm condition automatically resets when the condition no longer exists

(2) A fault indicates a malfunction that must be corrected and can only be reset after cycling power.

HIM Indication

The LCD HIM also provides visual notification of a fault or alarm condition.

Condition	Display
Drive is indicating a fault. The LCD HIM immediately reports the fault condition by displaying the following. • "Faulted" appears in the status line • Fault number • Fault name • Time that has passed since fault occurred Press Esc to regain HIM control.	 F-> Faulted Auto — Fault — F 5 OverVoltage Time Since Fault 0000:23:52
Drive is indicating an alarm. The LCD HIM immediately reports the alarm condition by displaying the following. • Alarm name (Type 2 alarms only) • Alarm bell graphic	 F-> Power Loss Auto 0.0 Hz Main Menu: Diagnostics Parameter Device Select

Manually Clearing Faults

Step	Key(s)
1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the HIM.	Esc
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.	
3. After corrective action has been taken, clear the fault by **one** of these methods. • Press Stop • Cycle drive power • Set parameter 240 [Fault Clear] to "1." • "Clear Faults" on the HIM Diagnostic menu.	○

Fault Descriptions

Table 4.A Fault Types, Descriptions and Actions

Fault	No.	Type[1]	Description	Action
Analog In Loss	29	① ③	An analog input is configured to fault on signal loss. A signal loss has occurred. Configure with [Anlg In 1, 2 Loss] on page 3-55.	1. Check parameters. 2. Check for broken/loose connections at inputs.
Anlg Cal Chksum	108		The checksum read from the analog calibration data does not match the checksum calculated.	Replace drive.
Auto Rstrt Tries	33	③	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of [Flt RstRun Tries]. Enable/Disable with [Fault Config 1] on page 3-45.	Correct the cause of the fault and manually clear.
AutoTune Aborted	80		Autotune function was canceled by the user or a fault occurred.	Restart procedure.
Auxiliary Input	2	①	Auxiliary input interlock is open.	Check remote wiring.
Cntl Bd Overtemp	55		The temperature sensor on the Main Control Board detected excessive heat.	1. Check Main Control Board fan. 2. Check surrounding air temperature. 3. Verify proper mounting/cooling.
DB Resistance	69		Resistance of the internal DB resistor is out of range.	Replace resistor.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time. **Refer to the Attention statement on page P-4 for further info.**
Drive OverLoad	64		Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded.	Reduce load or extend Accel Time.
Drive Powerup	49		No fault displayed. Used as a Power Up Marker in the Fault Queue indicating that the drive power has been cycled.	
Excessive Load	79		Motor did not come up to speed in the allotted time during autotune.	1. Uncouple load from motor. 2. Repeat Autotune.

Fault	No.	Type[1]	Description	Action
Encoder Loss	91		Requires differential encoder. One of the 2 encoder channel signals is missing.	1. Check Wiring. 2. Check motor rotation. 3. Check encoder pulses, rotation, etc. 4. Replace encoder.
Encoder Quad Err	90		Both encoder channels changed state within one clock cycle.	1. Check for externally induced noise. 2. Replace encoder.
Fatal Faults	900-930	②	Diagnostic code indicating a drive malfunction.	1. Cycle power. 2. Replace Main Control Board. 3. Contact Tech Support.
Faults Cleared	52		No fault displayed. Used as a marker in the Fault Queue indicating that the fault clear function was performed.	
Flt QueueCleared	51		No fault displayed. Used as a marker in the Fault Queue indicating that the clear queue function was performed.	
FluxAmpsRef Rang	78		The value for flux amps determined by the Autotune procedure exceeds the programmed [Motor NP FLA].	1. Reprogram [Motor NP FLA] with the correct motor nameplate value. 2. Repeat Autotune.
Ground Fault	13	①	A current path to earth ground greater than 25% of drive rating.	Check the motor and external wiring to the drive output terminals for a grounded condition.
Hardware Fault	93		Hardware enable is disabled (jumpered high) but logic pin is still low.	1. Check jumper. 2. Replace Main Control Board.
Hardware Fault	130		Gate array load error.	1. Cycle power. 2. Replace Main Control Board.
Hardware Fault	131		Dual port failure.	1. Cycle power. 2. Replace Main Control Board.
Hardware PTC	18		Motor PTC (Positive Temperature Coefficient) Overtemp.	
Heatsink LowTemp v6	10	①	Annunciates a too low temperature case or an open NTC (heatsink temperature sensing device) circuit.	1. Verify ambient temperature. 2. In cold ambient temperatures, add space heaters.
Heatsink OvrTemp	8	①	Heatsink temperature exceeds 100% of [Drive Temp] or is less than approximately -19 degrees C.	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excess load. 4. In cold ambient temperatures, add space heaters.
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.

Fault	No.	Type[1]	Description	Action
Incompat MCB-PB	106	②	Drive rating information stored on the power board is incompatible with the main control board.	1. Load compatible version files into drive. 2. Frame 7-10 drives must have firmware version 4.009 or greater.
I/O Comm Loss	121		I/O Board lost communications with the Main Control Board.	Check connector. Check for induced noise. Replace I/O board or Main Control Board.
I/O Failure	122		I/O was detected, but failed the powerup sequence.	Replace Main Control Board.
Input Phase Loss	17		The DC bus ripple has exceeded a preset level.	Check incoming power for a missing phase/blown fuse.
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.
IXo VoltageRange	87		Voltage calculated for motor inductive impedance exceeds 25% of [Motor NP Volts].	1. Check for proper motor sizing. 2. Check for correct programming of [Motor NP Volts], parameter 41. 3. Additional output impedance may be required.
Load Loss	15		Drive output torque current is below [Load Loss Level] for a time period greater than [Load Loss time].	1. Verify connections between motor and load. 2. Verify level and time requirements.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/Disable with [Fault Config 1] on page 3-45.	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA].
Motor Thermistor	16		Thermistor output is out of range.	1. Verify that thermistor is connected. 2. Motor is overheated. Reduce load.
NVS I/O Checksum	109		EEprom checksum error.	1. Cycle power and repeat function. 2. Replace Main Control Board.
NVS I/O Failure	110		EEprom I/O error.	1. Cycle power and repeat function. 2. Replace Main Control Board.
Output PhaseLoss	21		Current in one or more phases has been lost or remains below a preset level.	Check the drive and motor wiring. Check for phase-to-phase continuity at the motor terminals. Check for disconnected motor leads.
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].	Remove excessive load or overhauling conditions or increase [Overspeed Limit].

Fault	No.	Type(1)	Description	Action
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.
Parameter Chksum	100	②	The checksum read from the board does not match the checksum calculated.	1. Restore defaults. 2. Reload User Set if used.
Params Defaulted	48		The drive was commanded to write default values to EEPROM.	1. Clear the fault or cycle power to the drive. 2. Program the drive parameters as needed.
Phase U to Grnd	38		A phase to ground fault has been detected between the drive and motor in this phase.	1. Check the wiring between the drive and motor. 2. Check motor for grounded phase. 3. Replace drive.
Phase V to Grnd	39			
Phase W to Grnd	40			
Phase UV Short	41		Excessive current has been detected between these two output terminals.	1. Check the motor and drive output terminal wiring for a shorted condition. 2. Replace drive.
Phase VW Short	42			
Phase UW Short	43			
Port 1-6 DPI Loss v6 (Port 6)	81-86	②	DPI port stopped communicating. A SCANport device was connected to a drive operating DPI devices at 500k baud.	1. If adapter was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, adapters, Main Control Board or complete drive as required. 2. Check HIM connection. 3. If an adapter was intentionally disconnected and the [Logic Mask] bit for that adapter is set to "1", this fault will occur. To disable this fault, set the [Logic Mask] bit for the adapter to "0."
Port 1-6 Adapter v6 (Port 6)	71-76		The communications card has a fault.	1. Check DPI device event queue and corresponding fault information for the device.
Power Down v6 Csum	111		EEPROM data is corrupt on drive power up.	Clear the fault or cycle power to the drive.
Power Loss	3	① ③	DC bus voltage remained below 85% of nominal for longer than [Power Loss Time]. Enable/Disable with [Fault Config 1] on page 3-45.	Monitor the incoming AC line for low voltage or line power interruption.
Power Unit	70		One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	1. Check for damaged output transistors. 2. Replace drive.

Fault	No.	Type(1)	Description	Action
Pulse In Loss	92		Z Channel is selected as a pulse input and no signal is present.	1. Check wiring. 2. Replace pulse generator.
Pwr Brd Chksum1	104		The checksum read from the EEPROM does not match the checksum calculated from the EEPROM data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	②	The checksum read from the board does not match the checksum calculated.	1. Cycle power to the drive. 2. If problem persists, replace drive.
Replaced MCB-PB	107	②	Main Control Board was replaced and parameters were not programmed.	1. Restore defaults. 2. Reprogram parameters.
See Manual	28		Encoderless TorqProve has been enabled but user has not read and understood application concerns of encoderless operation.	1. Read the "Attention" on page C-5 relating to the use of TorqProve with no encoder.
Shear Pin	63	③	Programmed [Current Lmt Val] has been exceeded. Enable/Disable with [Fault Config 1] on page 3-45.	Check load requirements and [Current Lmt Val] setting.
Software Fault	88		Microprocessor handshake error.	Replace Main Control Board.
Software Fault	89		Microprocessor handshake error.	Replace Main Control Board.
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.
TorqPrv Spd Band	20		Difference between [Commanded Speed] and [Encoder Speed] has exceeded the level set in [Spd Dev Band] for a time period greater than [Spd Band Integrat].	1. Check wiring between drive and motor. 2. Check release of mechanical brake.
Trnsistr OvrTemp	9	①	Output transistors have exceeded their maximum operating temperature.	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excess load.
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value of 407V DC at 400/480V input or 204V DC at 200/240V input. Enable/Disable with [Fault Config 1] (page 3-45).	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	②	The checksum read from the user set does not match the checksum calculated.	Re-save user set.
UserSet2 Chksum	102	②		
UserSet3 Chksum	103	②		

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

Table 4.B Fault Cross Reference

No.(1)	Fault
2	Auxiliary Input
3	Power Loss
4	UnderVoltage
5	OverVoltage
7	Motor Overload
8	Heatsink OvrTemp
9	Trnsistr OvrTemp
10(2)	Heatsink Low Temp
12	HW OverCurrent
13	Ground Fault
15	Load Loss
16	Motor Thermistor
17	Input Phase Loss
18	Hardware PTC
20	TorqPrv Spd Band
21	Output PhaseLoss
24	Decel Inhibit
25	OverSpeed Limit
28	See Manual
29	Analog In Loss
33	Auto Rstrt Tries
36	SW OverCurrent
38	Phase U to Grnd
39	Phase V to Grnd
40	Phase W to Grnd
41	Phase UV Short
42	Phase VW Short
43	Phase UW Short
48	Params Defaulted
49	Drive Powerup
51	Flt QueueCleared
52	Faults Cleared
55	Cntl Bd Overtemp
63	Shear Pin
64	Drive OverLoad
69	DB Resistance
70	Power Unit
71- 75	Port 1-5 Adapter
76(2)	Port 6 Adapter
77	IR Volts Range
78	FluxAmpsRef Rang
79	Excessive Load
80	AutoTune Aborted
81- 85	Port 1-5 DPI Loss
86(2)	Port 6 DPI Loss
87	IXo VoltageRange
88	Software Fault
89	Software Fault
90	Encoder Quad Err
91	Encoder Loss
92	Pulse In Loss
93	Hardware Fault
100	Parameter Chksum
101-103	UserSet Chksum
104	Pwr Brd Chksum1
105	Pwr Brd Chksum2
106	Incompat MCB-PB
107	Replaced MCB-PB
108	Anlg Cal Chksum
109	NVS I/O Checksum
110	NVS I/O Failure
111(2)	Power Down Csum
121	I/O Comm Loss
122	I/O Failure
130	Hardware Fault
131	Hardware Fault
900-930	Fatal Faults

(1) Fault numbers not listed are reserved for future use.

(2) Firmware 6.002 and later only.

Clearing Alarms

Alarms are automatically cleared when the condition that caused the alarm is no longer present.

Alarm Descriptions

Table 4.C Alarm Descriptions and Actions

Alarm	No.	Type[1]	Description
AdjVoltRef Cflct	33	①	Invalid adjustable voltage reference selection conflict.
Analog In Loss	5	①	An analog input is configured for “Alarm” on signal loss and signal loss has occurred.
Bipolar Conflict	20	②	Parameter 190 [Direction Mode] is set to “Bipolar” or “Reverse Dis” and one or more of the following digital input functions is configured: “Fwd/Reverse,” “Run Forward,” “Run Reverse,” “Jog Forward” or “Jog Reverse.”
Brake Slipped	32	②	Encoder movement has exceeded the level in [BrkSlipCount] after the brake was set.
Brake Slipping v6	16	②	Brake slip procedure is in progress.
Decel Inhibt	10	①	Drive is being inhibited from decelerating.
Dig In ConflictA	17	②	Digital input functions are in conflict. Combinations marked with a “🔔” will cause an alarm.

	Acc2/Dec2	Accel 2	Decel 2	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev
Acc2/Dec2		🔔	🔔				
Accel 2	🔔						
Decel 2	🔔						
Jog 1/2					🔔	🔔	
Jog Fwd				🔔			🔔
Jog Rev				🔔			🔔
Fwd/Rev					🔔	🔔	

Alarm	No.	Type[1]	Description
Dig In ConflictB	18	②	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.

	Start	Stop-CF	Run	Run Fwd	Run Rev	Jog 1/2	Jog Fwd	Jog Rev	Fwd/Rev
Start			🔔	🔔	🔔		🔔	🔔	
Stop-CF									
Run	🔔			🔔	🔔		🔔	🔔	
Run Fwd	🔔		🔔			🔔			🔔
Run Rev	🔔		🔔			🔔			🔔
Jog 1/2				🔔	🔔				
Jog Fwd	🔔		🔔						
Jog Rev	🔔		🔔						
Fwd/Rev				🔔	🔔				

Alarm	No.	Type(1)	Description
Dig In ConflictC	19	②	More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions. Forward/Reverse, Speed Select 1, Speed Select 2, Speed Select 3, Run Forward Run Reverse, Jog Forward, Jog Reverse, Run, Stop Mode B Bus Regulation Mode B, Acc2 / Dec2, Accel 2, Decel 2
Drive OL Level 1	8	①	The calculated IGBT temperature requires a reduction in PWM frequency. If [Drive OL Mode] is disabled and the load is not reduced, an overload fault will eventually occur.
Drive OL Level 2	9	①	The calculated IGBT temperature requires a reduction in Current Limit. If [Drive OL Mode] is disabled and the load is not reduced, an overload fault will eventually occur.
FluxAmpsRef Rang	26	②	The calculated or measured Flux Amps value is not within the expected range. Verify motor data and rerun motor tests.
Ground Warn	15	①	Ground current has exceeded the level set in [Gnd Warn Level].
Home Not Set	34	①	Configurable alarm set in parameter 259, bit 17. When set to "1," this alarm is displayed when any of the following occur: • parameter 88 is set to "7" (Pos/Spd Prof) • on power up and parameter 88 = "7" • recall user sets and parameter 88 = "7" Alarm is cleared when: • setting parameter 88 to a value other than "7" • reset defaults • parameter 259, bit 17 is cleared • a digital input is configured as "Set Home" and input is True • parameter 705, bit 9 is "Enabled" • parameter 700, bit 13 (At Home) is "Enabled" - position regulator will set this bit if device is "home"
In Phase Loss	13	①	The DC bus ripple has exceeded a preset level.
IntDBRes OvrHeat	6	①	The drive has temporarily disabled the DB regulator because the resistor temperature has exceeded a predetermined value.
IR Volts Range	25	②	The drive auto tuning default is "Calculate" and the value calculated for IR Drop Volts is not in the range of acceptable values. This alarm should clear when all motor nameplate data is properly entered.
Ixo Vlt Rang	28	②	Motor leakage inductance is out of range.
Load Loss	14	①	Output torque current is below [Load Loss Level] for a time period greater than [Load Loss time].
MaxFreq Conflict	23	②	The sum of [Maximum Speed] and [Overspeed Limit] exceeds [Maximum Freq]. Raise [Maximum Freq] or lower [Maximum Speed] and/or [Overspeed Limit] so that the sum is less than or equal to [Maximum Freq].
Motor Thermistor	12	①	The value at the thermistor terminals has been exceeded.
Motor Type Cflct	21	②	[Motor Type] has been set to "Synchr Reluc" or "Synchr PM" and one or more of the following exist: • [Motor Cntl Sel] = "Sensrls Vect," "SV Economize" or "Fan/Pmp V/Hz." • [Flux Up Time] is greater than 0.0 Secs. • [Speed Mode] is set to "Slip Comp." • [Autotune] = "Static Tune" or "Rotate Tune."

Alarm	**No.**	**Type**[1]	**Description**
NP Hz Conflict	22	②	Fan/pump mode is selected in [Motor Cntl Sel] and the ratio of [Motor NP Hertz] to [Maximum Freq] is greater than 26.
PI Config Conflict	52	②	Check [PI Configuration], both "AdjVoltTrim" & "Torque Trim" are selected.
Power Loss	3	①	Drive has sensed a power line loss.
Precharge Active	1	①	Drive is in the initial DC bus precharge state.
Prof Step Cflct	50	②	An error is detected in trend step(s). • Set if Sleep Mode is enabled. • Set if: any profile step uses "Encoder Incr" and/or "Enc Absolute" *and* [Motor Cntl Sel], parameter 53 is not set to "FVC Vector" *and* [Feedback Select], parameter 80 is not set to "Encoder" or "Simulator" *and* [Speed/Torque Mod], parameter 88 = "7" (Pos/Spd Prof). • a Step Type is configured for "Dig Input" and the Step Value is greater than 6, less than –6, or zero *or* the digital input selected with [Digital Inx Sel] is not set to "57, Prof Input." • Cleared if none of the above occur.
PTC Conflict	31	②	PTC is enabled for Analog In 1, which is configured as a 0-20 mA current source in [Anlg In Config].
Sleep Config	29	②	Sleep/Wake configuration error. With [Sleep-Wake Mode] = "Direct," possible causes include: drive is stopped and [Wake Level] < [Sleep Level]. "Stop=CF," "Run," "Run Forward," or "Run Reverse" is not configured in [Digital Inx Sel].
Speed Ref Cflct	27	②	[Speed Ref x Sel] or [PI Reference Sel] is set to "Reserved".
Start At PowerUp	4	①	[Start At PowerUp] is enabled. Drive may start at any time within 10 seconds of drive powerup.
TB Man Ref Cflct	30	②	Occurs when: • "Auto/Manual" is selected (default) for [Digital In3 Sel], parameter 363 *and* • [TB Man Ref Sel], parameter 96 has been reprogrammed. No other use for the selected analog input may be programmed. Example: If [TB Man Ref Sel] is reprogrammed to "Analog In 2," all of the factory default uses for "Analog In 2" must be reprogramed (such as parameters 90, 117, 128 and 179). See also page 1-47. To correct: • Verify/reprogram the parameters that reference an analog input *or* • Reprogram [Digital In3] to another function or "Unused."
TorqProve Cflct	49	②	When [TorqProve Cnfg] is enabled, [Motor Cntl Sel], [Feedback Select] and [Motor Fdbk Type] must be properly set (refer to page C-7).
UnderVoltage	2	①	The bus voltage has dropped below a predetermined value.
VHz Neg Slope	24	②	[Torq Perf Mode] = "Custom V/Hz" & the V/Hz slope is negative.
Waking	11	①	The Wake timer is counting toward a value that will start the drive.

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

Table 4.D Alarm Cross Reference

No. (1)	Alarm
1	Precharge Active
2	UnderVoltage
3	Power Loss
4	Start At PowerUp
5	Analog in Loss
6	IntDBRes OvrHeat
8	Drive OL Level 1
9	Drive OL Level 2
10	Decel Inhibt
11	Waking
12	Motor Thermistor
13	In Phase Loss
14	Load Loss
15	Ground Warn
16 (2)	Brake Slipping
17	Dig In ConflictA
18	Dig In ConflictB
19	Dig In ConflictC
20	Bipolar Conflict
21	Motor Type Cflct
22	NP Hz Conflict
23	MaxFreq Conflict
24	VHz Neg Slope
25	IR Volts Range
26	FluxAmpsRef Rang
27	Speed Ref Cflct
28	Ixo Vlt Rang
29	Sleep Config
30	TB Man Ref Cflct
31	PTC Conflict
32	Brake Slipped
33	AdjVoltRef Cflct
34	Home Not Set
49	Torq Prove Cflct
50	Prof Step Cflct
52	PI Config Conflict

(1) Alarm numbers not listed are reserved for future use.

(2) Firmware 6.002 and later only.

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. • Press Stop • Cycle power • Set [Fault Clear] to 1 (See page 3-45) • "Clear Faults" on the HIM Diagnostic menu.
Incorrect input wiring. See pages 1-44 & 1-45 for wiring examples. • 2 wire control requires Run, Run Forward, Run Reverse or Jog input. • 3 wire control requires Start and Stop inputs. • Jumper from terminal 25 to 26 is required.	None	Wire inputs correctly and/or install jumper.
Incorrect digital input programming. • Mutually exclusive choices have been made (i.e., Jog and Jog Forward). • 2 wire and 3 wire programming may be conflicting. • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop is factory default and is not wired.	None	Program [Digital Inx Sel] for correct inputs. (See page 3-58) Start or Run programming may be missing.
	Flashing yellow status light and "DigIn CflctB" indication on LCD HIM. [Drive Status 2] shows type 2 alarm(s).	Program [Digital Inx Sel] to resolve conflicts. (See page 3-58) Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Drive does not Start from 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. See [Save HIM Ref] on page 3-36. If 3 wire control is required, program [Digital Inx Sel] for correct inputs. (See page 3-58)

Drive does not respond to changes in speed command.

Cause(s)	Indication	Corrective Action
No value is coming from the source of the command.	LCD HIM Status Line indicates "At Speed" and output is 0 Hz.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check [Commanded Speed] for correct source. (See page 3-7)
Incorrect reference source has been programmed.	None	3. Check [Speed Ref Source] for the source of the speed reference. (See page 3-41) 4. Reprogram [Speed Ref A Sel] for correct source. (See page 3-20)
Incorrect Reference source is being selected via remote device or digital inputs.	None	5. Check [Drive Status 1], page 3-39, bits 12 and 13 for unexpected source selections. 6. Check [Dig In Status], page 3-42 to see if inputs are selecting an alternate source. 7. Reprogram digital inputs to correct "Speed Sel x" option. (See page 3-58)

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

Cause(s)	Indication	Corrective Action
Acceleration time is excessive.	None	Reprogram [Accel Time x]. (See page 3-28)
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. (See page 3-39) Remove excess load or reprogram [Accel Time x].(See page 3-28)
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] (See page 3-17) and [Maximum Freq] (See page 3-11) to assure that speed is not limited by programming.

Motor operation is unstable.

Cause(s)	Indication	Corrective Action
Motor data was incorrectly entered or Autotune was not performed.	None	1. Correctly enter motor nameplate data. 2. Perform "Static" or "Rotate" Autotune procedure. (Param #061, page 3-12)

Drive will not reverse motor direction.

Cause(s)	Indication	Corrective Action
Digital input is not selected for reversing control.	None	Check [Digital Inx Sel], page 3-58. Choose correct input and program for reversing mode.
Digital input is incorrectly wired.	None	Check input wiring. (See page 1-38)
Direction mode parameter is incorrectly programmed.	None	Reprogram [Direction Mode], page 3-35 for analog “Bipolar” or digital “Unipolar” control.
Motor wiring is improperly phased for reverse.	None	Switch two motor leads.
A bipolar analog speed command input is incorrectly wired or signal is absent.	None	1. Use meter to check that an analog input voltage is present. 2. Check wiring. (See page 1-38) Positive voltage commands forward direction. Negative voltage commands reverse direction.

Stopping the drive results in a Decel Inhibit fault.

Cause(s)	Indication	Corrective Action
The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation.	Decel Inhibit fault screen. LCD Status Line indicates “Faulted”.	1. See Attention statement on page P-4. 2. Reprogram parameters 161/162 to eliminate any “Adjust Freq” selection. 3. Disable bus regulation (parameters 161 & 162) and add a dynamic brake. 4. Correct AC input line instability or add an isolation transformer. 5. Reset drive.

Testpoint Codes and Functions

Select testpoint with [Testpoint x Sel], parameters 234/236. Values can be viewed with [Testpoint x Data], parameters 235/237.

No.(1)	Description	Units	Values		
			Minimum	**Maximum**	**Default**
01	DPI Error Status	1	0	255	0
02	Heatsink Temp	0.1 degC	–100.0	100.0	0
03	Active Cur Limit	1	0	32767	0
04	Active PWM Freq	1 Hz	2	10	4
05	Life MegaWatt Hr(2)	0.0001 MWh	0	214748.3647	0
06	Life Run Time	0.0001 Hrs	0	214748.3647	0
07	Life Pwr Up Time	0.0001 Hrs	0	214748.3647	0
08	Life Pwr Cycles	1	0	4294967295	0
09	Life MW-HR Fract(2)	1	0	4294967295	0
10	MW-HR Frac Unit(2)	1	0	4294967295	0
11	MCB Life Time	0.0001 Hrs	0	214748.3647	0
12	Raw Analog In 1	1	0		0
13	Raw Analog In 2	1	0		0
16	CS Msg Rx Cnt	1	0	65535	0
17	CS Msg Tx Cnt	1	0	65535	0
18	CS Timeout Cnt	1	0	255	0
19	CS Msg Bad Cnt	1	0	255	0
22	PC Msg Rx Cnt	1	0	65535	0
23	PC Msg Tx Cnt	1	0	65535	0
24-29	PC1-6 Timeout Cnt	1	0	255	0
30	CAN BusOff Cnt	1	0	65535	0
31	No. of Analog Inputs	1	0	x	0
32	Raw Temperature	1	0	65535	0
33	MTO Norm Mtr Amp	0.1 Amps	0	65535	0
34	DTO-Cmd Frequency	1	0	420	0
35	DTO-Cmd Cur Lim	0.1	0		0
36	DTO-Cmd DC Hold	1	0	32767	0
37	Control Bd Temp	0.1	0.0	60.0	0.0
629	Motor OL Count				

(1) Enter in [Testpoint x Sel].

(2) Use the equation below to calculate total Lifetime MegaWatt Hours.

$$\left(\frac{\text{Value of Code 9}}{\text{Value of Code 10}} \times 0.1\right) + \text{Value of Code 5} = \text{Total Lifetime MegaWatt Hours}$$

Supplemental Drive Information

Specifications

Category	Frames				Specification	
	0…4		5…6	7…10		
	230…480V	*600V*				
Agency Listings, Certification or Tests	✔	✔	✔	✔	c UL US	Listed to UL508C and CAN/CSA-C22.2 No. 14-05. Packaged drives may be listed to UL508A
	✔	✔	✔	✔	TÜV Ex II (2) G D	EC-Type-Examination Certificate TUV 05 ATEX 7153 for directive 94/9/EC: Safe turn off of certified ATEX motors used in Group II Category (2) GD potentially explosive atmospheres.
	✔		✔		**EPRI / SEMIF47**	EPRI Quality Star Certificates SEMIF47.115 and SEMIF47.127 for SEMI F47 compliance, 480V units tested
	✔		✔		**ABS**	American Bureau of Shipping MA Certificate 08-HS303172B/1-PDA for auxiliary services on AB Classed vessels and offshore platforms
	✔		✔		**LLoyd's Register**	Lloyd's Register Type Approval Certificate 08 / 60015 (marine certification)
	✔	✔	✔		**RINA**	RINA Type Approval Certificate ELE283205CS (Registo Italiano Navale - marine certification)
	✔	✔	✔		**Trentec**	Tested by Trentec to be compliant with AC156 Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components and 2003 International Building Code for worst-case seismic level for USA excluding site class F
Rockwell Automation Certifications					CE	Certified by Rockwell Automation to be in conformity with the essential requirements of the applicable European Directives and the standards referenced below have been applied:
	✔	✔	✔	✔		2006/95/EC (Low Voltage Directive) EN 50178 Electronic Equipment for use in Power Installations
	✔		✔	✔(1)		2004/108/EC (EMC Directive) EN 61800-3 Adjustable Speed electrical power drive systems - Part 3: EMC requirements and specific test methods.
	✔		✔	✔	N223	Certified by Rockwell Automation to be in conformity with the requirements of the applicable Australian legislation and the standards referenced below: IEC 61800-3

	Frames				
	0…4				
Category	*230…480V*	*600V*	**5…6**	**7…10**	**Specification**
Designed to Meet Applicable Requirements	✔	✔	✔	✔	CMAA Specification #70 (Crane Manufacturers of America Association)
	✔	✔	✔	✔	NFPA 70 - US National Electrical Code
	✔	✔	✔	✔	NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems
	✔	✔	✔	✔	IEC 61800-2 Adjustable Speed Electrical Power Drive Systems - Part 2: General Requirements - Rating specifications for low voltage adjustable frequency AC power drive systems.

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

Category	**Specification**						
Protection	**Drive**	200…208V	240V	380/400V	480V	600V *Frm. 0…4*	600/690V *Frm. 5…6*
	AC Input Overvoltage Trip:	285VAC	285VAC	570VAC	570VAC	716VAC	818VAC
	AC Input Undervoltage Trip:	120VAC	138VAC	233VAC	280VAC	345VAC	345VAC
	Bus Overvoltage Trip:	405VDC	405VDC	810VDC	810VDC	1013VDC	1162VDC
	Bus Undervoltage Shutoff/Fault:	153VDC	153VDC	305VDC	305VDC	381VDC	437VDC
	Nominal Bus Voltage:	281VDC	324VDC	540VDC	648VDC	810VDC	932VDC
	All Drives						
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip					
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip:	 200% of rated current (typical) 220…300% of rated current (dependent on drive rating)					
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991					
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak					
	Power Ride-Thru:	15 milliseconds at full load					
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical					
	Ground Fault Trip:	Phase-to-ground on drive output					
	Short Circuit Trip:	Phase-to-phase on drive output					
Environment	Altitude:	1000 m (3300 ft) max. without derating					
	Maximum Surrounding Air Temperature without Derating - IP20, NEMA/UL Type Open: Frames 0…6 Frames 7…10	0…50 °C (32…122 °F), typical. See pages A-12…A-19 for exceptions. 0…40 °C (32…104 °F) for chassis (heatsink) 0…65 °C (32…149 °F) for control (front of backplane)					
	Storage Temperature (all const.):	–40…70 °C (–40…158 °F)					
	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.					
	Relative Humidity:	5 to 95% non-condensing					
	Shock:	15G peak for 11ms duration (±1.0 ms)					
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak					

Category	Specification			
Environment (continued)	Sound:	Frame	Fan Speed	Sound Level	Note: Sound pressure level is measured at 2 meters.
		0	30 CFM	58 dB	
		1	30 CFM	59 dB	
		2	50 CFM	57 dB	
		3	120 CFM	61 dB	
		4	190 CFM	59 dB	
		5	200 CFM	71 dB	
		6	300 CFM	72 dB	
		7	756 CFM	74 dB	
		8	1200 CFM	78 dB	
		9	2800 CFM	82 dB	
		10 Inv.	1850 CFM	78 dB	
		10 Cnv.	1200 CFM	78 dB	
Electrical	Voltage Tolerance:	See page C-45 for full power and operating range.			
	Input Frequency Tolerance:	47…63 Hz.			
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current (see page A-10). Frames 0…7: Drive can be supplied as 6 pulse or 18 pulse in an engineered package.			
	Displacement Power Factor:	0.98 across entire speed range.			
	Efficiency:	97.5% at rated amps, nominal line volts.			
	Maximum Short Circuit Rating:	200,000 Amps symmetrical.			
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker.			
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex Reference Manual). The drive can be supplied as 6 pulse or 18 pulse in a configured package.			
	Carrier Frequency:	2, 4, 8 & 10 kHz. Drive rating based on 4 kHz (see pages A-12 through A-24 for exceptions).			
	Output Voltage Range:	0 to rated motor voltage			
	Output Frequency Range:	Standard Control – 0 to 400 Hz., Vector Control – 0 to 420 Hz			
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.			
	Frequency Control:	Speed Regulation - w/Slip Compensation (Volts per Hertz Mode) 0.5% of base speed across 40:1 speed range, 40:1 operating range 10 rad/sec bandwidth			
		Speed Regulation - w/Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth			
		Speed Regulation - w/Feedback (Sensorless Vector Mode) 0.1% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth			
	Speed Control:	Speed Regulation - w/o Feedback (Vector Control Mode) 0.1% of base speed across 120:1 speed range, 120:1 operating range 50 rad/sec bandwidth			
		Speed Regulation - w/Feedback (Vector Control Mode) 0.001% of base speed across 120:1 speed range, 1000:1 operating range, 250 rad/sec bandwidth			
	Torque Regulation:	Torque Regulation - w/o Feedback ±5%, 600 rad/sec bandwidth			
		Torque Regulation - w/Feedback ±2%, 2500 rad/sec bandwidth			
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability. PF700 adds Vector Control.			
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.			
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0…3600 seconds in 0.1 second increments.			
	Intermittent Overload:	110% Overload capability for up to 1 minute, 150% Overload capability for up to 3 seconds			
	Current Limit Capability:	Proactive Current Limit programmable from 20…160% of rated output current. Independently programmable proportional & integral gain.			

Category	Specification						
Control (continued)	Electronic Motor Overload Protection:	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.					
	Digital/Analog Input Latency	Signal		Motor Control	Latency		
					Min.	Max	Typical
		Digital Input	Start	FVC	8.4 ms	10.4 ms	8.4 ms
				SVC	9.2 ms	16.0 ms	9.2 ms
			Stop	FVC	10.0 ms	12.4 ms	10.4 ms
				SVC	10.0 ms	12.0 ms	10.4 ms
		Analog Input	Torque 4 kHz PWM	FVC	772 µs	1.06 ms	840 µs
			Torque 2 kHz PWM	FVC	1.008 ms	1.46 ms	1.256 ms
			Speed	FVC	4.6 ms	8.6 ms	4.8 ms
			Speed	SVC	4.8 ms	12.4 ms	6.4 ms
Encoder	Type:	Incremental, dual channel					
	Supply:	12V, 250 mA. 12V, 10 mA minimum inputs isolated with differential transmitter, 250 kHz maximum.					
	Quadrature:	90°, ±27 degrees at 25 degrees C.					
	Duty Cycle:	50%, +10%					
	Requirements:	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8…15V DC output (4…6V DC when jumpers are in 5V position), single-ended or differential and capable of supplying a minimum of 10 mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12V DC square-wave with a minimum high state voltage of 7.0V DC. With the jumpers in the 5V position, the encoder will accept a 5V DC square-wave with a minimum high state voltage of 3.0V DC. In either jumper position, the maximum low state voltage is 0.4V DC.					

Watts Loss (Rated Load, Speed & PWM)(1)

IP20, NEMA/UL Type 1 – Frames 0…6

Voltage	ND Hp/kW	External Watts	Internal Watts	Total Watts Loss
240V	0.5	9	37	46
	1	22	39	61
	2	38	39	77
	3	57	41	98
	5	97	82	179
	7.5	134	74	208
	10	192	77	269
	15	276	92	368
	20	354	82	436
	25	602	96	698
	30	780	96	876
	40	860	107	967
	50	1132	138	1270
	60	1296	200	1496
	75	1716	277	1993
	100	1837	418	2255
400V	0.37	11	42	53
	0.75	19	44	63
	1.5	31	45	76
	2.2	46	46	93
	4	78	87	164
	5.5	115	79	194
	7.5	134	84	218
	11	226	99	326
	15	303	91	394
	18.5	339	102	441
	22	357	103	459

Voltage	ND Hp/kW	External Watts	Internal Watts	Total Watts Loss
400V (continued)	30	492	117	610
	37	568	148	717
	45	722	207	930
	55	821	286	1107
	55	1130	397	1527
	90	1402	443	1845
	110	1711	493	2204
	132	1930	583	2513
480V	0.5	11	42	53
	1	19	44	63
	2	31	45	76
	3	46	46	93
	5	78	87	164
	7.5	115	79	194
	10	134	84	218
	15	226	99	326
	20	303	91	394
	25	339	102	441
	30	357	103	459
	40	492	117	610
	50	568	148	717
	60	722	207	930
	75	821	286	1107
	100	1130	397	1527
	125	1402	443	1845
	150	1711	493	2204
	200	1930	583	2513
600V	0.5	9	37	46
	1	14	40	54
	2	25	40	65
	3	41	42	83
	5	59	83	142
	7.5	83	75	157
	10	109	77	186
	15	177	93	270
	20	260	83	343
	25	291	95	385
	30	324	95	419
	40	459	109	569
	50	569	141	710
	60	630	195	825
	75	1053	308	1361
	100	1467	407	1874
	125	1400	500	1900
	150	1668	612	2280
IP54, NEMA/UL Type 12				
480V	75	873	234	1107
	100	1237	290	1527
	125	1563	282	1845
	150	1874	330	2204
	200	2100	413	2513
600V	75	1091	270	1361
	100	1537	337	1874
	125	1584	316	1900
	150	1895	385	2280

IP20, NEMA/UL Type 1 – Frames 7…10

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

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

Communication Configurations

Typical Programmable Controller Configurations

Important: If block transfers are programmed to continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous transfers. If attribute 9 is selected, each program scan will complete a write to the drives non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do Not assign attribute 9 to continuous block transfers. Refer to the individual communications adapter User Manual for additional details.

Logic Command/Status Words

Figure A.1 Logic Command Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Command**	**Description**
															x	Stop(1)	0 = Not Stop 1 = Stop
														x		Start(1)(2)	0 = Not Start 1 = Start
													x			Jog	0 = Not Jog 1 = Jog
												x				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										x	x					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									x							Local Control	0 = No Local Control 1 = Local Control
								x								MOP Increment	0 = Not Increment 1 = Increment
						x	x									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				x	x											Decel Rate	00 = No Command 01 = Use Decel Time 1 10 = Use Decel Time 2 11 = Use Present Time
	x	x	x													Reference Select(3)	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
x																MOP Decrement	0 = Not Decrement 1 = Decrement

(1) A "0 = Not Stop" condition (logic 0) must first be present before a "1 = Start" condition will start the drive. The Start command acts as a momentary Start command. A "1" will start the drive, but returning to "0" will not stop the drive.

(2) This Start will not function if a digital input (parameters 361-366) is programmed for 2-Wire Control (option 7, 8 or 9).

(3) This Reference Select will not function if a digital input (parameters 361-366) is programmed for "Speed Sel 1, 2 or 3" (option 15, 16 or 17). When using the Logic Command Word for the Speed Reference Selection, always set bit 12, 13, or 14 to "1." Note that Reference Selection is "Exclusive Ownership" see [Reference Owner] on page 3-52.

Figure A.2 Logic Status Word

Logic Bits																Status	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															x	Ready	0 = Not Ready 1 = Ready
														x		Active	0 = Not Active 1 = Active
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Alarm	0 = No Alarm 1 = Alarm
								x								Fault	0 = No Fault 1 = Fault
							x									At Speed	0 = Not At Reference 1 = At Reference
				x	x	x										Local Control [1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Reserved 111 = No Local
x	x	x	x													Reference Source	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = Reserved 1111 = Jog Ref

[1] See “Owners” on page 3-50 for further information.

Output Devices

Common mode cores are internal to the drive. For information on output contactors see page 1-23. Other devices such as cable terminators and output reactors are discussed in the *Wiring and Grounding Guidelines* manual, publication DRIVES-IN001.

Drive, Fuse & Circuit Breaker Ratings

The tables on the following pages provide drive ratings (including single-phase) and recommended three-phase 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(1), 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.

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

208/240 Volt Single-Phase AC Input Ratings

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

380…480 Volt Single-Phase AC Input Ratings

480V Single-Phase AC Input						380…400V Single-Phase AC Input						
Drive Catalog Number	**Frame**	**Hp Rating**	**Input Amps**	**Three-Phase Output**		**Drive Catalog Number**	**Frame**	**kW Rating**	**Input Amps**	**Three-Phase Output**		**Temp.**
				V AC	*Amps*					*V AC*	*Amps*	*°C*
20BD1P1	0	0.25	0.7	0-460	0.6	20BC1P3	0	0.2	1	0-400	0.7	25
20BD2P1	0	0.5	1.4	0-460	1.1	20BC2P1	0	0.4	1.6	0-400	1.1	25
20BD3P4	0	1	2.3	0-460	1.7	20BC3P5	0	0.75	2.7	0-400	1.8	25
20BD5P0	0	1.5	3.4	0-460	2.5	20BC5P0	0	1.1	3.9	0-400	2.5	25
20BD8P0	0	2.5	6	0-460	4	20BC8P7	0	2	6.9	0-400	4.4	25
20BD011	0	3.75	8.2	0-460	5.5	20BC011	0	2.75	9.3	0-400	5.8	25
20BD014	1	5	10.9	0-460	7	20BC015	1	3.75	12.5	0-400	7.7	25
20BD022	1	7.5	17.3	0-460	11	20BC022	1	5.5	17.8	0-400	11	25
20BD027	2	10	21.4	0-460	13.5	20BC030	2	7.5	24.6	0-400	15	25
20BD034	2	12.5	27	0-460	17	20BC037	2	9.25	30.3	0-400	18.5	25
20BD040	3	15	31.8	0-460	20	20BC043	3	11	35.2	0-400	21.5	25
20BD052	3	20	41.3	0-460	26	20BC056	3	15	45.9	0-400	28	25
20BD065	3	25	51.6	0-460	32.5	20BC072	3	18.5	59.7	0-400	36	25
20BD077	4	30	62.6	0-460	38.5	20BC085	4	22.5	70.5	0-400	42.5	25
20BD096	5	37.5	78.1	0-460	48	20BC105	5	27.5	87	0-400	52.5	25
20BD125	5	50	101.6	0-460	62.5	20BC125	5	27.5	103.6	0-400	62.5	25
–	–	–	–	–	–	20BC140	5	37.5	117.4	0-400	70	25
20BD156	6	62.5	126.8	0-460	78	20BC170	6	45	142.6	0-400	85	25
20BD180	6	75	146.4	0-460	90	20BC205	6	55	171.9	0-400	102.5	25
20BD248	6	100	201.6	0-460	124	20BC260	6	66	220.6	0-400	130	25
20BD292	7	125	237.4	0-460	146	20BC292	7	80	247.7	0-400	146	25
20BD325	7	125	264.3	0-460	162.5	20BC325	7	90	275.7	0-400	162.5	25

600…690 Volt Single-Phase AC Input Rating

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

Table A.A 208 Volt AC Input Protection Devices (See page A-20 for Notes)

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (1)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (1)	Min. (1)	Max. (1)	Max. (1)	Max. (1)	Available Catalog Numbers - 140... (1)			
208 Volt AC Input																				
20BB2P2	0	0.5	0.33	4	50	1.9	0.7	2.5	2.8	3.8	3	6	3	10	15	3	M-C2E-B25	M-D8E-B25	–	–
20BB4P2	0	1	0.75	4	50	3.7	1.3	4.8	5.6	7	6	10	6	17.5	15	7	M-C2E-B63	M-D8E-B63	–	–
20BB6P8	1	2	1.5	4	50	6.8	2.4	7.8	10.4	13.8	10	15	10	30	30	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	–
20BB9P6	1	3	2	4	50	9.5	3.4	11	12.1	17	12	20	12	40	40	15	M-C2E-C16	M-D8E-C16	M-F8E-C16	–
20BB015	1	5	3	4	50	15.7	5.7	17.5	19.3	26.3	20	35	20	70	70	30	M-C2E-C20	M-D8E-C20	M-F8E-C20	–
20BB022	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
20BB028	2	10	7.5	4	50	29.6	10.7	32.2	38	50.6	40	70	40	125	125	50	–	–	M-F8E-C32	-CMN-4000
20BB042	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
20BB052	3	20	15	4	50	51.5	17.1	56	64	86	80	125	80	200	200	100	–	–	–	-CMN-6300
20BB070	4	25	20	4	50	72	25.9	78.2	93	124	90	175	90	300	300	100	–	–	–	-CMN-9000
20BB080	4	30	25	4	50	84.7	30.5	92	117	156	110	200	110	350	350	150	–	–	–	-CMN-9000
20BB104 (1)	5	40	–	4	50	113	40.7	120	132	175	150	250	150	475	350	150	–	–	–	–
		–	30	4	50	84.7	30.5	92	138	175	125	200	125	350	300	150	–	–	–	-CMN-9000
20BB130 (1)	5	50	–	4	50	141	44.1	130	143	175	175	275	175	500	375	250	–	–	–	–
		–	40	4	50	113	35.3	104	156	175	125	225	125	400	300	150	–	–	–	–
20BB154 (1)	6	60	–	4	50	167	60.1	177	195	266	225	350	225	500	500	250	–	–	–	–
		–	50	4	50	141	50.9	150	225	300	200	300	200	500	450	250	–	–	–	–
20BB192 (1)	6	75	–	4	50	208	75	221	243	308	300	450	300	600	600	400	–	–	–	–
		–	60	4	50	167	60.1	177	266	308	225	350	225	500	500	250	–	–	–	–
20BB260 (1)	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 A.B 240 Volt AC Input Protection Devices (See page A-20 for Notes)

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (1)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (1)	Min. (1)	Max. (1)	Max. (1)	Max. (1)	Available Catalog Numbers - 140… (1)			
240 Volt AC Input																				
20BB2P2	0	0.5	0.33	4	50	1.7	0.7	2.2	2.4	3.3	3	6	3	10	15	3	M-C2E-B25	M-D8E-B25	–	–
20BB4P2	0	1	0.75	4	50	3.3	1.4	4.2	4.8	6.4	5	8	5	15	15	7	M-C2E-B63	M-D8E-B63	–	–
20BB6P8	1	2	1.5	4	50	5.9	2.4	6.8	9	12	10	15	10	25	25	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	–
20BB9P6	1	3	2	4	50	8.3	3.4	9.6	10.6	14.4	12	20	12	35	35	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	–
20BB015	1	5	3	4	50	13.7	5.7	15.3	16.8	23	20	30	20	60	60	30	M-C2E-C16	M-D8E-C16	M-F8E-C16	–
20BB022	1	7.5	5	4	50	19.9	8.3	22	24.2	33	25	50	25	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	35	100	100	50	–	–	M-F8E-C32	-CMN-4000
20BB042	3	15	10	4	50	38.5	16	42	46.2	63	50	90	50	150	150	50	–	–	M-F8E-C45	-CMN-6300
20BB052	3	20	15	4	50	47.7	19.8	52	63	80	60	100	60	200	200	100	–	–	–	-CMN-6300
20BB070	4	25	20	4	50	64.2	26.7	70	78	105	90	150	90	275	275	100	–	–	–	-CMN-9000
20BB080	4	30	25	4	50	73.2	30.5	80	105	140	100	180	100	300	300	100	–	–	–	-CMN-9000
20BB104 (1)	5	40	–	4	50	98	40.6	104	115	175	125	225	125	400	300	150	–	–	–	–
		–	30	4	50	73	30.5	80	120	160	100	175	100	300	300	100	–	–	–	-CMN-9000
20BB130 (1)	5	50	–	4	50	122	50.7	130	143	175	175	275	175	500	375	250	–	–	–	–
		–	40	4	50	98	40.6	104	156	175	125	225	125	400	300	150	–	–	–	–
20BB154 (1)	6	60	–	4	50	145	60.1	154	169	231	200	300	200	600	450	250	–	–	–	–
		–	50	4	50	122	50.7	130	195	260	175	275	175	500	375	250	–	–	–	–
20BB192 (1)	6	75	–	4	50	180	74.9	192	211	288	225	400	225	600	575	250	–	–	–	–
		–	60	4	50	145	60.1	154	231	308	200	300	200	600	450	250	–	–	–	–
20BB260 (1)	6	100	–	2	45	233	96.7	260	286	390	300	575	300	750	750	300	–	–	–	–
		–	75	2	50	169	70.1	205	305	410	225	450	225	600	600	250	–	–	–	–

Table A.C 400 Volt AC Input Protection Devices (See page A-20 for Notes)

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	*HD*	*kHz*	*°C*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.* (1)	*Max.* (1)	*Min.* (1)	*Max.* (1)	*Max.* (1)	*Max.* (1)	*Available Catalog Numbers - 140...* (1)			
400 Volt AC Input																				
20BC1P3	0	0.37	0.25	4	50[1]	1.1	0.77	1.3	1.4	1.9	3	3	3	6	15	3	M-C2E-B16	–	–	–
20BC2P1	0	0.75	0.55	4	50[1]	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[1]	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[1]	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[1]	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[1]	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[1]	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[1]	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[1]	28.4	19.7	30	33	45	35	60	35	120	120	50	–	–	M-F8E-C32	–
20BC037	2	18.5	15	4	50[1]	35	24.3	37	45	60	45	80	45	125	125	50	–	–	M-F8E-C45	–
20BC043	3	22	18.5	4	50[1]	40.7	28.2	43	56	74	60	90	60	150	150	60	–	–	–	–
20BC056	3	30	22	4	50[1]	53	36.7	56	64	86	70	125	70	200	200	100	–	–	–	–
20BC072	3	37	30	4	50[1][1]	68.9	47.8	72	84	112	90	150	90	250	250	100	–	–	–	–
20BC085[1]	4	45	–	4	45[1]	81.4	56.4	85	94	128	110	200	110	300	300	150	–	–	–	–
		–	37	4	45[1]	68.9	47.8	72	108	144	90	175	90	275	300	100	–	–	–	–
20BC105[1]	5	55	–	4	50[1]	100.5	69.6	105	116	158	125	225	125	400	300	150	–	–	–	–
		–	45	4	50[1]	81.4	56.4	85	128	170	110	175	110	300	300	150	–	–	–	–
20BC125[1]	5	55	–	4	50[1]	121.1	83.9	125	138	163	150	275	150	500	375	250	–	–	–	–
		–	45	4	50[1]	91.9	63.7	96	144	168	125	200	125	375	375	150	–	–	–	–
20BC140[1]	5	75	–	4	40[1]	136	93.9	140	154	190	200	300	200	400	400	250	–	–	–	–
		–	55	4	40[1]	101	69.6	105	157	190	150	225	150	300	300	150	–	–	–	–
20BC170[1]	6	90	–	4	50[1]	164	126	170	187	255	250	375	250	600	500	250	–	–	–	–
		–	75	4	50[1]	136	103	140	210	280	200	300	200	550	400	250	–	–	–	–
20BC205[1]	6	110	–	4	40[1]	199	148	205	220	289	250	450	250	600	600	400	–	–	–	–
		–	90	4	40[1]	164	126	170	255	313	250	375	250	600	500	250	–	–	–	–
20BC260[1]	6	132	–	2	45[1]	255	177	260	286	390	350	550	350	750	750	400	–	–	–	–
		–	110	2	50[1]	199	138	205	308	410	250	450	250	600	600	400	–	–	–	–

Table A.D 400 Volt AC Input Protection Devices *Continued* **(See page A-20 for Notes)**

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (1)	Min. (1)	Max. (1)	Max. (1)	Max. (1)	Available Catalog Numbers - 140… (1)			
400 Volt AC Input																				
20BC292(1)	7	160		4	40(1)	293	203	292	322	438	375	650	375	850	850	400	–	–	–	–
			150	4	40(1)	264	183	263	395	526	350	550	350	550	750	400	–	–	–	–
20BC325(1)	7	180		4	40(1)	326	226	325	358	488	425	700	425	950	950	600	–	–	–	–
			180	4	40(1)	326	226	325	488	650	425	700	425	950	950	600	–	–	–	–
20BC365(1)	8	200		2	40(1)	366	253	365	402	548	475	800	475	1000	1000	600	–	–	–	–
			180	2	40(1)	326	226	325	488	650	425	700	425	950	950	600	–	–	–	–
20BC415(1)	8	240		2	40(1)	416	288	415	457	623	525	900	525	1200	1200	600	–	–	–	–
			200	2	40(1)	366	253	365	548	730	475	800	475	1000	1000	600	–	–	–	–
20BC481(1)	8	280		2	40(1)	483	334	481	530	722	600	1000	600	1400	1400	700	–	–	–	–
			240	2	40(1)	416	288	415	623	830	525	900	525	1200	1200	600	–	–	–	–
20BC535(1)	8	300		2	40(1)	537	372	535	589	803	700	1200	700	1600	1600	700	–	–	–	–
			280	2	40(1)	483	334	481	722	962	600	1000	600	1400	1400	700	–	–	–	–
20BC600(1)	8	350		2	40(1)	602	417	600	660	900	750	1300	750	1800	1800	800	–	–	–	–
			300	2	40(1)	537	371	535	803	1070	700	1200	700	1600	1600	700	–	–	–	–
20BC730(1)	9	400		2	40(1)	702	486	730	803	1095	900	1500	900	2100	2100	900	–	–	–	–
			350	2	40(1)	602	417	600	900	1200	750	1300	750	1800	1800	800	–	–	–	–
20BC875(1)	10	500		2	40(1)	877	608	875	963	1313	1100	1900	1100	2600	2600	1200	–	–	–	–
			400	2	40(1)	877	486	700	1050	1400	900	1500	900	2100	2100	900	–	–	–	–

Table A.E 480 Volt AC Input Protection Devices (See page A-20 for Notes)

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (1)	Min. (1)	Max. (1)	Max. (1)	Max. (1)	Available Catalog Numbers - 140... (1)			
480 Volt AC Input																				
20BD1P1	0	0.5	0.33	4	50(1)	0.9	0.7	1.1	1.2	1.6	3	3	3	6	15	3	M-C2E-B16	–	–	–
20BD2P1	0	1	0.75	4	50(1)	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(1)	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(1)	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(1)	6.9	5.7	8	8.8	12	10	15	10	30	30	15	M-C2E-C10	M-D8E-C10	M-F8E-C10	–
20BD011	0	7.5	5	4	50(1)	9.5	7.9	11	12.1	16.5	15	20	15	40	40	15	M-C2E-C16	M-D8E-C16	M-F8E-C16	–
20BD014	1	10	7.5	4	50(1)	12.5	10.4	14	16.5	22	17.5	30	17.5	50	50	20	M-C2E-C16	M-D8E-C16	M-F8E-C16	–
20BD022	1	15	10	4	50(1)	19.9	16.6	22	24.2	33	25	50	25	80	80	30	M-C2E-C25	M-D8E-C25	M-F8E-C25	-CMN-2500
20BD027	2	20	15	4	50(1)	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	M-F8E-C32	-CMN-4000
20BD034	2	25	20	4	50(1)	31.2	25.9	34	40.5	54	40	70	40	125	125	50	–	–	M-F8E-C45	-CMN-4000
20BD040	3	30	25	4	50(1)	36.7	30.5	40	51	68	50	90	50	150	150	50	–	–	M-F8E-C45	-CMN-4000
20BD052	3	40	30	4	50(1)	47.7	39.7	52	60	80	60	110	60	200	200	70	–	–	–	-CMN-6300
20BD065	3	50	40	4	50(1)	59.6	49.6	65	78	104	80	125	80	250	250	100	–	–	–	-CMN-9000
20BD077 (1)	4	60	–	4	50(1)	72.3	60.1	77	85	116	100	170	100	300	300	100	–	–	–	-CMN-9000
		–	50	4	50(1)	59.6	49.6	65	98	130	80	125	80	250	250	100	–	–	–	-CMN-9000
20BD096 (1)	5	75	–	4	50(1)	90.1	74.9	96	106	144	125	200	125	350	350	125	–	–	–	–
		–	60	4	50(1)	72.3	60.1	77	116	154	100	170	100	300	300	100	–	–	–	-CMN-9000
20BD125 (1)	5	100	–	4	50(1)	117	97.6	125	138	163	150	250	150	500	375	150	–	–	–	–
		–	75	4	50(1)	90.1	74.9	96	144	168	125	200	125	350	350	125	–	–	–	–
20BD156 (1)	6	125	–	4	50(1)	147	122	156	172	234	200	350	200	600	450	250	–	–	–	–
		–	100	4	50(1)	131	109	125	188	250	175	250	175	500	375	250	–	–	–	–
20BD180 (1)	6	150	–	4	50(1)	169	141	180	198	270	225	400	225	600	500	250	–	–	–	–
		–	125	4	50(1)	147	122	156	234	312	200	350	200	600	450	250	–	–	–	–
20BD248 (1)	6	200	–	2	45(1)	233	194	248	273	372	300	550	300	700	700	400	–	–	–	–
		–	150	2	50(1)	169	141	180	270	360	225	400	225	600	500	250	–	–	–	–

Table A.F 480 Volt AC Input Protection Devices *Continued* **(See page A-20 for Notes)**

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp.	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	*HD*	*kHz*	*°C*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.* (1)	*Max.* (1)	*Min.* (1)	*Max.* (1)	*Max.* (1)	*Max.* (1)	*Available Catalog Numbers - 140…* (1)			
480 Volt AC Input																				
20BD292 (1)	7	250		4	40(1)	281	233	292	322	438	375	650	375	850	850	400	–	–	–	–
			200	4	40(1)	253	210	263	395	526	350	550	350	550	750	400	–	–	–	–
20BD325 (1)	7	250		4	40(1)	313	260	325	358	488	425	700	425	950	950	600	–	–	–	–
			250	4	40(1)	313	260	325	488	650	425	700	425	950	950	600	–	–	–	–
20BD365 (1)	8	300		2	40(1)	351	292	365	402	548	475	800	475	1000	1000	600	–	–	–	–
			250	2	40(1)	313	260	325	488	650	425	700	425	950	950	600	–	–	–	–
20BD415 (1)	8	350		2	40(1)	399	331	415	457	623	525	900	525	1200	1200	600	–	–	–	–
			300	2	40(1)	351	291	365	548	730	475	800	475	1000	1000	600	–	–	–	–
20BD481 (1)	8	400		2	40(1)	462	384	481	530	722	600	1000	600	1400	1400	700	–	–	–	–
			350	2	40(1)	399	331	415	623	830	525	900	525	1200	1200	600	–	–	–	–
20BD535 (1)	8	450		2	40(1)	514	427	535	589	803	700	1200	700	1600	1600	700	–	–	–	–
			400	2	40(1)	462	384	481	722	962	600	1000	600	1400	1400	700	–	–	–	–
20BD600 (1)	8	500		2	40(1)	577	479	600	660	900	750	1300	750	1800	1800	800	–	–	–	–
			450	2	40(1)	514	427	535	803	1070	700	1200	700	1600	1600	700	–	–	–	–
20BD730 (1)	9	600		2	40(1)	673	559	730	803	1095	900	1500	900	2100	2100	900	–	–	–	–
			500	2	40(1)	577	479	600	900	1200	750	1300	750	1800	1800	800	–	–	–	–
20BD875 (1)	10	700		2	40(1)	841	699	875	963	1313	1100	1900	1100	2600	2600	1200	–	–	–	–
			600	2	40(1)	673	559	700	1050	1400	900	1500	900	2100	2100	900	–	–	–	–

Table A.G 600 Volt AC Input Protection Devices (See page A-20 for Notes) (1)

Drive Catalog Number	Frame	Hp Rating		PWM Freq.	Temp. (1)	Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker (1)	Motor Circuit Protector (1)	140M Motor Protector with Adjustable Current Range (1)(1)			
		ND	HD	kHz	°C	Amps	kVA	Cont.	1 Min.	3 Sec.	Min. (1)	Max. (1)	Min. (1)	Max. (1)	Max. (1)	Max. (1)	Available Catalog Numbers - 140... (1)			
600 Volt AC Input																				
20BE1P7	0	1	0.5	4	50	1.3	1.4	1.7	2	2.6	2	4	2	6	15	3	M-C2E-B16	–	–	–
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	M-F8E-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	M-F8E-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	M-F8E-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	M-F8E-C25	-CMN-2500
20BE027	2	25	20	4	50	24.8	25.7	27	33	44	35	60	35	100	100	50	–	–	M-F8E-C25	-CMN-2500
20BE032	3	30	25	4	50	29.4	30.5	32	40.5	54	40	70	40	125	125	50	–	–	M-F8E-C32	-CMN-4000
20BE041	3	40	30	4	50	37.6	39.1	41	48	64	50	90	50	150	150	100	–	–	M-F8E-C45	-CMN-4000
20BE052	3	50	40	4	50	47.7	49.6	52	61.5	82	60	110	60	200	200	100	–	–	–	-CMN-6300
20BE062	4	60	50	2	50	58.2	60.5	62	78	104	80	125	80	225	225	100	–	–	–	-CMN-6300
20BE077 (1)	5	75	–	2	50 (1)	72.3	75.1	77	85	116	90	150	90	300	300	100	–	–	–	-CMN-9000
		–	60	2	50 (1)	58.2	60.5	63	94	126	90	125	90	250	250	100	–	–	–	-CMN-6300
20BE099 (1)	5	100	–	2	40 (1)	92.9	96.6	99	109	126	125	200	125	375	375	150	–	–	–	–
		–	75	2	40 (1)	72.3	75.1	77	116	138	100	175	100	300	300	100	–	–	–	-CMN-9000
20BE125 (1)	6	125	–	2	50 (1)	117	122	125	138	188	150	250	150	375	375	250	–	–	–	–
		–	100	2	50 (1)	93	96.6	99	149	198	125	200	125	375	375	150	–	–	–	–
20BE144 (1)	6	150	–	2	50 (1)	135	141	144	158	216	175	300	175	400	400	250	–	–	–	–
		–	125	2	50 (1)	117	122	125	188	250	150	275	150	375	375	250	–	–	–	–

Table A.H 690 Volt AC Input Protection Devices[1]

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

Notes:

(1) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
(1) 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.
(1) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(1) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor FLA. Ratings shown are maximum.
(1) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.
(1) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/ 347. Not UL listed for use on 480V or 600V Delta/Delta systems.
(1) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.
(1) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
(1) 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.
(1) Must remove top label and vent plate, drive enclosure rating will be IP00, NEMA/UL Type Open.
(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.
(1) Drives have dual current ratings; one for normal duty applications, and one for heavy duty applications. The drive may be operated at either rating.
(1) Frame 7…10 drives are CE Certified for use with 400V AC and 480V AC center grounded neutral power supply systems only. 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.
(1) Temperature rating is for IP20, NEMA/UL Type 1. For IP00, NEMA Type Open the temperature rating is 65 °C for the control board and 40 °C for the heat sink entry air.

Table A.I 325 Volt DC Input Protection Devices (See page A-24 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.		
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 A.J 540 Volt DC Input Protection Devices (See page A-24 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*	*kW*	*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	JKS-3
20BC2P1	0	0.75	0.55	4	50	2.1		2.1	2.4	3.2	6	JKS-6
20BC3P5	0	1.5	0.75	4	50	3.7		3.5	4.5	6	8	JKS-8
20BC5P0	0	2.2	1.5	4	50	5.3		5	5.5	7.5	10	JKS-10
20BC8P7	0	4	3	4	50	9.3		8.7	9.9	13.2	15	HSJ15
20BC011	0	5.5	4	4	50	12.6		11.5	13	17.4	20	HSJ20
20BC015	1	7.5	5.5	4	50	16.8		15.4	17.2	23.1	25	HSJ25
20BC022	1	11	7.5	4	50	24		22	24.2	33	40	HSJ40
20BC030	2	15	11	4	50	33.2		30	33	45	50	HSJ50
20BC037	2	18.5	15	4	50	40.9		37	45	60	70	HSJ70
20BC043	3	22	18.5	4	50	47.5		43	56	74	90	HSJ90
20BC056	3	30	22	4	50	61.9		56	64	86	100	HSJ100
20BC072	3	37	30	4	50(7)	80.5		72	84	112	125	HSJ125
20BC085(3)(5)	4	45	–	4	45	95.1		85	94	128	150	HSJ150
		–	37	4	45	80.5		72	108	144	175	HSJ175
20BH105(3)(5)	5	55	–	4	50(4)	120.2		105	116	158	175	HSJ175
		–	45	4	50(4)	95.1		85	128	170	200	HSJ200
20BH140(3)(5)	5	75	–	4	40(4)	159		140	154	190	225	HSJ225
		–	55	4	40(4)	120.2		105	158	190	225	HSJ225
20BH170(3)(5)	6	90	–	4	50(4)	192.3		170	187	255	300	HSJ300
		–	75	4	50(4)	159		140	210	280	300	HSJ300
20BH205(3)(5)	6	110	–	4	40(4)	226		205	220	289	350	HSJ350
		–	90	4	40(4)	192.3		170	255	313	350	HSJ350
20BH260(3)(5)	6	132	–	2	45(4)	298		260	286	390	500	HSJ500
		–	110	2	50(4)	226		205	305	410	500	HSJ500
20BP292	7	160		4	40	342	185	292	322	438	500	170M6608(10)
			150	4	40	309	166	263	395	526	630	170M6610(10)
20BP325	7	180		4	40	381	206	325	358	488	630	170M6610(10)
			180	4	40	381	206	325	488	650	800	170M6612(10)
20BP365	8	200		2	40	428	231	365	402	548	630	170M6610(10)
			180	2	40	381	206	325	488	650	800	170M6612(10)
20BP415	8	240		2	40	487	262	415	457	623	800	170M6612(10)
			200	2	40	428	231	365	548	730	900	170M6613(10)
20BP481	8	280		2	40	564	304	481	530	722	900	170M6613(10)
			240	2	40	487	262	415	623	830	1000	170M6614(10)
20BP535	8	300		2	40	627	338	535	589	803	1000	170M6614(10)
			280	2	40	564	304	481	722	962	1100	170M6615(10)
20BP600	8	350		2	40	703	379	600	660	900	1100(8)	170M6615(10)
			300	2	40	627	338	535	803	1070	1200(8)	170M6616(10)
20BP730	9	400		2	40	855	461	730	803	1095	1200(9)	170M6616(10)
			350	2	40	703	379	600	900	1200	1400(9)	170M6617(10)
20BH875 No Precharge	10	500		2	40	1025	553	875	963	1313	2 x 800	170M6612(10)
			400	2	40	820	443	700	1050	1400	2 x 800	170M6612(10)

Table A.K 650 Volt DC Input Protection Devices (See page A-24 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*	*kW*	*Cont.*	*1 Min.*	*3 Sec.*		
650 Volt DC Input												
20BD1P1	0	0.5	0.33	4	50	1.0		1.1	1.2	1.6	3	JKS-3
20BD2P1	0	1	0.75	4	50	1.9		2.1	2.4	3.2	6	JKS-6
20BD3P4	0	2	1.5	4	50	3.0		3.4	4.5	6.0	6	JKS-6
20BD5P0	0	3	2	4	50	4.5		5.0	5.5	7.5	10	JKS-10
20BD8P0	0	5	3	4	50	8.1		8.0	8.8	12	15	HSJ15
20BD011	0	7.5	5	4	50	11.1		11	12.1	16.5	20	HSJ20
20BD014	1	10	7.5	4	50	14.7		14	16.5	22	30	HSJ30
20BD022	1	15	10	4	50	23.3		22	24.2	33	40	HSJ40
20BD027	2	20	15	4	50	28.9		27	33	44	50	HSJ50
20BD034	2	25	20	4	50	36.4		34	40.5	54	60	HSJ60
20BD040	3	30	25	4	50	42.9		40	51	68	80	HSJ80
20BD052	3	40	30	4	50	55.7		52	60	80	90	HSJ90
20BD065	3	50	40	4	50	69.7		65	78	104	100	HSJ100
20BD077 (3)	4	60	–	4	50	84.5		77	85	116	150	HSJ150
		–	50	4	50	69.7		65	98	130	150	HSJ150
20BR096 (3)(6)	5	75	–	4	50 (4)	105.3		96	106	144	175	HSJ175
		–	60	4	50 (4)	84.5		77	116	154	175	HSJ175
20BR125 (3)(6)	5	100	–	4	50 (4)	137.1		125	138	163	200	HSJ200
		–	75	4	50 (4)	105.3		96	144	168	200	HSJ200
20BR156 (3)(6)	6	125	–	4	50 (4)	171.2		156	172	234	300	HSJ300
		–	100	4	50 (4)	137.1		125	188	250	300	HSJ300
20BR180 (3)(6)	6	150	–	4	50 (4)	204		180	198	270	400	HSJ400
		–	125	4	50 (4)	171.2		156	234	312	400	HSJ400
20BR248 (3)(6)	6	200	–	2	45 (4)	272		248	273	372	400	HSJ400
		–	150	2	50 (4)	204		180	270	360	400	HSJ400
20BR292	7	250		4	40	328	212	292	322	438	630	170M6608 (10)
			200	4	40	296	191	263	395	526	630	170M6608 (10)
20BR325	7	250		4	40	365	236	325	358	488	800	170M6612 (9)
			250	4	40	365	236	325	488	650	800	170M6612 (10)
20BR365	8	300		2	40	410	265	365	402	548	800	170M6612 (10)
			250	2	40	365	236	325	488	650	800	170M6612 (10)
20BR415	8	350		2	40	466	302	415	457	623	800	170M6612 (10)
			300	2	40	410	265	365	548	730	800	170M6612 (10)
20BR481	8	400		2	40	540	350	481	530	722	900	170M6613 (10)
			350	2	40	466	302	415	623	830	900	170M6613 (10)
20BR535	8	450		2	40	601	389	535	589	803	1000	170M6614 (10)
			400	2	40	540	350	481	722	962	1000	170M6614 (10)
20BR600	8	500		2	40	674	436	600	660	900	1200 (8)	170M6616 (10)
			450	2	40	601	389	535	803	1070	1200 (8)	170M6616 (10)
20BR730	9	600		2	40	820	533	730	803	1095	1400 (9)	170M6617 (10)
			500	2	40	674	436	600	900	1200	1400 (9)	170M6617 (10)
20BJ875 No Precharge	10	700		2	40	983	636	875	963	1313	2 x 800	170M6612 (10)
			600	2	40	786	509	700	1050	1400	2 x 800	170M6612 (10)

Table A.L 810 Volt DC Input Protection Devices

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

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

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

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

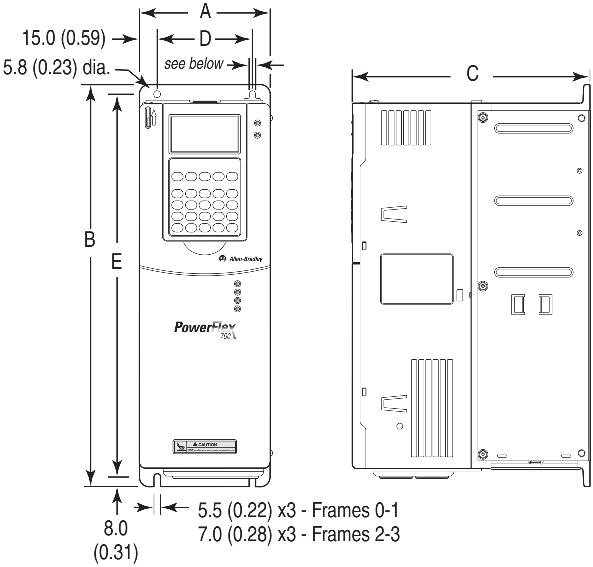
(8) Two 630A Bussmann 170M6608 can also be used.

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

(10) Bussmann or equivalent.

Dimensions

Figure A.3 PowerFlex 700 Frames 0-3 *(0 Frame Shown)*



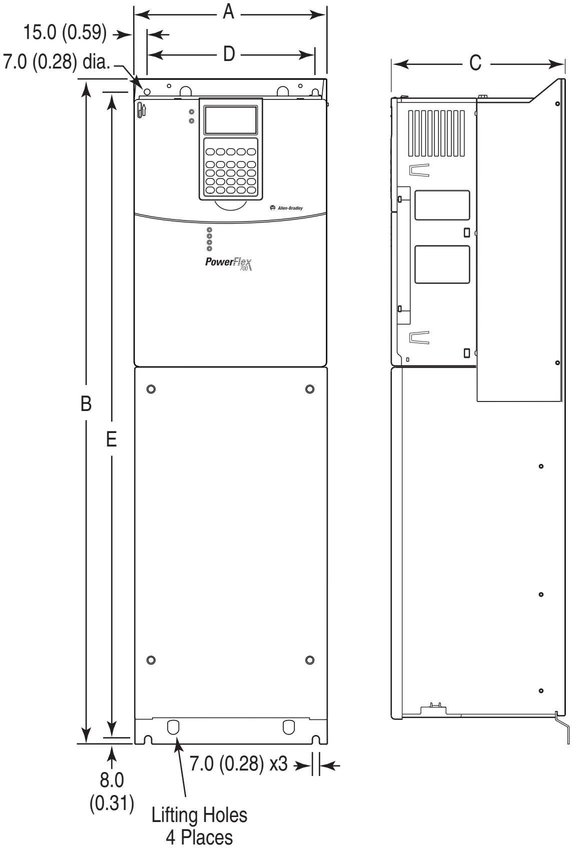
Dimensions are in millimeters and (inches).

Frame[1]	**A**	**B**	**C**	**D**	**E**	**Weight**[2] *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 Drive, Fuse & Circuit Breaker Ratings for frame information.

[2] Weights include HIM and Standard I/O.

Figure A.4 PowerFlex 700 Frame 4



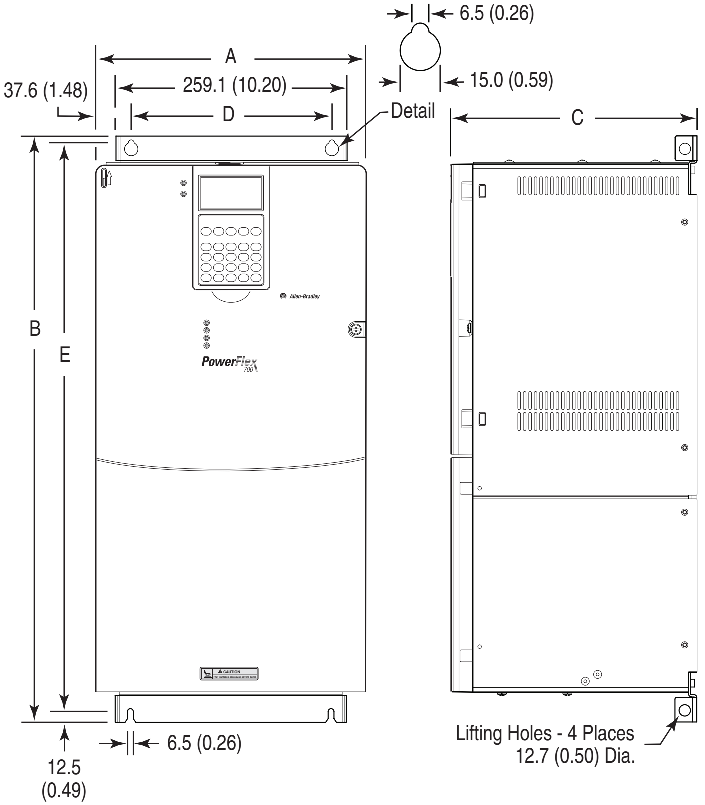
Dimensions are in millimeters and (inches)

Frame[1]	A *(Max.)*	B	C *(Max.)*	D	E	Approx. Weight [2] *kg (lbs.)* Drive	Approx. Weight [2] *kg (lbs.)* 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 Drive, Fuse & Circuit Breaker Ratings for frame information.

[2] Weights include HIM and Standard I/O.

Figure A.5 PowerFlex 700 Frame 5



Dimensions are in millimeters and (inches).

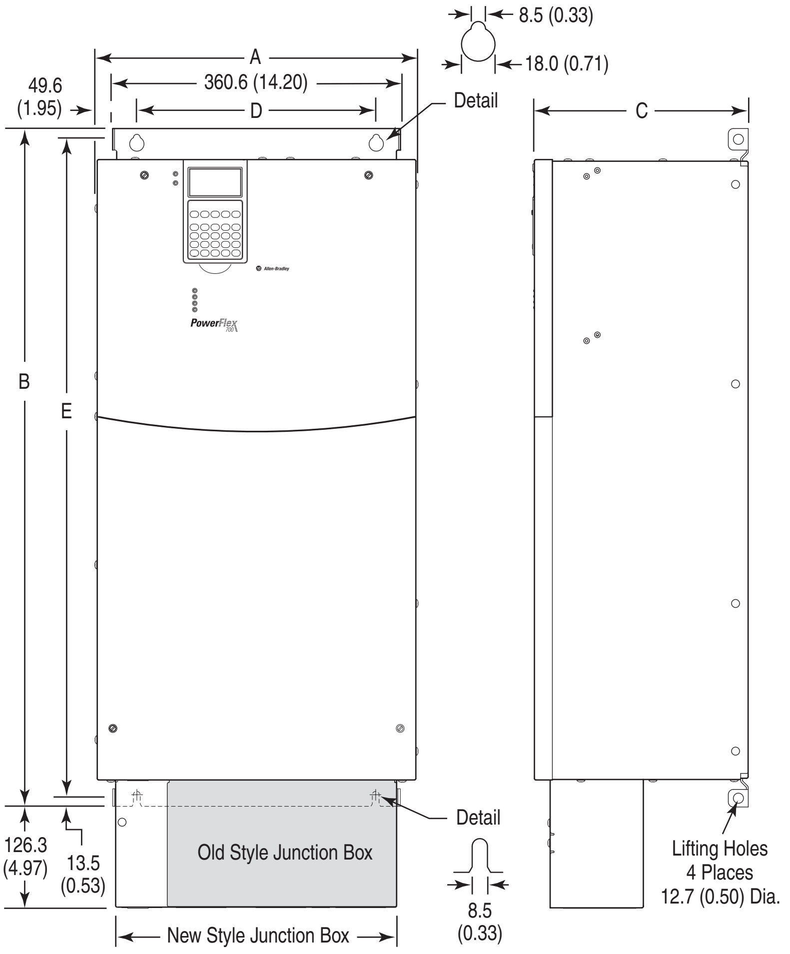
Frame[1]	**A** *(Max.)*	**B**	**C** *(Max.)*	**D**	**E**	**Approx. Weight**[2] *kg (lbs.)*	
						Drive	**Drive & Packaging**
5	308.9 (12.16)	644.5 (25.37)[3]	275.4 (10.84)	225.0 (8.86)	625.0 (24.61)	37.19 (82.0)	49.50 (109.0)

[1] Refer to Drive, Fuse & Circuit Breaker Ratings 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.

Figure A.6 PowerFlex 700 Frame 6



Dimensions are in millimeters and (inches)

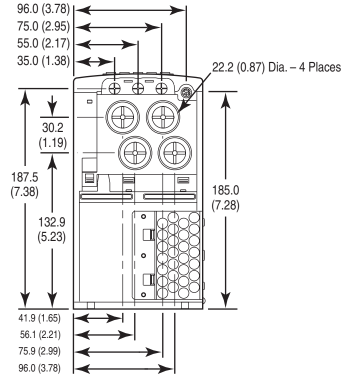
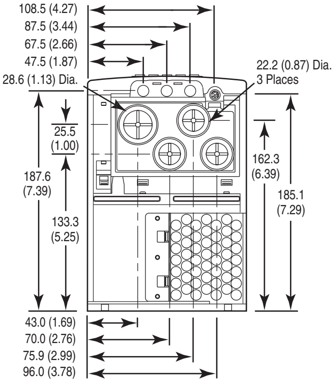
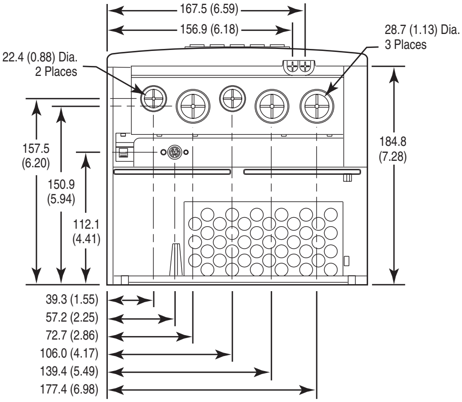
Frame[1]	**A** *(Max.)*	**B**[2]	**C** *(Max.)*	**D**	**E**	**Approx. Weight**[3] *kg (lbs.)*	
						Drive	**Drive & Packaging**
6	403.9 (15.90)	850.0 (33.46)	275.5 (10.85)	300.0 (11.81)	825.0 (32.48)	71.44 (157.5)	100.9 (222.0)

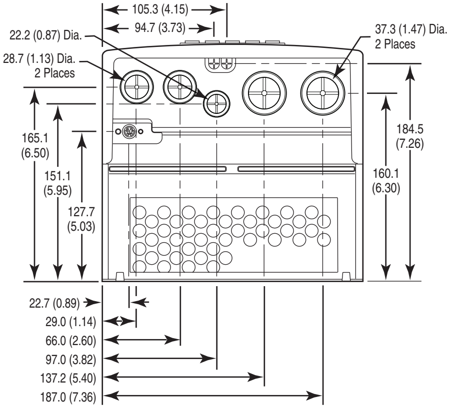
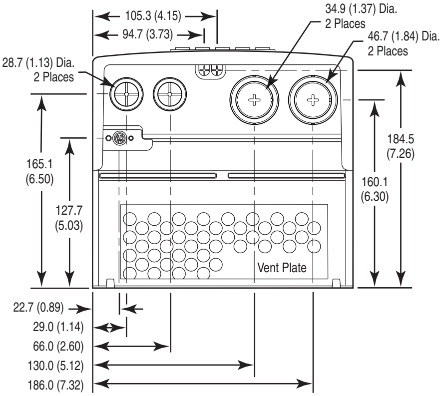
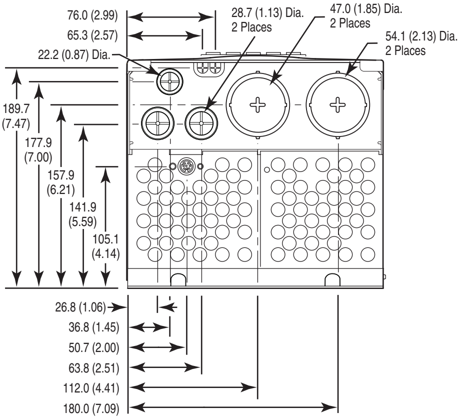
[1] Refer to Drive, Fuse & Circuit Breaker Ratings for frame information.

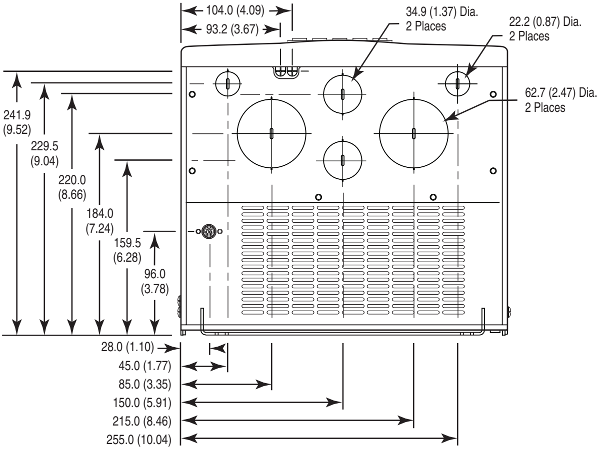
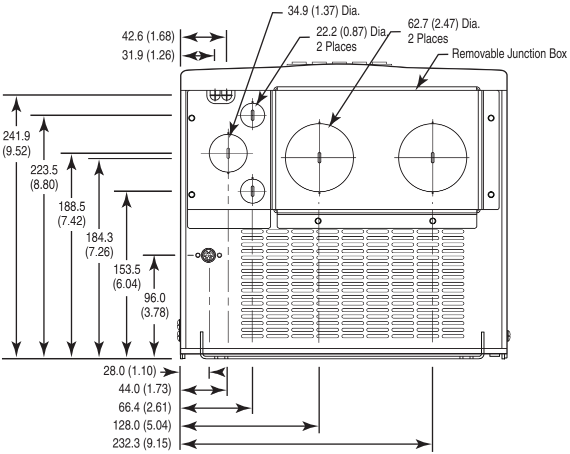
[2] Junction Box can be removed if drive is mounted in a cabinet.

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

Figure A.7 PowerFlex 700 Bottom View Dimensions

<table>
<tr><th>Frame</th><th>Rating</th><th>Dimensions</th></tr>
<tr><td>0</td><td>All</td><td>
</td></tr>
<tr><td>1</td><td>All</td><td>
</td></tr>
<tr><td>2</td><td>All</td><td>
</td></tr>
</table>

<table>
<tr><th>Frame</th><th>Rating</th><th>Dimensions</th></tr>
<tr><td rowspan="2">3</td><td>All
except
50 Hp,
480V
(37 kW,
400V)</td><td>
</td></tr>
<tr><td>50 Hp,
480V
(37 kW,
400V)
Normal
Duty
Drive</td><td>
</td></tr>
<tr><td>4</td><td>All</td><td>
</td></tr>
</table>

Frame	Rating	Dimensions
5	75 Hp, 480V (55kW, 400V) Normal Duty Drive	
	100 Hp, 480V Normal Duty Drive	

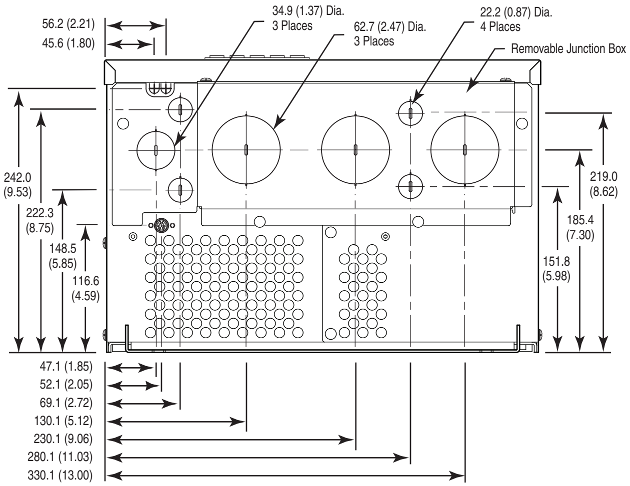
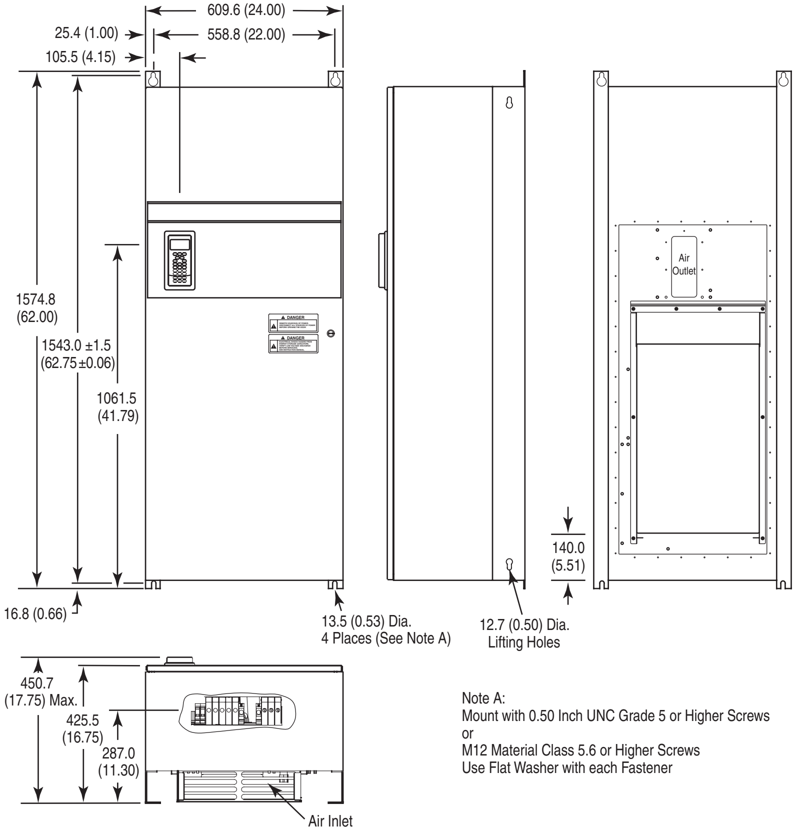
Frame	Rating	Dimensions
6	All	

Figure A.8 Frame 5 NEMA/UL Type 12 Standalone (400-690V drives only)



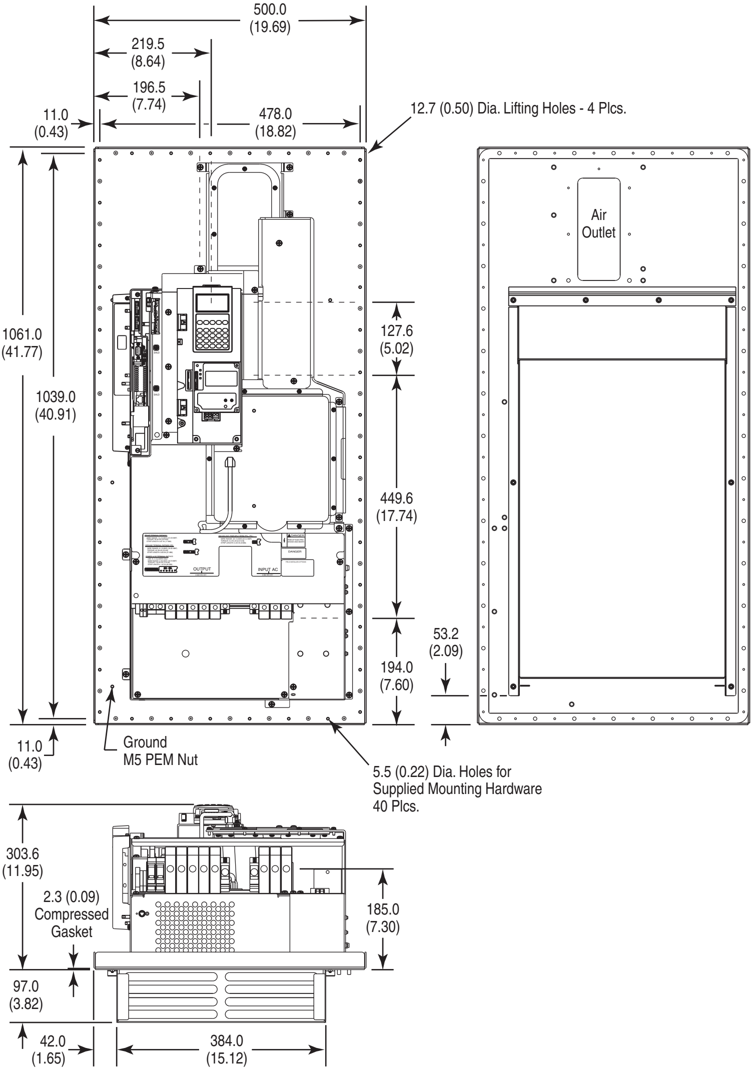
Note A:
Mount with 0.50 Inch UNC Grade 5 or Higher Screws
or
M12 Material Class 5.6 or Higher Screws
Use Flat Washer with each Fastener

Dimensions are in millimeters and (inches)

Frame	**Description**	**Approx. Weight** [1] *kg (lbs.)*	
		Drive	**Drive & Packaging**
5	Standalone	102.51 (226.0)	154.68 (341.0)

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

Figure A.9 Frame 5 NEMA/UL Type 12 Flange Mount (400-690V drives only)

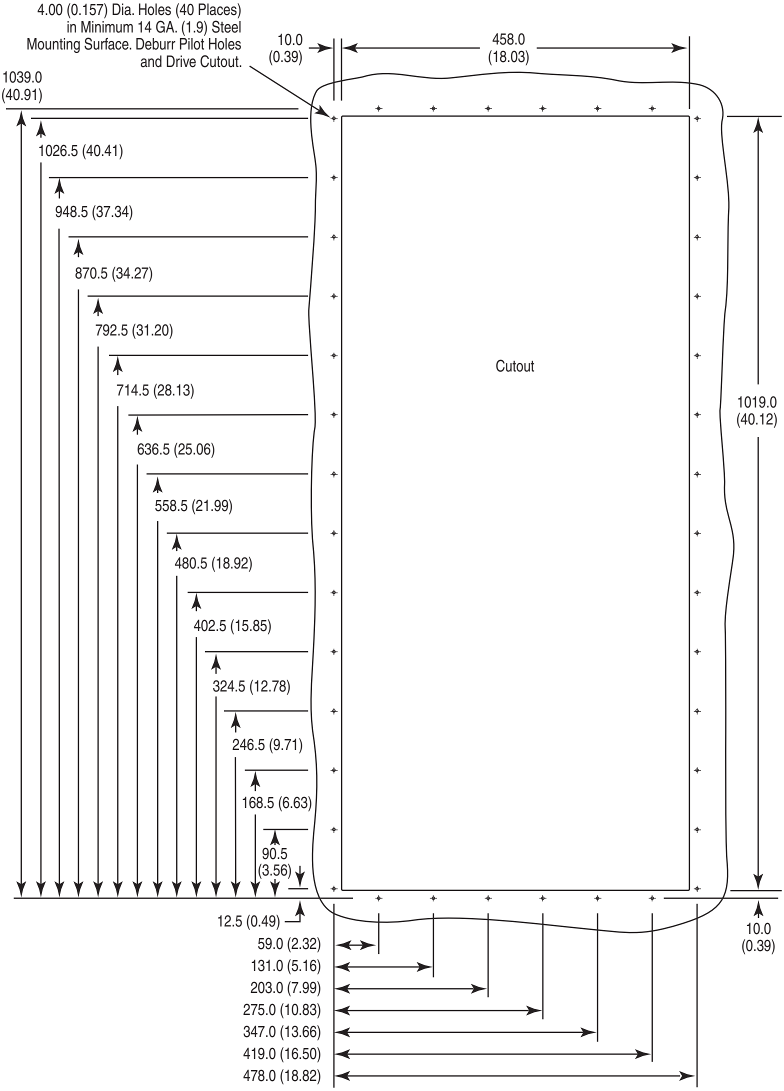


Dimensions are in millimeters and (inches)

Frame	Description	Approx. Weight (1) kg (lbs.)	
		Drive	Drive & Packaging
5	Flange Mount	61.69 (136.0)	81.65 (180.0)

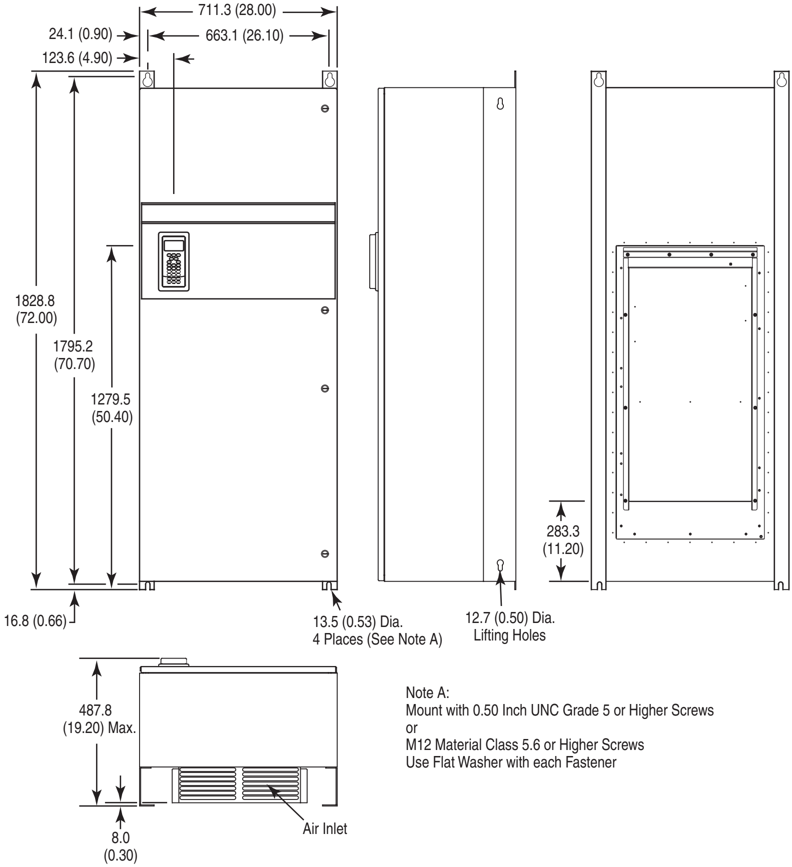
(1) Weights include HIM and Standard I/O.

Figure A.10 Frame 5 Flange Mount Cutout



Dimensions are in millimeters and (inches)

Figure A.11 Frame 6 NEMA/UL Type 12 Standalone (400-690V drives only)



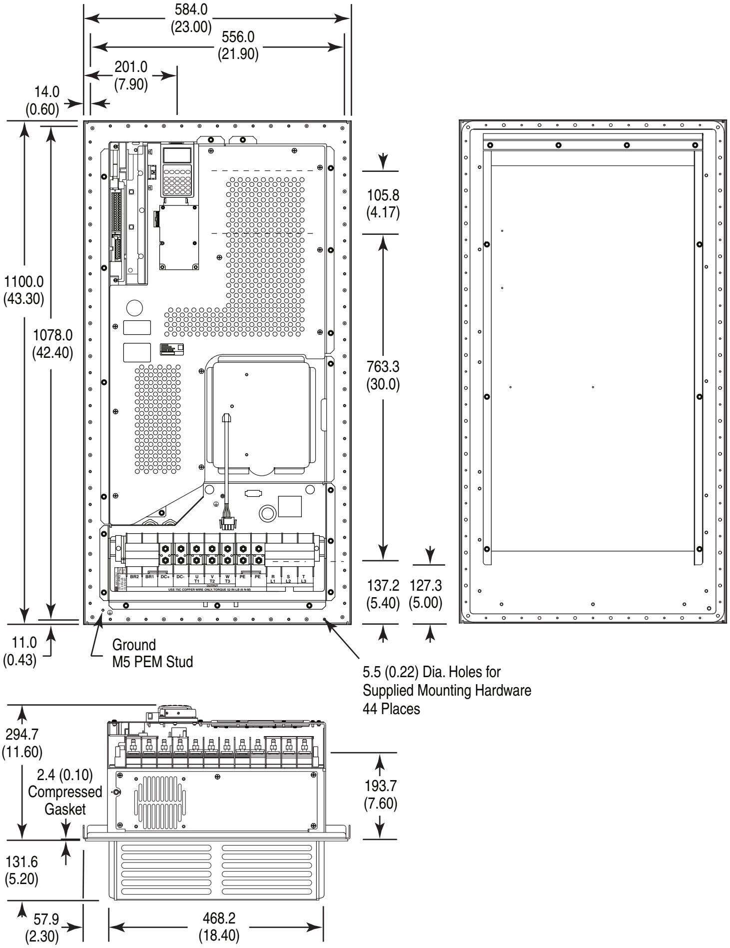
Note A:
Mount with 0.50 Inch UNC Grade 5 or Higher Screws
or
M12 Material Class 5.6 or Higher Screws
Use Flat Washer with each Fastener

Dimensions are in millimeters and (inches)

Frame	**Description**	**Approx. Weight** (1) *kg (lbs.)*	
		Drive	**Drive & Packaging**
6	Standalone	176.90 (390.0)	229.07 (505.0)

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

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

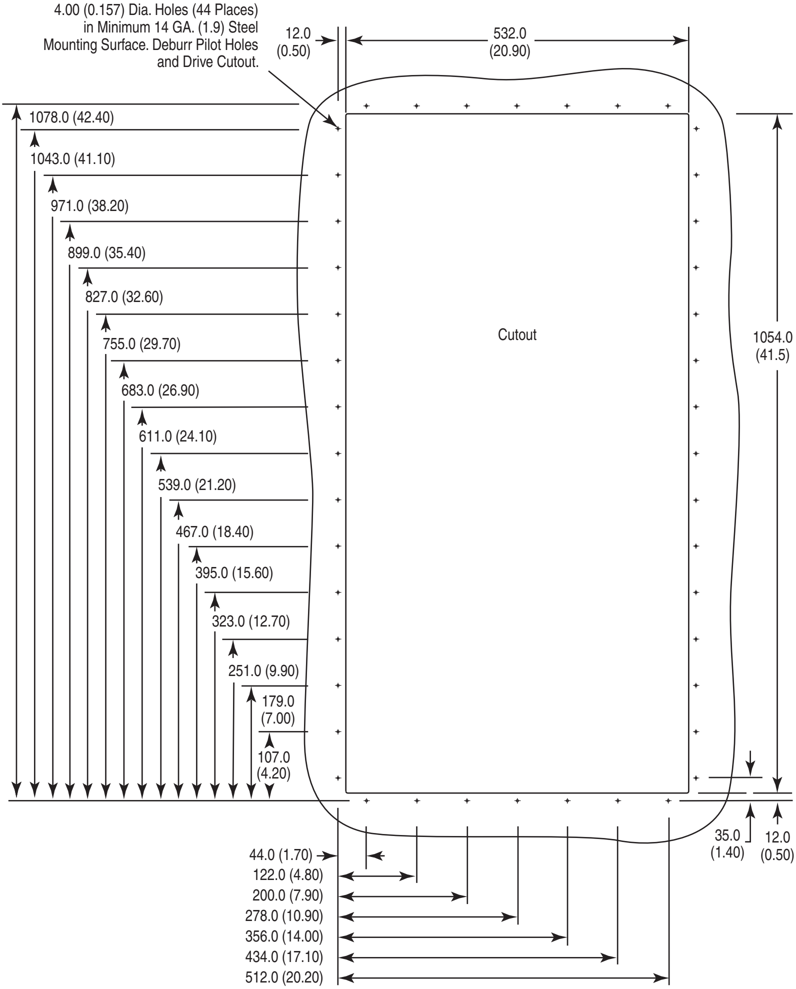


Dimensions are in millimeters and (inches)

Frame	**Description**	**Approx. Weight** [1] *kg (lbs.)*	
		Drive	**Drive & Packaging**
6	Flange Mount	99.79 (220.0)	119.75 (264.0)

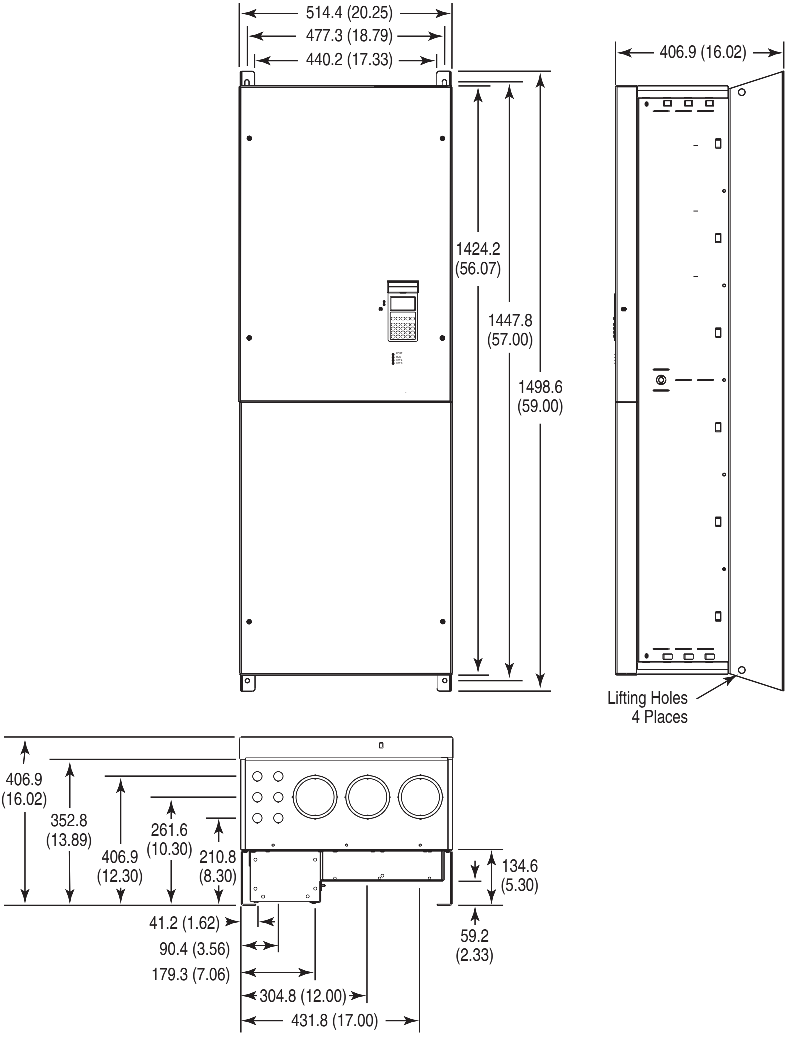
(1) Weights include HIM and Standard I/O.

Figure A.13 Frame 6 Flange Mount Cutout



Dimensions are in millimeters and (inches)

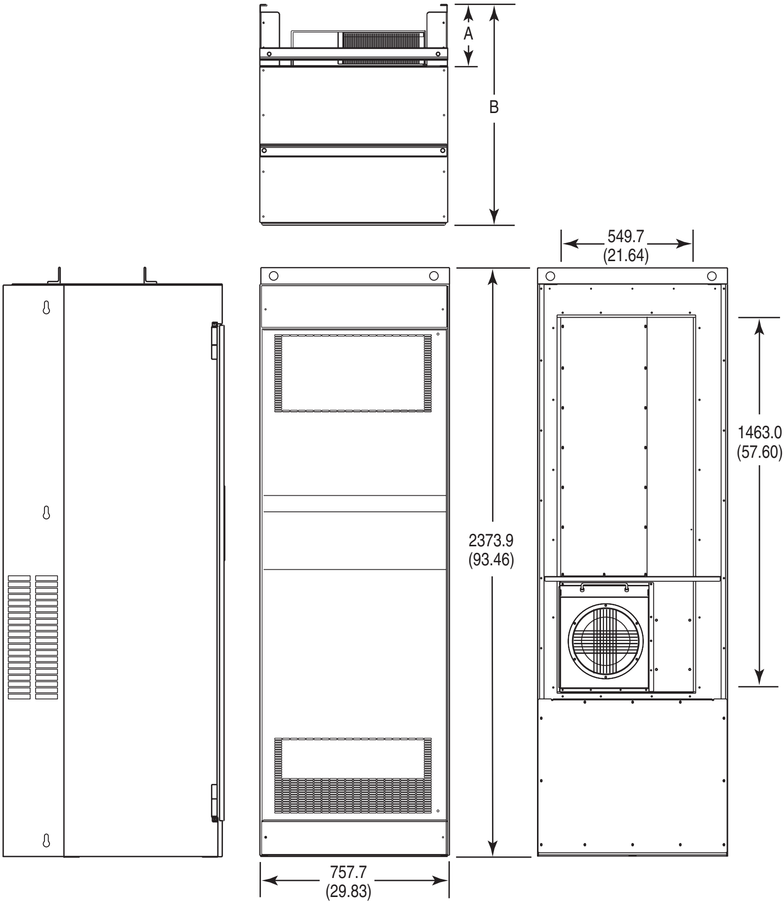
Figure A.14 IP20, NEMA/UL Type 1 – Frame 7



Dimensions are in millimeters and (inches)

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

Figure A.15 IP20, NEMA/UL Type 1 – Frames 8 & 9



Depth

Drive Catalog No.	**A** *(Behind Backplane)*	**B** *(Total Depth)*
20Bx365, 415, 481	254.0 (10.00)	889.0 (35.00)
20Bx535, 600, 730	381.0 (15.00)	1016.0 (40.00)

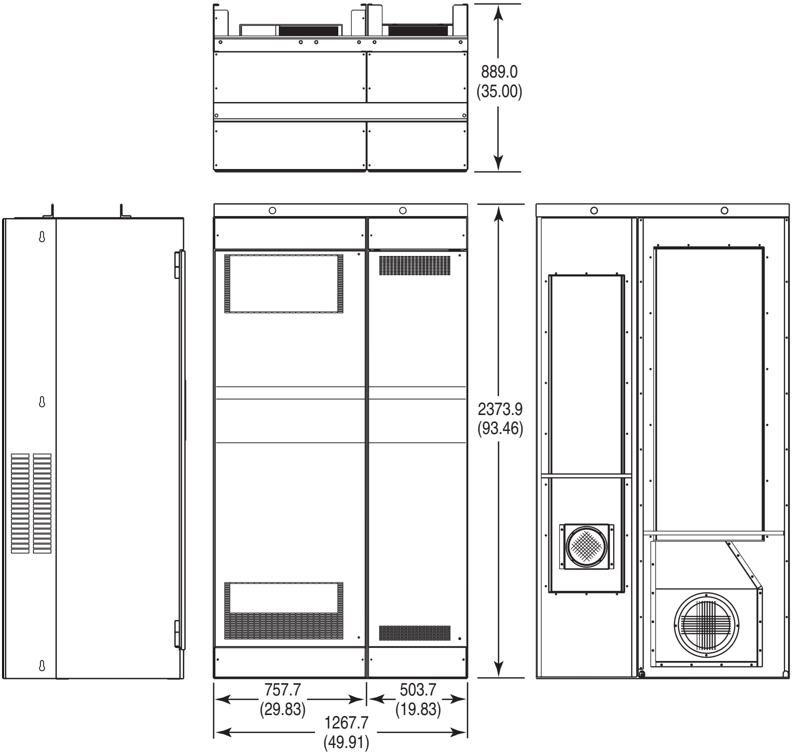
Dimensions are in millimeters and (inches)

Approx. Weight *kg (lbs.)*

Frame	**Drive**	**Drive & Packaging**
8	509 (1122)	556 (1225)
9	526 (1159)	603 (1262)

Figure A.16 IP20, NEMA/UL Type 1 – Frame 10

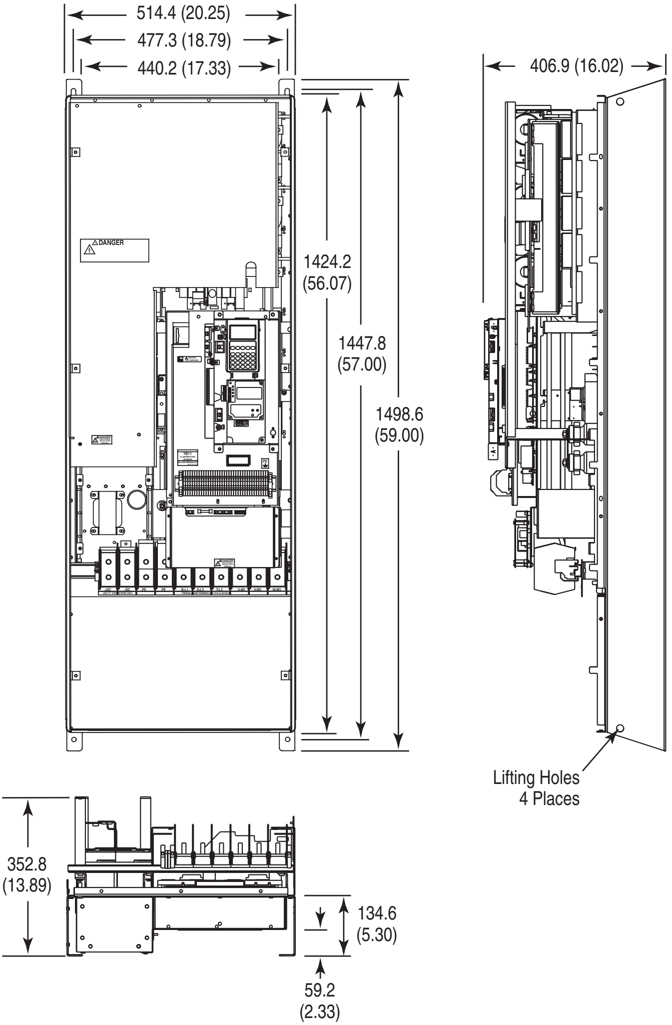
AC Input Shown, for DC Input Dimensions use the Inverter (Left) Bay



Dimensions are in millimeters and (inches)

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

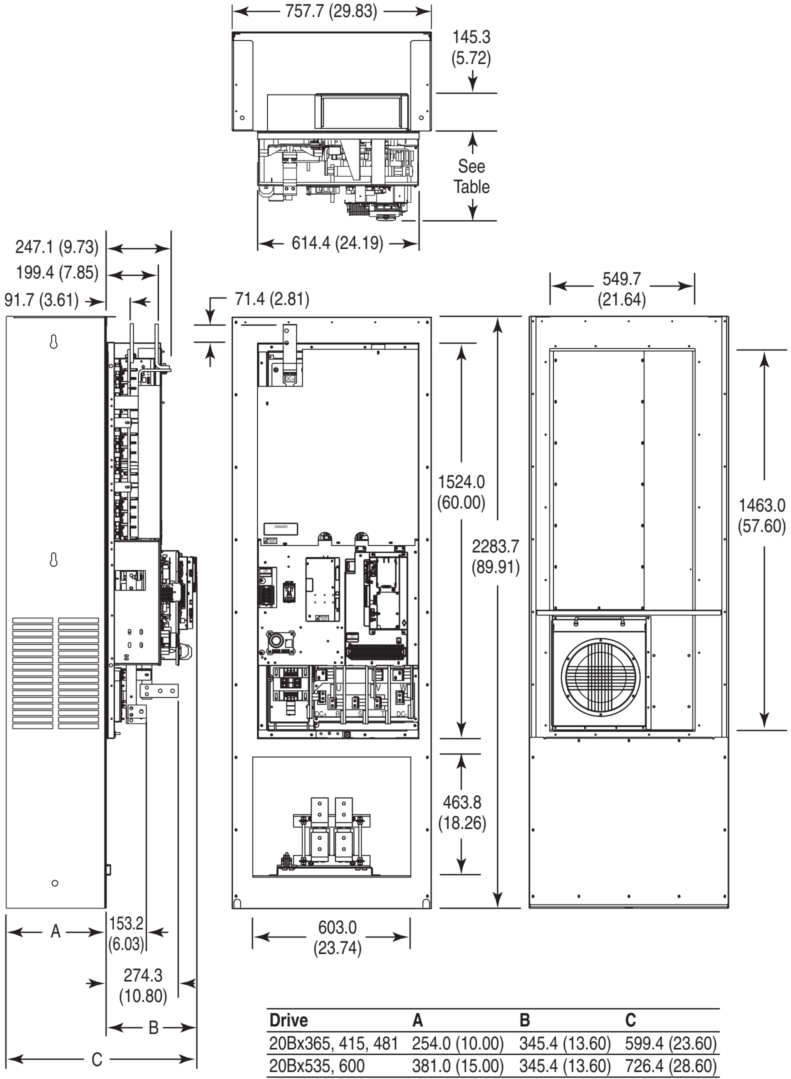
Figure A.17 IP00, NEMA/UL Type Open – Frame 7



Dimensions are in millimeters and (inches)

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

Figure A.18 IP00, NEMA/UL Type Open – Frames 8 & 9



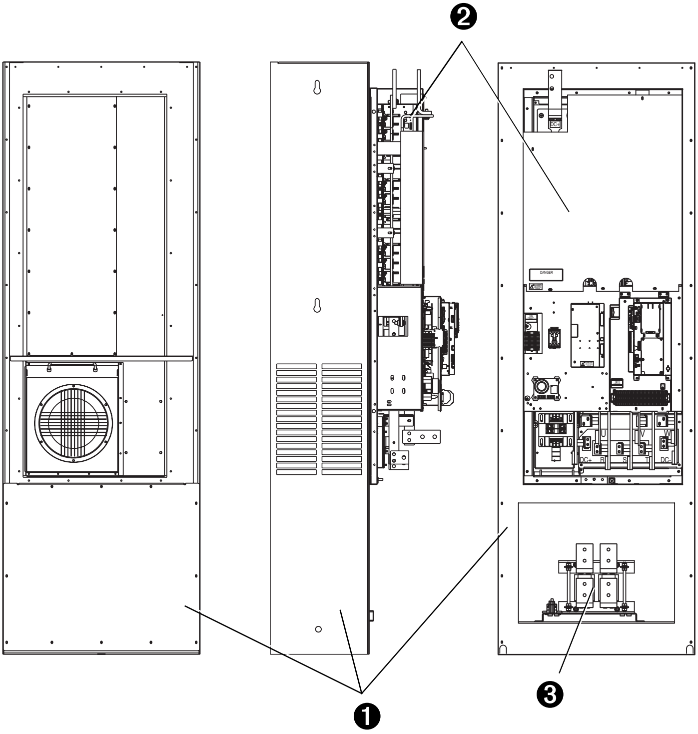
Drive	A	B	C
20Bx365, 415, 481	254.0 (10.00)	345.4 (13.60)	599.4 (23.60)
20Bx535, 600	381.0 (15.00)	345.4 (13.60)	726.4 (28.60)
20Bx730	381.0 (15.00)	400.8 (15.78)	781.8 (30.78)

Dimensions are in millimeters and (inches)

Approx. Weight *kg (lbs.)*

Frame	Drive	Drive & Packaging
8	384 (847)	431 (950)
9	401 (884)	448 (987)

Figure A.19 Converting an IP00 Drive for Flange Mounting – Frames 8 & 9



No.	Component
❶	Remove these IP00 enclosure components.
❷	Drive assembly to be flange mounted.
❸	DC link choke - mounts separately in enclosure (see page A-45 for dimensions) and is wired directly to drive.

Figure A.20 DC Link Choke – Frame 8

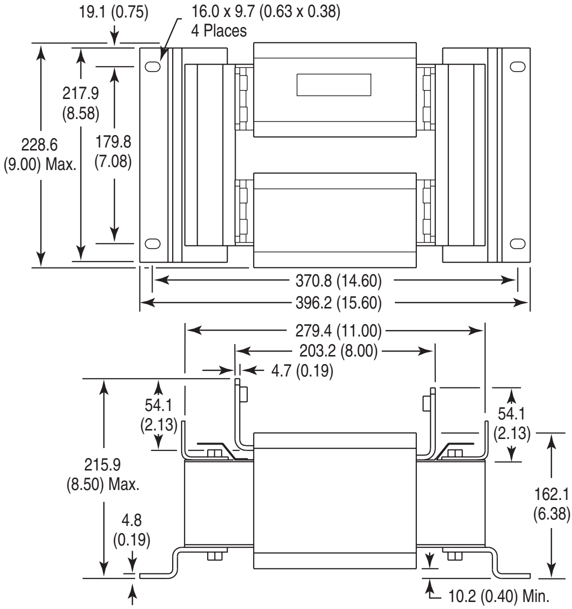
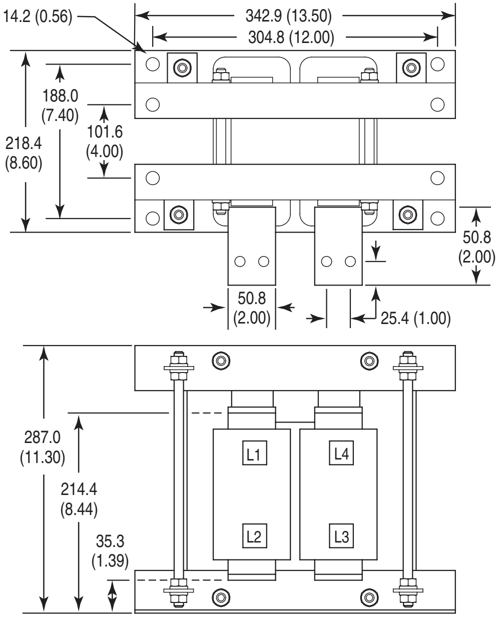


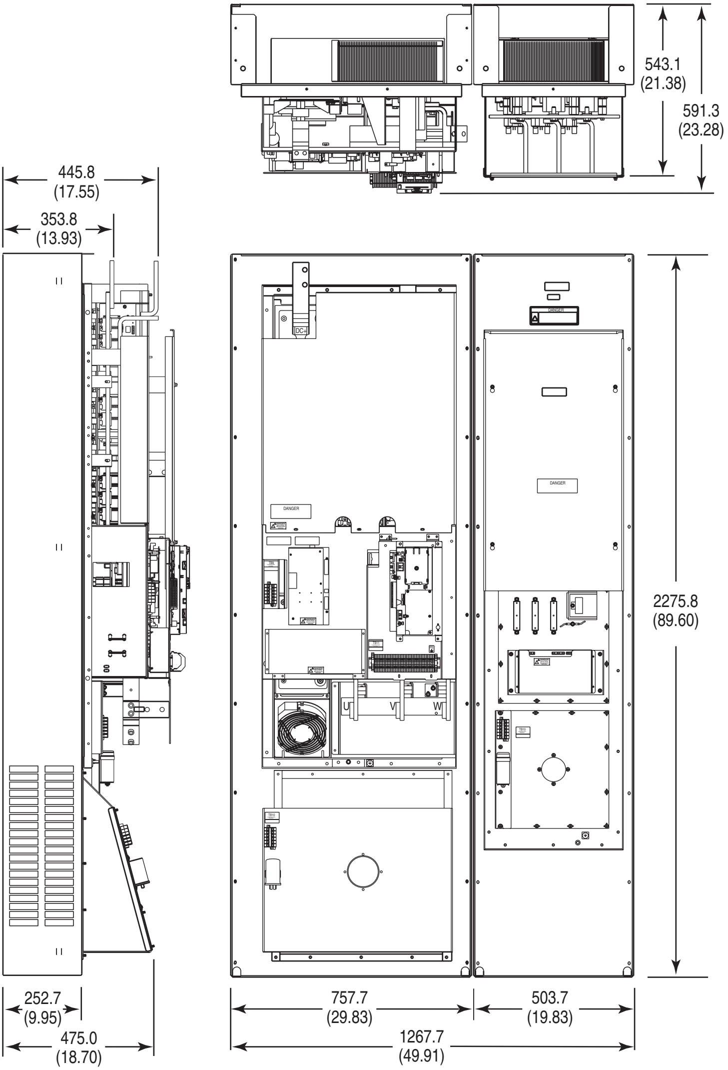
Figure A.21 DC Link Choke – Frame 9



Dimensions are in millimeters and (inches)

Figure A.22 IP00, NEMA/UL Type Open – Frame 10

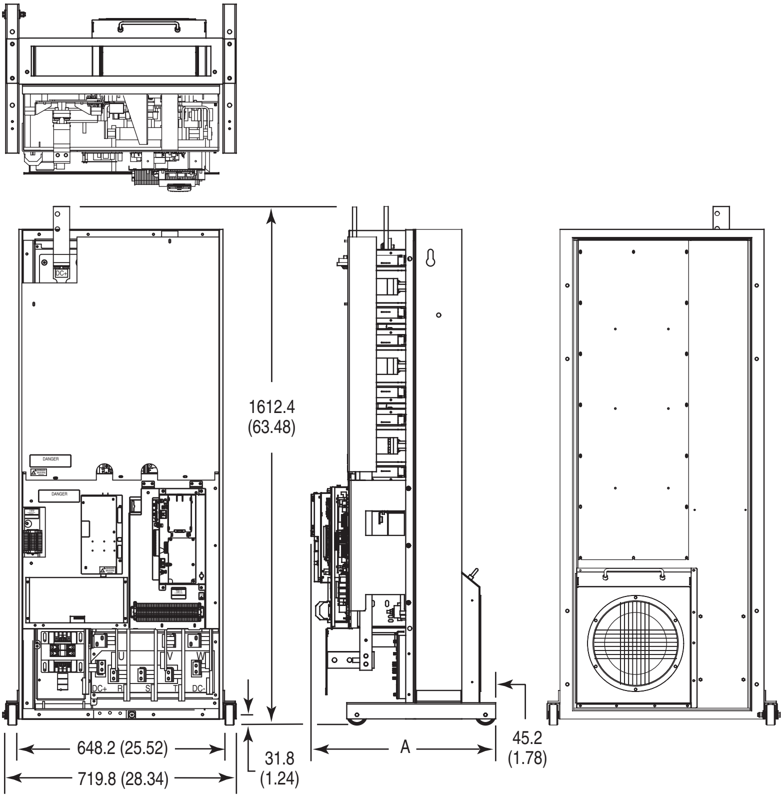
AC Input Shown, for DC Input Dimensions use the Inverter (Left) Bay



Dimensions are in millimeters and (inches)

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

Figure A.23 IP00, NEMA/UL Type Open – Frame 8 & 9 Roll-In

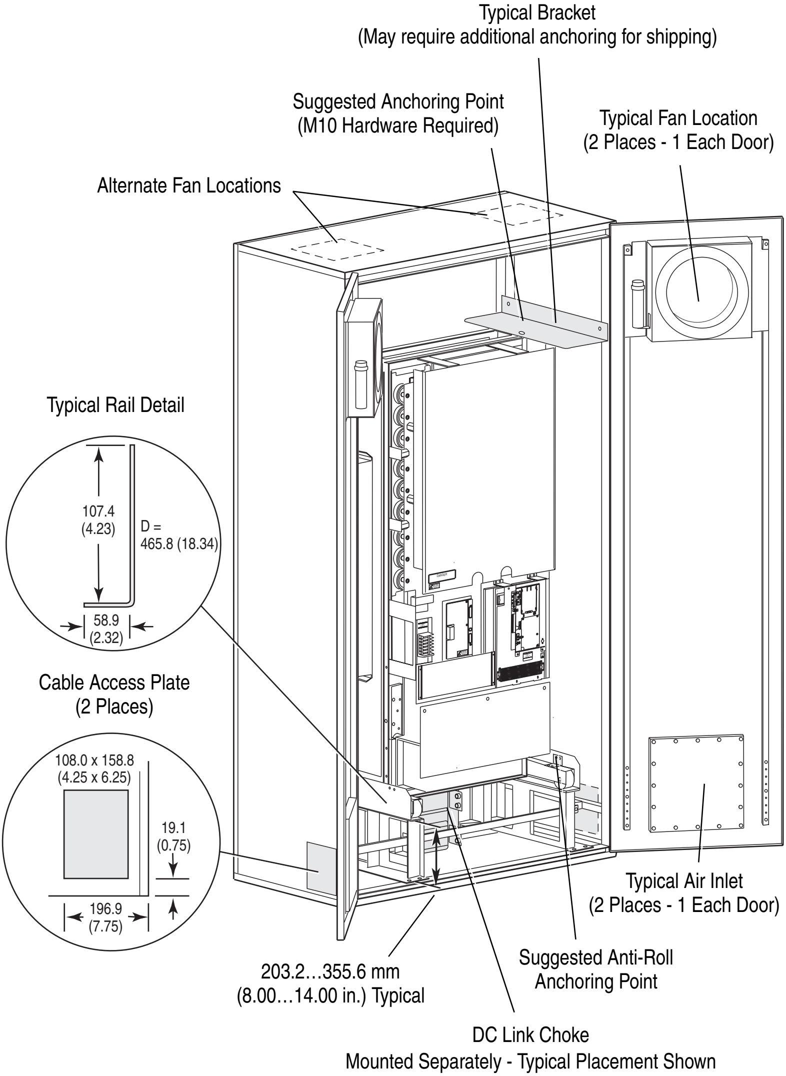


Drive	A
20Bx365, 415, 481	574.8 (22.63)
20Bx535, 600	574.8 (22.63)
20Bx730	630.2 (24.81)

Dimensions are in millimeters and (inches)

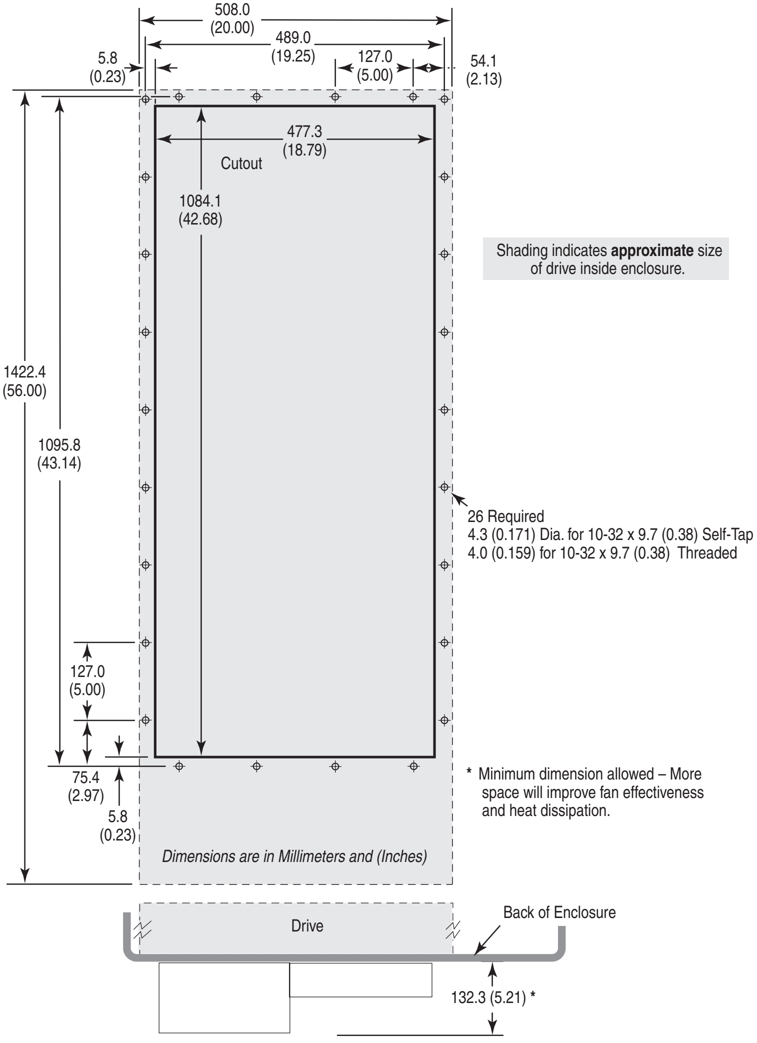
Approx. Weight *kg (lbs.)*		
Frame	**Drive**	**Drive & Packaging**
8	250 (552)	297 (655)
9	267 (589)	314 (692)

Figure A.24 Frame 8 & 9 Roll-In Mounting Considerations



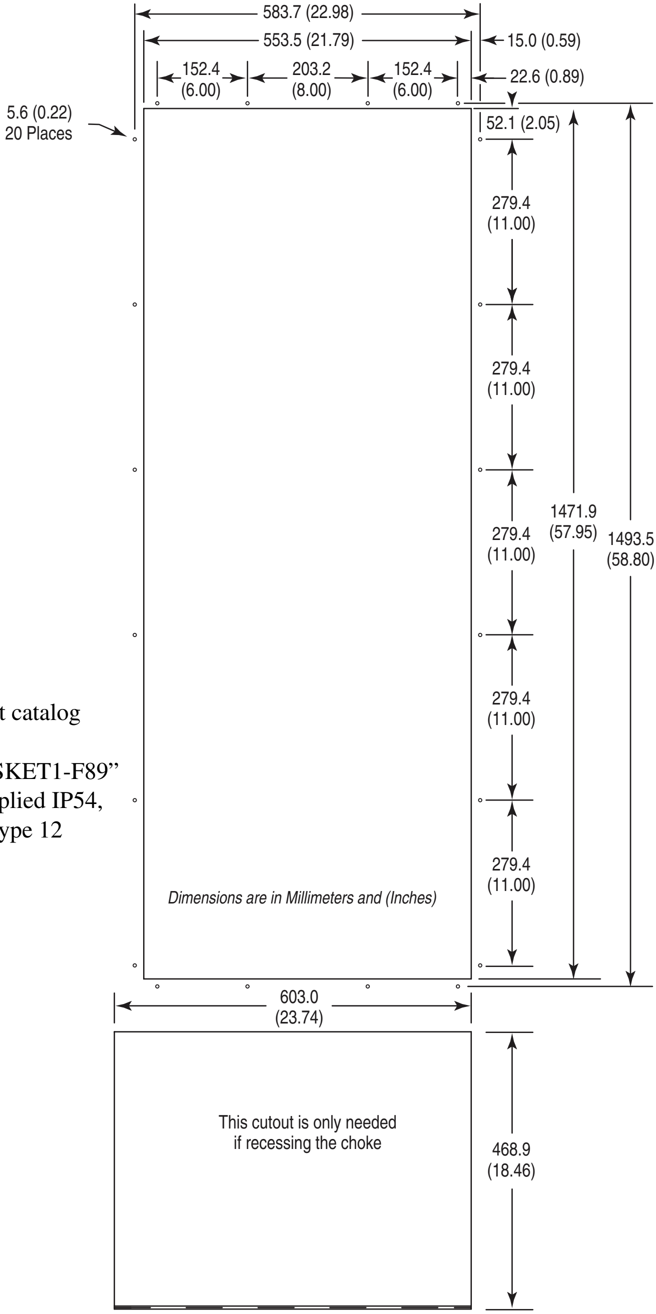
Important: This information illustrates how an open roll-in style drive could be mounted in a user supplied enclosure. Illustrations are only intended to identify structural mounting points and hardware shapes. You must design and fabricate steel components based on the actual mounting configuration,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

Figure A.25 Frame 7 Flange Mount Cutout



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

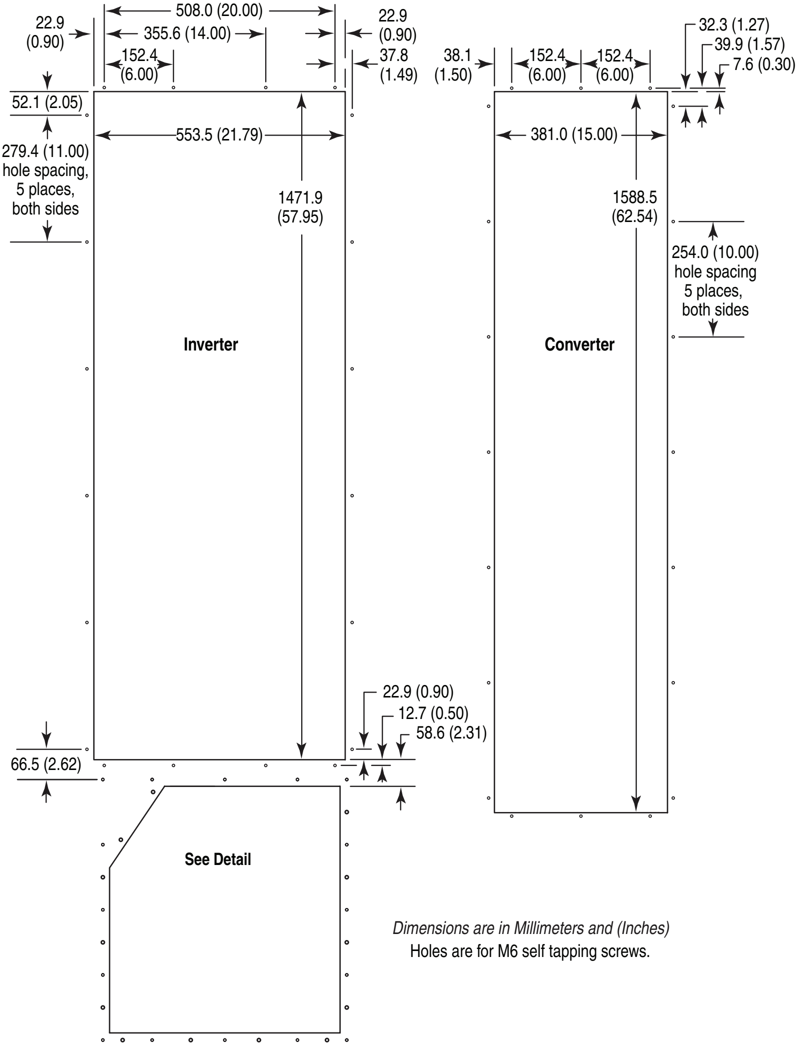
Figure A.26 Frame 8 & 9 Flange Mount Cutout



Important:

Use gasket kit catalog number "SK-G1-GASKET1-F89" with user supplied IP54, NEMA/UL Type 12 enclosure.

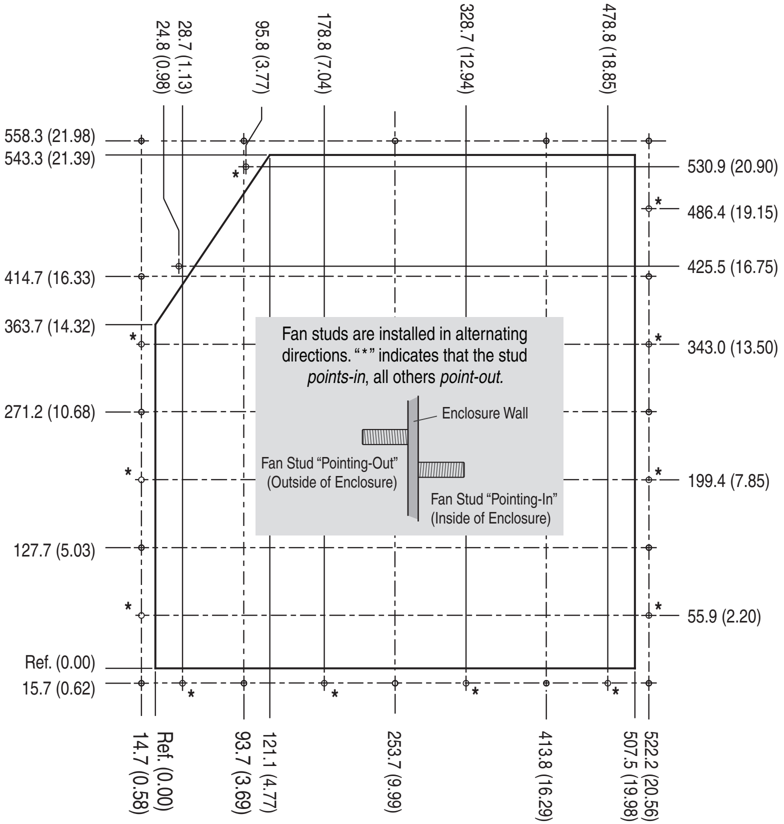
Figure A.27 Frame 10 Flange Mount Cutout



Dimensions are in Millimeters and (Inches)
Holes are for M6 self tapping screws.

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

Figure A.28 Frame 10 Flange Mount Cutout Detail



Dimensions are in millimeters and (inches)

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

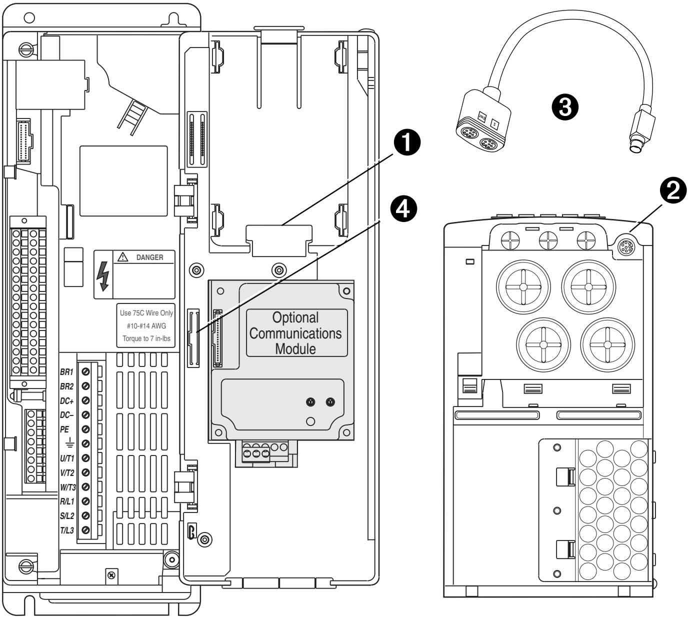
Appendix B

HIM Overview

External & Internal Connections

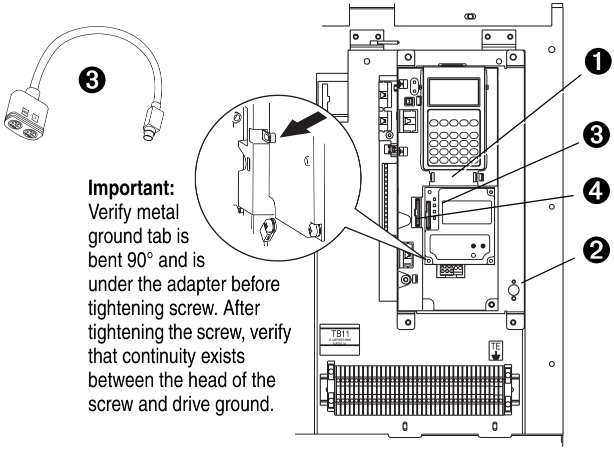
The PowerFlex 700 provides a number of cable connection points.

Figure B.1 Port Locations - Frames 0…6 (0 Frame shown).



No.	Connector	Description
❶	DPI Port 1	HIM connection when installed in cover.
❷	DPI Port 2	Cable connection for handheld and remote options.
❸	DPI Port 3 or 2	Splitter cable connected to DPI Port 2 provides additional port.
❹	DPI Port 5	Cable connection for communications adapter.

Figure B.2 Port Locations - Frames 7…10



Important: Verify metal ground tab is bent 90° and is under the adapter before tightening screw. After tightening the screw, verify that continuity exists between the head of the screw and drive ground.

No.	Connector	Description
❶	DPI Port 1	HIM connection.
❷	DPI Port 2	Cable connection for handheld and remote options. Located on side of chassis for Frame 7 IP20, NEMA/UL Type 1.
❸	DPI Port 3 or 2	Splitter cable connected to DPI Port 2 provides additional port.
❹	DPI Port 5	Cable connection for communications adapter.

LCD Display Elements

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

The top line of the HIM display can be configured with [DPI Fdbk Select], parameter 299.

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:

Table B.A ALT Key Functions

ALT Key and then ...			Performs this function ...
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen.
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	▲	Lang	Displays the language selection screen.
	▼	Auto / Man	Switches between Auto and Manual Modes.
	↵	Remove	Allows HIM removal without causing a fault if the HIM is not the last controlling device and does not have Manual control of the drive.
	+/–	Param #	Allows entry of a parameter number for viewing/ editing.

Removing/Installing the HIM

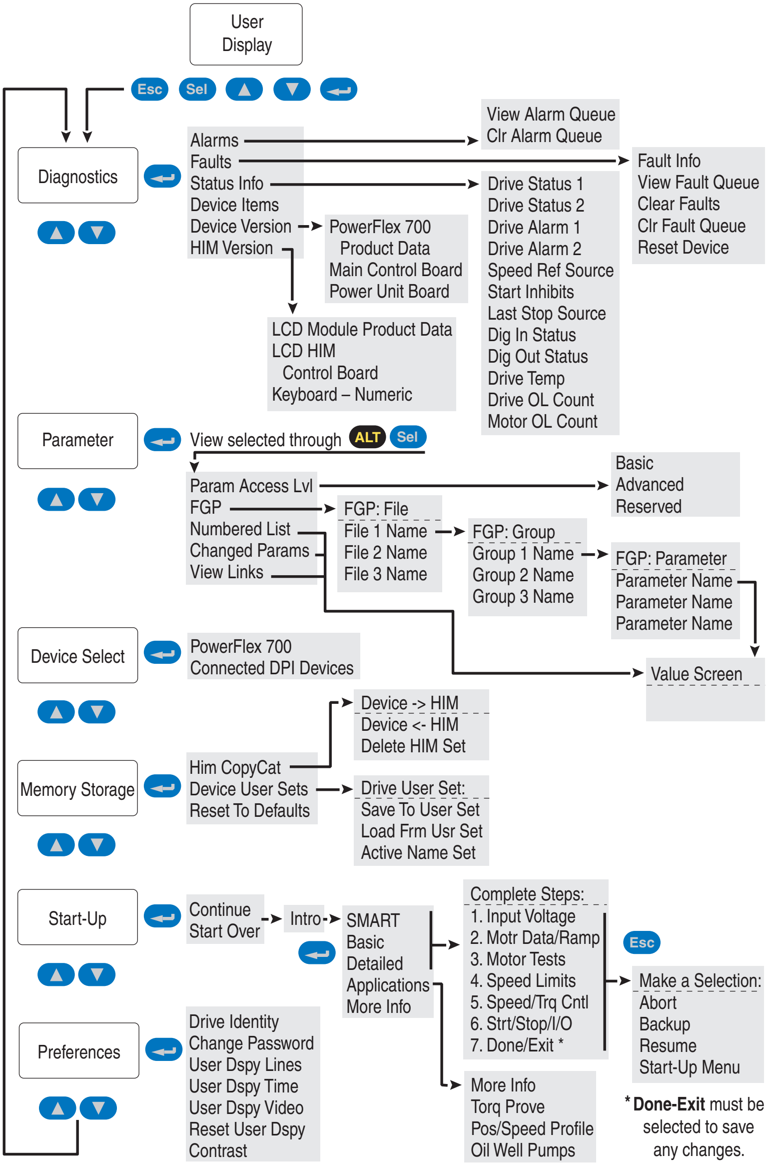
The HIM can be removed or installed while the drive is powered.

Important: HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault will occur.

Step	Key(s)	Example Displays
To remove the HIM . . .		
1. Press ALT and then Enter (Remove). The Remove HIM confirmation screen appears.	ALT + ↵	Remove Op Intrfc: Press Enter to Disconnect Op Intrfc? (Port 1 Control)
2. Press Enter to confirm that you want to remove the HIM.		
3. Remove the HIM from the drive.		
To install HIM . . .		
1. Insert into drive or connect cable.		

Menu Structure

Figure B.3 HIM Menu Structure



Press ▲ ▼ *to move between menu items*

Press ↵ *to select a menu item*

Press Esc *to move 1 level back in the menu structure*

Press ALT Sel *to select how to view parameters*

Diagnostics Menu

When a fault trips the drive, use this menu to access detailed data about the drive.

Option	**Description**
Alarms	View alarm queue and clear alarms.
Faults	View fault queue or fault information, clear faults or reset drive.
Status Info	View parameters that display status information about the drive.
Device Version	View the firmware version and hardware series of components.
HIM Version	View the firmware version and hardware series of the HIM.

Parameter Menu

Refer to Viewing and Editing Parameters on page B-6.

The drive is initially set to Basic Parameter View. To view all parameters, set parameter 196 [Param Access Lvl] to option 1 "Advanced." To view Engineering parameters (refer to the *PowerFlex Reference Manual*, publication PFLEX-RM002 for details) select option 2 "Reserved." Parameter 196 is not affected by the Reset to Defaults.

Option	**Description**
Changed	Parameters changed for default.

Device Select Menu

Use this menu to access parameters in connected peripheral devices.

Memory Storage Menu

Drive data can be saved to, or recalled from, User and HIM sets.
User sets are files stored in permanent nonvolatile drive memory.
HIM sets are files stored in permanent nonvolatile HIM memory.

Option	**Description**
HIM Copycat Device -> HIM Device <- HIM	Save data to a HIM set, load data from a HIM set to active drive memory or delete a HIM set.
Device User Sets	Save data to a User set, load data from a User set to active drive memory or name a User set.
Reset To Defaults	Restore the drive to its factory-default settings.

Start Up Menu

See Chapter 2.

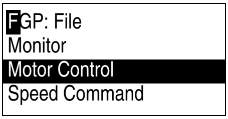
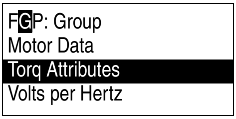
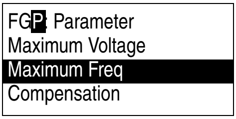
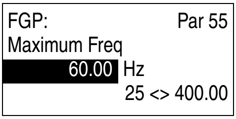
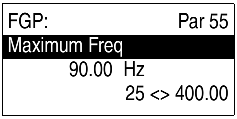
Preferences Menu

The HIM and drive have features that you can customize.

Option	Description
Drive Identity	Add text to identify the drive.
Change Password	Enable/disable or modify the password.
User Dspy Lines	Select the display, parameter, scale and text for the User Display. The User Display is two lines of user-defined data that appears when the HIM is not being used for programming.
User Dspy Time	Set the wait time for the User Display or enable/disable it.
User Dspy Video	Select Reverse or Normal for the Frequency and User Display lines.
Reset User Dspy	Return all the options for the User Display to factory default values.

Viewing and Editing Parameters

LCD HIM

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to "Parameter."	▲ or ▼	
2. Press Enter. "FGP File" appears on the top line and the first three files appear below it.	↵	 FGP: File Monitor Motor Control Speed Command
3. Press the Up Arrow or Down Arrow to scroll through the files.	▲ or ▼	
4. Press Enter to select a file. The groups in the file are displayed under it.	↵	 FGP: Group Motor Data Torq Attributes Volts per Hertz
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		 FGP: Parameter Maximum Voltage Maximum Freq Compensation
6. Press Enter to edit the parameter.	↵	
7. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit, letter to letter, or bit to bit. The digit or bit that you can change will be highlighted.	▲ or ▼ Sel	 FGP: Par 55 Maximum Freq 60.00 Hz 25 <> 400.00
8. Press Enter to save the value. If you want to cancel a change, press Esc.	↵	 FGP: Par 55 Maximum Freq 90.00 Hz 25 <> 400.00
9. Press the Up Arrow or Down Arrow to scroll through the parameters in the group, or press Esc to return to the group list.	▲ or ▼ Esc	

Numeric Keypad Shortcut

If using a HIM with a numeric keypad, press the ALT key and the +/– key to access the parameter by typing its number.

Linking Parameters

Most parameter values are entered directly by the user. However, certain parameters can be "linked," so the value of one parameter becomes the value of another. For Example: the value of an analog input can be linked to [Accel Time 2]. Rather than entering an acceleration time directly (via HIM), the link allows the value to change by varying the analog signal. This can provide additional flexibility for advanced applications.

Each link has 2 components:

- Source parameter – sender of information.
- Destination parameter – receiver of information.

Most parameters can be a source of data for a link, except parameter values that contain an integer representing an ENUM (text choice). These are not allowed, since the integer is not actual data (it represents a value). Table B.B lists the parameters that can be destinations. All links must be established between equal data types (parameter value formatted in floating point can only source data to a destination parameter value that is also floating point). A maximum of ten links is allowed.

Establishing A Link

Step	Key(s)	Example Displays
1. Select a valid destination parameter (see Table B.B) to be linked (refer to page B-6). The parameter value screen will appear.		FGP: Parameter Accel Time 1 Accel Time 2 Decel Time 1
2. Press Enter to edit the parameter. The cursor will move to the value line.	↵	Min: 0.1 Secs Max: 3600.0 Secs Dflt: 10.0 Secs Present Value
3. Press ALT and then View (Sel). Next, press the Up or Down Arrow to change "Present Value" to "Define Link." Press Enter.	ALT + Sel ▲ or ▼ ↵	· · · Define Link
4. Enter the Source Parameter Number and press Enter. The linked parameter can now be viewed two different ways by repeating steps 1-4 and selecting "Present Value" or "Define Link." If an attempt is made to edit the value of a linked parameter, "Parameter is Linked!" will be displayed, indicating that the value is coming from a source parameter and can not be edited.	↵	Parameter: #141 Accel Time 2 Link: 017 Analog In1 Value
5. To remove a link, repeat steps 1-5 and change the source parameter number to zero (0).		
6. Press Esc to return to the group list.	Esc	

Table B.B Linkable Parameters

No.	Parameter
54	Maximum Voltage
58	Flux Up Time
59	SV Boost Filter
66	Autotune Torque
69	Start/Acc Boost
70	Run Boost
71	Break Voltage
72	Break Frequency
84-86	Skip Frequency X
87	Skip Freq Band
91	Speed Ref A Hi
92	Speed Ref A Lo
94	Speed Ref B Hi
95	Speed Ref B Lo
97	TB Man Ref Hi
98	TB Man Ref Lo
100	Jog Speed 1
101-107	Preset Speed X
108	Jog Speed 2
116	Trim % Setpoint
119	Trim Hi
120	Trim Lo
121	Slip RPM @ FLA
122	Slip Comp Gain
127	PI Setpoint
129	PI Integral Time
130	PI Prop Gain
131	PI Lower Limit
132	PI Upper Limit
133	PI Preload
139	PI BW Filter
140-142	Accel Time X
141-143	Accel Time X
146	S Curve %
148	Current Lmt Val
149	Current Lmt Gain
151	PWM Frequency
152	Droop RPM @ FLA
153	Regen Power Lim
154	Current Rate Lim
158	DC Brake Level
159	DC Brake Time
160	Bus Reg Ki
164	Bus Reg Kp
165	Bus Reg Kd
167	Powerup Delay
170	Flying StartGain
175	Auto Rstrt Delay
177	Gnd Warn Level
180	Wake Level
181	Wake Time
182	Sleep Level
183	Sleep Time
185	Power Loss Time
186	Power Loss Level
187	Load Loss Level
188	Load Loss Time
189	Shear Pin Time
195	MOP Rate
308	HighRes Ref
322-325	Analog In X Hi
323-326	Analog In X Lo
343-345	Analog OutX Hi
344-346	Analog OutX Lo
354-355	Anlg OutX Scale
377-358	Anlg OutX Setpt
381-389	Dig OutX Level
382-390	Dig OutX OnTime
383-391	Dig OutX OffTime
419	Notch FilterFreq
420	Notch Filter K
428	Torque Ref A Hi
429	Torque Ref A Lo
430	Torq Ref A Div
432	Torque Ref B Hi
433	Torque Ref B Lo
434	Torq Ref B Mult
435	Torque Setpoint1
436	Pos Torque Limit
437	Neg Torque Limit
438	Torque Setpoint2
445	Ki Speed Loop
446	Kp Speed Loop
447	Kf Speed Loop
448	Spd Err Filt BW
449	Speed Desired BW
450	Total Inertia
459	PI Deriv Time
460	PI Reference Hi
461	PI Reference Lo
462	PI Feedback Hi
463	PI Feedback Lo
464	PI Output Gain
494	ScaleX In Value
495	ScaleX In Hi
496	ScaleX In Lo
497	ScaleX Out Hi
498	ScaleX Out Lo
602	Spd Dev Band
603	SpdBand Integrat
604	Brk Release Time
605	ZeroSpdFloatTime
606	Float Tolerance
607	Brk Set Time
608	TorqLim SlewRate
609	Brk Slip Count
610	Brk Alarm Travel
611	MicroPos Scale%
613	Brake Test Torq
632	TorqAlarm Level
634	TorqAlarm Dwell
635	TorqAlrm Timeout
637	PCP Pump Sheave
638	Max Rod Torque
639	Min Rod Speed
640	Max Rod Speed
642	Gearbox Rating
643	Gearbox Sheave
644	Gearbox Ratio
645	Motor Sheave
647	DB Resistor
648	Gearbox Limit
652	Adj Volt Ref Hi
653	Adj Volt Ref Lo
654-660	Adj Volt PresetX
661	Min Adj Voltage
663	MOP Adj VoltRate
670	Adj Volt Trim Hi
671	Adj Volt Trim Lo
672	Adj Volt Trim %
675	Adj Volt AccTime
676	Adj Volt DecTime
677	Adj Volt S Curve
702	Home Position
707	Encoder Pos Tol
711	Vel Override
713	Find Home Speed
714	Find Home Ramp
718	Pos Reg Filter
719	Pos Reg Gain
721-871	Step X Velocity
722-872	Step X AccelTime
723-873	Step X DecelTime
724-874	Step X Value
725-875	Step X Dwell
726-876	Step X Batch
727-877	Step X Next

Appendix C

Application Notes

Adjustable Voltage Operation

In Adjustable Voltage control mode, the output voltage is controlled independently from the output frequency. The voltage and frequency components have independent references and acceleration/deceleration rates. Single-phase and three-phase output is possible with this feature. The Adjustable Voltage mode is designed to operate on electro-magnetic loads - not typical AC motors.

Typical applications include:

- Linear Motors
- Vibration Welding
- Vibratory conveying
- Electromagnetic Stirring
- Induction Heating (400 Hz or lower)
- Resistive Loads (dryers)
- Power Supplies

Enabling Adjustable Voltage

Adjustable Voltage is enabled in [Motor Cntl Sel], parameter 053 by selecting “5, Adj Voltage.” In this mode, current limit will now reduce voltage instead of frequency when the threshold is reached. Aggressive ramp rates on the voltage command should be avoided to minimize nuisance overcurrent trips.

Fixed Frequency Control Applications

Many of the applications require a fixed frequency operation with variable voltage levels. For these applications it is best to set the frequency ramp rates to “0” using [Accel Time 1 & 2] and [Decel Time 1 & 2], parameters 140-143. The ramp rates for output voltage are independently controlled with parameters [Adj Volt AccTime] and [Adj Volt DecTime], parameters 675-676.

Output Filters

Several adjustable voltage applications may require the use of output filters. Any L-C or sine wave filter used on the output side of the drive must be compatible with the desired frequency of operation, as well as the PWM voltage waveform developed by the inverter. The drive is capable of operating from 0-400 Hz output frequency and the PWM frequencies range from 2-10 kHz. When a filter is used on the output of the drive, [Drive OL Mode], parameter 150 should be programmed so that PWM frequency is not affected by an overload condition (i.e. “0, Disabled” or “1, Reduce CLim”).

Trim Function

The trim function can be used with the Adjustable Voltage mode. The value of the selection in [Adj Volt TrimSel], parameter 669 is summed with the value of [Adj Volt Select], parameter 651. Scaling of the trim function is controlled with [Adj Volt Trim%], parameter 672. When the sign of [Adj Volt Trim%] is negative, the value selected in [Adj Volt TrimSel] is subtracted from the reference.

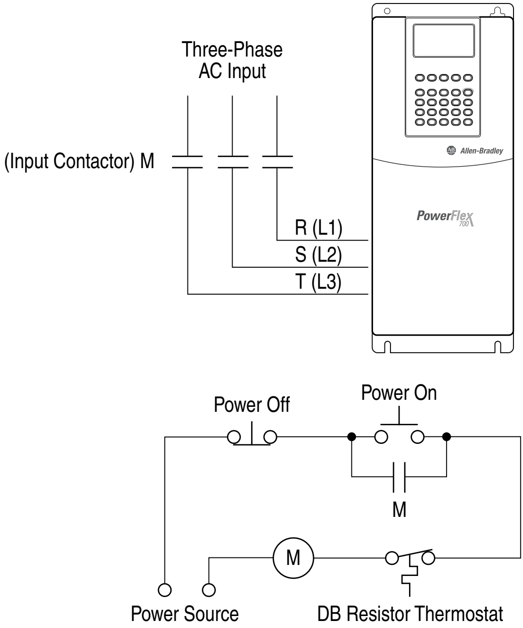
Process Control

The Process PI loop in the drive can be configured to regulate the frequency or voltage commands of the drive. Typical applications using the Adjustable Voltage mode will close the loop around the voltage command. Process PI is enabled by selecting “1, AdjVoltTrim” in bit 10 of [PI Configuration], parameter 124. This bit configures the PI regulator output to trim the voltage reference, rather than the torque or speed references. The trim can be configured to be exclusive by selecting “1, Excl Mode” in bit 0 of [PI Configuration], parameter 124. Trimming the voltage reference is not compatible with trimming the torque reference, thus if bits 10 and 8 of [PI Configuration] are set, a type II alarm will occur, setting bit 19 (PI Cfg Cflct) in [Drive Alarm 2], parameter 212.

External Brake Resistor

ATTENTION: The drive does not offer protection for externally mounted brake resistors. A risk of fire exists if external braking resistors are not protected. External resistor packages must be self-protected from over temperature or a circuit equivalent to the one shown below must be supplied.

Figure C.1 External Brake Resistor Circuitry



Lifting/Torque Proving

The TorqProve™ feature of the PowerFlex 700 is intended for applications where proper coordination between motor control and a mechanical brake is required. Prior to releasing a mechanical brake, the drive will check motor output phase continuity and verify proper motor control (torque proving). The drive will also verify that the mechanical brake has control of the load prior to releasing drive control (brake proving). After the drive sets the brake, motor movement is monitored to ensure the brakes ability to hold the load. TorqProve can be operated with an encoder or encoderless.

TorqProve functionality with an encoder includes:

- Torque Proving (includes flux up and last torque measurement)
- Brake Proving
- Brake Slip (feature slowly lowers load if brake slips/fails)
- Float Capability (ability to hold full torque at zero speed)
- Micro-Positioning
- Fast Stop
- Speed Deviation Fault, Output Phase Loss Fault, Encoder Loss Fault.

Encoderless TorqProve functionality includes:

- Torque Proving (includes flux up and last torque measurement)
- Brake Proving
- Micro-Positioning
- Fast Stop
- Speed Deviation Fault, Output Phase Loss Fault.

Important: Brake Slip detection and Float capability (ability to hold load at zero speed) are not available in encoderless TorqProve

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 600-612 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.

ATTENTION: User must read the following prior to the use of TorqProve with no encoder.

Encoderless TorqProve must be limited to lifting applications where personal safety is not a concern. Encoders offer additional protection and must be used where personal safety is a concern. Encoderless TorqProve cannot hold a load at zero speed without a mechanical brake and does not offer additional protection if the brake slips/fails. Loss of control in suspended load applications can cause personal injury and/or equipment damage.

It is the responsibility of the engineer and/or user to configure drive parameters, test any lifting functionality and meet safety requirements in accordance with all applicable codes and standards. If encoderless TorqProve is desired, the user must certify the safety of the application. To acknowledge that the end user has read this "Attention" and properly certified their encoderless application, bit 8 ("TPEncdless") of [Compensation], parameter 56 must be changed to a "1." This will disable Fault 28, "See Manual" and allow bit 1 of Parameter 600 to be changed to a "1" enabling encoderless TorqProve.

TorqProve Manual Start Up

It is possible to use the Assisted Start Up (see page 2-3) 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 steps 1 through 12 on the following pages.

ATTENTION: To guard against personal injury and/or equipment damage caused by unexpected brake release, verify the Digital Out 1 brake connections and/or programming. The **default** drive configuration energizes the Digital Out 1 relay when power is applied to the drive. The PowerFlex 700 drive **will not control the mechanical brake until TorqProve is enabled.** If the brake is connected to this relay, it could be released. If necessary, **disconnect the relay output until wiring/programming can be completed and verified.**

Initial Static Auto Tune Test

1. Set the following parameters as shown.

No.	Name	Value	Notes
380	[Digital Out1 Sel]	"9, At Speed"	keeps brake engaged during test
041-045	[Motor NP . . .]	per nameplate	enter motor nameplate data
053	[Motor Cntl Sel]	"4, FVC Vector"	
080	[Feedback Select]	"3, Encoder"	
061	[Autotune]	"1, Static Tune"	

2. Press the Start key on the HIM. Parameters 062-064 will be updated.

Motor Rotation/Encoder Direction Test

3. Set the following parameters as shown.

No.	Name	Value	Notes
053	[Motor Cntl Sel]	"0, Sensrls Vect"	
080	[Feedback Select]	"0, Open Loop"	
090	[Speed Ref A Sel]	"11, Preset Spd1"	
238	[Fault Config 1]	Bit 8, "In PhaseLoss" = 1 Bit 12, "OutPhaseLoss" = 1	
380	[Digital Out1 Sel]	"4, Run"	releases brake

Important: If the direction of travel is critical at this point, perform short jogs to determine which run direction (RUNFWD or RUNREV) should be used in the next steps.

4. Press Start and run the drive in the desired direction. Observe the direction of motor rotation.

   If rotation is not in the desired direction:
   - remove drive power and reverse the two motor leads, or . . .
   - set bit 5 of [Compensation], parameter 56 to "Mtr Lead Rev."

5. With the drive running, observe [Encoder Speed], parameter 415. If the sign of the encoder is not the same as the displayed frequency, remove drive power and reverse encoder leads A and A NOT.

6. With the drive running, verify correct motor rotation and encoder direction. Set [Motor Fdbk Type], parameter 412 to "1, Quad Check." Stop the drive.

Rotate AutoTune Test

ATTENTION: In this test the following conditions will occur:

- The motor will be run for 12 seconds at base frequency (60 Hz). Note that equipment travel during this 12 second interval may exceed equipment limits. However, travel distance can be reduced by setting [Maximum Speed], parameter 82 to a value less than 45 Hz (i.e. 22.5 Hz = 12 seconds at 30 Hz).
- The brake will be released without torque provided by the drive for 15 seconds.

To guard against personal injury and/or equipment damage, this test should not be performed if either of the above conditions are considered unacceptable by the user.

7. Set the following parameters as shown.

No.	Name	Value	Notes
053	[Motor Cntl Sel]	"4, FVC Vector"	
080	[Feedback Select]	"3, Encoder"	
061	[Autotune]	"2, Rotate Tune"	

8. Start the drive and run the motor in the desired direction. Parameters 062, 063, 064 & 121 will be updated.

Inertia AutoTune Test

9. Set [Inertia Autotune], parameter 067 to “1, Inertia Tune.”

10. Press Start and run the motor in the direction desired. Parameters 445, 446 and 450 will be updated.

11. Set [Speed Desired BW], parameter 449 to desired setting.

12. Set up is complete - check for proper operation.

Drive Setup

TorqProve with Encoder

To Enable TorqProve with an encoder, bit 0 of [TorqProve Cnfg], parameter 600 must be set to “1.” Once this is set, a Type 2 alarm will be active until the following settings are entered:

No.	Name	Value	Notes
053	[Motor Cntl Sel]	“4, FVC Vector”	
080	[Feedback Select]	“3, Encoder”	
412	[Motor Fdbk Type]	“1, Quad Check”	

Encoderless TorqProve

To Enable Encoderless TorqProve, both bits 0 and 1 of [TorqProve Cnfg], parameter 600 must be set to “1.” Once this is set, a Type 2 alarm will be active until the following settings are entered:

No.	Name	Value	Notes
053	[Motor Cntl Sel]	“4, FVC Vector” or “0, Sensrls Vect”	
080	[Feedback Select]	“1, Slip Comp”	

Encoderless Guidelines

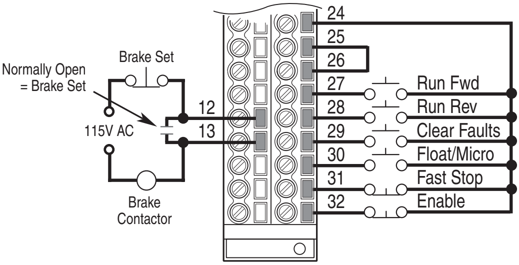
You can not hold zero speed in encoderless mode or operate near zero speed because of this, it is very important to set [Minimum Speed], parameter 81 to **two or three times the slip frequency** when in encoderless mode. (Example: A 1740 RPM motor has 2 Hz of slip. Set [Minimum Speed] to 4-6 Hz.)

Also set [Float Tolerance], parameter 606 to **one to three times the slip frequency** when in encoderless mode. You should also use fast accel and decel times (less than 2 seconds) when operating in encoderless mode.

Installation/Wiring

When [TorqProve Cnfg] is set to “Enable,” the Digital Out 1 relay is used to control the external brake contactor. The normally open (N.O.) contact, when closed, is intended to energize the contactor. This provides the mechanical brake with voltage, causing the brake to release. Any interruption of power to the contactor will set the mechanical brake. Programming [Digital Out1 Sel], parameter 380 will be ignored when [TorqProve Cnfg] is set to “Enable.”

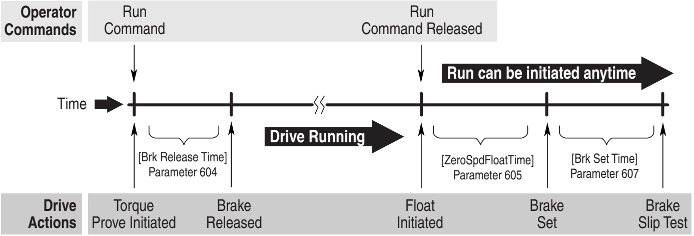
Figure C.2 Typical 24V Torque Proving Configuration



Lifting/Torque Proving Application Programming

The PowerFlex 700 lifting application is mainly influenced by parameters 600 through 611 in the Torque Proving group of the Application file. Figure C.3 and the paragraphs that follow describe programming.

Figure C.3 Torque Proving Flow Diagram



All times between Drive Actions are programmable and can be made very small
(i.e. Brake Release Time can be 0.1 seconds)

Torque Proving

When the drive receives a start command to begin a lifting operation, the following actions occur:

1. The drive first performs a transistor diagnostic test to check for phase-to-phase and phase-to-ground shorts. A failure status from either of these tests will result in a drive fault and the brake relay will NOT be energized (brake remains set).
2. The drive will then provide the motor with flux as well as perform a check for current flow through all three motor phases. This ensures that torque will be delivered to the load when the mechanical brake is released. When torque proving is enabled, open phase loss detection is performed regardless of the setting of Bit 12 of [Fault Config 1], parameter 238.
3. If the drive passes all tests, the brake will be released and the drive will take control of the load after the programmed time in [Brk Release Time], parameter 604 which is the typical mechanical release time of the brake.

Brake Proving

When the drive receives a stop command to end a lifting operation, the following actions occur:

1. The brake is commanded closed when the speed of the motor reaches zero.
2. After the time period programmed in [Brk Set Time], parameter 607, the drive will verify if the brake is capable of holding torque. It will do this by ramping the torque down at a rate set in [TorqLim SlewRate], parameter 608. Note that the drive can be started again at anytime without waiting for either of the above timers to finish.
3. While the torque is ramping down, the drive will perform a brake slip test. If movement exceeds the limit set in [BrkSlip Count], parameter 609, then an alarm is set (32, Brake Slipped) and the drive will start a brake slip procedure. The drive will allow the motor to travel the distance programmed [Brk Alarm Travel], parameter 610. Another slip test will be performed and will repeat continuously until; A) the load stops slipping, or B) the load reaches the ground. This feature keeps control of the load and returns it to the ground in a controlled manner in the event of a mechanical brake failure.

   Once a Brake Slipped alarm occurs, drive power must be cycled to clear the alarm and re-start the drive.

Speed Monitoring / Speed Band Limit

This routine is intended to fault the drive if the difference between the speed reference and the encoder feedback is larger than the value set in [Spd Dev Band], parameter 602 and the drive is NOT making any progress toward the reference. [SpdBand Integrat], parameter 603 sets the time that the speed difference can be greater than the deviation band before causing a fault and setting the brake.

Float

Float is defined as the condition when the drive is holding the load at zero hertz while holding off the mechanical brake. The float condition starts when the frequency drops below the speed set in [Float Tolerance], parameter 606. Float will stay active for a period of time set by [ZeroSpdFloatTime], parameter 605. If a digital input (parameters 361-366) is set to “Micro Pos” (also Float) and it is closed, the Float condition will stay active and will disregard the timer. This signal is also available through a communication device, see [TorqProve Setup], parameter 601.

When encoderless TorqProve is enabled, the drive cannot hold the load at zero speed. Parameter 606 [Float Tolerance] will then define the speed at which the brake is set.

Micro Position

Micro Position refers to rescaling of the commanded frequency by a percentage entered in [MicroPos Scale %], parameter 611. This allows for slower operation of a lift which provides an operator with better resolution when positioning a load. Micro Position is activated only when the drive is running at or near zero speed. This can be initiated by a digital input configured as Micro Pos or through a communication device ([TorqProve Setup]) which is the same digital input which signals the float condition. To allow the Micro Position digital input to change the speed command while the drive is running, enter a “1” in Parameter 600, Bit 2 “MicroPosSel.” A “0” will require drive to reach zero speed for micro position speed to become active.

Fast Stop

Fast Stop is intended to stop the load as fast as possible then set the mechanical brake. The Fast Stop can be initiated from a digital input or through a communication device through [TorqProve Setup]. The difference from a normal stop is that the decel time is forced to be 0.1 seconds. When the Torque Proving function is enabled, the Float time is ignored at the end of the ramp. This feature can be used without enabling the Torque Proving function.

Limit Switches for Digital Inputs

The PowerFlex 700 includes digital input selections for decel and end limit switches. These can be used for applications that use limit switches for decelerating near the end of travel and then stopping at the end position. The end limit switch can also be used for end limit stops as many hoists require. These inputs can be used with or without TorqProve enabled.

Decel Limit for Digital Inputs

Decel Limit is enabled by selecting "Decel Limit" as one of the digital inputs in [Digital In1-6 Select], parameters 361-366. When this input is "low" (opposite logic), the speed reference command will change from the selected reference to the value in [Preset Speed 1], parameter 101. The deceleration rate will be based on the active deceleration time. This limit will be enforced only in the direction the drive was running when the switch was activated (momentarily or continuously, see "B" in Figure C.4). The opposite direction will still be allowed to run at the selected reference speed. No speed limitation will occur between the limit switches ("A" in Figure C.4).

Two different switches can be connected in series to one digital input to provide a decel limit at both ends of the application (i.e. lift, conveyor, etc.). With proper set up, the drive will automatically apply the speed reduction based on the direction of the load even though only one digital input is being used. See "B" in Figure C.4.

End Travel Limit for Digital Inputs

End Travel Limit is enabled by selecting "End Limit" as one of the digital inputs in [Digital In1-6 Select]. A "low" at this input (opposite logic) will cause the drive to do a fast decel (0.1 sec) and turn off. This Stop limit will be enforced only in the direction the drive was running when the switch was activated (momentarily or continuously, see "C" in Figure C.4).

A Start command in the same direction will only allow 0 Hz to be commanded. A Start in the opposite direction will allow motion with a speed command from the selected speed reference. If TorqProve is Enabled, the drive will hold zero speed for a time determined by [ZeroSpdFloat Time], parameter 605.

Two different input switches can be connected in series to one digital input to provide an end limit at both ends of the application (e.g. lift, conveyor, etc.). With proper set up, the drive will automatically apply the proper stopping based on the direction of the load even though only one digital input is being used.

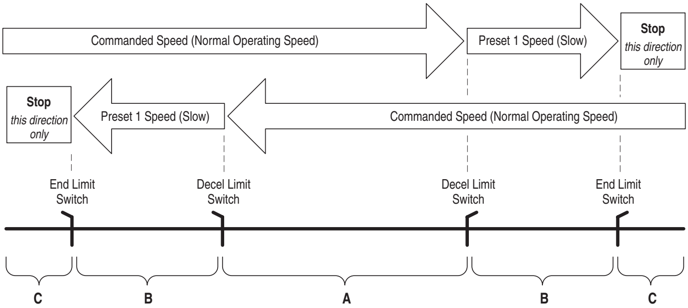
Limit Switch Set up

1. Move the load to a position between the two decel switches ("A" in Figure C.4).
2. Select the switches in [Digital In1-6 Select]. If switches are only used on one end of travel, simply keep the load off of both switches when selecting in [Digital In1-6 Select].

If the set up is done incorrectly, the application will not move or will move at an incorrect (slower) speed. This can be corrected by selecting "Not Used" for both limit switches in [Digital In1-6 Select]. Then, move the load between the Decel Switches and select the limit switches again in [Digital In1-6 Select].

Important: When properly set up, the drive will remember its location during power cycles (or power loss) unless the load is manually moved during power down conditions. If this occurs, simply reset the feature using the procedure above.

Figure C.4 Limit Switch Operation



Minimum Speed

Refer to Reverse Speed Limit on page C-32.

Motor Control Technology

Within the PowerFlex family there are several motor control technologies:

- Torque Producers
- Torque Controllers
- Speed Regulators

Torque Producers

Volts/Hertz

This technology follows a specific pattern of voltage and frequency output to the motor, regardless of the motor being used. The shape of the V/Hz curve can be controlled a limited amount, but once the shape is determined, the drive output is fixed to those values. Given the fixed values, each motor will react based on its own speed/torque characteristics.

This technology is good for basic centrifugal fan/pump operation and for most multi-motor applications. Torque production is generally good.

Sensorless Vector

This technology combines the basic Volts/Hertz concept with known motor parameters such as Rated FLA, Hp, Voltage, stator resistance and flux producing current. Knowledge of the individual motor attached to the drive allows the drive to adjust the output pattern to the motor and load conditions. By identifying motor parameters, the drive can maximize the torque produced in the motor and extend the speed range at which that torque can be produced.

This technology is excellent for applications that require a wider speed range and applications that need maximum possible torque for breakaway, acceleration or overload. Centrifuges, extruders, conveyors and others are candidates.

Torque Controllers

Vector

This technology differs from the two above, because it actually controls or regulates torque. Rather than allowing the motor and load to actually determine the amount of torque produced, Vector technology allows the drive to regulate the torque to a defined value. By independently identifying and controlling both flux and torque currents in the motor, true control of torque is achieved. High bandwidth current regulators remain active with or without encoder feedback to produce outstanding results.

This technology is excellent for those applications where torque control, rather than mere torque production, is key to the success of the process. These include web handling, demanding extruders and lifting applications such as hoists or material handling.

Vector Control can operate in one of two configurations:

1. Encoderless

   Not to be confused with Sensorless Vector above, Encoderless Vector based on Allen-Bradley's patented Field Oriented Control technology means that a feedback device is not required. Torque control can be achieved across a significant speed range without feedback.

2. Closed Loop (with Encoder)

   force
   TECHNOLOGY

   Vector Control with encoder feedback utilizes Allen-Bradley's Force Technology™. This industry leading technology allows the drive to control torque over the entire speed range, including zero speed. For those applications that require smooth torque regulation at very low speeds or full torque at zero speed, Closed Loop Vector Control is the answer.

Speed Regulators

Any of the PowerFlex drives, regardless of their motor control technology (Volts/Hz, Sensorless Vector or Vector) can be set up to regulate speed. Speed regulation and torque regulation must be separated to understand drive operation.

The PowerFlex 700 can offer improved speed regulation by adding speed feedback. Using a speed feedback device (encoder) tightens speed regulation to 0.001% of base speed and extends the speed range to zero speed

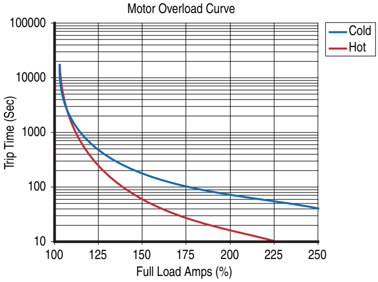
Motor Overload

For single motor applications the drive can be programmed to protect the motor from overload conditions. An electronic thermal overload I^2T function emulates a thermal overload relay. This operation is based on three parameters; [Motor NP FLA], [Motor OL Factor] and [Motor OL Hertz] (parameters 042, 048 and 047, respectively).

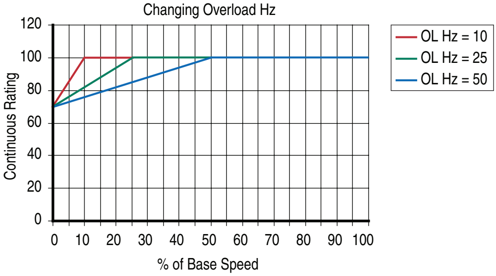
[Motor NP FLA] is multiplied by [Motor OL Factor] to allow the user to define the continuous level of current allowed by the motor thermal overload. [Motor OL Hertz] is used to allow the user to adjust the frequency below which the motor overload is derated.

The motor can operate up to 102% of FLA continuously. If the drive was just activated, it will run at 150% of FLA for 180 seconds. If the motor had been operating at 100% for over 30 minutes, the drive will run at 150% of FLA for 60 seconds. These values assume the drive is operating above [Motor OL Hertz], and that [Motor OL Factor] is set to 1.00.

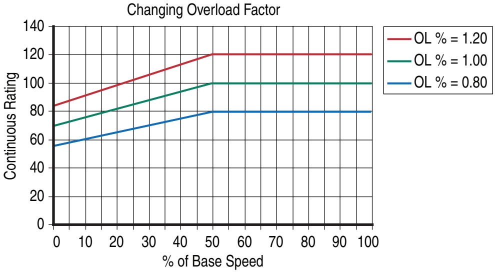
Operation below 100% current causes the temperature calculation to account for motor cooling.



[Motor OL Hertz] defines the frequency where motor overload capacity derate should begin. The motor overload capacity is reduced when operating below [Motor OL Hertz]. For all settings of [Motor OL Hertz] other than zero, the overload capacity is reduced to 70% at an output frequency of zero.



[Motor NP FLA] is multiplied by [Motor OL Factor] to select the rated current for the motor thermal overload. This can be used to raise or lower the level of current that will cause the motor thermal overload to trip. The effective overload factor is a combination of [Motor OL Hertz] and [Motor OL Factor].



Motor Overload Memory Retention Per 2005 NEC

Firmware version 4.002 or greater – has the ability to retain the motor overload count at power down per the 2005 NEC motor overtemp requirement. To Enable/Disable this feature, refer to the table below. Once Enabled, the value for [Testpoint 1 Sel] may be changed.

Overload Retention	[Testpoint 1 Sel], param 234	[Testpoint 1 Data], param 235
Enable	"629"	"1"
Disable	"499" (1)	"0" (1)

(1) Default setting.

Firmware version 6.002 or greater – when bit 0 of [Motor OL Mode], parameter 50 is set to "1," the value of [Motor OL Count], parameter 220 is maintained through a power cycle or drive reset. This is an enhanced version of the v4.002 Motor Overload Memory function. The testpoint method will still work, but the preferred method is to set [Motor OL Mode], parameter 50.

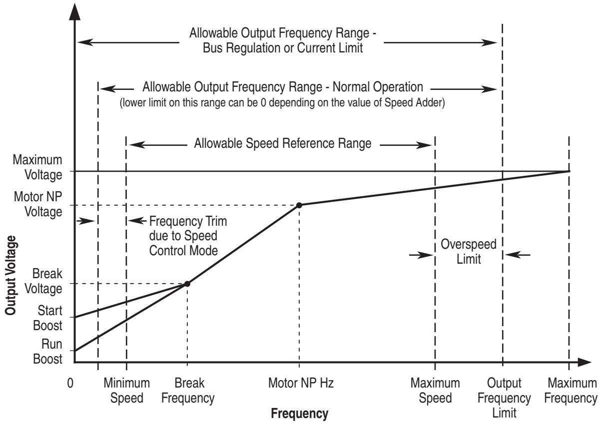
Overspeed

Overspeed Limit is a user programmable value that allows operation at maximum speed, but also provides an "overspeed band" that will allow a speed regulator such as encoder feedback or slip compensation to increase the output frequency above maximum speed in order to maintain maximum motor speed.

The figure below illustrates a typical Custom V/Hz profile. Minimum Speed is entered in Hertz and determines the lower speed reference limit during normal operation. Maximum Speed is entered in Hertz and determines the upper speed reference limit. The two "Speed" parameters only limit the speed reference and not the output frequency.

The actual output frequency at maximum speed reference is the sum of the speed reference plus "speed adder" components from functions such as slip compensation.

The Overspeed Limit is entered in Hertz and added to Maximum Speed and the sum of the two (Speed Limit) limit the output frequency. This sum (Speed Limit) must is compared to Maximum Frequency and an alarm is initiated which prevents operation if the Speed Limit exceeds Maximum Frequency.



Position Indexer/Speed Profiler

The PowerFlex 700 includes a position indexer/speed profiler which provides either point-to-point positioning with a position regulator or speed profiling using a velocity regulator. Point-to point positioning can be either incremental moves or absolute moves which are referenced to home. Encoder feedback (incremental encoder) is required for the position regulator. Speed profiling steps can be time-based or triggered by digital inputs, encoder counts or parameter levels. These speed profiling steps can be operated open loop or with an encoder.

The indexer is programmed by entering data into a 16 step array. Each step has several variables for optimal customization (see below). The steps can be run in a continuous cycle or a single cycle. The process can also move to or from any step in the array.

Step Type	Value	Velocity	Accel Time	Decel Time	Next Step Condition	Dwell	Batch	Next

This feature also includes homing capability to a limit switch or a marker pulse using an automatic homing procedure.

Important: The PowerFlex 700 uses an incremental encoder only. Since absolute encoders are not used, your process must be able to accommodate this homing procedure after a power down or power loss.

Common Guidelines for all Step Types

- Enabling Position Indexer/Speed Profiler

  This feature is enabled by selecting “7 - Pos/Spd Prof” in [Speed/Torque Mod], parameter 088. Parameters 700-877 set up the indexer/profiler.

- Motor Control Modes

  For Position Indexing with an encoder, only FVC Vector Control should be used for optimum performance.

  For Velocity Profiling, any motor control mode can be used. However, Sensorless Vector or FVC Vector Control modes will offer the best performance.

- Direction Control

  The drive must be configured to allow the profile to control the direction. This is accomplished by setting [Direction Mode], parameter 190 to “Bipolar” (default is “Unipolar”).

- Limits

  Many threshold values can affect the performance of the profile/indexer. To help minimize the possibility of overshooting a position, ensure that the following parameters are set for the best performance.

No.	Parameter	Description
153	[Regen Power Limit]	Default is –50% and will likely require a greater negative value. A brake or other means of dissipating regenerative energy is recommended.
147	[Current Lmt Sel]	By default these parameters are set to provide 150% of drive rating. If lowered, the performance may be degraded.
148	[Current Lmt Val]	
161 162	[Bus Reg Mode A] [Bus Reg Mode B]	The default setting will adjust frequency to regulate the DC Bus voltage under regenerative conditions. This will most likely cause a position overshoot. To resolve this, select “Dynamic Brak” and size the load resistor for the application.

- Speed Regulator

  The bandwidth of the speed regulator will affect the performance. If the connected inertia is relatively high, the bandwidth will be low and therefore a bit sluggish. When programming the acceleration and deceleration rates for each step, do not make them too aggressive or the regulator will be limited and therefore overshoot the desired position.

Position Loop Tuning

Two parameters are available for tuning the position loop.

- [Pos Reg Filter], parameter 718 is a low pass filter at the input of the position regulator.
- [Pos Reg Gain], parameter 719 is a single adjustment for increasing or decreasing the responsiveness of the regulator.

By default these parameters are set at approximately a 6:1 ratio (filter = 25, gain = 4). It is recommended that a minimum ratio of 4:1 be maintained.

Profile Command Control Word

The profile/indexer is controlled with [Pos/Spd Prof Cmd], parameter 705. The bit definitions are as follows:

Bit	Name	Description
0	Start Step 0	The binary value of these bits determines which step will be the starting step for the profile when a start command is issued. If the value of these bits are not 1-16 the drive will not run since it does not have a valid step to start from. Valid Examples: 00011 = step 3, 01100 = step 12
1	Start Step 1	
2	Start Step 2	
3	Start Step 3	
4	Start Step 4	
5-7	Reserved	Reserved for future use
8	Hold Step	When set, this command will inhibit the profile from transitioning to the next step when the condition(s) required are satisfied. When the *hold* command is released, the profile will transition to the next step.
9	Pos Redefine	This bit is used to set the present position as *home*. When this bit is set, [Profile Status] bit *At Home* will be set and the [Units Traveled] will be set to zero.
10	Find Home	This bit is used to command the find home routine.
11	Vel Override	When this bit is set the velocity of the present step will be multiplied by the value in [Vel Override].
12-31	Reserved	Reserved for future use

The [Pos/Spd Prof Cmd] bits can be set via DPI interface (HIM or Comm) or digital inputs. When digital input(s) are programmed for “Pos Sel 1-5,” the starting step of the profile is exclusively controlled by the digital inputs. The DPI interface value for bits 0-4 will be ignored.

If a digital input is configured for the bit 8-11 functions (see above), the DPI interface or the digital input can activate the command.

Velocity Regulated Step Types and Parameters

Each of the Velocity Regulated steps has the following associated parameters or functions. Refer to the following page for descriptions.

Step Type	Value	Velocity	Accel Time	Decel Time	Next Step Condition	Dwell	Batch	Next
Time	Total Move Time	Speed & Direction	Accel Rate	Decel Rate	Time greater than [Step Value]	Dwell Time	Batch Number	Next Step
Time Blend	Total Time	Speed & Direction	Accel Rate	Decel Rate	Time greater than [Step Value]	NA	NA	Next Step
Digital Input	Digital Input Number	Speed & Direction	Accel Rate	Decel Rate	Digital Input logic	Dwell Time	Batch Number	Next Step
Encoder Incremental Blend	Position & Direction	Speed	Accel Rate	Decel Rate	At Position [Step Value]	NA	NA	Next Step
Parameter Level	Parameter Number +/–	Speed & Direction	Accel Rate	Decel Rate	[Step Value] > or < [Step Dwell]	Compare Value	NA	Next Step
End	NA	NA	NA	Decel Rate	At Zero transition	Dwell Time	NA	Stop

NA = Function not applicable to this step type

Time

When started, the drive will ramp to the desired velocity, hold the speed, and then ramp to zero in the programmed time for the given step. Dwell time and batch affect when the next step is executed.

Time Blend

When started, the drive will ramp to the desired velocity and hold speed for the programmed time. At this point it will transition to the next step and ramp to the programmed velocity without going to zero speed.

Digital Input

When started, the drive will ramp to the desired velocity and hold speed until the digital input programmed in the value transitions in the direction defined. When this occurs, the profile will transition to the next step after dwell and batch settings are satisfied. It will then ramp to the programmed velocity without going to zero speed.

Encoder Incremental Blend (EncIncrBlend)

When started, the drive will ramp to the desired velocity and hold speed until the units of travel programmed is reached (within tolerance window). The profile will then transition to the next step and the drive will ramp to the speed of the new step without first going to zero speed.

Encoder Incremental Blend with Hold

This profile is the same as the previous, but contains the "Hold" function. While "Hold" is applied, the step transition is inhibited. When released, the step can then transition if the conditions to transition are satisfied.

Parameter Level (Param Level)

When started, the drive will ramp to the desired velocity, hold speed and compare the parameter value of the parameter number programmed in [Step Value] to the [Step Dwell] level. The sign of the [Step Value] defines "less than or greater than" [Step Dwell]. When true, the profile will transition to the next step.

End

The drive ramps to zero speed and stops the profile. It clears the current step bits and sets the "Complete" bit (14) in [Profile Status], parameter 700.

Position Regulated Step Types and Parameters

Each of the Position Regulated steps has the following associated parameters or functions:

Step Type	Value	Velocity	Accel Time	Decel Time	Next Step Condition	Dwell	Batch	Next
Encoder Absolute	Position & Direction	Speed	Accel Rate	Decel Rate	At Position	Dwell Time	NA	Next Step
Encoder Incremental	Position & Direction	Speed	Accel Rate	Decel Rate	At Position	Dwell Time	Batch Number	Next Step
End Hold Position	NA	NA	NA	NA	At Position	Dwell Time	NA	Stop

NA = Function not applicable to this step type

Encoder Absolute

This is a move to an absolute position, which is referenced from the home position. When started the drive ramps to the desired velocity in the direction required, holds the speed, then ramps to zero speed landing or ending at the commanded position within the tolerance window.

Encoder Incremental (Encoder Incr)

This is a move increment from the current position in the direction, distance and speed programmed. When started the drive ramps to the desired velocity, holds the speed, then ramps to zero speed landing or ending at the commanded position within the tolerance window.

End Hold Position

The drive holds the last position and stops the profile after dwell time expires. Must be used with position regulated profile. Do Not use “End.”

Homing Routine

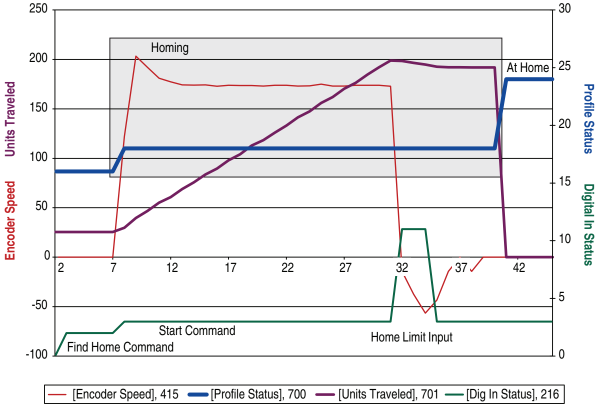
Each time the profile/indexer is enabled, the drive requires a home position to be detected. The following options are available:

- Homing to Marker Pulse with Encoder Feedback

  When “Find Home” is commanded the homing routine is run when a start command is issued. The Homing bit (11) in [Profile Status] will be set while the homing routine is running. The drive will ramp to the speed and direction set in [Find Home Speed], parameter 713 at the rate set in [Find Home Ramp], parameter 714 until the digital input defined as “Home Limit” is activated. The drive will then ramp to zero and then back up to first marker pulse prior to the Home Limit switch at 1/10 the [Find Home Speed]. When on the marker pulse, the At Home bit (13) is set in [Profile Status] and the drive is stopped.

  Figure C.5 shows the sequence of operation for homing to a marker pulse. [Encoder Z Chan], parameter 423 must be set to “Marker Input” or “Marker Check” for this type of homing.

Figure C.5 Homing to Marker

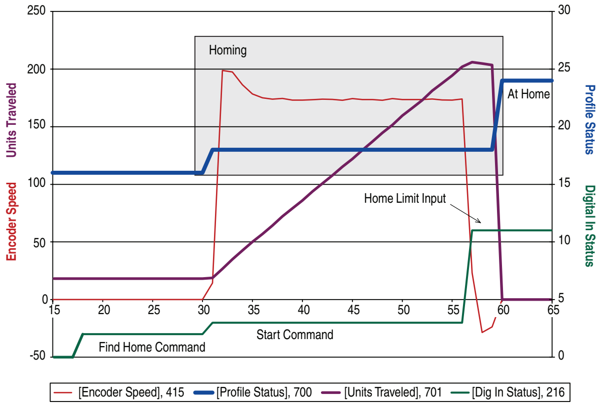


- Homing to Limit Switch with Encoder Feedback

  When “Find Home” is commanded, the homing routine is run when a start command is issued. The Homing bit (11) in [Profile Status] will be set while the homing routine is running. The drive will ramp to the speed and direction set in [Find Home Speed] at the rate set in [Find Home Ramp] until the digital input defined as Home Limit is activated. The drive will then reverse direction at 1/10 the [Find Home Speed] to the point where the Home Limit switch activated and stop.

  Figure C.6 shows the sequence of operation for homing to a limit switch with encoder feedback (without a marker pulse). [Encoder Z Chan] must be set to “Pulse Input” or “Pulse Check.”

Figure C.6 Homing to a Limit Switch

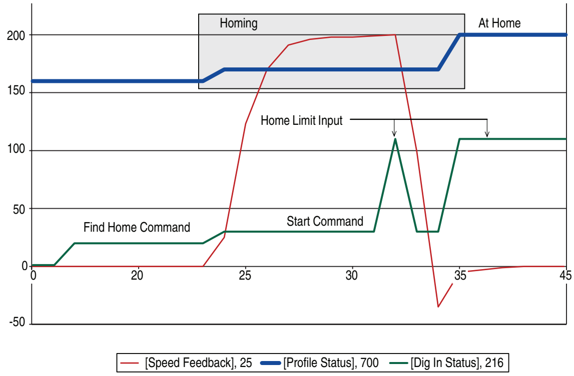


- Homing to Limit Switch w/o Encoder Feedback

  When “Find Home” is commanded, the homing routine is run when a Start command is issued. The Homing bit (11) in [Profile Status] will be set while the homing routine is running. The drive will ramp to the speed and direction set in [Find Home Speed] at the rate set in [Find Home Ramp] until the digital input defined as Home Limit is activated. The drive will then decelerate to zero. If the switch is no longer activated, the drive will reverse direction at 1/10 the [Find Home Speed] to the switch position and then stop. The Home Limit switch will be active when stopped.

  Figure C.7 shows the sequence of operation for homing to a limit switch without encoder feedback.

Figure C.7 Homing to Limit Switch (No Feedback)



- Position Redefine

  When “Pos Redefine” is set, the present position is established as Home and [Units Traveled] is set to zero.

- Disable Homing Requirement

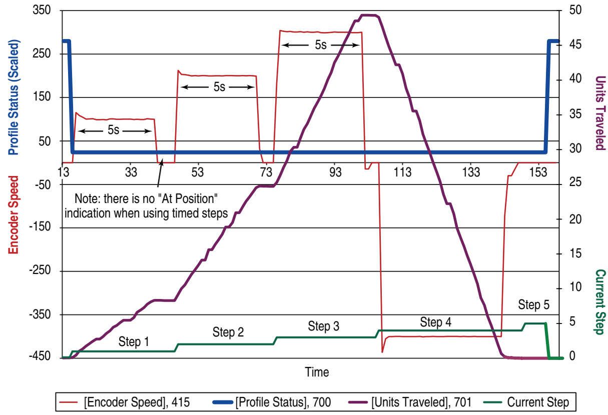
  If a home position is not required, the routine can be disabled by clearing [Alarm Config 1], bit 17 (Prof SetHome) to “0”. This will disable the alarm from being set when Pos/Spd Profile mode is configured in [Speed/Torque Mod] and will set the present position as Home.

  Once Homing is complete the Find Home command must be removed to allow the profile to be run. If the Find Home command is not removed, when the drive is started the routine will see that it is At Home and the drive will stop.

Example 1
Five Step Velocity Profile (Time-Based and Encoder-Based)

The first three steps are “Time” steps followed by an “Encoder Abs” step to zero and then an “End” step. For each Time step the drive ramps at [Step x AccelTime] to [Step x Velocity] in the direction of the sign of [Step x Velocity]. The drive then decelerates at [Step X DecelTime] to zero. The [Step X Value] is programmed to the desired time for the total time of the accel, run and decel of the step. Each step has a 1 second time programmed in [Step X Dwell] which is applied to the end of each step. After the dwell time expires, the profile transitions to the next step. The absolute step is used to send the profile back to the home position. This is done by programming [Step 4 Value] to zero.

Figure C.8 Time Example



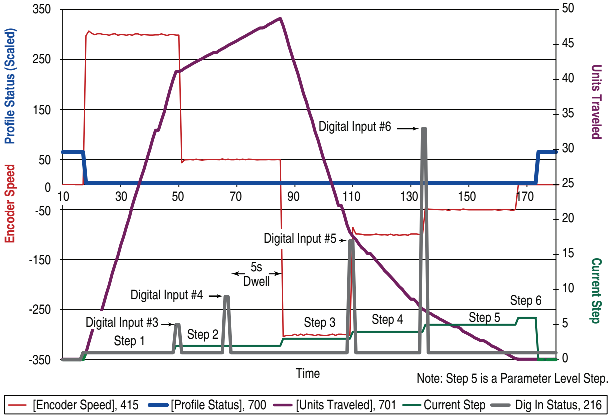
Step #	[Step x Type]	[Step x Velocity]	[Step x AccelTime]	[Step x DecelTime]	[Step x Value]	[Step x Dwell]	[Step x Batch]	[Step x Next]
1	Time	100	0.5	0.5	5.00	1.00	1	2
2	Time	200	0.5	0.5	5.00	1.00	1	3
3	Time	300	0.5	0.5	5.00	1.00	1	4
4	Encoder Abs	400	0.5	0.5	0.00	1.00	1	5
5	End	N/A	N/A	0.5	N/A	0.00	N/A	N/A

Example 2
Six Step Velocity Profile (Digital Input-Based)

In each step, the drive ramps at [Step x AccelTime] to [Step x Velocity] in the direction of the sign of [Step x Velocity] until a digital input is detected. When the input is detected it transitions to the next step in the profile. This continues through Digital Input #6 activating step 5. Step 5 is defined as a “Parameter Level” step. Digital Inputs used in the profile must be defined as “Prof Input.”

Important: A transition is required to start each step. If the input is already true when transitioning to a digital input step, the indexer will not go to the next step.

Figure C.9 Digital Input Example

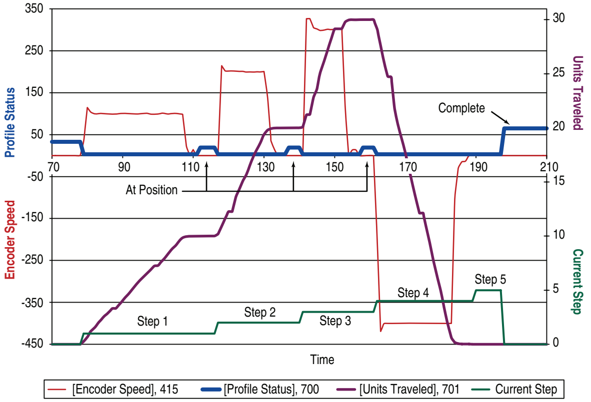


Step #	[Step x Type]	[Step x Velocity]	[Step x AccelTime]	[Step x DecelTime]	[Step x Value]	[Step x Dwell]	[Step x Batch]	[Step x Next]
1	Digital Input	300	0.5	0.5	3.00	0.00	1	2
2	Digital Input	50	0.5	0.5	4.00	5.00	1	3
3	Digital Input	-300	0.5	0.5	5.00	0.00	1	4
4	Digital Input	-100	0.5	0.5	6.00	0.00	1	5
5	Param Level	-50	0.5	0.5	701	0.00	1	6
6	End	N/A	N/A	0.5	N/A	0.00	N/A	N/A

Example 3
Five Step Positioner with Incremental Encoder

The first three steps of this indexer are “Encoder Incr” steps followed by an “Encoder Abs” step to zero and then an “End Hold Position” step. For each “Encoder Incr” step the drive ramps at [Step x AccelTime] to [Step x Velocity] in the direction of the sign of [Step xValue]. It then decelerates at the rate of [Step x DecelTime] to the position programmed in [Step x Value] which sets the desired units of travel for the step. When the value programmed in [Step x Value] is reached within the tolerance window programmed in [Encoder Pos Tol], the “At Position” bit is set in [Profile Status]. In this example a dwell value held each of the first three steps “At Position” for 1 second. After the [Step x Dwell] time expires, the profile transitions to the next step. The absolute step is used to send the profile back to the home position. This is accomplished by programming [Step 4 Value] to zero.

Figure C.10 Encoder Incremental w/Dwell Example



Step #	[Step x Type]	[Step x Velocity]	[Step x AccelTime]	[Step x DecelTime]	[Step x Value]	[Step x Dwell]	[Step x Batch]	[Step x Next]
1	Encoder Incr	100	0.5	0.5	10.00	1.00	1	2
2	Encoder Incr	200	0.5	0.5	10.00	1.00	1	3
3	Encoder Incr	300	0.5	0.5	10.00	1.00	1	4
4	Encoder Abs	400	0.5	0.5	0.00	1.00	N/A	5
5	End Hold Position	N/A	N/A	0.5	N/A	0.00	N/A	N/A

Power Loss Ride Through

When AC input power is lost, energy is being supplied to the motor from the DC bus capacitors. The energy from the capacitors is not being replaced (via the AC line), thus, the DC bus voltage will fall rapidly. The drive must detect this fall and react according to the way it is programmed. Two parameters display DC bus voltage:

- [DC Bus Voltage] - displays the instantaneous value
- [DC Bus Memory] - displays a 6 minute running average of the voltage.

All drive reactions to power loss are based on [DC Bus Memory]. This averages low and high line conditions and sets the drive to react to the average rather than assumed values. For example, a 480V installation would have a 480V AC line and produce a nominal 648V DC bus. If the drive were to react to a fixed voltage for line loss detect, (i.e. 533V DC), then normal operation would occur for nominal line installations.

However, if a lower nominal line voltage of 440V AC was used, then nominal DC bus voltage would be only 594V DC. If the drive were to react to the fixed 533V level (only –10%) for line loss detect, any anomaly might trigger a false line loss detection. Line loss, therefore always uses the 6 minute average for DC bus voltage and detects line loss based on a fixed percentage of that memory. In the same example, the average would be 594V DC instead of 650V DC and the fixed percentage, 27% for "Coast to Stop" and 18% for all others, would allow identical operation regardless of line voltage.

The PowerFlex 70 uses only these fixed percentages. The PowerFlex 700 can selectively use the same percentages or the user can set a trigger point for line loss detect. The adjustable trigger level is set using [Power Loss Level] (see [Power Loss Level] on page 3-35).

Figure C.11 Power Loss Mode = Coast

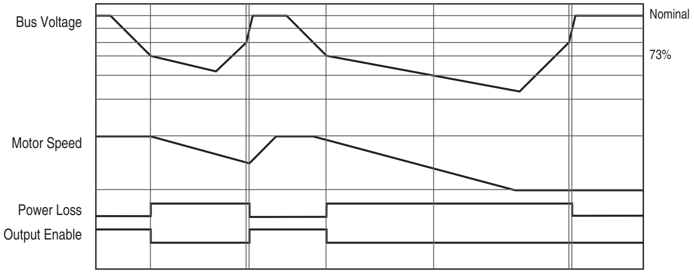
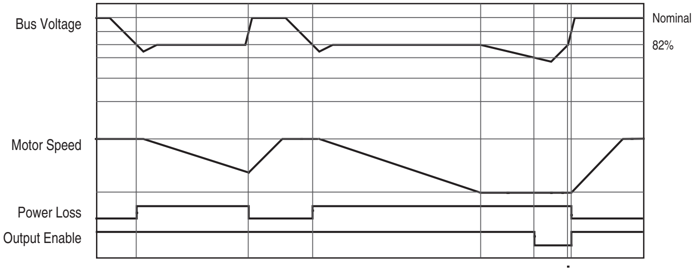


Figure C.12 Power Loss Mode = Decel

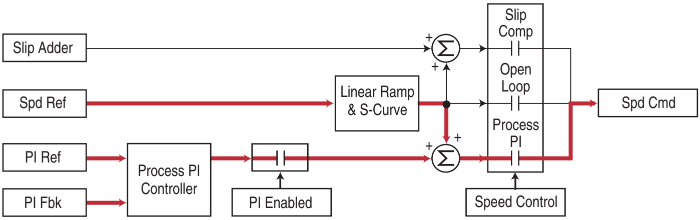


Process PID

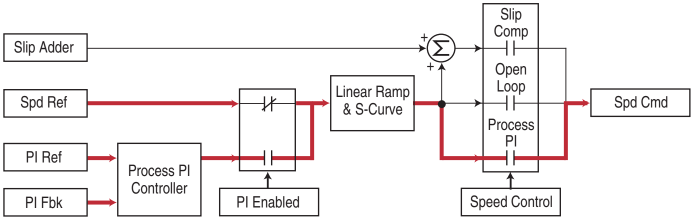
The internal PI function of the PowerFlex 700 provides closed loop process control with proportional and integral control action. The function is designed for use in applications that require simple control of a process without external control devices. The PI function allows the microprocessor of the drive to follow a single process control loop.

The PI function reads a process variable input to the drive and compares it to a desired setpoint stored in the drive. The algorithm will then adjust the output of the PI regulator, changing drive output frequency to try and make the process variable equal the setpoint.

It can operate as trim mode by summing the PI loop output with a master speed reference.



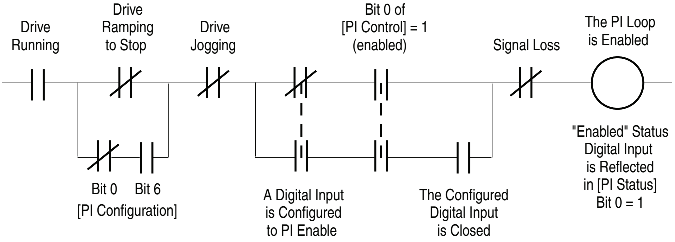
Or, it can operate as control mode by supplying the entire speed reference. This method is identified as "exclusive mode"



PI Enable

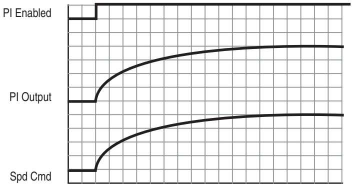
The output of the PI loop can be turned on (enabled) or turned off (disabled). This control allows the user to determine when the PI loop is providing part or all of the commanded speed. The logic for enabling the PI loop is shown below.

The drive must be running for the PI loop to be enabled. The loop will be disabled when the drive is ramping to a stop (unless "Stop Mode" is configured in [PI Configuration]), jogging or the signal loss protection for the analog input(s) is sensing a loss of signal.

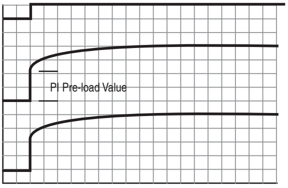


If a digital input has been configured to “PI Enable,” two events are required to enable the loop: the digital input must be closed AND bit 0 of the PI Control parameter must be = 1.

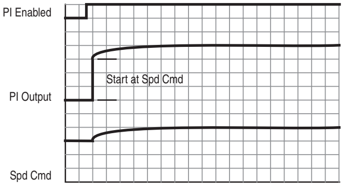
If no digital input is configured to “PI Enable,” then only the Bit 0 = 1 condition must be met. If the bit is permanently set to a “1”, then the loop will become enabled as soon as the drive goes into “run”.



PI Pre-load Value = 0



PI Pre-load Value > 0



Pre-load to Command Speed

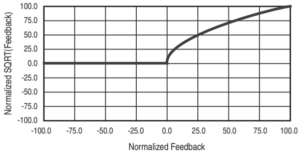
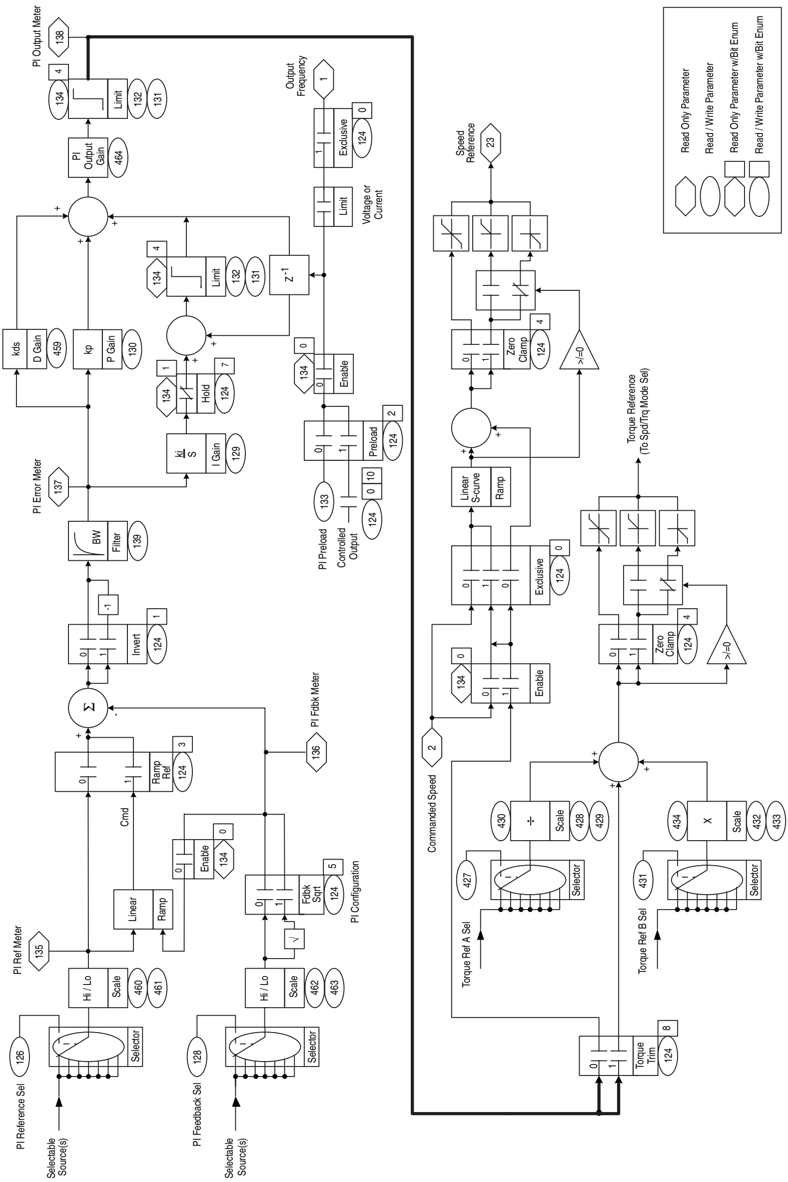


Figure C.13 Process Trim



Reverse Speed Limit

Figure C.14 [Rev Speed Limit], parameter 454 set to zero

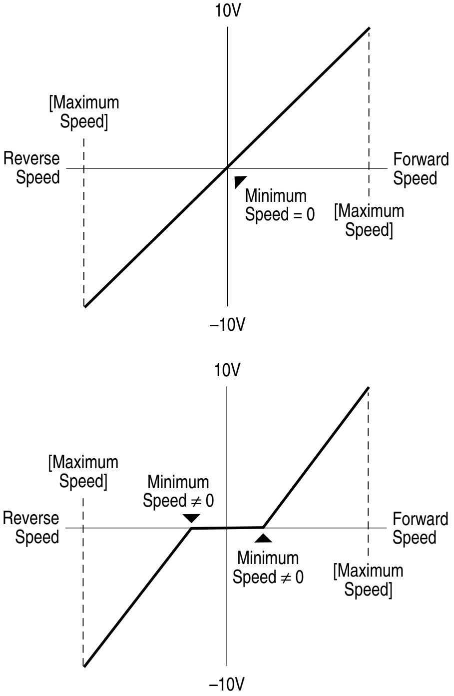
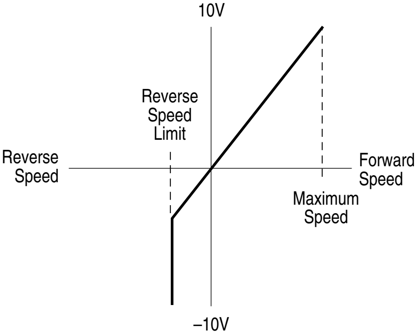
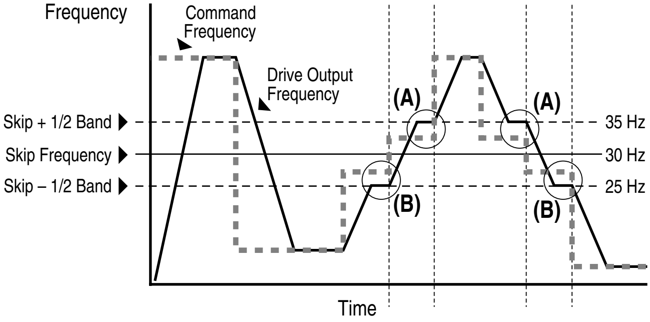


Figure C.15 [Rev Speed Limit], parameter 454 set to a non-zero Value



Skip Frequency

Figure C.16 Skip Frequency



Some machinery may have a resonant operating frequency that must be avoided to minimize the risk of equipment damage. To assure that the motor cannot continuously operate at one or more of the points, skip frequencies are used. Parameters 084-086, ([Skip Frequency 1-3]) are available to set the frequencies to be avoided.

The value programmed into the skip frequency parameters sets the center point for an entire "skip band" of frequencies. The width of the band (range of frequency around the center point) is determined by parameter 87, [Skip Freq Band]. The range is split, half above and half below the skip frequency parameter.

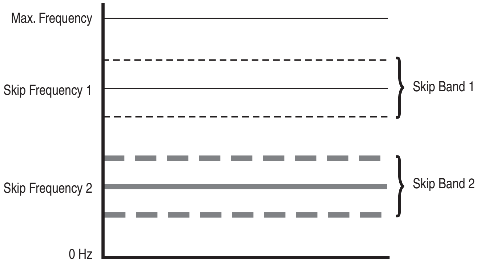
If the commanded frequency of the drive is greater than or equal to the skip (center) frequency and less than or equal to the high value of the band (skip plus 1/2 band), the drive will set the output frequency to the high value of the band. See (A) in Figure C.16.

If the commanded frequency is less than the skip (center) frequency and greater than or equal to the low value of the band (skip minus 1/2 band), the drive will set the output frequency to the low value of the band. See (B) in Figure C.16.

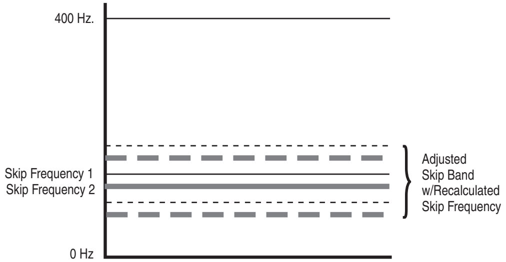
Acceleration and deceleration are not affected by the skip frequencies. Normal accel/decel will proceed through the band once the commanded frequency is greater than the skip frequency. See (A) & (B) in Figure C.16. This function affects only continuous operation within the band.

Skip Frequency Examples

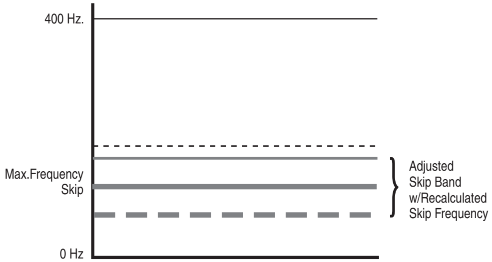
The skip frequency will have hysteresis so the output does not toggle between high and low values. Three distinct bands can be programmed. If none of the skip bands touch or overlap, each band has its own high/low limit.



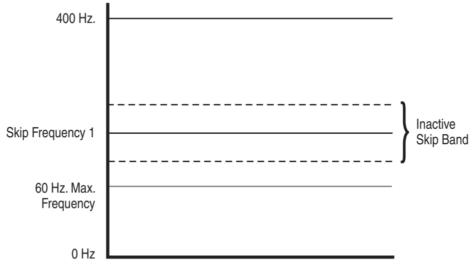
If skip bands overlap or touch, the center frequency is recalculated based on the highest and lowest band values.



If a skip band(s) extend beyond the max frequency limits, the highest band value will be clamped at the max frequency limit. The center frequency is recalculated based on the highest and lowest band values.



If the band is outside the limits, the skip band is inactive.



Sleep Wake Mode

This function stops (sleep) and starts (wake) the drive based on separately configurable analog input levels rather than discrete start and stop signals. When enabled in “Direct” mode, the drive will start (wake) when an analog signal is greater than or equal to the user specified [Wake Level], and stop the drive when an analog signal is less than or equal to the user specified [Sleep Level]. When Sleep Wake is enabled for “Invert” mode(1), the drive will start (wake) when an analog signal is less than or equal to the user specified [Wake Level], and stop the drive when an analog signal is greater than or equal to the user specified [Sleep Level].

Definitions

- Wake - A start command generated when the analog input value remains above [Wake Level] (or below when Invert mode is active) for a time greater than [Wake Time].
- Sleep - A Stop command generated when the analog input value remains below [Sleep Level] (or above when Invert mode is active) for a time greater than [Sleep Time].
- Speed Reference – The active speed command to the drive as selected by drive logic and [Speed Ref x Sel].
- Start Command - A command generated by pressing the Start button on the HIM, closing a digital input programmed for Start, Run, Run Forward or Run Reverse.

Refer to Figure C.17.

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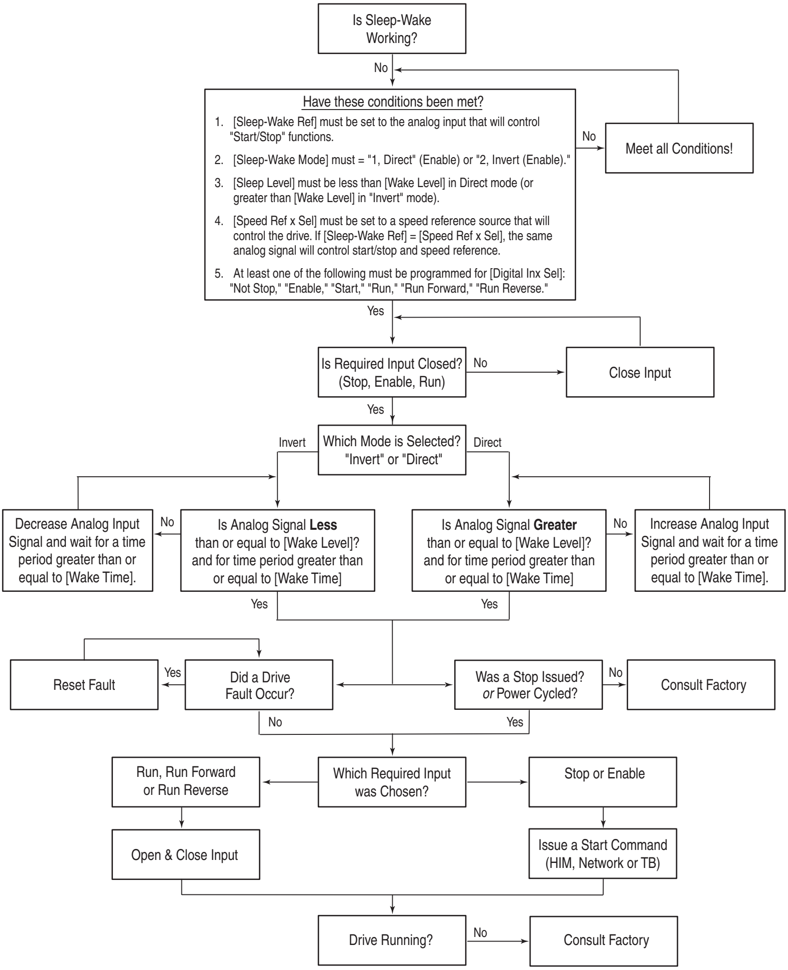
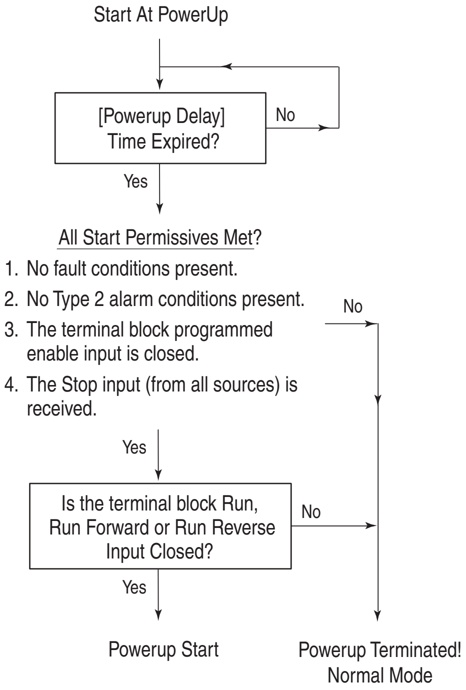
(1) Invert mode is only available with Vector firmware 3.xxx and later.

Figure C.17 Sleep Wake Mode



Start At PowerUp

A powerup delay time of up to 30 seconds can be programmed through [Powerup Delay], parameter 167. After the time expires, the drive will start if all of the start permissive conditions are met. Before that time, restart is not possible.



Stop Mode

The PowerFlex 700 offers several methods for stopping a load. The method/mode is defined by [Stop/Brk Mode A/B], parameters 155 & 156. These modes include:

- Coast
- Ramp
- Ramp to Hold
- DC Brake
- Fast Brake

Additionally, [Flux Braking], parameter 166 can be selected separately to provide additional braking during a "Stop" command or when reducing the speed command. For "Stop" commands, this will provide additional braking power during "Ramp" or "Ramp to Hold" selections only. If "Fast Brake" or "DC Brake" is used, "Flux Braking" will only be active during speed changes (if enabled).

A "Ramp" selection will always provide the fastest stopping time if a method to dissipate the required energy from the DC bus is provided (i.e. resistor brake, regenerative brake, etc.). The alternative braking methods to external brake requirements can be enabled if the stopping time is not as restrictive. Each of these methods will dissipate energy in the motor (use care to avoid motor overheating). Table C.A describes several braking capability examples.

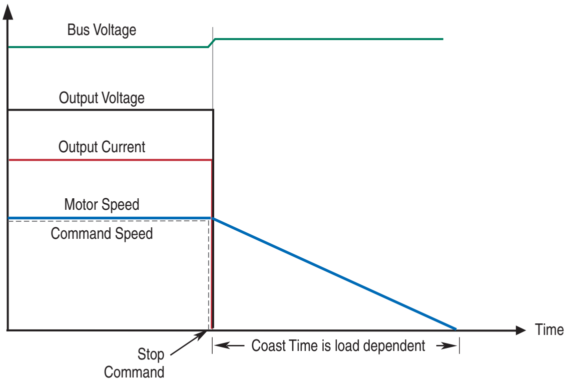
Table C.A Braking Method Examples

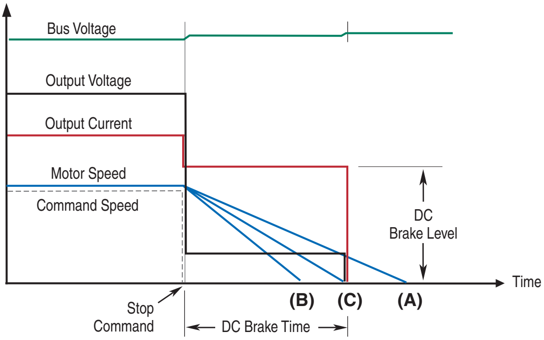
Method	Use When Application Requires . . .	Braking Power
Ramp	• The fastest stopping time or fastest ramp time for speed changes (external brake resistor or regenerative capability required for ramp times faster than the methods below). • High duty cycles, frequent stops or speed changes. (The other methods may result in excessive motor heating).	Most, if an external resistor or regenerative device is connected.
Fast Brake	• Additional braking capability without use of an external brake resistor or regenerative unit, but only effective during stop events, not speed changes. **Important:** For this feature to function properly the active Bus Reg Mode A or B must be set to Adjust "Freq" and NOT be "Disabled".	More than Flux Braking or DC Brake
Flux Braking	In some applications, Flux Braking can provide a method for fast speed changes or stops. It is not suitable for high inertia loads or high duty cycle operation for applications greater than 1 cycle per minute. This feature supplies additional flux current to the motor and can cause motor thermistor or overvoltage faults in the drive. • Fast speed changes and fast stopping time. • Typical stop from speeds below 50% of base speed ("Flux Braking" will likely stop the load faster than "Fast Brake" in this case). **Important:** This can be used in conjunction with "Ramp" or "Ramp to Hold" for additional braking power or with "Fast Brake" or "DC Brake" for speed changes. **Important:** For this feature to function properly the active Bus Reg Mode A or B must be set to Adjust "Freq" and NOT be "Disabled".	More than DC Brake
DC Brake	• Additional braking capability without use of external brake resistor or regenerative units	Less than above methods

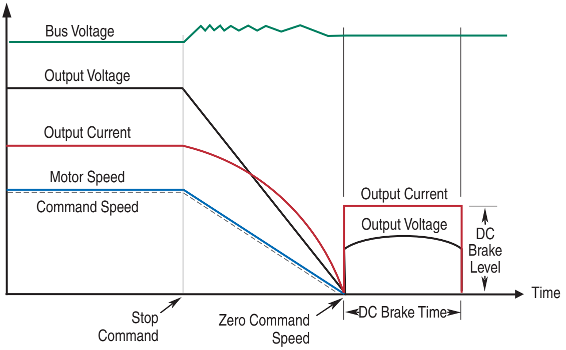
Configuration

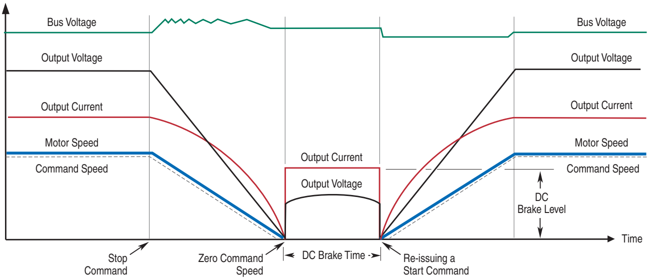
- [Stop/Brk Mode A], parameter 155
- [Stop/Brk Mode B], parameter 156
  - 0 = Coast
  - 1 = Ramp
  - 2 = Ramp to Hold
  - 3 = DC Brake
  - 4 = Fast Brake
- [DC Brk Lvl Sel], parameter 157
  - 0 = “DC Brake Lvl” – selects parameter 158 as the source for the DC brake level
  - 1 = “Analog in 1”
  - 2 = “Analog in 2”
- [DC Brake Level], parameter 158 – sets the DC brake level in amps, when parameter 157 = “DC Brake Lvl”
- [DC Brake Time], parameter 159 – sets the amount of time that DC braking is applied after the ramp (if any).
- [Flux Braking], parameter 166 – may need to adjust parameter 549
  - 0 = Disabled, 1 = Enabled
- [Digital InX Sel], parameters 361-366
  - 13 = “Stop Mode B” – setting a digital input to this function allows the use of a digital input to switch between Stop Mode A (open input) and Stop Mode B (closed input).

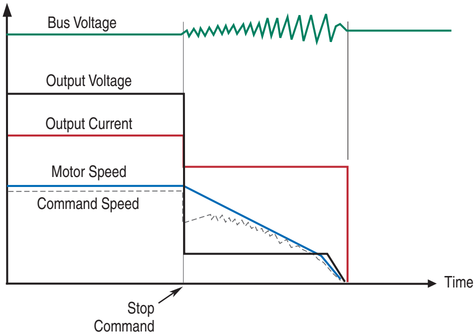
Detailed Operation

Mode	Description
Coast to Stop	 **Coast** is selected by setting [Stop Mode A/B] to a value of “0.” When in Coast to Stop, the drive acknowledges the Stop command by shutting off the drive output and releasing control of the motor. The load and motor will coast until the kinetic energy is dissipated.

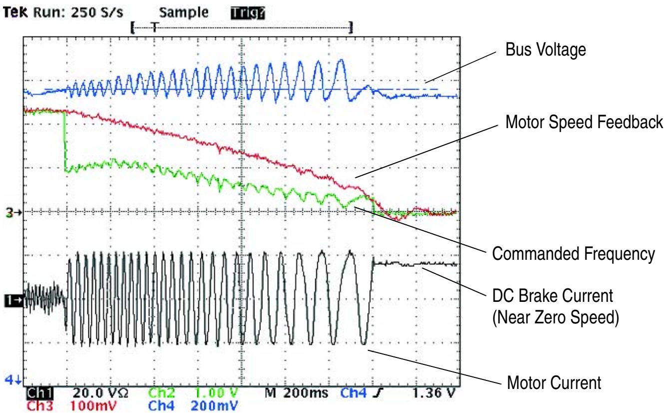
Mode	Description
DC Brake to Stop	 This method uses DC injection of the motor to Stop and/or hold the load. **DC Brake** is selected by setting [Stop Mode A/B] to a value of “3.” The amount of time that braking will be applied is programmed in [DC Brake Time] and the magnitude of the current used for braking is programmed in and [DC Brake Level]. This mode of braking will generate up to 40% of rated motor torque for braking and is typically used for low inertia loads with infrequent Stop cycles. 1. On Stop, three-phase drive output goes to zero (off). 2. Drive outputs DC voltage on the last used phase at the level programmed in [DC Brake Level], parameter 158. This voltage causes a “stopping” brake torque. If the voltage is applied for a time that is longer than the actual possible stopping time, the remaining time will be used to attempt to hold the motor at zero speed (decel profile “B” on the diagram above). 3. DC voltage to the motor continues for the amount of time programmed in [DC Brake Time], parameter 159. Braking ceases after this time expires. 4. After the DC Braking ceases, no further power is supplied to the motor. The motor/load may or may not be stopped. The drive has released control of the motor/load (decel profile “A” on the diagram above). 5. The motor, if rotating, will coast from its present speed for a time that is dependent on the remaining kinetic energy and the mechanics of the system (inertia, friction, etc.). 6. Excess motor current and/or applied duration, could cause motor damage. The user is also cautioned that motor voltage can exist long after the Stop command is issued. The right combination of Brake Level and Brake Time must be determined to provide the safest, most efficient stop (decel profile “C” on the diagram above).

Mode	Description
Ramp	 This method uses drive output reduction to stop the load. **Ramp** is selected by setting [Stop Mode A/B] to a value of “1”. The drive will ramp the frequency to zero based on the deceleration time programmed into [Decel Time 1/2]. The “normal” mode of machine operation can utilize [Decel Time 1]. If the machine “stop” requires a faster deceleration than desired for normal deceleration, [Decel Time 2] can be activated with a faster rate selected. When in Ramp mode, the drive acknowledges the stop command by decreasing or “ramping” the output voltage and frequency to zero in a programmed period (Decel Time), maintaining control of the motor until the drive output reaches zero. The drive output is then shut off. The load and motor should follow the decel ramp. Other factors such as bus regulation and current limit can alter the actual decal rate. Ramp mode can also include a “timed” hold brake. Once the drive has reached zero output hertz on a Ramp-to-Stop and both parameters [DC Brake Time] and [DC Brake Level] are not zero, the drive applies DC to the motor producing current at the DC Brake Level for the DC Brake Time. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed [Maximum Freq] and the programmed active [Decel Time x]. 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches zero the output is shut off. 4. The motor, if rotating, will coast from its present speed for a time that is dependent on the mechanics of the system (inertia, friction, etc.).

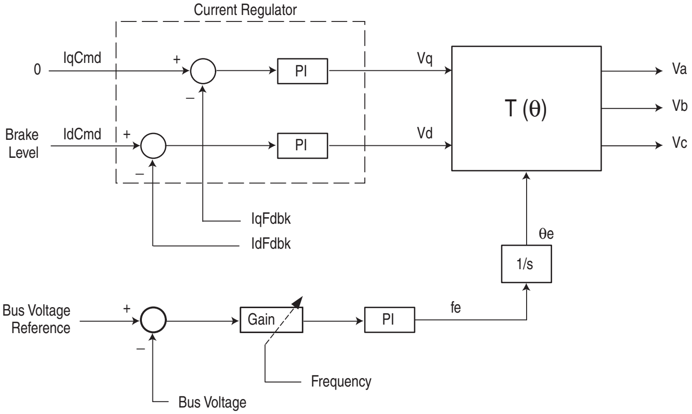
Mode	Description
Ramp to Hold	 This method combines two of the methods above. It uses drive output reduction to stop the load and DC injection to hold the load at zero speed once it has stopped. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed [Maximum Freq] and the programmed active [Decel Time x]. 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches zero, three-phase drive output goes to zero (off) and the drive outputs DC voltage on the last used phase at the level programmed in [DC Brake Level], parameter 158. This voltage causes a “holding” brake torque. 4. DC voltage to the motor continues until a Start command is reissued or the drive is disabled. 5. If a Start command is reissued, DC Braking ceases and the drive returns to normal AC operation. If an Enable command is removed, the drive enters a “not ready” state until the enable is restored.

Mode	Description
Fast Brake	 This method takes advantage of the characteristic of the induction motor whereby frequencies greater than zero (DC braking) can be applied to a spinning motor that will provide more braking torque without causing the drive to regenerate. 1. On Stop, the drive output will decrease based on the motor speed, keeping the motor out of the regen region. This is accomplished by lowering the output frequency below the motor speed where regeneration will not occur. This causes excess energy to be lost in the motor. 2. The method uses a PI based bus regulator to regulate the bus voltage to a reference (e.g. 750V) by automatically decreasing output frequency at the proper rate. 3. When the frequency is decreased to a point where the motor no longer causes the bus voltage to increase, the frequency is forced to zero. DC brake will be used to complete the stop if the DC Braking Time is non-zero, then the output is shut off. 4. Use of the current regulator ensures that over current trips don’t occur and allow for an easily adjustable and controllable level of braking torque. 5. Use of the bus voltage regulator results in a smooth, continuous control of the frequency and forces the maximum allowable braking torque to be utilized at all times. 6. **Important:** For this feature to function properly the active Bus Reg Mode A or B must be set to Adjust “Freq” and NOT be “Disabled”.

Test Example for Fast Braking



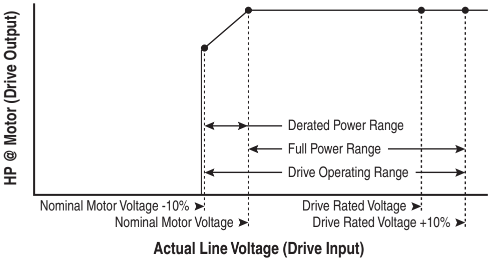
Implementation Block Diagram for Fast Braking



Voltage Tolerance

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

Drive Full Power Range =	Nominal Motor Voltage to Drive Rated Voltage +10%. Rated power is available across the entire Drive Full Power Range.
Drive Operating Range =	Lowest (*) Nominal Motor Voltage –10% to Drive Rated Voltage +10%. Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage.

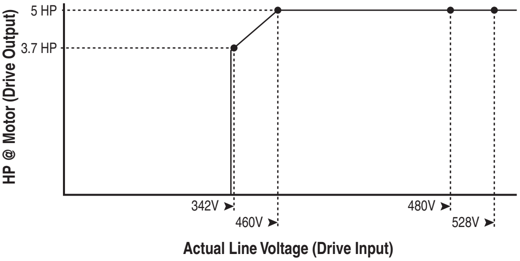


Example:

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

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

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



Notes:

Appendix D

Instructions for ATEX Approved Drives in Group II Category (2) G D Applications with ATEX Approved Motors

General

This document provides information on operation of an ATEX Approved drive and ATEX approved motor. The motor is located in a defined hazardous environment, while the drive is not. A protective system is required to stop current flow to the motor when an over temperature condition has been sensed in the motor. When sensed, the drive will go into a fault stop condition.

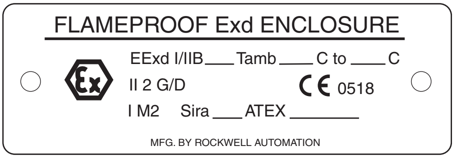
The drive is manufactured under the guidelines of the ATEX directive 94/9/EC. These Drives are in Group II Category (2) GD Applications with ATEX Approved Motors. Certification of the drive for the ATEX group and category on its nameplate requires installation, operation, and maintenance according to this document and to the requirements found in the User Manual and appropriate Motor Instruction Manual(s).

ATTENTION: Operation of this ATEX certified drive with an ATEX certified motor that is located in a hazardous environment requires additional installation, operation, and maintenance procedures beyond those stated in the standard user manual. Equipment damage and/or personal injury may result if all additional instructions in this document are not observed.

Motor Requirements

- The motor must be manufactured under the guidelines of the ATEX directive 94/9/EC. It must be installed, operated, and maintained per the motor manufacturer supplied instructions.
- Only motors with nameplates marked for use on an inverter power source, and labeled for specific hazardous areas, may be used in hazardous areas on inverter (variable frequency) power.
- When the motor is indicated for ATEX Group II Category 2 for use in gas environments (Category 2G) the motor must be of flameproof construction, EEx d (according to EN50018) or Ex d (according to EN60079-1 or IEC60079-1). Group II motors are marked with a temperature or a temperature code.
- When the motor is indicated for ATEX Group II Category 2 for use in dust environments (Category 2D) the motor must be protected by an enclosure (according to EN50281-1-1 or according to IEC61241-1: Ex tD). Group II motors are marked with a temperature.
- The motor over temperature signal supplied to the drive must be a normally closed contact (open during over temperature condition) compatible with the drive's digital (logic) input circuitry. If multiple sensors are required in the motor, the connection at the drive must be the resultant of all required contacts wired in series. Note that the drives are available with either 24V DC or 115V AC input circuitry. Refer to the drive User Manual for details.
- Refer to all product markings for additional cautions that may apply.
- Typical motor markings are contained on a motor certification nameplate similar to Figure D.1.

Figure D.1 Sample Motor Nameplate

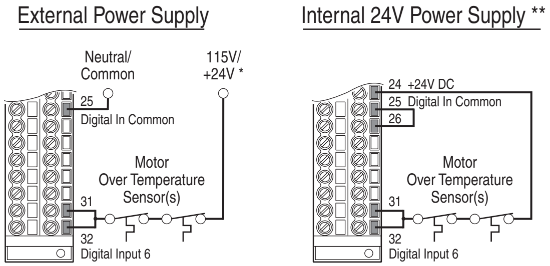


Drive Wiring

Important: ATEX certification of this drive requires that 2 separate digital (logic) inputs be configured to monitor a normally closed over temperature contact (or multiple contacts wired in series) presented to the drive from the motor.

The first input must be “Digital Input6/Hardware Enable” (terminal 32). The second can be any other unused digital input between 1 and 5. Note that all inputs are typically supplied in a “default” configuration to a function such as Start and Stop. This may influence the input selected by the user for this function. The following examples will assume Digital Input 5 (terminal 31) is being used as the additional required input. The 2 input terminals must be wired in “parallel” (jumper is acceptable) so each is monitoring the over temperature contacts. Digital signal inputs are wired with respect to the digital input common. Refer to the drive User Manual regarding setup for either internal or external 24V DC or external 115V AC logic power, depending on the type that is supplied in your drive. Motor supplied contacts must have ratings compatible with the drive’s input circuit ratings and applied voltage level.

Figure D.2 Wiring Example



External Power Supply

Internal 24V Power Supply **

* Voltage is Board Dependent

** Not available with 115V I/O

Drive Configuration

Both of the digital inputs required to monitor for motor over temperature must be configured correctly to assure that the drive will shut down independent of drive software operation, and be put into a fault condition that will require a fault reset before the drive can be restarted.

Hardware

Digital Input 6 must be configured as a Hardware Enable. This is accomplished by removing Jumper J10 from the Main Control Board in the I/O Control Cassette. Refer to the instructions in the I/O wiring section of the Installation/Wiring Chapter in the drive User Manual.

Firmware

- The functionality of Digital Input 5 is determined by parameter 365 [Digital In5 Sel]. (If a different digital input "x" is selected, refer to the corresponding [Digital In "x" Sel] parameter.) This parameter must be set to a value of "3" to configure this input as an "Aux Fault." When this digital input is opened, the drive will immediately shut down in a fault condition and require a fault reset before the drive can be restarted.
- Opening Digital Input 6 when configured as a Hardware Enable will interrupt IGBT gate firing directly. Additionally, Digital Input 6 will put the drive into a normal "not-enabled" shutdown condition. It is configured by parameter 366 [Digital In6 Sel]. This parameter must be set to a value of "1" to configure this input as an "Enable." When Digital Input 6 is opened, the gate firing will be interrupted and the drive will go into a "not-enabled" shutdown condition. Because the additional digital Input (typically Digital Input 5) must be wired to open simultaneously and be configured to put the drive into a fault condition, the drive will not restart if a new start command is given until the fault is reset.

Start-Up & Periodic Drive Testing Requirement

The integrity of both the Hardware Enable input (Digital Input 6) and the additional Aux Fault input must be maintained and verified periodically to meet certification requirements. The interval must be determined by the requirements of the application, but not be greater than one year. In addition to any requirements to check the integrity of the over temperature device(s) and the wiring of the over temperature contact closure to the drive terminals, the drive circuitry itself requires testing. This must be done during a maintenance period when the motor environment is not hazardous and all necessary precautions have been taken to repeatedly start and stop the drive and motor safely.

ATTENTION: Power must be applied to the drive to perform the following 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. If an event does not occur while performing this procedure, **Do Not Proceed**. **Remove Power** including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to then drive. Correct the malfunction before continuing.

Preparation

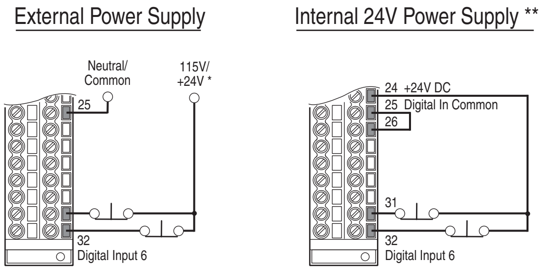
1. Disconnect all power from the drive including control power, if supplied.

2. Disconnect the motor from the driven load if necessary, to run this test.

3. Disconnect the motor over temperature contact connections from the drive. This includes both Digital Input 6 (terminal 32) and the additional required input (typically Digital Input 5, terminal 31). Remove the jumper between the two inputs if one is in place.

4. Connect a means to open and close a N.C. contact between Digital Input 6 (terminal 32) and input common. Connect a separate means to open and close a N.C. contact between the additional input (typically Digital Input 5, terminal 31) and input common (see Figure D.3). The switching devices (pushbutton, relay, etc.) must have contacts rated for either the 24V DC or 115V AC input circuit, whichever was supplied with the drive.

Figure D.3 Example Test Circuit



External Power Supply

Internal 24V Power Supply **

* Voltage is Board Dependent

** Not available with 115V I/O

5. Be sure both sets of test contacts are closed. Assure all control connections are properly made to the drive. Reapply power to the drive including external control power, if supplied.

Test

6. Perform any necessary parameter adjustments and start the drive. Confirm that the drive stops and starts normally, then start and slowly accelerate the motor.

7. Open Digital Input 6. The drive should stop and the motor coast to rest. The HIM/OIM should indicate that the drive is "Not Enabled."

8. Close Digital Input 6. The drive should not start but the HIM/OIM should indicate that the drive is "Stopped."

   Important: The drive should not start when closing Digital Input 6 even if a maintained start command is present and had not been removed when the drive stopped.

9. Provide the command to restart the drive. In the case of a maintained start, remove and reapply the start command. In either case the drive should run normally.
10. With the motor running, open Digital Input 5. The drive should stop and the motor coast to rest. The HIM/OIM should indicate that the drive is in an "Auxiliary Input" fault condition.
11. Close Digital Input 5. The drive should not start and the HIM/OIM will continue to indicate an "Auxiliary Input" fault condition.
12. Provide the command to restart the drive. In the case of a maintained start, remove and reapply the start command. In either case the drive should remain stopped and in a fault condition.
13. Provide a Fault Reset command to the drive. The drive fault should clear. The drive should not start even if a maintained start is applied when the fault is reset.
14. Provide the command to restart the drive. In the case of a maintained start, remove and reapply the start command. In either case the drive should run normally.
15. Stop the drive, and disconnect all power from the drive including external control power.
16. Disconnect the test switching devices from the two digital inputs.
17. Determine a way to interrupt the continuity of the over temperature circuit when it is reconnected to the motor.
18. Properly reconnect the motor over temperature contact connection to the drive and include the test mechanism to interrupt the over temperature circuit's continuity. This includes both Digital Input 6 (terminal 32) and the additional required digital input. Reconnect the jumper between the two inputs if one had been in place.
19. Reconnect power to the drive including external control power.
20. Start drive and confirm that it is operating properly.
21. Interrupt the continuity of the over temperature circuit connected to the drive. The drive should stop and the motor coast to rest. The HIM/OIM should indicate that the drive is in an Auxiliary Input fault condition.

22. Remake continuity of the over temperature circuit connected to the drive's digital inputs. The drive should remain stopped and in an Auxiliary Input fault condition.

23. Provide the command to restart the drive. In the case of a maintained start, remove and reapply the start command. The drive should remain stopped and in an Auxiliary Input fault condition.

24. Provide a fault reset command to the drive. The drive fault should clear but the drive should not restart.

25. Provide the command to restart the drive. The drive should run normally.

26. Stop the drive and disconnect all power including external control power.

27. Remove the test mechanism, reconnect original wires and verify all wiring.

28. Reconnect the motor to the load if it had been previously disconnected.

29. Check for proper operation.

Notes:

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PowerFlex 700 Parameter Record

Number	Parameter Name	Setting
40	Motor Type	
41	Motor NP Volts	
42	Motor NP FLA	
43	Motor NP Hertz	
44	Motor NP RPM	
45	Motor NP Power	
46	Mtr NP Pwr Units	
47	Motor OL Hertz	
48	Motor OL Factor	
49	Motor Poles	
50	Motor OL Mode	
53	Motor Cntl Sel	
54	Maximum Voltage	
55	Maximum Freq	
56	Compensation	
57	Flux Up Mode	
58	Flux Up Time	
59	SV Boost Filter	
61	Autotune	
62	IR Voltage Drop	
63	Flux Current Ref	
64	Ixo Voltage Drop	
66	Autotune Torque	
67	Inertia Autotune	
69	Start/Acc Boost	
70	Run Boost	
71	Break Voltage	
72	Break Frequency	
79	Speed Units	
80	Feedback Select	
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82	Maximum Speed	
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87	Skip Freq Band	
88	Speed/Torque Mod	
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91, 94	Speed Ref X Hi	
92, 95	Speed Ref X Lo	
96	TB Man Ref Sel	
97	TB Man Ref Hi	
98	TB Man Ref Lo	
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101-107	Preset Speed X	
108	Jog Speed 2	
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117	Trim In Select	
118	Trim Out Select	
119	Trim Hi	
120	Trim Lo	
121	Slip RPM @ FLA	
122	Slip Comp Gain	
124	PI Configuration	
125	PI Control	
126	PI Reference Sel	
127	PI Setpoint	
128	PI Feedback Sel	
129	PI Integral Time	
130	PI Prop Gain	
131	PI Lower Limit	
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142, 143	Decel Time X	
145	DB While Stopped	
146	S Curve %	
147	Current Lmt Sel	
148	Current Lmt Val	
149	Current Lmt Gain	
150	Drive OL Mode	
151	PWM Frequency	
152	Droop RPM @ FLA	
153	Regen Power Limit	
154	Current Rate Limit	
155, 156	Stop Mode X	
157	DC Brk Lvl Sel	
158	DC Brake Level	
159	DC Brake Time	
160	Bus Reg Ki	
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163	DB Resistor Type	
164	Bus Reg Kp	
165	Bus Reg Kd	
166	Flux Braking	
167	Powerup Delay	
168	Start At PowerUp	
169	Flying Start En	
170	Flying StartGain	
174	Auto Rstrt Tries	
175	Auto Rstrt Delay	
177	Gnd Warn Level	
178	Sleep-Wake Mode	
179	Sleep-Wake Ref	
180	Wake Level	
181	Wake Time	
182	Sleep Level	
183	Sleep Time	
184	Power Loss Mode	
185	Power Loss Time	
186	Power Loss Level	
187	Load Loss Level	
188	Load Loss Time	
189	Shear Pin Time	
190	Direction Mode	
192	Save HIM Ref	
193	Man Ref Preload	
194	Save MOP Ref	
195	MOP Rate	
196	Param Access Lvl	
197	Reset To Defalts	
198	Load Frm Usr Set	
199	Save To User Set	
200	Reset Meters	
201	Language	
202	Voltage Class	
204	Dyn UsrSet Cnfg	
205	Dyn UsrSet Sel	
234, 236	Testpoint X Sel	
238	Fault Config 1	
240	Fault Clear	
241	Fault Clear Mode	
259	Alarm Config 1	
261	Alarm Clear	
270	DPI Baud Rate	
274	DPI Port Sel	
276	Logic Mask	

Number	Parameter Name	Setting
277	Start Mask	
278	Jog Mask	
279	Direction Mask	
280	Reference Mask	
281	Accel Mask	
282	Decel Mask	
283	Fault Clr Mask	
284	MOP Mask	
285	Local Mask	
298	DPI Ref Select	
299	DPI Fdbk Select	
300-307	Data In XX	
308	HighRes Ref	
310-317	Data Out XX	
320	Anlg In Config	
321	Anlg In Sqr Root	
322, 325	Analog In X Hi	
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382, 386, 390	Dig OutX OnTime	
383, 387, 391	Dig OutX OffTime	
392	Dig Out Invert	
393	Dig Out Param	
394	Dig Out Mask	
411	DigIn DataLogic	
412	Motor Fdbk Type	
413	Encoder PPR	
416	Fdbk Filter Sel	
419	Notch Filter Freq	
420	Notch Filter K	
422	Pulse In Scale	
423	Encoder Z Chan	
427, 431	Torque Ref X Sel	
428, 432	Torque Ref X Hi	
429, 433	Torque Ref X Lo	
430	Torq Ref A Div	
434	Torque Ref B Mult	
435	Torque Setpoint	
436	Pos Torque Limit	
437	Neg Torque Limit	
438	Torque Setpoint2	
440	Control Status	
445	Ki Speed Loop	
446	Kp Speed Loop	
447	Kf Speed Loop	
448	Spd Err Filt BW	
449	Speed Desired BW	
450	Total Inertia	
454	Rev Speed Limit	
459	PI Deriv Time	
460	PI Reference Hi	
461	PI Reference Lo	
462	PI Feedback Hi	
463	PI Feedback Lo	
464	PI Output Gain	

Number	Parameter Name	Setting
476-494	ScaleX In Value	
477-495	ScaleX In Hi	
478-496	ScaleX In Lo	
479-497	ScaleX Out Hi	
480-498	ScaleX Out Lo	
596	Write Mask Cfg	
600	TorqProve Cnfg	
601	TorqProve Setup	
602	Spd Dev Band	
603	SpdBand Integrat	
604	Brk Release Time	
605	ZeroSpdFloatTime	
606	Float Tolerance	
607	Brk Set Time	
608	TorqLim SlewRate	
609	BrkSlip Count	
610	Brk Alarm Travel	
611	MicroPos Scale%	
613	Brake Test Torq	
632	TorqAlarm Level	
633	TorqAlarm Action	
634	TorqAlarm Dwell	
635	TorqAlrm Timeout	
636	TorqAlrm TO Act	
637	PCP Pump Sheave	
638	Max Rod Torque	
639	Min Rod Speed	
640	Max Rod Speed	
641	OilWell Pump Sel	
642	Gearbox Rating	
643	Gearbox Sheave	
644	Gearbox Ratio	
645	Motor Sheave	
647	DB Resistor	
648	Gearbox Limit	
650	Adj Volt Phase	
651	Adj Volt Select	
652	Adj Volt Ref Hi	
653	Adj Volt Ref Lo	
654-660	Adj Volt Preset1-7	
661	Min Adj Voltage	
663	MOP Adj VoltRate	
669	Adj Volt TrimSel	
670	Adj Volt Trim Hi	
671	Adj Volt Trim Lo	
672	Adj Volt Trim %	
675	Adj Volt AccTime	
676	Adj Volt DecTime	
677	Adj Volt S Curve	
702	Home Position	
705	Pos/Spd Prof Cmd	
707	Encoder Pos Tol	
708	Counts Per Unit	
711	Vel Override	
713	Find Home Speed	
714	Find Home Ramp	
718	Pos Reg Filter	
719	Pos Reg Gain	
720…	Step x Type	
721…	Step x Velocity	
722…	Step x AccelTime	
723…	Step x DecelTime	
724…	Step x Value	
725…	Step x Dwell	
726…	Step x Batch	
727…	Step x Next	

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

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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