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Allen-Bradley

PowerFlex 70 AC Drives

User Manual
Standard Control Firmware 2.xxx
Enhanced Control Firmware 2.xxx…4.xxx



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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.

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Summary of Changes

The information below summarizes the changes to the PowerFlex 70 User Manual since the April 2006 release.

Parameter Updates

The following parameters have been added or updated with firmware version 4.001 of the Enhanced Control option.

Description of New or Updated Information	Page
Parameter 476 [Scale1 In Value]	3-50
Parameter 477 [Scale1 In Hi]	3-50
Parameter 478 [Scale1 In Lo]	3-50
Parameter 482 [Scale2 In Value]	3-50
Parameter 483 [Scale2 In Hi]	3-50
Parameter 484 [Scale2 In Lo]	3-50

Additional Manual Updates

Description of New or Updated Information	Page
List of Reference Materials expanded.	P-2
General Precautions updated.	P-3
Catalog number explanation updated. Frame sizes added.	P-7
Single-phase operation clarified.	1-7
MOV and CMC disconnection instructions expanded.	1-11
Drive supplied 24V DC (I/O Terminals 7, 8 and 9) intended usage clarified.	1-16
Details regarding possible changes to parameter default values during Motor Tests added.	2-4
Parameter 40 [Motor Type] Important note added regarding options 1 and 2.	3-13
Parameter 49 [Motor Poles] description expanded.	3-13
Parameter 50 [Motor OL Mode] related parameter reference corrected.	3-14
Parameter 56 [Compensation] option descriptions corrected.	3-15
P126 [PI Reference Sel] description expanded.	3-26
Parameter 153 [Regen Power Lim] description expanded.	3-31
Parameter 184 [Power Loss Mode] option descriptions added.	3-38
Parameter 192 [AutoMan Cnfg], Enhanced Control, description added.	3-39
Parameter 196 [Param Access Lvl] description expanded.	3-40
Parameter 238 [Fault Config 1] footnote 3 added.	3-48
Parameter 242 [Power Up Marker] description expanded.	3-48
Parameter 366 [Digital In6 Sel] is no longer changeable.	3-59

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Description of New or Updated Information	Page
Parameter 380/384 [Digital OutX Sel] option 61 “Speed Fdbk” added.	3-61
Parameter 411 [DigIn DataLogic] description corrected.	3-60
Description expanded for Enable Hardware fault 111.	4-4
Description clarified for Power Loss fault 3.	4-6
Standard and Enhanced Control trip levels provided for UnderVoltage fault 4.	4-7
Cooling Fan Operation added.	A-2
Description of Speed Regulation with feedback corrected.	A-3
Watts Loss data added.	A-4
Frame Size reference table updated.	A-8
Tables added for Single-Phase Input Drive Ratings and Protection Devices	A-19
Section added on Using the HIM with a 20-HIM-B1 Bezel Kit.	B-2
Menu Structure for Start-Up corrected.	B-4
Discussion of Stop Modes expanded.	C-4

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Table of Contents

Preface	**Overview**	Who Should Use this Manual?	P-1
		What Is Not in this Manual	P-1
		Reference Materials	P-2
		Manual Conventions	P-3
		Drive Frame Sizes	P-3
		General Precautions	P-3
		Catalog Number Explanation	P-7
Chapter 1	**Installation/Wiring**	Opening the Cover	1-1
		Mounting Considerations	1-2
		AC Supply Source Considerations	1-3
		General Grounding Requirements	1-4
		Fuses and Circuit Breakers	1-5
		Power Wiring	1-5
		IP66 (4X/12) Installations	1-10
		Using Input/Output Contactors	1-10
		Disconnecting MOVs and CM Capacitors	1-11
		I/O Wiring	1-14
		Speed Reference Control	1-22
		Auto/Manual Examples	1-23
		EMC Instructions	1-24
Chapter 2	**Start Up**	Prepare For Drive Start-Up	2-1
		Status Indicators	2-3
		Start-Up Routines	2-4
		Running S.M.A.R.T. Start	2-5
		Running an Assisted Start Up	2-5
Chapter 3	**Programming and Parameters**	About Parameters	3-1
		How Parameters are Organized	3-3
		Monitor File (File A)	3-11
		Motor Control File (File B)	3-13
		Speed Command File (File C)	3-20
		Dynamic Control File (File D)	3-30
		Utility File (File E)	3-39
		Communication File (File H)	3-51
		Inputs & Outputs File (File J)	3-56
		Applications File (File K)	3-63
		Parameter Cross Reference – by Name	3-64
Chapter 4	**Troubleshooting**	Faults and Alarms	4-1
		Drive Status	4-2
		Manually Clearing Faults	4-3
		Fault Descriptions	4-3
		Clearing Alarms	4-8
		Alarm Descriptions	4-8
		Testpoint Codes and Functions	4-11
		Common Symptoms/Corrective Actions	4-12
Appendices	**See Next Page**		

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Appendix A **Supplemental Drive Information**
Specifications. A-1
Communication Configurations A-5
Dimensions A-8
Output Devices A-15
Drive, Fuse & Circuit Breaker Ratings . . A-15

Appendix B **HIM Overview**
External and Internal Connections B-1
LCD Display Elements B-3
ALT Functions B-3
Removing the HIM B-3
Menu Structure B-4
Viewing and Editing Parameters B-6

Appendix C **Application Notes**
External Brake Resistor C-1
Skip Frequency C-2
Stop Modes C-4
Motor Overload C-10
Motor Overload Memory Retention Per 2005 NEC C-11
Start At PowerUp. C-12
Overspeed C-13
Process PI for Standard Control C-14
Voltage Tolerance C-17

Index

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Overview

The purpose of this manual is to provide you with the basic information needed to install, start-up and troubleshoot the PowerFlex 70 Adjustable Frequency AC Drive.

For information on...	See page...
Who Should Use this Manual?	P-1
What Is Not in this Manual	P-1
Reference Materials	P-2
Manual Conventions	P-3
Drive Frame Sizes	P-3
General Precautions	P-3
Catalog Number Explanation	P-7

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 70 User Manual is designed to provide only basic start-up information. For detailed drive information, please refer to the PowerFlex Reference Manuals, publications PFLEX-RM001 and PFLEX-RM004.

The reference manual and updates to this user manual are available online at **http://www.rockwellautomation.com/literature**.

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Reference Materials

For detailed PowerFlex 70 and related information refer to the following publications online at **www.rockwellautomation.com/literature**:

Title	Publication
PowerFlex 70 & 700 Reference Manual - Vol. 1	PFLEX-RM001
PowerFlex 70EC & 700VC Reference Manual	PFLEX-RM004
DriveGuard Safe-Off Option (Series B) for PowerFlex 40P and PowerFlex 70 AC Drives	20A-UM003
PowerFlex Comm Adapter Manuals	20COMM-UM
Dynamic Braking Resistor Calculator	PFLEX-AT001

The following manuals are recommended for general drive information:

Title	Publication	Available Online at ...
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives	DRIVES-IN001	**www.rockwellautomation.com/literature**
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	

For Allen-Bradley Drives Technical Support:

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

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Manual Conventions

- In this manual we refer to the PowerFlex 70 Adjustable Frequency AC Drive as; drive, PowerFlex 70 or PowerFlex 70 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 70 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

Qualified Personnel

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

Personal Safety

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC terminal of the Power Terminal Block and the -DC test point (refer to Chapter 1 for locations). The voltage must be zero.

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

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

Product Safety

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

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

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

ATTENTION: 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.

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ATTENTION: Nuisance tripping may occur in Standard Control firmware version 1.011 and earlier due to unstable currents. When using a motor that is connected for a voltage that is different from the drive (e.g., using a 230V connected motor with a 460V drive) the following adjustment must be made to "Stability Gain" using DriveExplorer software and a personal computer.

$$\frac{\text{Motor Nameplate Voltage}}{\text{Drive Rated Voltage}} \times 128$$

Any adjustment made to "Stability Gain" must be manually restored if the drive is reset to defaults or is replaced.

If unstable currents are still present after making the adjustment, contact the factory for assistance.

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 F25 "OverSpeed Limit" fault will occur if the speed reaches P82 [Max Speed] + P83 [Overspeed Limit]. 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 [Bus Reg Mode A] and 162 [Bus Reg Mode B]).
2. Actual deceleration times can be longer than commanded deceleration times; however, a "Decel Inhibit" fault 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 [Bus Reg Mode A] and 162 [Bus Reg Mode B]). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

Note: These faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

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Output Contactor Precaution



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

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Catalog Number Explanation

Position Number

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

a

Drive	
Code	Type
20A	PowerFlex 70

b

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

c1

ND Rating

208V, 60 Hz Input

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

c2

ND Rating

240V, 60 Hz Input

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

c3

ND Rating

400V, 50 Hz Input

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

c4

ND Rating

480V, 60 Hz Input

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

c5

ND Rating

600V, 60 Hz Input ⋆

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

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

d

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

⋆ Only available on Frame E.

e

HIM	
Code	Interface Module
0	Blank Cover
3	Full Numeric LCD
5	Prog. Only LCD
8	Wireless Interface Module - IP66, NEMA/UL Type 4X/12 Only

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Position Number

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

f

Documentation	
Code	**Type**
A	Manual
N	No Manual

g

Brake IGBT	
Code	**w/Brake IGBT**
Y	Yes

h

Internal Brake Resistor	
Code	**w/Resistor**
Y	Yes
N	No

i

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

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

❄ Increases size to Frame B.

j

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

k

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

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

l

Feedback	
Code	**Feedback**
N	NA - Standard Control
0	No Feedback - Enhanced Control
1	5V/12V Encoder w/Enhanced Control

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Installation/Wiring

This chapter provides information on mounting and wiring the PowerFlex 70 Drive.

For information on...	See page
Opening the Cover	1-1
Mounting Considerations	1-2
AC Supply Source Considerations	1-3
General Grounding Requirements	1-4
Fuses and Circuit Breakers	1-5
Power Wiring	1-5
Using Input/Output Contactors	1-10

For information on...	See page
Disconnecting MOVs and Common Mode Capacitors	1-11
I/O Wiring	1-14
Speed Reference Control	1-22
Auto/Manual Examples	1-23
EMC Instructions	1-24

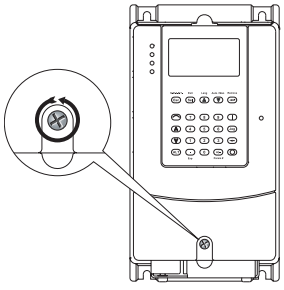
Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. 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.

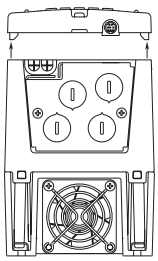
Opening the Cover

IP 20 (NEMA/UL Type 1)

1. Loosen cover screw.



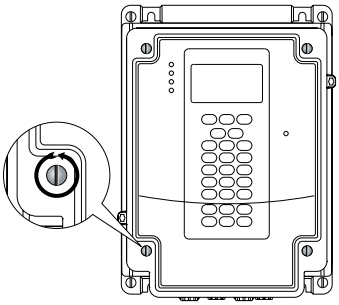
2. Pull cover straight off chassis to avoid damaging connector pins.



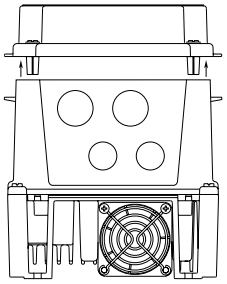
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IP 66 (NEMA/UL Type 4X/12)

1. Loosen the cover screws.



2. Pull cover straight off chassis.



Important: Torque cover screws to 0.79 N•m (7 lb•in).

Mounting Considerations

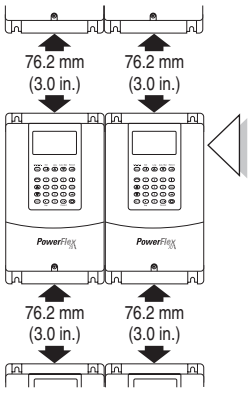
Maximum Surrounding Air Temperature

Enclosure Rating	Temperature Range
Open Type, IP 20, NEMA/UL Type 1 & Flange Mount	0…50 °C (32…122 °F)
IP 54, IP 66 & NEMA/UL Type 12	0…40 °C (32…104 °F)

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

Minimum Mounting Clearances

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



Clearances apply to all PowerFlex 70 Drives:

- Panel Mount
- Flange Mount
- NEMA/UL Type 4X/12

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AC Supply Source Considerations

PowerFlex 70 drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes, and a maximum of 600 volts.

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 (Residual Current Device) is to be used, only Type B (adjustable) devices should be used to avoid nuisance tripping.

Unbalanced, Ungrounded, High Resistance 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 AC Drives* (publication DRIVES-IN001).

ATTENTION: PowerFlex 70 drives contain protective MOVs and common mode capacitors that are referenced to ground. To guard against drive damage, these devices must be disconnected if the drive is installed on an ungrounded, high-resistance or B phase grounded distribution system. See page 1-11 for jumper locations.

Input Power Conditioning

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

1. **All drives**
   - The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
   - The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
   - The power source has frequent interruptions.
2. **5 HP or Less Drives (in addition to "1" above)**
   - The nearest supply transformer is larger than 100 kVA or the available short circuit (fault) current is greater than 100,000 A.
   - 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

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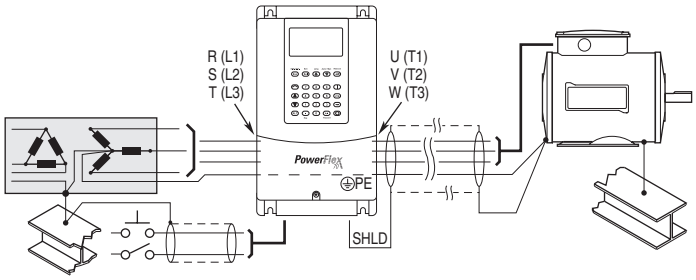
install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance can be calculated using the information supplied in the *Wiring and Grounding Guidelines for Pulse Width Modulated (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.

Figure 1.1 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 - SHLD

The Shield terminal (see Figure 1.2 on page 1-8) 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.

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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 70 can be installed with either 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 70 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 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.

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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*, publication 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.

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Table 1.A 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

Refer to EMC Instructions on page 1-24 for details.

Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to guidelines presented in Wiring and Grounding Guidelines for Pulse Width Modulated (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 (approximately 100 feet) are acceptable. However, if your application dictates longer lengths, refer to Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives for details.

Single-Phase Input Power

The PowerFlex 70 drive is typically used with a three-phase input supply. The drive has been listed by U.L. to operate on single-phase input power with the following requirement:

- Output current is derated by 50% of the three-phase ratings identified in tables A.B through A.D.

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Generator Input Power

Contact Allen-Bradley Drives Technical Support for details on how to properly power a drive using generator power.

Power Terminal Block

Figure 1.2 Typical Power Terminal Block Location (B Frame Shown)

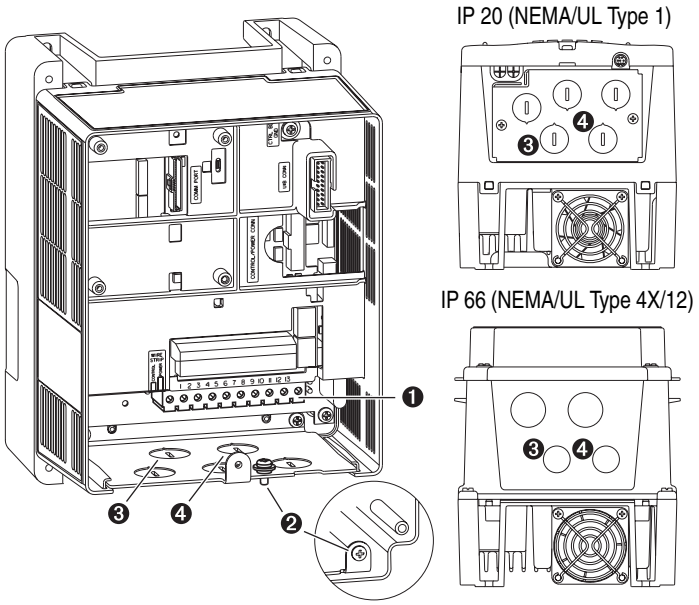


Table 1.B Power Terminal Block Specifications

No.	Name	Frame	Description	Wire Size Range(1)		Torque	
				Maximum	Minimum	Maximum	Recommended
1	Power Terminal Block	A, B, C	Input power and motor connections	4.0 mm^2 (10 AWG)	0.3 mm^2 (22 AWG)	1.1 N•m (10 lb•in)	0.8 N•m (7 lb•in)
		D	Input power and motor connections	10.0 mm^2 (6 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb•in)	1.4 N•m (12 lb•in)
		E	Input power and motor connections	25.0 mm^2 (3 AWG)	2.5 mm^2 (14 AWG)	2.71 N•m (24 lb•in)	2.71 N•m (24 lb•in)
2	SHLD terminal	All	Terminating point for wiring shields	—	—	1.6 N•m (14 lb•in)	1.6 N•m (14 lb•in)

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

Table 1.C Wire Routing Recommendations

No.	Description
3	Suggested entry for incoming line wiring.
4	Suggested entry for motor wiring.

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Cable Entry Plate Removal

If additional wiring access is needed, the Cable Entry Plate on all drive Frames can be removed. Simply loosen the screws securing the plate to the heat sink and slide the plate out.

Figure 1.3 Frames A, B, C, D Power Terminal Block and DC Bus Test Points

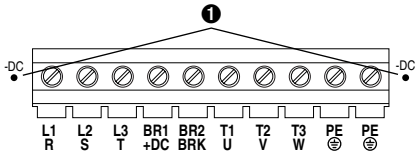
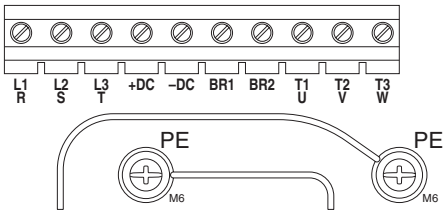
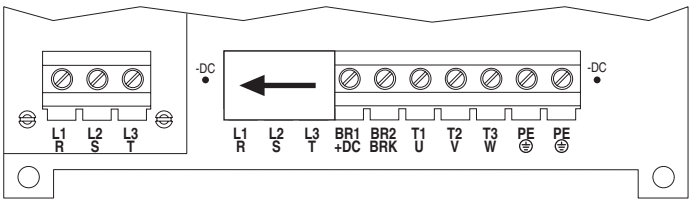


Figure 1.4 Frame E Power Terminal Block



Terminal	Description	Notes
R	R (L1)	3-Phase AC Line Input Power For 1-Phase Input, connect to any two terminals.
S	S (L2)	
T	T (L3)	
BR1	DB Resistor	DB Resistor Connection - **Important:** Do not connect both an internal and external DB resistor at the same time. This may violate the minimum allowed DB resistance and cause drive damage. It is recommended that the DB wires are twisted and kept as short as possible
BR2	DB Resistor	
U	U (T1)	To Motor
V	V (T2)	To Motor
W	W (T3)	To Motor
PE	PE Ground	
PE	PE Ground	
-DC	DC Bus (–)	❶ Test point on Frames A-D located to the left or right of the Power Terminal Block. Frame E has a dedicated terminal that can be used for a DB chopper module.
+DC	DC Bus (+)	

Figure 1.5 Power Input Terminals on Frame B with Internal RFI Filter Option

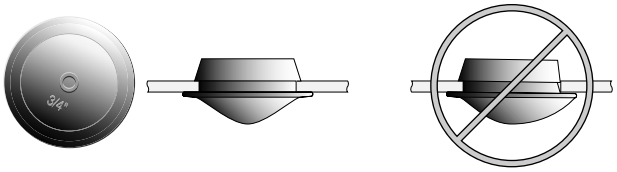


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IP66 (NEMA/UL Type 4X/12) Installations

Use the plugs supplied with IP66 (NEMA/UL Type 4X/12) rated drives to seal unused holes in the conduit entry plate.

Important: Completely seat the plug inner rim for the best seal.



Using Input/Output Contactors

Input Contactor Precautions

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

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

Output Contactor Precaution

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

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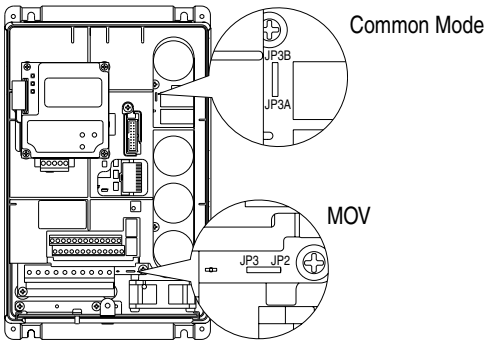
Disconnecting MOVs and Common Mode Capacitors

PowerFlex 70 drives contain protective MOVs and common mode capacitors that are referenced to ground. To guard against drive damage, these devices must be disconnected if the drive is installed on an ungrounded, high-resistance or B phase grounded distribution system. 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. To disconnect these devices, remove the jumper(s) listed under Phase to Ground MOV Removal (Figures 1.6 and 1.7). Jumpers can be removed by carefully pulling the jumper straight out. See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on ungrounded systems.

Important: Common mode capacitors are required to conform with the EMC directive and MOV's are needed to meet UL certification. Removing these devices will withdraw the associated directive/certification.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before removing/installing jumpers. Measure the DC bus voltage at the +DC terminal of the Power Terminal Block and the -DC test point on Frames A…D, or the -DC terminal of the Frame E Power Terminal Block. The voltage must be zero.

Figure 1.6 Frame A, C, D Jumper Locations (Frame C Shown)
Note: Frame A does not have a Common Mode jumper.



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Figure 1.7 Frame B Jumper Locations

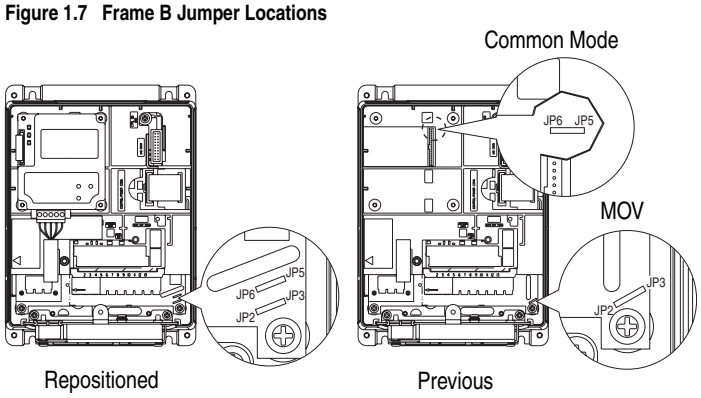
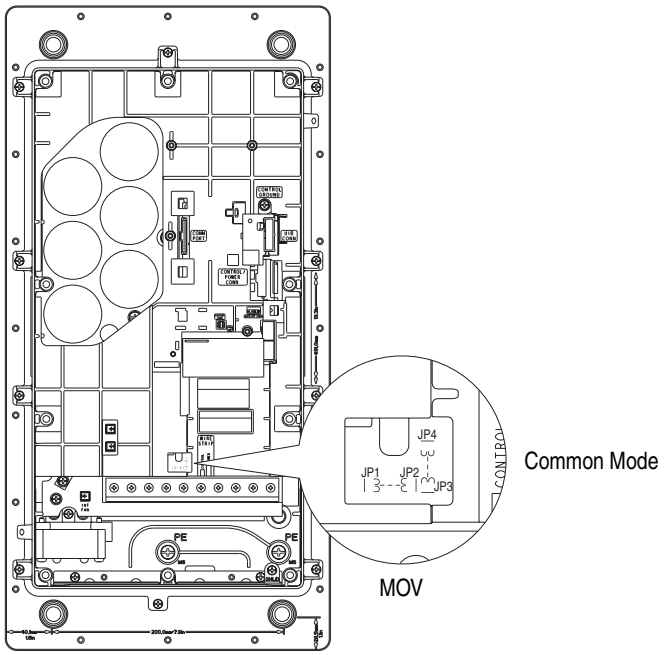


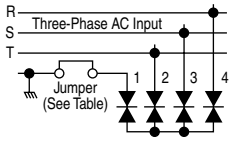
Figure 1.8 Frame E Jumper Locations



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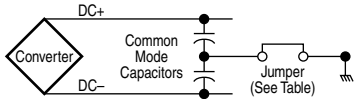
ATTENTION: When installing a drive on an ungrounded, high-resistance or B phase grounded distribution system, disconnect the phase-to-ground MOV circuit and the common mode capacitors from ground to guard against drive damage.

Figure 1.9 Phase to Ground MOV Removal



Frame	Jumper	Removes
A, B, C and D	JP3 – JP2	MOV to Ground
E	JP2 – JP1	MOV and Line to Line Capacitors to Ground

Figure 1.10 Common Mode Capacitors to Ground Removal



Frame	Jumper	Removes
A	N/A	
B	JP6 – JP5	Common Mode Capacitors to Ground
C and D	JP3B – JP3A	Common Mode Capacitors to Ground
E	JP3 – JP4	Common Mode Capacitors to Ground

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I/O Wiring

Important points to remember about I/O wiring:

- Use copper wire only. Wire gauge requirements and recommendations are based on 75 °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 "(–)" Digital In Common or "Common" are not connected 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.D Recommended Signal Wire

Signal Type	Wire Type(s)	Description	Minimum Insulation Rating
Analog I/O	Belden 8760/9460 (or equiv.)	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (1).	300V, 75…90 °C (167…194 °F)
	Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded for remote pot only.	
Encoder	Belden 9728 (or equiv.)	0.196 mm^2 (24 AWG), individually shielded.	
EMC Compliance	Refer to EMC Instructions on page 1-24 for details.		

(1) 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.E Recommended Control Wire for Digital I/O

	Wire Type(s)	Description	Minimum 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.	

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I/O Terminal Block

Figure 1.11 Typical I/O Terminal Block Location (B Frame Shown)

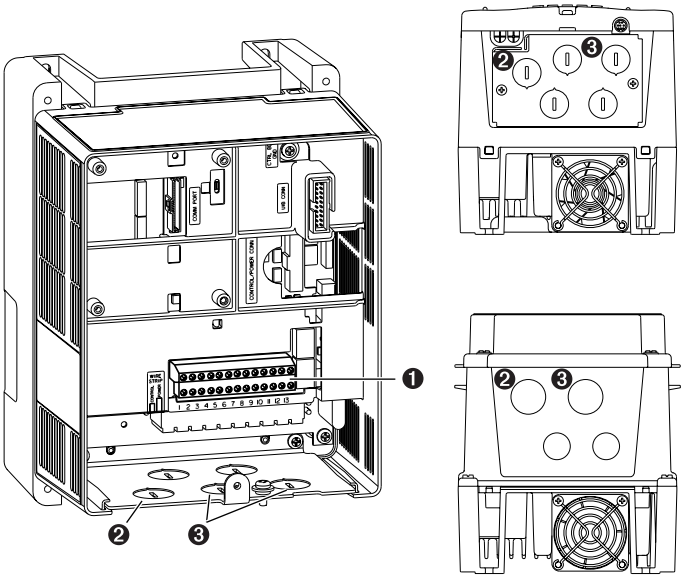


Table 1.F I/O Terminal Block Specifications

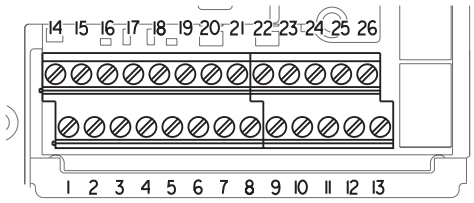
No.	Name	Description	Wire Size Range[1]		Torque	
			Maximum	Minimum	Maximum	Recommended
❶	I/O Terminal Block	Signal & control connections	1.5 mm^2 (16 AWG)	0.05 mm^2 (30 AWG)	0.55 N•m (4.9 lb•in)	0.5 N•m (4.4 lb•in)

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

Table 1.G Wire Routing Recommendations

No.	Description
❷	Suggested entry for communication wiring.
❸	Suggested entry for I/O and control wiring.

Figure 1.12 I/O Terminal Positions



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Table 1.H I/O Terminal Designations – Standard and Enhanced Control

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

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

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

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

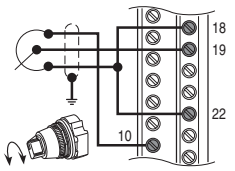
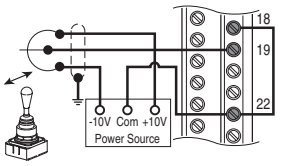
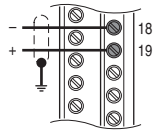
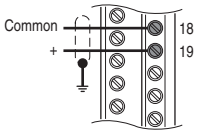
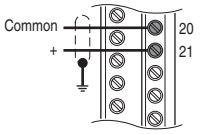
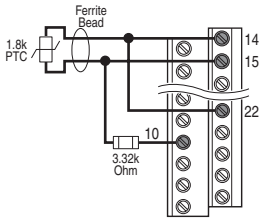
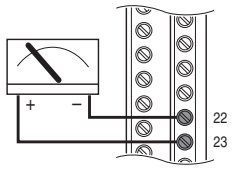
(4) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

(5) Analog output current is only available with Enhanced Control drives.

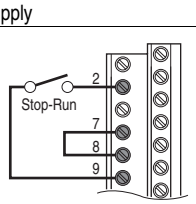
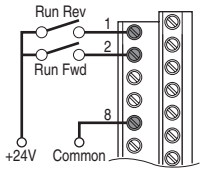
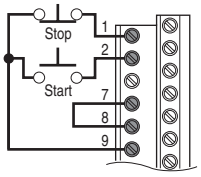
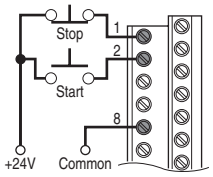
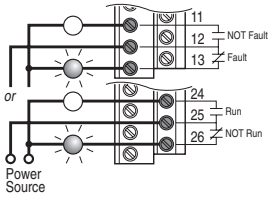
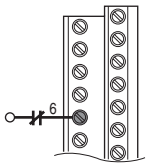
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I/O Wiring Examples

The following basic wiring examples may differ from your application.

Input/Output	Connection Example	Required Parameter Settings
Potentiometer Unipolar Speed Reference 10k Ohm Pot. Recommended (2k Ohm minimum)		Select Speed Reference source: Param. 090 = 2 “Analog In 2” Adjust Scaling: Param. 091, 092, 322, 323 Check Results: Param. 017
Joystick Bipolar Speed Reference ±10V Input		Set Direction Mode: Param. 090 = 2 “Analog In 2” Param. 190 = 1 “Bipolar” Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Bipolar Speed Reference ±10V Input		Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Unipolar Speed Reference 0 to +10V Input		Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Unipolar Speed Reference 0-20 mA Input		Configure Input for Current: Param. 320, Bit #1 = 1 “Current” Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input, Positive Temperature Coefficient PTC OT set > 5V PTC OT cleared < 4V PTC Short < 0.2V		Set Fault Config 1: Param. 238, Bit #7 = 1 “Enabled” Set Alarm Config 1: Param. 259, Bit #11 = 1 “Enabled”
Analog Output Unipolar 0 to +10V Output. Can Drive a 2k Ohm load (25 mA short circuit limit) 0-20 mA Output. 400 Ohm max load.		Select Source Value: Param. 342 Adjust Scaling: Param. 343, 344

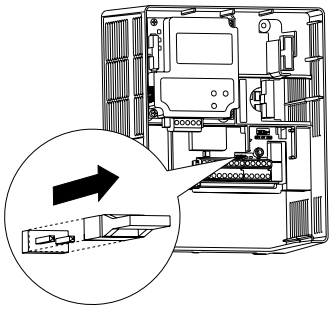
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Input/Output	Connection Example	Required Parameter Settings
2 Wire Control Non-Reversing	Internal Supply 	Disable Digital Input 1: Param. 361 = 0 “Not Used” Set Digital Input 2: Param. 362 = 7 “Run”
2 Wire Control Reversing	External Supply 	Set Digital Input 1: Param. 361 = 9 “Run Reverse” Set Digital Input 2: Param. 362 = 8 “Run Forward”
3 Wire Control	Internal Supply 	Use factory default parameter settings.
3 Wire Control	External Supply 	Use factory default parameter settings.
Digital Output Form C Relays Energized in Normal State.		Select Source: Param. 380, 384
Enable Input Shown in enabled state.		Standard Control Configure with parameter 366 Enhanced Control Configure with parameter 366 For dedicated hardware Enable: Remove Enable Jumper (see page 1-19)

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Hardware Enable Circuitry (Enhanced Control Only)

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a hardware enable configuration can be utilized. This is done by removing the enable jumper (ENBL JMP) and wiring the enable input to "Digital In 6" (see below). Note that P366 [Digital In6 Sel] is no longer changeable.



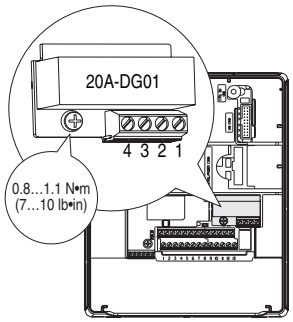
1.Remove drive cover as described on pages 1-1 and 1-2.

2.Locate and remove the Enable Jumper on the Main Control Board (see diagram).

3.Wire Enable to "Digital In 6" (see Table 1.H).

Safe Off Board (Enhanced Control Only)

The PowerFlex Safe-Off board, when used with suitable safety components, provides protection according to EN 954-1:1997; Category 3 for safe off and protection against restart. The PowerFlex safe off option is just one safety control system. All components in the system must be chosen and applied correctly, to achieve the desired level of operator safeguarding.



Important: The hardware enable jumper (ENBL JMP) must be removed when using the DriveGuard Safe-Off option. Failure to remove the jumper will cause the drive to fault when a start command is issued.

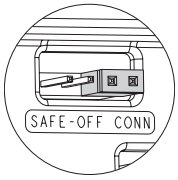
Table 1.I Terminal Description

No.	Signal	Description
1	Monitor - N.C.	Normally closed contacts for monitoring relay status. Maximum Resistive Load: 250V AC / 30V DC / 50 VA / 60 Watts Maximum Inductive Load: 250V AC / 30V DC / 25 VA / 30 Watts
2	Common - N.C.	
3	+24V DC	Connections for user supplied power to energize coil.
4	24V Common	

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For detailed information on installing and wiring a safety relay system, refer to the DriveGuard“ Safe-Off Option (Series B) for PowerFlex 40P and PowerFlex 70 AC Drives User Manual, publication PFLEX-UM003.

Important: If the Safe-Off board is removed from the drive, pins 3 and 4 of the Safe-Off Connector must be jumpered for the drive to run. If the Safe-Off board or the jumper is not installed, and the drive is commanded to run, an F111 “Enable Hardware” fault will occur.



Encoder Interface (Enhanced Control Only)

The PowerFlex Encoder Interface can source 5 or 12 volt power and accept 5 or 12 volt single ended differential inputs.

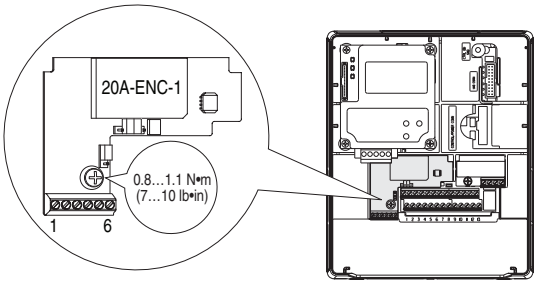
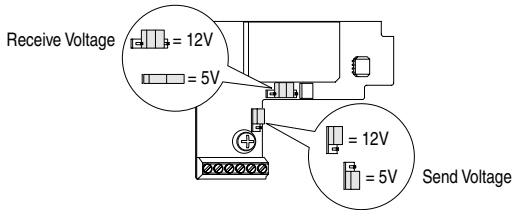


Table 1.J Terminal Description

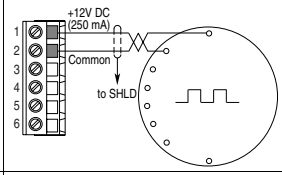
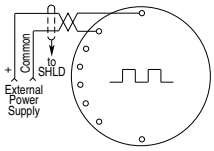
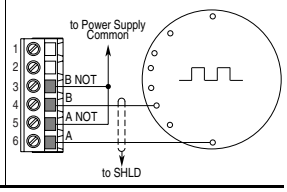
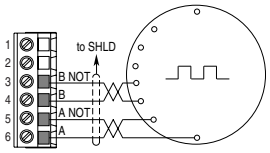
No.	Signal	Description
1	5-12V Power	Internal power source 250 mA (isolated).
2	Power Return	
3	Encoder B (NOT)	Single channel or quadrature B input.
4	Encoder B	
5	Encoder A (NOT)	Single channel or quadrature A input.
6	Encoder A	

Figure 1.13 Jumper Settings



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Figure 1.14 Sample Encoder Wiring

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

Refer to page A-3 for additional Encoder specifications.

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Speed 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 input 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 P90 [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive will use other parameters as the speed command source.

If a communication device is the source of the speed reference, refer to the appropriate Communications manual for additional information.

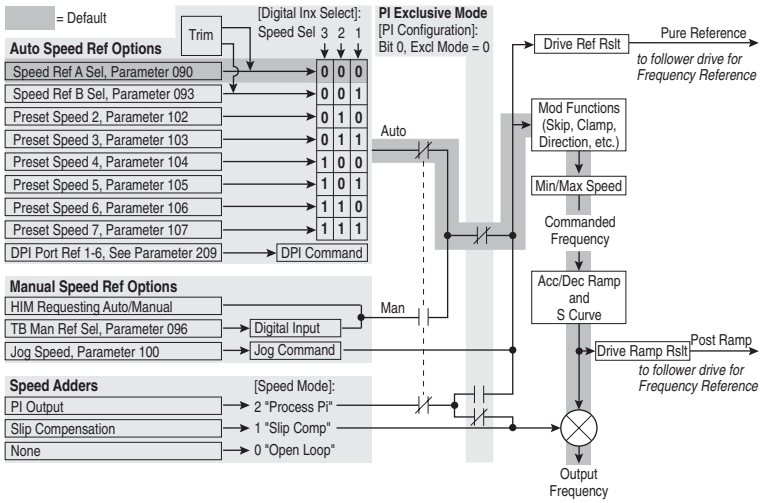
"Manual" Speed Sources

The manual source for speed command to the drive is either the HIM requesting manual control (see ALT Functions on page B-3) or the control terminal block (analog input 1, 2, or MOP based on P96 [TB Man Ref Sel]) if a digital input is programmed to "Auto/Manual".

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.

Figure 1.15 Speed Reference Selection Chart (1)



(1) To access Preset Speed 1, set [Speed Ref A Sel] or [Speed Ref B Sel] to "Preset Speed 1".

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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, P90 [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.

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, P90 [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”), P96 [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 digital input 4.
  With the input closed, the speed command comes from the potentiometer.

Release to Auto Control

- Open digital input 4.
  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.

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EMC Instructions

CE Conformity[1]

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 comply with the EN standards listed below when installed according to the instructions in this manual and the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001.

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

Low Voltage Directive (2006/95/EC)

- 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

- 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 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 provided in this section, 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 generate conducted low frequency disturbances (harmonic emissions) on the AC supply system.

[1] CE Certification testing has not been completed for 600 Volt class drives.

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General Notes (continued)

- When operated on a public supply system, it is the responsibility of the installer or user to ensure, by consultation with the distribution network operator and Rockwell Automation if necessary, that applicable requirements have been met.

Essential Requirements for CE Compliance

Conditions 1-6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN 61800-3:2004**.

1. Standard PowerFlex 70 CE compatible Drive.
2. Review important precautions/attention statements throughout this manual before installing the drive.
3. Grounding as described on page 1-5.
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. Conditions in Table 1.K or 1.L.

Table 1.K PowerFlex 70 EN61800-3 EMC Compatibility

Frame	Drive Description	Second Environment				First Environment Restricted Distribution
		Restrict Motor Cable to 40 m (131 ft)	*Internal Filter Option*	*External Filter*	*Input Ferrite (1)*	
A	Drive Only	✔		✔		
	with any Comm Option	✔		✔		
	with Remote I/O	✔		✔	✔	
B	Drive Only	✔	✔			
	with any Comm Option	✔	✔			
	with Remote I/O	✔	✔		✔	
C	Drive Only	✔				
	with any Comm Option	✔				Refer to *Table 1.L*
	with Remote I/O	✔			✔	
D	Drive Only	✔				
	with any Comm Option	✔				
	with Remote I/O	✔			✔	
E	Drive Only	✔				
	with any Comm Option	✔				
	with Remote I/O	✔			✔	

(1) Input cables through a Ferrite Core (Frames A, B and C Fair-Rite #2643102002 or equivalent, Frames D and E Fair-Rite #2643251002 or equivalent).

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Table 1.L PowerFlex 70 EN61800-3 First Environment Restricted Distribution

Frame	Drive Description	First Environment Restricted Distribution				
		Restrict Motor Cable to:	*Internal Filter Option*	*External Filter (1)*	*Comm Cable Ferrite (2)*	*Common Mode Core (3)*
A	Drive Only	40 m (131 ft)		✔		
	Drive with any Comm Option	40 m (131 ft)		✔		
	Drive with Remote I/O	40 m (131 ft)		✔	✔	
B	Drive Only	12 m (40 ft)	✔			
	Drive with any Comm Option	12 m (40 ft)	✔			
	Drive with Remote I/O	12 m (40 ft)	✔		✔	
C	Drive Only	12 m (40 ft)				✔
	Drive with any Comm Option	12 m (40 ft)				✔
	Drive with Remote I/O	12 m (40 ft)			✔	✔
D	Drive Only	12 m (40 ft)				
	Drive with any Comm Option	12 m (40 ft)				
	Drive with Remote I/O	12 m (40 ft)			✔	
E	Drive Only	30 m (98 ft)		✔		
	Drive with any Comm Option	30 m (98 ft)		✔		
	Drive with Remote I/O	30 m (98 ft)		✔	✔	

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

(2) Two turns of the blue comm option cable through a Ferrite Core (Frames A, B, C Fair-Rite #2643102002, Frame D Fair-Rite #2643251002 or equivalent).

(3) Refer to the 1321 Reactor and Isolation Transformer Technical Data publication, 1321-TD001x for 1321-Mxxx selection information.

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Table 1.M PowerFlex 70 Recommended Filters

Manufacturer	Frame	Manufacturer Part Number(1)	Class A (Meters)	Class B (Meters)	Manufacturer Part Number(1)	Class A (Meters)	Class B (Meters)
Deltron	A	KMF306A	25	25	–	–	–
	B w/o Filter	KMF310A	50	25	–	–	–
	B w/Filter	KMF306A	100	50	MIF306	–	100
	C	KMF318A	–	150	–	–	–
	D	KMF336A	150	5	MIF330	–	150
	D w/o DC CM Capacitor	KMF336A	–	50	–	–	–
	E	–	–	–	MIF3100	–	30
Schaffner	A	FN3258-7-45	–	50	–	–	–
	B w/o Filter	FN3258-7-45	100	50	–	–	–
	B w/Filter	FN3258-7-45	–	100	–	–	–
	C	FN3258-16-45	–	150	–	–	–
	D	FN3258-30-47	0	0	FN258-30-07	–	150
	D w/o DC CM Capacitor	FN3258-30-47	–	150	–	–	–
	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.

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Notes:

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Start Up

This chapter describes how you start up the PowerFlex 70 Drive. Refer to Appendix B for a brief description of the LED and LCD HIM (Human Interface Module).

For information on...	See page...
Prepare For Drive Start-Up	2-1
Status Indicators	2-3
Start-Up Routines	2-4
Running S.M.A.R.T. Start	2-5
Running an Assisted Start Up	2-5

Prepare For Drive Start-Up

- The check list that follows supports the Start-Up menu option.
- A Human Interface Module (HIM) is required to run the Start-Up routine.
- The Start-Up routine may modify parameter values for Analog and Digital I/O.

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 the drive. Correct the malfunction before continuing.

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.

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❑ **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 the drive will not start. Refer to Alarm Descriptions on page 4-8 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 and their indications below.

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

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Status Indicators

Figure 2.1 Drive Status Indicators (Typical)



#	Name	Color	State	Description
❶	STS (Status)	Green	Flashing	Drive ready, but not running and no faults are present.
			Steady	Drive running, no faults are present.
		Yellow See page 4-8	Flashing, Drive Stopped	An inhibit condition exists, the drive cannot be started. Check parameter 214 [Start Inhibits].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
		Red See page 4-3	Flashing	A fault has occurred. Check parameters 243, 245, 247 and 249
			Steady	A non-resetable fault has occurred.
❷	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).

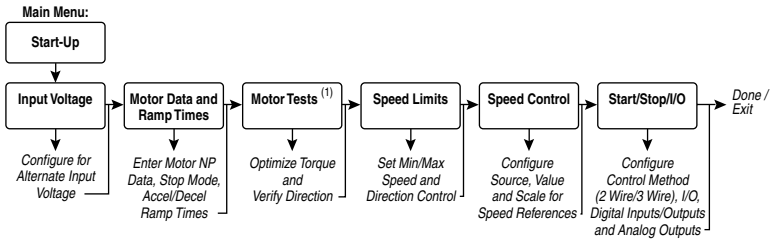
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Start-Up Routines

The PowerFlex 70 is designed so that start up is simple and efficient. If you have an LCD HIM, two methods are provided, allowing the user to select the desired level needed for the application.

- **S.M.A.R.T. Start**
  This routine allows you to quickly set up the drive by programming values for the most commonly used functions (see below).
- **Assisted Start Up**
  This routine prompts you for information that is needed to start up a drive for most applications, such as line and motor data, commonly adjusted parameters and I/O. With Enhanced Control, two levels of Assisted Start Up are provided; Basic and Detailed.

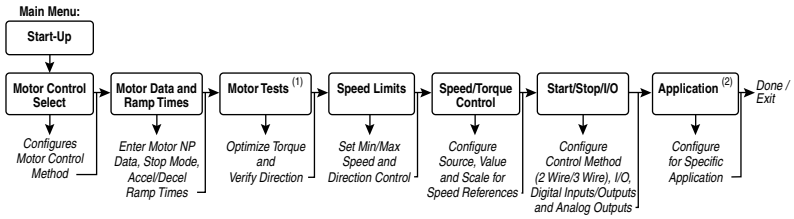
Figure 2.2 Standard Control Start Up Menu



If you do not have an LCD HIM, you must set parameters individually using the LED HIM or other configuration tools, Refer to Chapter 3 for parameters.

Important: Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status when power is applied.

Figure 2.3 Enhanced Control 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.

(2) Detailed start-up mode only.

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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 70 drive offers S.M.A.R.T. start, which displays the most commonly changed parameters. With these parameters, you can set the following functions:

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

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

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

Running an Assisted Start Up

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

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

To perform an Assisted Start-Up

Step	Key(s)	Example LCD Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Start Up”. 2. Press Enter.	▲ ▼ ↵	F-> Stopped Auto 0.0 Hz Main Menu: Memory Storage Start Up Preferences

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

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Notes:

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Programming and Parameters

Chapter 3 provides a complete listing and description of the PowerFlex 70 parameters. The parameters can be programmed (viewed/edited) using an LED or 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 brief descriptions of the LED and LCD Human Interface Modules.

For information on...	See page...
About Parameters	3-1
How Parameters are Organized	3-3
Monitor File (File A)	3-11
Motor Control File (File B)	3-13
Speed Command File (File C)	3-20
Dynamic Control File (File D)	3-30
Utility File (File E)	3-39
Communication File (File H)	3-51
Inputs & Outputs File (File J)	3-56
Applications File (File K)	3-63
Parameter Cross Reference – by Name	3-64

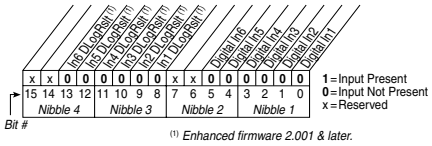
About Parameters

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. The LED HIM will display a number 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.

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❶ File	❷ Group	❸ No.	❹ Parameter Name & Description	❺ Values	❻ Related
UTILITY (File E)	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
	Diagnostics	216	**[Dig In Status]** Status of the digital inputs.  (1) Enhanced firmware 2.001 & later.	
MOTOR . . .	Torq . . .	059	E C **[SV Boost Filter]** Sets the amount of filtering used to boost voltage during Sensorless Vector operation.	Default: 500 Min/Max: 0/32767 Units: 1	

No.	Description		
❶	**File** – Lists the major parameter file category.		
❷	**Group** – Lists the parameter group within a file.		
❸	**No.** – Parameter number. = Parameter value can not be changed until drive is stopped. = 32 bit parameter. = 32 bit parameter in Enhanced Control drives only. = Parameter only displayed when [Motor Cntl Sel] is set to "4."		
❹	**Parameter Name & Description** – Parameter name as it appears on an LCD HIM, with a brief description of the parameters function. Standard = This parameter is specific to Standard Control drives. E C = This parameter will only be available with Enhanced Control drives.		
❺	**Values** – Defines the various operating characteristics of the parameter. Three types exist.		
	ENUM	Default:	Lists the value assigned at the factory. "Read Only" = no default.
		Options:	Displays the programming selections available.
	Bit	Bit #:	Lists the bit place holder and definition for each bit.
	Numeric	Default:	Lists the value assigned at the factory. "Read Only" = no default.
		Min/Max: Units:	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 320 [Anlg In Config]. • Values that pertain to Enhanced Control drives only will be indicated by " E C ."	
		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.		

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How Parameters are Organized

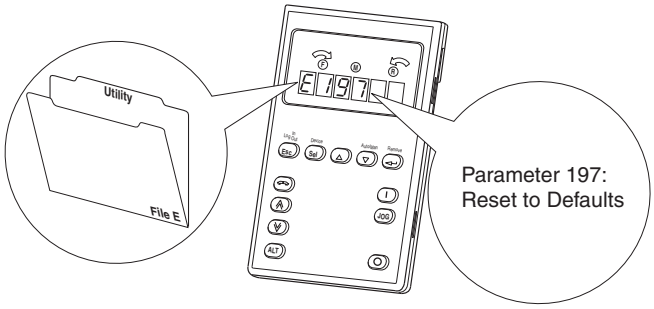
LED HIM (Human Interface Module)

The LED HIM displays parameters in **Numbered List** order. Parameters are accessed by first selecting the file letter then a parameter number.

Important: The PowerFlex 70 Enhanced Control drive does not support the LED HIM.

File Letter Designations

The LED HIM identifies each parameter by File Letter and Parameter Number.



LCD HIM (Human Interface Module)

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 196 [Param Access Lvl], the user has the option to display *all* parameters, commonly used parameters or diagnostic parameters.

Control Options

Two different control options are available for the PowerFlex 70; Standard and Enhanced. Standard Control drives provide Volts per Hertz and Sensorless Vector operation. Enhanced Control drives support the addition of FVC Vector Control, DriveGuard Safe Off option and more.

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File-Group-Parameter View

This simplifies programming by grouping parameters that are used for similar functions. The parameters are organized into 6 files in Basic Parameter view or 7 files in Advanced Parameter view. 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.

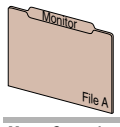
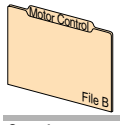
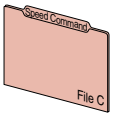
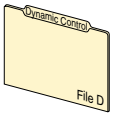
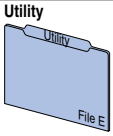
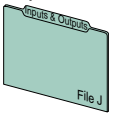
Numbered List View

All parameters are in numerical order.

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Basic Parameter View – Standard Control

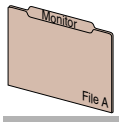
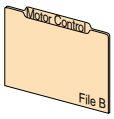
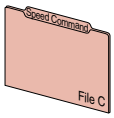
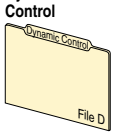
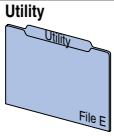
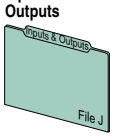
Parameter 196 [Param Access Lvl] set to option 0 “Basic.”

File	Group	Parameters					
Monitor 	Metering	Output Freq Commanded Freq Output Current DC Bus Voltage	001 002 003 012				
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	047
	Torq Attributes	Torque Perf Mode Maximum Voltage	053 054	Maximum Freq Autotune	055 061		
Speed Command 	Spd Mode & Limits	Minimum Speed Maximum Speed	081 082				
	Speed References	Speed Ref A Sel Speed Ref A Hi Speed Ref A Lo	090 091 092	Speed Ref B Sel Speed Ref B Hi Speed Ref B Lo	093 094 095	TB Man Ref Sel TB Man Ref Hi TB Man Ref Lo	096 097 098
	Discrete Speeds	Jog Speed Preset Speed 1-7	100 101-107				
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 Current Lmt Val	147 148				
	Stop/Brake Modes	Stop Mode A Stop 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		
Utility 	Direction Config	Direction Mode	190				
	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
	Faults	Fault Config 1	238				
Inputs & Outputs 	Analog Inputs	Anlg In Config	320	Analog In1 Hi Analog In1 Lo	322 323	Analog In2 Hi Analog In2 Lo	325 326
	Analog Outputs	Analog Out1 Sel Analog Out1 Hi Analog Out1 Lo	342 343 344				
	Digital Inputs	Digital In1-6 Sel	361-366				
	Digital Outputs	Digital Out1 Sel Dig Out1 Level	380 381	Digital Out2 Sel Dig Out2 Level	384 385		

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Basic Parameter View – Enhanced Control

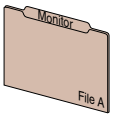
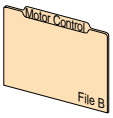
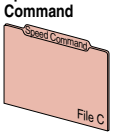
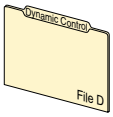
Parameter 196 [Param Access Lvl] set to option 0 “Basic.”

File	Group	Parameters					
Monitor 	Metering	Output Freq Commanded Freq Output Current Torque Current DC Bus Voltage Commanded Torque**	001 002 003 004 012 024				
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	053 054 055	Autotune Autotune Torque** Inertia Autotune**	061 066 067	Torque Ref A Sel** Torque Ref A Hi** Torque Ref A Lo** Pos Torque Limit** Neg Torque Limit**	427 428 429 436 437
	Speed Feedback	Motor Fdbk Type** Encoder PPR**	412 413				
Speed Command 	Spd Mode & Limits	Feedback Select	080	Minimum Speed Maximum Speed	081 082		
	Speed References	Speed Ref A Sel Speed Ref A Hi Speed Ref A Lo	090 091 092	Speed Ref B Sel Speed Ref B Hi Speed Ref B Lo	093 094 095	TB Man Ref Sel TB Man Ref Hi TB Man Ref Lo	096 097 098
	Discrete Speeds	Jog Speed 1	100	Preset Speed 1-7	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 Brake 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		
Utility 	Direction Config	Direction Mode	190				
	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
	Faults	Fault Config 1	238				
Inputs & Outputs 	Analog Inputs	Anlg In Config	320	Analog In 1 Hi Analog In 2 Hi	322 325	Analog In 1 Lo Analog In 2 Lo	323 326
	Analog Outputs	Analog Out1 Sel	342	Analog Out1 Hi Analog Out1 Lo	343 344		
	Digital Inputs	Digital In1-6 Sel	361-366				
	Digital Outputs	Digital Out1 Sel Digital Out2 Sel	380 384	Dig Out1 Level Dig Out2 Level	381 385		

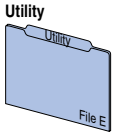
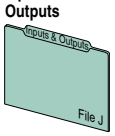
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Advanced Parameter View – Standard Control

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

File	Group	Parameters					
Monitor 	Metering	Output Freq Commanded Freq Output Current Torque Current Flux Current	001 002 003 004 005	Output Voltage Output Power Output Powr Fctr Elapsed MWh Elapsed Run Time	006 007 008 009 010	MOP Frequency DC Bus Voltage DC Bus Memory Analog In1 Value Analog In2 Value	011 012 013 016 017
	Drive Data	Rated kW Rated Volts	026 027	Rated Amps Control SW Ver	028 029		
Motor Control 	Motor Data	Motor Type Motor NP Volts Motor NP FLA Motor NP Hertz	040 041 042 043	Motor NP RPM Motor NP Power Mtr NP Pwr Units Motor OL Hertz	044 045 046 047	Motor OL Factor	048
	Torq Attributes	Torque Perf Mode Maximum Voltage Maximum Freq	053 054 055	Compensation Flux Up Mode Flux Up Time	056 057 058	Autotune IR Voltage Drop Flux Current Ref	061 062 063
	Volts per Hertz	StAcc Boost Run Boost	069 070	Break Voltage Break Frequency	071 072		
Speed Command 	Spd Mode & Limits	Speed Mode Minimum Speed Maximum Speed	080 081 082	Overspeed Limit Skip Frequency 1 Skip Frequency 2	083 084 085	Skip Frequency 3 Skip Freq Band	086 087
	Speed References	Speed Ref A Sel Speed Ref A Hi Speed Ref A Lo	090 091 092	Speed Ref B Sel Speed Ref B Hi Speed Ref B Lo	093 094 095	TB Man Ref Sel TB Man Ref Hi TB Man Ref Lo	096 097 098
	Discrete Speeds	Jog Speed Preset Speed 1-7	100 101-107				
	Speed Trim	Trim In Select Trim Out Select	117 118	Trim Hi Trim Lo	119 120		
	Slip Comp	Slip RPM @ FLA Slip Comp Gain	121 122	Slip RPM Meter	123		
	Process PI	PI Configuration PI Control PI Reference Sel PI Setpoint PI Feedback Sel	124 125 126 127 128	PI Integral Time PI Prop Gain PI Lower Limit PI Upper Limit PI Preload	129 130 131 132 133	PI Status PI Ref Meter PI Fdback Meter PI Error Meter PI Output Meter	134 135 136 137 138
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 Current Lmt Val Current Lmt Gain	147 148 149	Drive OL Mode PWM Frequency	150 151		
	Stop/Brake Modes	Stop Mode A Stop Mode B DC Brake Lvl Sel	155 156 157	DC Brake Level DC Brake Time Bus Reg Gain	158 159 160	Bus Reg Mode A Bus Reg Mode B DB Resistor Type	161 162 163
	Restart Modes	Start At PowerUp Flying Start En	168 169	Flying StartGain Auto Rstrt Tries	170 174	Auto Rstrt Delay	175
	Power Loss	Power Loss Mode Power Loss Time	184 185				

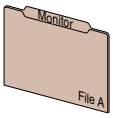
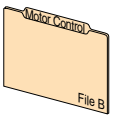
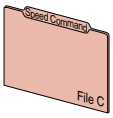
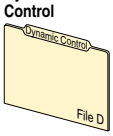
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File	Group	Parameters					
Utility 	Direction Config	Direction Mode	190				
	HIM Ref Config	Save HIM Ref Man Ref Preload	192 193				
	MOP Config	Save MOP Ref MOP Rate	194 195				
	Drive Memory	Param Access Lvl Reset To Defalts Load Frm Usr Set	196 197 198	Save To User Set Reset Meters Language	199 200 201	Voltage Class Drive Checksum	202 203
	Diagnostics	Drive Status 1 Drive Status 2 Drive Alarm 1 Drive Alarm 2 Speed Ref Source Start Inhibits Last Stop Source Dig In Status	209 210 211 212 213 214 215 216	Dig Out Status Drive Temp Drive OL Count Motor OL Count Fault Frequency Fault Amps Fault Bus Volts Status 1 @ Fault	217 218 219 220 224 225 226 227	Status 2 @ Fault Alarm 1 @ Fault Alarm 2 @ Fault Testpoint 1 Sel Testpoint 1 Data Testpoint 2 Sel Testpoint 2 Data	228 229 230 234 235 236 237
	Faults	Fault Config 1 Fault Clear	238 240	Fault Clear Mode Power Up Marker	241 242	Fault 1-4 Code Fault 1-4 Time	243-249 244-250
	Alarms	Alarm Config 1	259				
Communication 	Comm Control	DPI Data Rate Drive Logic Rslt	270 271	Drive Ref Rslt Drive Ramp Rslt	272 273		
	Masks & Owners	Logic Mask Start Mask Jog Mask Direction Mask Reference Mask Accel Mask Decel Mask	276 277 278 279 280 281 282	Fault Clr Mask MOP Mask Local Mask Stop Owner Start Owner Jog Owner Direction Owner	283 284 285 288 289 290 291	Reference Owner Accel Owner Decel Owner Fault Clr Owner MOP Owner Local Owner	292 293 294 295 296 297
	Datalinks	Data In A1-D2 Data Out A1-D2	300-307 310-317				
Inputs & Outputs 	Analog Inputs	Anlg In Config Anlg In Sqr Root	320 321	Analog In 1 Hi Analog In 1 Lo Anlg In 1 Loss	322 323 324	Analog In 2 Hi Analog In 2 Lo Anlg In 2 Loss	325 326 327
	Analog Outputs	Anlg Out Absolut Analog Out1 Sel	341 342	Analog Out1 Hi Analog Out1 Lo	343 344		
	Digital Inputs	Digital In1-6 Sel	361-366				
	Digital Outputs	Digital Out1 Sel Dig Out1 Level Dig Out1 OnTime Dig Out1 OffTime	380 381 382 383	Digital Out2 Sel Dig Out2 Level Dig Out2 OnTime Dig Out2 OffTime	384 385 386 387		

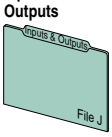
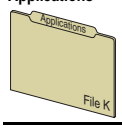
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Advanced Parameter View – Enhanced Control

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

File	Group	Parameters							
Monitor 	Metering	Output Freq	001	Output Powr Fctr	008	Torque Estimate	015[3.x]
		Commanded Freq	002	Elapsed MWh	009	Analog In1 Value	016
		Output Current	003	Elapsed Run Time	010	Analog In2 Value	017
		Torque Current	004	MOP Frequency	011	Ramped Speed	022
		Flux Current	005	DC Bus Voltage	012	Speed Reference	023
		Output Voltage	006	DC Bus Memory	013	Commanded Torque**	024
		Output Power	007	Elapsed kWh	014	Speed Feedback	025
	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 Poles	049
		Motor NP FLA	042	Mtr NP Pwr Units	046	Motor OL Mode	050[3.x]
		Motor NP Hertz	043	Motor OL Hertz	047		
	Torq Attributes	Motor Cntl Sel	053	Autotune	061	Torque Ref A Hi**	428
		Maximum Voltage	054	IR Voltage Drop	062	Torque Ref A Lo**	429
		Maximum Freq	055	Flux Current Ref	063	Torque Setpoint1**	435
		Compensation	056	Ixo Voltage Drop	064	Pos Torque Limit**	436
		Flux Up Mode	057	Autotune Torque**	066	Neg Torque Limit**	437
		Flux Up Time	058	Inertia Autotune**	067	Control Status**	440
		SV Boost Filter	059	Torque Ref A Sel**	427	Torq Current Ref**	441
	Volts per Hertz	StAcc Boost*	069	Break Voltage*	071		
		Run Boost*	070	Break Frequency*	072		
	Speed Feedback	Motor Fdbk Type	412	Enc Pos Feedback	414	Fdbk Filter Sel**	416
		Encoder PPR	413	Encoder Speed	415	Notch FilterFreq**	419
						Notch Filter K**	420
Speed Command 	Spd Mode & Limits	Feedback Select	080	Skip Frequency 1	084	Skip Freq Band	087
		Minimum Speed	081	Skip Frequency 2	085	Speed/Torque Mod**	088
		Maximum Speed	082	Skip Frequency 3	086	Rev Speed Limit	454
		Overspeed Limit	083				
	Speed References	Speed Ref A Sel	090	Speed Ref B Sel	093	TB Man Ref Sel	096
		Speed Ref A Hi	091	Speed Ref B Hi	094	TB Man Ref Hi	097
		Speed Ref A Lo	092	Speed Ref B Lo	095	TB Man Ref Lo	098
	Discrete Speeds	Jog Speed 1	100	Preset Speed 1-7	101-107	Jog Speed 2	108
	Speed Trim	Trim % Setpoint	116	Trim In Select	117	Trim Hi	119
				Trim Out Select	118	Trim Lo	120
	Slip Comp	Slip RPM @ FLA	121	Slip Comp Gain*	122	Slip RPM Meter	123
	Process PI	PI Configuration	124	PI Lower Limit	131	PI Output Meter	138
		PI Control	125	PI Upper Limit	132	PI BW Filter	139
		PI Reference Sel	126	PI Preload	133	PI Deriv Time	459
		PI Setpoint	127	PI Status	134	PI Reference Hi	460
		PI Feedback Sel	128	PI Ref Meter	135	PI Reference Lo	461
		PI Integral Time	129	PI Fdback Meter	136	PI Feedback Hi	462
		PI Prop Gain	130	PI Error Meter	137	PI Feedback Lo	463
	Speed Regulator	Ki Speed Loop**	445	Spd Err Filt BW	448[3.x]	Total Inertia**	450
		Kp Speed Loop**	446	Speed Desired BW**	449	Speed Loop Meter**	451
		Kf Speed Loop**	447				
Dynamic Control 	Restart Modes	Powerup Delay	167	Auto Rstrt Tries	174	Wake Level	180
		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
	Power Loss	Gnd Warn Level	177	Power Loss Time	185	Load loss Time	188
		Power Loss Mode	184	Load Loss Level	187		
	Ramp Rates	Accel Time 1	140	Decel Time 1	142	S Curve %	146
		Accel Time 2	141	Decel Time 2	143		
	Load Limits	Current Lmt Sel	147	Drive OL Mode	150	Regen Power Lim**	153
		Current Lmt Val	148	PWM Frequency	151	Current Rate Lim**	154
		Current Lmt Gain	149	Droop RPM@FLA	152	Shear Pin Time*	189

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File	Group	Parameters					
Dynamic Control *continued*	Stop/Brake Modes	DB While Stopped	145	DC Brake Time	159	Bus Reg Kp*	164
		Stop/Brk Mode A	155	Bus Reg Ki*	160	Bus Reg Kd*	165
		Stop/Brk Mode B	156	Bus Reg Mode A	161	Flux Braking	166
		DC Brake Lvl Sel	157	Bus Reg Mode B	162		
		DC Brake Level	158	DB Resistor Type	163		
Utility 	Direction Config	Direction Mode	190				
	HIM Ref Config	AutoMan Cnfg	192				
	MOP Config	Save MOP Ref	194	MOP Rate	195		
	Drive Memory	Param Access Lvl	196	Reset Meters	200	Dyn UsrSet Cnfg	204
		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		
	Diagnostics	Drive Status 1	209	Drive Temp	218	Status 1 @ Fault	227
		Drive Status 2	210	Drive OL Count	219	Status 2 @ Fault	228
		Drive Alarm 1	211	Motor OL Count	220	Alarm 1 @ Fault	229
		Drive Alarm 2	212	Mtr OL Trip Time	221[3.x]	Alarm 2 @ Fault	230
		Speed Ref Source	213	Drive Status 3	222[3.x]	Testpoint 1 Sel	234
		Start Inhibits	214	Status 3 @ Fault	223[3.x]	Testpoint 1 Data	235
		Last Stop Source	215	Fault Frequency	224	Testpoint 2 Sel	236
		Dig In Status	216	Fault Amps	225	Testpoint 2 Data	237
		Dig Out Status	217	Fault Bus Volts	226		
	Faults	Fault Config 1	238	Fault Clear Mode	241	Fault 1-4 Code	243-249
		Fault Clear	240	Power Up Marker	242	Fault 1-4 Time	244-250
	Alarms	Alarm Config 1	259				
	Scaled Blocks	Scale1 In Value	476	Scale2 In Value	482		
		Scale1 In Hi	477	Scale2 In Hi	483		
		Scale1 In Lo	478	Scale2 In Lo	484		
Communication 	Comm Control	DPI Data Rate	270	Drive Ramp Rslt	273	DPI Ref Select	298
		Drive Logic Rslt	271	DPI Port Select	274		
		Drive Ref Rslt	272	DPI Port Value	275		
	Masks & Owners	Logic Mask	276	Fault Clr Mask	283	Reference Owner	292
		Start Mask	277	MOP Mask	284	Accel Owner	293
		Jog Mask	278	Local Mask	285	Decel Owner	294
		Direction Mask	279	Stop Owner	288	Fault Clr Owner	295
		Reference Mask	280	Start Owner	289	MOP Owner	296
		Accel Mask	281	Jog Owner	290	Local Owner	297
		Decel Mask	282	Direction Owner	291		
	Datalinks	Data In A1-D2	300-307	HighRes Ref	308	Data Out A1-D2	310-317
	Security	PortMask Act	595	Write Mask Act	597	Logic Mask Act	598
		Write Mask Cfg	596	Logic Mask	276		
Inputs & Outputs 	Analog Inputs	Anlg In Config	320	Analog In 1 Lo	323	Analog In 2 Lo	326
		Anlg In Sqr Root	321	Analog In 1 Loss	324	Analog In 2 Loss	327
		Analog In 1 Hi	322	Analog In 2 Hi	325		
	Analog Outputs	Anlg Out Config	340	Analog Out1 Hi	343	Anlg Out1 Setpt	377
		Anlg Out Absolut	341	Analog Out1 Lo	344		
		Analog Out1 Sel	342	Anlg Out Scale	354		
	Digital Inputs	Digital In1-6 Sel	361-366	DigIn DataLogic	411		
	Digital Outputs	Dig Out Setpt	379	Dig Out1 OnTime	382	Dig Out2 Level	385
		Digital Out1 Sel	380	Dig Out1 OffTime	383	Dig Out2 OnTime	386
		Dig Out1 Level	381	Digital Out2 Sel	384	Dig Out2 OffTime	387
Applications[3.x] 	Fiber Functions[3.x]	Fiber Control	620[3.x]	Traverse Inc	623[3.x]	P Jump	626[3.x]
		Fiber Status	621[3.x]	Traverse Dec	624[3.x]		
		Sync Time	622[3.x]	Max Traverse	625[3.x]		

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

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

[3.x] Firmware 3.002 & later only.

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Monitor File (File A)

File A	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MONITOR (File A)	Metering	001	**[Output Freq]** Output frequency present at T1, T2 & T3 (U, V & W)	Default: Read Only Min/Max: –/+[Maximum Freq] Units: 0.1 Hz	
		002	**[Commanded Freq]** Value of the active frequency command.	Default: Read Only Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	213
		003	**[Output Current]** EC 32 The total output current present at T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated Amps × 2 Units: 0.1 Amps 0.01 Amps EC	
		004	**[Torque Current]** EC 32 The amount of current that is in phase with the fundamental voltage component.	Default: Read Only Min/Max: Drive Rating × –2/+2 Units: 0.1 Amps 0.01 Amps EC	
		005	**[Flux Current]** EC 32 The amount of current that is out of phase with the fundamental voltage component.	Default: Read Only Min/Max: Drive Rating × –2/+2 Units: 0.1 Amps 0.01 Amps EC	063
		006	**[Output Voltage]** Output voltage present at terminals T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated Volts Units: 0.1 VAC	054 202
		007	**[Output Power]** EC 32 Output power present at T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated kW × 2 Units: 0.1 kW 0.01 kW EC	
		008	**[Output Powr Fctr]** Output power factor.	Default: Read Only Min/Max: 0.00/1.00 Units: 0.01	
		009	**[Elapsed MWh]** 32 Accumulated output energy of the drive.	Default: Read Only Min/Max: 0.0/429496729.5 MWh Units: 0.1 MWh	
		010	**[Elapsed Run Time]** 32 Accumulated time drive is outputting power.	Default: Read Only Min/Max: 0.0/429496729.5 Hrs Units: 0.1 Hrs	
		011	**[MOP Frequency]** Value of the signal at MOP (Motor Operated Potentiometer).	Default: Read Only Min/Max: –/+[Maximum Frequency] Units: 0.1 Hz	194 195
		012	**[DC Bus Voltage]** Present DC bus voltage level.	Default: Read Only Min/Max: 0.0/Drive Rating Based Units: 0.1 VDC	
		013	**[DC Bus Memory]** 6 minute average of DC bus voltage level.	Default: Read Only Min/Max: 0.0/Drive Rating Based Units: 0.1 VDC	

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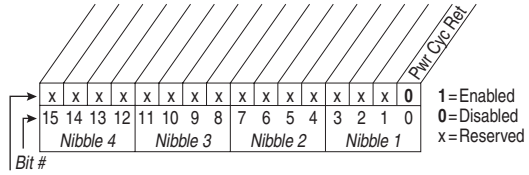
File A	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MONITOR (File A)	Metering	014 32	E C **[Elapsed kWh]** Accumulated output energy of the drive.	Default: Read Only Min/Max: 0.0/429496729.5 kWh Units: 0.1 kWh	
		015	E C v3 **[Torque Estimate]** Estimated motor torque output as percent of motor rated torque.	Default: Read Only Min/Max: –/+800.0 % Units: 0.1 %	
		016 017	**[Analog In1 Value]** **[Analog In2 Value]** Value of the signal at the analog inputs.	Default: Read Only Min/Max: 0.000/20.000 mA –/+10.000V Units: 0.001 mA 0.001 Volt	320 thru 327
		022	E C **[Ramped Speed]** 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: –/+500.0 Hz Units: 0.1 Hz	
		023	E C **[Speed Reference]** Summed value of ramped speed and Process PI.	Default: Read Only Min/Max: –/+500.0 Hz Units: 0.1 Hz	053 138 152
		024 FV	E C v2 **[Commanded Torque]** Final torque reference value after limits & filtering are applied. % motor rated torque.	Default: Read Only Min/Max: –/+800.0% Units: 0.1%	053
		025	E C v2 **[Speed Feedback]** Value of actual motor speed, measured by encoder feedback or estimated.	Default: Read Only Min/Max: –/+500.0 Hz Units: 0.1 Hz	053
	Drive Data	026 32	**[Rated kW]** Drive power rating.	Default: Read Only Min/Max: 0.37/15.0 kW 0.00/300.00 kW E C Units: 0.01 kW	
		027	**[Rated Volts]** The drive input voltage class (208, 240, 400 etc.).	Default: Read Only Min/Max: 208/600 Volt 0.0/6553.5 Volt E C Units: 0.1 VAC	
		028	**[Rated Amps]** The drive rated output current.	Default: Read Only Min/Max: 1.1/32.2 Amps 0.0/6553.5 Amps E C Units: 0.1 Amps	
		029	**[Control SW Ver]** Main Control Board software/firmware version.	Default: Read Only Min/Max: 0.000/65.256 0.0/65.535 E C Units: 0.001	196

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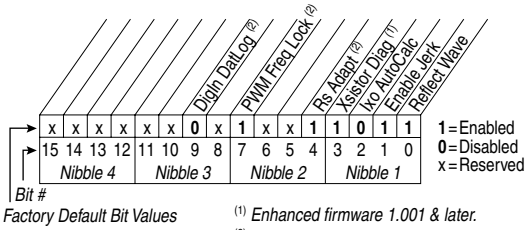
Motor Control File (File B)

File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	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: Drive Rating Based Min/Max: 0.0/[Rated Volts] Units: 0.1 VAC	
		042	**[Motor NP FLA]** Set to the motor nameplate rated full load amps.	Default: Drive Rating Based Min/Max: 0.0/[Rated Amps] × 2 Units: 0.1 Amps	047 048 148
		043	**[Motor NP Hertz]** Set to the motor nameplate rated frequency.	Default: Drive Rating Based Min/Max: 5.0/400.0 Hz 5.0/500.0 Hz EC Units: 0.1 Hz	
		044	**[Motor NP RPM]** Set to the motor nameplate rated RPM.	Default: Drive Rating Based Min/Max: 60/30000 RPM Units: 1 RPM	049 080 121
		045	**[Motor NP Power]** Set to the motor nameplate rated power. 32 (1) See [Mtr NP Pwr Units]	Default: Drive Rating Based Min/Max: 0.00/100.00 0.00/412.48 EC Units: 0.01 kW/HP(1)	046
		046	**[Mtr NP Pwr Units]** Selects the motor power units to be used.	Default: Drive Rating Based Options: 0 "Horsepower" 1 "kiloWatts"	045
		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: 0.0/500.0 Hz Units: 0.1 Hz	042 220 i
		048	**[Motor OL Factor]** Sets operating level for motor overload service factor. P42 [Motor NP FLA] x P48 [Motor OL Factor] = Operating Level	Default: 1.00 Min/Max: 0.20/2.00 Units: 0.01	042 220 i
		049	EC **[Motor Poles]** Defines the number of poles in the motor. Number of Poles = (120 x P43 [Motor NP Hertz]) / P44 [Motor NP RPM]	Default: 4 Min/Max: 2/40 Units: 2 Pole	043 044

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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Motor Data	050	E C v3 **[Motor OL Mode]** If "0," [Motor OL Count], P220 is reset to zero by a drive reset or a power cycle. If "1," the value is maintained. A "1" to "0" transition resets [Motor OL Count], P220 to zero.  *Factory Default Bit Values*		220
	Torq Attributes	053	Standard **[Torque Perf Mode]** Sets the method of motor torque production.	Default: 0 "Sensrls Vect" Options: 0 "Sensrls Vect" 1 "SV Economize" 2 "Custom V/Hz" 3 "Fan/Pmp V/Hz"	062 063 069 070
			E C **[Motor Cntl Sel]** Sets the method of motor control used in the drive. **Important:** "FVC Vector" mode requires autotuning of the motor, both coupled and uncoupled to the load. (1) Enhanced firmware 2.001 & later.	Default: 0 "Sensrls Vect" Options: 0 "Sensrls Vect" 1 "SV Economize" 2 "Custom V/Hz" 3 "Fan/Pmp V/Hz" 4 "FVC Vector"(1)	
		054	**[Maximum Voltage]** Sets the highest voltage the drive will output.	Default: Drive Rated Volts Min/Max: Rated Volts × 0.25/Rated Volts Units: 0.1 VAC	197
		055	**[Maximum Freq]** Sets the highest frequency the drive will output. Refer to parameter 083 [Overspeed Limit].	Default: 110.0 or 130.0 Hz Min/Max: 5.0/400.0 Hz 5.0/500.0 Hz E C Units: 0.1 Hz	082 083 202 298

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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Torq Attributes	056	**[Compensation]** Enables/disables correction options.  *Factory Default Bit Values* (1) *Enhanced firmware 1.001 & later.* (2) *Enhanced firmware 2.001 & later.* Option Descriptions Reflect Wave — Provides 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 — Power transistor power diagnostic tests run at each start command. Rs Adapt — FVC w/Encoder Only - Disabling may improve torque regulation at lower speeds (typically not needed). PWM Freq Lock — Keeps the PWM frequency from decreasing to 2 kHz at low operating frequencies in FVC Vector mode without encoder. DigIn DatLog — Enables logic functions that can be applied to parameter 411 [DigIn DataLogic] and the specified digital input.		140 thru 143 411
		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: 0.00 Secs Min/Max: 0.00/5.00 Secs Units: 0.01 Secs	053 058
		059	E C **[SV Boost Filter]** Sets the amount of filtering used to boost voltage during Sensorless Vector operation.	Default: 500 Min/Max: 0/32767 Units: 1	

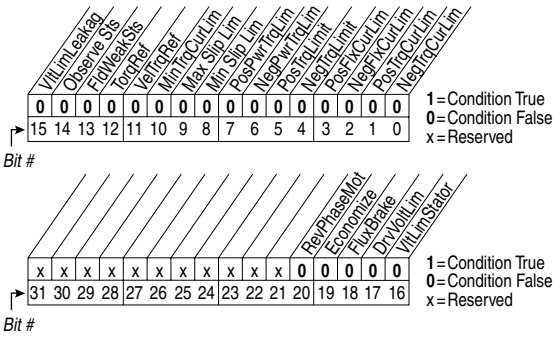
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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Torq Attributes	061	**[Autotune]** Provides a manual or automatic method for setting P62 [IR Voltage Drop] and P63 [Flux Current Ref], which affect sensorless vector performance. Valid only when P53 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 P62 [IR Voltage Drop], P64 [Ixo Voltage Drop] and P63 [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 P62 [IR Voltage Drop] in all valid modes and a non-rotational motor leakage inductance test for the best possible automatic setting of P64 [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 P63 [Flux Current Ref]. In "FVC Vector" mode, with encoder feedback, a test for the best possible automatic setting of P121 [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 P62 [IR Voltage Drop], P64 [Ixo Voltage Drop], P63 [Flux Current Ref] and P121 [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: Drive Rating Based Min/Max: 0.0/[Motor NP Volts]×0.5 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: Drive Rating Based Min/Max: [Motor NP FLA] × 0.05/[Motor NP FLA] × 0.9 Units: 0.01 Amps	053 061

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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Torq Attributes	064	E C v2 **[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 "FVC Vector."	Default: Based on Drive Rating Min/Max: 0.0/Motor NP Volts Units: 0.1 VAC	053 061
		066	E C v2 **[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	E C v2 **[Inertia Autotune]** Provides an automatic method of setting [Total Inertia]. This test is automatically run during Start-Up motor tests. **Important:** Use when motor is coupled to the load. Results may not be valid if the load is not coupled to the motor during this procedure. "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"	053 066 445 446 449 450
		427	E C v2 **[Torque Ref A Sel]** Selects the source of the external torque reference to the drive. How this reference is used is dependent upon P88 [Speed/Torque Mod]. (1) See *Appendix B* for DPI port locations.	Default: 0 "Torque Setpt" Options: 0 "Torque Setpt" 1 "Analog In 1" 2 "Analog In 2" 3-17 "Reserved" 18-22 "DPI Port 1-5" (1) 23 "Reserved" 24 "Disabled"	053 088 320 thru 327 428 thru 437
		428	E C v2 **[Torque Ref A Hi]** Scales the upper value of the [Torque Ref A Sel] selection when the source is an analog input.	Default: 100.0% Min/Max: –/+800.0% Units: 0.1%	053 427
		429	E C v2 **[Torque Ref A Lo]** Scales the lower value of the [Torque Ref A Sel] selection when the source is an analog input.	Default: 0.0% Min/Max: –/+800.0% Units: 0.1%	053 427
		435	E C v2 **[Torque Setpoint1]** Provides an internal fixed value for Torque Setpoint when [Torque Ref Sel] is set to "Torque Setpt."	Default: 0.0% Min/Max: –/+800.0% Units: 0.1%	053 427
		436	E C v2 **[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

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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Torq Attributes	437	E C v2 **[Neg Torque Limit]** FV 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
		440	E C v2 **[Control Status]** FV Displays a summary status of any condition that may be limiting either the current or the torque reference. 	Read Only	053
		441	E C v2 **[Torq Current Ref]** FV Displays the torque current reference value that is present at the output of the current rate limiter (parameter 154).	Default: Read Only Min/Max: –/+3276.7 Amps Units: 0.1 Amps	053
	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: Drive Rating Based Min/Max: 0.0/[Motor NP Volts] × 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. Refer to the diagram at parameter 083.	Default: Drive Rating Based Min/Max: 0.0/[Motor NP Volts] × 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 [Overspeed Limit].	Default: [Motor NP Hertz] × 0.25 Min/Max: 0.0/[Maximum Freq] Units: 0.1 Hz	053 071

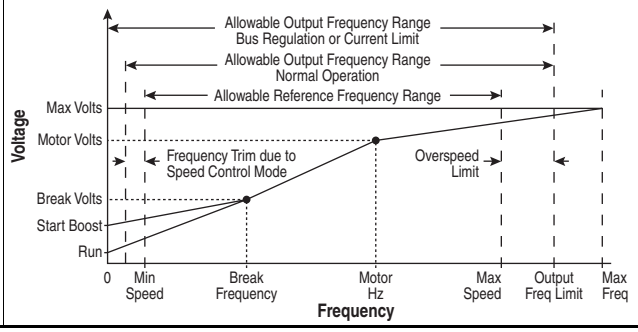
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File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Speed Feedback	412	E C v2 **[Motor Fdbk Type]** Selects the encoder type; single channel or quadrature. Options 1 & 3 detect 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"	080 088
		413	E C v2 **[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: 1/20000 PPR Units: 1 PPR	080
		414	E C v2 **[Enc Pos Feedback]** 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	E C v2 **[Encoder Speed]** Provides a monitoring point that reflects speed as seen from the feedback device.	Default: Read Only Min/Max: –/+500.0 Hz Units: 0.1 Hz	
		416	E C v2 **[Fdbk Filter Sel]** FV 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	E C v2 **[Notch FilterFreq]** FV 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	E C v2 **[Notch Filter K]** FV Sets the width for the 2-pole notch filter.	Default: 0.3 Min/Max: 0.1/0.9 Units: 0.1	053

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Speed Command File (File C)

File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Spd Mode & Limits	080	Standard **[Speed Mode]** Sets the method of speed regulation.	Default: 0 "Open Loop" Options: 0 "Open Loop" 1 "Slip Comp" 2 "Process PI"	121 thru 138, 125, 412, 413
			E C **[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"	
		081	**[Minimum Speed]** Sets the low limit for speed reference after scaling is applied. Refer to parameter 083 [Overspeed Limit].	Default: 0.0 Hz Min/Max: 0.0/[Maximum Speed] Units: 0.1 Hz	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 (Dependent on voltage class) Min/Max: 5.0/400.0 Hz 5.0/500.0 Hz E C Units: 0.1 Hz	055, 083, 091, 094, 202, 298
		083	**[Overspeed Limit]** Sets the incremental amount of the output frequency (above [Maximum Speed]) allowable for functions such as slip compensation. P82 [Maximum Speed] + P83 [Overspeed Limit] must be ≤ P55 [Maximum Freq]	Default: 10.0 Hz Min/Max: 0.0/20.0 Hz Units: 0.1 Hz	055, 082



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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Spd Mode & Limits	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: –/+500.0 Hz Units: 0.1 Hz	087
		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
		088 FV	E C v2 **[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. **ATTENTION:** The speed of the drive could reach P82 [Maximum Speed] + P83 [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"	053 361 thru 366
		454	E C **[Rev Speed Limit]** Sets a limit on speed in the negative direction. A value of zero disables this parameter and uses [Min Speed] for minimum speed.	Default: 0.0 Hz Min/Max: –[Max Speed]/0.0 Hz Units: 0.1 Hz	

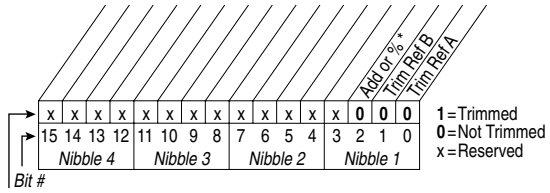
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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Speed References	090	**[Speed Ref A Sel]** Selects the source of the speed reference to the drive unless [Speed Ref B Sel] or [Preset Speed 1-7] is selected. For more information on selecting a speed reference source, see Figure 1.15 on page 1-22. (1) See Appendix B for DPI port locations. (2) Enhanced Control Drives Only.	Default: 2 "Analog In 2" Options: 1 "Analog In 1" 2 "Analog In 2" 3-7 "Reserved" 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 "Reserved" 22 "DPI Port 5"(1) 23-29 "Reserved" 30 "HighRes Ref"(2)	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	082 090
		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 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	081 090
		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	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 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	090 093

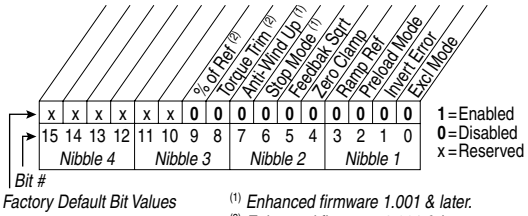
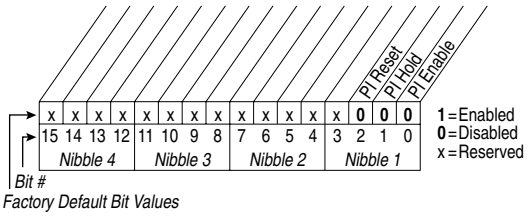
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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Speed References	096	**[TB Man Ref Sel]** Sets the manual speed reference source when a digital input is configured for "Auto/Manual." (1) "Analog In 2" is not a valid selection if it was selected for any of the following: - P117 [Trim In Select] - P128 [PI Feedback Sel] - P126 [PI Reference Sel] - P147 [Current Lmt Sel]	Default: 1 "Analog In 1" Options: 1 "Analog In 1" 2 "Analog In 2"(1) 3-8 "Reserved" 9 "MOP Level"	097 098 213
		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	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 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	096
	Discrete Speeds	100	Standard **[Jog Speed]** Sets the output frequency when a jog command is issued.	Default: 10.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	361 thru 366
			E C **[Jog Speed 1]** Sets the output frequency when Jog Speed 1 is selected.	Default: 10.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	
		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 10.0 Hz 20.0 Hz 30.0 Hz 40.0 Hz 50.0 Hz 60.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	090 093 213 361 thru 366
		108	E C **[Jog Speed 2]** Sets the output frequency when Jog Speed 2 is selected.	Default: 10.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	361 thru 366

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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Speed Trim	116	E C **[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: 0.00% Min/Max: –/+200.00% Units: 0.01%	090 093 117
		117	**[Trim In Select]** Specifies which analog input signal is being used as a trim input. (1) See Appendix B for DPI port locations.	Default: 2 "Analog In 2" Options: 1 "Analog In 1" 2 "Analog In 2" 3-7 "Reserved" 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 "Reserved" 22 "DPI Port 5"(1) 23 "Reserved" 24 "Reserved" 25 "Scale Block1" 26 "Scale Block2"	090 093 116
		118	**[Trim Out Select]** Specifies which speed references are to be trimmed. To apply negative trim, P190 [Direction Mode] must be set to 1 "Bipolar."  *Factory Default Bit Values* * *Enhanced Control Option Only.*	117 119 120 190
		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 % E C	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 % E C	117

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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Slip Comp		**Important:** Parameters in the Slip Comp Group are used to enable and tune the Slip Compensation Regulator. In order to allow the Slip Compensation Regulator to control drive operation, parameter 080 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.	Default: Based on [Motor NP RPM] Min/Max: 0.0/1200.0 RPM Units: 0.1 RPM	044 061 080 122 123
		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: 0.0/300.0 RPM –/+300.0 RPM EC Units: 0.1 RPM	080 121 122
	Process PI		**Important:** Parameters in the Process PI Group are used to enable and tune the PI Loop. Standard To allow the PI Loop to control drive operation, parameter 080 must be set to 2 "Process PI".		
		124	**[PI Configuration]** Sets configuration of the PI regulator.  *Factory Default Bit Values* (1) *Enhanced firmware 1.001 & later.* (2) *Enhanced firmware 2.001 & later.*	124 thru 138 140 thru 143
		125	**[PI Control]** Controls the PI regulator.  *Factory Default Bit Values*	080 361 thru 366

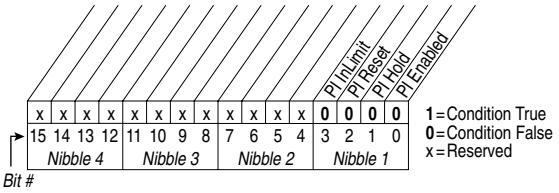
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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Process PI	126	**[PI Reference Sel]** Selects the source of the PI reference. (1) Enhanced Control Drives Only.	Default: 0 "PI Setpoint" Options: See Table	124 thru 138 460

Options		P462 [PI Feedback Hi]	P463 [PI Feedback Lo]
0	"Setpoint"	+100	-100
1	"Analog In 1"	P322 [Analog In1 Hi]	P323 [Analog In1 Lo]
2	"Analog In 2"	P325 [Analog In2 Hi]	P326 [Analog In2 Lo]
3-7	"Reserved"		
8	"Encoder"	+P55 [Maximum Freq]	-P55 [Maximum Freq]
9	"MOP Level"	+P55 [Maximum Freq]	-P55 [Maximum Freq]
10	"Master Ref"	+P55 [Maximum Freq]	-P55 [Maximum Freq]
11-17	"Preset Spd1-7"	+P55 [Maximum Freq]	-P55 [Maximum Freq]
18-20	"DPI Port 1-3"	+32767	-32676
21	"Reserved"		
22	"DPI Port 5"	+32767	-32676
23-24	"Reserved"		
25	"Scale Block1"	P477 [Scale1 In Hi]	P478 [Scale1 In Lo]
26	"Scale Block2"	P483 [Scale2 In Hi]	P484 [Scale2 In Lo]
27-29	"Reserved"		
30	"HighRes Ref" (1)	+32767 x 2^{16}	-32767 x 2^{16}
31	"CommandedTrq" (2)	P436 [Pos Torque Limit]	P437 [Neg Torque Limit]
32	"Torque Est" (2)	P436 [Pos Torque Limit]	P437 [Neg Torque Limit]
33	"Torque Amps" (2)	+P28 [Rated Amps]	-P28 [Rated Amps]

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 reference.	Default: 2 "Analog In 2" Options: See P126 [PI Reference Sel].	124 thru 138 462 463
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). A value of zero disables this parameter	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 × PI Prop Gain = PI Output	Default: 1.00 Min/Max: 0.00/100.00 Units: 0.01	124 thru 138
131	**[PI Lower Limit]** Sets the lower limit of the PI output.	Default: –[Maximum Freq] –100% EC Min/Max: –/+400.0 Hz –/+800% EC Units: 0.1 Hz 0.1% EC	124 thru 138

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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Process PI	132	**[PI Upper Limit]** Sets the upper limit of the PI output.	Default: +[Maximum Freq] 100% EC Min/Max: –/+400.0 Hz –/+800.0% EC Units: 0.1 Hz 0.1% EC	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% EC Min/Max: [PI Lower Limit]/ [PI Upper Limit Units: 0.1 Hz 0.1% EC	124 thru 138
		134	**[PI Status]** Status of the Process PI regulator. 	Read Only	124 thru 138
		135	**[PI Ref Meter]** Present value of the PI reference signal.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		136	**[PI Fdback Meter]** Present value of the PI feedback signal.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		137	**[PI Error Meter]** Present value of the PI error.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		138	**[PI Output Meter]** Present value of the PI output.	Default: Read Only Min/Max: –/+100.0 Hz –/+800.0% EC Units: 0.1 Hz 0.1% EC	124 thru 138
		139	E C v2 **[PI BW Filter]** *Firmware 2.001 & later* – 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 R/s Min/Max: 0.0/240.0 R/s Units: 0.1 R/s	137
		459	E C v2 **[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	

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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Process PI	460	E C **[PI Reference Hi]** Scales the upper value of [PI Reference Sel] of the source.	Default: 100.0% Min/Max: –/+100.0% Units: 0.1%	126
		461	E C **[PI Reference Lo]** Scales the lower value of [PI Reference Sel] of the source.	Default: –100.0% Min/Max: –/+100.0% Units: 0.1%	126
		462	E C **[PI Feedback Hi]** Scales the upper value of [PI Feedback] of the source.	Default: 100.0% Min/Max: –/+100.0% Units: 0.1%	128
		463	E C **[PI Feedback Lo]** Scales the lower value of [PI Feedback] of the source.	Default: 0.0% Min/Max: –/+100.0% Units: 0.1%	
	Speed Regulator	445	E C v2 **[Ki Speed Loop]** FV Controls the integral error gain of the speed regulator. The drive automatically adjusts P445 [Ki Speed Loop] when a non-zero value is entered for P449 [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. P449 [Speed Desired BW] is set to "0" when a manual adjustment is made to this parameter.	Default: 7.8 Min/Max: 0.0/4000.0 Units: 0.1	053 449 450
		446	E C v2 **[Kp Speed Loop]** FV Controls the proportional error gain of the speed regulator. The drive automatically adjusts P446 [Kp Speed Loop] when a non-zero value is entered for P449 [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. P449 [Speed Desired BW] is set to "0" when a manual adjustment is made to this parameter.	Default: 6.3 Min/Max: 0.0/200.0 Units: 0.1	053 449 450
		447	E C v2 **[Kf Speed Loop]** FV 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	E C v3 **[Spd Err Filt BW]** FV 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

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File C	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
SPEED COMMAND (File C)	Speed Regulator	449	E C v2 **[Speed Desired BW]** FV 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 P445 [Ki Speed Loop] and P446 [Kp Speed Loop] gains.	Default: 0.0 Radians/Sec Min/Max: 0.0/250.0 Radians/Sec Units: 0.1 Radians/Sec	053 067 445 446
		450	E C v2 **[Total Inertia]** FV 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 P445 [Ki Speed Loop] and P446 [Kp Speed Loop] gains.	Default: 0.10 Secs Min/Max: 0.01/600.0 Secs Units: 0.01 Secs	053 067 445 446 449
		451	E C v2 **[Speed Loop Meter]** FV Value of the speed regulator output. When in FVC mode, units are in percent.	Default: Read Only Min/Max: –/+800.0%/Hz Units: 0.1%/Hz	053 121

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Dynamic Control File (File D)

File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Ramp Rates	140 141	**[Accel Time 1]** **[Accel Time 2]** Sets the rate of accel for all speed increases. $\frac{\text{Max Speed}}{\text{Accel Time}}$ = Accel Rate	Default: 10.0 Secs 10.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	142 143 146 361 thru 366
		142 143	**[Decel Time 1]** **[Decel Time 2]** Sets the rate of decel for all speed decreases. $\frac{\text{Max Speed}}{\text{Decel Time}}$ = Decel Rate	Default: 10.0 Secs 10.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	140 141 146 361 thru 366
		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: 0.0% Min/Max: 0.0/100.0% Units: 0.1%	056 140 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"	146 148 149
		148	**[Current Lmt Val]** Defines the current limit value when [Current Lmt Sel] = "Cur Lim Val."	Default: [Rated Amps] × 1.5 (Equation approximates default value.) Min/Max: Drive Rating Based Units: 0.1 Amps	028 147 149
		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 drive's response to increasing drive temperature.	Default: 3 "Both–PWM 1st" Options: 0 "Disabled" 1 "Reduce CLim" 2 "Reduce PWM" 3 "Both–PWM 1st"	219
		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*, publication PFLEX-RM001.	Default: 4 kHz Min/Max: 2, 3, 4, 5, 6, 7, 8, 9, 10 kHz 2, 4, 8, 12 kHz (1) EC Units: 1 kHz (1) Frames A…D only.	

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Load Limits	152	E C v2 **[Droop RPM @ FLA]** Selects amount of droop that the speed reference is reduced when at full load torque. Zero disables the droop function. Setting parameter 080 to 0 is recommended when using the Droop function.	Default: 0.0 RPM Min/Max: 0.0/200.0 RPM Units: 0.1 RPM	
		153	E C v2 **[Regen Power Lim]** FV 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 minimum (–800.0%) value. Overvoltage trips may occur if set too negative and the connected brake is unable to dissipate the energy.	Default: –50.0% Min/Max: –800.0/0.0% Units: 0.1%	053 161 162 163
		154	E C v2 **[Current Rate Lim]** FV 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
		189	E C **[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	
	Stop/Brake Modes	145	E C **[DB While Stopped]** Enables/disables dynamic brake operation. Disabled = DB will only operate when drive is running. Enable = DB operates whenever drive is energized.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	
		155 156	Standard **[Stop Mode A]** Standard **[Stop Mode B]** Active stop mode. [Stop Mode A] is active unless [Stop Mode B] is selected by digital inputs programmed for "Stop Mode B." (1) When using options 1 or 2, refer to the Attention statements at [DC Brake Level].	Default: 1 "Ramp" Default: 0 "Coast" Options: 0 "Coast" 1 "Ramp"(1) 2 "Ramp to Hold"(1) 3 "DC Brake"	157 158 159 161 163 168 361 thru 366
			E C v2 **[Stop/Brk Mode A]** E C v2 **[Stop/Brk Mode B]** See description above.	Default: 1 "Ramp" Default: 0 "Coast" Options: 0 "Coast" 1 "Ramp"(1) 2 "Ramp to Hold"(1) 3 "DC Brake" 4 "Fast Brake" E C v3	ℹ

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	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. 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*, publication PFLEX-RM001. **Important:** Frame E drives may be limited to less than 150% depending on the setting of parameter 151 [PWM Frequency]. **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	155 156 157
		159	**[DC Brake Time]** Sets the amount of time DC brake current is "injected" into the motor.	Default: 0.0 Secs Min/Max: 0.0/90.0 Secs Units: 0.1 Secs	155 thru 158
		160	Standard **[Bus Reg Gain]** E C **[Bus Reg Ki]** Sets the responsiveness of the bus regulator.	Default: 450 Min/Max: 0/5000 Units: 1	161 162

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Stop/Brake Modes	161 162	**[Bus Reg Mode A]** **[Bus Reg Mode B]** Active bus regulation mode. Choices are dynamic brake, frequency adjust or both. Sequence is determined by programmed value or digital input programmed for "Bus Reg Md B." Dynamic Brake Setup If a dynamic brake resistor is connected to the drive, both these parameters must be set to either option 2, 3 or 4. Refer to the Attention statement on page P-5 for important information on bus regulation. **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-1 (or equivalent) must be supplied.	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"	155 156 160 163 361 thru 366
		163	**[DB Resistor Type]** Selects whether the internal or an external DB resistor will be used. If a dynamic brake resistor is connected to the drive, P161/162 [Bus Reg Mode x], A, B or Both (if used), must be set to either option 2, 3 or 4. **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-1, or equivalent, must be supplied. **ATTENTION:** Equipment damage may result if a drive mounted (internal) resistor is installed and this parameter is set to "External Res." Thermal protection for the internal resistor will be disabled, resulting in possible device damage.	Default: 0 "Internal Res" 2 "None" EC Options: 0 "Internal Res" 1 "External Res" 2 "None"	161 162 166
		164	EC **[Bus Reg Kp]** Proportional gain for the bus regulator. Used to adjust regulator response.	Default: 1500 Min/Max: 0/10000 Units: 1	
		165	EC **[Bus Reg Kd]** Derivative gain for the bus regulator. Used to control regulator overshoot.	Default: 1000 Min/Max: 0/10000 Units: 1	

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Stop/Brake Modes	166	E C v2 **[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. For more information about applying this mode of operation, see Stop Modes on page C-4.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	
	Restart Modes	167	E C **[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: 0.0/30.0 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"	167 169 174 361 thru 366

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Restart Modes	169	**[Flying Start En]** Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	170
		170	**[Flying StartGain]** Sets the response of the flying start function.	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. Refer to the PowerFlex Reference Manual, publication PFLEX-RM004 for additional information. **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: 0.5/30.0 Secs Units: 0.1 Secs	174

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File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Restart Modes	178	E C v2 **[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)	179 thru 183

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)

Input	After Power-Up	After a Drive Fault		After a Stop Command
		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 Direct Mode Analog Sig. > Sleep Level(6) Invert Mode 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 Direct Mode Analog Sig. > Sleep Level(6) Invert Mode 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 Speed Reference Control on page 1-22. 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) Enhanced firmware 2.001 & later. For Invert function, refer to [Analog In x Loss].

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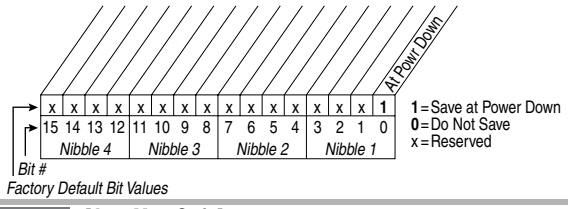
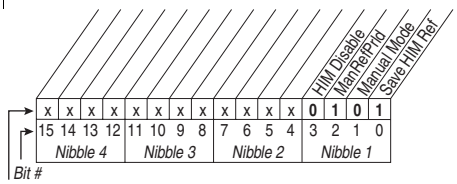
File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Restart Modes	179	E C v2 **[Sleep Wake Ref]** Selects the source of the input controlling the Sleep-Wake function.	Default: 2 "Analog In 2" Options: 1 "Analog In 1" 2 "Analog In 2"	178 180 183 320 thru 327
		180	E C v2 **[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 [Sleep Level]/10.000 Volts Units: 0.001 mA 0.001 Volts	178 179 181 183
		181	E C v2 **[Wake Time]** Defines the amount of time at or above [Wake Level] before a Start is issued.	Default: 1.0 Secs Min/Max: 0.0/1000.0 Secs Units: 0.1 Secs	178 180
		182	E C v2 **[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	178 180 183
		183	E C v2 **[Sleep Time]** Defines the amount of time at or below [Sleep Level] before a Stop is issued.	Default: 1.0 Secs Min/Max: 0.0/1000.0 Secs Units: 0.1 Secs	182

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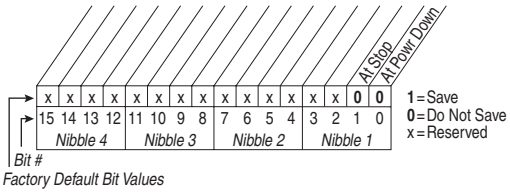
File D	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
DYNAMIC CONTROL (File D)	Power Loss	177	E C v2 **[Gnd Warn Level]** Sets the level at which a ground warning fault will occur. Configure with [Alarm Config 1].	Default: 3.0 Amps Min/Max: 1.0/5.0 Amps 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". "Coast" = Disable drive and allow the motor to coast. "Decel" = Decelerate the motor at a rate which will regulate the DC Bus until the load's Kinetic Enrgy can no longer power the drive. "Continue" = Allow the drive to power the motor down to 50% of the nominal DC Bus voltage. Refer to the PowerFlex 70EC/700VC Reference Manual, publication PFLEX-RM004 for additional information. **ATTENTION:** To guard against drive damage, a minimum line impedance must be provided to limit inrush current when the power line recovers. The input impedance should be equal or greater than the equivalent of a 5% transformer with a VA rating 6 times the drive's input VA rating.	Default: 0 "Coast" Options: 0 "Coast" 1 "Decel" 2 "Continue" E C 3 "Reserved" 4 "Reserved" 5 "Decel 2 Stop" E C v4	013 185 361 thru 366
		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
		187	E C v2 **[Load Loss Level]** Sets the percentage of motor nameplate torque at which a load loss alarm will occur.	Default: 200.0% Min/Max: 0.0/800.0% Units: 0.1%	211 259
		188	E C v2 **[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

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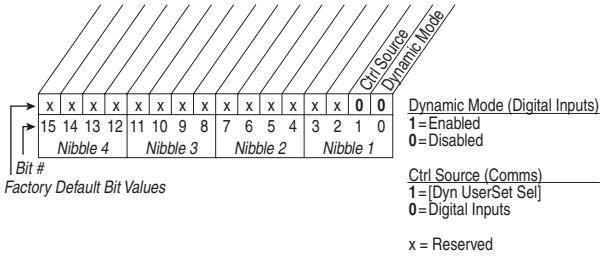
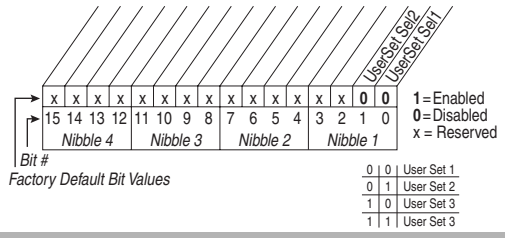
Utility File (File E)

File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Direction Config	190	**[Direction Mode]** Selects the method for changing drive direction. **Mode** / **Direction Change** Unipolar / Drive Logic Bipolar / Sign of Reference Reverse Dis / Not Changable	Default: 0 "Unipolar" Options: 0 "Unipolar" 1 "Bipolar" 2 "Reverse Dis"	320 thru 327, 361 thru 366
	HIM Ref Config	192	**Standard** **[Save HIM Ref]** 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.  1 = Save at Power Down 0 = Do Not Save x = Reserved *Factory Default Bit Values* **E C** **[AutoMan Cnfg]** 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 preset 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* Manual Mode **1** = HIM has exclusive Start & Jog control in Manual mode. **0** = Disabled HIM Disable **1** = HIM does not start drive. **0** = HIM starts drive x = Reserved Save HIM Ref 1 = Saves HIM reference, Reloads HIM reference at power-up. **0** = Disabled ManRefPrld **1** = Preloads auto reference into HIM upon Auto to Manual transition. **0** = Disabled		
		193	**Standard** **[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"	

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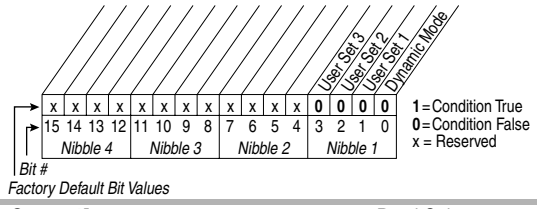
File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	MOP Config	194	**[Save MOP Ref]** Enables/disables the feature that saves the present MOP frequency reference at power down or at stop.  *Factory Default Bit Values*		090 093 096 361 thru 366
		195	**[MOP Rate]** Sets rate of change of the MOP reference in response to a digital input.	Default: 1.0 Hz/s Min/Max: 0.2/[Maximum Freq] Units: 0.1 Hz/s	090 093 096 361 thru 366
	Drive Memory	196	**[Param Access Lvl]** Selects the parameter display level viewable on the HIM. Basic = Reduced param. set Advanced = Full param. set Reserved = Full param. set and Engineering params.	Default: 0 "Basic" Options: 0 "Basic" 1 "Advanced" 2 "Reserved" EC	
		197	**[Reset To Defalts]** Resets all parameter values (except parameters 196, 201 & 202) to defaults. Option 1 resets drive to factory settings. Options 2 and 3 will reset drive to alternate voltage and current rating.	Default: 0 "Ready" Options: 0 "Ready" 1 "Factory" 2 "Low Voltage" 3 "High Voltage"	
		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. To maintain control consistancy when using the drive inputs (P361…P366), verify that the input settings are identical in each of the user sets.	Default: 0 "Ready" Options: 0 "Ready" 1 "User Set 1" 2 "User Set 2" 3 "User Set 3"	198 361 thru 366
		200	**[Reset Meters]** Resets selected meters to zero.	Default: 0 "Ready" Options: 0 "Ready" 1 "MWh" 2 "Elapsed Time"	

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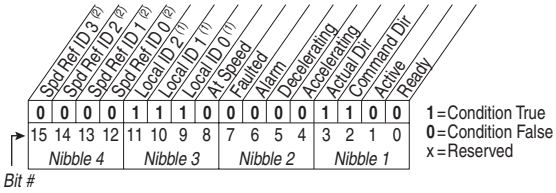
File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Drive Memory	201	**[Language]** Selects the display language when using an LCD HIM. This parameter is not functional with an LED HIM.	Default: 0 "Not Selected" Options: 0 "Not Selected" 1 "English" 2 "Français" 3 "Español" 4 "Italiano" 5 "Deutsch" 6 "Reserved" 7 "Português" 8-9 "Reserved" 10 "Nederlands"	
		202	**[Voltage Class]** Configures the drive current rating and associates it with the selected voltage (i.e. 400 or 480V). This parameter is normally used when downloading parameter sets.	Default: Based on Drive Cat. No. Options: 2 "Low Voltage" 3 "High Voltage"	
		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	E C v2 **[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.  	198 199 361 thru 366
		205	E C v2 **[Dyn UsrSet Sel]** Selects user set if [Dyn UsrSet Cnfg] = xxx xx11.  	204

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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Drive Memory	206	E C v2 **[Dyn UserSet Actv]** Indicates the active user set and if the operation is dynamic or normal.	Read Only	198 199 361 thru 366
	Diagnostics	209	**[Drive Status 1]** Present operating condition of the drive.	Read Only	210 213
		210	**[Drive Status 2]** Present operating condition of the drive.	Read Only	209

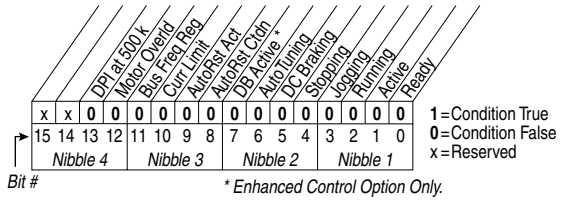


Factory Default Bit Values



Bits (2)				Description
15	14	13	12	
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

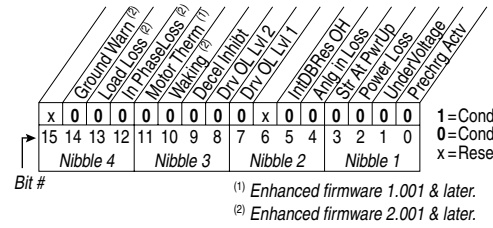
Bits (1)			Description
11	10	9	
0	0	0	Port 0 (TB)
0	0	1	Port 1
0	1	0	Port 2
0	1	1	Port 3
1	0	0	Port 4
1	0	1	Port 5
1	1	0	Port 6
1	1	1	No Local Control

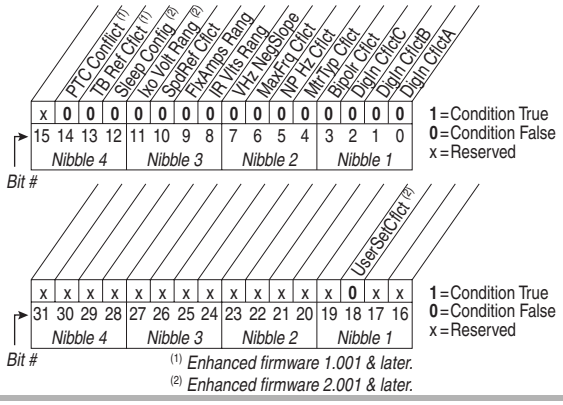


** Enhanced Control Option Only.*

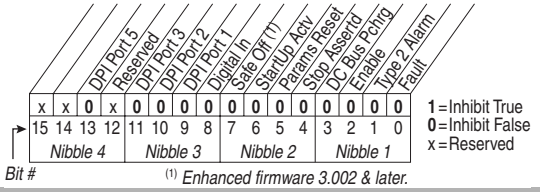
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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	211	**[Drive Alarm 1]**	Read Only	212
			Alarm conditions that currently exist in the drive. See Chapter 4 for information on Type 1 alarms.		
		212	**[Drive Alarm 2]**	Read Only	211
			Alarm conditions that currently exist in the drive. See Chapter 4 for information on Type 2 alarms.		

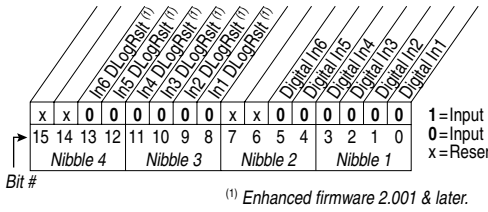
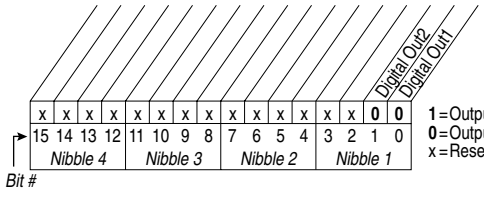




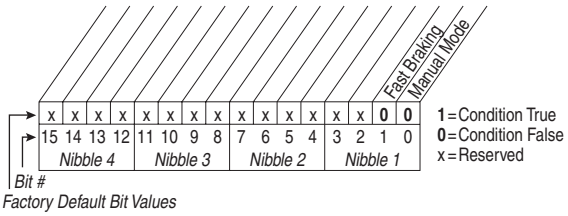
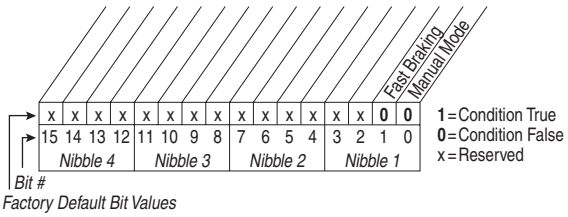
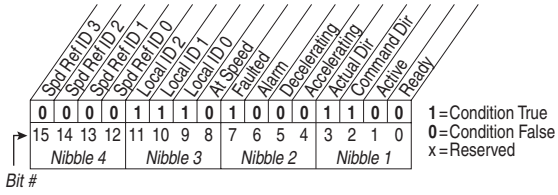
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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	213	**[Speed Ref Source]** Displays the source of the speed reference to the drive. (1) Displays after Start is pressed. (2) Enhanced Control Drives Only.	Default: Read Only Options: 0 "PI Output"(1) 1 "Analog In 1" 2 "Analog In 2" 3-7 "Reserved" 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" 19 "DPI Port 2" 20 "DPI Port 3" 21 "Reserved" 22 "DPI Port 5" 23-29 "Reserved" 30 "HighRes Ref"(2)	002 090 093 096 101
		214	**[Start Inhibits]** Displays the inputs currently preventing the drive from starting.  (1) *Enhanced firmware 3.002 & later.*	Read Only	243 361 thru 366
		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.	Default: Read Only Options: 0 "Pwr Removed" 1 "DPI Port 1" 2 "DPI Port 2" 3 "DPI Port 3" 4 "Reserved" 5 "DPI Port 5" 6 "Reserved" 7 "Digital In" 8 "Fault" 9 "Not Enabled" 10 "Sleep" 11 "Jog" 12 "Autotune" EC 13 "Precharge" EC 14 "Safe Off" EC v3	361 thru 366

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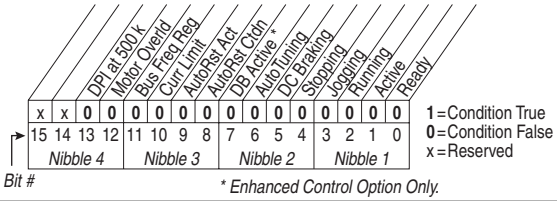
File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	216	**[Dig In Status]** Status of the digital inputs.  (1) *Enhanced firmware 2.001 & later.*	Read Only	361 thru 366 411
		217	**[Dig Out Status]** Status of the digital outputs.  	Read Only	380 thru 384
		218	**[Drive Temp]** Present operating temperature of the drive power section. For heatsink temperature, refer to P234 [Testpoint 1 Sel].	Default: Read Only Min/Max: –/+100 degC 0.0/100.0% EC Units: 1.0 degC 0.1% EC	
		219	**[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].	Default: Read Only Min/Max: 0.0/100.0% Units: 0.1%	150
		220	**[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.	Default: Read Only Min/Max: 0.0/100.0% Units: 0.1%	047 048
		221	EC v3 **[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.	Default: Read Only Min/Max: 0/99999 Units: 1	220

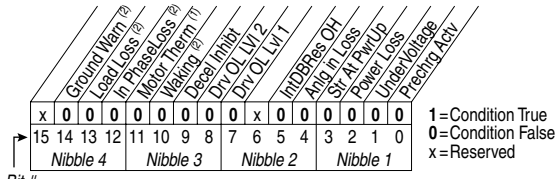
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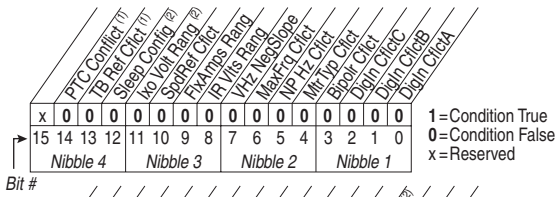
File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	222	E C v3 **[Drive Status 3]** Present operating condition of the drive. Manual Mode - See *Manual Speed Sources* on page 1-22. Fast Braking - Fast Braking is active, see [Stop/ Brk Mode A] on page 3-31.  *Factory Default Bit Values*	Read Only	
		223	E C v3 **[Status 3 @ Fault]** Captures and displays [Drive Status 3] bit pattern at the time of the last fault.  *Factory Default Bit Values*	Read Only	
		224	**[Fault Frequency]** 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] Units: 0.1 Hz	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

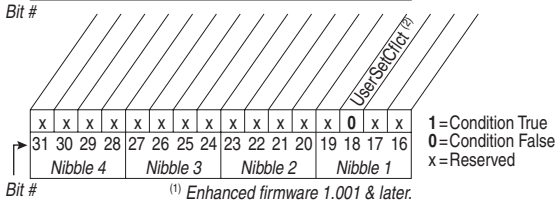
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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	228	**[Status 2 @ Fault]** Captures and displays [Drive Status 2] bit pattern at the time of the last fault.	Read Only	210 224 thru 230
		229	**[Alarm 1 @ Fault]** Captures and displays [Drive Alarm 1] at the time of the last fault.	Read Only	211 224 thru 230
		230	**[Alarm 2 @ Fault]** Captures and displays [Drive Alarm 2] at the time of the last fault.	Read Only	212 224 thru 230

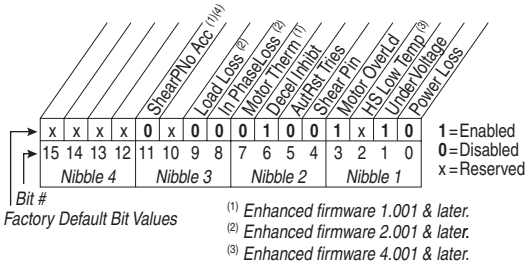




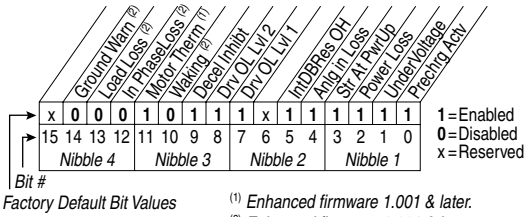




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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Diagnostics	234 236	**[Testpoint 1 Sel]** **[Testpoint 2 Sel]** Selects the function whose value is displayed value in [Testpoint x Data]. These are internal values that are not accessible through parameters. See Testpoint Codes and Functions on page 4-11 for a listing of available codes and functions.	Default: 499 Min/Max: 0/999 0/65535 EC Units: 1	235 237
		235 237	**[Testpoint 1 Data]** **[Testpoint 2 Data]** EC 32 The present value of the function selected in [Testpoint x Sel].	Default: Read Only Min/Max: 0/65535 –/+2147483647 EC Units: 1	234 236
	Faults	238	**[Fault Config 1]** Enables/disables annunciation of the listed faults.  *Factory Default Bit Values* (1) *Enhanced firmware 1.001 & later.* (2) *Enhanced firmware 2.001 & later.* (3) *Enhanced firmware 4.001 & later.* (4) Bit 11 enables the shear pin fault to be ignored during acceleration and deceleration. Using Bit 11 with Bit 4 set to "0" will have no effect.		189
		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]** 32 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. Parameter value updates at power up only. For relevance to most recent power up see [Fault x Time].	Default: Read Only Min/Max: 0.0000/429496.7295 Hrs Units: 0.0001 Hrs	246

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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Faults	243 245 247 249	**[Fault 1 Code]** **[Fault 2 Code]** **[Fault 3 Code]** **[Fault 4 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: 0/9999 0/65535 EC Units: 0	214 238
		244 246 248 250	**[Fault 1 Time]** **[Fault 2 Time]** **[Fault 3 Time]** **[Fault 4 Time]**	Default: Read Only Min/Max: 0.0000/429496.7295 Hrs Units: 0.0001 Hrs	242
		32	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) Remaining Time x 60 minutes = (# of minutes).(remaining seconds) 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		
	Alarms	259	**[Alarm Config 1]** Enables/disables alarm conditions that will initiate an active drive alarm.  *Factory Default Bit Values* (1) *Enhanced firmware 1.001 & later.* (2) *Enhanced firmware 2.001 & later.*	

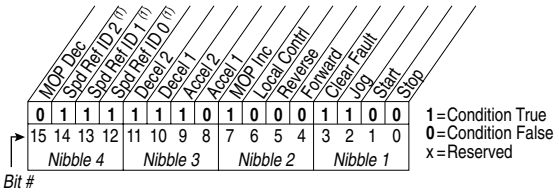
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File E	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
UTILITY (File E)	Scaled Blocks	476 482	E C v4 **[Scale1 In Value]** E C v4 **[Scale2 In Value]** Displays the value of the signal being sent to [ScaleX In Value] using a datalink.	Default: 0.0 Min/Max: -3276.8/+3276.7 Units: 0.1	090 093 117 126 127 427
		477 483	E C v4 **[Scale1 In Hi]** E C v4 **[Scale2 In Hi]** Scales the upper value of [ScaleX In Value].	Default: 0.0 Min/Max: -3276.8/+3276.7 Units: 0.1	091 094 119 428 460 462
		478 484	E C v4 **[Scale1 In Lo]** E C v4 **[Scale2 In Lo]** Scales the lower value of [ScaleX In Value].	Default: 0.0 Min/Max: -3276.8/+3276.7 Units: 0.1	092 095 120 429 461 463

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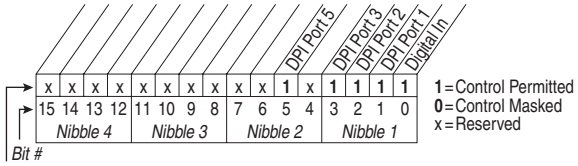
Communication File (File H)

File H	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION (File H)	Comm Control	270	**[DPI Data 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: 0 "125 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 any corrections supplied by slip comp, PI, etc.	Default: Read Only Min/Max: –/+32767 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: –/+32767 Units: 1	

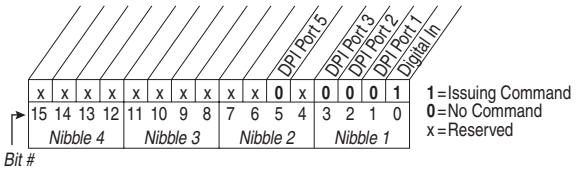


Bits(1)			
14	13	12	Description
0	0	0	No Command - Man. Mode
0	0	1	Ref A Auto
0	1	0	Ref B Auto
0	1	1	Preset 3 Auto
1	0	0	Preset 4 Auto
1	0	1	Preset 5 Auto
1	1	0	Preset 6 Auto
1	1	1	Preset 7 Auto

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File H	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION (File H)	Comm Control	274	E C **[DPI Port Select]** Selects which port reference value will appear in [DPI Port Value].	Default: 0 "Not Used" Options: 0 "Not Used" 1 "DPI Port 1" 2 "DPI Port 2" 3 "DPI Port 3" 4 "Reserved" 5 "DPI Port 5"	
		275	E C **[DPI Port Value]** Value of the DPI reference selected in [DPI Port Sel].	Default: Read Only Min/Max: –/+32767 Units: 1	
		298	E C **[DPI Ref Select]** Scales DPI on [Maximum Freq] or [Maximum Speed]. This will adjust the resolution of the DPI reference.	Default: 0 "Max Freq" Options: 0 "Max Freq" 1 "Max Speed"	055 082
	Masks & Owners	276	**[Logic Mask]** Determines which adapters can control the drive when 598, bit 15 is set to "1." If the bit for an adapter is "0," the adapter will have no control functions except for stop.  *Factory Default Bit Values*	288 thru 297
		277	**[Start Mask]** Controls which adapters can issue start commands.	See P276 [Logic Mask].	288 thru 297
		278	**[Jog Mask]** Controls which adapters can issue jog commands.	See P276 [Logic Mask].	288 thru 297
		279	**[Direction Mask]** Controls which adapters can issue forward/reverse direction commands.	See P276 [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 P276 [Logic Mask].	288 thru 297
		281	**[Accel Mask]** Controls which adapters can select [Accel Time 1, 2].	See P276 [Logic Mask].	288 thru 297
		282	**[Decel Mask]** Controls which adapters can select [Decel Time 1, 2].	See P276 [Logic Mask].	288 thru 297
		283	**[Fault Clr Mask]** Controls which adapters can clear a fault.	See P276 [Logic Mask].	288 thru 297

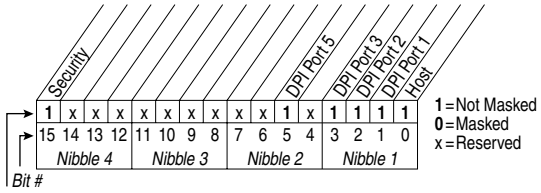
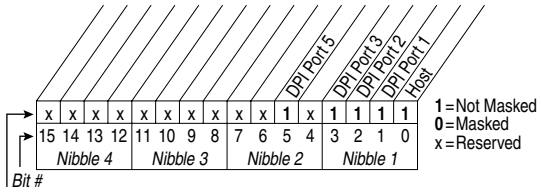
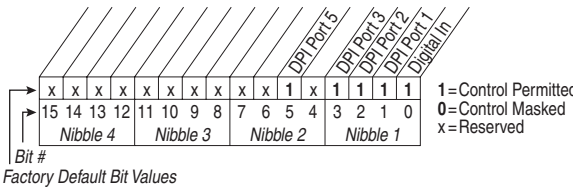
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File H	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION (File H)	Masks & Owners	284	**[MOP Mask]** Controls which adapters can issue MOP commands to the drive.	See P276 [Logic Mask].	288 thru 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 P276 [Logic Mask].	288 thru 297
		288	**[Stop Owner]** Adapters that are presently issuing a valid stop command.  	Read Only	276 thru 285
		289	**[Start Owner]** Adapters that are presently issuing a valid start command.	See P288 [Stop Owner].	276 thru 285
		290	**[Jog Owner]** Adapters that are presently issuing a valid jog command.	See P288 [Stop Owner].	276 thru 285
		291	**[Direction Owner]** Adapter that currently has exclusive control of direction changes.	See P288 [Stop Owner].	276 thru 285
		292	**[Reference Owner]** Adapter that has the exclusive control of the command frequency source selection.	See P288 [Stop Owner].	276 thru 285
		293	**[Accel Owner]** Adapter that has exclusive control of selecting [Accel Time 1, 2].	See P288 [Stop Owner].	140 276 thru 285
		294	**[Decel Owner]** Adapter that has exclusive control of selecting [Decel Time 1, 2].	See P288 [Stop Owner].	142 276 thru 285
		295	**[Fault Clr Owner]** Adapter that is presently clearing a fault.	See P288 [Stop Owner].	276 thru 285
		296	**[MOP Owner]** Adapters that are currently issuing increases or decreases in MOP command frequency.	See P288 [Stop Owner].	276 thru 285

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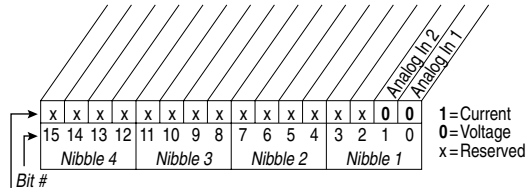
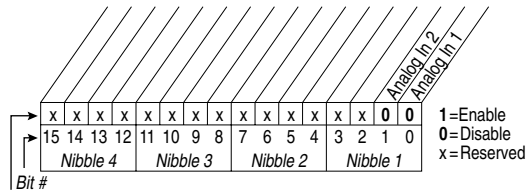
File H	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION (File H)	Masks & Owners	297	**[Local Owner]** Adapter that has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non-functional. Local control can only be obtained when the drive is not running.	See P288 [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. Parameters that can only be changed while drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will "Disable" the link. Refer to your communications option manual for datalink information.	Default: 0 (0 = "Disabled") Min/Max: 0/387 0/545 EC 0/598 EC v2 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.	
		304 305	**[Data In C1] -** Link C Word 1 **[Data In C2] -** Link C Word 2	See [Data In A1] - Link A Word 1.	
		306 307	**[Data In D1] -** Link D Word 1 **[Data In D2] -** Link D Word 2	See [Data In A1] - Link A Word 1.	
		310 311	**[Data Out A1] -** Link A Word 1 **[Data Out A2] -** Link A Word 2 Parameter number whose value will be written to a communications device data table.	Default: 0 (0 = "Disabled") Min/Max: 0/387 0/545 EC 0/598 EC v2 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.	
		314 315	**[Data Out C1] -** Link C Word 1 **[Data Out C2] -** Link C Word 2	See [Data Out A1] - Link A Word 1.	
		316 317	**[Data Out D1] -** Link D Word 1 **[Data Out D2] -** Link D Word 2	See [Data Out A1] - Link A Word 1.	
		308 32	EC **[HighRes Ref]** Used as a high resolution, 32 bit reference with Datalinks. –/+[Maximum Freq] or –/+[Maximum Speed] = 2147418112	Default: 0 Min/Max: –/+2147483647 Units: 1	090 093 126 128 213 298

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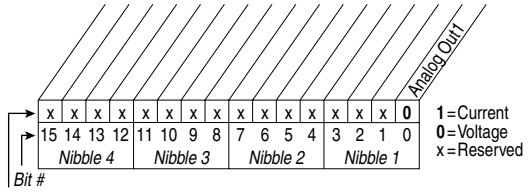
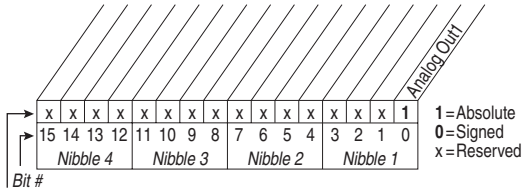
File H	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
COMMUNICATION (File H)	Security	595	E C v2 **[Port Mask Act]** Active status for port communication.  *Factory Default Bit Values*		
		596	E C v2 **[Write Mask Cfg]** Enables/disables write access (parameters, etc.) for ports. Changes to this parameter only become affective upon power cycle, drive reset or when 597, bit 15 transitions from “1” to “0.”  *Factory Default Bit Values*		
		597	E C v2 **[Write Mask Act]** Active status of write access for ports. Bit 15 determines if network security is controlling the write mask instead of 596.	See [Port Mask Act].	
		276	**[Logic Mask]** Determines which adapters can control the drive when 597, 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.  *Factory Default Bit Values*		288 thru 297
		598	E C v2 **[Logic Mask Act]** Active status of logic mask for ports. Bit 15 determines if network security is controlling the logic mask instead of 276.	See [Port Mask Act].	

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Inputs & Outputs File (File J)

File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Analog Inputs	320	**[Anlg In Config]** Selects the mode for the analog inputs.  *Factory Default Bit Values*		322 323
		321	**[Anlg In Sqr Root]** Enables/disables the square root function for each input.  *Factory Default Bit Values*		
		322 325	**[Analog In 1 Hi]** **[Analog In 2 Hi]** Sets the highest input value to the analog input x scaling block.	Default: 10.000 Volt 10.000 Volt Min/Max: 4.000/20.000 mA Standard, 0.000/20.000 mA E C, –/+10.000V, Units: 0.000/10.000V 0.001 mA, 0.001 Volt	091 092
		323 326	**[Analog In 1 Lo]** **[Analog In 2 Lo]** Sets the lowest input value to the analog input x scaling block.	Default: 0.000 Volt 0.000 Volt Min/Max: 4.000/20.000 mA, 0.000/10.000V (No. 323), –/+10.000V (No. 326) Units: 0.000/10.000V, 0.001 mA, 0.001 Volt	091 092
		324 327	**[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.	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"	091 092

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File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Analog Outputs	340	E C **[Anlg Out Config]** Selects the mode for the analog outputs.  *Factory Default Bit Values*		
		341	**[Anlg Out Absolut]** Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the analog output.  *Factory Default Bit Values*		342
		342	**[Analog Out1 Sel]** Selects the source of the value that drives the analog output.	Default: 0 "Output Freq" Options: See Table	001 002 003 004 005 007 006 012 135 136 137 138 220 219 024 441 023 025 015 377

Options		[Analog Out1 Lo] Value *Param. 341= Signed*	[Analog Out1 Lo] Value *Param. 341 = Absolute*	[Analog Out1 Hi] Value
0	"Output Freq"	–[Maximum Speed]	0 Hz	+[Maximum Speed]
1	"Command Freq"	–[Maximum Speed]	0 Hz	+[Maximum Speed]
2	"Output Amps"	0 Amps	0 Amps	200% Drive Rated
3	"Torque Amps"	–200%	0 Amps	200% Drive Rated
4	"Flux Amps"	0 Amps	0 Amps	200% Drive Rated
5	"Output Power"	0 kW	0 kW	200% Drive Rated
6	"Output Volts"	0 Volts	0 Volts	120% Drive Rated
7	"DC Bus Volts"	0 Volts	0 Volts	200% Drive Rated
8	"PI Reference" (1)	–100%	0%	100%
9	"PI Feedback"	–100%	0%	100%
10	"PI Error"	–100%	0%	100%
11	"PI Output"	–800%	0%	800%
12	"%Motor OL"	0%	0%	100%
13	"%Drive OL"	0%	0%	100%
14	"CommandedTrq:" (3)	–800%	0%	800% Motor Rated
15	"MtrTrqCurRef" (1)(3)	–200%	0 Amps	200% Motor Rated
16	"Speed Ref" (3)	–[Maximum Speed]	0 Hz	[Maximum Speed]
17	"Speed Fdbk" (3)	–[Maximum Speed]	0 Hz	[Maximum Speed]
19	"Torque Est" (1)(3)	–800%	0%	800% Motor Rated
24	"Param Cntl" (1)(2)			
25	"SpdFdBk NoFilt" (1)	–[Maximum Speed]	0 Hz	[Maximum Speed]

(1) Refer to Option Definitions on page 3-62.
(2) Enhanced firmware 1.001 & later.
(3) Enhanced firmware 2.002 & later.

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File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Analog Outputs	343	**[Analog Out1 Hi]** Sets the analog output value when the source value is at maximum.	Default: 10.00 Volts Min/Max: 0.00/10.00 Volts 0.00/20.00 mA EC Units: 0.01 Volt 0.01 mA EC	340 342
		344	**[Analog Out1 Lo]** Sets the analog output value when the source value is at minimum.	Default: 0.00 Volts Min/Max: 0.00/10.00 Volts 0.00/20.00 mA EC Units: 0.01 Volt 0.01 mA EC	340 342
		354	EC **[Anlg Out1 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: 0.01	341 342
		377	EC **[Anlg Out1 Setpt]** Controls the analog output value from a communication device. Example Set [Data In A1] to "377" which will be the value from the communication device.	Default: 0.00 Volts Min/Max: 0.00/10.00 Volts 0.00/20.00 mA EC Units: 0.01 Volt 0.01 mA EC	340

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File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Digital Inputs	361 362 363 364 365 366	**[Digital In1 Sel]** **[Digital In2 Sel]** **[Digital In3 Sel]** **[Digital In4 Sel]** **[Digital In5 Sel]** **[Digital In6 Sel]**(7)	Default: 4 "Stop – CF"(1) Default: 5 "Start" Default: 18 "Auto/ Manual" Default: 15 "Speed Sel 1" Default: 16 "Speed Sel 2" Default: 17 "Speed Sel 3"	
			Selects the function for the digital inputs. (1) When [Digital Inx Sel] is set to option 2 "Clear Faults" the Stop button cannot be used to clear a fault condition. (2) (3) (4) Enhanced Control Drives Only. (5) Enhanced Firmware V2.001 and later. (6) Opening an "Enable" input will cause the motor to coast-to-stop, ignoring any programmed Stop modes. (7) A dedicated hardware enable input is available via a jumper selection. Refer to page 1-19 for further information. (8) Auto/Manual - Refer to Figure 1.15 on page 1-22 for details. (9) Typical 3-Wire Inputs - Requires that only 3-wire functions are chosen. Including 2-wire selections will cause a type 2 alarm. (10) Typical 2-Wire Inputs - Requires that only 2-wire functions are chosen. Including 3-wire selections will cause a type 2 alarm.	Options: 0 "Not Used" 1 "Enable"(6) 2 "Clear Faults"(1) 3 "Aux Fault" 4 "Stop – CF"(1) 5 "Start"(9)(11) 6 "Fwd/ Reverse"(9) 7 "Run"(10) 8 "Run Forward"(10) 9 "Run Reverse"(10) 10 "Jog"(9) "Jog1"(4) 11 "Jog Forward" 12 "Jog Reverse" 13 "Stop Mode B" 14 "Bus Reg Md B" 15-17 "Speed Sel 1-3"(2) 18 "Auto/ Manual"(8) 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 "Reserved" 30 "Precharge En"(4)(12) 31-33 "Spd/Trq Sel1-3"(3)(13) 34 "Jog 2"(4) 35 "PI Invert"(4) 36-40 "Reserved" 41-42 "UserSet Sel1-2"(5) 43 "Run Level"(5)(12) 44 "RunFwd Level"(5)(12) 45 "RunRev Level"(5)(12) 46 "Run w/Comm"(5)(12) 47-57 "Reserved" 58 "Sync Enable"(13) 59 "Traverse Ena"(13)	100 156 162 096 140 194 380 125 088 108 124 205 620

3	2	1	<-- "Speed Sel 1-3"
0	0	0	Reference A - P90
0	0	1	Reference B - P93
0	1	0	Preset Speed 2 - P102
0	1	1	Preset Speed 3 - P103
1	0	0	Preset Speed 4 - P104
1	0	1	Preset Speed 5 - P105
1	1	0	Preset Speed 6 - P106
1	1	1	Preset Speed 7 - P107

To access Preset Speed 1, set [Speed Ref A Sel] or [Speed Ref B Sel] to "Preset Speed 1".

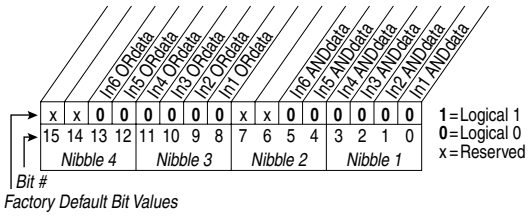
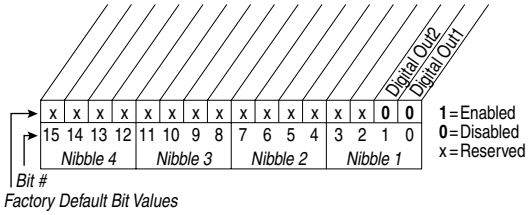
3	2	1	<-- "Spd/Trq Sel1-3"
0	0	0	Zero Torque
0	0	1	Spd Reg
0	1	0	Torque Reg
0	1	1	Min Spd/Trq
1	0	0	Max Spd/Trq
1	0	1	Sum Spd/Trq
1	1	0	Absolute
1	1	1	Zero Trq

(11) A "Dig In ConflictB" alarm will occur if a "Start" input is programmed without a "Stop" input. 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" in 2-wire. Refer to Alarm Descriptions on page 4-8 for information on resolving this type of conflict.

(12) Refer to Option Definitions on page 3-62.

(13) Enhanced Firmware V3.002 and later.

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File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Digital Inputs	411	E C **[DigIn DataLogic]** Provides data to the logical operations that will be done with the digital inputs when parameter 056 option 9 "DigIn DatLog" is set to 1.  	056
	Digital Outputs	379	E C **[Dig Out Setpt]** Controls output relays (CRx) when parameter 380 or 384 is set to option 30 "Param Cntl".  	

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File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values		Related
INPUTS & OUTPUTS (File J)	Digital Outputs	380 384	**[Digital Out1 Sel]** **[Digital Out2 Sel]** Selects the drive status that will energize a (CRx) output relay. (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 page 1-16. (2) Activation level is defined in [Dig Outx Level] below. (3) Enhanced Control Drives Only. (4) Enhanced Firmware V3.002 and later. (5) Enhanced Firmware V4.001 and later.	Default: Options:	1 "Fault" 4 "Run" 1 "Fault"(1) 2 "Alarm"(1) 3 "Ready" 4 "Run" 5 "Forward Run" 6 "Reverse Run" 7 "Auto Restart" 8 "Powerup Run" 9 "At Speed" 10 "At Freq"(2) 11 "At Current"(2) 12 "At Torque"(2) 13 "At Temp"(2) 14 "At Bus Volts"(2) 15 "At PI Error"(2) 16 "DC Braking" 17 "Curr Limit" 18 "Economize" 19 "Motor Overld" 20 "Power Loss" 21 "Input 1 Link" 22 "Input 2 Link" 23 "Input 3 Link" 24 "Input 4 Link" 25 "Input 5 Link" 26 "Input 6 Link" 27 "PI Enabled"(3) 28 "PI Hold"(3) 29 "Drive Overld"(3) 30 "Param Cntl"(3) 31-57 "Reserved" 58 "Manual Mode"(4) 59 "Fast Braking"(4) 60 "Reserved" 61 "Speed Fdbk"(2)(5)	381 385 382 383 002 001 003 004 218 012 137 157 147 053 048 184
		381 385	**[Dig Out1 Level]** **[Dig Out2 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: Min/Max: Units:	0.0 0.0 0.0/819.2 0.1	380
		382 386	**[Dig Out1 OnTime]** **[Dig Out2 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: Min/Max: Units:	0.0 Secs 0.0 Secs 0.0/600.0 Secs 0.1 Secs	380

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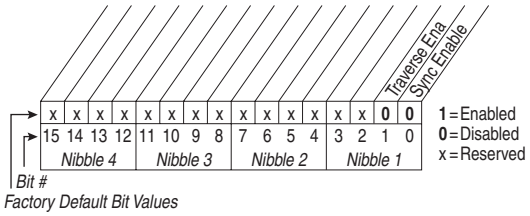
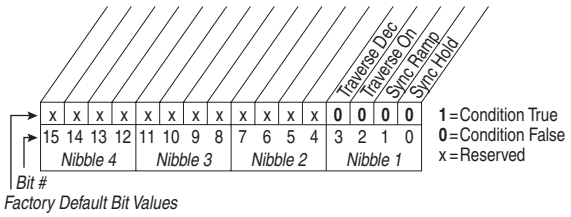
File J	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
INPUTS & OUTPUTS (File J)	Digital Outputs	383 387	**[Dig Out1 OffTime]** **[Dig Out2 OffTime]** Sets the "OFF Delay" time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.	Default: 0.0 Secs 0.0 Secs Min/Max: 0.0/600.0 Secs Units: 0.1 Secs	380

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
Excl Link	Links digital input to a digital output if the output is set to "Input 1-6 Link."	361
Input 1-6 Link	When Digital Output 1 is set to 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
Manual Mode	Either the HIM or I/O Terminal Block (analog input) has control of the speed reference.	380
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.	342
PI Reference	Reference for PI block (see Process PI for Standard Control on page C-14).	342
Precharge En	Forces drive into precharge state. Typically controlled by auxiliary contact on the disconnect at the DC input to the drive.	361
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.	
RunFwd Level		
RunRev Level		
Run w/Comm	Allows the comms start bit to operate like a run with the run input on the terminal block. Ownership rules apply.	
SpdFdBk NoFilt	Provides an unfiltered value to an analog output. The filtered version "Speed Fdbk" includes a 125 ms filter.	342
Sync Enable	The fiber feature Synchronized Speed Change has been enabled. Allows a coordinated change in drive speeds to change machine speed.	622
Torque Est	Calculated percentage of rated motor torque.	342
Traverse Enable	The Traverse function has been enabled. This adds a triangle wave and square wave modulation to the speed reference.	623 624 625 626

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Applications File (File K)

File K	Group	No.	Parameter Name & Description *See page 3-2 for symbol descriptions*	Values	Related
Fiber Functions		620	E C v3 **[Fiber Control]** Controls the Sync and Traverse functions.  *Factory Default Bit Values*		
		621	E C v3 **[Fiber Status]** Read Only Status of Sync and Traverse functions.  *Factory Default Bit Values*		
		622	E C v3 **[Sync Time]** The time to ramp from the "held speed reference" to the current speed reference, after the Sync input is de-energized.	Default: 0.0 Secs Min/Max: 0.0/3600.0 Secs Units: 0.1 Secs	
		623	E C v3 **[Traverse Inc]** Sets the time period of increasing frequency.	Default: 0.00 Secs Min/Max: 0.00/30.00 Secs Units: 0.01 Secs	
		624	E C v3 **[Traverse Dec]** Sets the time period of decreasing frequency.	Default: 0.00 Secs Min/Max: 0.00/30.00 Secs Units: 0.01 Secs	
		625	E C v3 **[Max Traverse]** Sets the amplitude of the triangle wave speed modulation.	Default: 0.00 Hz Min/Max: 0.00/Maximum Speed Units: 0.01 Hz	
		626	E C v3 **[P Jump]** Sets the amplitude of the square wave speed modulation.	Default: 0.00 Hz Min/Max: 0.00/Maximum Speed Units: 0.01 Hz	

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Parameter Cross Reference – by Name

Parameter Name	Number	Group	Page
Accel Mask	281	Masks & Owners	3-52
Accel Owner	293	Masks & Owners	3-53
Accel Time X	140, 141	Ramp Rates	3-30
Alarm Config 1	259	Alarms	3-49
Alarm X @ Fault	229, 230	Diagnostics	3-47
Analog In X Hi	322, 325	Analog Inputs	3-56
Analog In X Lo	323, 326	Analog Inputs	3-56
Analog In X Loss	324, 327	Analog Inputs	3-56
Analog In1 Value	16	Metering	3-12
Analog In2 Value	17	Metering	3-12
Analog Out1 Hi	343	Analog Outputs	3-58
Analog Out1 Lo	344	Analog Outputs	3-58
Analog Out1 Sel	342	Analog Outputs	3-57
Anlg In Config	320	Analog Inputs	3-56
Anlg In Sqr Root	321	Analog Inputs	3-56
Anlg Out Absolut	341	Analog Outputs	3-57
Anlg Out Config	340	Analog Outputs	3-57
Anlg Out1 Scale	354	Analog Outputs	3-58
Anlg Out1 Setpt	377	Analog Outputs	3-58
Auto Rstrt Delay	175	Restart Modes	3-35
Auto Rstrt Tries	174	Restart Modes	3-35
AutoMan Cnfg	192	HIM Ref Config	3-39
Autotune	61	Torq Attributes	3-16
Autotune Torque	66	Torq Attributes	3-17
Break Frequency	72	Volts per Hertz	3-18
Break Voltage	71	Volts per Hertz	3-18
Bus Reg Gain	160	Stop/Brake Modes	3-32
Bus Reg Kd	165	Stop/Brake Modes	3-33
Bus Reg Ki	160	Stop/Brake Modes	3-32
Bus Reg Kp	164	Stop/Brake Modes	3-33
Bus Reg Mode X	161, 162	Stop/Brake Modes	3-33
Commanded Freq	2	Metering	3-11
Commanded Torque	24	Metering	3-12
Compensation	56	Torq Attributes	3-15
Control Status	440	Torq Attributes	3-18
Control SW Ver	29	Drive Data	3-12
Current Lmt Gain	149	Load Limits	3-30
Current Lmt Sel	147	Load Limits	3-30
Current Lmt Val	148	Load Limits	3-30
Current Rate Limit	154	Load Limits	3-31
Data In XX	300-307	Datalinks	3-54
Data Out XX	310-317	Datalinks	3-54
DB Resistor Type	163	Stop/Brake Modes	3-33
DB While Stopped	145	Stop/Brake Modes	3-31
DC Brake Level	158	Stop/Brake Modes	3-32
DC Brake Lvl Sel	157	Stop/Brake Modes	3-32
DC Brake Time	159	Stop/Brake Modes	3-32
DC Bus Memory	13	Metering	3-11
DC Bus Voltage	12	Metering	3-11
Decel Mask	282	Masks & Owners	3-52
Decel Owner	294	Masks & Owners	3-53
Decel Time X	142, 143	Ramp Rates	3-30
Dig In Status	216	Diagnostics	3-45
Dig Out Setpt	379	Digital Outputs	3-60

Parameter Name	Number	Group	Page
Dig Out Status	217	Diagnostics	3-45
Dig OutX Level	381, 385	Digital Outputs	3-61
Dig OutX OffTime	383, 387	Digital Outputs	3-62
Dig OutX OnTime	382, 386	Digital Outputs	3-61
DigIn DataLogic	411	Digital Inputs	3-60
Digital InX Sel	361-366	Digital Inputs	3-59
Digital OutX Sel	380, 384	Digital Outputs	3-61
Direction Mask	279	Masks & Owners	3-52
Direction Mode	190	Direction Config	3-39
Direction Owner	291	Masks & Owners	3-53
DPI Data Rate	270	Comm Control	3-51
DPI Port Select	274	Comm Control	3-52
DPI Port Value	275	Comm Control	3-52
DPI Ref Select	298	Comm Control	3-52
Drive Alarm X	211, 212	Diagnostics	3-43
Drive Checksum	203	Drive Memory	3-41
Drive Logic Rslt	271	Comm Control	3-51
Drive OL Count	219	Diagnostics	3-45
Drive OL Mode	150	Load Limits	3-30
Drive Ramp Rslt	273	Comm Control	3-51
Drive Ref Rslt	272	Comm Control	3-51
Drive Status 1, 2	209, 210	Diagnostics	3-42
Drive Status 3	222	Diagnostics	3-46
Drive Temp	218	Diagnostics	3-45
Droop RPM @ FLA	152	Stop/Brake Modes	3-31
Dyn UserSet Actv	206	Drive Memory	3-42
Dyn UsrSet Cnfg	204	Drive memory	3-41
Dyn UsrSet Sel	205	Drive memory	3-41
Elapsed kWh	14	Metering	3-12
Elapsed MWh	9	Metering	3-11
Elapsed Run Time	10	Metering	3-11
Enc Position Fdbk	414	Speed Feedback	3-19
Encoder PPR	413	Speed Feedback	3-19
Encoder Speed	415	Speed Feedback	3-19
Fault Amps	225	Diagnostics	3-46
Fault Bus Volts	226	Diagnostics	3-46
Fault Clear	240	Faults	3-48
Fault Clear Mode	241	Faults	3-48
Fault Clr Mask	283	Masks & Owners	3-52
Fault Clr Owner	295	Masks & Owners	3-53
Fault Config 1	238	Faults	3-48
Fault Frequency	224	Diagnostics	3-46
Fault X Code	243-249	Faults	3-49
Fault X Time	244-250	Faults	3-49
Fdbk Filter Sel	416	Speed Feedback	3-19
Feedback Select	80	Spd Mode & Limits	3-20
Fiber Control	620	Fiber Functions	3-63
Fiber Status	621	Fiber Functions	3-63
Flux Braking	166	Stop/Brake Modes	3-34
Flux Current	5	Metering	3-11
Flux Current Ref	63	Torq Attributes	3-16
Flux Up Mode	57	Torq Attributes	3-15
Flux Up Time	58	Torq Attributes	3-15
Flying Start En	169	Restart Modes	3-35

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Parameter Name	Number	Group	Page
Flying StartGain	170	Restart Modes	3-35
Gnd Warn Level	177	Restart Modes	3-38
HighRes Ref	308	Datalinks	3-54
Inertia Autotune	67	Torq Attributes	3-17
IR Voltage Drop	62	Torq Attributes	3-16
Ixo Voltage Drop	64	Torq Attributes	3-17
Jog Mask	278	Masks & Owners	3-52
Jog Owner	290	Masks & Owners	3-53
Jog Speed	100	Discrete Speeds	3-23
Jog Speed 1	100	Discrete Speeds	3-23
Jog Speed 2	108	Discrete Speeds	3-23
Kf Speed Loop	447	Speed Regulator	3-28
Ki Speed Loop	445	Speed Regulator	3-28
Kp Speed Loop	446	Speed Regulator	3-28
Language	201	Drive Memory	3-41
Last Stop Source	215	Diagnostics	3-44
Load Frm Usr Set	198	Drive Memory	3-40
Load Loss Level	187	Power Loss	3-38
Load Loss Time	188	Power Loss	3-38
Logic Mask Act	598	Security	3-55
Local Mask	285	Masks & Owners	3-53
Local Owner	297	Masks & Owners	3-54
Logic Mask	276	Masks & Owners	3-52
Man Ref Preload	193	HIM Ref Config	3-39
Max Traverse	625	Fiber Functions	3-63
Maximum Freq	55	Torq Attributes	3-14
Maximum Speed	82	Spd Mode & Limits	3-20
Maximum Voltage	54	Torq Attributes	3-14
Minimum Speed	81	Spd Mode & Limits	3-20
MOP Frequency	11	Metering	3-11
MOP Mask	284	Masks & Owners	3-53
MOP Owner	296	Masks & Owners	3-53
MOP Rate	195	MOP Config	3-40
Motor Cntl Sel	53	Torq Attributes	3-14
Motor Fdbk Type	412	Speed Feedback	3-19
Motor NP FLA	42	Motor Data	3-13
Motor NP Hertz	43	Motor Data	3-13
Motor NP Power	45	Motor Data	3-13
Motor NP RPM	44	Motor Data	3-13
Motor NP Volts	41	Motor Data	3-13
Motor OL Count	220	Diagnostics	3-45
Motor OL Factor	48	Motor Data	3-13
Motor OL Hertz	47	Motor Data	3-13
Motor OL Mode	50	Motor Data	3-14
Motor Poles	49	Motor Data	3-14
Motor Type	40	Motor Data	3-13
Mtr NP Pwr Units	46	Motor Data	3-13
Mtr OL Trip Time	221	Diagnostics	3-45
Neg Torque Limit	437	Torq Attributes	3-18
Notch Filter K	420	Speed Feedback	3-19
Notch FilterFreq	419	Speed Feedback	3-19
Output Current	3	Metering	3-11
Output Freq	1	Metering	3-11
Output Power	7	Metering	3-11
Output Powr Fctr	8	Metering	3-11
Output Voltage	6	Metering	3-11
Overspeed Limit	83	Spd Mode & Limits	3-20
P Jump	626	Fiber Functions	3-63
Param Access Lvl	196	Drive Memory	3-40

Parameter Name	Number	Group	Page
PI BW Filter	139	Process PI	3-27
PI Configuration	124	Process PI	3-25
PI Control	125	Process PI	3-25
PI Deriv Time	459	Process PI	3-27
PI Error Meter	137	Process PI	3-27
PI Fdback Meter	136	Process PI	3-27
PI Feedback Hi	462	Process PI	3-28
PI Feedback Lo	463	Process PI	3-28
PI Feedback Sel	128	Process PI	3-26
PI Integral Time	129	Process PI	3-26
PI Lower Limit	131	Process PI	3-26
PI Output Meter	138	Process PI	3-27
PI Preload	133	Process PI	3-27
PI Prop Gain	130	Process PI	3-26
PI Reference Hi	460	Process PI	3-28
PI Reference Lo	461	Process PI	3-28
PI Reference Sel	126	Process PI	3-26
PI Ref Meter	135	Process PI	3-27
PI Setpoint	127	Process PI	3-26
PI Status	134	Process PI	3-27
PI Upper Limit	132	Process PI	3-27
Pos Torque Limit	436	Torq Attributes	3-17
Port Mask Act	595	Security	3-55
Power Loss Mode	184	Power Loss	3-38
Power Loss Time	185	Power Loss	3-38
Power Up Marker	242	Faults	3-48
Powerup Delay	167	Restart Modes	3-34
Preset Speed X	101-107	Discrete Speeds	3-23
PWM Frequency	151	Load Limits	3-30
Ramped Speed	22	Metering	3-12
Rated Amps	28	Drive Data	3-12
Rated kW	26	Drive Data	3-12
Rated Volts	27	Drive Data	3-12
Reference Mask	280	Masks & Owners	3-52
Reference Owner	292	Masks & Owners	3-53
Regen Power Lim	153	Load Limits	3-31
Reset Meters	200	Drive Memory	3-40
Reset To Defalts	197	Drive Memory	3-40
Rev Speed Limit	454	Spd Mode & Limits	3-21
Run Boost	70	Volts per Hertz	3-18
S Curve %	146	Ramp Rates	3-30
Save HIM Ref	192	HIM Ref Config	3-39
Save MOP Ref	194	MOP Config	3-40
Save To User Set	199	Drive Memory	3-40
Scale1 In Hi	476	Scaled Blocks	3-50
Scale1 In Lo	477	Scaled Blocks	3-50
Scale1 In Value	478	Scaled Blocks	3-50
Scale2 In Hi	482	Scaled Blocks	3-50
Scale2 In Lo	483	Scaled Blocks	3-50
Scale2 In Value	484	Scaled Blocks	3-50
Shear Pin Time	189	Load Limits	3-31
Skip Freq Band	87	Spd Mode & Limits	3-21
Skip Frequency X	84-86	Spd Mode & Limits	3-21
Sleep Level	182	Restart Modes	3-37
Sleep Time	183	Restart Modes	3-37
Sleep Wake Mode	178	Restart Modes	3-36
Sleep Wake Ref	179	Restart Modes	3-37
Slip Comp Gain	122	Slip Comp	3-25
Slip RPM @ FLA	121	Slip Comp	3-25

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Parameter Name	Number	Group	Page
Slip RPM Meter	123	Slip Comp	3-25
Spd Err Filt BW	448	Speed Regulator	3-28
Speed Desired BW	449	Speed Regulator	3-29
Speed Feedback	25	Metering	3-12
Speed Loop Meter	451	Speed Regulator	3-29
Speed Mode	80	Spd Mode & Limits	3-20
Speed Ref X Hi	91, 94	Speed Reference	3-22
Speed Ref X Lo	92, 95	Speed Reference	3-22
Speed Ref X Sel	90, 93	Speed Reference	3-22
Speed Reference	23	Metering	3-12
Speed Ref Source	213	Diagnostics	3-44
Speed/Torque Mod	88	Spd Mode & Limits	3-21
Start At PowerUp	168	Restart Modes	3-34
Start Inhibits	214	Diagnostics	3-44
Start Mask	277	Masks & Owners	3-52
Start Owner	289	Masks & Owners	3-53
StAcc Boost	69	Volts per Hertz	3-18
Status X @ Fault	227, 228	Diagnostics	3-46
Status 3 @ Fault	223	Diagnostics	3-46
Stop/Brk Mode X	155, 156	Stop/Brake Modes	3-31
Stop Owner	288	Masks & Owners	3-53
SV Boost Filter	59	Torq Attributes	3-15
Sync Time	622	Fiber Functions	3-63
TB Man Ref Hi	97	Speed Reference	3-23
TB Man Ref Lo	98	Speed Reference	3-23
TB Man Ref Sel	96	Speed Reference	3-23
Testpoint X Data	235, 237	Diagnostics	3-48
Testpoint X Sel	234, 236	Diagnostics	3-48
Torq Current Ref	441	Torq Attributes	3-18
Torque Current	4	Metering	3-11
Torque Estimate	15	Metering	3-12
Torque Perf Mode	53	Torq Attributes	3-14
Torque Ref A Hi	428	Torq Attributes	3-17
Torque Ref A Lo	429	Torq Attributes	3-17
Torque Ref A Sel	427	Torq Attributes	3-17
Torque Setpoint1	435	Torq Attributes	3-17
Total Inertia	450	Speed Regulator	3-29
Traverse Dec	624	Fiber Functions	3-63
Traverse Inc	623	Fiber Functions	3-63
Trim % Setpoint	116	Speed Trim	3-24
Trim Hi	119	Speed Trim	3-24
Trim In Select	117	Speed Trim	3-24
Trim Lo	120	Speed Trim	3-24
Trim Out Select	118	Speed Trim	3-24
Voltage Class	202	Drive Memory	3-41
Wake Level	180	Restart Modes	3-37
Wake Time	181	Restart Modes	3-37
Write Mask Act	597	Security	3-55
Write Mask Cfg	596	Security	3-55

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Troubleshooting

Chapter 4 provides information to guide you in troubleshooting the PowerFlex 70. Included is a listing and description of drive faults (with possible solutions, when applicable) and alarms.

For information on...	See page...
Faults and Alarms	4-1
Drive Status	4-2
Manually Clearing Faults	4-3
Fault Descriptions	4-3
Clearing Alarms	4-8
Alarm Descriptions	4-8
Testpoint Codes and Functions	4-11
Common Symptoms and Corrective Actions	4-12

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 3-35) is set to a value greater than "0," a user-configurable timer, [Auto Rstrt Delay] (see page 3-35) 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. Drive must remain in Run state. If Stop is initiated, Restart function is aborted.
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 3-49.
②	Non-Configurable	These alarms are always enabled.

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Drive Status

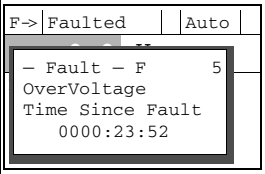
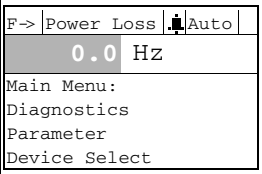
The condition or state of your drive is constantly monitored. Any changes will be indicated through the LEDs and/or the HIM (if present).

LED Indications

See page 2-3 for information on LED status indicators.

HIM Indication

The LCD and LED HIMs also provide 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. The LED HIM reports the fault condition by displaying the specific fault code.	LCD HIM  LED HIM 
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	LCD HIM  LED HIM No indication.

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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 3-56.	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 3-48.	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.
Decel Inhibit	24	③	The drive is not following a commanded acceleration or 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.
Drive OverLoad	64		Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded.	Reduce load or extend Accel Time.

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Fault	No.	Type(1)	Description	Action
Drive Powerup E C v2	49		No fault displayed. Used as a Power Up Marker in the Fault Queue indicating that the drive power has been cycled.	
Enable Hardware E C	111		Safe-Off board is not installed and pins 3 and 4 of the Safe-Off Connector are not jumpered.	Install Safe-Off board or jumper pins 3 and 4.
			If Safe-Off board is installed, verify the hardware enable jumper is removed.	Locate and remove the enable jumper on the main control board. Refer to Chapter 1 of this manual for instructions and location.
			Safe-Off board has failed.	Replace Safe-Off board.
			Hardware enable circuitry failed.	Replace control board.
Encoder Loss E C v2	91		One or both encoder channel signals is missing.	1. Check Wiring. 2. Replace encoder.
Excessive Load	79		Motor did not come up to speed in the allotted time during autotune.	1. Uncouple load from motor. 2. Repeat Autotune.
Faults Cleared E C v2	52		No fault displayed. Used as a marker in the Fault Queue indicating that the fault clear function was performed.	
Flt QueueCleared E C v2	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.
Heatsink OvrTemp	8	①	Heatsink temperature exceeds 100% of [Drive Temp].	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excess load.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	1. Check output of drive or motor for shorts. 2. Check programming. 3. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
Incompat MCB-PB	106	②	Drive rating information stored on the power board is incompatible with the main control board.	Load compatible version files into drive.
Input Phase Loss E C v2	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.

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Fault	No.	Type(1)	Description	Action
IXo VoltageRange E C v2	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 E C v2	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 3-48.	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA]. If enabled, check level of flux braking in parameter P549 [Flux Braking %].
Motor Thermistor E C	16		Thermistor output is out of range.	1. Verify that thermistor is connected. 2. Motor is overheated. Reduce load.
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].
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			

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Fault	No.	Type(1)	Description	Action
Port 1-5 DPI Loss	81-85		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 1-5 Adapter	71-75		The communications card has a fault.	Check DPI device event queue and corresponding fault information for the device.
Power Loss	3	① ③	DC bus voltage remained below trigger of nominal for longer than [Power Loss Time]. Enable/ Disable with [Fault Config 1] on page 3-48.	Monitor the incoming AC line for low voltage or line power interruption.
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.
Shear Pin	63	③	Programmed [Current Lmt Val] has been exceeded. Enable/ Disable with [Fault Config 1] on page 3-48.	Check load requirements and [Current Lmt Val] setting.
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. If enabled, check level of flux braking in parameter P549 [Flux Braking %].
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 excessive load.

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Fault	No.	Type(1)	Description	Action
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value. Standard Control: 509V DC at 600V input, 407V DC at 400/480V input or 204V DC at 200/240V input. Enhanced Control: 375V DC at 600V input, 300V DC at 400/480 input or 160V DC at 200/240V input. Enable/Disable with [Fault Config 1] on page 3-48.	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		

(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
12	HW OverCurrent
15	Load Loss
16	Motor Thermistor
17	Input Phase Loss
24	Decel Inhibit
25	OverSpeed Limit
29	Analog In Loss
33	Auto Rstrt Tries
36	SW OverCurrent

No.(1)	Fault
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
63	Shear Pin
64	Drive Overload
71-75	Port 1-5 Adapter
77	IR Volts Range
78	FluxAmpsRef Rang

No.(1)	Fault
79	Excessive Load
80	AutoTune Aborted
81-85	Port 1-5 DPI Loss
87	IXo VoltageRange
91	Encoder Loss
100	Parameter Chksum
101	UserSet1 Chksum
102	UserSet2 Chksum
103	UserSet3 Chksum
104	Pwr Brd Chksum1
105	Pwr Brd Chksum2
106	Incompat MCB-PB
107	Replaced MCB-PB
108	Anlg Cal Chksum
111	Enable Hardware

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

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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
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”.
Decel Inhibit	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.
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.

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

	Start	Stop–CF	Run	Run Fwd	Run Rev	Jog	Jog Fwd	Jog Rev	Fwd/ Rev
Start									
Stop–CF									
Run									
Run Fwd									
Run Rev									
Jog									
Jog Fwd									
Jog Rev									
Fwd / Rev									

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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, Run Reverse, Bus Regulation Mode B Speed Select 1, Jog Forward, Acc2 / Dec2 Speed Select 2, Jog Reverse, Accel 2 Speed Select 3, Run, Decel 2 Run Forward, Stop Mode B
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 E C v2	15	①	Ground current has exceeded the level set in [Gnd Warn Level].
In Phase Loss E C v2	13	①	The DC bus ripple has exceeded the level in [Phase Loss 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 VoltageRange E C v2	28	②	Motor leakage inductance is out of range.
Load Loss E C v2	14		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 E C	12		[Fault Config 1] or [Alarm Config 1] Bit 7 “Motor Therm” is enabled and the analog Input voltage is <0.2 Volts or >5.0 Volts.
Motor Type Cflct	21	②	[Motor Type] has been set to “Synchr Reluc” or “Synchr PM” and one or more of the following exist: • [Torque Perf Mode] = “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.”
NP Hz Conflict	22	②	Fan/pump mode is selected in [Torq Perf Mode] and the ratio of [Motor NP Hertz] to [Maximum Freq] is greater than 26.
Power Loss	3	①	Drive has sensed a power line loss.

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Alarm	No.	Type[1]	Description
Precharge Active	1	①	Drive is in the initial DC bus precharge state.
PTC Conflict E C	31		[Fault Config 1] or [Alarm Config 1] Bit 7 “Motor Therm” is enabled and Analog In 1 is set to milliamperes.
Sleep Config E C v2	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 E C	30		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 reprogrammed (such as parameters 90, 117, 128 and 179). See also Auto/Manual Examples on page 1-23. To correct: • Verify/reprogram the parameters that reference an analog input *or* • Reprogram [Digital In3] to another function or “Unused.”
UnderVoltage	2	①	The bus voltage has dropped below a predetermined value.
UserSet Conflict E C v2	51	②	[Digital Inx Sel] values differ in different user sets.
VHz Neg Slope	24	②	[Torq Perf Mode] = “Custom V/Hz” and the V/Hz slope is negative.
Waking E C v2	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.

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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 Inhibit
11	Waking

No.(1)	Alarm
12	Motor Thermistor
13	In Phase Loss
14	Load Loss
15	Ground Warn
17	Dig In ConflictA
18	Dig In ConflictB
19	Dig In ConflictC
20	Bipolar Conflict
21	Motor Type Cflct
22	NP Hz Conflict

No.(1)	Alarm
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
51	UserSet Conflict

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

Testpoint Codes and Functions

Code Selected in [Testpoint x Sel]	Function Whose Value is Displayed in [Testpoint x Data]
1	DPI Error Status
2	Heatsink Temperature
3	Active Current Limit
4	Active PWM Frequency
5	Lifetime MegaWatt Hours(1)
6	Lifetime Run Time
7	Lifetime Powered Up Time
8	Lifetime Power Cycles
9	Life MegaWatt Hours Fraction(1)
10	Life MegaWatt Hours Fraction Units(1)
11-99	Reserved for Factory Use

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

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

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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 3-48) • "Clear Faults" on the HIM Diagnostic menu
Incorrect input wiring. See page 1-17 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 7 to 8 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 3-59) 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 3-59) 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.	None	If 2 wire control is required, no action is necessary. If 3 wire control is required, program [Digital Inx Sel] for correct inputs. (See page 3-59)

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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 Freq] for correct source. (Param #002, page 3-11)
Incorrect reference source has been programmed.	None	3. Check [Speed Ref Source] for the source of the speed reference. (Param #213, page 3-44) 4. Reprogram [Speed Ref A Sel] for correct source. (Param #090, page 3-22)
Incorrect Reference source is being selected via remote device or digital inputs.	None	5. Check [Drive Status 1], bits 12 and 13 for unexpected source selections. (Param #209, page 3-42) 6. Check [Dig In Status] to see if inputs are selecting an alternate source. (Param #216, page 3-45) 7. Reprogram digital inputs to correct “Speed Sel x” option. (See page 3-59)

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 3-30)
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 3-42) Remove excess load or reprogram [Accel Time x]. (See page 3-30)
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] (Param #082, page 3-20) and [Maximum Freq] (Param #055, page 3-14) 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 3-16)

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Drive will not reverse motor direction.

Cause(s)	Indication	Corrective Action
Digital input is not selected for reversing control.	None	Check [Digital Inx Sel] (See page 3-59). Choose correct input and program for reversing mode.
Digital input is incorrectly wired.	None	Check input wiring. (See page 1-16)
Direction mode parameter is incorrectly programmed.	None	Reprogram [Direction Mode] for analog "Bipolar" or digital "Unipolar" control. (Param #190, page 3-39)
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 1-17) 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 Preface-5. 2. Reprogram bus regulation (parameters 161 and 162) to eliminate any "Adjust Freq" selection. 3. Disable bus regulation (parameters 161 and 162) and add a dynamic brake. 4. Correct AC input line instability or add an isolation transformer. 5. Reset drive.

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Supplemental Drive Information

Specifications

PowerFlex 70 Compliance with Laws, Standards, and Agency Requirements

Category	Frames A…E 240…480V	Frames A…E 600V	Compliance	
Agency Listings, Certifications, or Tests	✔	✔	c UL us	Listed to UL508C and CAN/CSA C22.2 No. 14-05 Configured drives may be listed to UL508A
	✔	✔	EN 50178	TÜV Rheinland Certificate T72041027 01 tested to EN 50178
	✔		TÜV	TÜV Rheinland Certificate of a Competent Body AV 72061059 0001 for compliance with EMC Directive (89/336/EEC)
	✔		TÜV FS	TÜV Rheinland Certificate 968/EZ 166.01/06 Safe Off Option satisfies requirements for Category 3 safety function according to EN 954-1
	✔		EPRI SOLUTIONS	EPRI Quality Star Certificates SEMIF47.116 for SEMI F47 compliance, 480V units tested
	✔	✔	ABS	American Bureau of Shipping MA Certificate 08-HS303172A/1-PDA for auxiliary servies on AB Classed vessels and offshore platforms
	✔		Lloyd's Register	Lloyd's Register Type Approval Certificate 08 / 60014 (marine certification)
	✔	✔		RINA Type Approval Certificate ELE283205CS (marine certification)
	✔	✔		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
	✔	✔	NSF	Type 4X enclosure NSF Listed to meet Criteria C2 for splash and non food zones
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
	✔			**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 standards referenced below: IEC 61800-3
Designed to Meet Applicable Requirements	✔	✔		**NFPA 70** - US National Electric 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

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Category	Specification						
Protection	**Drive**	**200-208V**	**240V**	**380/400**	**480V**	**600V**	**690V**
	AC Input Overvoltage Trip:	247VAC	285VAC	475VAC	570VAC	690VAC	
	AC Input Undervoltage Trip:	120VAC	138VAC	233VAC	280VAC	345VAC	
	Bus Overvoltage Trip:	405VDC	405VDC	810VDC	810VDC	1013VDC	
	Bus Undervoltage Output Shutoff:	300VDC	300VDC	407V DC	407V DC	508V DC	
	Bus Undervoltage Fault Level:	160VDC	160VDC	300VDC	300VDC	375VDC	
	Nominal Bus Voltage:	281VDC	324VDC	540VDC	648VDC	810VDC	
	All Drives						
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip					
	Drive Overcurrent Trip Software Current Limit: Hardware Current Limit: Instantaneous Current Limit:	 20…160% of rated current 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 1: Flange Mount: IP66, NEMA/UL Type 4X/12:	 0…50 °C (32…122 °F) 0…50 °C (32…122 °F) 0…40 °C (32…104 °F)					
	Cooling Fan Operation Frames A and C: Frames B, D and E:	 Fan operates when power is applied. Fan operates when power is applied and in Run condition.					
	Storage Temperature (all const.):	–40…70 °C (–40…158 °F)					
	Atmosphere	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.					
	Relative Humidity:	5…95% non-condensing					
	Shock:	15 g peak for 11 ms duration (±1.0 ms)					
	Vibration:	0.152 mm (0.006 in.) displacement, 1 g peak					

Category	Specification	
Electrical	Voltage Tolerance:	–10% of minimum, +10% of maximum. See page C-17 for Full Power and Operating Range.
	Frequency Tolerance:	47-63 Hz.
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.
	Displacement Power Factor (all drives):	0.98 across speed range.
	Efficiency:	97.5% at rated amps, nominal line volts.
	Maximum Short Circuit Rating:	200,000 Amps symmetrical.
	Max. Short Circuit Current Rating: Using Recommended Fuse or Circuit Breaker Type	Maximum short circuit current rating to match specified fuse/circuit breaker capability.

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Category	Specification	
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives.
	Carrier Frequency:	2, 3, 4, 5, 6, 7, 8, 9 & 10 kHz Standard. 2, 4, 8 & 12 kHz EC. Drive rating based on 4 kHz.
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	0…400 Hz Standard. 0…500 Hz EC.
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.
	Frequency Control - Speed Regulation	with Slip Compensation (V/Hz Mode) 0.5% of base speed across 40:1 speed range 40:1 operating range 10 rad/sec bandwidth
		with Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
		with feedback (Sensorless Vector Mode) EC 0.001% of base speed across 40:1 speed range 0.1% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
	Speed Control - Speed Regulation	without feedback (Vector Control Mode) EC 0.1% of base speed across 120:1 speed range 120:1 operating range 30 rad/sec bandwidth
		with feedback (Vector Control Mode) EC 0.001% of base speed across 120:1 speed range 1000:1 operating range 125 rad/sec bandwidth
	Torque Regulation	without feedback +/-10% EC
		with feedback +/-5% EC
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability and vector control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Fast Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:	Two independently programmable accel & decel times. Each time may be programmed from 0-3600 seconds in 0.1 sec. 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 to 160% of rated output current. Independently programmable proportional and integral gain.
	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.
Encoder	Type:	Incremental, dual channel
	Supply:	5V/12V Configurable +/-5%
	Quadrature:	90° +/-27°
	Duty Cycle:	50% +10%
	Requirements	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), single-ended or differential and capable of supplying a minimum of 10 mA per channel. The Encoder Interface Board accepts 5V or 12V DC square-wave with a minimum high state voltage of 3.5V DC (5V mode) and 7.0V DC (12V mode). Maximum low state voltage is 1V DC (for both 5V and 12V modes). Maximum input frequency is 250 kHz.

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IP20, NEMA/UL Type 1 Watts Loss (Rated Load, Speed & PWM)(1)

Voltage	ND HP	External Watts	Internal Watts	Total Watts Loss
208V	0.5	12.2	19.2	31.4
	1.0	30.7	20.5	51.2
	2.0	44.6	22.6	67.2
	3.0	67.3	25.4	92.7
	5.0	141.3	33.2	174.5
	7.5	205.7	34.2	239.9
	10	270.4	48.1	318.5
	15	385.6	40.3	425.9
	20	494.6	44.9	539.5
	25	650.7	51.6	702.3
240V	0.5	12.2	19.2	31.4
	1.0	30.7	20.5	51.2
	2.0	44.6	22.6	67.2
	3.0	67.3	25.4	92.7
	5.0	141.3	33.2	174.5
	7.5	205.7	34.2	239.9
	10	270.4	48.1	318.5
	15	385.6	40.3	425.9
	20	494.6	44.9	539.5
	25	650.7	51.6	702.3
400V	0.37	11.5	17.9	29.4
	0.75	27.8	19.5	47.3
	1.5	43.6	21.6	65.2
	2.2	64.6	24	88.6
	4.0	99.5	28.2	127.7
	5.5	140	27.8	167.8
	7.5	193.3	32	225.3
	11	305.4	34.2	339.6
	15	432.9	42.9	475.8
	18.5	363.8	40.5	404.3
	22	396.8	41.5	438.3
	30	500.8	50	550.8
	37	632	57.7	689.7
480V	0.5	11.5	17.9	29.4
	1.0	27.8	19.5	47.3
	2.0	43.6	21.6	65.2
	3.0	64.6	24	88.6
	5.0	99.5	28.2	127.7
	7.5	140	27.8	167.8
	10	193.3	32	225.3
	15	305.4	34.2	339.6
	20	432.9	42.9	475.8
	25	363.8	40.5	404.3
	30	396.8	41.5	438.3
	40	500.8	50	550.8
	50	632	57.7	689.7
600V	0.5	11.5	17.9	29.4
	1.0	27.8	19.5	47.3
	2.0	43.6	21.6	65.2
	3.0	64.6	24	88.6
	5.0	99.5	28.2	127.7
	7.5	140	27.8	167.8
	10	193.3	32	225.3
	15	305.4	34.2	339.6
	20	432.9	42.9	475.8
	25	281.4	42.4	323.8
	30	311.9	43.4	355.3
	40	389.9	51.8	441.7
	50	501.4	59.9	561.3

(1) Worst case condition including HIM and Communication Module

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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.



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Logic Command/Status Words

Figure A.1 Logic Command Word

Logic Bits															Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															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. Note that Reference Selection is “Exclusive Ownership” see [Reference Owner] on page 3-53.

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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 = Port 6 111 = 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 = DPI 6 Manual 1111 = Jog Ref

(1) See “Owners” on page 3-53 for further information.

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Dimensions

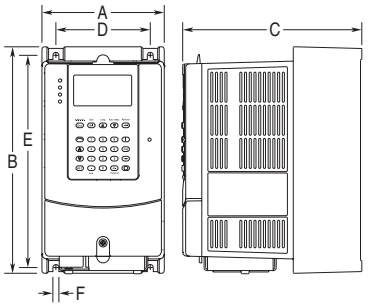
Table A.A PowerFlex 70 Frames

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

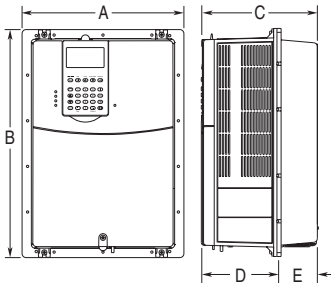
(1) Not Filtered indicated if Position 13 of the Catalog Number = N.

(2) Filtered indicated if Position 13 of the Catalog Number = A.

IP20/66 (NEMA/UL Type 1/4X/12)



Flange Mount



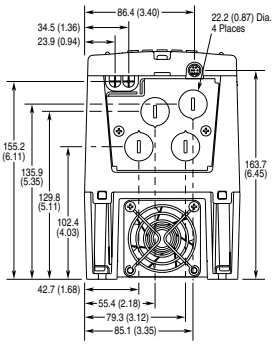
Frame	Dimension *Dimensions are in millimeters and (inches)* A	B	C	D	E	F	Weight [1] *kg (lb)*
	IP20 / NEMA/UL Type 1						
A	122.4 (4.82)	225.7 (8.89)	179.8 (7.08)	94.2 (3.71)	211.6 (8.33)	5.8 (0.23)	2.71 (6.0)
B	171.7 (6.76)	234.6 (9.24)	179.8 (7.08)	122.7 (4.83)	220.2 (8.67)	5.8 (0.23)	3.60 (7.9)
C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

(1) Weights include Human Interface Module (HIM).

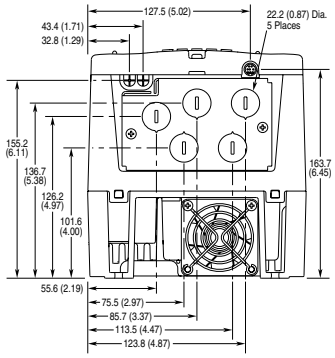
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Figure A.3 PowerFlex 70 IP20 / NEMA/UL Type 1 Bottom View Dimensions

Frame A (1)

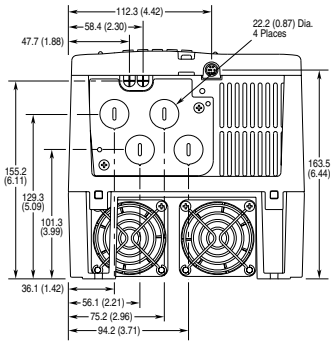


Frame B

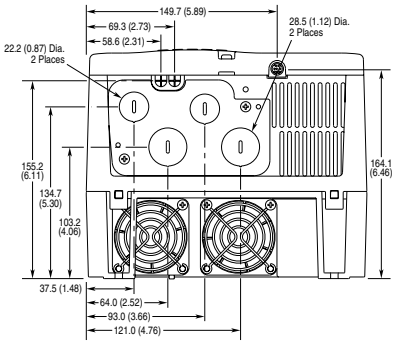


(1) Fan may not be present based on drive rating.

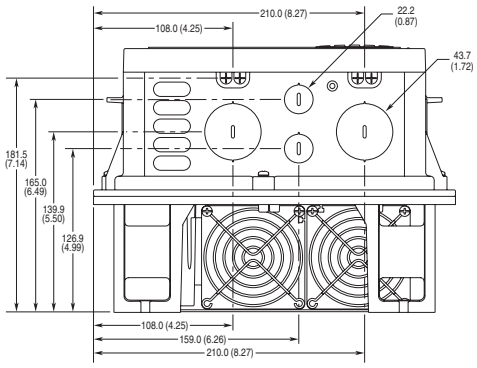
Frame C



Frame D



Frame E



Dimensions are in millimeters and (inches).

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Figure A.4 PowerFlex 70 IP 66 (NEMA/UL Type 4X/12) Bottom View Dimensions

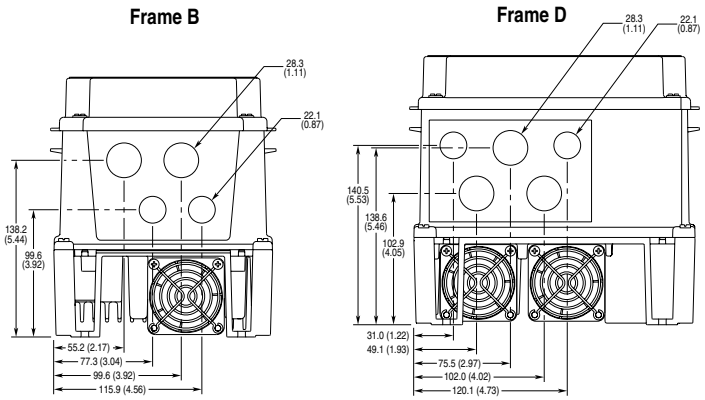
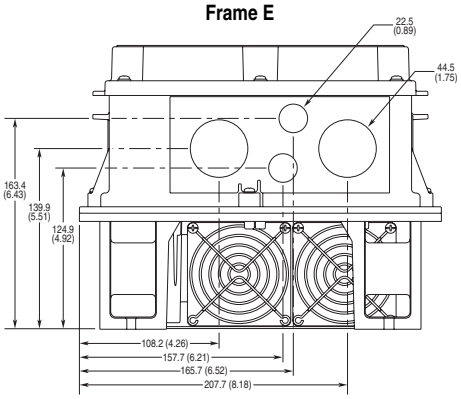


Figure A.5 PowerFlex 70 IP 54 / IP 66 (NEMA/UL Type 4X/12) Bottom View Dimensions

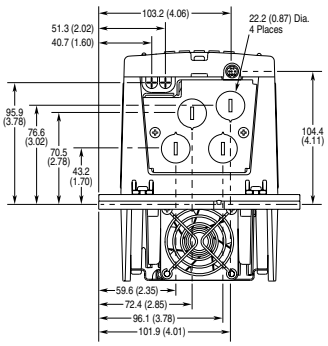


Dimensions are in millimeters and (inches).

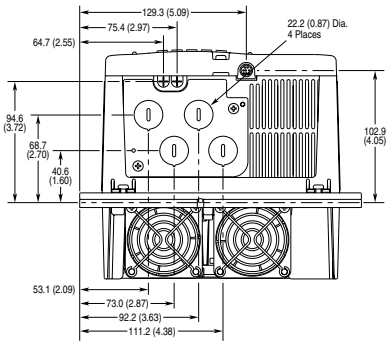
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Figure A.6 PowerFlex 70 Flange Mount Bottom View Dimensions

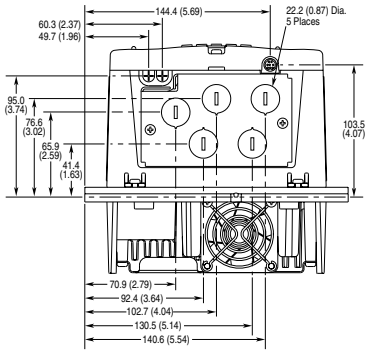
Frame A



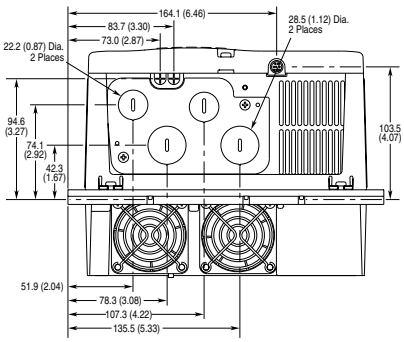
Frame C



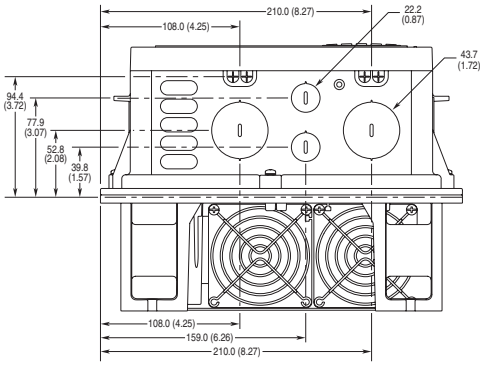
Frame B



Frame D



Frame E

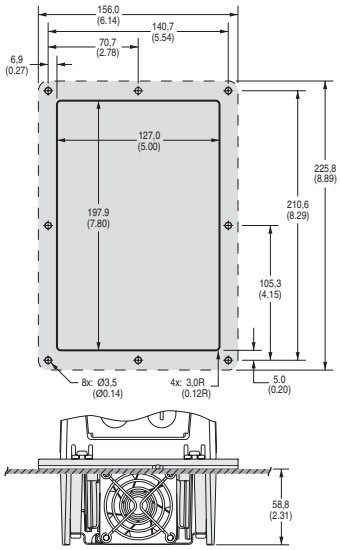


Dimensions are in millimeters and (inches).

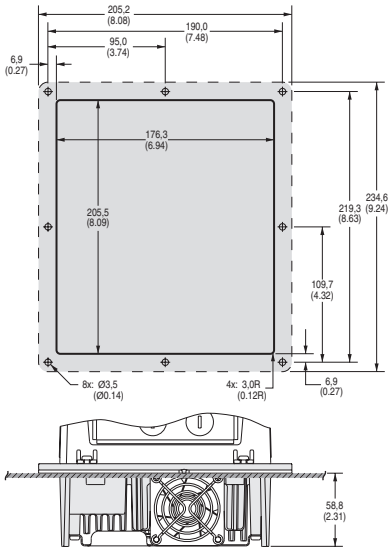
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Figure A.7 PowerFlex 70 Cutout Dimensions

Frame A

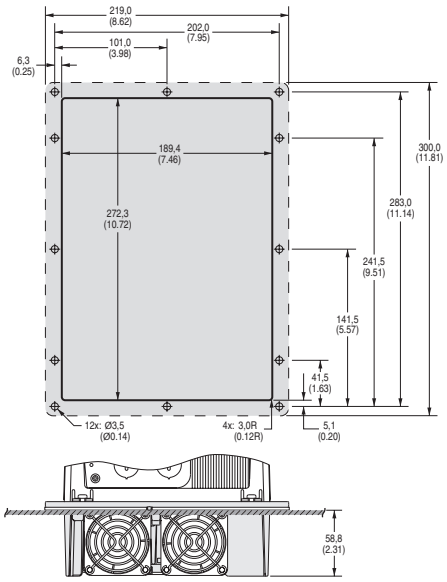


Frame B

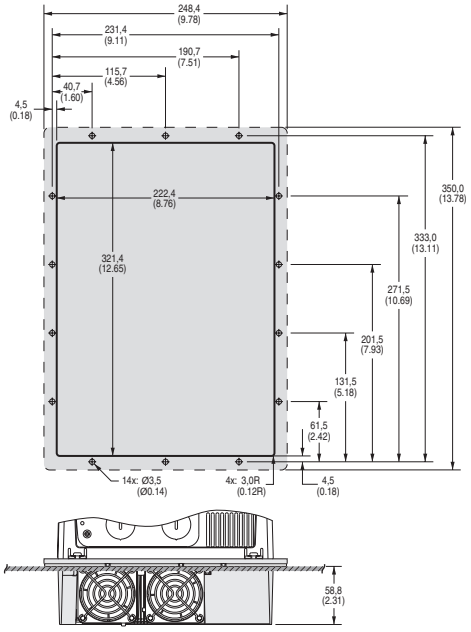


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Frame C

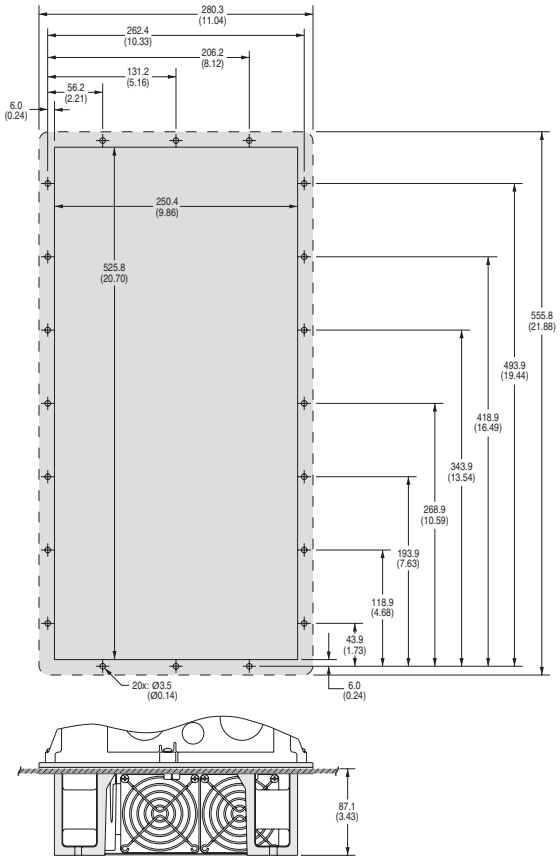


Frame D



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Frame E



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Output Devices

For information on output devices such as output contactors, cable terminators and output reactors refer to the *PowerFlex Reference Manual*, publication PFLEX-RM001.

Drive, Fuse & Circuit Breaker Ratings

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

Fusing

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

- IEC – BS88 (British Standard) Parts 1 & 2[(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.

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

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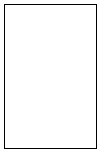
Table A.B 208/240 Volt AC Three-Phase Input Drive Ratings and Protection Devices (See page A-18 for Notes)

Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	HD	Amps	kVA	Cont.	1 Min.	3 Sec.	Min.(2)	Max.(3)	Min.(2)	Max.(3)	Max.(5)	Max.(5)	Available Catalog Numbers(9)			
208 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.9	1.1	2.5	2.7	3.7	6	6	6	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AB4P2	A	1	0.75	5.6	2	4.8	5.5	7.4	10	10	10	17.5	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	10	3.6	7.8	10.3	13.8	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	14	5.1	11	12.1	16.5	20	25	20	40	40	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	16	5.8	17.5	19.2	26.6	20	35	20	70	70	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB022	D	7.5	5	23.3	8.3	25.3	27.8	37.9	30	50	30	100	100	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	29.8	10.7	32.2	37.9	50.6	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	39.8	14.3	43	55.5	74	60	100	60	175	175	70	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	57.5	20.7	62.1	72.4	96.6	80	125	80	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	72.3	26.0	78.2	93.1	124	90	175	90	300	300	100	–	–	–	140-CMN-9000
240 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.5	1.1	2.2	2.4	3.3	3	4.5	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AB4P2	A	1	0.75	4.8	2	4.2	4.8	6.4	6	9	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	8.7	3.6	6.8	9	12	15	15	15	25	25	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	12.2	5.1	9.6	10.6	14.4	20	20	20	35	35	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	13.9	5.8	15.3	17.4	23.2	20	30	20	60	60	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB022	D	7.5	5	19.9	8.3	22	24.4	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	25.7	10.7	28	33	44	35	60	35	110	110	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	38.7	16.1	42	46.2	63	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	49.8	20.7	54	63	84	60	100	60	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	64.5	26.8	70	81	108	90	150	90	275	275	100	–	–	–	140-CMN-9000

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Table A.C 400/480 Volt AC Three-Phase Input Drive Ratings and Protection Devices (See page A-18 for Notes).

Drive Catalog Number	Frame[1]	kW *(400V)* HP *(480V)* Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.[2]*	*Max.[3]*	*Min.[2]*	*Max.[3]*	*Max.[5]*	*Max.[5]*	*Available Catalog Numbers[9]*			
400 Volt AC Input																		
20AC1P3	A	0.37	0.25	1.6	1.1	1.3	1.4	1.9	3	3	3	5	15	3	140M-C2E-B16	–	–	–
20AC2P1	A	0.75	0.55	2.5	1.8	2.1	2.4	3.2	4	6	4	8	15	7	140M-C2E-B25	140M-D8E-B25	–	–
20AC3P5	A	1.5	1.1	4.3	3	3.5	4.5	6	6	6	6	12	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AC5P0	B	2.2	1.5	6.5	4.5	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AC8P7	B	4	3	11.3	7.8	8.7	9.9	13.2	15	17.5	15	30	30	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC011	C	5.5	4	10.5	7.6	11.5	13	17.4	15	25	15	45	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC015	C	7.5	5.5	145.1	10.4	15.4	17.2	23.1	20	30	20	60	60	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC022	D	11	7.5	21.9	15.2	22	24.2	33	30	45	30	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AC030	D	15	11	30.3	21	30	33	45	40	60	40	120	120	50	–	–	140M-F8E-C32	140-CMN-4000
20AC037	D	18.5	15	35	24.3	37	45	60	50	80	50	125	140	50	–	–	140M-F8E-C45	140-CMN-4000
20AC043	D	22	18.5	40.7	28.2	43	56	74	60	90	60	150	160	70	–	–	–	140-CMN-6300
20AC060	E	30	22	56.8	39.3	60	66	90	80	125	80	225	240	80	–	–	–	140-CMN-6300
20AC072	E	37	30	68.9	47.8	72	90	120	90	150	90	250	280	100	–	–	–	140-CMN-9000
480 Volt AC Input																		
20AD1P1	A	0.5	0.33	1.3	1.1	1.1	1.2	1.6	3	3	3	4	15	3	140M-C2E-B16	–	–	–
20AD2P1	A	1	0.75	2.4	2	2.1	2.4	3.2	3	6	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AD3P4	A	2	1.5	3.8	3.2	3.4	4.5	6	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AD5P0	B	3	2	5.6	4.7	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-B63	140M-D8E-B63	–	–
20AD8P0	B	5	3	9.8	8.4	8	8.8	12	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AD011	C	7.5	5	9.4	7.9	11	12.1	16.5	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD014	C	10	7.5	12.4	10.4	14	16.5	22	20	30	20	50	50	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD022	D	15	10	19.9	16.6	22	24.2	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	–
20AD027	D	20	15	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C32	140-CMN-2500
20AD034	D	25	20	31.2	25.9	34	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C45	140-CMN-4000
20AD040	D	30	25	36.7	30.5	40	51	68	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-4000
20AD052	E	40	30	47.7	39.7	52	60	80	60	110	60	200	200	70	–	–	–	140-CMN-6300
20AD065	E	50	40	59.6	49.6	65	78	104	80	125	80	250	250	100	–	–	–	140-CMN-9000



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Table A.D 600 Volt AC Three-Phase Input Drive Ratings and Protection Devices

Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.(2)*	*Max.(3)*	*Min.(2)*	*Max.(3)*	*Max.(5)*	*Max.(5)*	*Available Catalog Numbers(9)*			
600 Volt AC Input																		
20AE0P9	A	0.5	0.33	1.3	1.3	0.9	1.1	1.4	3	3	3	3.5	15	3	140M-C2E-B16	–	–	–
20AE1P7	A	1	0.75	1.9	2	1.7	2	2.6	3	6	3	6	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AE2P7	A	2	1.5	3	3.1	2.7	3.6	4.8	4	6	4	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AE3P9	B	3	2	4.4	4.5	3.9	4.3	5.9	6	8	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AE6P1	B	5	3	7.5	7.8	6.1	6.7	9.2	10	12	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE9P0	C	7.5	5	7.7	8	9	9.9	13.5	10	20	10	35	35	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE011	C	10	7.5	9.8	10.1	11	13.5	18	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AE017	D	15	10	15.3	15.9	17	18.7	25.5	20	35	20	60	60	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AE022	D	20	15	20	20.8	22	25.5	34	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AE027	D	25	20	24.8	25.7	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C25	140-CMN-2500
20AE032	D	30	25	29.4	30.5	32	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AE041	E	40	30	37.6	39.1	41	48	64	50	90	50	150	150	100	–	–	140M-F8E-C45	140-CMN-4000
20AE052	E	50	40	47.7	49.6	52	61.5	82	60	110	60	200	200	100	–	–	–	140-CMN-6300

(1) For IP 66 (NEMA/UL Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.

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

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

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

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

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

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

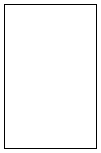
(8) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/347. Not UL listed for use on 480V or 600V Delta/Delta systems in single motor applications.

(9) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.

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Table A.E 208/240 Volt AC Single-Phase Input Drive Ratings and Protection Devices (See page A-21 for Notes)

Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	HD	Amps	kVA	Cont.	1 Min.	3 Sec.	Min.(2)	Max.(3)	Min.(2)	Max.(3)	Max.(5)	Max.(5)	Available Catalog Numbers(9)			
208 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.9	1.1	2.5	2.7	3.7	6	6	6	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AB4P2	A	1	0.75	5.6	2	4.8	5.5	7.4	10	10	10	17.5	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	10	3.6	7.8	10.3	13.8	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	14	5.1	11	12.1	16.5	20	25	20	40	40	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	16	5.8	17.5	19.2	26.6	20	35	20	70	70	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB022	D	7.5	5	23.3	8.3	25.3	27.8	37.9	30	50	30	100	100	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	29.8	10.7	32.2	37.9	50.6	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	39.8	14.3	43	55.5	74	60	100	60	175	175	70	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	57.5	20.7	62.1	72.4	96.6	80	125	80	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	72.3	26.0	78.2	93.1	124	90	175	90	300	300	100	–	–	–	140-CMN-9000
240 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.5	1.1	2.2	2.4	3.3	3	4.5	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AB4P2	A	1	0.75	4.8	2	4.2	4.8	6.4	6	9	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	8.7	3.6	6.8	9	12	15	15	15	25	25	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	12.2	5.1	9.6	10.6	14.4	20	20	20	35	35	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	13.9	5.8	15.3	17.4	23.2	20	30	20	60	60	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB022	D	7.5	5	19.9	8.3	22	24.4	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	25.7	10.7	28	33	44	35	60	35	110	110	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	38.7	16.1	42	46.2	63	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	49.8	20.7	54	63	84	60	100	60	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	64.5	26.8	70	81	108	90	150	90	275	275	100	–	–	–	140-CMN-9000



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Table A.F 400/480 Volt AC Single-Phase Input Drive Ratings and Protection Devices (See page A-21 for Notes).

Drive Catalog Number	Frame[1]	kW *(400V)* HP *(480V)* Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.[2]*	*Max.[3]*	*Min.[2]*	*Max.[3]*	*Max.[5]*	*Max.[5]*	*Available Catalog Numbers[9]*			
400 Volt AC Input																		
20AC1P3	A	0.37	0.25	1.6	1.1	1.3	1.4	1.9	3	3	3	5	15	3	140M-C2E-B16	–	–	–
20AC2P1	A	0.75	0.55	2.5	1.8	2.1	2.4	3.2	4	6	4	8	15	7	140M-C2E-B25	140M-D8E-B25	–	–
20AC3P5	A	1.5	1.1	4.3	3	3.5	4.5	6	6	6	6	12	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AC5P0	B	2.2	1.5	6.5	4.5	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AC8P7	B	4	3	11.3	7.8	8.7	9.9	13.2	15	17.5	15	30	30	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC011	C	5.5	4	11	7.6	11.5	13	17.4	15	25	15	45	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC015	C	7.5	5.5	15.1	10.4	15.4	17.2	23.1	20	30	20	60	60	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC022	D	11	7.5	21.9	15.2	22	24.2	33	30	45	30	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AC030	D	15	11	30.3	21	30	33	45	40	60	40	120	120	50	–	–	140M-F8E-C32	140-CMN-4000
20AC037	D	18.5	15	35	24.3	37	45	60	50	80	50	125	140	50	–	–	140M-F8E-C45	140-CMN-4000
20AC043	D	22	18.5	40.7	28.2	43	56	74	60	90	60	150	160	70	–	–	–	140-CMN-6300
20AC060	E	30	22	56.8	39.3	60	66	90	80	125	80	225	240	80	–	–	–	140-CMN-6300
20AC072	E	37	30	68.9	47.8	72	90	120	90	150	90	250	280	100	–	–	–	140-CMN-9000
480 Volt AC Input																		
20AD1P1	A	0.5	0.33	1.3	1.1	1.1	1.2	1.6	3	3	3	4	15	3	140M-C2E-B16	–	–	–
20AD2P1	A	1	0.75	2.4	2	2.1	2.4	3.2	3	6	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AD3P4	A	2	1.5	3.8	3.2	3.4	4.5	6	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AD5P0	B	3	2	5.6	4.7	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-B63	140M-D8E-B63	–	–
20AD8P0	B	5	3	9.8	8.4	8	8.8	12	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AD011	C	7.5	5	9.5	7.9	11	12.1	16.5	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD014	C	10	7.5	12.5	10.4	14	16.5	22	20	30	20	50	50	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD022	D	15	10	19.9	16.6	22	24.2	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	–
20AD027	D	20	15	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C32	140-CMN-2500
20AD034	D	25	20	31.2	25.9	34	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C45	140-CMN-4000
20AD040	D	30	25	36.7	39.7	40	51	68	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-4000
20AD052	E	40	30	47.7	39.7	52	60	80	60	110	60	200	200	70	–	–	–	140-CMN-6300
20AD065	E	50	40	59.6	49.6	65	78	104	80	125	80	250	250	100	–	–	–	140-CMN-9000

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Table A.G 600 Volt AC Single-Phase Input Drive Ratings and Protection Devices

Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.(2)*	*Max.(3)*	*Min.(2)*	*Max.(3)*	*Max.(5)*	*Max.(5)*	*Available Catalog Numbers(9)*			
600 Volt AC Input																		
20AE0P9	A	0.5	0.33	1.3	1.3	0.9	1.1	1.4	3	3	3	3.5	15	3	140M-C2E-B16	–	–	–
20AE1P7	A	1	0.75	1.9	2	1.7	2	2.6	3	6	3	6	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AE2P7	A	2	1.5	3	3.1	2.7	3.6	4.8	4	6	4	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AE3P9	B	3	2	4.4	4.5	3.9	4.3	5.9	6	8	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AE6P1	B	5	3	7.5	7.8	6.1	6.7	9.2	10	12	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE9P0	C	7.5	5	7.7	8	9	9.9	13.5	10	20	10	35	35	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE011	C	10	7.5	9.8	10.1	11	13.5	18	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AE017	D	15	10	15.3	15.9	17	18.7	25.5	20	35	20	60	60	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AE022	D	20	15	20	20.8	22	25.5	34	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AE027	D	25	20	24.8	25.7	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C25	140-CMN-2500
20AE032	D	30	25	29.4	30.5	32	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AE041	E	40	30	37.6	39.1	41	48	64	50	90	50	150	150	100	–	–	140M-F8E-C45	140-CMN-4000
20AE052	E	50	40	47.7	49.6	52	61.5	82	60	110	60	200	200	100	–	–	–	140-CMN-6300

(1) For IP 66 (NEMA/UL Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.

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

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

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

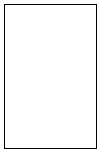
(5) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

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

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

(8) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/347. Not UL listed for use on 480V or 600V Delta/Delta systems in single motor applications.

(9) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.



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Notes:

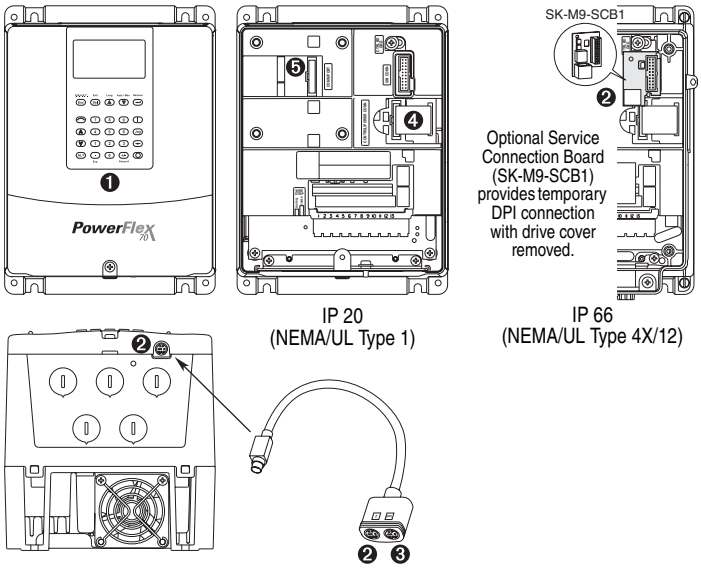
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HIM Overview

For information on...	See page	For information on...	See page
External and Internal Connections	B-1	Menu Structure	B-4
LCD Display Elements	B-3	Viewing and Editing Parameters	B-6
ALT Functions	B-3	Removing the HIM	B-3

External and Internal Connections

The PowerFlex 70 provides a number of cable connection points (B Frame shown).

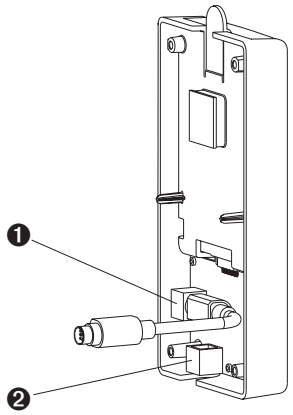


No.	Connector	Description
❶	DPI Port 1	HIM connection when installed in cover.
❷	DPI Port 2	Cable connection for handheld and remote options.
❸	DPI Port 3	Splitter cable connected to DPI Port 2 provides additional port.
❹	Control / Power Connection	Connection between control and power boards.
❺	DPI Port 5	Cable connection for communications adapter.

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Using the HIM with a 20-HIM-B1 Bezel Kit

The 20-HIM-B1 bezel kit allows remote HIM (Human Interface Module) or WIM (Wireless Interface Module) operation and provides an additional remote DPI port for accessories. The bezel cradle connection is used to mount the NEMA/UL 1 HIM or NEMA/UL 1 WIM and is designated Port 3. The accessory port on the bottom of the bezel is for standard DPI peripherals such as 1203-SSS, 1203-USB, or another handheld HIM, and is designated Port 2 (just like the accessory port on the drive). The internal connection on the back side of the bezel is used to connect the bezel to the host drive using a standard DPI cable. The 20-HIM-B1 bezel kit cannot be used with a 1203-S03 two-way splitter cable, or a 1203-SG2 two-way or 1203-SG4 four-way splitter module.



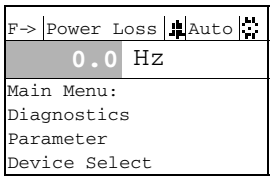
No.	Connector	Description
1	Upper DPI Port	Connects the 20-HIM-B1 bezel to the drive.
2	Lower DPI Port	Connects a 1203-SSS or 1203-USB converter to the drive.

Important: The bezel's lower DPI port is always Port 2 and the cradle connection port is always Port 3.

- The HIM in the bezel, set parameter 90 [Speed Ref A Sel] or parameter 93 [Speed Ref B Sel] depending on your application requirements to option 20 "DPI Port 3."
- A remote 20-HIM-C* HIM connected directly into Port 2 on the bottom of the drive, set parameter 90 [Speed Ref A Sel] or parameter 93 [Speed Ref B Sel] to option 19 "DPI Port 2."

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LCD Display Elements

Display	Description
	Direction | Drive Status | Alarm | Auto/Man | Information Commanded or Output Frequency Programming / Monitoring / Troubleshooting

ALT Functions

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

ALT Key and then ...			Performs this function ...	HIM Type
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen.	LCD only
	Esc	Log In/Out	Log in to change parameter settings. Log out to protect parameter settings. Change a password.	LED only
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.	LCD only
	Sel	Device	Select a connected adapter for editing.	LED only
	▲	Lang	Displays the language selection screen.	LCD only
	▼	Auto / Man	Switches between Auto and Manual Modes.	LCD and LED
	↵	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.	LCD and LED
	.	Exp	Allows value to be entered as an exponent. (Not available on PowerFlex 70.)	LCD only
	+/–	Param #	Allows entry of a parameter number for viewing/ editing.	LCD only

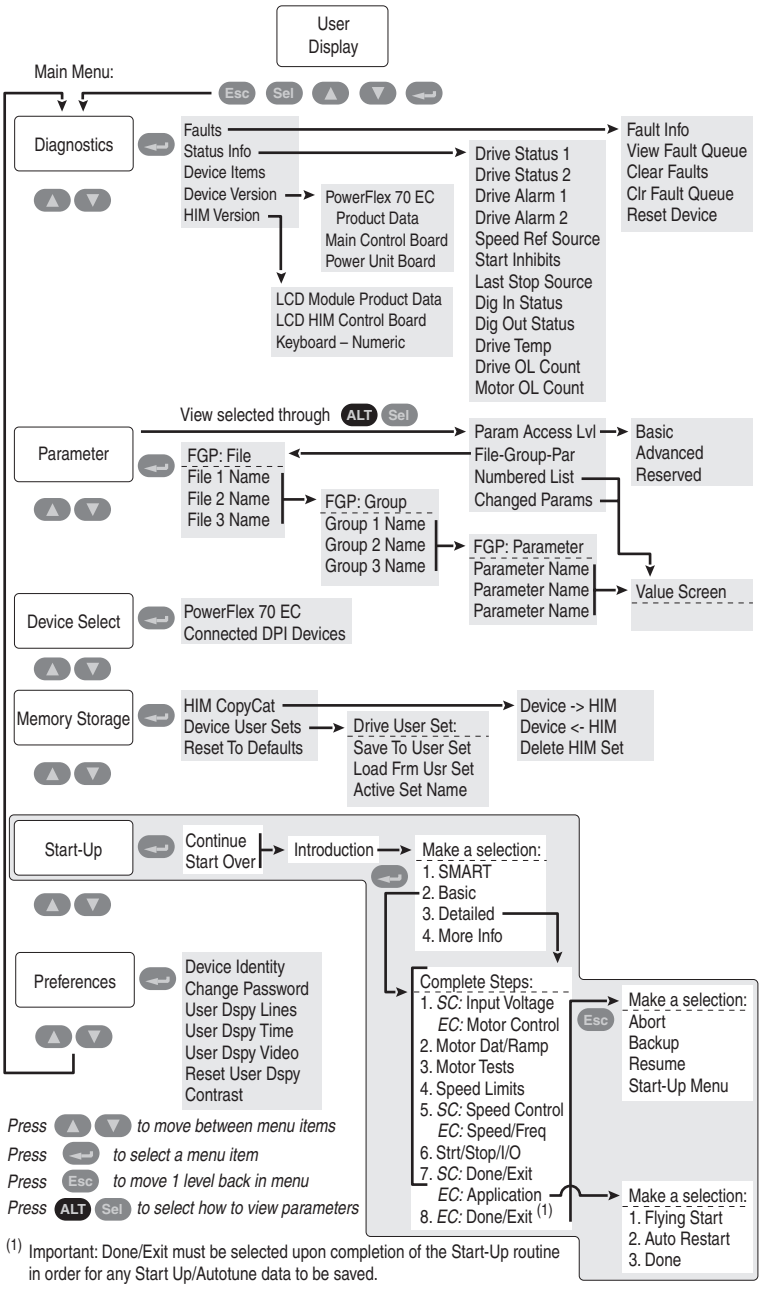
Removing the HIM

The HIM can be removed while the drive is powered. Normally, the drive issues a fault when the HIM is removed because it detects that a device is missing.

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.

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Menu Structure



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Diagnostics Menu

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

Option	Description
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.

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.

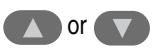
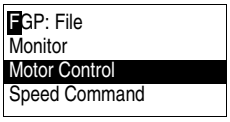
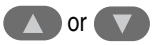
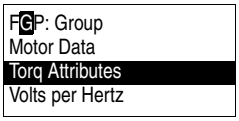
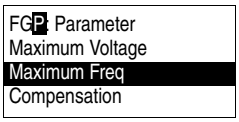
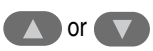
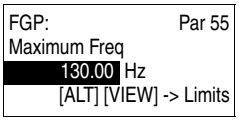
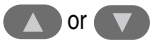
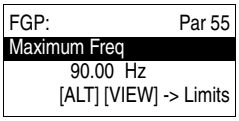
Option	Description
Drive Identity	Add text to identify the drive.
Change Password	Enable/disable or modify the password.
User Dspy Lines	Select the display, parameter, scale and text for the User Display. The User Display is two lines of user-defined data that appears when the HIM is not being used for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

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Viewing and Editing Parameters

The PowerFlex 70 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, set parameter 196 to option 2 “Reserved”. Refer to the PowerFlex 70/700 Reference Manual, publication PFLEX-RM004 for descriptions of these parameters. Parameter 196 is not affected by the Reset to Defaults function.

LCD HIM

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Parameter.”		
2. Press Enter. “FGP File” appears on the top line and the first three files appear below it.		
3. Press the Up Arrow or Down Arrow to scroll through the files.		
4. Press Enter to select a file. The groups in the file are displayed under it.		
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		
6. Press Enter to edit the parameter.		
7. Press the Up Arrow or Down Arrow to scroll through the parameters. Press Sel to move the curser down 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.	 	
8. Press Enter to save the value. If you want to cancel a change, press Esc.		
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.	 	

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.

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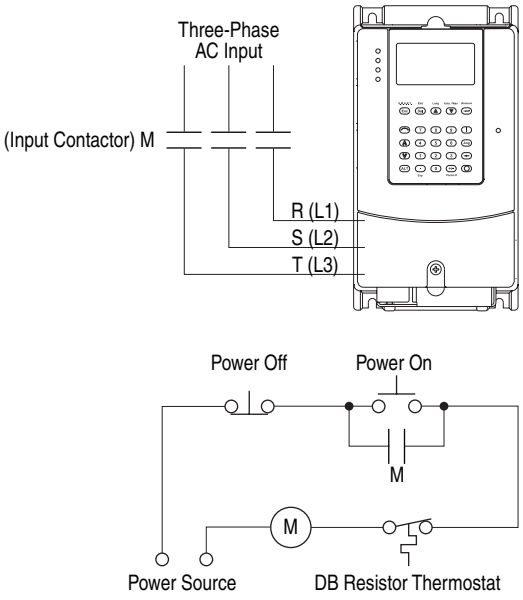
Application Notes

For information on...	See page...
External Brake Resistor	C-1
Skip Frequency	C-2
Stop Modes	C-4
Motor Overload	C-10

For information on...	See page...
Start At PowerUp	C-12
Overspeed	C-13
Process PI for Standard Control	C-14

External Brake Resistor

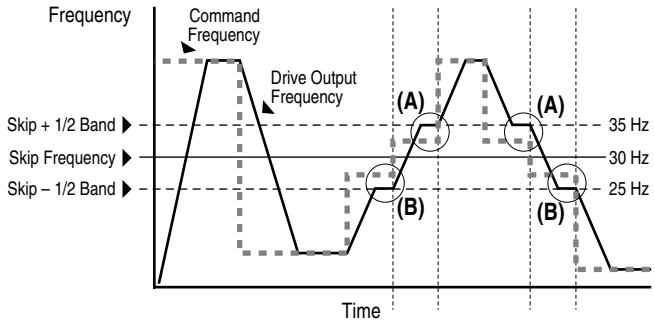
Figure C.1 External Brake Resistor Circuitry



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Skip Frequency

Figure C.2 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.

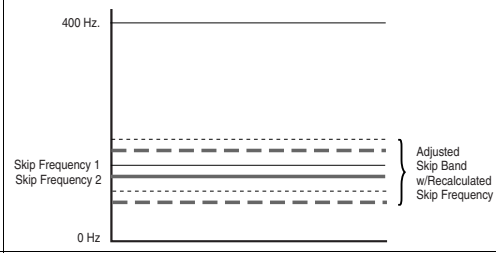
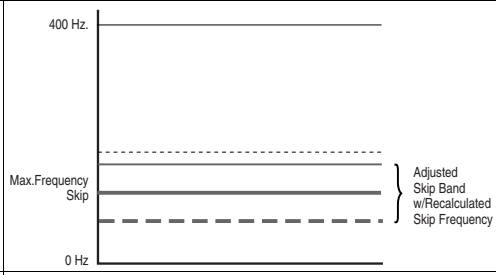
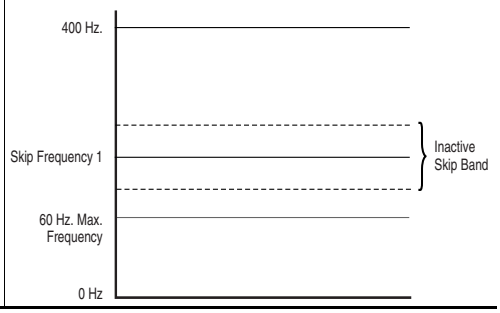
The value programmed into the skip frequency parameters sets the center point for an entire “skip band” of frequencies. The width of the band (range of frequency around the center point) is determined by parameter 87, [Skip Freq Band]. The range is split, half above and half below the skip frequency 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.2.

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.2.

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.2. This function affects only continuous operation within the band.

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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.	

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Stop Modes

Several methods are available for braking or stopping a load as described in the table below.

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

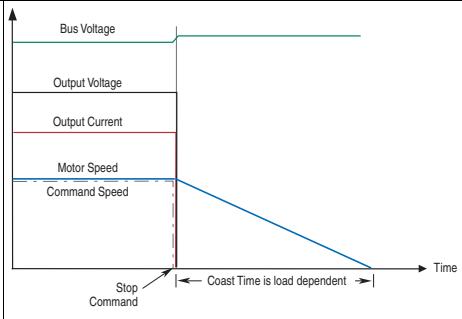
In addition to these modes, the drive can be programmed for "Coast" and "Ramp to Hold," which are described in further detail in this section.

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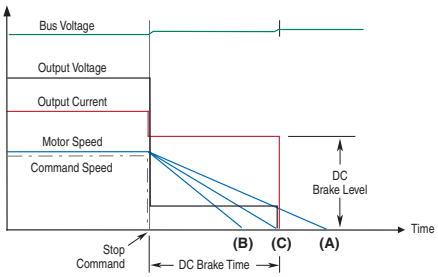
Configuration

- [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 (PowerFlex 70 & 700 Only)
- [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).

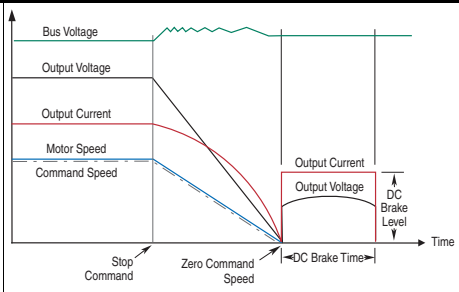
Detailed Operation

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.

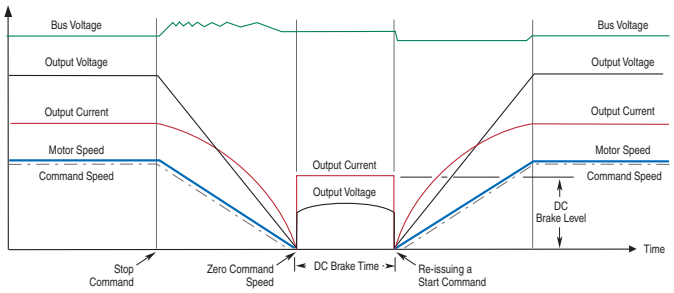
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Mode	Description
DC Brake to Stop	 This method uses DC injection of the motor to Stop and/or hold the load. **DC Brake** is selected by setting [Stop Mode A/B] to a value of "3." The amount of time that braking will be applied is programmed in [DC 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, 3 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).

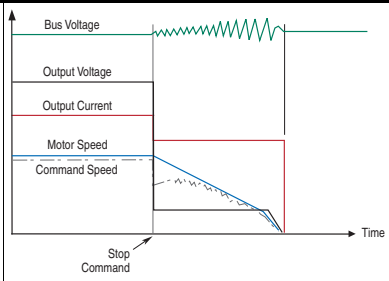
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Mode	Description
Ramp	 This method uses drive output reduction to stop the load. **Ramp** is selected by setting [Stop Mode A/B] to a value of "1". The drive will ramp the frequency to zero based on the deceleration time programmed into [Decel Time 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.).

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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, 3 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.

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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".

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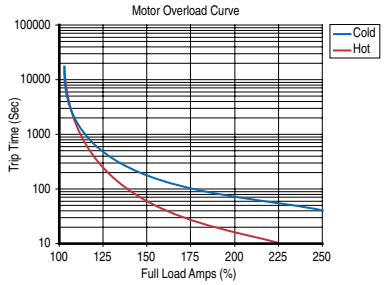
Motor Overload

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).

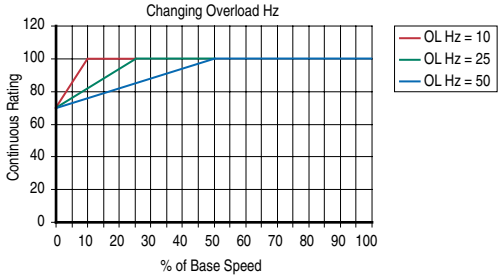
[Motor NP FLA] is multiplied by [Motor OL Factor] to allow the user to define the continuous level of current allowed by the motor thermal overload. [Motor OL Hertz] is used to allow the user to adjust the frequency below which the motor overload is derated.

The motor can operate up to 102% of FLA continuously. If the drive had just been 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.

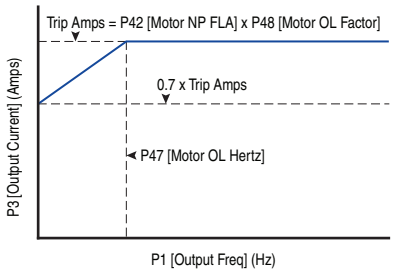


[Motor OL Hertz] defines the frequency where motor overload capacity derate should begin. The motor overload capacity is reduced when operating below [Motor OL Hertz]. For all settings of [Motor OL Hertz] other than zero, the overload capacity is reduced to 70% at an output frequency of zero.



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[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].

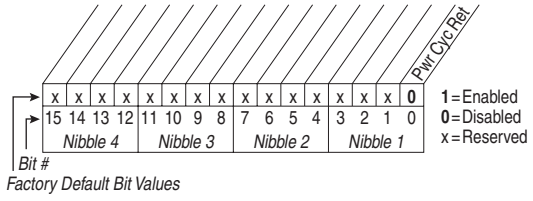


The motor overload, if enabled, allows continuous operation at or below the line. Above the line, the overload will trip after a time delay. The further above the line, the shorter the trip time.

Motor Overload Memory Retention Per 2005 NEC

The PowerFlex 70 EC (Firmware Revision 3.002 or greater) has the ability to retain the motor overload count at power down per the 2005 NEC motor overtemp requirement. A parameter has been added to provide this functionality. To Enable/Disable this feature, refer to the information below.

File B	Group	No.	Parameter Name and Description *See page 3-2 for symbol descriptions*	Values	Related
MOTOR CONTROL (File B)	Motor Data	050	E C v3 **[Motor OL Mode]** If "0," [Motor OL Count], P220 is reset to zero by a drive reset or a power cycle. If "1," the value is maintained. A "1" to "0" transition resets [Motor OL Count], P220 to zero.		220



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Start At PowerUp

When Start At Powerup in 2 wire control is configured, the drive will start if all start permissive conditions are met (within 10 seconds of drive power being applied), and the terminal block start input (Run, Run Forward or Run Reverse for 2-wire) is closed. An alarm will be annunciated from application of power until the drive actually starts, indicating the powerup start attempt is in progress.

The powerup start attempt will be aborted if any of the following occurs anytime during the 10-second start interval:

- A fault condition occurs
- A Type 2 alarm condition occurs
- The terminal block programmed enable input is opened
- All terminal block run, run forward, or run reverse, inputs are canceled
- A Stop request (from any source) is received

If the drive has not started within the 10 second interval, the powerup start attempt will be terminated.

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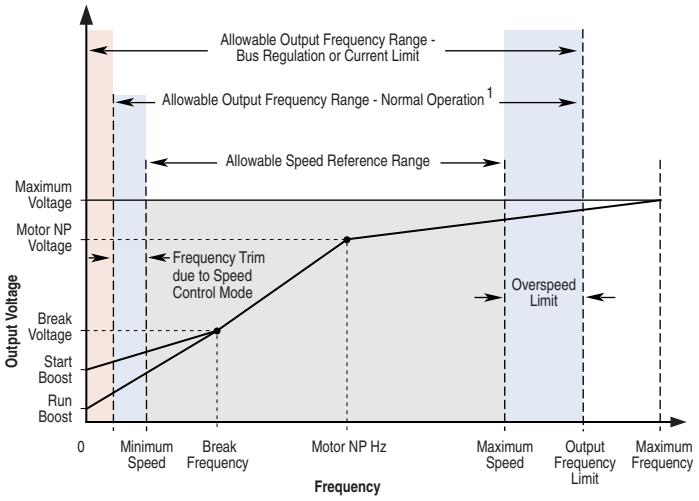
Overspeed

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.



Note 1: The lower limit on this range can be 0 depending on the value of Speed Adder

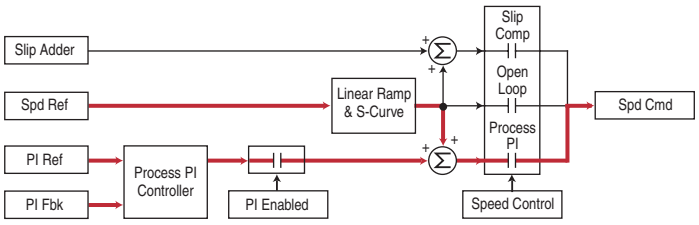
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Process PI for Standard Control

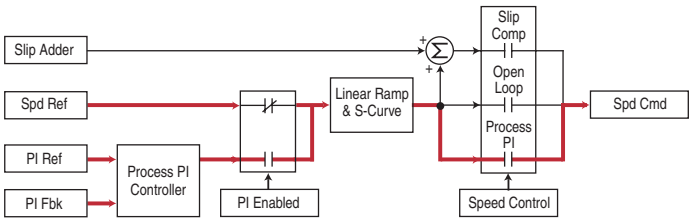
The internal PI function of the PowerFlex 70 provides closed loop process control with proportional and integral control action. The function is designed for use in applications that require simple control of a process without external control devices. The PI function allows the microprocessor of the 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.



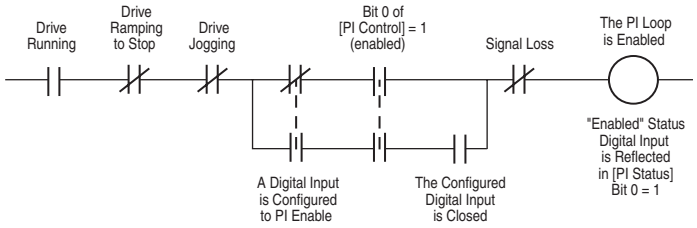
Or, it can operate as control mode by supplying the entire speed reference. This method is identified as “exclusive mode”



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PI Enable

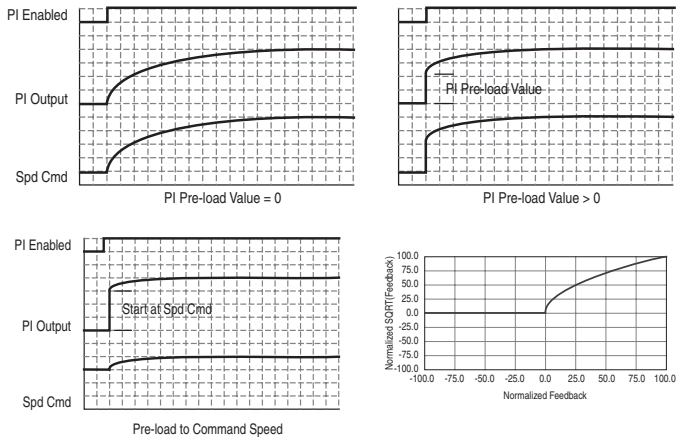
The output of the PI loop can be turned on (enabled) or turned off (disabled). This control allows the user to determine when the PI loop is providing part or all of the commanded speed. The logic for enabling the PI loop is shown in below.



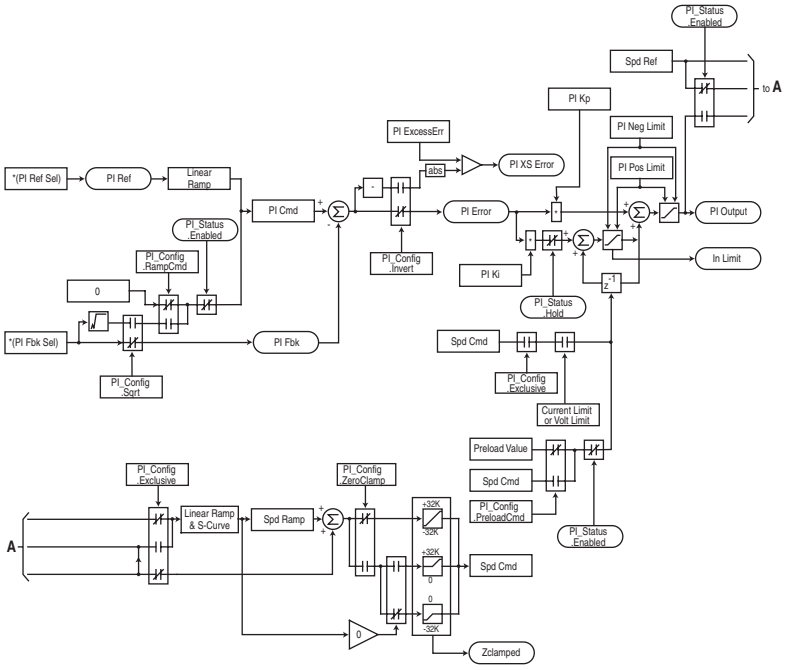
The drive must be running for the PI loop to be enabled. The loop will be disabled when the drive is ramping to a stop, jogging or the signal loss protection for the analog input(s) is sensing a loss of signal.

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”.



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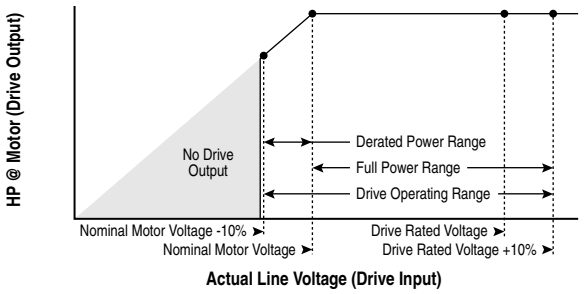


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Voltage Tolerance

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

Drive Full Power Range =	Nominal Motor Voltage to Drive Rated Voltage + 10%. Rated current is available across the entire Drive Full Power Range
Drive Operating Range =	Lowest† Nominal Motor Voltage - 10% to Drive Rated Voltage + 10%. Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage

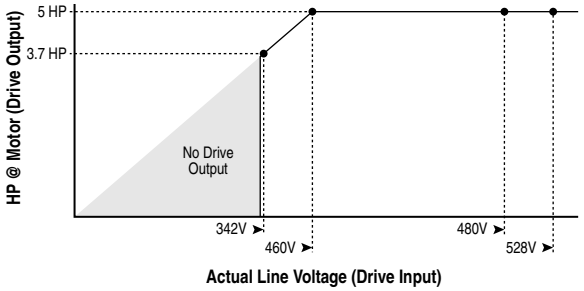


Example:

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

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

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



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Notes:

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A

AC Input Line Circuit Breakers, **A-1**, **A-15**
AC Input Line Fuses, **A-1**, **A-15**
AC Supply
  Ground, **1-4**
  Source, **1-3**
  Unbalanced, **1-3**
  Ungrounded, **1-3**
Accel Mask, **3-52**
Accel Owner, **3-53**
Accel Time x, **3-30**
Access Level, Parameter, **3-3**
Advanced Parameter View, **3-3**
Agency Certification, **A-1**
Alarm 1 @ Fault, **3-47**
Alarm Config 1, **3-49**
Alarm Descriptions, **4-8**
Alarms
  Analog in Loss, **4-8**
  Bipolar Conflict, **4-8**
  Clearing, **4-8**
  Decel Inhibit, **4-8**
  Defined, **4-8**
  Dig In Conflict, **4-8**
  Drive OL Level, **4-9**
  FluxAmpsRef Rang, **4-9**
  Ground Warn, **4-9**
  In Phase Loss, **4-9**
  IntDBRes OvrHeat, **4-9**
  IR Volts Range, **4-9**
  IXo Voltage Range, **4-9**
  Load Loss, **4-9**
  MaxFreq Conflict, **4-9**
  Motor Thermistor, **4-9**
  Motor Type Cflct, **4-9**
  NP Hz Conflict, **4-9**
  Power Loss, **4-9**
  Precharge Active, **4-10**
  PTC Conflict, **4-10**
  Sleep Config, **4-10**
  Speed Ref Cflct, **4-10**
  Start At PowerUp, **4-10**
  TB Man Ref Cflct, **4-10**
  UnderVoltage, **4-10**
  UserSet Conflict, **4-10**
  VHz Neg Slope, **4-10**
  Waking, **4-10**
Alarms Group, **3-49**
ALT Key Functions, **B-3**
Ambient Temperature, **1-2**
Analog in Loss Alarm, **4-8**
Analog In Loss Fault, **4-3**
Analog In x Hi, **3-56**
Analog In x Lo, **3-56**
Analog In x Loss, **3-56**
Analog Inputs Group, **3-56**
Analog Inx Value, **3-12**
Analog Out1 Hi, **3-58**
Analog Out1 Lo, **3-58**
Analog Out1 Sel, **3-57**
Analog Outputs Group, **3-57**
Anlg Cal Chksum Fault, **4-3**
Anlg In Config, **3-56**
Anlg In Sqr Root, **3-56**
Anlg Out Absolut, **3-57**
Anlg Out Config, **3-57**
Anlg Out1 Scale, **3-58**
Anlg Out1 Setpt, **3-58**
Applications File, **3-63**
Armored Cable, **1-7**
Assisted Start Up, **2-4**
Auto Mode, **1-22**
Auto Rstrt Delay, **3-35**
Auto Rstrt Tries, **3-35**
Auto Rstrt Tries Fault, **4-3**
Auto/Manual
  Control, **1-23**
  Modes, **1-22**
AutoMan Cnfg, **3-39**
Autotune, **3-16**
AutoTune Aborted Fault, **4-3**
Autotune Torque, **3-17**
Auxiliary Input Fault, **4-3**

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B

B Phase Grounded Distribution Systems, **1-11**
Basic Parameter View, **3-3**, **3-5**
Before Applying Power, **2-1**
Bipolar Conflict Alarm, **4-8**
Bottom Plate Removal, **1-9**
Break Frequency, **3-18**
Break Voltage, **3-18**
Bus Capacitors, Discharging, **P-3**
Bus Reg Gain, **3-32**
Bus Reg Kd, **3-33**
Bus Reg Ki, **3-32**
Bus Reg Kp, **3-33**
Bus Reg Mode x, **3-33**
Bus Voltage, Measuring, **1-9**

C

Cable Entry Plate Removal, **1-9**
Cable Length
  Motor, **1-7**
  Signal, **1-14**
Cable Trays, **1-7**
Cables, Power
  Armored, **1-7**
  Insulation, **1-5**
  Separation, **1-5**
  Shielded, **1-5**, **1-7**
  Type, **1-5**
  Unshielded, **1-5**, **1-6**
Capacitors, Discharging, **P-3**
Catalog Number Explanation, **P-7**
CE Conformity, **1-24**
Checklist, Start-Up, **2-1**
Circuit Breakers
  Input, **1-5**
  Ratings, **A-1**, **A-15**
Clearing
  Alarms, **4-8**
  Faults, **4-3**
Comm Control Group, **3-51**
Commanded Freq, **3-11**
Commanded Torque, **3-12**
Common Mode Capacitors, **1-11**
Common Symptoms and Corrective Action, **4-12**
Communication File, **3-51**
Communications
  Logic Command Word, **A-6**
  Logic Status Word, **A-7**
  Programmable Controller Configurations, **A-5**
Compensation, **3-15**
Conduit, **1-7**
Contactors, Input, **1-10**
Control Options, **3-3**
Control Status, **3-18**
Control SW Ver, **3-12**
Control, 2 and 3 Wire, **1-17**
Control, Auto/Manual, **1-23**
Conventions, Manual, **P-3**
Cover, Opening, **1-1**
Cross Reference, Parameter, **3-64**
Current Lmt Gain, **3-30**
Current Lmt Sel, **3-30**
Current Lmt Val, **3-30**
Current Rate Lim, **3-31**

D

Data In, **3-54**
Data Out, **3-54**
Data, Diagnostic, **B-5**
Data, Saving, **B-5**
Datalinks Group, **3-54**
DB Resistor Type, **3-33**
DB While Stopped, **3-31**
DC Brake Level, **3-32**
DC Brake Lvl Sel, **3-32**
DC Brake Time, **3-32**
DC Bus Memory, **3-11**
DC Bus Voltage, **3-11**
DC Bus, Measuring Voltage, **1-9**
Decel Inhibit Alarm, **4-8**
Decel Inhibit Fault, **4-3**
Decel Mask, **3-52**
Decel Owner, **3-53**

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Decel Time x, **3-30**
Diagnostic Data, Viewing, **B-5**
Diagnostics Group, **3-42**
Dig In Conflict Alarm, **4-8**
Dig In Status, **3-45**
Dig Out Setpt, **3-60**
Dig Out Status, **3-45**
Dig Outx Level, **3-61**
Dig Outx OffTime, **3-62**
Dig Outx OnTime, **3-61**
DigIn DataLogic, **3-60**
Digital Inputs Group, **3-59**
Digital Inx Sel, **3-59**
Digital Outputs Group, **3-60**
Digital Outx Sel, **3-61**
Dimensions
  Minimum Clearances, **1-2**
  Mounting, **1-2**
    PowerFlex 700, **A-8**
Direction Config Group, **3-39**
Direction Mask, **3-52**
Direction Mode, **3-39**
Direction Owner, **3-53**
Discharging Bus Capacitors, **P-3**
Discrete Speeds Group, **3-23**
Distribution Systems, **1-3**
DPI Data Rate, **3-51**
DPI Port Locations, **B-1**
DPI Port Select, **3-52**
DPI Port Value, **3-52**
DPI Ref Select, **3-52**
Drive Alarm 1, **3-43**
Drive Checksum, **3-41**
Drive Data Group, **3-12**
Drive Frame Size, **P-3**
Drive Grounding, **1-4**
Drive Logic Rslt, **3-51**
Drive Memory Group, **3-40**
Drive OL Count, **3-45**
Drive OL Level Alarm, **4-9**
Drive OL Mode, **3-30**
Drive OverLoad Fault, **4-3**
Drive Powerup Fault, **4-4**
Drive Ramp Rslt, **3-51**
Drive Ratings, **A-1**, **A-15**
Drive Ref Rslt, **3-51**
Drive Status 1, **3-42**
Drive Status 3, **3-46**
Drive Temp, **3-45**
DriveExplorer, **3-1**
DriveTools, **3-1**
Droop RPM @ FLA, **3-31**
Dyn UserSet Actv, **3-42**
Dyn UsrSet Cnfg, **3-41**
Dyn UsrSet Sel, **3-41**
Dynamic Brake Resistor Selection, **3-33**
Dynamic Control File, **3-30**

E

Earthing, see *Grounding*
Editing Parameters, **3-1**
Elapsed kWh, **3-12**
Elapsed MWh, **3-11**
Elapsed Run Time, **3-11**
EMI/RFI
  Grounding, Filter, **1-5**
  Interference, **1-24**
Enable Hardware Fault, **4-4**
Enc Pos Feedback, **3-19**
Enclosure Rating, **1-2**
Encoder Loss Faults, **4-4**
Encoder PPR, **3-19**
Encoder Specifications, **A-3**
Encoder Speed, **3-19**
Encoder Wiring, **1-21**
Enhanced Control, **3-3**
ESD, Static Discharge, **P-4**
Excessive Load Fault, **4-4**

F

Fault Amps, **3-46**
Fault Bus Volts, **3-46**
Fault Clear, **3-48**
Fault Clear Mode, **3-48**
Fault Clr Mask, **3-52**
Fault Clr Owner, **3-53**
Fault Config 1, **3-48**

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Fault Descriptions, **4-3**
Fault Frequency, **3-46**
Fault x Code, **3-49**
Fault x Time, **3-49**
Faults
  Analog In Loss, **4-3**
  Anlg Cal Chksum, **4-3**
  Auto Rstrt Tries, **4-3**
  AutoTune Aborted, **4-3**
  Auxiliary Input, **4-3**
  Clearing, **4-3**
  Decel Inhibit, **4-3**
  Defined, **4-3**
  Drive OverLoad, **4-3**
  Drive Powerup, **4-4**
  Enable Hardware, **4-4**
  Encoder Loss, **4-4**
  Excessive Load, **4-4**
  FluxAmpsRef Rang, **4-4**
  Heatsink OvrTemp, **4-4**
  HW OverCurrent, **4-4**
  Incompat MCB-PB, **4-4**
  Input Phase Loss, **4-4**
  IR Volts Range, **4-4**
  IXo VoltageRange, **4-5**
  Load Loss, **4-3**
  Motor Overload, **4-5**
  Motor Thermistor, **4-5**
  OverSpeed Limit, **4-5**
  OverVoltage, **4-5**
  Parameter Chksum, **4-5**
  Params Defaulted, **4-5**
  Phase Short, **4-5**
  Phase to Grnd, **4-5**
  Port X Adapter Fault, **4-6**
  Port X DPI Loss, **4-6**
  Power Loss, **4-6**
  Pwr Brd Chksum, **4-6**
  Replaced MCB-PB, **4-6**
  Shear Pin, **4-6**
  SW OverCurrent, **4-6**
  Trnsistr OvrTemp, **4-6**
  UnderVoltage, **4-7**
  UserSet Chksum, **4-7**
  Viewing, **4-3**
Faults Cleared Marker, **4-4**
Fdbk Filter Sel, **3-19**
Feedback Select, **3-20**
FGP (File-Group-Parameter), **3-3**
Fiber Control, **3-63**
Fiber Functions Group, **3-63**
Fiber Status, **3-63**
File
  Applications, **3-63**
  Communication, **3-51**
  Dynamic Control, **3-30**
  Inputs & Outputs, **3-56**
  Monitor, **3-11**
  Motor Control, **3-13**
  Speed Command, **3-20**
  Utility, **3-39**
File-Group-Parameter (FGP), **3-3**
Filter Option Power Input Terminals, **1-9**
Filter, RFI, **1-5**
Flt Queue Cleared Marker, **4-4**
Flux Braking, **3-34**
Flux Current, **3-11**
Flux Current Ref, **3-16**
Flux Up Mode, **3-15**
Flux Up Time, **3-15**
FluxAmpsRef Rang Alarm, **4-9**
FluxAmpsRef Rang Fault, **4-4**
Flying Start En, **3-35**
Flying StartGain, **3-35**
Frame Designations, **A-1**, **A-15**
Frame Size, Drive, **P-3**
Fuses
  Input, **1-5**
  Ratings, **A-1**, **A-15**

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G

General Precautions, **P-3**
Gnd Warn Level, **3-38**
Ground Warn Alarm, **4-9**
Grounding
  Bus, **1-4**
  Conductor, **1-4**
  Filter, **1-5**
  General, **1-4**
  Impedance, **1-4**
  Motor, **1-7**
  Safety, PE, **1-4**
  Shields, TE, **1-4**
Group
  Alarms, **3-49**
  Analog Inputs, **3-56**
  Analog Outputs, **3-57**
  Comm Control, **3-51**
  Datalinks, **3-54**
  Diagnostics, **3-42**
  Digital Inputs, **3-59**
  Digital Outputs, **3-60**
  Direction Config, **3-39**
  Discrete Speeds, **3-23**
  Drive Data, **3-12**
  Drive Memory, **3-40**
  Fiber Functions, **3-63**
  HIM Ref Config, **3-39**
  Load Limits, **3-30**
  Masks & Owners, **3-52**
  Metering, **3-11**
  MOP Config, **3-40**
  Motor Data, **3-13**
  Power Loss, **3-38**
  Process PI, **3-25**, **3-26**
  Ramp Rates, **3-30**
  Restart Modes, **3-34**, **3-35**
  Security, **3-55**
  Slip Comp, **3-25**
  Spd Mode & Limits, **3-20**
  Speed References, **3-22**
  Speed Trim, **3-24**
  Stop/Brake Modes, **3-31**
  Torque Attributes, **3-14**
  Volts per Hertz, **3-18**

H

Hardware Enable Circuitry
  Enable Circuitry, **1-19**
Heatsink OvrTemp Fault, **4-4**
HighRes Ref, **3-54**
High-Resistance Distribution Systems, **1-11**
HIM Menu Structure, **B-4**
HIM Ref Config Group, **3-39**
HIM, Removing, **B-3**
HW OverCurrent Fault, **4-4**

I

I/O
  Terminal Block, **1-15**
  Wiring, **1-14**
  Wiring Examples, **1-17**
In Phase Loss Alarm, **4-9**
Incompat MCB-PB Fault, **4-4**
Indicators, LED, **2-3**
Inertia Autotune, **3-17**
Input Contactor
  Start/Stop, **1-10**
Input Devices
  Circuit Breakers, **1-5**
  Contactors, **1-10**
  Fuses, **1-5**
Input Fusing, **1-5**
Input Phase Loss Fault, **4-4**
Input Power
  Single-Phase, **1-7**
Input Power Conditioning, **1-3**
Input Terminals, Power, **1-9**
Inputs & Outputs File, **3-56**
Installation, **1-1**
IntDBRes OvrHeat Alarm, **4-9**
Interference, EMI/RFI, **1-24**
IP66 Installations, **1-10**
IR Voltage Drop, **3-16**
IR Volts Range Alarm, **4-9**
IR Volts Range Fault, **4-4**

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IXo Voltage Drop, **3-17**
IXo VoltageRange Alarm, **4-9**
IXo VoltageRange Fault, **4-5**

J

Jog Mask, **3-52**
Jog Owner, **3-53**
Jog Speed, **3-23**
Jog Speed 1, **3-23**
Jog Speed 2, **3-23**

K

Kf Speed Loop, **3-28**
Ki Speed Loop, **3-28**
Kp Speed Loop, **3-28**

L

Language, **3-41**
Last Stop Source, **3-44**
LCD HIM, Menus, **B-4**
LED Indicators, **2-3**
Load Frm Usr Set, **3-40**
Load Limits Group, **3-30**
Load Loss Alarm, **4-9**
Load Loss Fault, **4-3**
Load Loss Level, **3-38**
Load Loss Time, **3-38**
Local Mask, **3-53**
Local Owner, **3-54**
Logic Command Word, **A-6**
Logic Mask, **3-52**, **3-55**
Logic Mask Act, **3-55**
Logic Status Word, **A-7**

M

Man Ref Preload, **3-39**
Manual Mode, **1-22**
Manual/Auto Control, **1-23**
Marker
  Faults Cleared, **4-4**
  Flt QueueCleared, **4-4**
Masks & Owners Group, **3-52**
Max Traverse, **3-63**
MaxFreq Conflict Alarm, **4-9**
Maximum Freq, **3-14**
Maximum Speed, **3-20**
Maximum Voltage, **3-14**
Measuring DC Bus Voltage, **1-9**
Menu Structure, HIM, **B-4**
Metering Group, **3-11**
Minimum Clearances, **1-2**
Minimum Speed, **3-20**
MOD LED, **2-3**
Modes, Auto/Manual, **1-22**
Monitor File, **3-11**
MOP Config Group, **3-40**
MOP Frequency, **3-11**
MOP Mask, **3-53**
MOP Owner, **3-53**
MOP Rate, **3-40**
Motor Cable Lengths, **1-7**
Motor Cntl Sel, **3-14**
Motor Control File, **3-13**
Motor Data Group, **3-13**
Motor Fdbk Type, **3-19**
Motor NP FLA, **3-13**
Motor NP Hertz, **3-13**
Motor NP Power, **3-13**
Motor NP RPM, **3-13**
Motor NP Volts, **3-13**
Motor OL Count, **3-45**
Motor OL Factor, **3-13**
Motor OL Hertz, **3-13**
Motor OL Mode, **3-12**, **3-14**, **C-11**
Motor Overload Fault, **4-5**
Motor Poles, **3-13**
Motor Starters, **A-1**, **A-15**
Motor Thermistor Alarm, **4-9**
Motor Thermistor Fault, **4-5**
Motor Type, **3-13**
Motor Type Cflct Alarm, **4-9**
Mounting Clearances and Orientation, **1-2**
MOVs, **1-11**
Mtr NP Pwr Units, **3-13**
Mtr OL Trip Time, **3-45**, **3-50**

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N

Neg Torque Limit, **3-18**
NEMA Type 4X/12 Installations, **1-10**
NET LEDs, **2-3**
Notch Filter K, **3-19**
Notch FilterFreq, **3-19**
NP Hz Conflict Alarm, **4-9**

O

Opening the Cover, **1-1**
Operating Modes, **1-22**
Operating Temperature, **1-2**
Operator Interface, **B-6**
Output Current, **3-11**
Output Freq, **3-11**
Output Power, **3-11**
Output Powr Fctr, **3-11**
Output Voltage, **3-11**
Overspeed Limit, **3-20**
OverSpeed Limit Fault, **4-5**
OverVoltage Fault, **4-5**

P

P Jump, **3-63**
Param Access Lvl, **3-40**
Parameter
- Changing/Editing, **B-6**
- Descriptions, **3-1**
- Numbered List, **3-3**
- Organization, **3-3**
- Types, **3-1**
- Viewing, **B-6**
- Viewing List Of Changed, **B-3**

Parameter Access Level, **3-3**
Parameter Chksum Fault, **4-5**
Parameter Cross Reference, **3-64**
Parameter View
- Advanced
  - Enhanced Control, **3-9**
  - Standard Control, **3-7**
- Basic
  - Enhanced Control, **3-6**
  - Standard Control, **3-5**

Parameters
- Accel Mask, **3-52**
- Accel Owner, **3-53**
- Accel Time x, **3-30**
- Alarm 1 @ Fault, **3-47**
- Alarm Config 1, **3-49**
- Analog In x Hi, **3-56**
- Analog In x Lo, **3-56**
- Analog In x Loss, **3-56**
- Analog Inx Value, **3-12**
- Analog Out1 Hi, **3-58**
- Analog Out1 Lo, **3-58**
- Analog Out1 Sel, **3-57**
- Anlg In Config, **3-56**
- Anlg In Sqr Root, **3-56**
- Anlg Out Absolut, **3-57**
- Anlg Out Config, **3-57**
- Anlg Out1 Scale, **3-58**
- Anlg Out1 Setpt, **3-58**
- Auto Rstrt Delay, **3-35**
- Auto Rstrt Tries, **3-35**
- AutoMan Cnfg, **3-39**
- Autotune, **3-16**
- Autotune Torque, **3-17**
- Break Frequency, **3-18**
- Break Voltage, **3-18**
- Bus Reg Gain, **3-32**
- Bus Reg Kd, **3-33**
- Bus Reg Ki, **3-32**
- Bus Reg Kp, **3-33**
- Bus Reg Mode x, **3-33**
- Commanded Freq, **3-11**
- Commanded Torque, **3-12**
- Compensation, **3-15**
- Control Status, **3-18**
- Control SW Ver, **3-12**
- Current Lmt Gain, **3-30**
- Current Lmt Sel, **3-30**
- Current Lmt Val, **3-30**
- Current Rate Lim, **3-31**
- Data In, **3-54**
- Data Out, **3-54**

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DB Resistor Type, **3-33**
DB While Stopped, **3-31**
DC Brake Level, **3-32**
DC Brake Lvl Sel, **3-32**
DC Brake Time, **3-32**
DC Bus Memory, **3-11**
DC Bus Voltage, **3-11**
Decel Mask, **3-52**
Decel Owner, **3-53**
Decel Time x, **3-30**
Dig In Status, **3-45**
Dig Out Setpt, **3-60**
Dig Out Status, **3-45**
Dig Outx Level, **3-61**
Dig Outx OffTime, **3-62**
Dig Outx OnTime, **3-61**
DigIn DataLogic, **3-60**
Digital Inx Sel, **3-59**
Digital Outx Sel, **3-61**
Direction Mask, **3-52**
Direction Mode, **3-39**
Direction Owner, **3-53**
DPI Data Rate, **3-51**
DPI Port Select, **3-52**
DPI Port Value, **3-52**
DPI Ref Select, **3-52**
Drive Alarm 1, **3-43**
Drive Checksum, **3-41**
Drive Logic Rslt, **3-51**
Drive OL Count, **3-45**
Drive OL Mode, **3-30**
Drive Ramp Rslt, **3-51**
Drive Ref Rslt, **3-51**
Drive Status 1, **3-42**
Drive Status 3, **3-46**
Drive Temp, **3-45**
Droop RPM @ FLA, **3-31**
Dyn UserSet Actv, **3-42**
Dyn UsrSet Cnfg, **3-41**
Dyn UsrSet Sel, **3-41**
Elapsed kWh, **3-12**
Elapsed MWh, **3-11**
Elapsed Run Time, **3-11**
Enc Pos Feedback, **3-19**
Encoder PPR, **3-19**
Encoder Speed, **3-19**
Fault Amps, **3-46**
Fault Bus Volts, **3-46**
Fault Clear, **3-48**
Fault Clear Mode, **3-48**
Fault Clr Mask, **3-52**
Fault Clr Owner, **3-53**
Fault Config 1, **3-48**
Fault Frequency, **3-46**
Fault x Code, **3-49**
Fault x Time, **3-49**
Fdbk Filter Sel, **3-19**
Feedback Select, **3-20**
Fiber Control, **3-63**
Fiber Status, **3-63**
Flux Braking, **3-34**
Flux Current, **3-11**
Flux Current Ref, **3-16**
Flux Up Mode, **3-15**
Flux Up Time, **3-15**
Flying Start En, **3-35**
Flying StartGain, **3-35**
Gnd Warn Level, **3-38**
HighRes Ref, **3-54**
Inertia Autotune, **3-17**
IR Voltage Drop, **3-16**
IXo Voltage Drop, **3-17**
Jog Mask, **3-52**
Jog Owner, **3-53**
Jog Speed, **3-23**
Jog Speed 1, **3-23**
Jog Speed 2, **3-23**
Kf Speed Loop, **3-28**
Ki Speed Loop, **3-28**
Kp Speed Loop, **3-28**
Language, **3-41**
Last Stop Source, **3-44**
Load Frm Usr Set, **3-40**
Load Loss Level, **3-38**

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Load Loss Time, **3-38**
Local Mask, **3-53**
Local Owner, **3-54**
Logic Mask, **3-52**, **3-55**
Logic Mask Act, **3-55**
Man Ref Preload, **3-39**
Max Traverse, **3-63**
Maximum Freq, **3-14**
Maximum Speed, **3-20**
Maximum Voltage, **3-14**
Minimum Speed, **3-20**
MOP Frequency, **3-11**
MOP Mask, **3-53**
MOP Owner, **3-53**
MOP Rate, **3-40**
Motor Cntl Sel, **3-14**
Motor Fdbk Type, **3-19**
Motor NP FLA, **3-13**
Motor NP Hertz, **3-13**
Motor NP Power, **3-13**
Motor NP RPM, **3-13**
Motor NP Volts, **3-13**
Motor OL Count, **3-45**
Motor OL Factor, **3-13**
Motor OL Hertz, **3-13**
Motor OL Mode, **3-12**, **3-14**, **C-11**
Motor Poles, **3-13**
Motor Type, **3-13**
Mtr NP Pwr Units, **3-13**
Mtr OL Trip Time, **3-45**, **3-50**
Neg Torque Limit, **3-18**
Notch Filter K, **3-19**
Notch FilterFreq, **3-19**
Output Current, **3-11**
Output Freq, **3-11**
Output Power, **3-11**
Output Powr Fctr, **3-11**
Output Voltage, **3-11**
Overspeed Limit, **3-20**
P Jump, **3-63**
Param Access Lvl, **3-40**
PI BW Filter, **3-27**
PI Configuration, **3-25**
PI Control, **3-25**
PI Deriv Time, **3-27**
PI Error Meter, **3-27**
PI Fdback Meter, **3-27**
PI Feedback Hi, **3-28**
PI Feedback Lo, **3-28**
PI Feedback Sel, **3-26**
PI Integral Time, **3-26**
PI Lower Limit, **3-26**
PI Output Meter, **3-27**
PI Preload, **3-27**
PI Prop Gain, **3-26**
PI Ref Meter, **3-27**
PI Reference Hi, **3-28**
PI Reference Lo, **3-28**
PI Reference Sel, **3-26**
PI Setpoint, **3-26**
PI Status, **3-27**
PI Upper Limit, **3-27**
Port Mask Act, **3-55**
Pos Torque Limit, **3-17**
Power Loss Mode, **3-38**
Power Loss Time, **3-38**
Power Up Marker, **3-48**
Powerup Delay, **3-34**
Preset Speed x, **3-23**
PWM Frequency, **3-30**
Ramped Speed, **3-12**
Rated Amps, **3-12**
Rated kW, **3-12**
Rated Volts, **3-12**
Reference Mask, **3-52**
Reference Owner, **3-53**
Regen Power Lim, **3-31**
Reset Meters, **3-40**
Reset To Defalts, **3-40**
Rev Speed Limit, **3-21**
Run Boost, **3-18**
S Curve %, **3-30**
Save HIM Ref, **3-39**
Save MOP Ref, **3-40**
Save To User Set, **3-40**
Shear Pin Time, **3-31**

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Skip Freq Band, **3-21**
Skip Frequency x, **3-21**
Sleep Level, **3-37**
Sleep Time, **3-37**
Sleep Wake Mode, **3-36**
Sleep Wake Ref, **3-37**
Slip Comp Gain, **3-25**
Slip RPM @ FLA, **3-25**
Slip RPM Meter, **3-25**
Spd Err Filt BW, **3-28**
Speed Desired BW, **3-29**
Speed Feedback, **3-12**
Speed Loop Meter, **3-29**
Speed Mode, **3-20**
Speed Ref A Hi, **3-22**
Speed Ref A Lo, **3-22**
Speed Ref A Sel, **3-22**
Speed Ref B Hi, **3-22**
Speed Ref B Lo, **3-22**
Speed Ref B Sel, **3-22**
Speed Ref Source, **3-44**
Speed Reference, **3-12**
Speed/Torque Mod, **3-21**
Start At PowerUp, **3-34**
Start Inhibits, **3-44**
Start Mask, **3-52**
Start Owner, **3-53**
Start/Acc Boost, **3-18**
Status 1 @ Fault, **3-46**
Status 3 @ Fault, **3-46**
Stop Mode x, **3-31**
Stop Owner, **3-53**
Stop/Brk Mode x, **3-31**
SV Boost Filter, **3-15**
Sync Time, **3-63**
TB Man Ref Hi, **3-23**
TB Man Ref Lo, **3-23**
TB Man Ref Sel, **3-23**
Testpoint x Data, **3-48**
Testpoint x Sel, **3-48**
Torq Current Ref, **3-18**
Torque Current, **3-11**
Torque Estimate, **3-12**
Torque Perf Mode, **3-14**
Torque Ref x Hi, **3-17**
Torque Ref x Lo, **3-17**
Torque Ref x Sel, **3-17**
Torque Setpoint1, **3-17**
Total Inertia, **3-29**
Traverse Dec, **3-63**
Traverse Inc, **3-63**
Trim % Setpoint, **3-24**
Trim Hi, **3-24**
Trim In Select, **3-24**
Trim Lo, **3-24**
Trim Out Select, **3-24**
Voltage Class, **3-41**
Wake Level, **3-37**
Wake Time, **3-37**
Write Mask Act, **3-55**
Write Mask Cfg, **3-55**
Params Defaulted Fault, **4-5**
PE Ground, **1-4**, **1-7**
Phase Short Fault, **4-5**
Phase to Grnd Fault, **4-5**
PI BW Filter, **3-27**
PI Configuration, **3-25**
PI Control, **3-25**
PI Deriv Time, **3-27**
PI Error Meter, **3-27**
PI Fdback Meter, **3-27**
PI Feedback Hi, **3-28**
PI Feedback Lo, **3-28**
PI Feedback Sel, **3-26**
PI Integral Time, **3-26**
PI Lower Limit, **3-26**
PI Output Meter, **3-27**
PI Preload, **3-27**
PI Prop Gain, **3-26**
PI Ref Meter, **3-27**
PI Reference Hi, **3-28**
PI Reference Lo, **3-28**
PI Reference Sel, **3-26**
PI Setpoint, **3-26**
PI Status, **3-27**
PI Upper Limit, **3-27**

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PORT LED, **2-3**
Port Locations, DPI, **B-1**
Port Mask Act, **3-55**
Port X Adapter Fault, **4-6**
Port X DPI Loss Fault, **4-6**
Pos Torque Limit, **3-17**
Power Cables/Wiring, **1-5**
Power Conditioning, Input, **1-3**
Power Input Terminals, **1-9**
Power LED, **2-3**
Power Loss Alarm, **4-9**
Power Loss Fault, **4-6**
Power Loss Group, **3-38**
Power Loss Mode, **3-38**
Power Loss Time, **3-38**
Power Terminal Block, **1-8**
Power Up Marker, **3-48**
Powering Up the Drive, **2-1**
Powerup Delay, **3-34**
Precautions, General, **P-3**
Precharge Active Alarm, **4-10**
Preferences, Setting, **B-5**
Preset Speed x, **3-23**
Process PI Group, **3-25**, **3-26**
Programmable Controller Configurations, **A-5**
Programming, **3-1**
PTC Conflict Alarm, **4-10**
Publications, Reference, **P-2**
PWM Frequency, **3-30**
Pwr Brd Chksum Fault, **4-6**

R

Ramp Rates Group, **3-30**
Ramped Speed, **3-12**
Rated Amps, **3-12**
Rated kW, **3-12**
Rated Volts, **3-12**
Ratings, **A-1**, **A-15**
Reference Manual, **P-1**
Reference Mask, **3-52**
Reference Material, **P-2**
Reference Owner, **3-53**
Regen Power Lim, **3-31**
Removing Cover, **1-1**
Repeated Start/Stop, **1-10**
Replaced MCB-PB Fault, **4-6**
Reset Meters, **3-40**
Reset To Defalts, **3-40**
Restart Modes Group, **3-34**, **3-35**
Rev Speed Limit, **3-21**
RFI Filter Option, **1-9**
RFI Filter, Input Terminals, **1-9**
RFI, see *EMI/RFI*
Run Boost, **3-18**

S

S Curve %, **3-30**
S.M.A.R.T. Start Up, **2-4**
Safe Off Operation, **1-19**
Safety Ground, **1-4**
Save HIM Ref, **3-39**
Save MOP Ref, **3-40**
Save To User Set, **3-40**
Saving Data, Viewing, **B-5**
Security Group, **3-55**
Setting Preferences, **B-5**
Shear Pin Fault, **4-6**
Shear Pin Time, **3-31**
Shielded Power Cables, **1-7**
Short Circuit Protection, **1-5**
Single-Phase Input Power, **1-7**
Skip Freq Band, **3-21**
Skip Frequency x, **3-21**
Sleep Config Alarm, **4-10**
Sleep Level, **3-37**
Sleep Time, **3-37**
Sleep Wake Mode, **3-36**
Sleep Wake Ref, **3-37**
Slip Comp Gain, **3-25**
Slip Comp Group, **3-25**
Slip RPM @ FLA, **3-25**
Slip RPM Meter, **3-25**
Spare Parts, **P-1**
Spd Err Filt BW, **3-28**
Spd Mode & Limits Group, **3-20**

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Specifications
Agency Certification, **A-1**
Control, **A-3**
Drive, **P-1**
Drive Ratings, **A-1**, **A-15**
Electrical, **A-2**
Encoder, **A-3**
Environment, **A-2**
Protection, **A-2**
Speed Command File, **3-20**
Speed Command Sources, **1-22**
Speed Desired BW, **3-29**
Speed Feedback, **3-12**
Speed Loop Meter, **3-29**
Speed Mode, **3-20**
Speed Ref A Hi, **3-22**
Speed Ref A Lo, **3-22**
Speed Ref A Sel, **3-22**
Speed Ref B Hi, **3-22**
Speed Ref B Lo, **3-22**
Speed Ref B Sel, **3-22**
Speed Ref Cflct Alarm, **4-10**
Speed Ref Source, **3-44**
Speed Reference, **3-12**
Speed Reference Control, **1-22**
Speed Reference Selection, **1-22**
Speed References Group, **3-22**
Speed Trim Group, **3-24**
Speed/Torque Mod, **3-21**
Standard Control, **3-3**
Start At PowerUp, **3-34**
Start At PowerUp Alarm, **4-10**
Start Inhibits, **3-44**
Start Mask, **3-52**
Start Owner, **3-53**
Start/Acc Boost, **3-18**
Start/Stop, Repeated, **1-10**
Start-Up
Assisted, **2-4**
Checklist, **2-1**
S.M.A.R.T., **2-4**
Static Discharge, ESD, **P-4**
Status (STS) LED, **2-3**
Status 1 @ Fault, **3-46**
Status 3 @ Fault, **3-46**
Stop Mode x, **3-31**
Stop Owner, **3-53**
Stop/Brake Modes Group, **3-31**
Stop/Brk Mode x, **3-31**
Supply Source, **1-3**
SV Boost Filter, **3-15**
SW OverCurrent Fault, **4-6**
Sync Time, **3-63**
System Grounding, **1-4**

T

TB Man Ref Cflct Alarm, **4-10**
TB Man Ref Hi, **3-23**
TB Man Ref Lo, **3-23**
TB Man Ref Sel, **3-23**
TE Ground, **1-4**
Terminal Block
I/O, **1-15**
Power, **1-8**
Testpoint Codes and Functions, **4-11**
Testpoint x Data, **3-48**
Testpoint x Sel, **3-48**
Three Wire Control, **1-17**
Torq Attributes Group, **3-14**
Torq Current Ref, **3-18**
Torque Current, **3-11**
Torque Estimate, **3-12**
Torque Perf Mode, **3-14**
Torque Ref x Hi, **3-17**
Torque Ref x Lo, **3-17**
Torque Ref x Sel, **3-17**
Torque Setpoint1, **3-17**
Total Inertia, **3-29**
Traverse Dec, **3-63**
Traverse Inc, **3-63**
Trim % Setpoint, **3-24**
Trim Hi, **3-24**
Trim In Select, **3-24**
Trim Lo, **3-24**
Trim Out Select, **3-24**
Trnsistr OvrTemp Fault, **4-6**

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Troubleshooting, **4-3**
Two Wire Control, **1-17**

U

Unbalanced/Ungrounded Supply, **1-3**
UnderVoltage
  Fault, **4-7**
UnderVoltage Alarm, **4-10**
Ungrounded Distribution Systems, **1-11**
Unshielded Power Cables, **1-6**
UserSet Chksum Fault, **4-7**
UserSet Conflict Alarm, **4-10**
Utility File, **3-39**

V

VHz Neg Slope Alarm, **4-10**
Viewing and Changing Parameters, **B-6**
Viewing Changed Parameters, **B-3**
Voltage Class, **3-41**
Volts per Hertz Group, **3-18**

W

Wake Level, **3-37**
Wake Time, **3-37**
Waking Alarm, **4-10**
Watts Loss
  IP20 (NEMA Type 1) drives, **A-4**
Web Sites, see *WWW, World Wide Web*
Wiring, **1-1**
  Cable Entry Plate Removal, **1-9**
  Encoder, **1-21**
  I/O, **1-14**
  I/O Examples, **1-17**
  Power, **1-5**
  Signal, **1-14**
Write Mask Act, **3-55**
Write Mask Cfg, **3-55**
WWW, World Wide Web, **P-2**

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