User Manual

Allen-Bradley

PowerFlex Digital DC Drive

PowerFlex DC Drive V1.006…4.002, Stand-Alone Regulator V4.002

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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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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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.
⚠	**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 consequence
⚡	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
♨	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Summary of Changes

This manual contains new and updated information.

New and Updated Information

This table contains the changes made to this revision.

Change	Page(s)
Added the 575V AC input, frame B & C drives and 690V AC input, frame C drives to the Standard Drive Catalog Number Explanation.	15
Added the Stand-Alone Regulator catalog numbers.	16
Added the 575V AC input drives to Table 2 “Frame B Weights”.	20
Added the 690V AC input drives to Table 3 “Frame C Weights”.	21
Updated the frame D dimensions.	22
Updated installation information regarding use of isolation transformers and line reactors.	30
Updated Tables 14 and 15 in the Field Current Configuration section to include a field current scale setting for 1 A.	55
Updated the S15 DIP Switch Configuration section to include 575V and 690V AC input drives.	70
Added the data type description for all parameters in Chapter 3.	102
The “Basic” and “Advanced” parameter view tables have been updated to reflect all parameter additions and changes for firmware version 4.001.	104 106
Added the following new parameters for firmware version 4.001:	

Parameter	Page	Parameter	Page
232 [Inertia Comp Out]	114	1006 [Droop Out]	112
464 [SAR Volts Scale]	117	1007 [Droop Out Pct]	112
476 [Field Curve Out]	114	1008 [Spd Reg Fdbk]	113
643 [SpdReg AntiBckup]	134	1009 [Spd Reg Fdbk Pct]	113
801 [Anlg In2 Filter]	176	1010 [Spd Reg Err]	113
802 [Anlg In3 Filter]	176	1011 [Spd Reg Err Pct]	113

Parameters 731 [PID Steady Delay] and 734 [P Init Intgl Gain] have been moved from the “PID Control” group to the “PI Control” group.	142
Parameter 444 was renamed from [Spd Fdbk Filter] to [Spd Reg P Filter] for firmware version 4001.	133
Added option 2 “Off” to parameter 1016 [SpdFuncSelect].	134
The options for parameter 715 [Torq Limit Type] have been corrected for firmware version 4.001.	138
Added option 47 “Encoder Spd” to parameter 786 [PID Source].	146
Added new “Init Diam Calc” group to the “Applications” file to simplify programming.	147
Parameters 1187 [Winder Type] and 1204 [Line Spd Source] have been moved from the “Winder Functions” group to the “Diameter Calc” group.	149
Added the option list for [PID Source] to parameters 1204 [Line Spd Source] and 1284 [Ref Spd Source].	149 154
The following parameters have been moved to the “Winder Functions” group: • Parameter 1212 [Acc Dec Filter] - moved from the “Ramp Rates” group. • Parameters 1188 [Accel Status], 1189 [Decel Status], and 1190 [Fast Stop Status] - moved from the “Diagnostics” group. • Parameters 1191 [InertiaCompCnst] and 1192 [InertiaCompVar] - moved from the “Speed Regulator” group.	151
Updated the actions for a “Feedback Loss” (F91) fault to include possible encoder configuration errors.	199
Updated the Watts Loss tables for 575 and 690V AC input drives.	215
Updated all Drive Power Circuit Protection tables for 575 and 690V AC input drives.	219

Change	Page(s)
Updated all AC Input Line Reactors and AC Input Contactors tables for 575 and 690V AC input drives.	238
Updated all Dynamic Brake Resistor Kits and DC Output Contactors tables for 575 and 690V AC input drives.	242
Added the Alternate Dynamic Brake Resistor Kits and DC Output Contactors tables for 575 and 690V AC input drives.	244
Added 575 and 690V AC input drives to the Alternate EMC Filters tables.	246
Updated the Terminal Adapter Kits for frame D drives table.	249
Updated the Block Diagrams to reflect all additions and changes for firmware version 4.001.	309
Added Appendix H - PowerFlex DC Stand-Alone Regulator Installation.	345
Added Appendix I - History of Changes to contain all previous manual revision information (see note below).	347

Changes to this manual for previous revisions are included in Appendix I History of Changes on page 347.

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The purpose of this manual is to provide you with the basic information needed to install, start-up and troubleshoot the PowerFlex DC drive. This manual is intended for qualified personnel. You must be able to program and operate DC drives. In addition, you must have an understanding of the parameter settings and functions detailed in this manual.

For information on…	See page…
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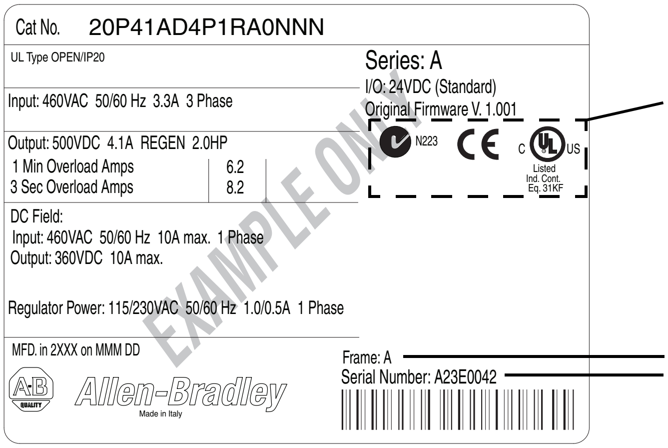
Drive Storage Conditions

If it is necessary to store the drive for any length of time before installation, follow these storage guidelines in order to ensure satisfactory operation at start up and to maintain warranty coverage:

- After receipt and inspection, repack the drive in its original shipping container and store in a clean, dry place.
- Place where the ambient temperatures do not exceed -25° C (-13° F) or +55° C (131° F)
- Place where the relative air humidity range does not exceed 5…95%.
- At an altitude of less than 3,000 meters (10,000 ft.) above sea level.

Drive Nameplate Data

The PowerFlex DC drive contains a data nameplate label located on the side of each drive that identifies the specific model number design, applicable AC input power and DC output power data. All communication with Rockwell Automation personnel concerning this product should include this information.



Cat No. 20P41AD4P1RA0NNN

UL Type OPEN/IP20

Input: 460VAC 50/60 Hz 3.3A 3 Phase

Output: 500VDC 4.1A REGEN 2.0HP

1 Min Overload Amps	6.2
3 Sec Overload Amps	8.2

DC Field:
Input: 460VAC 50/60 Hz 10A max. 1 Phase
Output: 360VDC 10A max.

Regulator Power: 115/230VAC 50/60 Hz 1.0/0.5A 1 Phase

MFD. in 2XXX on MMM DD

Series: A
I/O: 24VDC (Standard)
Original Firmware V. 1.001

Frame: A
Serial Number: A23E0042

Note: Certification Marks Location.

Refer to the data nameplate label on your drive for actual agency certifications.

Drive frame size

Drive serial number

Drive Frame Sizes

Similar PowerFlex DC drive sizes are grouped into frame sizes to simplify spare parts ordering, dimensioning, etc. The drive frame size can be located just above the serial number on the data nameplate label. Refer to the Standard Drive Catalog Number Explanation on page 15 for a list of drive catalog numbers and their respective frame sizes.

Drive Firmware Version

The original firmware version of the drive as shipped from the factory appears on the data nameplate label just above the certifications. If the firmware version has been upgraded since the drive was shipped, you can view the current version on the HIM (if installed). See Diagnostics Menu on page 255 for details.

Specifications

For drive specification information, see the PowerFlex Digital DC Drive, Technical Data, 20P-TD001.

Additional Resources

These documents contain additional information concerning related Rockwell Automation practices and products.

Resource	Description
Preventive Maintenance of Industrial Control and Drive System Equipment, DRIVES-TD001	Provides a checklist for performing preventive maintenance.
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control, SGI-1.1	Provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
A Global Reference Guide for Reading Schematic Diagrams, 100-2.10	Provides a simple cross-reference of common schematic/wiring diagram symbols used throughout various parts of the world.
Guarding Against Electrostatic Damage, 8000-4.5.2	Provides common practices to help guard against ESD.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at: http://literature.rockwellautomation.com. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

Technical Support

For Allen-Bradley Drives Technical Support:

Title	Online at . . .
Allen-Bradley Drives Technical Support	www.ab.com/support/abdrives

Conventions

- 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: [Armature 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

General Precautions

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

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

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

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

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

Contact Allen-Bradley for assistance with application or wiring.

Standard Drive Catalog Number Explanation

Position

1-3	4	5	6	7	8-10	11	12	13	14	15	16
20P	4	1	A	D	4P1	R	A	0	N	N	N
a	b	c	d	e	f	g	h	i	j	k	l

a

Drive

Code	Type
20P	PowerFlex DC

b

Motor Operation

Code	Type
2	Two Quadrant Operation ∗
4	Four Quadrant Operation

∗ Not available for 230V AC input drives.

c

Input Type

Code	Type
1	6 Pulse

d

Enclosure

Code	Enclosure Rating	Conform. Coat
A	IP20, NEMA/UL Type Open	No

e

Input Voltage

Code	Voltage
B	230V AC
D	460V AC ∗
E	600V AC
F	690V AC

∗ Use this code for 400V AC input applications.

f1

230V, 60 Hz Input

Code	Hp	Armature Amps	Frame	Field Amps
7P0	1.5	7	A	10
9P0	2	9	A	10
012	3	12	A	10
020	5	20	A	10
029	7.5	29	A	10
038	10	38	A	10
055	15	55	A	10
073	20	73	A	14
093	25	93	A	14
110	30	110	A	14
146	40	146	B	20
180	50	180	B	20
218	60	218	B	20
265	75	265	B	20
360	100	360	B	20
434	125	434	B	20
521	150	521	C	20
700	200	700	C	20
875	250	875	D	40
1K0	300	1050	D	40

f2

460V, 60 Hz Input

Code	Hp	Armature Amps	Frame	Field Amps
4P1	2	4.1	A	10
6P0	3	6	A	10
010	5	10	A	10
014	7.5	14	A	10
019	10	19	A	10
027	15	27	A	10
035	20	35	A	10
045	25	45	A	10
052	30	52	A	10
073	40	73	A	14
086	50	86	A	14
100	60	100	A	14
129	75	129	A	14
167	100	167	B	20
207	125	207	B	20
250	150	250	B	20
330	200	330	B	20
412	250	412	B	20
495	300	495	C	20
667	400	667	C	20
830	500	830	D	40
996	600	996	D	40
1K1	700	1162	D	40
1K3	800	1328	D	40
1K4	900	1494	D	40

f3

575V, 60 Hz Input

Code	Hp	Armature Amps	Frame	Field Amps
067	50	67.5	B	20
101	75	101.3	B	20
135	100	135	B	20
270	200	270	B	20
405	300	405	B	20
540	400	540	C	20
675	500	675	C	20
810	600	810	D	40
1K0	800	1080	D	40
1K2	900	1215	D	40
1K3	1000	1350	D	40
1K6	1250	1668	D	40

f4

690V, 60 Hz Input

Code	Hp	Armature Amps	Frame	Field Amps
452	400	452	C	20
565	500	565	C	20
678	600	678	D	40
791	700	791	D	40
904	800	904	D	40
1K0	900	1017	D	40
1K1	1000	1130	D	70
1K2	1100	1243	D	70
1K4	1250	1413	D	70
1K5	1400	1582	D	70

Standard Drive Catalog Number Explanation, Cont.

Position

1-3	4	5	6	7	8-10	11	12	13	14	15	16
20P	4	1	A	D	4P1	R	A	0	N	N	N
a	b	c	d	e	f	g	h	i	j	k	l

g

Field Supply	
Code	Type
R	Single-Phase Regulated

h

Packaging/Documentation		
Code	Shipping Carton	User Manual
A	Yes	Yes

i

HIM	
Code	Operator Interface
0	Blank Cover ∗

∗ Standard - for additional selections, refer to the PowerFlex Digital DC Drive Technical Data, publication 20P-TD001. . .

j

I/O Options ∗	
Code	Control
A	I/O Expansion Card (4 Additional 24V dc Digital Inputs & Outputs, 2 Analog Outputs)
B	115V ac Conversion Card (8 Digital Inputs & Outputs)
C	I/O Expansion Card + 115V ac Conversion
N	None (8 - 24V dc Digital Inputs & Outputs, 3 Analog Outputs and 2 Analog Inputs are Standard)

∗ All I/O Options are purchased separately and are user installed.

k

Communication Options	
Code	Description
N	None ∗

∗ Standard - for additional selections, refer to the PowerFlex Digital DC Drive Technical Data, publication 20P-TD001. . .

l

Cabinet Options	
Code	Type
N	None

Stand-Alone Regulator Catalog Numbers

All catalog numbers below are provided with conformally coated circuit boards.

230V / 460V AC Input Regulators **Catalog Number**	**575V / 690V AC Input Regulators** **Catalog Number**	**Field Amps**
23PMD4	23PMF4	40
23PMD7	23PMF7	70
23PAMP (1)	23PAMP (1)	(1)

(1) Gate Amplifier - used with all voltage classes of the Stand-Alone Regulator. Note: The Stand-Alone Regulator and Gate Amplifier are currently sold through Rockwell Automation Drive Systems only. Consult the factory for availability.

Chapter 1

Installation and Wiring

This chapter provides information on mounting and wiring the PowerFlex DC drive.

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.

For PowerFlex DC Stand-Alone Regulator (SAR) installations, refer to Appendix H for important installation and configuration information. The SAR is identified by a 23PMDx catalog number contained on the data nameplate on the drive (see Drive Nameplate Data on page 12 for location).

IMPORTANT The PowerFlex DC drive is not designed for use with multiple motor applications or resistive loads.

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

Mounting Considerations

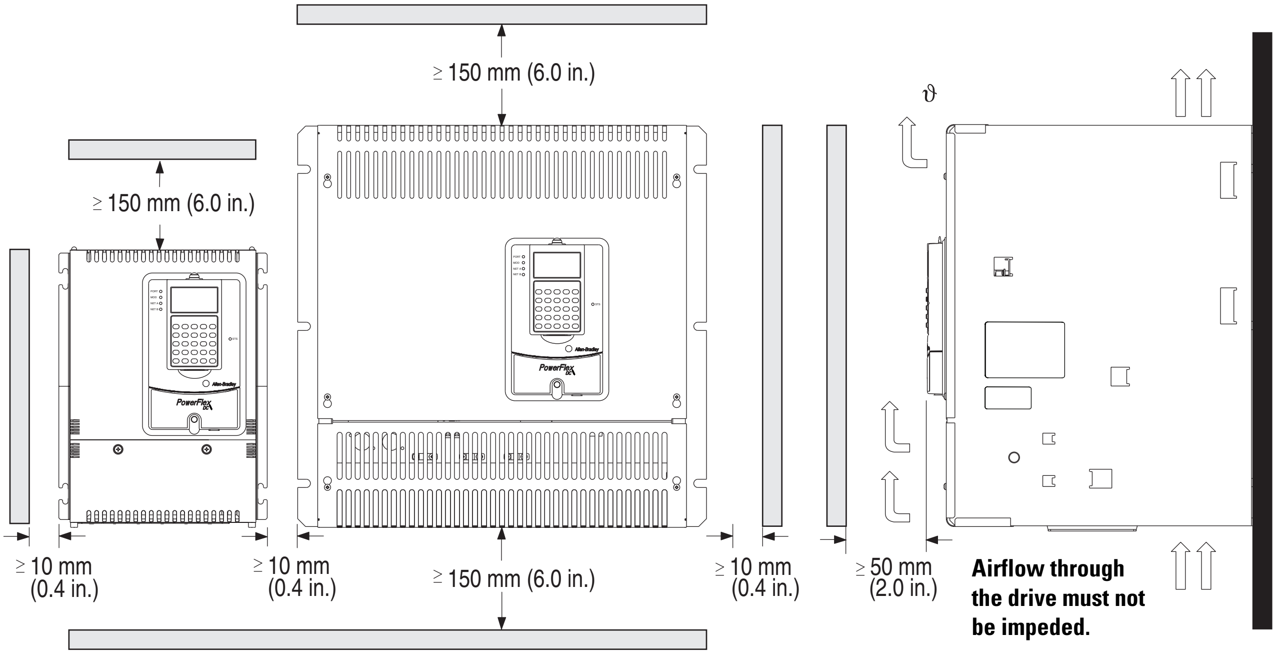
Operating Conditions and Temperatures

PowerFlex DC drives are designed to operate at 0°...50° C (32°... 122° F) surrounding air temperature without derating. The drive must be mounted in a clean, dry location. Contaminants such as oils, corrosive vapors and abrasive debris must be kept out of the enclosure. NEMA/UL Type Open, IP20 enclosures are intended for indoor use primarily to provide a degree of protection against contact with enclosed equipment. These enclosures offer no protection against airborne contaminants.

Minimum Mounting Clearances

Minimum clearance requirements (indicated in Figure 1 below) 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. The drive must be mounted in a vertical orientation as shown below and must not be mounted at an angle greater than 30 degrees from vertical. In addition, inlet air temperature must not exceed the product specification.

Figure 1 - Drive Enclosure Minimum Mounting Clearances



Airflow through the drive must not be impeded.

Approximate Drive Dimensions and Weights

The PowerFlex DC drive is available in a NEMA/UL Type Open, IP20 enclosure only. Follow all mounting dimensions and instructions in order to ensure proper operation.

ATTENTION: Remove all loose packing materials, including the container(s) of desiccants (if any), from the drive enclosure before mounting and energizing the drive.

Figure 2 - Frame A Drive Dimensions

A	**B**	**C**	**A1**	**A2**	**B1**
mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)
267 (10.5)	359 (14.0)	287 (11.3)	7 (0.3)	250 (9.8)	275 (10.8)

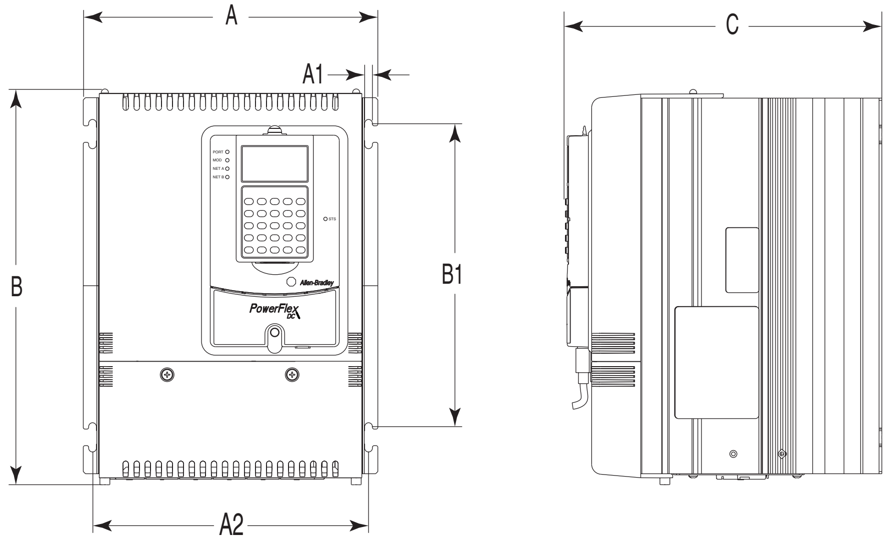
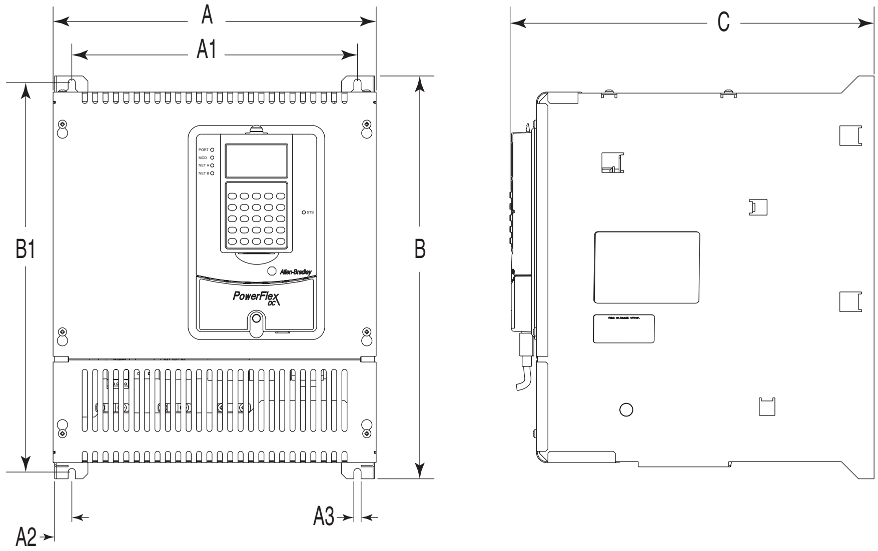


Table 1 - Frame A Weights

		Weight	
Drive Current Rating Code		**Drive**	**Drive & Packaging**
230V	**460V**	**kg (lb)**	**kg (lb)**
7P0	4P1	8.4 (19.5)	10.5 (23.2)
9P0	6P0		
012	010		
020	014		
–	019		
029	027		
038	035	8.8 (19.4)	11 (24.3)
055	045		
–	052		
073	073	10.8 (23.8)	13 (28.7)
093	086		
110	100		
–	129		

Figure 3 - Frame B Drive Dimensions

A	A1	A2	A3	B	B1	C
mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)
311 (12.2)	275 (10.8)	16.5 (0.65)	7 (0.3)	388 (15.3)	375 (14.8)	350 (13.8)



Terminal Details Dimensions in mm (in.)

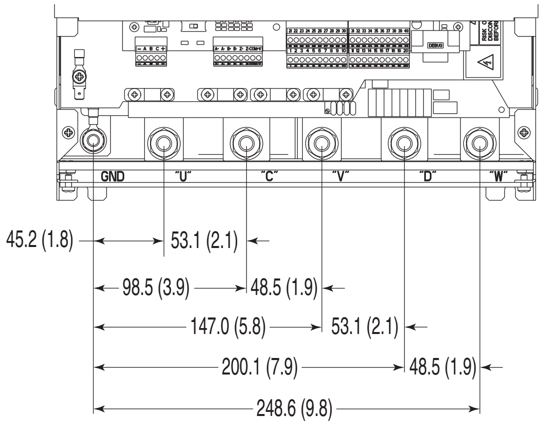
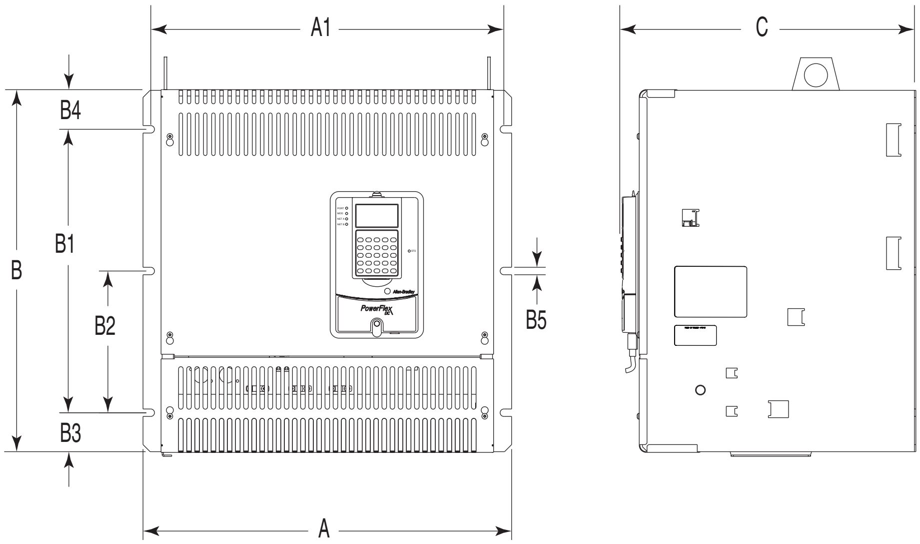


Table 2 - Frame B Weights

			Weight	
Drive w/ND Rating Code			Drive	Drive & Packaging
230V	460V	575V	kg (lb)	kg (lb)
146	167	067	25.5 (56.2)	27.5 (60.6)
180	207	101		
218	–	135		
265	250	270	29.5 (65.0)	31.5 (69.5)
360	330	405	32 (70.5)	34 (75)
434	412	–		

Figure 4 - Frame C Drive Dimensions

A	A1	B	B1	B2	B3	B4	B5	C
mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)	mm (in.)
521 (20.5)	499 (19.7)	511 (20.1)	400 (15.7)	200 (7.9)	55 (2.2)	56 (2.2)	10.5 (0.4)	416 (16.4)



Terminal Details Dimensions in mm (in.)

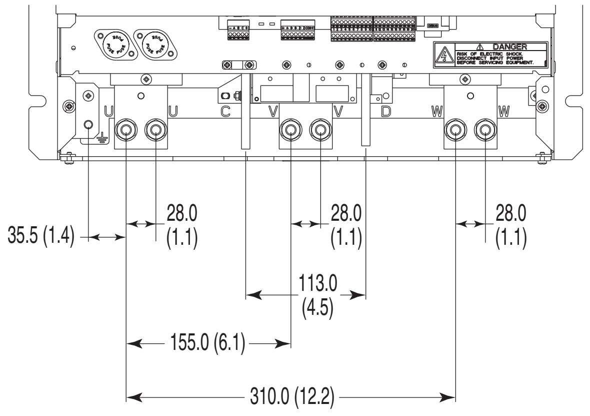
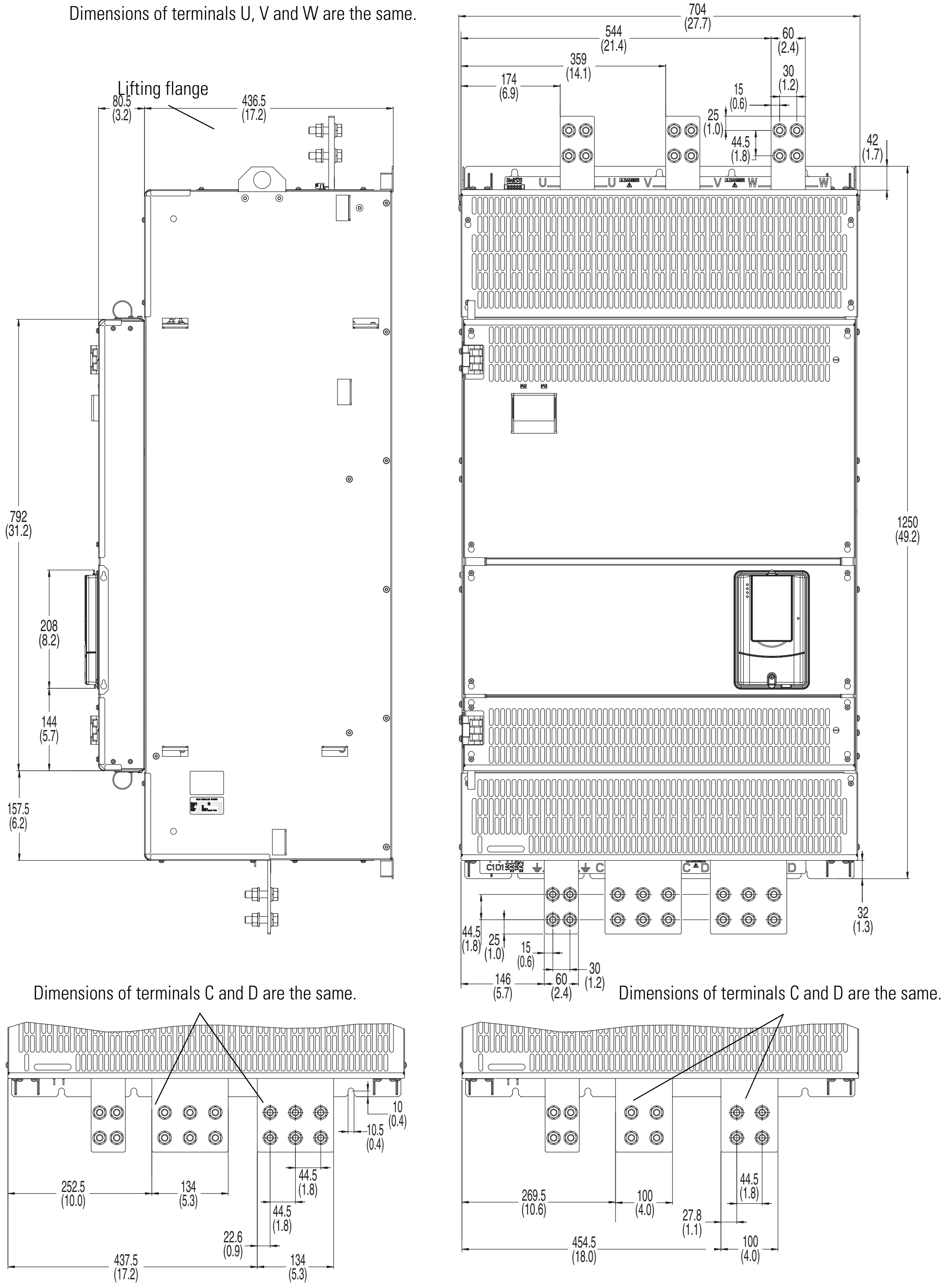


Table 3 - Frame C Weights

				Weight - Regenerative Drives		Weight - Non-regenerative Drives	
Drive w/ND Rating Code				Drive	Drive & Packaging	Drive	Drive & Packaging
230V	460V	575V	690V	kg (lb)	kg (lb)	kg (lb)	kg (lb)
–	495		–	61 (134.5)	83 (183.0)	57 (125.7)	79 (174.2)
521	667		–	65 (143.3)	87 (191.8)	62 (136.7)	84 (185.2)
700	–		–				
–	–	540	452	72 (158.7)	94 (207.2)	68 (150.0)	90 (198.4)
–	–	675	565				

Figure 5 - Frame D Dimensions - Right Side and Front Views

Dimensions are shown in mm and (in.)



Dimensions of terminals U, V and W are the same.

Dimensions of terminals C and D are the same.

Dimensions of terminals C and D are the same.

Figure 6 - Frame D Dimensions - Left Side and Back Views

Dimensions are shown in mm and (in.)

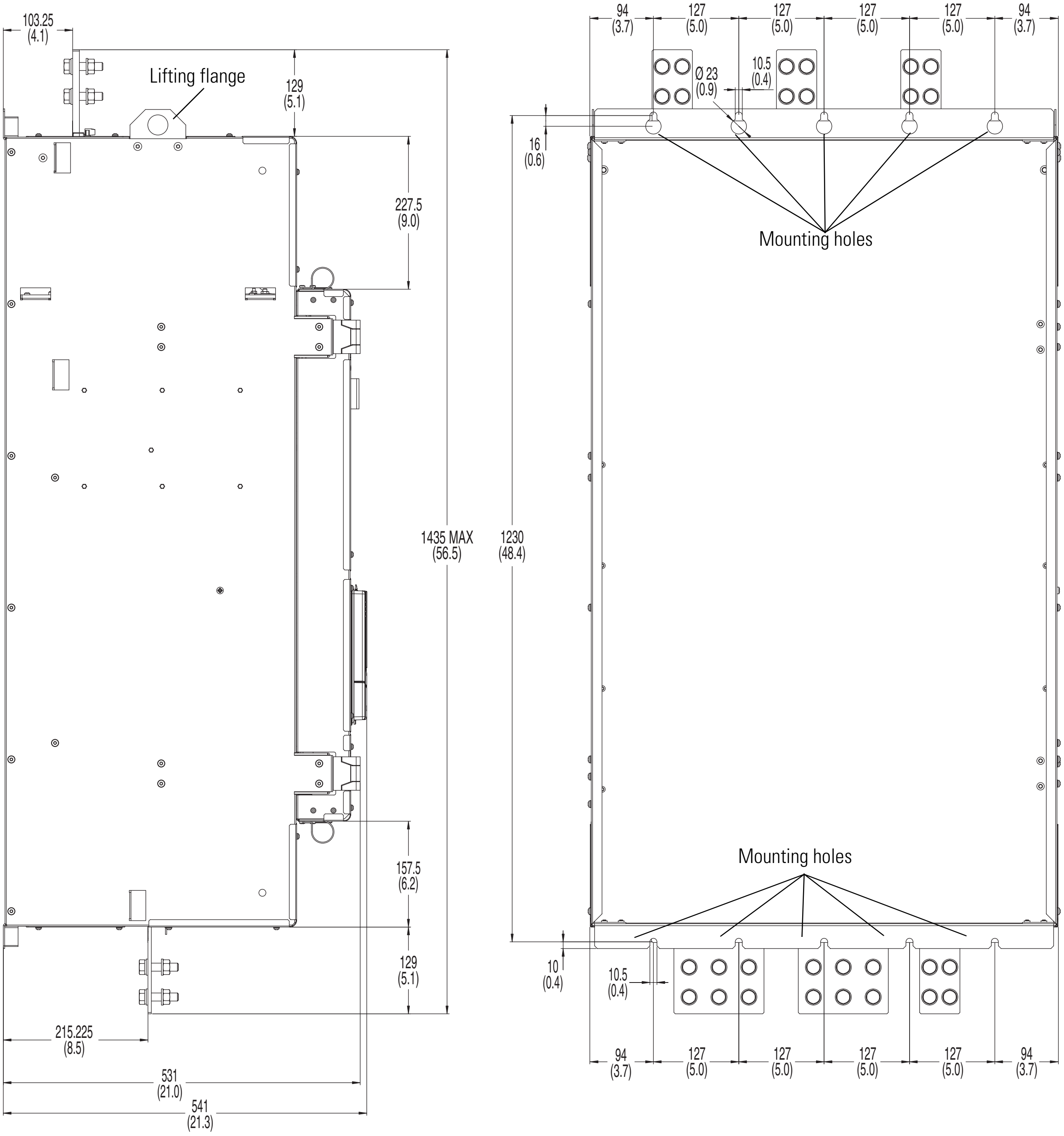


Table 4 - Frame D - 230V AC Input Drive Weights

Drive w/ND Rating Code	Weight - Regenerative Drives		Weight - Non-regenerative Drives	
	Drive	Drive & Packaging	Drive	Drive & Packaging
	kg (lb)	kg (lb)	kg (lb)	kg (lb)
875	203 (447.5)	281 (619.5)	152 (335.1)	230 (507.1)
1K0				

Table 5 - Frame D - 460V AC Input Drive Weights

Drive w/ND Rating Code	Weight - Regenerative Drives		Weight - Non-regenerative Drives	
	Drive	Drive & Packaging	Drive	Drive & Packaging
	kg (lb)	kg (lb)	kg (lb)	kg (lb)
830	202 (445.3)	280 (617.3)	152 (335.1)	230 (507.1)
996				
1K1	215 (474.0)	293 (646.0)	165 (363.8)	243 (535.7)
1K3				
1K4				

Table 6 - Frame D - 575V AC Input Drive Weights

Drive w/ND Rating Code	Weight - Regenerative Drives		Weight - Non-regenerative Drives	
	Drive	Drive & Packaging	Drive	Drive & Packaging
	kg (lb)	kg (lb)	kg (lb)	kg (lb)
810	198 (436.5)	276 (608.5)	148 (326.3)	226 (498.2)
1K0				
1K2	215 (474.0)	293 (646.0)	165 (363.8)	243 (535.7)
1K3	222 (489.4)	300 (661.4)	172 (379.2)	250 (551.2)
1K6	241 (531.3)	319 (703.3)	191 (421.1)	269 (593.0)

Table 7 - Frame D - 690V AC Input Drive Weights

Drive w/ND Rating Code	Weight - Regenerative Drives		Weight - Non-regenerative Drives	
	Drive	Drive & Packaging	Drive	Drive & Packaging
	kg (lb)	kg (lb)	kg (lb)	kg (lb)
678	198 (436.5)	276 (608.5)	148 (326.3)	226 (498.2)
791				
904	200 (440.9)	278 (612.9)	150 (330.7)	228 (502.7)
1K0	202 (445.3)	280 (617.3)	152 (335.1)	230 (507.1)
1K1	215 (474.0)	293 (646.0)		
1K2			165 (363.8)	243 (535.7)
1K4	241 (531.3)	319 (703.3)	172 (379.2)	250 (551.2)
1K5			191 (421.1)	269 (593.0)

Lifting PowerFlex DC Drives

The dimensions and weights specified above must be taken into consideration when mounting the device. Use the proper equipment to safely lift and hold the weight of the drive while mounting.

ATTENTION: To guard against possible personal injury or equipment damage . . .

- Inspect all lifting hardware for proper attachment before lifting the drive.
- Do Not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
- Do Not subject the drive to high rates of acceleration or deceleration while transporting to the mounting location or when lifting.
- Do Not allow personnel or their limbs directly underneath the drive when it is being lifted and mounted.

Mounting Frame C and D Drives

All lifting equipment and lifting components (hooks, bolts, lifts, slings, chains, etc.) must have a minimum lifting capacity of 453.6 kg (1,000 lb).

IMPORTANT Verify that all mounting screws are properly tightened before and after drive operation.

1. Verify the hole pattern on the panel to which the drive will be mounted. Refer to Figure 4 on page 21 or Figure 5 on page 22.
2. Install the mounting hardware:
   - ☐ For frame C drives, insert, but do not tighten, a bolt in one of the top holes in the panel. The bolt must be fully threaded into the panel before hanging the drive.
   - ☐ For Frame D drives, insert, but do not tighten, the six bolts for the top mounting flange on the drive into the panel. The bolts must be fully threaded into the panel before hanging the drive.
3. To limit the pull in forces on the drive, the lifting devices connected to the hooks must be long enough to make the angle between the chain or cable and a vertical line extending up from the flange center less than 45° angle as illustrated in Figure 7 on page 26 or Figure 8 on page 27.
   - ☐ For frame C drives, insert the properly sized and rated lifting hooks into the holes on the lifting flanges at the top of the drive. See Figure 7 on page 26.
   - ☐ For frame D drives, insert the properly sized lifting rod into the holes on the lifting flanges at the top of the drive. See Figure 8 on page 27.

Figure 7 - Lifting Frame C Drives

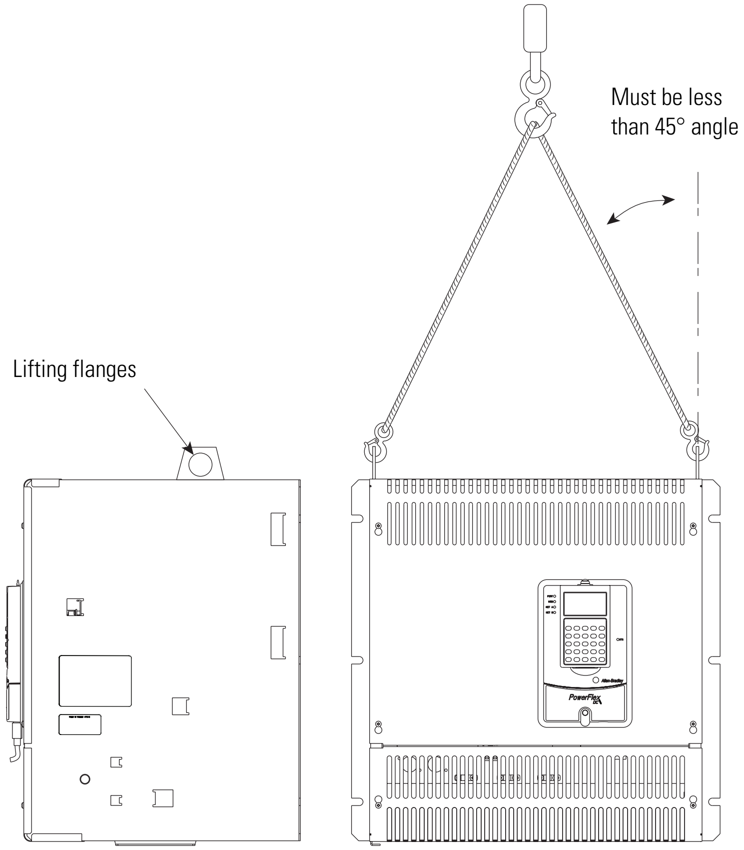
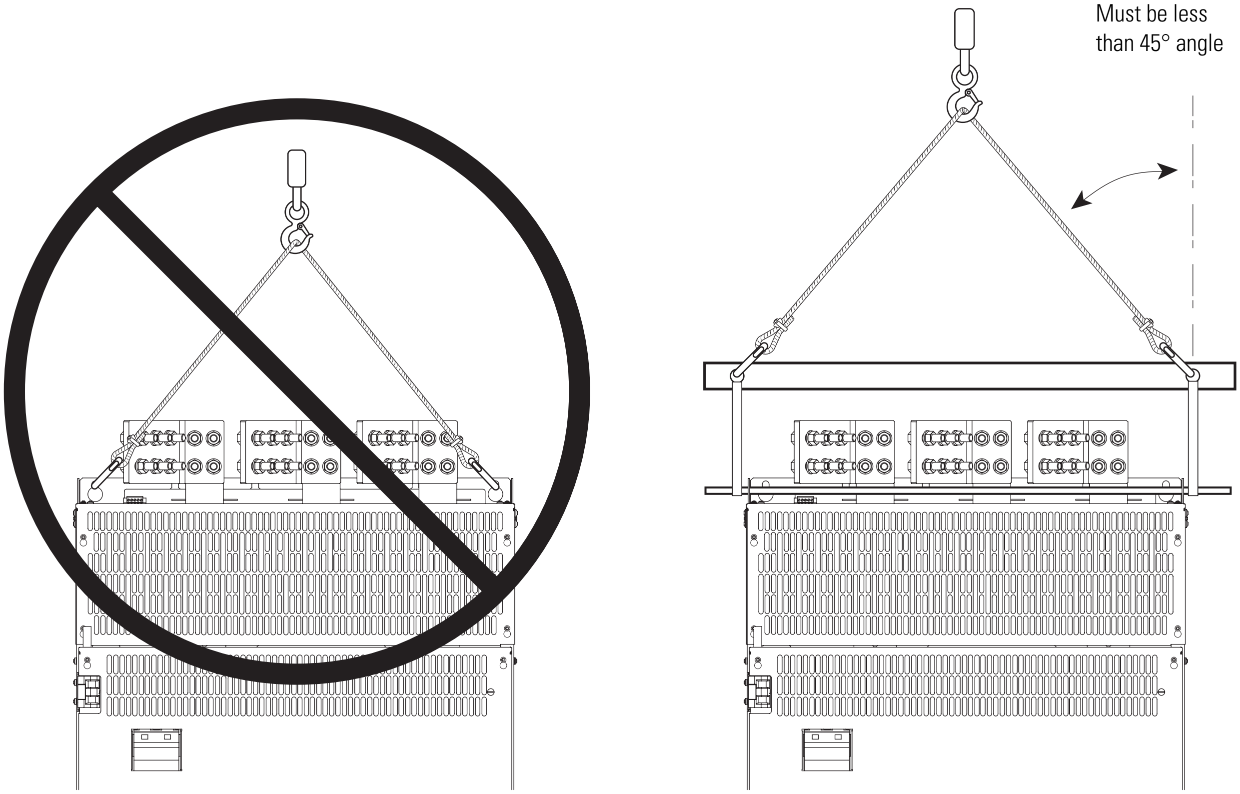


Figure 8 - Lifting Frame D Drives



4. Lift the drive into place onto the bolt(s) installed in the panel.
5. Install the remaining bolts into the panel. Tighten M8 bolts to a minimum torque of 15 N•m (132.7 lb•in) and M10 bolts to a minimum torque of 25 N•m (221.2 lb•in).

Removing the Drive Covers

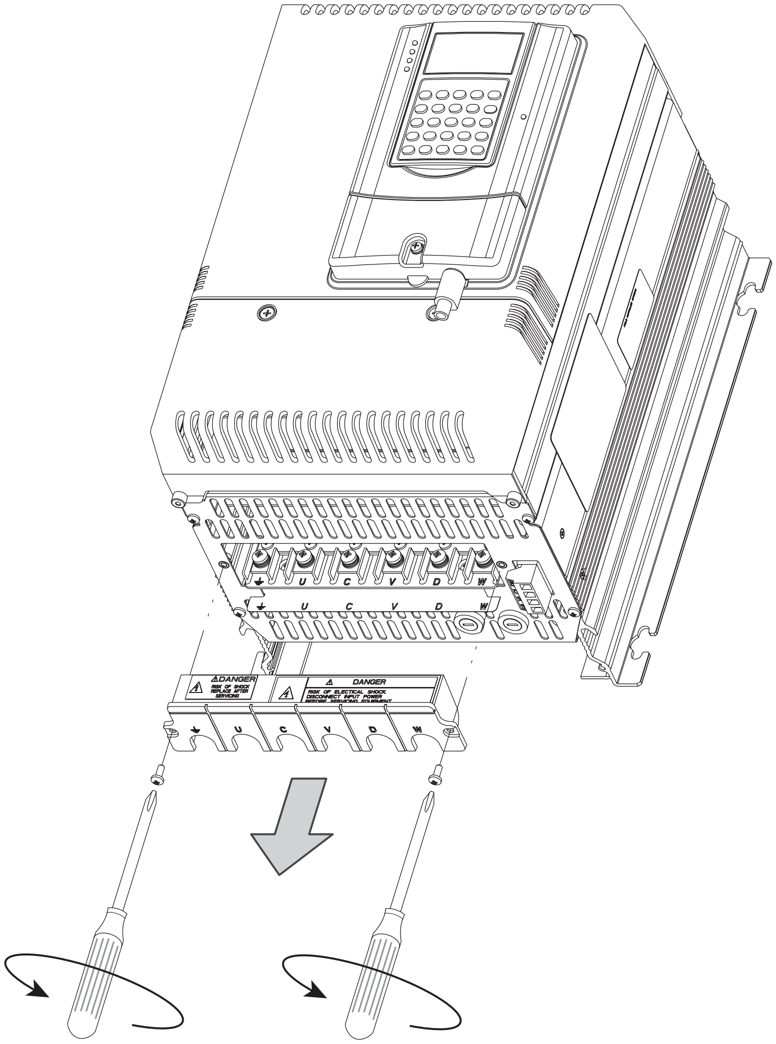
The appropriate protective cover(s) must be removed in order to access the drive's power and I/O terminals. The upper cover only needs to be removed to install an optional communication adapter and service the drive. (Refer to Installing a Communication Adapter on page 333 for information.)

Frame A Drives

You must remove both the lower protective cover and the power terminal cover on frame A drives to access the power terminals.

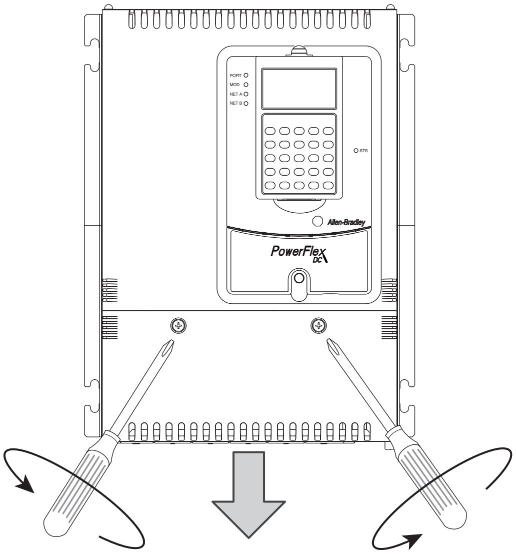
Remove the Power Terminal Cover

Remove the two screws as shown below and slide the cover down and off the chassis.



Remove the Lower Protective Cover

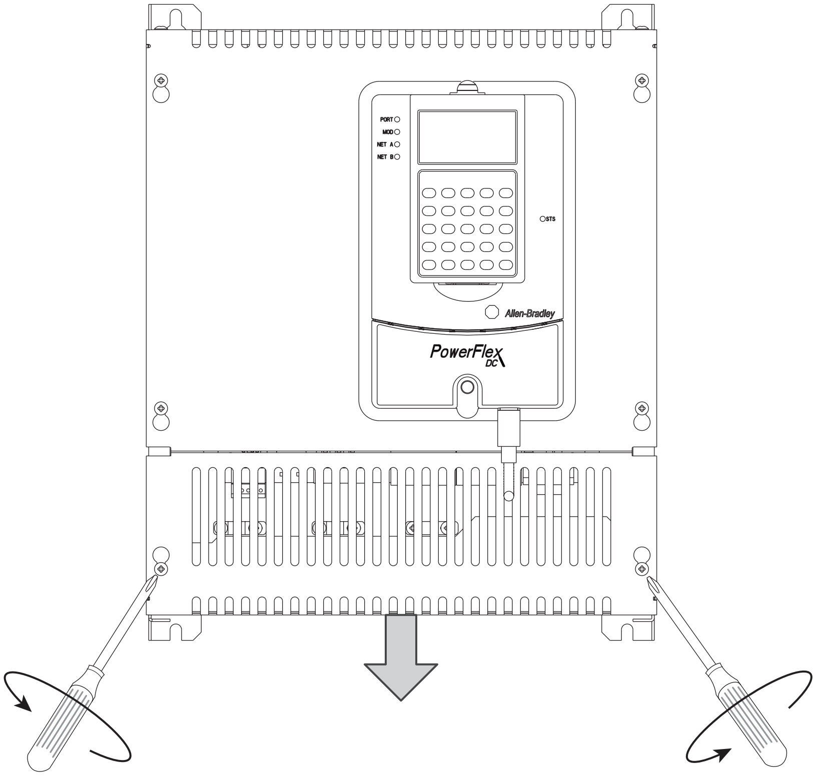
Remove the two screws as shown below and, while gently lifting along the top edge, slide the cover down and off the chassis.



Frame B and C Drives

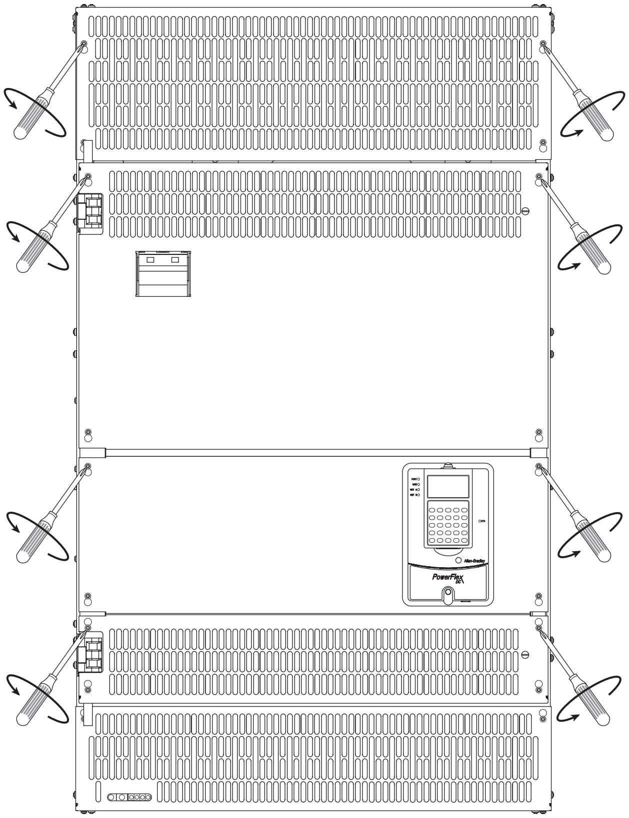
Loosen, but do not remove, the two screws that secure the bottom cover. Then, slide the cover down until the screw heads line up with the key holes and lift the cover off the chassis.

Frame B Shown



Frame D

For any protective cover, loosen, but do not remove, the Hexalobular head screws that secure the cover to the drive frame. Then, slide the cover up until the screw heads line up with the key holes and lift the cover off the chassis. The top and bottom most covers are also secured by screws at the top and bottom of the drive, respectively.



Isolation Transformers / Line Reactors

When connecting the drive directly to the main distribution system an isolation transformer and/or 3…5% impedance AC line reactor must be used to guard against system disturbance. If the isolation transformer provides the required 3…5% impedance, a line reactor is not required.

Refer to Isolation Transformers on page 240 for a list of recommended isolation transformers.

Refer to AC Input Line Reactors and AC Input Contactors on page 238 for a list of recommended AC line reactors. The type of line reactor used depends upon the following:

- the current absorbed by the AC input
- the AC input voltage
- the relative short circuit voltage
- the AC input frequency

Using Contactors

When using an AC input contactor, the IEC AC1 rating of the contactor must be equal to the rated thermal (RMS) current value at the mains input of the drive.

Drive configurations for AC or DC contactors, with or without a dynamic brake, are as follows (refer to Typical Power Wiring Diagrams on page 41 for wiring examples):

- When only an AC contactor is used:

❏ Set parameter 1391 [ContactorControl] to 1 "AC Cntctr" (default value) (1)

❏ Set one [Relay Out x Sel] parameter and one [Digital Inx Sel] parameter to "Contactor" (default value for parameters 1392 [Relay Out 1 Sel] and 140 [Digital In8 Sel])

- When only a DC contactor is used:

❏ Set parameter 1391 [ContactorControl] to 3 "DC Cntctr" (1)

❏ Set one [Relay Out x Sel] parameter and one [Digital Inx Sel] to "Contactor" (default value for parameters 1392 [Relay Out 1 Sel] and 140 [Digital In8 Sel])

- When an AC contactor and dynamic brake contactor are used:

❏ Set parameter 1391 [ContactorControl] to "AC Cntctr+DB" (1)

❏ Set one [Relay Out x Sel] parameter (1392 [Relay Out 1 Sel] or 629 [Relay Out 2 Sel]) to "Contactor" and the other relay output to "ContactorDB"

❏ Set one [Digital Inx Sel] parameter to "Contactor" (default value for parameter 140 [Digital In8 Sel])

- When a DC contactor and dynamic brake contactor are used:

❏ Set parameter 1391 [ContactorControl] to "DC Cntctr+DB" (1)

❏ Set one [Relay Out x Sel] parameter (1392 [Relay Out 1 Sel] or 629 [Relay Out 2 Sel]) to "Contactor" and the other relay output to "ContactorDB"

❏ Set one [Digital Inx Sel] parameter to "Contactor" (default value for parameter 140 [Digital In8 Sel])

- When a contactor is NOT used:

❏ Set parameter 1391 [ContactorControl] to "None" (1)

❏ Do NOT set either [Relay Out x Sel] parameter to "Contactor" or "ContactorDB"

❏ Do NOT set any [Digital Inx Sel] parameter to "Contactor"

(1) Par 1391 [ContactorControl] is contained in the "Advanced" parameter configuration group. Refer to How Parameters are Organized on page 103 for more information.

When operating a drive with firmware version 1.006 in field weakening mode with a DC contactor and/or inverting fault device installed in the armature circuit, refer to Field Weakening Mode Configuration (v1.006) on page 269.

AC Input Contactors

Refer to AC Input Line Reactors and AC Input Contactors on page 238 for a list of recommended AC input contactors.

DC Output Contactors

A DC output contactor can be used to connect the output of the armature circuit to the DC motor. If a DC output contactor is used, an AC input contactor is not needed.

Refer to Dynamic Brake Resistor Kits and DC Output Contactors on page 242 for a list of recommended DC output contactors.

Dynamic Brake Resistors

Refer to Dynamic Brake Resistor Kits and DC Output Contactors on page 242 for a list of recommended dynamic brake resistor kits.

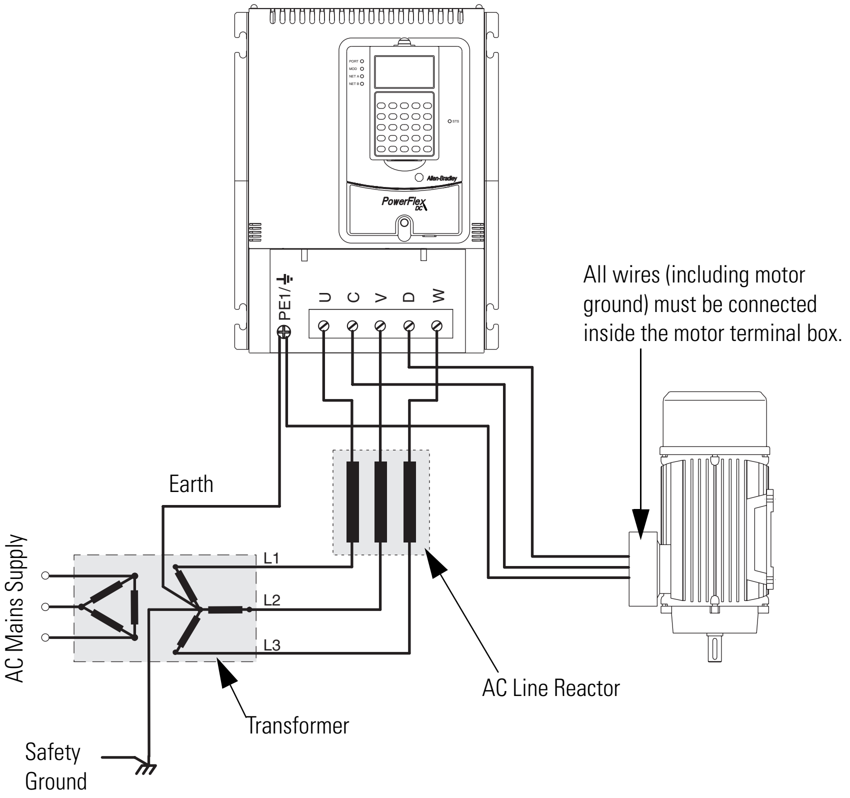
General Grounding Requirements

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.

ATTENTION: In order to comply with the essential requirements of the CE Low Voltage Directive 2006/95/EC, PowerFlex DC drives may not be powered from a corner-earthed (TN with one phase earthed) supply system. When operating PowerFlex DC drives from an IT or impedance-earthed supply system, only temporary operation is permitted after an earth fault is detected in the power system.

Figure 9 - 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.

Power Feeder

Each power feeder from the substation transformer to the drive must be provided with properly sized ground cables. The conduit or cable armor should be bonded to the substation ground at both ends. Each transformer enclosure and/or frame must be bonded to ground at a minimum of two locations.

Encoder Ground Connections

If used, must be routed in grounded steel conduit. The conduit must be grounded at both ends. The encoder cable shield must be connected to the shield ground on the drive side. Do not connect the encoder cable shield to ground on the motor side.

Tachometer Ground Connections

If used, ground connections must be routed in grounded steel conduit. The conduit must be grounded at both ends. Ground the cable shield at the drive end only using the shield clamps on the grounded metal plate supporting the control board (refer to I/O Terminal Block Locations on page 73 for shield clamp location).

CE Conformity

Conformity with the Low Voltage Directive and Electromagnetic Compatibility Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex DC drives comply with the EN standards listed below when installed according to this User Manual.

CE Declarations of Conformity are available online at:
www.rockwellautomation.com/products/certification/ce/

Low Voltage Directive (2006/95/EC)

- EN 50178 Electronic equipment for use in power installations.

EMC Directive (2004/108/EC)

- EN 61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Considerations

- For CE compliance, the drive installation must satisfy requirements related to both EN 50178 and EN 61800-3 provided in this document.
- PowerFlex DC drives comply with the EMC requirements of EN 61800-3 when installed according to good EMC practices and the instructions provided in this document. However, many factors can influence the EMC compliance of an entire machine or installation, and compliance of the drive itself does not ensure compliance of all applications.
- PowerFlex DC drives are not intended to be used on public low-voltage networks which supply domestic premises. Without additional mitigation, radio frequency interference is expected if used on such a network. The installer is responsible to take measures such as supplementary line filters and enclosures to prevent interference, in addition to the installation requirements of this document.
- PowerFlex DC drives generate notching and harmonic current emissions on the AC supply system. When operated on a public low-voltage network it is the responsibility of the installer or user to ensure that applicable requirements of the distribution network operator have been met.

ATTENTION: PowerFlex DC drives may produce DC current in the protective earthing conductor which can reduce the ability of RCD's (residual current-operated protective devices) or RCM's (residual current-operated monitoring devices) of type A or AC to provide protection for other equipment in the installation.

Installation Requirements Related to the Low Voltage Directive

- PowerFlex DC drives are designed to be CE compliant only if they are NOT connected to “corner-earthed” supply systems where one of the three phases of the supply system has been earthed.
- PowerFlex DC drives are compliant with the CE LV Directive when used at altitudes no greater than 2000 m (6562 ft).
- PowerFlex DC drives provided in enclosure type IP20 must be installed in a pollution degree 1 or 2 environment to be compliant with the CE LV Directive. Characteristics of the different pollution degree ratings are provided on 37.
- PowerFlex DC drives may produce leakage current in the protective earthing conductor which exceeds 3.5 mA AC and/or 10 mA DC. The minimum size of the protective earthing (grounding) conductor used in the application must comply with local safety regulations for high protective earthing conductor current equipment.
- Frame D PowerFlex DC drives must be installed in a supplementary enclosure which provides protection from electric shock in order to be compliant with the CE LV Directive.

Installation Requirements Related to EN 61800-3 and the EMC Directive

- The drive must be earthed (grounded) as described in this User Manual.
- PowerFlex DC drives require the use of an external EMC filter in order to comply with the EMC directive (2004/109/EC) and emission limits of EN 61800-3: 2004. PowerFlex DC drives have been tested and verified for compliance to the emission limits of EN 61800-3: 2004 using only the specific input filters and motor cable lengths indicated in the table below:

	Standard / Limits (Compliance with any of the limits in the table below satisfies RF emission requirements for the EMC Directive)				
Drive Frame Catalog Number	**EN61800-3 Category C1** **EN61000-6-3** **CISPR 11 Group 1 Class B**	**EN61800-3 Category C2** **EN61000-6-4** **CISPR11 Group 1 Class A** **…P ≤ 20kVA**	**CISPR11 Group 1 Class A** **…P > 20kVA**	**EN61800-3 Category C3** **…I ≤ 100A**	**EN61800-3 Category C3** **…I > 100A**
Frame A 20Px1Ax4P1… 20Px1Ax129	Compliance may be possible with supplementary mitigation (Consult factory)	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required(2) 50m motor cable limit	RF line filter required(2) 50m motor cable limit	RF line filter required(2) 50m motor cable limit
Frame B 20Px1Ax167… 20Px1Ax412	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required(1) 50m motor cable limit	RF line filter required(1) 50m motor cable limit	RF line filter required(1) 50m motor cable limit	RF line filter required(1) 50m motor cable limit
Frame C 20Px1Ax495… 20Px1Ax667	Compliance may be possible with supplementary mitigation (Consult factory)	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required(3) 50m motor cable limit	RF line filter required(3) 50m motor cable limit	RF line filter required(3) 50m motor cable limit
Frame D 20Px1Ax… 20Px1Ax	Compliance may be possible with supplementary mitigation (Consult factory)	Compliance may be possible with supplementary mitigation (Consult factory)	Compliance may be possible with supplementary mitigation (Consult factory)	RF line filter required(4) 50m motor cable limit	RF line filter required(4) 50m motor cable limit
	More Stringent Limits	⟷			Less Stringent Limits

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(1) RF 3xxx-MHU EMC filter from Rasmi Electronics Ltd. xxx designates filter current rating. Rasmi EMC filters are manufactured by Rasmi Electronics Ltd. Refer to the manufacturer’s literature for details.

(2) RF 3xxx-SIEI EMC filter from Rasmi Electronics Ltd. xxx designates filter current rating. Rasmi EMC filters are manufactured by Rasmi Electronics Ltd. Refer to the manufacturer’s literature for details.

(3) RF 3xxx-MHU EMC filter from Rasmi Electronics Ltd. xxx designates filter current rating. Rasmi EMC filters are manufactured by Rasmi Electronics Ltd. Refer to the manufacturer’s literature for details.

(4) EPCOS B84143B Type S081 EMC filter from EPCOS AG. EPCOS EMC filters are manufactured by EPCOS AG. Refer to the manufacturer’s literature for details.

IMPORTANT Use of other filters should be verified in the application. Additional filters are listed in Alternate EMC Filters on page 246.

- Output power wiring to the motor must employ cable with a braided shield providing 75% or greater coverage, or the cables must be housed in metal conduit, or equivalent shielding must be provided. Continuous shielding must be provided from the drive enclosure to the motor enclosure. Both ends of the motor cable shield (or conduit) must terminate with a low-impedance connection to earth.
- At the motor end, the motor cable shield or conduit must terminate in a shielded connector which must be properly installed in an earthed motor wiring box attached to the motor. The motor wiring box cover must be installed and earthed.
- All control (I/O) and signal wiring to the drive must use cable with a braided shield providing 75% or greater coverage, or the cables must be housed in metal conduit, or equivalent shielding must be provided. When shielded cable is used, only the drive end of the cable shield should be terminated with a low-impedance connection to earth.
- Motor cabling must be separated from control and signal wiring wherever possible.
- Maximum motor cable length must not exceed the maximum length indicated in the table on 36 for compliance with radio frequency emission limits for the specific standard and installation environment.

Pollution Degree Ratings According to EN 61800-5-1

Pollution Degree	Description
1	No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
2	Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the drive is out of operation.
3	Conductive pollution or dry non-conductive pollution occurs, which becomes conductive due to condensation, which is to be expected.
4	The pollution generates persistent conductivity caused, for example by conductive dust or rain or snow.

Power Circuit Protection

It is recommended that you install the PowerFlex DC drive with fast acting fuses to protect the armature converter on the AC input and DC output (for four quadrant drives only) sides. Internally mounted fuses for armature converter protection are provided with frame C and D PowerFlex DC drives. Refer to Drive Power Circuit Protection on page 219 for a list of replacement fuses and general fuse locations.

Control Power Protection

The 115V / 230V AC control circuit power input terminals U2 and V2 are required to be short circuit protected. This protection can be provided by using standard time delay fuses or a circuit breaker. The time delay fuses or circuit breaker must be selected to survive the short circuit available current of the feeder source for this circuit and the inrush current of the drive's power supply.

The rating of the fuses or circuit breaker should be sized mainly to protect the wiring from the fuses/circuit breaker connections to terminals U2 and V2, and not nuisance trip or blow from the inrush current.

The table below lists the input current characteristics of the control power.

Table 8 - Control Power Protection

	Control Power Supply					
			Rated input current		**Inrush input current**	
Frame	**Circuit Board ID / Revision**	**Power**	**115V AC**	**230V AC**	**115V AC**	**230V AC**
A & D	SW1-31 / H & below	60 W	1 A	0.5 A	20 A	10 A
	SW1-31 / I & above	80 W	1 A	0.5 A	6 A	10 A
B	SW2-32 / H & below	110 W	1.2 A	0.7 A	15 A	7.5 A
	SW2-32 / I & above	90 W	1.2 A	0.6 A	6 A	10 A
C	SW3-32 / H & below	110 W	1.2 A	0.7 A	15 A	7.5 A
	SW3-32 / I & above	90 W	1.2 A	0.6 A	6 A	10 A

Control power input should be supplied by a power source that is stabilized and buffered from the power system transients. The control power of many drives can be fed from a single source, as long as proper distribution protection is provided.

Cable and Wiring Recommendations

Use the following cable and spacing recommendations for all drives sizes:

					Minimum Spacing Between Classes Steel Conduit/Tray					
Category	**Wiring Class**	**Signal Definition**	**Signal Example**	**Cable Type**	**1**	**2/3/4**	**5/6**	**7/8**	**9/10/11**	**See Spacing Notes, 40**
Power	1	AC Power (600V Or Greater)	2.3kV 3/ph AC Lines	Per NEC & Local Codes	0	3/9 in. (76/229 mm)	3/9 in. (76/229 mm)	3/18 in. (76/457 mm)	See Note 6	1/2/5
	2	AC Power (Less Than 600V)	460V 3/ph AC Lines		3/9 in. (76/229 mm)	0	3/6 in. (76/152 mm)	3/12 in. (76/305 mm)	See Note 6	1/2/5
	3	DC Power	DC Motor Armature							
	4	DC Power	DC Motor Field							
Control	5	115V AC/DC Logic	Relay Logic/PLC I/O Motor Thermostat		3/9 in. (76/229 mm)	3/6 in. (76/152 mm)	0	3/9 in. (76/229 mm)	See Note 6	1/2/5
		115V AC Power	Power Supplies, Instruments							
	6	24V AC/DC Logic	PLC I/O							
Signal (Process)	7	Analog Signals, DC Supplies	Reference/Feedback Signal, 5 To 24V DC	Shielded Cable – Belden 8735, 8737, 8404	3/18 in. (76/457 mm)	3/12 in. (76/305 mm)	3/9 in. (76/229 mm)	0	1/3 in. (25/76 mm)	2/3/4/5
		Digital (Low Speed)	TTL							
	8	Digital (High Speed)	I/O, Encoder, Count Pulse Tach	Shielded Cable – Belden 9728, 9730						
Signal (Comm.)	9	Serial Communication	RS-232 (20-COMM-R), 422 To Terminals/ printers	Shielded Cable – Belden RS-232 – 8735, 8737 RS-422 – 9729, 9730	See Note 6			1/3 in. (25/76 mm)	0	–
	11	Serial Communication (Greater Than 20k Baud)	PLC Remote I/O, PLC Data Highway	Twinaxial Cable – Belden 9463, A-B 1770-CD						

Example:

Spacing relationship between 480V AC incoming power leads and 24V DC logic leads:

- 480V AC leads are Class 2; 24V DC leads are Class 6
- For separate steel conduits, the conduits must be 3 inches (76 mm) apart
- In a cable tray, the two groups of leads are to be 6 inches (152 mm) apart

				Minimum Spacing Between Classes Steel Conduit/Tray		
Category	Wiring Class	Signal Definition	Signal Example	1	**2/3/4**	**5/6**
Power	**2**	AC Power (less than 600V)	460V 3/Ph AC Lines →	→	→	**3/6 in. (76/152 mm)**
Control	**6**	24V AC/DC Logic	PLC I/O →	→	**3/6 in. (76/152 mm)**	

Spacing Notes:

1. Both outgoing and return current carrying conductors are to be pulled in same conduit or laid adjacent in tray.
2. Cables of the following classes can be grouped together.
   - **a.** Class 1; Equal to or above 601V.
   - **b.** Classes 2, 3 and 4 may have their respective circuits pulled in the same conduit or layered in the same tray.
   - **c.** Classes 5 and 6 may have their respective circuits pulled in the same conduit or layered in the same tray. Note: Bundle may not exceed conditions of NEC 310.
   - **d.** Classes 7 and 8 may have their respective circuits pulled in the same conduit or layered in the same tray. Note: Encoder cables run in a bundle may experience some amount of EMI coupling. The circuit application may dictate separate spacing.
   - **e.** Classes 9, 10 and 11 may have their respective circuits pulled in the same conduit or layered in the same tray. Communication cables run in a bundle may experience some amount of EMI coupling and corresponding communication faults. The application may dictate separate spacing.
3. All wires of class 7 through 11 MUST be shielded per the recommendations.
4. In cable trays, steel separators are advisable between the class groupings.
5. If conduit is used, it must be continuous and composed of magnetic steel.
6. Spacing of communication cables classes 2…6 is:

Conduit Spacing:	**Through Air:**
115V – 1 in. (25 mm)	115V – 2 in. (51 mm)
230V – 1.5 in. (38 mm)	230V – 4 in. (101.5 mm)
380/575V – 3 in. (76 mm)	380/575V – 8 in. (203 mm)
575V– proportional to 6 in. (152 mm) per 1000V.	575V – proportional to 12 in. (305 mm) per 1000V.

Power Wiring

AC Input Voltages

PowerFlex DC drives are rated for the following AC input voltages @ 50/60 Hz ±5%:

Mains Circuit (Terminals U, V, W)

- 230V ±10%, 3Ph
- 400V ±10%, 3Ph
- 440V ±10%, 3Ph
- 460V ±10%, 3Ph
- 480V ±10%, 3Ph
- 575V ±10%, 3Ph
- 690V ±10%, 3Ph

Field Circuit (Terminals U1, V1)

- 230V ±10%, 1Ph
- 400V ±10%, 1Ph
- 460V ±10%, 1Ph

Control Circuit (Terminals U2, V2)

- 115V ±15% or 230V ±15%, 1Ph

Note: For frame B and C drives only, a jumper must be placed between terminals SA-SB on the Switching Power Supply circuit board for the control circuits to work with 115V AC input. Refer to Figure 34 on page 62 for terminal block location on frame B drives and Figure 35 on page 63 for terminal block location on frame C drives.

DC Output Voltages

The output voltages below take into account an AC input undervoltage within the stated tolerance limits and a voltage drop of 4% due to an AC input line reactor. It is the same as the rated armature voltage suggested for the connected motor.

Armature Circuit

AC Input Voltage	DC Output Armature Voltage (Terminals C & D)	
(Terminals U, V, W)	Two Quadrant Drive	Four Quadrant Drive
230V ±10 %, 3Ph	260V	240V
400V ±10 %, 3Ph	470V	420V
440V ±10 %, 3Ph	530V	460V
460V ±10 %, 3Ph	560V	480V
480V ±10 %, 3Ph	580V	500V
575V ±10 %, 3Ph	680V	600V
690V ±10 %, 3Ph	810V	720V

Field Circuit

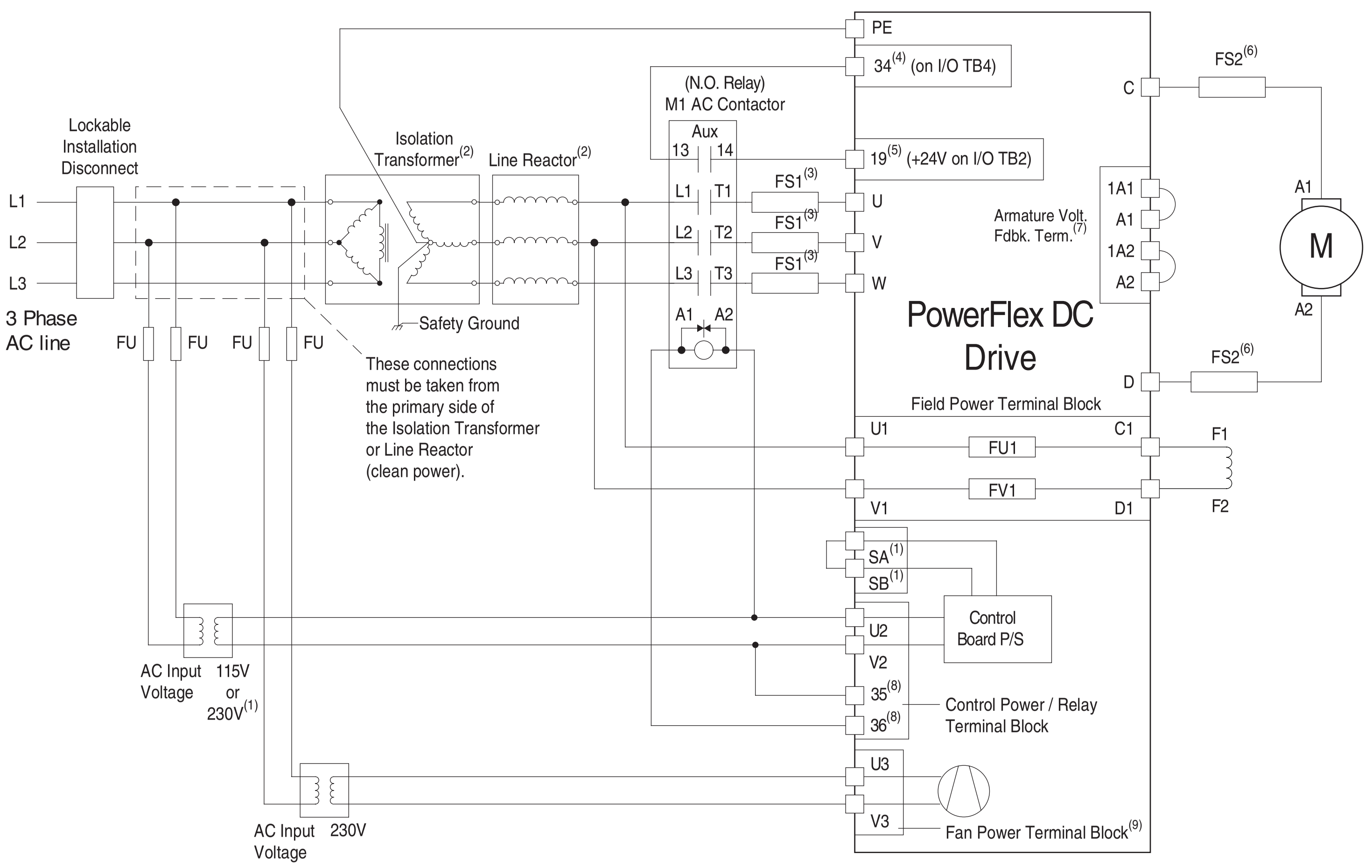
AC Input Voltage	DC Output Field Voltage(1) (Terminals C1 & D1)	
(Terminals U1 & V1)	Fixed Field	Adjustable Field
230V ±10 %, 1Ph	200V	200V
400V ±10 %, 1Ph	310V	310V
460V ±10%, 1Ph	360V	360V

(1) The max field voltage is equal to 0.85 x AC input line voltage

Typical Power Wiring Diagrams

Figure 10 on page 42… Figure 13 on page 45 represent recommended power wiring configurations for standard PowerFlex DC drive installations. For SAR installations, see Appendix H.

Figure 10 - Power Wiring with AC Input Contactor



(1) For frame B and C drives only, a jumper is required between terminals SA and SB for 115V AC control input power. See Control Circuit Input Power on page 59 for more information.

(2) An Isolation Transformer and/or 3…5% impedance Line Reactor is required. If the Isolation Transformer provides the required 3…5% impedance, a Line Reactor is not required. See AC Input Line Reactors and AC Input Contactors on page 238 and Isolation Transformers on page 240 for recommendations.

(3) AC input fuses for the armature converter are customer supplied for frame A and B drives and are internally mounted on frame C and D drives. See Drive Power Circuit Protection on page 219 for fuse recommendations.

(4) Par 140 [Digital In8 Sel] set to 31 “Contactor”

(5) If using the +24V internal power supply, terminal 18 (24V common) must be jumpered to terminal 35 (digital input common).

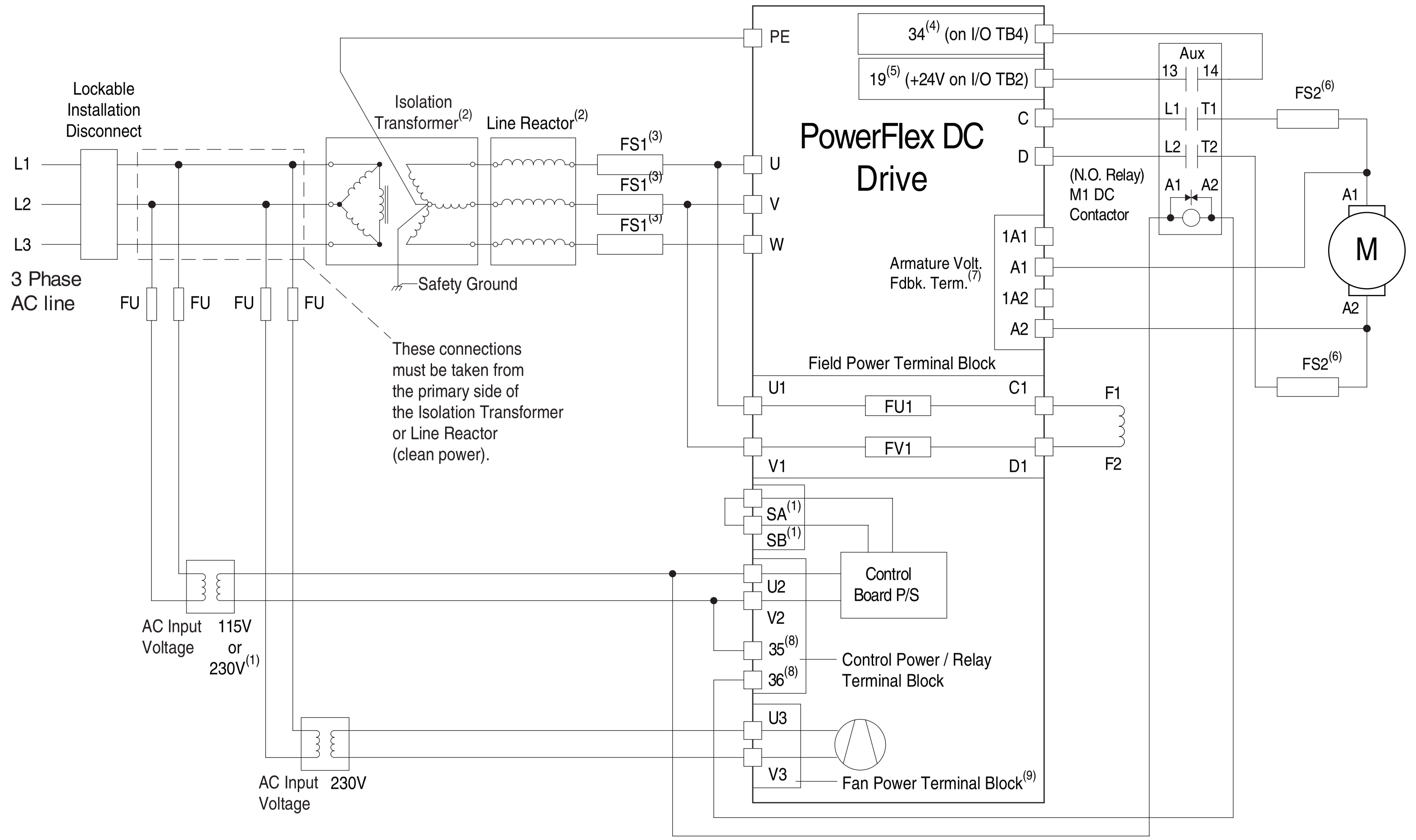
(6) Customer supplied armature output fuses are required on four quadrant and are recommended on two quadrant Frame A and B drives. See Drive Power Circuit Protection on page 219 for fuse recommendations. Fuses with Trip Indicator Switches are recommended for Inverting Fault protection when the motor will be Field Weakened and run above base speed. Refer to Figure 13 on page 45.

(7) Optional armature voltage feedback sensing not needed with AC contactor if Fuses with Trip Indicator are used (and wired to Inverting Fault input). See Figure 13 on page 45. If regular fuses are used, armature voltage TB can be used for overvoltage fault.

(8) Par 1391 [ContactorControl] = 1 “AC Cntctr” and Par 1392 [Relay Out 1 Sel] = 25 “Contactor”. **Important:** Terminal 35 and 36 are on the Control Power / Relay Terminal block, NOT the I/O terminal blocks. See Figure 26 through Figure 28.

(9) Frame C & D drives only require an external power supply for the heatsink cooling fan. See Frame C Heatsink Cooling Fans Power Supply Terminals on page 64 and Frame D Heatsink Cooling Fan Power Supply Terminals on page 65 for more information.

Figure 11 - Power Wiring with DC Output Contactor



(1) For frame B and C drives only, a jumper is required between terminals SA and SB for 115V AC control input power. See Control Circuit Input Power on page 59 for more information.

(2) An Isolation Transformer and/or 3…5% impedance Line Reactor is required. If the Isolation Transformer provides the required 3…5% impedance, a Line Reactor is not required. See AC Input Line Reactors and AC Input Contactors on page 238 and Isolation Transformers on page 240 for recommendations.

(3) AC input fuses for the armature converter are customer supplied for frame A and B drives and are internally mounted on frame C and D drives. See Drive Power Circuit Protection on page 219 for fuse recommendations.

(4) Par 140 [Digital In8 Sel] set to 31 "Contactor"

(5) If using the +24V internal power supply, terminal 18 (24V common) must be jumpered to terminal 35 (digital input common).

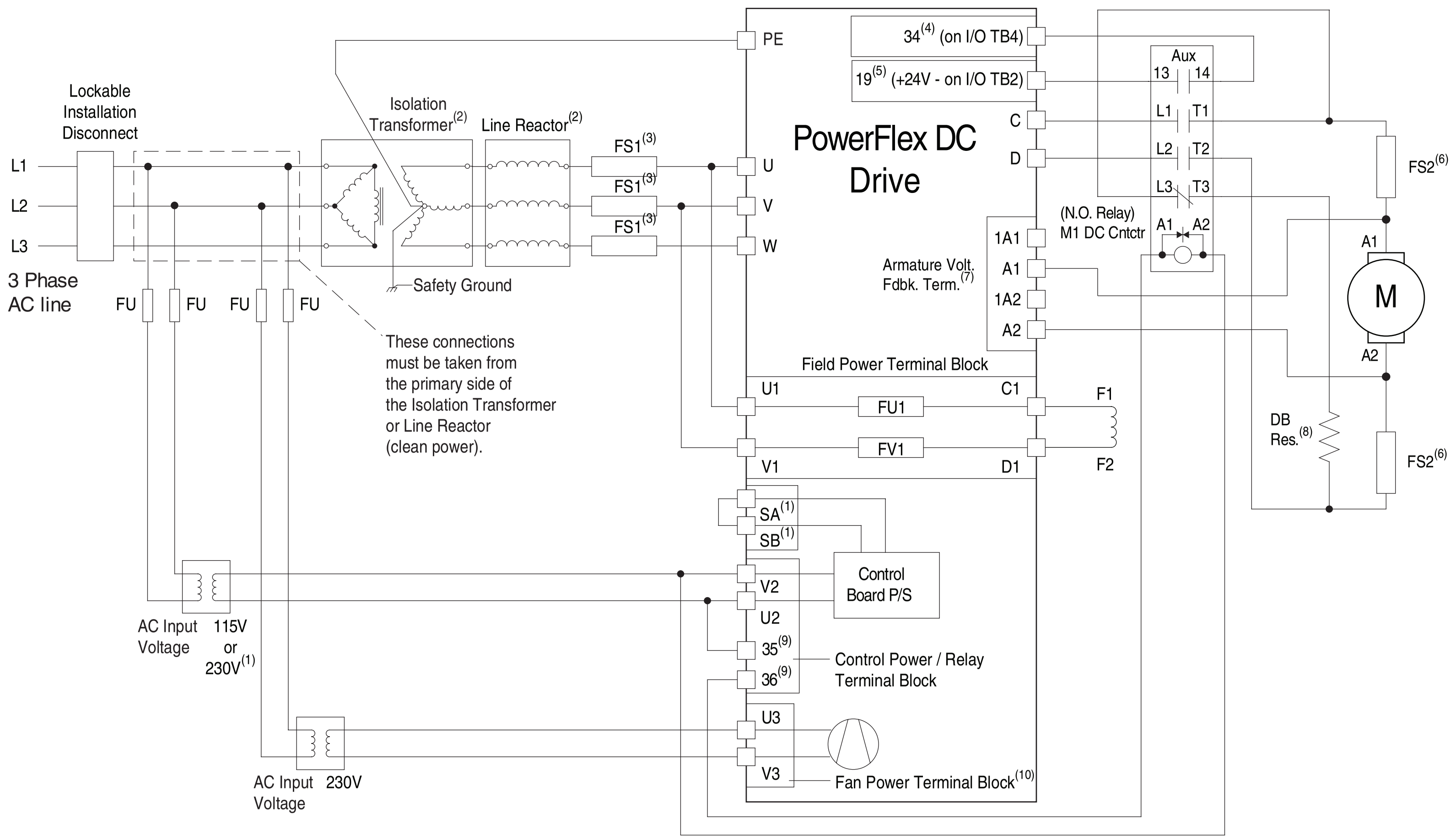
(6) Customer supplied armature output fuses are required on four quadrant and are recommended on two quadrant Frame A and B drives. See Drive Power Circuit Protection on page 219 for fuse recommendations. Fuses with Trip Indicator Switches are recommended for Inverting Fault protection when the motor will be Field Weakened and run above base speed. Refer to Figure 13 on page 45.

(7) Optional armature voltage feedback sensing not needed with DC contactor if Fuses with Trip Indicator are used (and wired to Inverting Fault input). See Figure 13 on page 45. If regular fuses are used, armature voltage TB can be used for overvoltage fault.

(8) Par 1391 [ContactorControl] = 3 "DC Cntctr" and Par 1392 [Relay Out 1 Sel] = 25 "Contactor". **Important:** Terminal 35 and 36 are on the Control Power / Relay Terminal block, NOT the I/O terminal blocks. See Figure 26 through Figure 28.

(9) Frame C & D drives only require an external power supply for the heatsink cooling fan. See Frame C Heatsink Cooling Fans Power Supply Terminals on page 64 and Frame D Heatsink Cooling Fan Power Supply Terminals on page 65 for more information.

Figure 12 - Power Wiring with DC Output/Dynamic Braking Contactor and a Dynamic Brake



(1) For frame B and C drives only, a jumper is required between terminals SA and SB for 115V AC control input power. See Control Circuit Input Power on page 59 for more information.

(2) An Isolation Transformer and/or 3…5% impedance Line Reactor is required. If the Isolation Transformer provides the required 3…5% impedance, a Line Reactor is not required. See AC Input Line Reactors and AC Input Contactors on page 238 and Isolation Transformers on page 240 for recommendations.

(3) AC input fuses for the armature converter are customer supplied for frame A and B drives and are internally mounted on frame C and D drives. See Drive Power Circuit Protection on page 219 for fuse recommendations.

(4) Par 140 [Digital In8 Sel] set to 31 “Contactor”

(5) If using the +24V internal power supply, terminal 18 (24V common) must be jumpered to terminal 35 (digital input common).

(6) Customer supplied armature output fuses are required on four quadrant and are recommended on two quadrant Frame A and B drives. See Drive Power Circuit Protection on page 219 for fuse recommendations. Fuses with Trip Indicator Switches are recommended for Inverting Fault protection when the motor will be Field Weakened and run above base speed. Refer to Figure 13 on page 45.

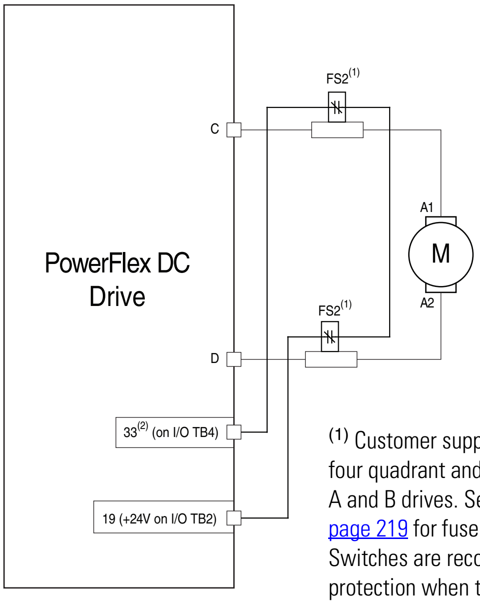
(7) Optional armature voltage feedback sensing not needed with DC contactor if Fuses with Trip Indicator are used (and wired to Inverting Fault input). See Figure 13 on page 45. If regular fuses are used, armature voltage TB can be used for overvoltage fault.

(8) The “Enable” input must be removed in order to perform a dynamic braking stop.

(9) Par 1391 [ContactorControl] = 3 “DC Cntctr” and Par 1392 [Relay Out 1 Sel] = 24 “ContactorDB”. **Important:** Terminal 35 and 36 are on the Control Power / Relay Terminal block, NOT the I/O terminal blocks. See Figure 26 through Figure 28.

(10) Frame C & D drives only require an external power supply for the heatsink cooling fan. See Frame C Heatsink Cooling Fans Power Supply Terminals on page 64 and Frame D Heatsink Cooling Fan Power Supply Terminals on page 65 for more information.

Figure 13 - Power Wiring with Armature Output Fuses and Inverting Fault Status



(1) Customer supplied armature output fuses are required on four quadrant and are recommended on two quadrant Frame A and B drives. See Drive Power Circuit Protection on page 219 for fuse recommendations. Fuses with Trip Indicator Switches are recommended (but optional) for Inverting Fault protection when the motor will be Field Weakened and run above base speed.

(2) Par 139 [Digital In7 Sel] set to 64 “Invert Flt”.

Armature Converter Connections

Terminals	Description
U, V, W	Three phase AC input to the armature converter
C, D	DC output to the motor armature
PE	Safety ground

Table 9 - Armature and Safety Ground (PE) Terminal Specifications

Frame	Drive Current Rating Code[1]				Terminals	Wire Size and Type	Terminal Bolt Size (mm)	Tightening Torque N•m (lb•in)
	230V	460V	575	690				
A	7P0…055	4P1…052	–	–	U, V, W, C, D, PE	See Cable and Wiring Recommendations on page 39	5	6 (53)
	073…110	073…129	–	–			Terminal Block	12 (106)
B	All	All	All	–	U, V, W, C, D		10	25 (221)
					PE		8	15 (132.75)
C	All	All	All	All	U, V, W, C, D		10	25 (221)
					PE		8	15 (132.75)
D	All	All	All	All	U, V, W, C, D, PE		12	45 (398.2)

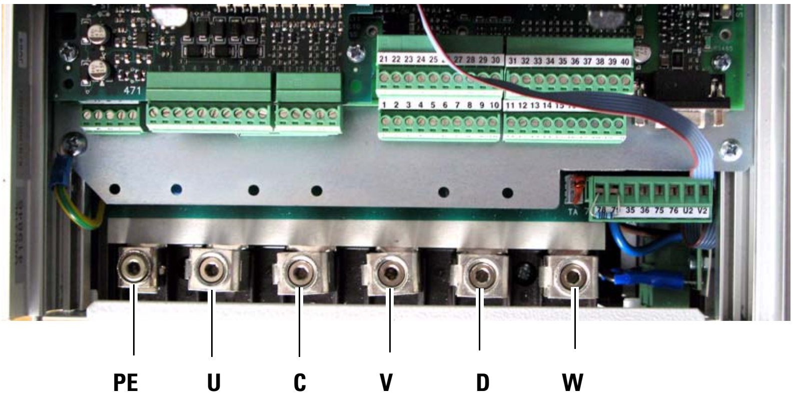
(1) See Standard Drive Catalog Number Explanation on page 15, positions 8, 9 and 10 for corresponding drive HP rating, armature amp rating and field amp rating.

IMPORTANT Certain frame D drives require the use of a terminal adapter kit(s) for terminals U, V, W, C and D. Refer to Terminal Adapter Kits for Frame D Drives on page 249 for details.

Figure 14 - Frame A Armature Converter Terminal Locations

Front View

Note: Front view of drive shown with bottom protective and power terminal covers removed. Refer to Removing the Drive Covers on page 28 for information on removing the drive covers.



ATTENTION: Do not operate the drive with the power terminal cover removed. Operating the drive with the power terminal cover removed may result in a hazardous condition that could cause personal injury and/or equipment damage.

Figure 15 - Frame B Armature Converter Terminal Locations

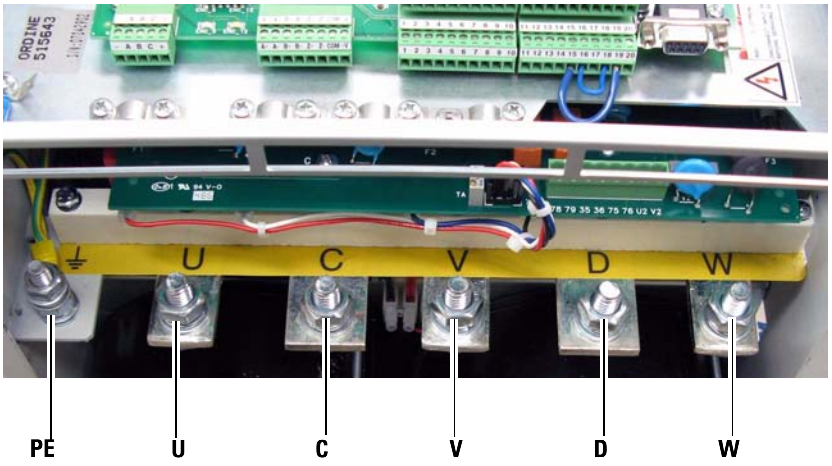
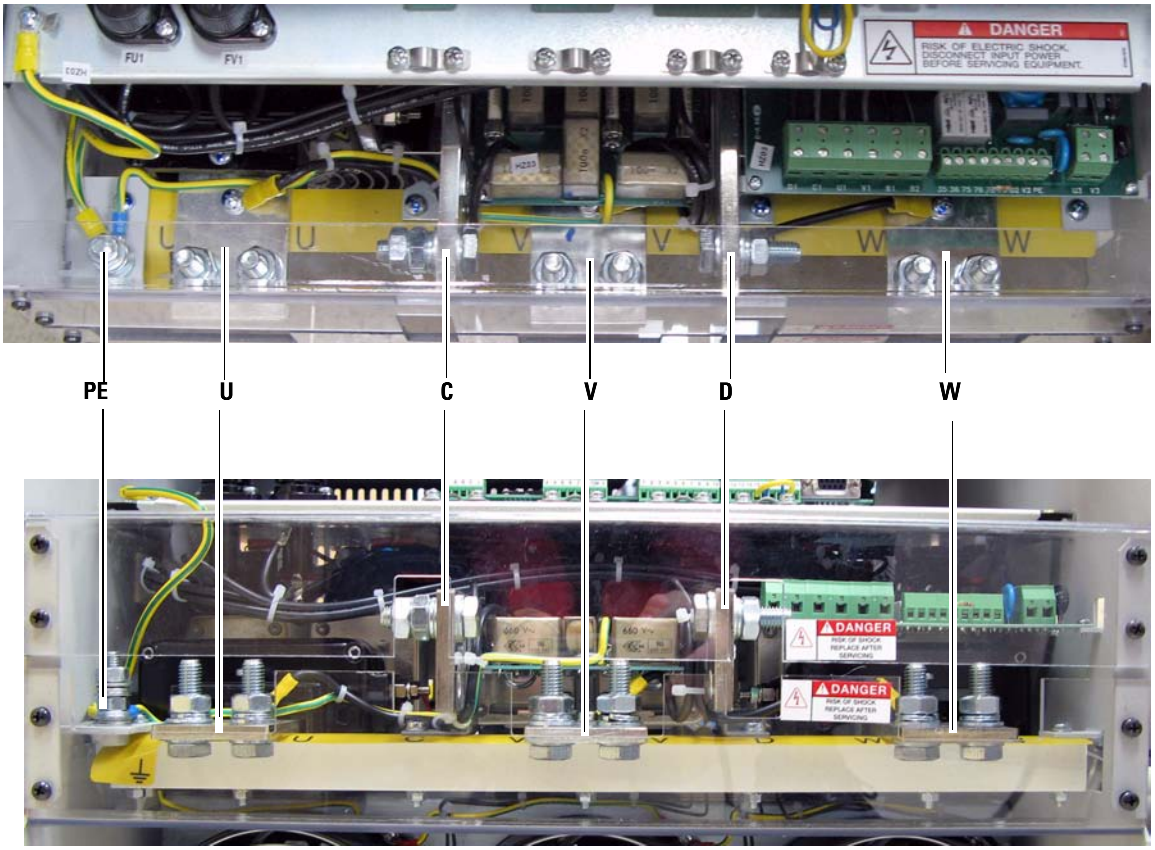


Figure 16 - Frame C Armature Converter Terminal Locations

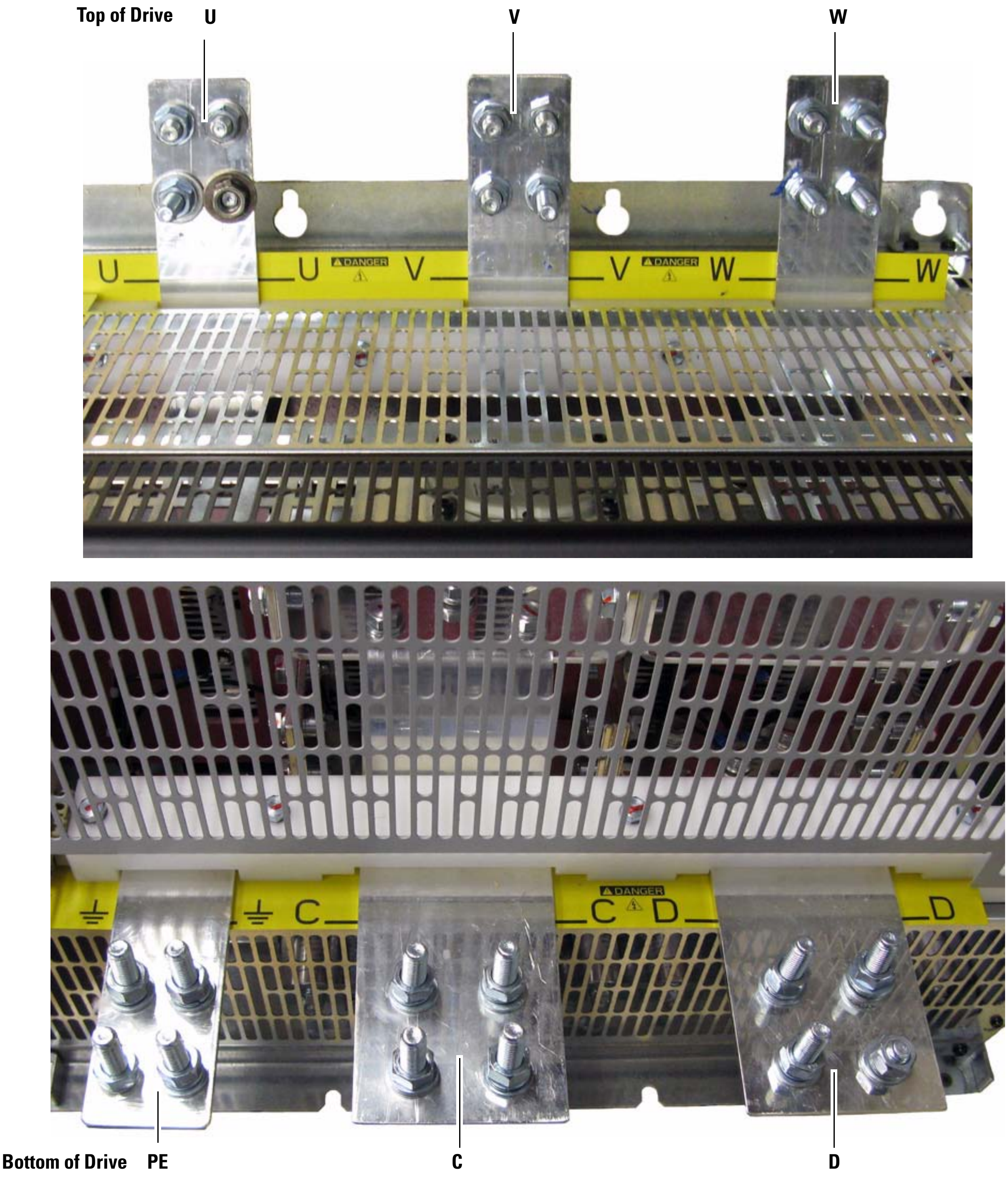
Front View



Bottom View

Figure 17 - Frame D Armature Converter Terminal Locations

Important: Certain frame D drives require the use of a terminal adapter kit(s) for terminals U, V, W, C and D. Refer to Terminal Adapter Kits for Frame D Drives on page 249 for details.



Armature Voltage Feedback Connections

When a DC output contactor or inverting fault breaker/fuse is used with the drive the Armature Voltage Feedback terminals can be used to monitor the armature voltage at the motor regardless of the state of the contactor or inverting fault device. When this terminal block is not connected to the motor armature terminals, the terminals must be jumpered (as described in the table below) and the armature voltage feedback is monitored internally within the drive. In this case, when a DC contactor is used with the drive, a speed feedback device is not used, and the contactor opens, the drive will no longer receive the armature voltage feedback signal.

IMPORTANT By default, these terminals are jumpered - 1A1 to A1 and 1A2 to A2. If these terminals are not wired to the motor terminals, the jumpers must be installed.

Note that this terminal block is not present on drives shipped from the factory prior to those with v3.001 firmware installed. However, new Pulse Transformer boards shipped as replacement parts from the factory will contain this terminal block and can be used with any version of firmware.

Table 10 - Armature Voltage Feedback Terminal Jumper Positions

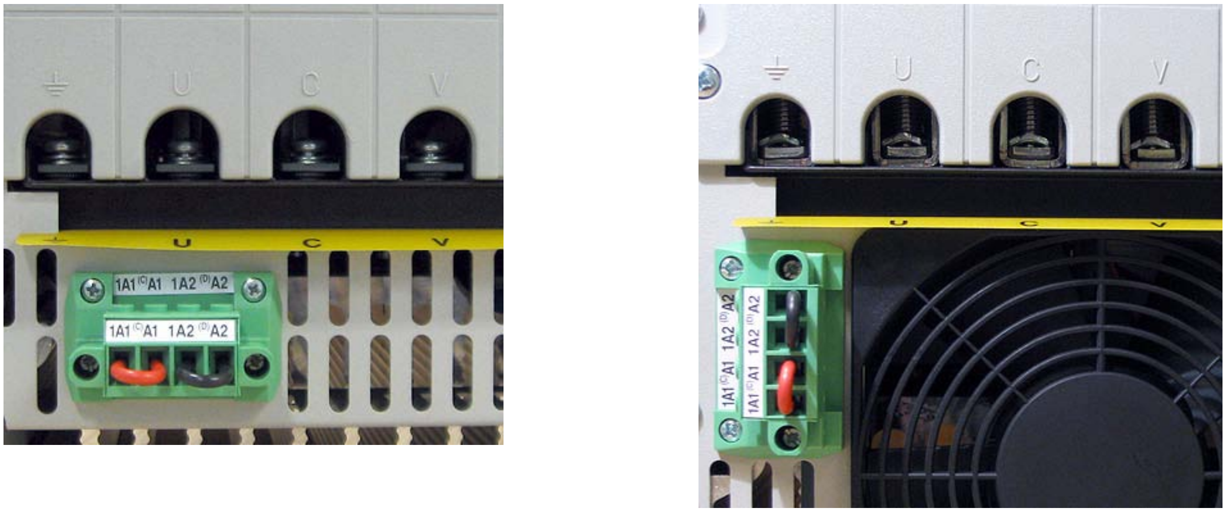
Terminals	Description
1A1	Jumpered to A1 when internal armature voltage feedback is used. Not used when A1 is connected to motor terminal A1.
A1	Voltage feedback from motor terminal A1.
1A2	Jumpered to A2 when internal armature voltage feedback is used. Not used when A2 is connected to motor terminal A2.
A2	Voltage feedback from motor terminal A2.

Table 11 - Armature Voltage Feedback Circuit Wire Sizes and Terminal Specifications

Frame	Terminals	Wire Size and Type[1]	Tightening Torque N•m (lb•in)
A, B & C	1A1, A1, 1A2, A2	24…10 AWG/kcmils	0.5…0.6 (4.4…5.3)
D		22…8 AWG/kcmils	0.8…1.6 (7.1…14.2)

(1) Wire with an insulation rating of 600V or greater is recommended. See Cable and Wiring Recommendations on page 39 for cable spacing information.

Figure 18 - Frame A Armature Voltage Feedback Circuit Terminal Block Location



Bottom of View of Drives

Drive with no fan

Drive with fan

Shown with terminals jumpered for internal armature voltage feedback.

Figure 19 - Frame B Armature Voltage Feedback Circuit Terminal Block Location

Top of Drive

Shown with terminals jumpered for internal armature voltage feedback.

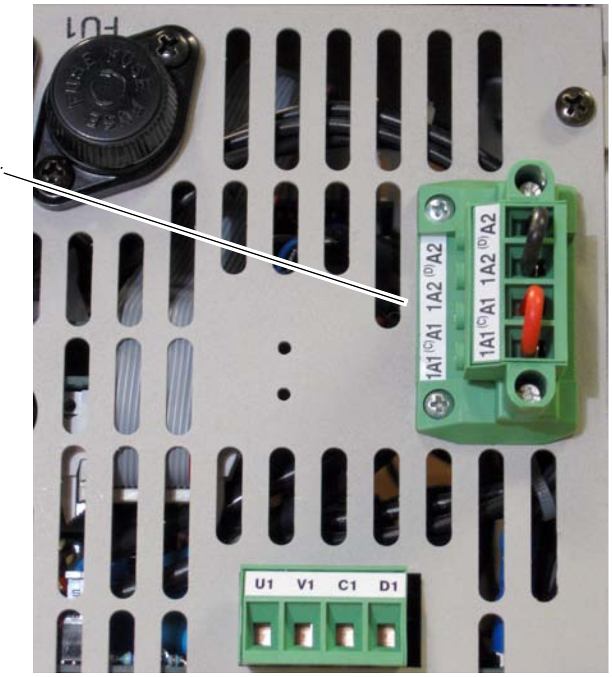
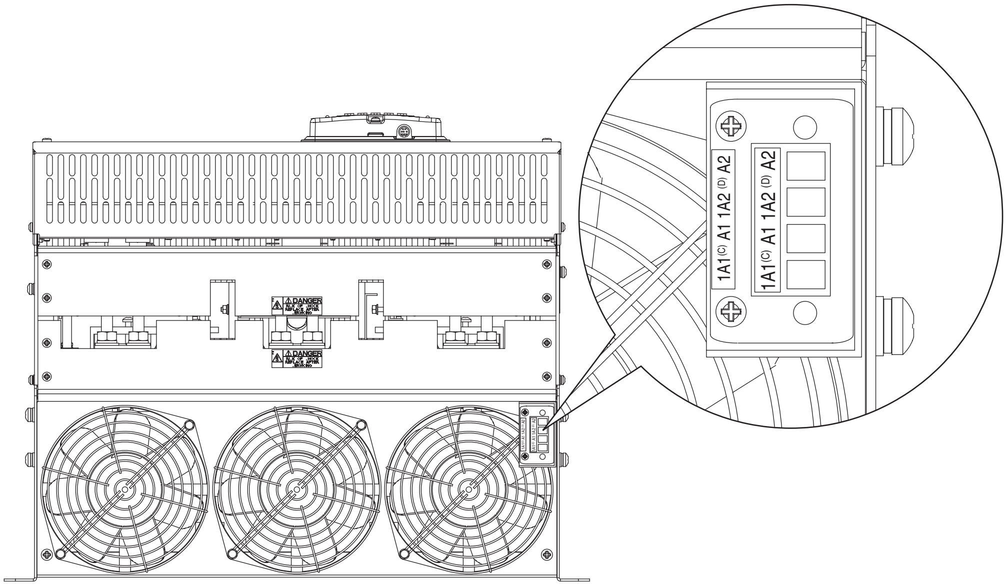
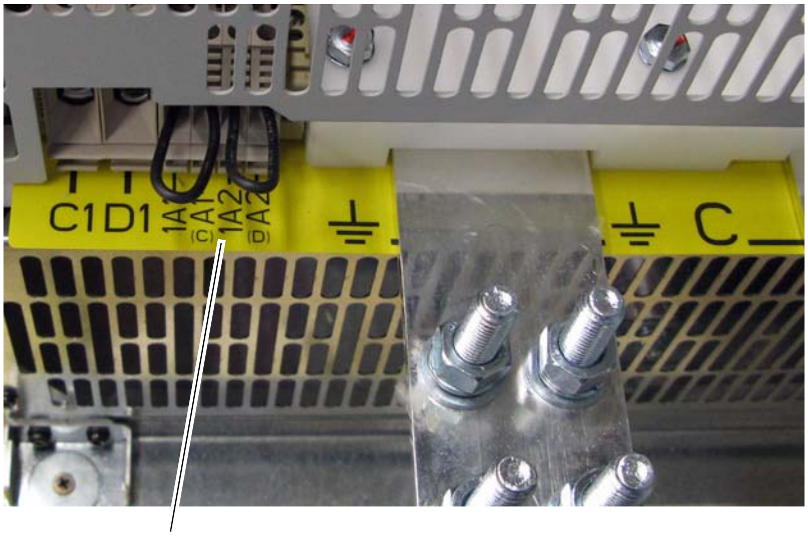


Figure 20 - Frame C Armature Voltage Feedback Circuit Terminal Block Location



Bottom of Drive

Figure 21 - Frame D Armature Voltage Feedback Circuit Terminal Block Location



Shown with terminals jumpered for internal armature voltage feedback.

Bottom of Drive, Left Side

Field Circuit Connections

Terminals	Description
U1, V1	Single phase AC input to the field circuit
C1, D1	DC output to the motor field

Table 12 - Frames A…C Field Circuit Wire Sizes and Terminal Specifications

Terminals	Wire Size and Type[1]	Tightening Torque N•m (lb•in)
U1, V1, C1, D1	24…10 AWG/kcmils	0.5…0.8 (4.4…7.1)

(1) See Cable and Wiring Recommendations on page 39 for more information.

Table 13 - Frame D Field Circuit Wire Sizes and Terminal Specifications

Drive Current Rating Code[1]				Terminals	Wire Size[2]	Tightening Torque N•m (lb•in)
230V	460V	575V	690V			
875	830	810	678	U1, V1, C1, D1	6 AWG	4.0 (35.4)
1K0	996	1K0	791			
–	–	1K2	904			
–	–	1K3	1K0			
–	–	1K6	–			
–	1K1	–	1K1		2 AWG	
–	1K3	–	1K2			
–	1K4	–	1K4			
–	–	–	1K5			

(1) See Standard Drive Catalog Number Explanation on page 15, positions 8, 9 and 10 for corresponding drive HP rating, armature amp rating and field amp rating.

(2) See Cable and Wiring Recommendations on page 39 for more information on wire types.

Figure 22 - Frame A Field Circuit Terminal Block Location

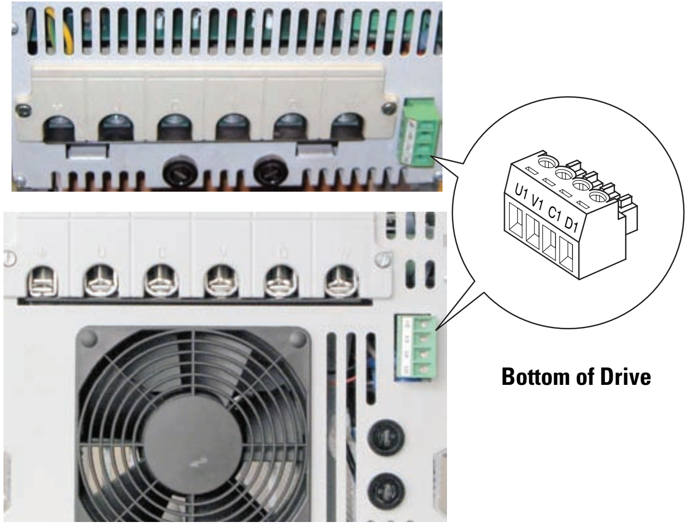
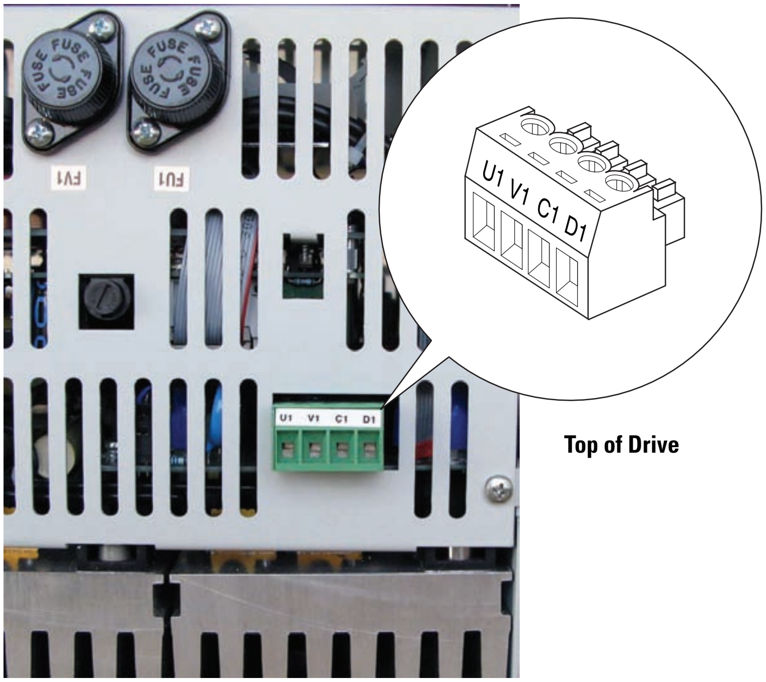
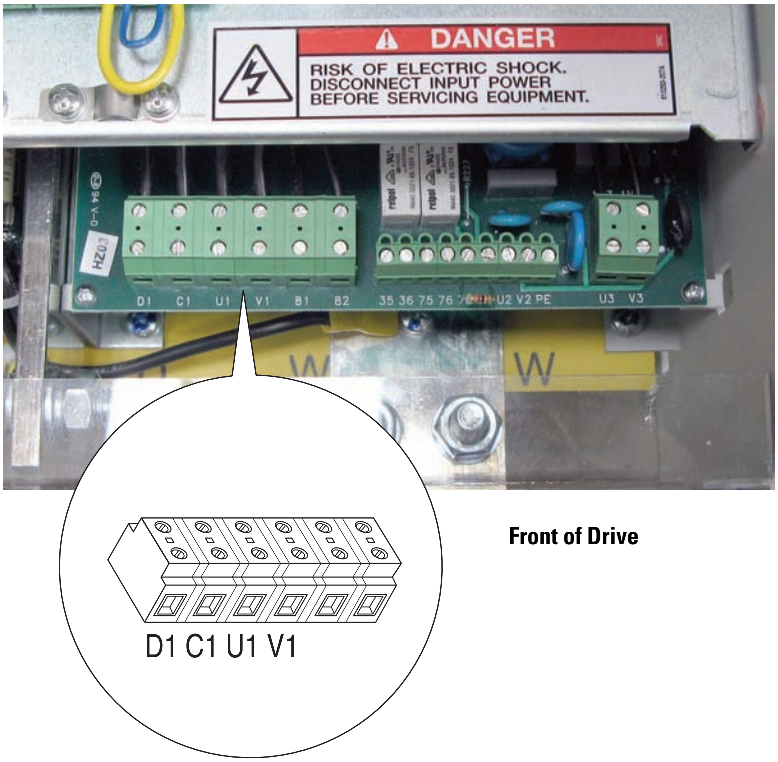


Figure 23 - Frame B Field Circuit Terminal Block Location



Top of Drive

Figure 24 - Frame C Field Circuit Terminal Block Location



Front of Drive

Figure 25 - Frame D Field Circuit Terminal Block Location

Top of Drive

AC input for field is at top of fuse holder (marked FU1, FV1)

Shown with control cover removed. Remove control cover to access terminals.

Bottom of Drive, Left Side

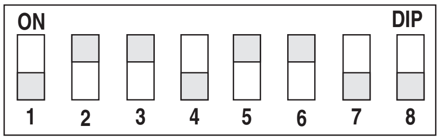
Field Current Configuration

The drive's control circuit board is factory set to the minimum field current rating based on the drive size. The setting of DIP switch S14 must be changed to be ≥ the rated field current specified on the motor nameplate or possible motor damage may result. In addition, the value selected with switch S14 must be entered in parameter 374 [Drv Fld Brdg Cur] in the control software when the drive is commissioned (refer to Drive Start Up on page 83.)

ATTENTION: DIP switch S14 must be set to be ≥ the rated field current specified on the motor nameplate or possible motor damage may result.

Compare the field current value of the motor to the rated value of the internal field converter of the drive and set switch S14 to the equivalent or next higher value. The rating of the Drive Field Supply is found on Drive Data Nameplate. Be sure to match your desired Field Current scale with the appropriate value in the Field Supply column in Table 14 below and Table 15 on page 56.

Note: The configuration of switch S14 is not required if the motor's field control is provided via an external source, however, it is recommended that the switch settings be completed as described above.



Note: Illustration is an example configuration only. DIP switch S14 must be set ≥ the rated field current specified on the motor nameplate or possible motor damage may result.

Table 14 - Frames A, B and C DIP Switch S14 Field Current Configuration Settings

Switch ohms:		**168.5**	**333.3**	**182**	**36.4**	**845**	**1668**	**3333**	**–**	**Equivalent Resistance**
Field Current Scale	**Field Supply**	**S14-1**	**S14-2**	**S14-3**	**S14-4**	**S14-5**	**S14-6**	**S14-7**	**S14-8**	**Ohm**
1 A	10 A	OFF	OFF	OFF	OFF	OFF	ON	Not used (OFF)		1668
2 A		OFF	OFF	OFF	OFF	ON	OFF			845
3 A		OFF	OFF	OFF	OFF	ON	ON			560.9
5 A		OFF	ON	OFF	OFF	OFF	OFF			333.3
10 A		ON	OFF	OFF	OFF	OFF	OFF			168.5
13 A	14 A	ON	OFF	OFF	OFF	ON	ON			129.6
17 A	20 A	OFF	ON	ON	OFF	ON	ON			97.3
20 A		ON	OFF	ON	OFF	OFF	ON			83.1

Table 15 - Frame D and Stand-Alone Regulator DIP Switch S14 Field Current Configuration Settings

Switch ohms:		**168.5**	**333.3**	**182**	**36.4**	**845**	**1668**	**3333**	**–**	**Equivalent Resistance**
Field Current Scale	**Field Supply**	**S14-1**	**S14-2**	**S14-3**	**S14-4**	**S14-5**	**S14-6**	**S14-7**	**S14-8**	**Ohm**
1 A	40 A	OFF	OFF	OFF	OFF	OFF	OFF	ON	Not used (OFF)	3333
2 A		OFF	OFF	OFF	OFF	OFF	ON	OFF		1668
4 A		OFF	OFF	OFF	OFF	ON	OFF	OFF		845
6 A		OFF	OFF	OFF	OFF	ON	ON	OFF		560.9
10 A		OFF	ON	OFF	OFF	OFF	OFF	OFF		333.3
20 A		ON	OFF	OFF	OFF	OFF	OFF	OFF		168.5
30 A		ON	ON	OFF	OFF	OFF	OFF	OFF		111.9
40 A		ON	OFF	ON	OFF	OFF	ON	OFF		83.1
1 A	70 A	OFF	OFF	OFF	OFF	OFF	ON	OFF	Not used (OFF)	1668
5 A		OFF	ON	OFF	OFF	OFF	OFF	OFF		333.3
10 A		ON	OFF	OFF	OFF	OFF	OFF	OFF		168.5
20 A		ON	OFF	ON	OFF	OFF	ON	OFF		83.1
50 A		OFF	ON	OFF	ON	OFF	OFF	OFF		32.8
70 A		ON	ON	ON	ON	OFF	OFF	OFF		23.9

Relay Outputs

Terminals 35 and 36 and 75 and 76 are N.O. relay outputs. The relay output between terminals 35 and 36 is configured with parameter 1392 [Relay Out 1 Sel]. The relay output between terminals 75 and 76 is configured with parameter 629 [Relay Out 2 Sel]. See Using Contactors on page 31 for more information.

Terminals	**Description**	**Maximum Voltage**	**Maximum Current**
35, 36	Normally open contact. Configured with parameter 1392 [Relay Out 1 Sel] - set to 25 "Contactor" by default.	250V AC	1 A
75, 76	Normally open contact. Configured with parameter 629 [Relay Out 2 Sel] - set to 5 "Ready" by default.		
78, 79	Motor thermistor (PTC) or thermal switch connections		

Thermistors and Thermal Switches

To detect motor overheating and protect the motor from overloading, an external, user-supplied thermistor (PTC) or thermal switch must be connected to terminals 78 and 79. The drive's response to a motor over temperature fault is configured in parameter 365 [OverTemp Flt Cfg]. If a thermistor or thermal switch is not used, a 1k ohm resistor must be connected between terminals 78 and 79 (installed at the factory). Follow the appropriate instructions below when installing a thermal sensor.

Thermistors (PTC)

PTC thermistors fitted in the motor can be connected directly to the drive via terminals 78 and 79. In this case the 1k ohm resistor is not required between terminals 78 and 79.

Thermal Switches (Klixon®) in the Motor Windings

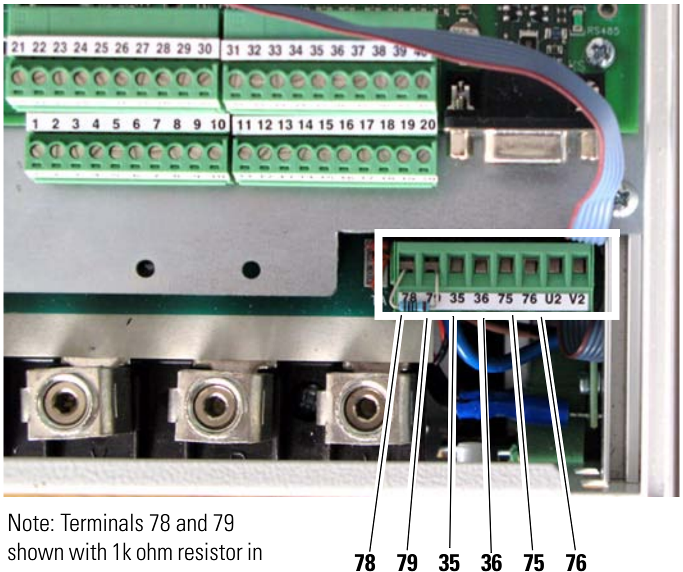
"Klixon" type temperature-dependent contacts can disconnect the drive from the motor via an external control or can be configured as an external fault using a digital input on drive. They can also be connected to terminals 78 and 79 in order to indicate a drive "Motor Over Temp" fault (F16), though this is not recommended due to the noise sensitivity of the current threshold circuitry. If a thermal switch is used a 1k ohm resistor must be placed in series between the switch and one of the terminals.

Table 16 - Relay Outputs and Thermistor/Thermal Switch Wire Sizes and Specifications

Signal Type	Terminals	Wire Size and Type[1]			Tightening Torque N•m (lb•in)
		Flexible (mm^2)	Multi-core (mm^2)	AWG	
Relay Outputs	35 & 36, 75 & 76	0.140…1.500	0.140…1.500	26…14	0.5 (4.4)
Thermistor and Thermal Switches	78 & 79				

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 26 - Frame A Relay and Thermistor/Thermal Switch Terminal Block Locations



Note: Terminals 78 and 79 shown with 1k ohm resistor in place of temperature sensor.

Figure 27 - Frame B Relay and Thermistor/Thermal Switch Terminal Block Locations

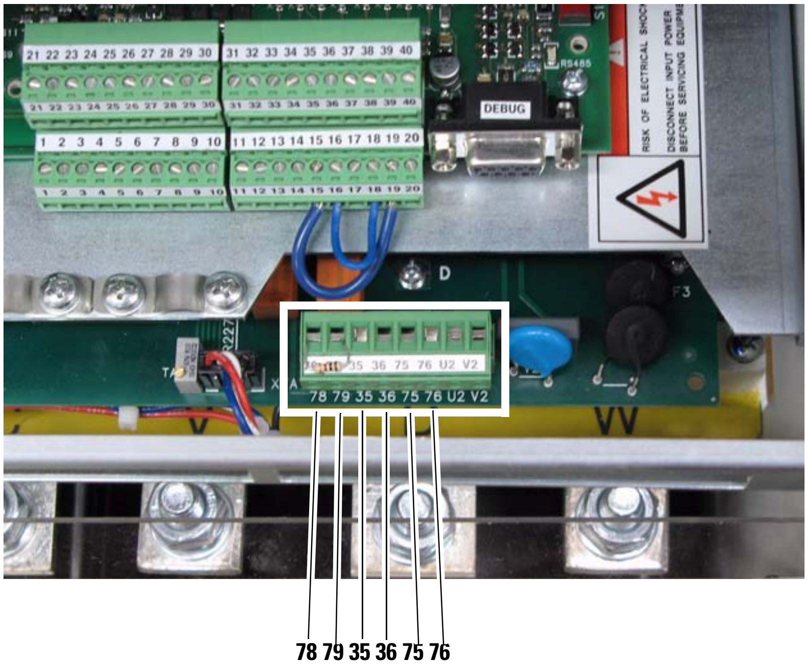


Figure 28 - Frame C Relay and Thermistor/Thermal Switch Terminal Block Locations

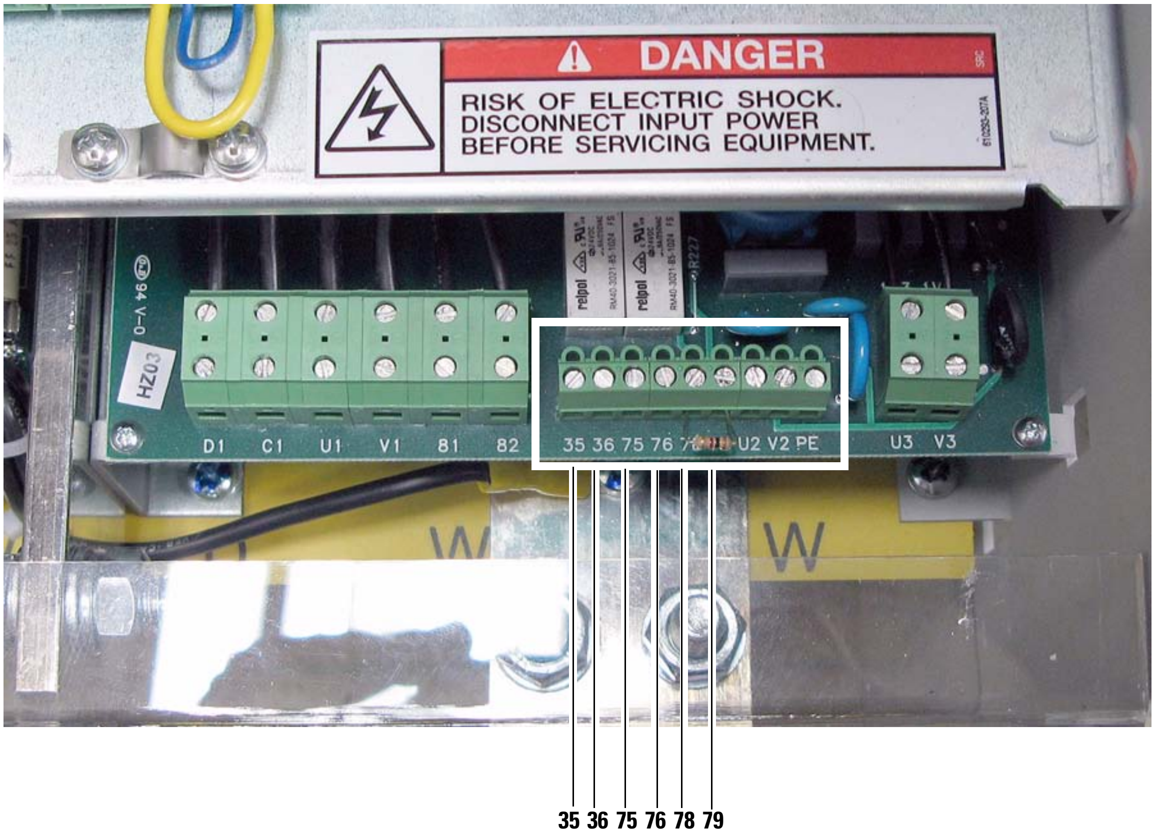
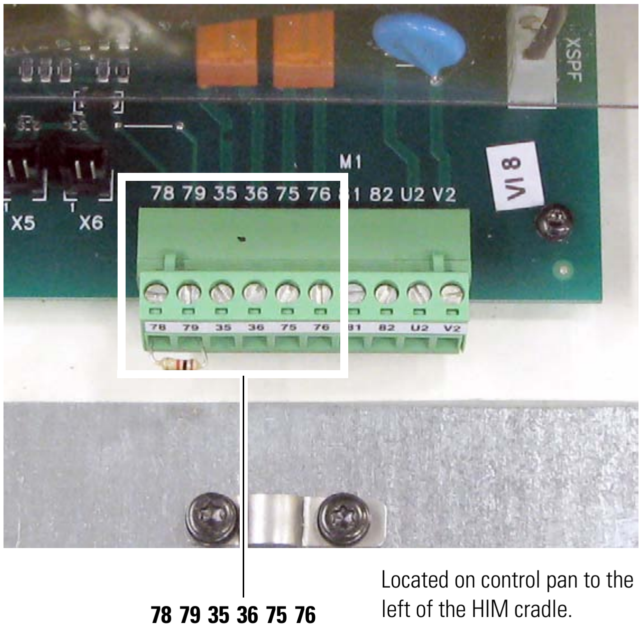


Figure 29 - Frame D Relay and Thermistor/Thermal Switch Terminal Block Locations



Located on control pan to the left of the HIM cradle.

Control Circuit Input Power

The control circuit must be powered by an external 230V AC or 115V AC single phase power supply. For frame B and C drives only, a jumper is required between terminals SA and SB for 115V AC control input power. For frame B drive SA-SB terminal block location, refer to Figure 34 on page 62. For frame C drive SA-SB terminal block location, refer to Figure 35 on page 63.

Terminals	Description
U2, V2	Single phase AC power for the control circuits
PE	Safety ground (on frame C drive terminal blocks only)

Table 17 - Control Circuit Wire Sizes and Terminal Specifications

Terminals	Wire Size and Type[1] Flexible (mm²)	Multi-core (mm²)	AWG	Tightening Torque N•m (lb•in)
U2, V2	0.14…1.5	0.14…2.5	26…14	0.5 (4.4)
PE	2.5…10	2.5…10	12…8	2.0 (18.0)

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 30 - Frame A Control Circuit Terminal Block Location

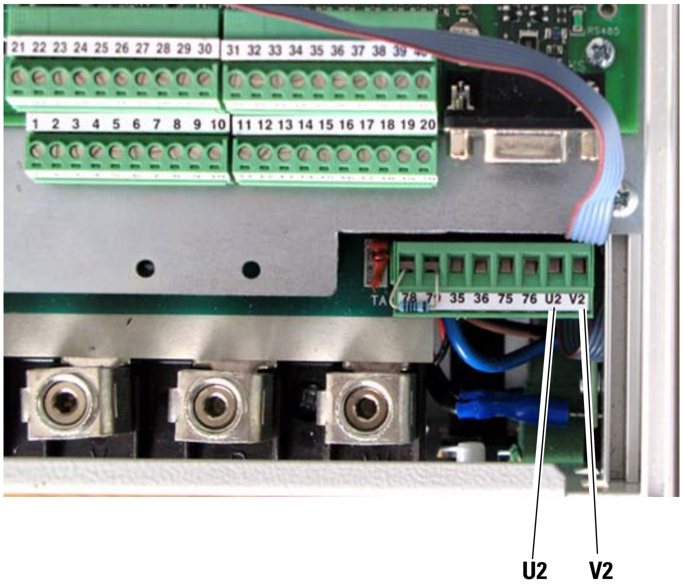


Figure 31 - Frame B Control Circuit Terminal Block Location

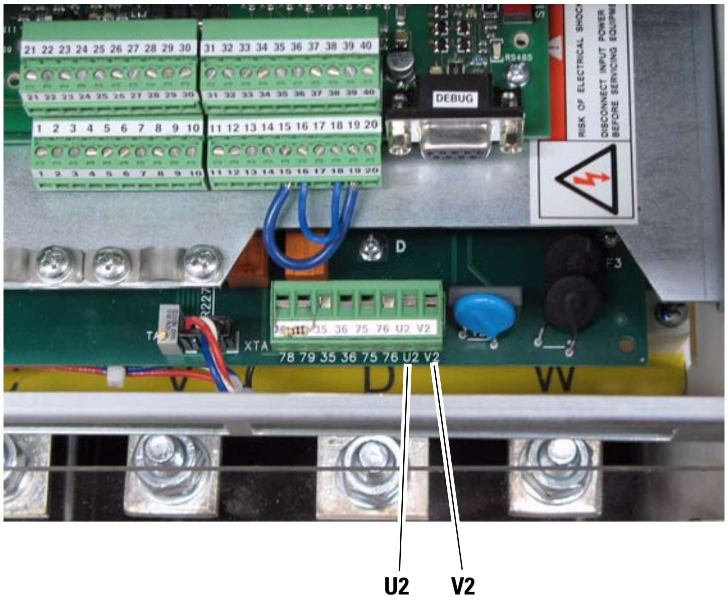


Figure 32 - Frame C Control Circuit Terminal Block Location

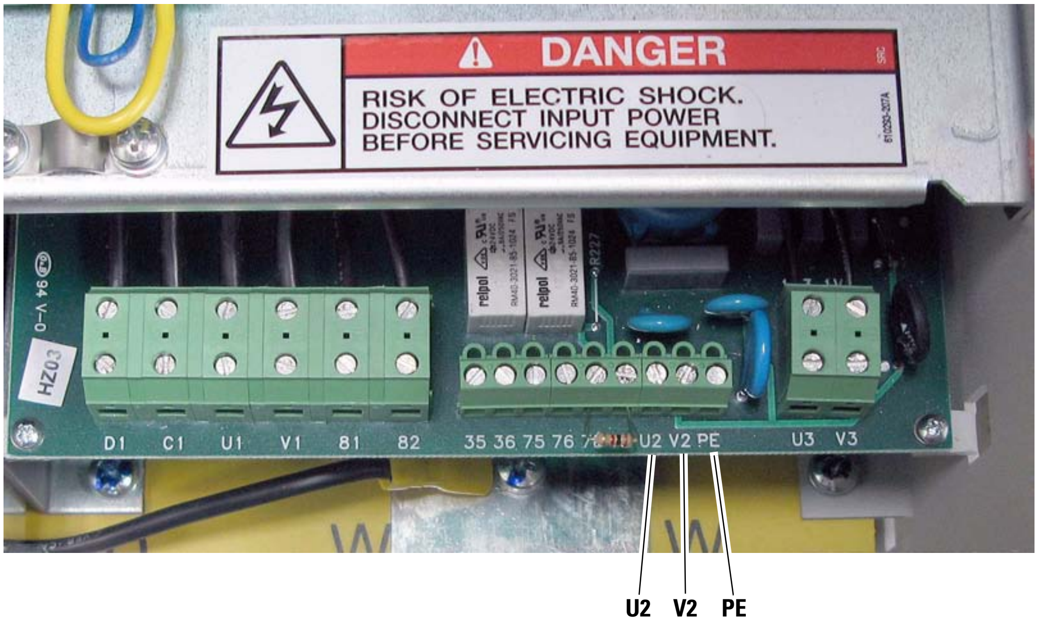


Figure 33 - Frame D Control Circuit Terminal Block Location

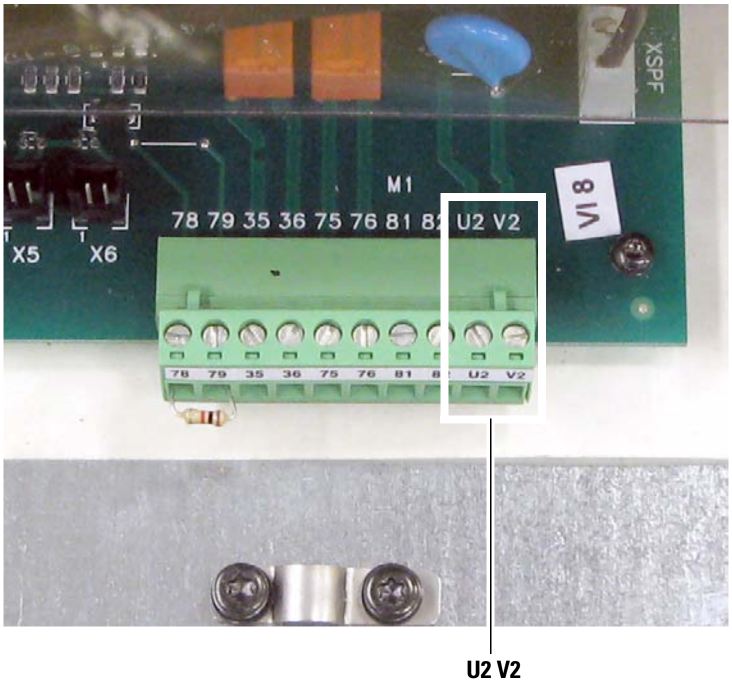
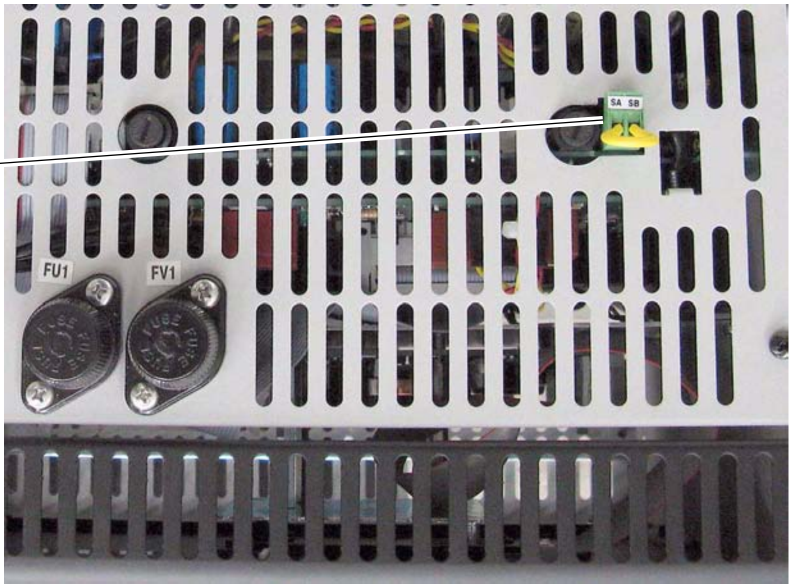


Figure 34 - SA-SB Terminal Block Location on Frame B Drives

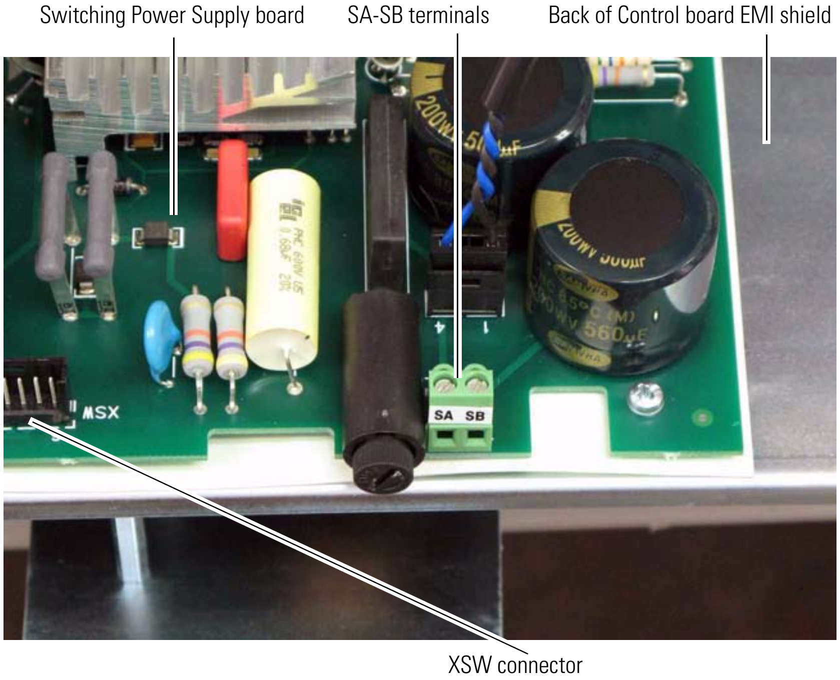


The SA-SB terminal block is located at the top of the drive.

Front of Drive

Figure 35 - SA-SB Terminal Block Location on Frame C Drives

The SA-SB terminal block is located on the Switching Power Supply circuit board on the back of the Control board EMI Shield.

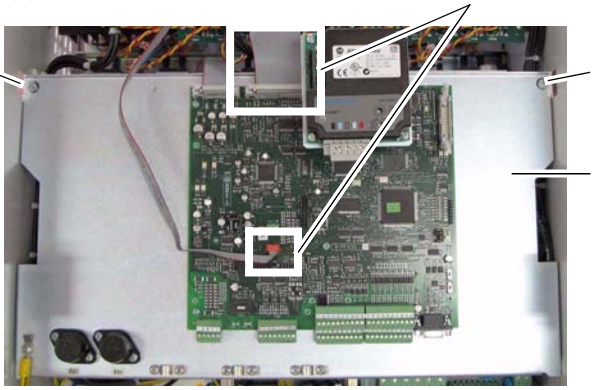


To access the SA-SB terminal block:

1. Remove the top protective cover from the drive.

2. Disconnect cables XFCD and XR.

3. Loosen captive screws.



3. Loosen captive screws.

4. Lower Control board EMI shield and disconnect cable XSW from Switching Power Supply board (see above).

Frame C Heatsink Cooling Fans Power Supply Terminals

Frame C drives require an external 230V AC power supply for the heatsink cooling fans. The power supply connections must be taken from the primary side of the installed Isolation Transformer or Line Reactor (clean power). Refer to Typical Power Wiring Diagrams on page 41.

In addition, the fan power input terminals U3 and V3 are required to be short circuit protected. This protection can be provided by using a circuit breaker. The circuit breaker must be selected to survive the short circuit available current of the feeder source for this circuit and the inrush current of the fan.

The rating of the circuit breaker should be sized mainly to protect the wiring from the circuit breaker connections to terminals U3 and V3, and not nuisance trip or blow from the inrush current.

Table 18 - Frame C Heatsink Cooling Fans Terminal Designations

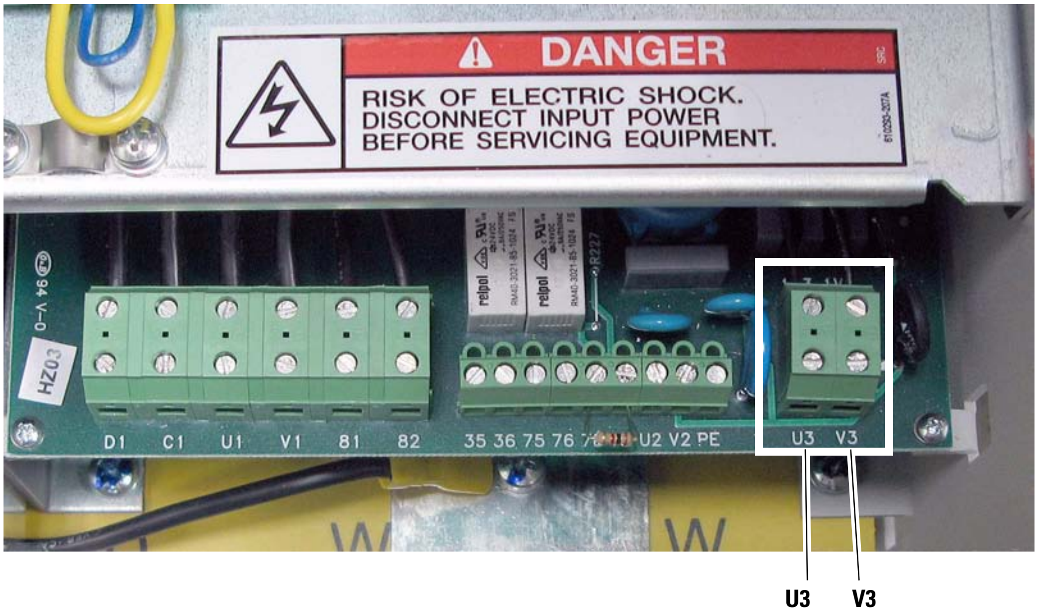
Terminal	Description	Maximum Voltage	Maximum Current
U3	Single-phase AC input power for cooling fans.	230V AC	1 A
V3			

Table 19 - Frame C Heatsink Cooling Fans Wire Sizes and Terminal Specifications

	Wire Size and Type[1]			
Terminals	Flexible (mm^2)	Multi-core (mm^2)	AWG	Tightening Torque N•m (lb•in)
U3, V3	0.14…1.5	0.14…2.5	26…16	0.4 (3.5)

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 36 - Frame C Heatsink Cooling Fan Terminal Block Location



Frame D Heatsink Cooling Fan Power Supply Terminals

Frame D drives require an external 230V AC power supply for the heatsink cooling fan. The power supply connections must be taken from the primary side of the installed Isolation Transformer or Line Reactor (clean power). Refer to Typical Power Wiring Diagrams on page 41.

The fan power input terminals U3 and V3 are required to be short circuit protected. This protection can be provided by using a circuit breaker. The circuit breaker must be selected to survive the short circuit available current of the feeder source for this circuit and the inrush current of the fan.

The rating of the circuit breaker should be sized mainly to protect the wiring from the circuit breaker connections to terminals U3 and V3, and not nuisance trip or blow from the inrush current.

In addition, a N.C. contact (at terminals 31 and 32) can be connected to an external device to provide indication of a fan supply failure or can be wired to drive digital input terminals configured for 14 “Aux Fault” (via Pars133…144).

Table 20 - Frame D Heatsink Cooling Fan Terminal Designations

Terminal	Description	Maximum Voltage	Maximum Current
U3	Single-phase AC input power for cooling fans.	230V AC	2.4…3.3 A (50/60 Hz)
V3			
31	Normally closed contact.	250V AC	1 A
32			
PE	Safety ground		

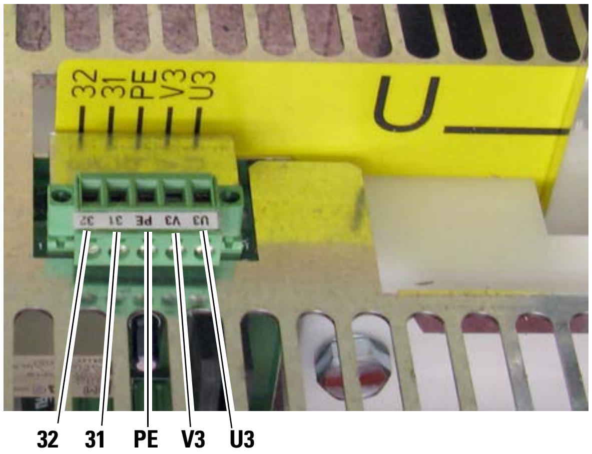
Table 21 - Frame D Heatsink Cooling Fan Signal Wire Sizes and Terminal Specifications

Terminals	Wire Size and Type[1]			Tightening Torque N•m (lb•in)
	Flexible (mm^2)	Multi-core (mm^2)	AWG	
U3, V3, 31, 32, PE	0.14…1.5	0.14…2.5	28…12	0.5…0.6 (4.4…5.3)

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 37 - Frame D Heatsink Cooling Fan Terminal Block Location

Top of Drive, Left Side



Frame C and D Armature Fuse Signal Terminals

Terminals 81 and 82 on frame C and D drives are connected to the internal armature circuit protection fuses and can be connected to an external device to provide indication that the fuses have opened. Alternatively, terminals 81 and 82 can be wired to drive digital input terminals configured for 64 “Invert Flt” (via Pars 133…144).

Table 22 - Armature Fuse Signal Terminal Designations

Terminal	Description	Maximum Voltage	Maximum Current
81	Internal armature fuse intervention signal.	250V AC	1 A
82			

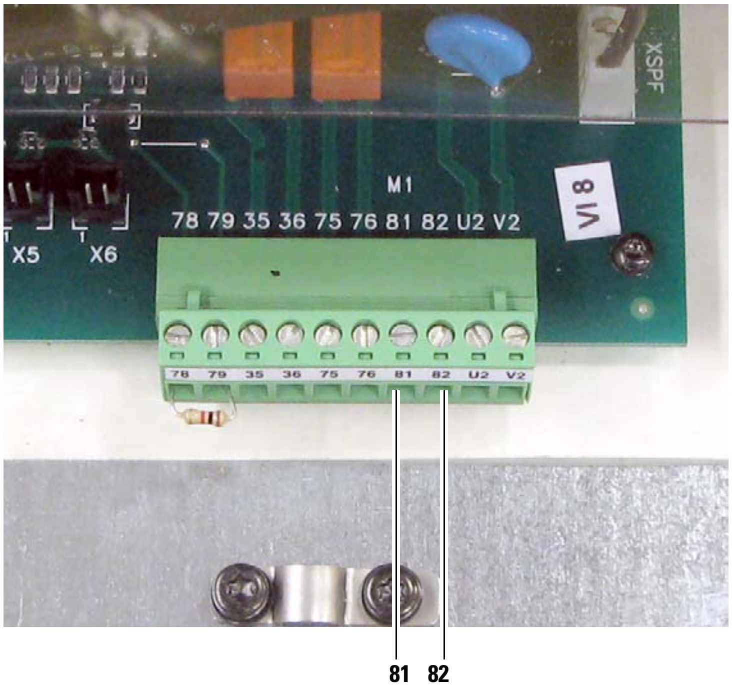
Table 23 - Armature Fuse Signal Wire Size and Terminal Specifications

Terminals	Wire Size and Type[1]			Tightening Torque N•m (lb•in)
	Flexible (mm^2)	Multi-core (mm^2)	AWG	
81, 82	0.14…1.5	0.14…2.5	26…16	0.4 (3.5)

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 38 - Frame C Internal Armature Fuse Signal Terminal Block Location

Figure 39 - Frame D Internal Armature Fuse Signal Terminal Block Location



DIP Switch and Jumper Settings

DIP switches and jumpers on the Control circuit board are used to configure the drive for flashing firmware to the control board EEPROM, the appropriate speed feedback device settings, analog input signals and minimum field current.

Refer to Table 24 on page 69 for descriptions corresponding to the ID numbers shown below.

Figure 40 - Control Circuit Board DIP Switch and Jumper Locations

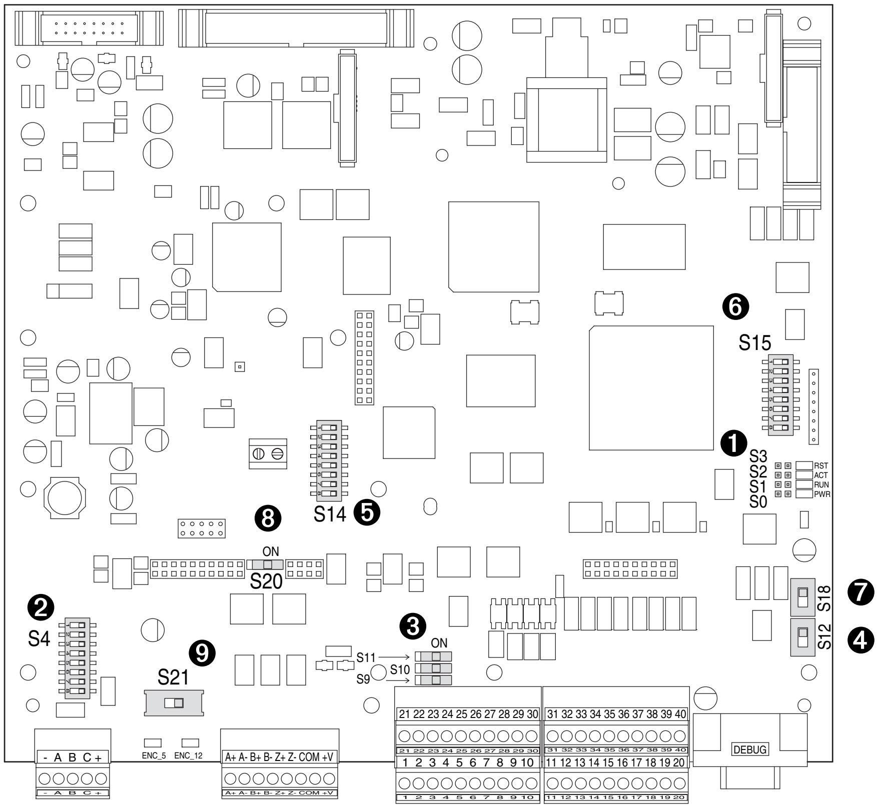
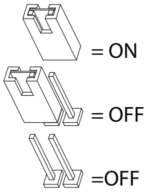
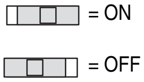
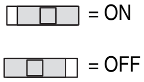
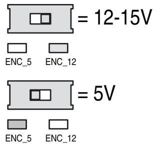


Table 24 - Control Circuit Board Jumper and DIP Switch Settings

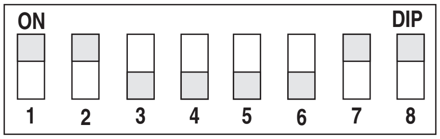
ID	Jumper/ Switch	Function	Factory Default	Example
❶	S0	For factory boot flashing only. Leave set to the factory setting. Jumper On Firmware boot Jumper Off Normal function	Jumper Off	
	S1	For factory boot flashing only. Leave set to the factory setting. Jumper On Write firmware boot code Jumper Off Boot code on flash is protected	Jumper Off	
	S2	Not used. Leave set to the factory setting.	Jumper Off	
	S3	For factory boot flashing only. Leave set to the factory setting. Jumper On Reset Jumper Off Normal function	Jumper Off	
❷	S4	Configures the input voltage of the DC analog tachometer. Refer to Table 25 on page 70 for configuration.	90V	–
❸	S9	Configures the input signal of Analog Input 1 (terminals 1 and 2): Off Position 0…20 mA / 4…20 mA On Position 0…10V / ±10V Note: The input signal type must also be programmed accordingly using Par 71 [Anlg In1 Config].	On	
	S10	Configures the input signal of Analog Input 2 (terminal 3 and 4): Off Position 0…20 mA / 4…20 mA On Position 0…10V / ±10V Note: The input signal type must also be programmed accordingly using Par 76 [Anlg In2 Config].	On	
	S11	Configures the input signal of Analog Input 3 (terminals 5 and 6): Off Position 0…20 mA / 4…20 mA On Position 0…10V / ±10V Note: The input signal type must also be programmed accordingly using Par 81 [Anlg In3 Config].	On	
❹	S12	Not used. Leave set to the factory setting.	Off	–
❺	S14	Field current resistors setting, see Field Current Configuration on page 55. The value selected with switch S14 must be entered in Par 374 [Drv Fld Brdg Cur] when the drive is commissioned.	Minimum field current rating based on drive size.	–
❻	S15	Configuration of the control circuit board to the appropriate drive size. Leave set to the factory setting, unless the control board has been supplied as a spare part. Refer to DIP Switch S15 Settings on page 70 for switch configuration based on drive current rating code.	Armature current based on drive size.	–
❼	S18	Not used. Leave set to the factory setting.	Off	–
❽	S20	Monitoring of the Z channel of the Digital Encoder on connector XE2: Off Position Z channel monitored On Position Z channel not monitored The S20 setting should match the value selected in Par 911 [Z Channel Enable] (For example, If S20 = "Off", then Par 911 = 1 "Enabled").	On	
❾	S21	Encoder power supply voltage and input selection: This switch setting determines both the power supply (input) and feedback level (output) voltage of the connected encoder. Note: When control power is supplied to the drive, the appropriate LED lights to indicate the selection of the switch. ENC_5 +5 V encoder (+2.5…5.4V input range) ENC_12 +12…15 V encoder (+5.4V…15.2V input range)	12-15 V	

DIP Switch S4 Settings

ATTENTION: The drive can overspeed if DIP switch S4 is set incorrectly or the tachometer is wired incorrectly. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

DIP switch S4 must be configured to be greater than or equal to the maximum DC input voltage. Maximum DC Input Voltage = (Tach Volts/1000 rpm) x Par 45 [Max Ref Speed] x 1.1. See Drive Reference and Feedback Scaling on page 265 for details on programming speed feedback values.

Figure 41 - DC Analog Tachometer DIP Switch S4 Example



Note: The illustration depicts the DIP switch settings for 90V (factory default).

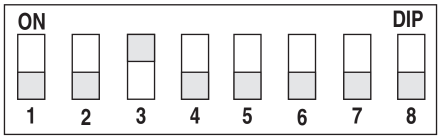
Table 25 - DC Analog Tachometer DIP Switch S4 Configuration

Maximum DC Input Voltage	S4-1 S4-8	S4-2 S4-7	S4-3 S4-6	S4-4 S4-5
22V	ON	ON	ON	ON
45V	ON	ON	ON	OFF
90V	ON	ON	OFF	OFF
180V	ON	OFF	OFF	OFF
300V	OFF	OFF	OFF	OFF

DIP Switch S15 Settings

DIP Switch S15 is configured for the appropriate drive size at the factory. Do not change the settings unless you are installing a replacement Control board.

Figure 42 - Drive Size DIP Switch S15 Example



Note: Illustration for example only.

Table 26 - Drives with 230V Input - DIP Switch S15 Configuration

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
A	7P0	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	9P0	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
	012	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
	020	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	029	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
	038	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
	055	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
	073	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
	093	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
	110	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
B	146	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
	180	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
	218	ON	OFF	ON	ON	OFF	OFF	OFF	OFF
	265	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
	360	ON	ON	ON	ON	OFF	OFF	OFF	OFF
	434	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
C	521	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
	700	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
D	875	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
	1K0	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF

Table 27 - Drives with 460V Input - DIP Switch S15 Configuration

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
A	4P1	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
	6P0	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
	010	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF
	014	ON	ON	OFF	OFF	OFF	OFF	ON	OFF
	019	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
	027	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
	035	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
	045	ON	ON	ON	OFF	OFF	OFF	ON	OFF
	052	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
	073	ON	OFF	OFF	ON	OFF	OFF	ON	OFF
	086	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
	100	ON	ON	OFF	ON	OFF	OFF	ON	OFF
	129	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
B	167	ON	OFF	ON	ON	OFF	OFF	ON	OFF
	207	OFF	ON	ON	ON	OFF	OFF	ON	OFF
	250	ON	ON	ON	ON	OFF	OFF	ON	OFF
	330	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF
	412	ON	OFF	OFF	OFF	ON	OFF	ON	OFF
C	495	OFF	ON	OFF	OFF	ON	OFF	ON	OFF
	667	ON	ON	OFF	OFF	ON	OFF	ON	OFF
D	830	OFF	OFF	ON	OFF	ON	OFF	ON	OFF
	996	ON	OFF	ON	OFF	ON	OFF	ON	OFF
	1K1	OFF	ON	ON	OFF	ON	OFF	ON	OFF
	1K3	ON	ON	ON	OFF	ON	OFF	ON	OFF
	1K4	OFF	OFF	OFF	ON	ON	OFF	ON	OFF

Table 28 - Drives with 575V Input - DIP Switch S15 Configuration

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
B	067	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
	101	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON
	135	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
	270	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
	405	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
C	540	ON	OFF	ON	OFF	OFF	OFF	OFF	ON
	675	OFF	ON	ON	OFF	OFF	OFF	OFF	ON

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
D	810	ON	ON	ON	OFF	OFF	OFF	OFF	ON
	1K0	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
	1K2	ON	OFF	OFF	ON	OFF	OFF	OFF	ON
	1K3	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
	1K6	ON	ON	OFF	ON	OFF	OFF	OFF	ON

Table 29 - Drives with 690V Input - DIP Switch S15 Configuration

Frame	Drive Current Rating Code	S15-1	S15-2	S15-3	S15-4	S15-5	S15-6	S15-7	S15-8
C	452	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
	565	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
D	678	OFF	ON	OFF	OFF	OFF	OFF	ON	ON
	791	ON	ON	OFF	OFF	OFF	OFF	ON	ON
	904	ON	OFF	ON	OFF	OFF	OFF	ON	ON
	1K0	OFF	ON	ON	OFF	OFF	OFF	ON	ON
	1K1	ON	ON	ON	OFF	OFF	OFF	ON	ON
	1K2	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
	1K4	OFF	ON	OFF	ON	OFF	OFF	ON	ON
	1K5	ON	ON	OFF	ON	OFF	OFF	ON	ON

I/O Wiring

Observe the following points when installing I/O wiring:

- Use copper wire only.
- Wire with an insulation rating of 600V or greater is recommended.

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

ATTENTION: Configuring an analog input for current operation and driving it from a voltage source could cause component damage. Verify proper switch configuration prior to applying input signals. Refer to DIP Switch and Jumper Settings on page 68.

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

I/O Signal and Control Wiring

Eight (8) digital inputs, four (4) digital outputs, three (3) analog inputs, and two (2) analog outputs are available on the standard I/O terminal blocks provided with the drive. One digital input (1…8) must be configured for "Enable" (digital input 4 by default = "Enable"). Refer to I/O and Control Wire Routing on page 81 for information on routing I/O signal and control wires.

Additional digital and analog I/O is available when using the optional I/O Expansion circuit board. Refer to Appendix F Optional Analog and Digital I/O Expansion Circuit Board for more information. Also, you can use the optional 115V AC Converter circuit board to convert 115V AC digital input signals to 24V DC digital inputs signals to interface with the digital inputs on the standard I/O terminal blocks. Refer to Appendix G Optional 115V AC to 24V DC I/O Converter Circuit Board for more information.

Table 30 - Analog I/O, Digital I/O and DC Analog Tachometer Wire Sizes and Terminal Specifications

Signal Type	Terminal Block (Terminals)	Wire Size and Type[1]			Tightening Torque N•m (lb•in)
		Flexible (mm^2)	Multi-core (mm^2)	AWG	
Analog and Digital I/O	TB1…4 (1…40)	0.140…1.500	0.140…1.500	26…16	0.4 (3.5)
DC Analog Tach	M3 (+ and –)				

(1) See Cable and Wiring Recommendations on page 39 for more information.

Figure 43 - I/O Terminal Block Locations

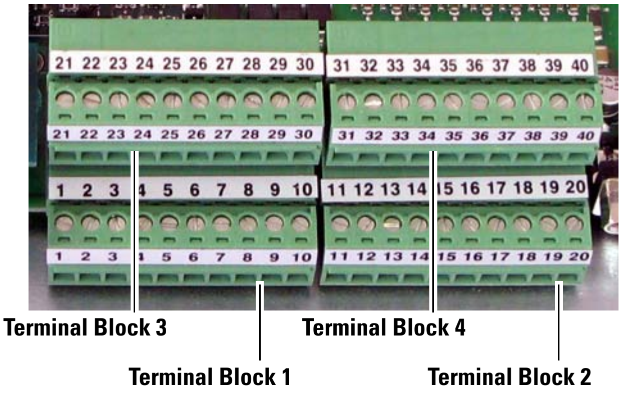
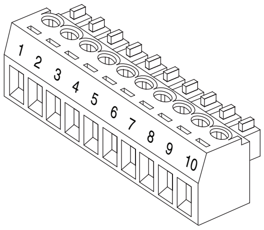


Table 31 - I/O Terminal Block 1 Designations

	No.	Signal	Description	Factory Default	Config. Parameter
	1	Analog Input 1 (+)	Isolated[1], bipolar, differential ±10V / 0…20 mA or 4…20 mA. **Important:** 0…20 mA or 4…20 mA operation requires that switch S9, S10, and S11 on the Control board be in the "Off" position. Drive damage may occur if the switch is not in the correct position based on the type of input signal. Refer to Table 24 on page 69. Max ±10V, Max 0.25 mA.	1 "Speed Ref A"	70 [Anlg In1 Sel]
	2	Analog Input 1 (–)			
	3	Analog Input 2 (+)		0 "Off"	75 [Anlg In2 Sel]
	4	Analog Input 2 (–)			
	5	Analog Input 3 (+)		0 "Off"	80 [Anlg In3 Sel]
	6	Analog Input 3 (–)			
	7	+10V Pot Reference	2-5k ohm load. Max ±10V, 10 mA.	–	–
	8	–10V Pot Reference			
	9	Pot Common	For (+) and (–) 10V pot references.	–	–
	10	PE ground	PE ground to drive chassis.	–	–

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

Table 32 - I/O Terminal Block 2 Designations

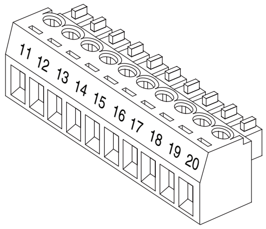
	No.	Signal	Description	Factory Default	Config. Parameter
	11	Internal 0V (Gnd)		–	–
	12	Digital Input 1	Max +30V, 15V/3.2 mA, 24V/5 mA, and 30V/6.4 mA. A digital input (1…8) must be configured for "Enable".	2 "Stop/CF"	133 [Digital In1 Sel]
	13	Digital Input 2		3 "Start"	134 [Digital In2 Sel]
	14	Digital Input 3		11 "Jog"	135 [Digital In3 Sel]
	15	Digital Input 4		1 "Enable"	136 [Digital In4 Sel]
	16	Digital Input Common	**Important:** When using the internal +24V DC supply (terminal 19) for digital inputs 1…4, you must connect the digital input common (terminal 16) to the +24V supply common (terminal 18).	–	–
	17	Not Used		–	–
	18	24V Supply Common	Common for the internal power supply.	–	–
	19	+24V DC Supply	Drive supplied control input power. Max. +20-30V, 200 mA **Note:** The total current draw is the sum of encoder power, digital outputs and any other loads connected to terminal 19.	–	–
	20	PE ground	PE ground to drive chassis.	–	–

Table 33 - I/O Terminal Block 3 Designations

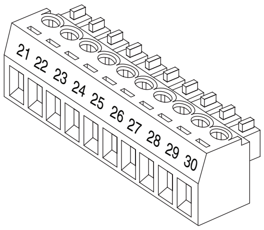
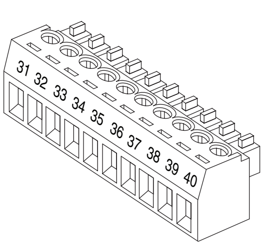
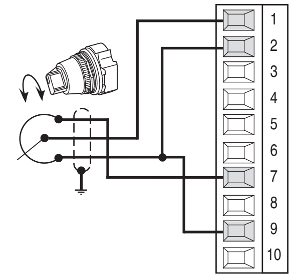
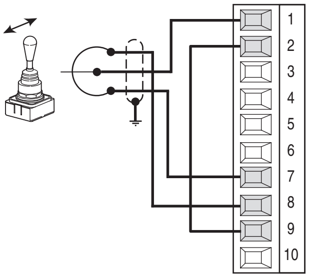
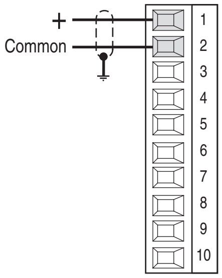
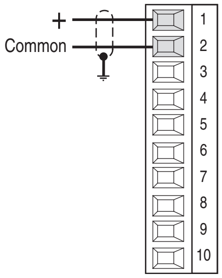
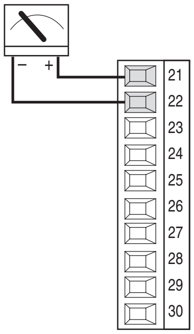
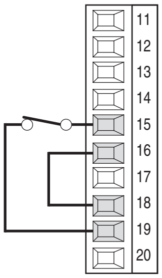
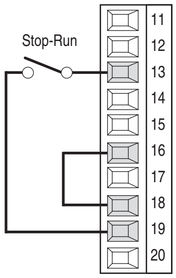
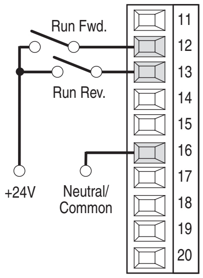
	No.	Signal	Description	Factory Default	Config. Parameter
	21	Analog Output 1 (+)	Max. ±10V, 5 mA.	12 "Motor Speed"	66 [Anlg Out1 Sel]
	22	Analog Output 1 (–)			
	23	Analog Output 2 (+)		13 "Motor Curr"	67 [Anlg Out2 Sel]
	24	Analog Output 2 (–)			
	25	Digital Output Common		–	–
	26	Digital Output 1	Max. +30V, 50 mA	5 "Ready"	145 [Digital Out1 Sel]
	27	Digital Output 2		9 "Fault"	146 [Digital Out2 Sel]
	28	Digital Output 3		2 "Spd Thresh"	147 [Digital Out3 Sel]
	29	Digital Output 4		4 "CurrentLimit"	148 [Digital Out4 Sel]
	30	+24VDC Supply	Supply voltage for the digital outputs. Max. +30V DC, 80 mA. **Important**: When using the internal +24V DC supply (terminal 19) for digital outputs 1…4, you must connect the digital output common (terminal 25) to the +24V supply common (terminal 18).	–	–

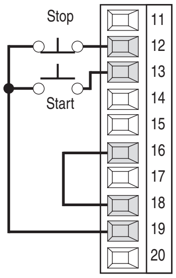
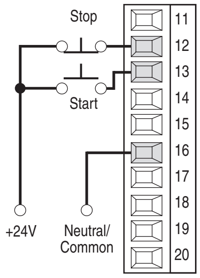
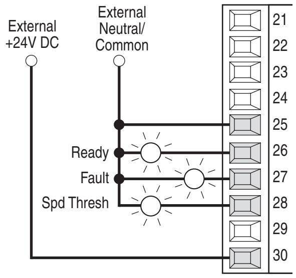
Table 34 - I/O Terminal Block 4 Designations

	No.	Signal	Description	Factory Default	Config. Parameter
	31	Digital Input 5	Max +30V, 15V/3.2 mA, 24V/5 mA, and 30V/6.4 mA. A digital input (1…8) must be configured for "Enable".	17 "Speed Sel 1"	137 [Digital In5 Sel]
	32	Digital Input 6		18 "Speed Sel 2"	138 [Digital In6 Sel]
	33	Digital Input 7		19 "Speed Sel 3"	139 [Digital In7 Sel]
	34	Digital Input 8		31 "Contactor"	140 [Digital In8 Sel]
	35	Digital Input Common	**Important**: When using the internal +24V DC supply (terminal 19) for digital inputs 5…8, you must connect the digital input common (terminal 35) to the +24V supply common (terminal 18).	–	–
	36 … 40	Not Used		–	–

I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Speed Reference 10kΩ Pot. Recommended (2kΩ Minimum)		• Adjust Scaling: 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] • View Signal Value: 1404 [Analog In1 Value] • View Signal Output: 385 [Speed Ref Out] Note: DIP switch S9 should be set to "On" (0…10V). Refer to Table 24 on page 69.
Joystick Bipolar Speed Reference ±10V Input **Important:** Refer to the Attention statement on 72 for important bipolar wiring information.		• Set Direction Mode: 1322 [Direction Mode] = 1 "Bipolar" • Adjust Scaling: 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] • View Signal Value: 1404 [Analog In1 Value] • View Signal Output: 385 [Speed Ref Out] Note: DIP switch S9 should be set to "On" (0…10V). Refer to Table 24 on page 69.
Analog Input Bipolar Speed Reference ±10V Input **Important:** Refer to the Attention statement on 72 for important bipolar wiring information.		• Set Direction Mode: 1322 [Direction Mode] = 1 "Bipolar" • Adjust Scaling: 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] • View Signal Value: 1404 [Analog In1 Value] • View Signal Output: 385 [Speed Ref Out] Note: DIP switch S9 should be set to "On" (0…10V). Refer to Table 24 on page 69.
Analog Input Unipolar Speed Reference 0…+10V Input or 0…20 mA or 4…20 mA		• Configure for Voltage or Current: 71 [Anlg In1 Config] • Adjust Scaling: 72 [Anlg In1 Scale] and 73 [Anlg1 Tune Scale] • View Signal Value: 1404 [Analog In1 Value] • View Signal Output: 385 [Speed Ref Out] Note: DIP switch S9 should be set to "On" for 0…10V operation, or "Off" for 0…20 mA or 4…20 mA operation. Refer to Table 24 on page 69.

Input/Output	Connection Example	Required Parameter Changes
Analog Output Bipolar Signal ±10V Bipolar (based on the signal of the assigned input source - for example Analog Input 1) or 0…10V/0…20 mA Unipolar *(shown)*		• Select Source Value: 66 [Anlg Out1 Sel] • Adjust Scaling: 62 [Anlg Out1 Scale]
Enable Input 24V DC internal supply		• No Changes Required. Note: If the digital input used for "Enable" is changed from the default setting of digital input 4, the wiring must be changed accordingly.
2-Wire Control Non-Reversing 24V DC internal supply **Important:** Programming inputs for 2-wire control deactivates the HIM Start and Jog buttons.		• Disable Digital Input 1: 133 [Digital In1 Sel] = 0 "Not Used" • Set Digital Input 2: 134 [Digital In2 Sel] = 5 "Run"
2-Wire Control Reversing 24V DC external supply **Important:** Programming inputs for 2-wire control deactivates the HIM Start and Jog buttons.		• Set Digital Input 1: 133 [Digital In1 Sel] = 6 "Run Forward" • Set Digital Input 2: 134 [Digital In2 Sel] = 7 "Run Reverse"

Input/Output	Connection Example	Required Parameter Changes
3-Wire Control 24V DC internal supply		- No Changes Required.
3-Wire Control 24V DC external supply Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections will cause a type 2 alarm (see page 203).		- No Changes Required
Sourcing Digital Outputs 24V DC external supply		- No Changes Required

Digital Encoder Terminal Block

The encoder connection cables should always be connected directly to the terminals on the encoder terminal block. The encoder cable must be made up of twisted pairs with the shield connected to the shield ground on the drive side. Do not connect the shield to ground on the motor side. In some cases (for example, cable lengths that exceed 100 meters), it may be necessary to ground the shield of each twisted pair on the power supply. Refer to page 214 for Digital Encoder specifications.

Figure 44 - Digital Encoder Terminal Block Location

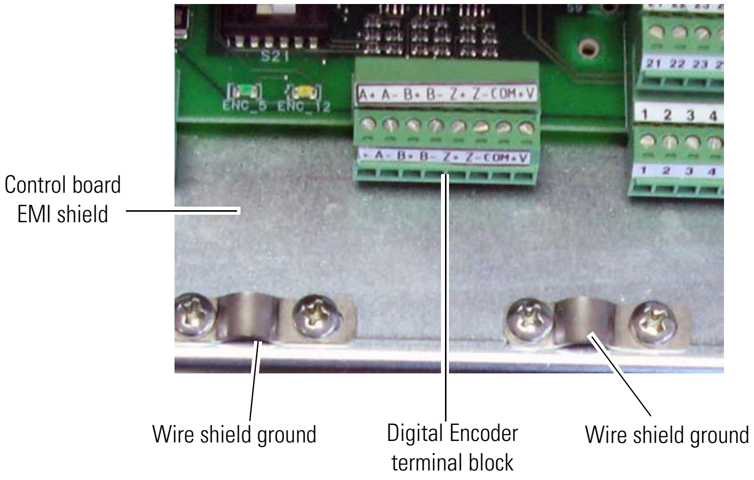
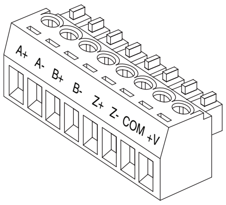


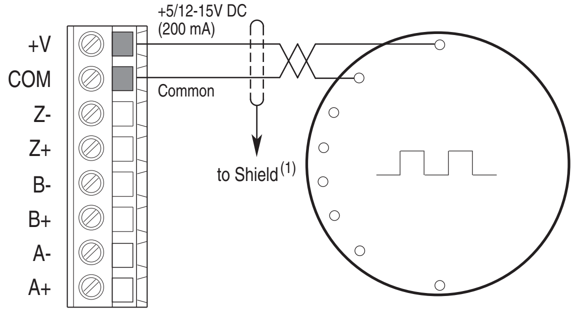
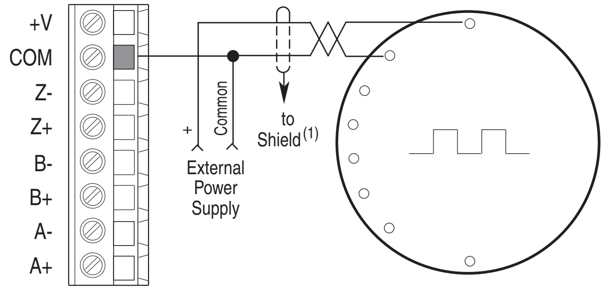
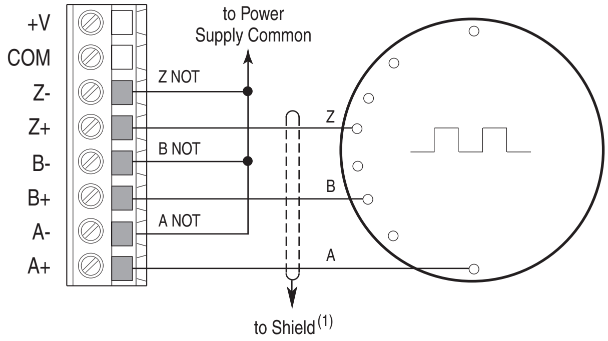
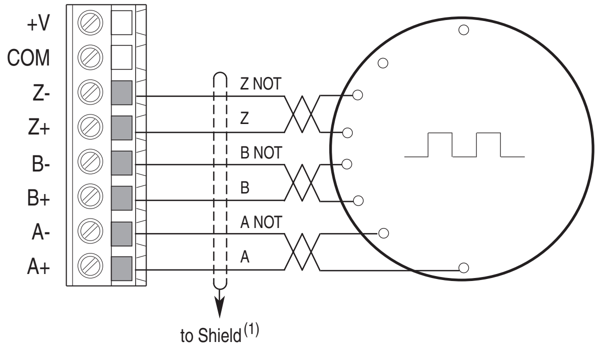
Table 35 - Digital Encoder Terminal Designations

	No.	Description	
	A+	Encoder A	Single channel or quadrature A input
	A-	Encoder A (NOT)	
	B+	Encoder B	Dual channel quadrature B input
	B-	Encoder B (NOT)	
	Z+	Encoder Z	Pulse, marker or registration input[2]
	Z-	Encoder Z (NOT)	
	COM	+5/12…15V[1] DC Return	Internal power common
	+V	+5/12…15V[1] DC Power	Internal power source 200 mA

(1) Selectable via switch S21 on the Control board. Refer to Table 24 on page 69.

(2) Selectable via switch S20 on the Control board. Refer to Table 24 on page 69.

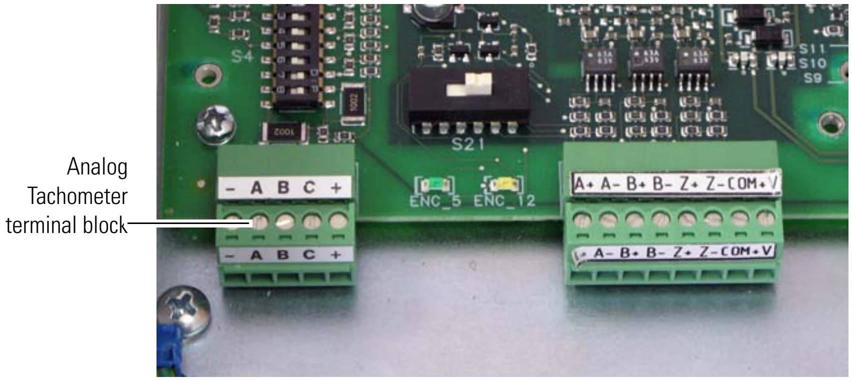
Figure 45 - Sample Encoder Wiring

<table>
<tr><th>I/O</th><th>Connection Example</th></tr>
<tr><td>Encoder Power – (1)
Internal Drive Power
Internal (drive) +5/12…15V DC, 200 mA</td><td>
</td></tr>
<tr><td>Encoder Power –External Power Source</td><td>
</td></tr>
<tr><td>Encoder Signal –Single-Ended, Dual Channel</td><td>
</td></tr>
<tr><td>Encoder Signal –
Differential, Dual Channel</td><td>
</td></tr>
</table>

(1) Shield connection is on drive Control board EMI shield. Refer to Figure 44 on page 78.

DC Analog Tachometer Terminal Block

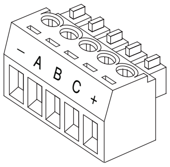
Figure 46 - Analog Tachometer Terminal Block Location



Refer to page 214 for DC Analog Tachometer specifications.

ATTENTION: The Drive can overspeed if DIP switch S4 is set incorrectly, or the tachometer is wired incorrectly. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Table 36 - DC Analog Tachometer Terminal Designations

	No.	Signal	Description
	–	Negative input	–
	A	(Not Used)	
	B		
	C		
	+	Positive input Refer to Verify Motor Rotation and Run Feedback Polarity Checks: on page 93 for information on determining feedback polarity.	22.7 / 45.4 / 90.7 / 181.6 / 302.9V(1) max voltage 8 mA max. current

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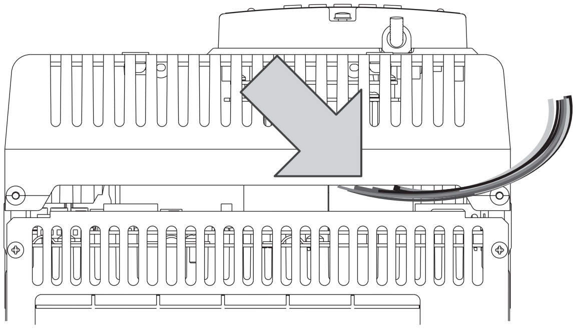
(1) Maximum voltage depends on the configuration of DIP switch S4. Refer to DC Analog Tachometer DIP Switch S4 Example on page 70

I/O and Control Wire Routing

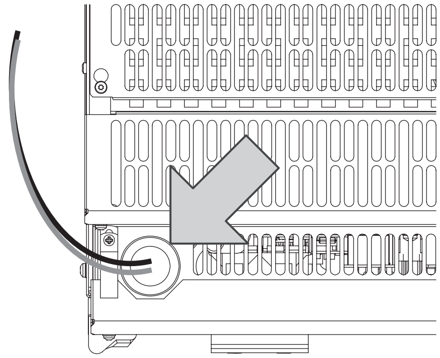
Frames A…C

Route all I/O and control wires from through the bottom of the drive, between the bottom front protective cover and the terminal cover (frame A) or plastic covers (frames B and C).

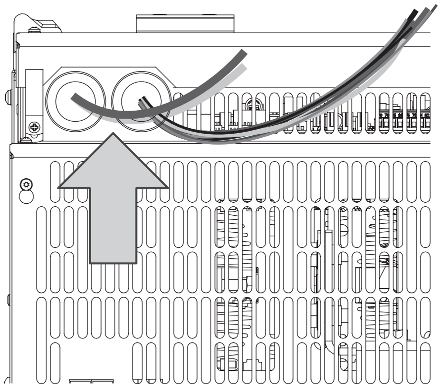


Frame D

Route the field power input cables through the opening at the top left side of the control panel.



Route control and I/O cables through the opening at the bottom left side of the control panel.



Notes:

Drive Start Up

This chapter describes how to start up the PowerFlex DC drive. If using the LCD HIM (Human Interface Module) to commission the drive, it is recommended that you read Appendix B - HIM Overview before performing these procedures.

⚠ **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. Correct the malfunction before continuing.

IMPORTANT	It is recommended that you uncouple the motor from all loads at this time, until otherwise directed.

Drive Start Up Checklist

This checklist contains the major steps required to complete the drive commissioning procedure.

☐ Verify all Drive Configuration Settings - page 84.

☐ Verify the Power Wiring - page 84.

☐ Verify the Control and I/O Wiring - page 84.

☐ Apply Voltage to the Control Circuits - page 85.

☐ Verify the Control Voltages - page 87.

☐ Load the Default Settings - page 87.

☐ Configure the Most Commonly Used Parameters - page 87.

☐ Tune the Current Regulator - page 92.

☐ Verify Motor Rotation and Run Feedback Polarity Checks - page 93.

☐ Configure the Speed Feedback Parameters - page 96.

☐ Tune the Speed Regulator - page 97.

☐ Verify Speed Reference Settings and Drive Operation - page 99.

Before Applying Power to the Drive

Verify all Drive Configuration Settings:

1. With the bottom cover removed from the drive (refer to Removing the Drive Covers on page 28), verify that DIP switch S14 is set correctly to be ≥ the rated field current specified on the motor nameplate. Refer to Table 14 on page 55.
2. Verify all switch settings (S9, S10, and S11) for the analog inputs. Refer to Table 24 on page 69.
3. Verify all DIP switch and jumper settings for the digital encoder or analog tachometer feedback device. Refer to Table 24 on page 69 and Figure 41 on page 70.

ATTENTION: The Drive can overspeed if DIP switch S4 is set incorrectly, or the tachometer is wired incorrectly. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Verify the Power Wiring:

Verify that the AC line power at the disconnect device is within the rated value of the drive and that all power wiring is correct. Refer to Power Wiring on page 40 for further information.

ATTENTION: Do not connect any external power to the armature output terminals, personal injury and/or equipment damage can occur.

Verify the Control and I/O Wiring:

1. Verify that control power and I/O wiring is correct. A digital input (1-8 only) must be wired and configured as a drive enable. Refer to Control Circuit Input Power on page 59 and I/O Wiring on page 72 for further information.
2. If you are using a PTC thermistor or thermal switch to protect the motor from overloading, remove the 1k ohm resistor between terminals 78 and 79. Refer to Thermistors and Thermal Switches on page 56

Applying Power to the Drive

The remainder of the "Drive Start Up" procedure in this manual uses a HIM to configure and autotune the drive. If you prefer, you can use the DriveExplorer™ or DriveTools™ SP software(1) to program drive parameters or use the drive "Start Up" wizard available with both software packages.

If an operator interface is not available, remote devices should be used to start up the drive. For information on using the HIM, refer to the HIM Overview on page 251.

IMPORTANT When power is first applied, the HIM may require approximately 5 seconds until commands are recognized (including the Stop key).

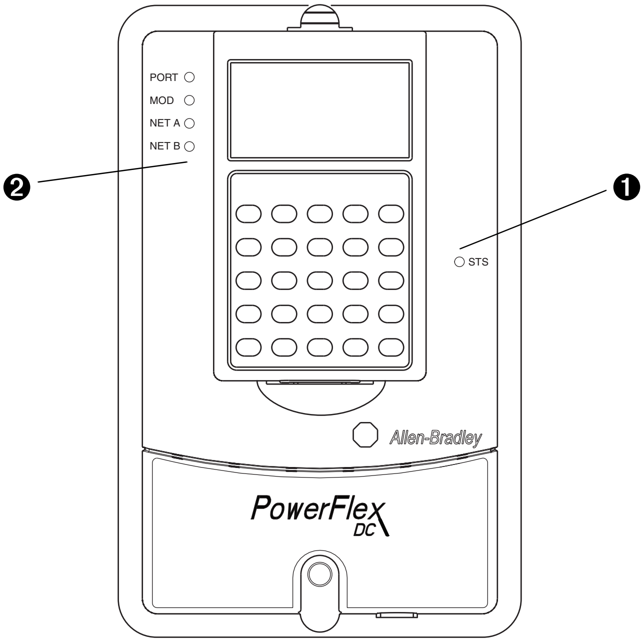
Apply Voltage to the Control Circuits:

1. Apply power to the control circuits (terminals U2 and V2) of the drive. If any of the digital inputs are configured to "Stop/CF" (CF = Clear Fault), "Enable" or "Aux Fault," verify that signals are present or reconfigure [Digital Inx Sel]. If a fault code displays, refer to Chapter 4 - Troubleshooting on page 195.
2. If the STS LED is not flashing green at this point, refer to "Drive Status Indicators" below.

---

(1) You must use DriveExplorer v5.02 or higher or DriveTools SP v4.01 or higher with a PowerFlex DC drive specific software patch. The patch can be downloaded from http://www.ab.com/support/abdrives/webupdate/

Figure 47 - Drive Status Indicators



#	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	Flashing, Drive Stopped	A condition exists that is preventing the drive from starting. Check parameters 1403 [Start Inhibits] and/or 1380 [Drive Alarm 1].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 1380 [Drive Alarm 1]. Refer to Fault Descriptions on page 198 and/or Alarm Descriptions on page 203.
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 1380 [Drive Alarm 1]. Refer to Fault Descriptions on page 198 and/or Alarm Descriptions on page 203.
		Red	Flashing	A fault has occurred. Check [Fault x Code] or view the Fault Queue on the HIM. Refer to Fault Descriptions on page 198.
			Steady	A non-resettable, non-configurable fault has occurred. Check [Fault x Code] or view the Fault Queue on the HIM. Refer to Fault Descriptions on page 198.
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).

Verify the Control Voltages:

☐ Verify that the following voltages are present at I/O terminal block 1 and 2. Refer to I/O Signal and Control Wiring on page 72:

Terminal Number…	Voltage	to Terminal Number…
7	+10V	9
8	-10V	9
19	+24 - 30V	18

Load the Default Settings:

It is recommended that you reset the drive to the default settings. By resetting the drive to the default settings, any previous parameter modifications you have made will be overwritten.

1. On the HIM, from the "Main" menu scroll to the "Memory Storage" menu and press Enter.
2. Scroll to "Reset To Defaults" and press Enter. A message displays to verify that you want to reset the drive to the factory settings.
3. Press Enter.
   Note: A "Params Defaulted" (F48) entry will be made in the drive's Fault Queue to indicate the change.

Configure the Most Commonly Used Parameters:

If your application only requires basic drive parameter set up, you can use the S.M.A.R.T. list screen available on the HIM to program the drive. Refer to Using the S.M.A.R.T. List Screen on page 253 for more information.

IMPORTANT In order to access all parameters in this procedure you must set the Parameter View option to "Advanced".

1. At the Main menu, scroll to the Parameter option and press the ALT and then Sel button.
2. Scroll to the Numbered List option and press Enter.
3. Type 211 and press Enter.
4. Press the Sel button.
5. Type 1 and press Enter.
6. Press the Esc button.
7. Press the ALT and then Sel button.
8. Scroll to the File-Group-Par option and press Enter.
9. Scroll to the "Motor Control" file and press Enter.

10. With the "Motor Data" group selected, press Enter and configure the following parameters:

Note: Parameters 45 [Max Ref Speed] and 162 [Max Feedback Spd] are typically set to the motor nameplate base speed. However, if a speed feedback device is used (encoder or tachometer), refer to Drive Reference and Feedback Scaling on page 265 for details on setting these parameters.

☐ 45 [Max Ref Speed] - Enter the motor nameplate base speed.

☐ 162 [Max Feedback Spd] - Enter the motor nameplate base speed.

☐ 175 [Rated Motor Volt] - Enter the rated motor nameplate armature voltage. This value should be the measured armature voltage when the motor is running at base speed with rated field current. This value should represent 100% of the rated armature voltage when field weakening is not used. If field weakening is used, this value should be set to 90% of the rated armature voltage to prevent a possible overvoltage condition when the drive transitions to the field weakening mode.

☐ 179 [Nom Mtr Arm Amps] - Enter the rated motor nameplate armature current.

☐ 374 [Drv Fld Brdg Cur] - Enter the rated current of the field bridge regulator to match the value set using the DIP switch S14. Refer to Field Current Configuration on page 55.

☐ 280 [Nom Mtr Fld Amps] - Enter the rated motor nameplate field current.

11. Access the “Field Config” group and configure the following parameters:

☐ If the motor field power is supplied by an external source, set Par 497 [Field Reg Enable] = 0 “Disabled”. Otherwise, verify that this parameter is set to 1 “Enabled” (default).

☐ If you are utilizing field economy when the drive is stopped or at zero speed, set Par 1407 [Field Econ Delay] to the desired amount of time to elapse after the drive stops or reaches zero speed before field economy becomes active (the value set in Par 468 [Min Fld Curr Pct]). The default value is 300 seconds.

☐ Par 469 [Field Mode Sel] - select the desired field mode (default = 0 “Base Speed”, constant field current):

○ 1 “Field Weaken”, field weakening mode

○ 2 “External”, power to the field is supplied externally

☐ If you are utilizing field economy at zero speed, set 468 [Min Fld Curr Pct] to the desired minimum field current for field economy (default = 30%).

☐ If you are operating the drive in field weakening mode, set Par 456 [Fld Weaken Ratio] = Motor nameplate base speed / Par 45 [Max Ref Speed] x 100.

IMPORTANT	When operating the drive in field weakening mode, it is necessary to refer to the CEMF value or to the crossover data. If the maximum field current is not within 10% of the maximum value of the internal field converter, configure the current feedback using DIP switch S14. Refer to Field Current Configuration on page 55.

12. Access the “Utility” file and press Enter.

13. Access the “Alarms” group and configure the following parameters:

    ☐ Par 481 [UnderVolt Thresh] - Enter the value at which an AC under voltage condition will be detected by the drive (default = 200V on a 240V AC line and 400V on a 480V AC line). Typically, this value is approximately 85% of the nominal AC line voltage.

    ☐ Par 584 [OverCurrent Thr] - Enter the value at which a drive over current condition will be detected (default = 175%). The threshold level should be at least 10% above the selected operating current limit (Par 7 [Current Limit]).

    ☐ Par 585 [OverSpeed Val] - Enter a value that is 10% above the maximum speed that the motor will achieve. Typically 10% above Par 162 [Max Feedback Spd].

14. Access the “Input & Output” file and press Enter.

15. Access the “Analog Inputs” group and configure the following:

    ☐ If you have connected a potentiometer to analog input 1 for a speed reference:

    ○ Verify that Par 70 [Anlg In1 Sel] is set to 1 “Speed Ref A” (default).

    ○ Verify that switch S9 and Par 71 [Anlg In1 Config] are configured to match (voltage versus a current signal). Refer to DIP Switch and Jumper Settings on page 68.

    ○ Set Par 72 [Anlg In1 Scale] and Par 74 [Anlg In1 Offset] appropriately.

    ☐ If you are using the HIM on the drive cover (Port 1) for the speed reference, set Par 70 [Anlg In1 Sel] to 0 “Off”.

16. Access the “Digital Inputs” group and configure the following parameters:

- ☐ Par 1391 [ContactorControl] - Select the type of contactor(s) used with the drive: 1 “Contactor” (default, AC input or DC output contactor), 2 “Contactor+DB” (AC input or DC output contactor and dynamic brake contactor), or 0 “None”.

  Note: If you select 0 “None” for Par 1391 [ContactorControl], a “CntactrCflct” alarm will display. The alarm will be resolved and automatically clear when you complete the Digital Output configuration below.

  Note: If Par 1391 [ContactorControl] is set to 1 or 2, an Auxiliary Status contactor must be wired to a digital input (default for digital input 8).

- ☐ Par 140 [Digital In8 Sel] - If a contactor is NOT used, set to other than 31 “Contactor” (for example, 0 “Not Used”).

- ☐ If an auxiliary status contactor is wired to a digital input, set the appropriate [Digital Inx Sel] parameter to 31 “Contactor”.

17. Access the “Digital Outputs” group and configure the following parameters:

- ☐ If a contactor and a dynamic brake resistor are used:

  - ○ Par 629 [Relay Out 2 Sel] = 24 “ContactorDB”.

- ☐ If a neither a contactor nor a dynamic brake resistor are used:

  - ○ Par 629 [Relay Out 2 Sel] = Set to other than 24 “ContactorDB” or 25 “Contactor” (for example, 0 “Not Used”).

  - ○ Par 1392 [Relay Out 1 Sel] = Set to other than 24 “ContactorDB” or 25 “Contactor” (for example, 0 “Not Used”).

18. If you are using the HIM on the drive cover (Port 1) for the speed reference, access the “DPI Inputs” group and set the appropriate [DPI Px Select] parameter to 1“Speed Ref A” and access the “Analog Inputs” group and set Par 70 [Anlg In1 Sel] to 0 “Not Used”.

If you are using another source for the speed reference, select either the appropriate [DPI Px Select] parameter to 1“Speed Ref A” or the appropriate [Anlg Inx Sel] parameter to 1“Speed Ref A” and set Par 70 [Anlg In1 Sel] to 0 “Not Used”, if appropriate.

Tune the Current Regulator:

⚠ **ATTENTION:** Prior to tuning the current regulator, you must provide a hard wired maintained external operator accessible coast/stop push button to disable the machine in case of improper operation. Uncontrolled machine operation can result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

⚠ **ATTENTION:** Prior to tuning the current regulator, uncouple the motor from equipment or processes that may be damaged by incorrect rotation of the motor or speed references.

Complete this test before running the drive for the first time. Upon completing this tuning procedure, the armature resistance value is stored in Par 453 [Arm Resistance] and the armature inductance value is stored in Par 454 [Arm Inductance].

1. If an external supply is used to power the motor field, disconnect the wires from the motor field terminals. If the drive supplies power to the motor field, the internal field circuit will automatically be disabled during this test.

IMPORTANT Verify that the motor does not start rotating (less than one-half a full turn) during the Current Regulator tuning test (due to remnant magnetization, series field, etc.). If necessary, mechanically block the motor shaft so it does not turn.

2. Access the “Motor Control” file, the “Torq Attributes” group and set Par 7 [Current Limit] to the appropriate level for your application. This parameter defaults to 150%. The drive’s armature output current will correspond to Par 179 [Nom Mtr Arm Amps] x Par 7 [Current Limit].

   Note: Par 8 [Current Lim Pos], the drive current limit for the positive direction and Par 9 [Current Lim Neg], the drive current limit for the negative direction, are set to 150% by default. If necessary, you can change the value of these parameters to suit your application.

3. Access the “Speed Feedback” group and verify that Par 414 [Fdbk Device Type] is set to 3 “Armature” (default).

4. Press the Esc key until you return to the “File” menu and access Par 452 [CurrReg Autotune] in the “Autotune” group, in the “Motor Control” file, and select 1 “On” and press Enter.

5. Press the Start button on the HIM. This will start the current regulator auto tuning test, which could take several minutes.

   At the end of the test, Par 453 [Arm Resistance] and Par 454 [Arm Inductance] are updated. The drive is automatically stopped and Par 452 [CurrReg Autotune] will be set to 0 “Off”.

It is also possible to manually tune the current regulator. Refer to Manually Adjusting the Current Regulator Tune Settings on page 298 for more information.

If a drive fault occurs during the tuning procedure, refer to Fault Descriptions starting on Fault Descriptions on page 198 for a list of fault descriptions and actions.

Verify Motor Rotation and Run Feedback Polarity Checks:

The jog function (on the HIM or terminal block) will be used to check motor direction and encoder operation. If the STS LED is not flashing green at this point, refer to Figure 47 on page 86 for more information.

ATTENTION: Prior to running the motor direction and polarity checks, you must provide a hard wired maintained external operator accessible coast/stop push button to disable the machine in case of improper operation. Uncontrolled machine operation can result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Prior to running the motor direction and polarity checks, uncouple the motor from equipment or processes that may be damaged by incorrect rotation of the motor or speed references.

1. When checking motor polarity, the drive will have power applied and the motor will rotate. Verify that the motor is uncoupled from the load. If the motor cannot be uncoupled from the load, the following motor checks are recommended:

   ☐ All electrical connections are tight.

   ☐ The brushes are properly seated.

   ☐ The motor shaft is free to rotate.

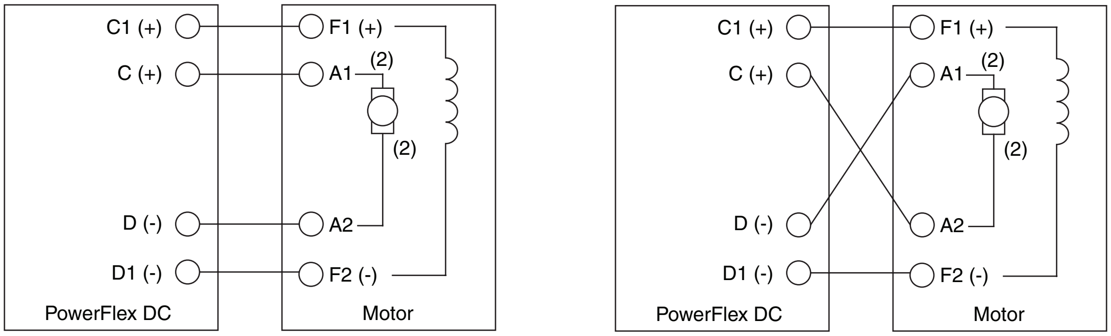
2. Access the “Motor Control” file, “Speed Feedback” group and verify that Par 414 [Fdbk Device Type] is set to 3 “Armature” (default).

3. Access the “Speed Command” file, “Discrete Speeds” group and verify that Par 266 [Jog Speed] is set to the default value (100 rpm) or to an acceptable speed level for this test.

4. If analog input 1 is wired, access the “Analog Inputs” group and verify that the voltage level is 0V in Par 1404 [Analog In1 Value].

5. While viewing Par 233 [Output Voltage], assert a Jog command (via the HIM keypad or digital input on the I/O terminal block) and observe the motor rotation direction. Verify whether or not Par 233 [Output Voltage] is positive.
6. If the observed rotation direction is incorrect, remove power from the drive and continue with step 6 below, while referring to the motor connection diagrams in Figure 48 below. If the observed rotation direction is correct, continue with step 10 below.
7. Make certain power is turned off and locked out.
8. Switch the armature leads connected to C (+) and D (–).

Figure 48 - Motor Connections



Straight Shunt Machine,
CCW Rotation Facing Commutator End

Straight Shunt Machine,
CW Rotation Facing Commutator End

9. Apply power to the drive.
10. Repeat steps 4 and 5 above and verify that the motor rotation is correct.

11. Complete the appropriate procedure based on the type of feedback device used for the application:

- ☐ For Armature Voltage feedback - Continue with Configure the Speed Feedback Parameters: on page 96.
- ☐ For Analog Tachometer feedback - Assert a Jog command and verify that the sign and value of Par 1408 [Tachometer Speed] corresponds with the actual direction of the motor. If the sign and value of Par 1408 [Tachometer Speed] and the motor direction do not correspond, remove power from the drive and reverse the tachometer connections at the drive. Continue with Configure the Speed Feedback Parameters: on page 96.
- ☐ For Encoder feedback - Assert a Jog command and verify that the sign and value of Par 420 [Encoder Speed] correspond with the actual direction of the motor. If the sign and value of [Par 420 [Encoder Speed] and the motor direction do not correspond, remove power from the drive and reverse the encoder connections at the drive. Reverse the polarity of only one channel, for example, B and B NOT. Refer to Table 35 on page 78 for digital encoder terminal block designations. Continue with Configure the Speed Feedback Parameters: on page 96.

Configure the Speed Feedback Parameters:

1. Access the “Speed Feedback” group and configure the following parameters:

   Note: If a speed feedback device is used (encoder or tachometer), refer to Drive Reference and Feedback Scaling on page 265 for instructions on associated parameter settings.

   ☐ Par 414 [Fdbk Device Type] - Select the source for motor velocity feedback: 1 “Encoder”, 2 “DC Tach” or 3 “Armature” (default). If operating the drive in field weakening mode, Par 414 [Fdbk Device Type] must be set to 1 "Encoder" or 2 "DC Tach".

   ☐ Par 457 [Spd Fdbk Control] - If you are using an encoder or tachometer, set this parameter to 1 “Enabled” to activate speed feedback control.

   ☐ If the speed feedback source is an analog tachometer, set the fine scaling value in Par 562 [Anlg Tach Gain]. This value is used to scale the analog tachometer feedback signal after it has been conditioned by the drive hardware.

   ATTENTION: The drive can overspeed if DIP switch S4 is set incorrectly, or the tach is wired incorrectly. Failure to observe this precaution could result in damage to the drive or process equipment. Refer to Table 41 on page 70.

   ☐ If the speed feedback source is a digital encoder, enter the pulses per revolution from the encoder nameplate in Par 169 [Encoder PPR]. Refer to Speed Feedback on page 279 for more information on setting the value of this parameter.

   ☐ If the speed feedback source is a digital encoder, set Par 652 [Encoder Err Chk] to 1 “Enabled” to activate monitoring of the digital encoder signals (verifies the presence of the A, B, A-, B-, or Z channel signals). Par 457 [Spd Fdbk Control] must be set to 1 “Enabled” for encoder monitoring to occur. Switch S20 must be set correctly to prevent Encoder faults. Refer to Table 24 on page 69.

2. Access the “Speed Command” file and press Enter.

3. With the “Limits” group selected, press Enter and configure the following parameters:

   ☐ Par 1 [Minimum Speed] - Enter the minimum speed reference limit.

   ☐ Par 2 [Maximum Speed] - Enter the maximum speed required by the application (this can be above the motor base speed if field weakening is used).

4. Access the “Dynamic Control” file and press Enter.

5. Access the “Ramp Rates” group and configure the following parameters:
   - ☐ Par 660 [Accel Time 1] - Set the desired acceleration ramp time.
   - ☐ Par 662 [Decel Time 1] - Set the desired deceleration ramp time.

Tune the Speed Regulator:

The speed regulator auto tuning test detects the total inertia value of the motor shaft (in Kg-m^2), the friction value (in N-m) and the calculation of the proportional (P) and integral (I) gains of the speed regulator.

IMPORTANT This test requires the free rotation of the motor shaft combined with the load. The auto tuning test of the speed loop cannot be carried out on machines with a limited stroke.

ATTENTION: The motor will rotate during this tuning procedure. Hazard of personal injury exists due to motor shaft rotation and/or machinery motion.

IMPORTANT The test is carried out by using the torque limit value set in the Par 1048 [Autotune Cur Lim] (recommended value = 20%). The torque reference is applied via a step reference (without a ramp); therefore there must not be any “backlash” in the mechanical transmission and it must be compatible with those operations using the torque limit value set in the Par 1048 [Autotune Cur Lim]. You can modify the torque limit value via this parameter.

IMPORTANT In applications where the system total inertia value is very high, it is necessary to increase the value of Par 1048 [Autotune Cur Lim] in order to avoid “Time out” errors. The speed regulator auto tuning test of the speed loop is not suitable for drives used in “elevator” and/or lifting system applications.

1. While still in the “Autotune” group, configure the motor shaft rotation direction via Par 1029 [Speed Tune Dir]; 1 “Forward” = clockwise or 2 “Reverse” = counter-clockwise, with reference to the motor commutator end.
2. Select the Par 1027 [Spd Reg Autotune], enter “1” and press Enter.

3. Press the Start button on the HIM. This will start the speed regulator auto tuning test, which could take several minutes. When the test has been completed, the drive will automatically stop.

   During the test the following are completed:

   ☐ An acceleration test, with the torque limit value set in the Par 1048 [Autotune Cur Lim].

   ☐ A deceleration test, with a lower torque limit value applied, until zero speed has been reached.

   ☐ Par 1013 [Torque Const] is calculated and updated based on the entered motor data.

   The test threshold speed is 33% of the lowest value set in the following Pars:

   ☐ 45 [Max Ref Speed]

   ☐ 3 [Max Speed Fwd] or 4 [Max Speed Rev] based on the rotation direction chosen in Par 1029 [Speed Tune Dir]

   The drive will determine the speed loop gains (Pars 87 [Spd Reg Kp] and 88 [Spd Reg Ki]) based on the motor and load inertia and friction characteristics.

   If any fault occur during the test, refer to Auto Tuning Faults on page 99 for a description and more information.

   Note: If any manual adjustments are required (due to vibrations, etc.), these should be carried out according to the value of the integral gain Par 88 [Spd Reg Ki]. If the speed regulator auto tuning test does not provide satisfactory results, refer to Fine Tuning the Regulators on page 297.

   The values determined by the Speed Regulator tuning tests are updated in Pars 87 [Spd Reg Kp], 88 [Spd Reg Ki], 1014 [Inertia] and 1015 [Friction] and displayed in the corresponding Pars 1032 [Speed Tune Kp], 1033 [Speed Tune Ki], 1030 [Spd Tune Inertia] and 1031 [SpdTune Friction], respectively. The values of Pars 1030 - 1033 can be used as a record of the Speed Regulator auto tuning results if the values of Pars 87, 88, 1014 and 1015 are subsequently changed.

Verify Speed Reference Settings and Drive Operation:

Verify the following speed and direction (for four quadrant drives) references of the drive under a load.

ATTENTION: This test requires the free rotation of the motor shaft combined with the load. All of the steps in the "Drive Start Up" procedure must have been completed before completing this step.

1. Set the speed reference to "0" (zero) using the assigned source (HIM or analog potentiometer). Refer to Reference Control on page 277 for more information on speed reference sources.
2. View Par 385 [Speed Ref Out] and verify that the value is "0".
3. Press the Start button on the HIM and slowly increase the speed reference until full speed is reached (viewed in Par 385 [Speed Ref Out]).
4. If using a four quadrant (regenerative) drive, press the Direction button on the HIM and verify that the motor ramps down to "0" speed and then to full speed in the opposite direction.
5. Press the Stop button on the HIM and verify that the drive ramps to "0" speed and stops.

Auto Tuning Faults

Following is a list of faults that may display during the speed regulator auto tuning test. In some cases, the drive's control circuits may detect a value(s) that is out of range for the configuration settings during the speed regulator auto tuning test. In these cases, make the suggested adjustments and repeat the test. If the fault occurs again, complete the Fine Tuning the Regulators procedures beginning on 297.

Fault	No.	Description	Action
STune Overspeed	56	The measured motor speed is too high during the speed regulator auto tuning procedure.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune Stalled	57	The drive stalled during the speed regulator auto tuning procedure.	Increase the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune LoadHi	58	One of the following has occurred:	
		• The loading torque value is too high at zero speed to complete the speed regulator auto tuning procedure.	Decrease the load torque, where applicable, and repeat the auto tune procedure.
		• Par 107 [Speed Zero Level] and/or 108 [Speed Zero Delay] is set too high.	Set Pars 107 and 108 to their default values when performing the Speed Loop Autotuning function.

Fault	No.	Description	Action
STune CurLimit	59	One of the following has occurred:	
		• The value of Par 1048 [Autotune Cur Lim] for auto tuning the speed regulator is set too high.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
		• Par 107 [Speed Zero Level] and/or 108 [Speed Zero Delay] is set too high.	Set Pars 107 and 108 to their default values when performing the Speed Loop Autotuning function.
STune FrictionLo	60	The friction value attained during the auto tuning procedure is zero or lower than the control precision limit.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune Timeout	61	The speed regulator auto tuning procedure did not complete within the available time.	Verify the value in Par 1048 [Autotune Cur Lim]. If this value is set to low, the motor will not be able to reach a maximum speed of 33% of the lower of the values in Par 45 [Max Ref Speed] or Par 3 [Max Speed Fwd] or Par 4 [Max Speed Rev] and not be able to complete the test. Set these values appropriately and repeat the auto tuning procedure.
STune Aborted	62	The speed regulator auto tuning procedure has been stopped by the user.	Informational only.

For additional regulator fine tuning procedures, refer to Fine Tuning the Regulators on page 297.

Speed-Up Function

Oscillation may occur during a speed change with loads presenting a high moment of inertia. These oscillations can be reduced by enabling the “Speed Up” function. Refer to Speed Up Function on page 285 for more information.

Configuring the Speed Zero Logic

The speed zero logic is factory set to 0 “Disabled”. Refer to Speed Zero Function on page 288 for more information.

Adaptive Speed Regulation

The adaptive function of the speed regulator is factory set to 0 “Disabled”. It should only be used when the gain of the speed regulator must go higher than the speed range. For instructions on configuring these parameters refer to Adaptive Speed Regulator on page 282.

Chapter 3

Programming and Parameters

This chapter provides a complete listing and description of the PowerFlex DC drive parameters. The parameters can be programmed (viewed/edited) using a Human Interface Module (HIM). As an alternative, programming can also be performed using DriveExplorer™ or DriveTools™ SP software(1) and a personal computer. Refer to Appendix B for a brief description of the LCD HIM. Refer to Appendix D for drive control block diagrams.

About Parameters

To configure a drive to operate in a specific way, certain parameters may need to be changed from the default value. Three types of parameters exist:

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

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

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(1) You must use DriveExplorer v5.02 or higher or DriveTools SP v4.01 or higher with a PowerFlex DC drive specific software patch. The patch can be downloaded from http://www.ab.com/support/abdrives/webupdate/

❶	❷	❸	❹	❺			❻	❼
File	**Group**	**No.**	**Parameter Name & Description**	**Values**			**Data Type**	**Related**
SPEED COMMAND	**Speed Regulator**	**388** A	**[Flying Start En]** Enables/Disables the ability of the drive to connect to a spinning motor at actual rpm when a start command is issued. • "Enabled" = When the drive is turned on, the speed of the motor is measured and the ramp output is set accordingly. The drive then runs at the set reference value. • "Disabled" = When the drive is turned on, the ramp starts from zero. Main uses: • To connect to a motor that is already spinning due to its load (for example, in the case of a pump, the flowing medium). • Re–connection to a spinning motor after a fault or alarm. Note: If the Flying Start function is disabled, ensure that the motor is not spinning when the drive is turned on, or harsh motor deceleration in current limit may occur.	Default: Options:	0 = 0 = 1 =	"Disabled" "Disabled" "Enabled"	16-bit Int	
		445 A	**[Spd Up Gain Pct]** The Speed Up function gain as a percentage of Par 446 [Speed Up Base].	Default: Min/Max: Units:	0.00 0.00 / 100.00 %		Real	
COMMUNICATIONS	**Masks & Owners**	**591** ○	**[Logic Mask]** Determines which ports can control the drive when Par 1377 [Write Mask Act], bit 15 is set to "1." If the bit for a port is set to "0," the port will have no control functions except for stop. 0 = Control Masked, 1 = Control Permitted, x = Reserved.					1377

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	x	x	x	x	x	x	x	x	x	x	0	0	0	0	1	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

No.	**Description**		
❶	**File** – Lists the major parameter file category.		
❷	**Group** – Lists the parameter group within a file.		
❸	**No.** – Parameter number. A = The parameter is only accessible when Par 211 [Param Access Lvl] = 1 "Advanced". ○ = The parameter value cannot be changed until the drive is stopped.		
❹	**Parameter Name & Description** – Parameter name as it appears on an LCD HIM, with a brief description of the parameters function.		
❺	**Values** – Defines the various operating characteristics of the parameter. Three types exist.		
	ENUM	Default:	Lists the value assigned at the factory. "Read Only" indicates that the parameter is not configurable.
		Options:	Displays the programming selections available.
	Bit	Options:	Bit name.
		Default: Bit:	Default setting. Lists the bit place holder and definition for each bit.
	Numeric	Default:	Lists the value assigned at the factory. "Read Only" indicates that the parameter is not configurable.
		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: • For example: Analog inputs can be set for current or voltage as with Par 71 [Anlg Inx Config].	
❻	**Data Type** - Identifies the parameter data type (i.e. integer, real).		
❼	**Related** – Lists parameters (if any) that interact with the selected parameter.		

How Parameters are Organized

The LCD HIM displays parameters in a **File–Group–Parameter** or **Numbered List** view order. To switch display mode, access the Main Menu, press ALT, then Sel (View) while the cursor is on the Parameter menu selection. In addition, using Par 211 [Param Access Lvl], you have the option to display the most commonly used parameters (Basic Parameter view) or all parameters (Advanced Parameter View).

File–Group–Parameter Order

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

Numbered List View

All parameters are in numerical order.

Cross Reference Tables

Refer to Parameter Cross Reference – by Name on page 186 and Parameter Cross Reference – by Number on page 190 for a list of parameters and page numbers.

Basic Parameter View

Parameter 211 [Param Access Lvl] set to option 0 “Basic”.

File	Group	Parameters					
Monitor	**Speed Meters**	[Speed Ref A]	44	[Ramp Out Pct]	114	[Spd Reg Fdbk]	1008
		[Speed Ref A Pct]	47	[Speed Draw Out]	1018	[Spd Reg Fdbk Pct]	1009
		[Speed Ref B]	48	[Spd Draw Out Pct]	1019	[Spd Feedback]	122
		[Speed Ref B Pct]	49	[Droop Out]	1006	[Spd Feedback Pct]	121
		[Speed Ref Out]	385	[Droop Out Pct]	1007	[Actual Speed]	924
		[Spd Ref Out Pct]	384	[Speed Reg In]	118	[Encoder Speed]	420
		[Ramp In]	110	[Speed Reg In Pct]	117	[Tachometer Speed]	1408
		[Ramp In Pct]	111	[Spd Reg Err]	1010		
		[Ramp Out]	113	[Spd Reg Err Pct]	1011		
	Current Meters	[Inertia Comp Out]	232	[Field Current]	351	[Flux Ref Pct]	500
		[Spd Reg Out Pct]	236	[Fld Current Pct]	234	[Field Curve Out]	476
		[Current Reg In]	41	[Cur Lim Pos Out]	10	[Selected TorqRef]	14
		[Arm Current]	200	[Cur Lim Neg Out]	11	[Motor Trq Ref]	17
		[Arm Current Pct]	199	[Filt TorqCur Pct]	928		
	Drive Data	[FaultCode]	57	[Output Voltage]	233	[Drive Size]	465
		[AC Line Voltage]	466	[Output Power]	1052	[Elapsed Lifetime]	235
		[AC Line Freq]	588	[Drive Type]	300	[Software Version]	331
Motor Control	**Motor Data**	[Max Ref Speed]	45	[Rated Motor Volt]	175	[Nom Mtr Fld Amps]	280
		[Max Feedback Spd]	162	[Nom Mtr Arm Amps]	179	[Drv Fld Brdg Cur]	374
	Field Config	[Field Reg Enable]	497	[Field Mode Sel]	469	[Fld Weaken Ratio]	456
		[Field Economy En]	499	[Max Fld Curr Pct]	467		
		[Field Econ Delay]	1407	[Min Fld Curr Pct]	468		
	Torq Attributes	[Current Limit]	7	[Torque Ref]	39	[Zero Torque]	353
		[Current Lim Pos]	8	[Trim Torque]	40		
		[Current Lim Neg]	9	[Torque Reduction]	342		
	Speed Feedback	[Fdbk Device Type]	414	[Feedback Offset]	563	[SpdReg FB Bypass]	458
		[Anlg Tach Gain]	562	[Spd Fdbk Control]	457		
	Autotune	[Autotune Cur Lim]	1048	[Spd Reg Autotune]	1027	[Spd Tune Inertia]	1030
		[CurrReg Autotune]	452	[Speed Tune Dir]	1029	[SpdTune Friction]	1031
		[Arm Resistance]	453	[Speed Tune Kp]	1032		
		[Arm Inductance]	454	[Speed Tune Ki]	1033		
Speed Command	**Limits**	[Minimum Speed]	1	[Min Speed Rev]	6	[Max Speed Fwd]	3
		[Min Speed Fwd]	5	[Maximum Speed]	2	[Max Speed Rev]	4
	Discrete Speeds	[Jog Speed]	266	[Preset Speed 3]	156	[Preset Speed 7]	160
		[Jog Off Delay]	1409	[Preset Speed 4]	157	[TB Manual Ref]	267
		[Preset Speed 1]	154	[Preset Speed 5]	158		
		[Preset Speed 2]	155	[Preset Speed 6]	159		
	Speed References	[Trim Ramp]	42	[Trim Speed]	43	[Speed Ratio]	1017
		[Trim Ramp Pct]	378	[Trim Speed Pct]	379		
	Speed Regulator	[Speed Reg En]	242 (1)	[Arm Volt Ki]	494	[Spd Reg Ki]	88
		[Arm Volt Kp]	493	[Spd Reg Kp]	87		
Dynamic Control	**Control Config**	[Spd Trq Mode Sel]	241				
	Ramp Rates	[Speed Ramp En]	245	[Accel Time 2]	24	[Jog Ramp Time]	1410
		[Ramp Type Select]	18	[Decel Time 2]	32	[S Curve Time]	19
		[Accel Time 1]	660	[MOP Accel Time]	22		
		[Decel Time 1]	662	[MOP Decel Time]	30		
	Restart Modes	[Start At Powerup]	1344	[Powerup Delay]	1345		

(1) This parameter available for use with firmware version 2.005 and lower only.

File	**Group**	**Parameters**					
Utility	**Reference Config**	[Direction Mode] [Save HIM Ref]	1322 209	[Man Ref Preload] [Save MOP Ref]	210 249	[MOP Select]	1375
	Drive Memory	[Param Access Lvl]	211	[Reset Defaults]	258	[Language]	302
	Diagnostics	[Drive Status 1] [Drive Status 2] [Last Stop Source]	381 382 1402	[Start Inhibits] [Drive Logic Rslt] [At Speed]	1403 1328 394	[At Zero Speed] [CurrLimit Active] [Spd Limit Active]	395 349 372
	Faults	[Clear Fault Que] [Fault Clear] [Fault Clr Mode] [Status1 at Fault]	263 1347 1348 1349	[Status2 at Fault] [Fault Arm Amps] [Fault Speed] [Fault Field Amps]	1350 1371 1372 1373	[Fault Voltage] [Fault 1 Code]	1374 1351
	Alarms	[Drive Alarm 1]	1380				
Communications	**Comm Control**	[DPI Baud Rate] [DPI Port Sel]	589 590	[DPI Fdbk Select]	1321	[DPI Port Value]	1343
	Masks & Owners	[Logic Mask] [Start Mask] [Jog Mask] [Direction Mask] [Reference Mask] [Accel Mask] [Fault Clr Mask]	591 592 593 594 595 596 597	[MOP Mask] [Local Mask] [Decel Mask] [Stop Owner] [Start Owner] [Jog Owner] [Direction Owner]	598 599 631 600 601 602 603	[Reference Owner] [Accel Owner] [Fault Clr Owner] [MOP Owner] [Local Owner] [Decel Owner]	604 605 606 607 608 609
	Datalinks	[Data In A1] [Data In A2] [Data In B1] [Data In B2] [Data In C1] [Data In C2]	610 611 612 613 614 615	[Data In D1] [Data In D2] [Data Out A1] [Data Out A2] [Data Out B1] [Data Out B2]	616 617 618 619 620 621	[Data Out C1] [Data Out C1] [Data Out D1] [Data Out D2] [Data In Val Sel] [Data In SelData]	622 623 624 625 1319 1320
	Security	[Logic Mask]	591				
Input / Output	**Analog Inputs**	[Anlg In1 Sel] [Anlg In1 Config] [Anlg In2 Sel] [Anlg In2 Config] [Anlg In3 Sel] [Anlg In3 Config]	70 71 75 76 80 81	[Anlg In1 Target] [Anlg In2 Target] [Anlg In3 Target] [Anlg In1 Cmp] [Anlg In1 Cmp Err] [Anlg In1 Cmp Dly]	295 296 297 1042 1043 1044	[Anlg In1 Cmp Eq] [Analog In1 Value] [Analog In2 Value] [Analog In3 Value]	1045 1404 1405 1406
	Analog Outputs	[Anlg Out1 Sel] [Anlg Out2 Sel] [Anlg Out3 Sel]	66 67 68	[Anlg Out4 Sel] [Analog Out1 Scale] [Analog Out2 Scale]	69 62 63	[Analog Out3 Scale] [Analog Out4 Scale]	64 65
	Digital Inputs	[Dig In Status] [Digital In1 Sel] [Digital In2 Sel] [Digital In3 Sel] [Digital In4 Sel] [Digital In5 Sel] [Digital In6 Sel] [Digital In7 Sel] [Digital In8 Sel]	564 133 134 135 136 137 138 139 140	[Digital In9 Sel] [Digital In10 Sel] [Digital In11 Sel] [Digital In12 Sel] [Dig In Term 1] [Dig In Term 2] [Dig In Term 3] [Dig In Term 4] [Dig In Term 5]	141 142 143 144 565 566 567 568 569	[Dig In Term 6] [Dig In Term 7] [Dig In Term 8] [Dig In Term 9] [Dig In Term 10] [Dig In Term 11] [Dig In Term 12]	570 571 572 573 574 575 576
	Digital Outputs	[Dig Out Status] [Digital Out1 Sel] [Digital Out2 Sel] [Digital Out3 Sel]	581 145 146 147	[Digital Out4 Sel] [Digital Out5 Sel] [Digital Out6 Sel] [Digital Out7 Sel]	148 149 150 151	[Digital Out8 Sel] [Relay Out 1 Sel] [Relay Out 2 Sel]	152 1392 629
	DPI Inputs	[DPI P1 Select] [DPI P2 Select]	1323 1324	[DPI P3 Select] [DPI P4 Select]	1325 1326	[DPI P5 Select]	1327

Advanced Parameter View

Parameter 211 [Param Access Lvl] set to option 1 “Advanced”.

File	Group	Parameters					
Monitor	**Speed Meters**	[Speed Ref A]	44	[Ramp Out Pct]	114	[Spd Reg Fdbk]	1008
		[Speed Ref A Pct]	47	[Speed Draw Out]	1018	[Spd Reg Fdbk Pct]	1009
		[Speed Ref B]	48	[Spd Draw Out Pct]	1019	[Spd Feedback]	122
		[Speed Ref B Pct]	49	[Droop Out]	1006	[Spd Feedback Pct]	121
		[Speed Ref Out]	385	[Droop Out Pct]	1007	[Actual Speed]	924
		[Spd Ref Out Pct]	384	[Speed Reg In]	118	[Encoder Speed]	420
		[Ramp In]	110	[Speed Reg In Pct]	117	[Tachometer Speed]	1408
		[Ramp In Pct]	111	[Spd Reg Err]	1010		
		[Ramp Out]	113	[Spd Reg Err Pct]	1011		
	Current Meters	[Inertia Comp Out]	232	[Field Current]	351	[Flux Ref Pct]	500
		[Spd Reg Out Pct]	236	[Fld Current Pct]	234	[Field Curve Out]	476
		[Current Reg In]	41	[Cur Lim Pos Out]	10	[Selected TorqRef]	14
		[Arm Current]	200	[Cur Lim Neg Out]	11	[Motor Trq Ref]	17
		[Arm Current Pct]	199	[Filt TorqCur Pct]	928		
	Drive Data	[FaultCode]	57	[Output Voltage]	233	[Drive Size]	465
		[AC Line Voltage]	466	[Output Power]	1052	[Elapsed Lifetime]	235
		[AC Line Freq]	588	[Drive Type]	300	[Software Version]	331
Motor Control	**Motor Data**	[Max Ref Speed]	45	[Nom Mtr Arm Amps]	179	[MtrOvrld Type]	376
		[Max Feedback Spd]	162	[Nom Mtr Fld Amps]	280	[SAR Volts Scale]	464
		[Rated Motor Volt]	175	[Drv Fld Brdg Cur]	374	[Drive Type Sel]	201
	Field Config	[Field Reg Enable]	497	[Fld Reg Kp]	91	[Reset Fld Curve]	920
		[Field Economy En]	499	[Fld Reg Ki]	92	[Fld Const 40 Pct]	916
		[Field Econ Delay]	1407	[Force Min Field]	498	[Fld Const 70 Pct]	917
		[Field Mode Sel]	469	[Out Volt Level]	921	[Fld Const 90 Pct]	918
		[Max Fld Curr Pct]	467	[Fld Reg Kp Base]	97	[Flux Divide]	462
		[Min Fld Curr Pct]	468	[Fld Reg Ki Base]	98	[Flux Filter BW]	463
		[Fld Weaken Ratio]	456	[Set Fld Curve]	919		
	Torq Attributes	[Current Limit]	7	[Torque Reduction]	342	[TrqTpr Lim2]	753
		[Current Lim Pos]	8	[Zero Torque]	353	[TrqTpr Lim3]	754
		[Current Lim Neg]	9	[TrqTpr Enable]	750	[TrqTpr Lim4]	755
		[Torque Ref]	39	[TrqTpr Lim0]	751	[TrqTpr Spd]	756
		[Trim Torque]	40	[TrqTpr Lim1]	752	[Torq Cur Filter]	926
	Speed Feedback	[Fdbk Device Type]	414	[Spd Fdbk Error]	455	[Encoder Err Chk]	652
		[Anlg Tach Gain]	562	[Spd FB Filt Gain]	914	[Z Channel Enable]	911
		[Feedback Offset]	563	[Spd FB Filt BW]	915	[Z Capture Pos En]	912
		[Spd Fdbk Control]	457	[Act Spd Filter]	923	[Z Captured Pos]	913
		[SpdReg FB Bypass]	458	[Encoder PPR]	169	[Encoder Counts]	1022
		[Spd Fdbk Invert]	461	[Encoder Out Sel]	1021		
	Autotune	[Autotune Cur Lim]	1048	[Speed Tune Dir]	1029	[I Reg Error]	587
		[CurrReg Autotune]	452	[Speed Tune Kp]	1032	[Inertia C Filter]	1012
		[Arm Resistance]	453	[Speed Tune Ki]	1033	[Torque Const]	1013
		[Arm Inductance]	454	[Spd Tune Inertia]	1030	[Inertia]	1014
		[Spd Reg Autotune]	1027	[SpdTune Friction]	1031	[Friction]	1015
	Test Generator	[TstGen Output]	58	[TstGen Offset]	61	[Fld Test Angle]	168
		[TstGen Frequency]	59	[Alpha Test]	166		
		[TstGen Amplitude]	60	[Arm Test Angle]	167		

File	Group	Parameters					
Speed Command	**Limits**	[Minimum Speed]	1	[Min Speed Rev]	6	[Max Speed Fwd]	3
		[Min Speed Fwd]	5	[Maximum Speed]	2	[Max Speed Rev]	4
	Discrete Speeds	[Jog Speed]	266	[Preset Speed 3]	156	[Preset Speed 7]	160
		[Jog Off Delay]	1409	[Preset Speed 4]	157	[TB Manual Ref]	267
		[Preset Speed 1]	154	[Preset Speed 5]	158		
		[Preset Speed 2]	155	[Preset Speed 6]	159		
	Speed References	[Trim Ramp]	42	[Trim Speed]	43	[Speed Ratio]	1017
		[Trim Ramp Pct]	378	[Trim Speed Pct]	379		
	Speed Regulator	[Speed Reg En]	242 (1)	[SpdOut FiltGain]	238	[Spd Zero P Gain]	126
		[Arm Volt Kp]	493	[SpdOut FiltBW]	239	[Lock Speed Integ]	348
		[Arm Volt Ki]	494	[Speed Thresh Pos]	101	[Flying Start En]	388
		[Spd Reg Kp]	87	[Speed Thresh Neg]	102	[SpdReg AntiBckup]	643
		[Spd Reg Ki]	88	[Threshold Delay]	103	[Spd Reg P Filter]	444
		[Arm Volt Kp Base]	495	[At Speed Error]	104	[Spd Up Gain Pct]	445
		[Arm Volt Ki Base]	496	[At Speed Delay]	105	[Speed Up Base]	446
		[Spd Reg Kp Base]	93	[Ref Zero Level]	106	[Speed Up Filter]	447
		[Spd Reg Ki Base]	94	[Speed Zero Level]	107	[SpdReg Kp Bypass]	459
		[Spd Reg Kp Outpt]	99	[Speed Zero Delay]	108	[SpdReg Ki Bypass]	460
		[Spd Reg Ki Outpt]	100	[Spd Zero I En]	123	[SpdFuncSelect]	1016
		[Spd Reg Pos Lim]	95	[Spd Ref Zero En]	124		
		[Spd Reg Neg Lim]	96	[Spd Zero P En]	125		
Dynamic Control	**Control Config**	[Spd Trq Mode Sel]	241	[SLAT Err Stpt]	15	[SLAT Dwell Time]	16
	Ramp Rates	[Speed Ramp En]	245	[MOP Accel Time]	22	[S Curve Accel 2]	667
		[Ramp Type Select]	18	[MOP Decel Time]	30	[S Curve Decel 2]	668
		[Accel Time 1]	660	[Jog Ramp Time]	1410	[Ramp Delay]	20
		[Decel Time 1]	662	[S Curve Time]	19	[Zero Ramp Output]	344
		[Accel Time 2]	24	[S Curve Accel 1]	665	[Zero Ramp Input]	345
		[Decel Time 2]	32	[S Curve Decel 1]	666	[Freeze Ramp]	373
	Load Limits	[Enable Droop]	699	[Droop Limit]	700	[Torq Limit Type]	715
		[Droop Percent]	696	[Load Comp]	698		
		[Droop Filter]	697	[Torq Red CurLim]	13		
	Stop Modes	[Fast Stop Time]	38	[Closing Speed]	1262	[Ramp In Zero En]	1265
		[Spd 0 Trip Delay]	627	[Opening Delay]	1263	[Actuator Delay]	1266
	Restart Modes	[Start At Powerup]	1344	[Powerup Delay]	1345		
	Adaptv Regulator	[Adaptive Spd En]	181	[Adaptive Joint 1]	186	[Adaptive I Gain2]	191
		[Adaptive Reg Typ]	182	[Adaptive Joint 2]	187	[Adaptive P Gain3]	192
		[Adaptive Ref]	183	[Adaptive P Gain1]	188	[Adaptive I Gain3]	193
		[Adaptive Spd 1]	184	[Adaptive I Gain1]	189		
		[Adaptive Spd 2]	185	[Adaptive P Gain2]	190		

(1) This parameter available for use with firmware version 2.005 and lower only.

File	Group	Parameters					
Applications	**PI Control**	[Enable PI]	769	[PI Prop Gain PID]	765	[PI Central v3]	778
		[PI Output]	771	[PI Integral Gain]	764	[PI Central v sel]	779
		[PI Steady Thrsh]	695	[PI Upper Limit]	784	[PI Central vs0]	780
		[PID Steady Delay]	731	[PI Lower Limit]	785	[PI Central vs1]	781
		[PI Init Prop Gn]	793	[PI Central v1]	776	[PI integr freeze]	783
		[PI Init Intgl Gn]	734	[PI Central v2]	777		
	PD Control	[Enable PD]	770	[PD Prop Gain 2]	788	[PD Deriv Gain 1]	766
		[PD Output PID]	421	[PD Prop Gain 3]	790	[PD Deriv Gain 2]	789
		[PD Prop Gain 1]	768	[PD Deriv Filter]	767	[PD Deriv Gain 3]	791
	PID Control	[Enable PI PD]	1258	[PID Target]	782	[PID Clamp]	757
		[PID Output]	774	[PID Output Scale]	773	[PID Setpoint 0]	760
		[Feed Fwd PID]	758	[PID Output Sign]	772	[PID Setpoint 1]	761
		[Real FF PID]	418	[PID Feedback]	763	[PID Setpoint Sel]	762
		[PID Source]	786	[PID Error]	759	[PID Accel Time]	1046
		[PID Source Gain]	787	[PID Error Gain]	1254	[PID Decel Time]	1047
	Init Diam Calc	[Diameter Calc]	794	[Gear Box Ratio]	797	[Diameter Calc St]	800
		[DncrPosSpd]	795	[Dancer Constant]	798		
		[Max Deviation]	796	[Minimum Diameter]	799		
	Diameter Calc	[Minimum Diameter]	799	[Line Speed Pct]	1160	[Diam Preset 1]	1165
		[Max Diameter]	1153	[Line Spd Thresh]	1155	[Diam Preset 2]	1166
		[Roll Diameter]	1154	[Base Omega]	1163	[Diam Preset 3]	1167
		[Diam Threshold]	1158	[Diameter Filter]	1162	[Diam Preset Sel]	1168
		[Diameter Reached]	1159	[Diam Init Filter]	1206	[Diameter Reset]	1157
		[Winder Type]	1187	[Diam Stdy Delay]	1207	[Diam Calc Dis]	1161
		[Line Spd Source]	1204	[Diam Inc Dec En]	1205		
		[Line Spd Gain]	1156	[Diam Preset 0]	1164		
	Winder Functions	[Torque Winder En]	1209	[InertiaCompCnst]	1191	[Ref Line Speed]	1286
		[Tension Ref]	1180	[InertiaCompVar]	1192	[W Target]	1210
		[Act Ten Ref Pct]	1194	[Static Friction]	1174	[W Reference]	1217
		[Torq Current Pct]	1193	[Static F Zero]	1287	[Winder Side]	1201
		[Int Acc Calc En]	1183	[Dynamic Friction]	1175	[W Gain]	1202
		[Time AccDec Min]	1182	[Actual Comp]	1213	[W Offset]	1199
		[Acc Dec Filter]	1212	[Closed Loop En]	1214	[Offs Accel Time]	1198
		[Line Accel Pct]	1184	[Close Loop Comp]	1208	[Speed Match]	1195
		[Line Decel Pct]	1185	[Tension Scale]	1181	[Spd Match Gain]	1200
		[Line FastStp Pct]	1186	[Taper Enable]	1176	[Spd Match Acc]	1196
		[Accel Status]	1188	[Initial Diameter]	1177	[Spd Match Dec]	1197
		[Decel Status]	1189	[Final Diameter]	1178	[Spd Match Torque]	1216
		[Fast Stop Status]	1190	[Tension Reduct]	1179	[Spd Match Compl]	1203
		[Variable J Comp]	1171	[Speed Demand En]	1215	[Jog TW Enable]	1256
		[Constant J Comp]	1172	[Ref Spd Source]	1284	[Jog TW Speed]	1255
		[Materl Width Pct]	1173	[Ref Speed Gain]	1285		
	Scale Blocks	[Scale1 Input]	484	[Scale3 Input]	1218	[Scale5 Input]	1236
		[Scale1 Output]	485	[Scale3 Output]	1219	[Scale5 Output]	1237
		[Scale1 Mul]	486	[Scale3 Mul]	1220	[Scale5 Mul]	1238
		[Scale1 Div]	487	[Scale3 Div]	1221	[Scale5 Div]	1239
		[Scale1 In Max]	488	[Scale3 In Max]	1222	[Scale5 In Max]	1240
		[Scale1 In Min]	489	[Scale3 In Min]	1223	[Scale5 In Min]	1241
		[Scale1 In Off]	490	[Scale3 In Off]	1224	[Scale5 In Off]	1242
		[Scale1 Out Off]	491	[Scale3 Out Off]	1225	[Scale5 Out Off]	1243
		[Scale1 In Abs]	492	[Scale3 In Abs]	1226	[Scale5 In Abs]	1244
		[Scale2 Input]	553	[Scale4 Input]	1227	[Scale6 Input]	1245
		[Scale2 Output]	554	[Scale4 Output]	1228	[Scale6 Output]	1246
		[Scale2 Mul]	555	[Scale4 Mul]	1229	[Scale6 Mul]	1247
		[Scale2 Div]	556	[Scale4 Div]	1230	[Scale6 Div]	1248
		[Scale2 In Max]	557	[Scale4 In Max]	1231	[Scale6 In Max]	1249
		[Scale2 In Min]	558	[Scale4 In Min]	1232	[Scale6 In Min]	1250
		[Scale2 In Off]	559	[Scale4 In Off]	1233	[Scale6 In Off]	1251
		[Scale2 Out Off]	560	[Scale4 Out Off]	1234	[Scale6 Out Off]	1252
		[Scale2 In Abs]	561	[Scale4 In Abs]	1235	[Scale6 In Abs]	1253

File	Group	Parameters					
Utility	**Reference Config**	[Direction Mode]	1322	[Man Ref Preload]	210	[MOP Select]	1375
		[Save HIM Ref]	209	[Save MOP Ref]	249		
	Drive Memory	[Param Access Lvl]	211	[Reset Defaults]	258	[Language]	302
	Diagnostics	[Drive Status 1]	381	[Speed Threshold]	393	[Ramp Select 1]	404
		[Drive Status 2]	382	[Torque Positive]	346	[Encoder State]	651
		[Last Stop Source]	1402	[Torque Negative]	347	[MtrOvrld Status]	1290
		[Start Inhibits]	1403	[MOP Inc Active]	396	[TestPoint Sel]	1381
		[Drive Logic Rslt]	1328	[MOP Dec Active]	397	[TestPoint Data]	1382
		[At Speed]	394	[Spd Select 0]	400	[TaskLoad 32 ms]	1383
		[At Zero Speed]	395	[Spd Select 1]	401	[TaskLoad 1 ms]	1384
		[CurrLimit Active]	349	[Spd Select 2]	402	[TaskLoad 2 ms]	1385
		[Spd Limit Active]	372	[Ramp Select 0]	403	[TaskLoad 8 ms]	1386
	Faults	[Clear Fault Que]	263	[Fault 2 Code]	1352	[Fault 2 Time]	1362
		[Fault Clear]	1347	[Fault 3 Code]	1353	[Fault 3 Time]	1363
		[Fault Clr Mode]	1348	[Fault 4 Code]	1354	[Fault 4 Time]	1364
		[Status1 at Fault]	1349	[Fault 5 Code]	1355	[Fault 5 Time]	1365
		[Status2 at Fault]	1350	[Fault 6 Code]	1356	[Fault 6 Time]	1366
		[Fault Arm Amps]	1371	[Fault 7 Code]	1357	[Fault 7 Time]	1367
		[Fault Speed]	1372	[Fault 8 Code]	1358	[Fault 8 Time]	1368
		[Fault Field Amps]	1373	[Fault 9 Code]	1359	[Fault 9 Time]	1369
		[Fault Voltage]	1374	[Fault 10 Code]	1360	[Fault 10 Time]	1370
		[Fault 1 Code]	1351	[Fault 1 Time]	1361		
	Alarms	[Drive Alarm 1]	1380	[FldLoss Flt Cfg]	473	[OverCurrent Thr]	584
		[OverVolt Flt Cfg]	203	[Spd Loss Flt Cfg]	478	[Overspeed Val]	585
		[Aux Inp Flt Cfg]	354	[MtrOvrld Flt Cfg]	479		
		[OverTemp Flt Cfg]	365	[UnderVolt Thresh]	481		
	User Defined	[UsrDsplyMult0]	50	[UserDefined14]	517	[UsrDefBitWrdA15]	535
		[UsrDsplyDiv0]	51	[UserDefined15]	518	[UsrDefBitWrdB]	536
		[UsrValMult1]	53	[UsrDefBitWrdA]	519	[UsrDefBitWrdB0]	537
		[UsrValDiv1]	54	[UsrDefBitWrdA0]	520	[UsrDefBitWrdB1]	538
		[UserDefined0]	503	[UsrDefBitWrdA1]	521	[UsrDefBitWrdB2]	539
		[UserDefined1]	504	[UsrDefBitWrdA2]	522	[UsrDefBitWrdB3]	540
		[UserDefined2]	505	[UsrDefBitWrdA3]	523	[UsrDefBitWrdB4]	541
		[UserDefined3]	506	[UsrDefBitWrdA4]	524	[UsrDefBitWrdB5]	542
		[UserDefined4]	507	[UsrDefBitWrdA5]	525	[UsrDefBitWrdB6]	543
		[UserDefined5]	508	[UsrDefBitWrdA6]	526	[UsrDefBitWrdB7]	544
		[UserDefined6]	509	[UsrDefBitWrdA7]	527	[UsrDefBitWrdB8]	545
		[UserDefined7]	510	[UsrDefBitWrdA8]	528	[UsrDefBitWrdB9]	546
		[UserDefined8]	511	[UsrDefBitWrdA9]	529	[UsrDefBitWrdB10]	547
		[UserDefined9]	512	[UsrDefBitWrdA10]	530	[UsrDefBitWrdB11]	548
		[UserDefined10]	513	[UsrDefBitWrdA11]	531	[UsrDefBitWrdB12]	549
		[UserDefined11]	514	[UsrDefBitWrdA12]	532	[UsrDefBitWrdB13]	550
		[UserDefined12]	515	[UsrDefBitWrdA13]	533	[UsrDefBitWrdB14]	551
		[UserDefined13]	516	[UsrDefBitWrdA14]	534	[UsrDefBitWrdB15]	552
Communications	**Comm Control**	[DPI Baud Rate]	589	[DPI Fdbk Select]	1321	[DPI Port Value]	1343
		[DPI Port Sel]	590				
	Masks & Owners	[Logic Mask]	591	[MOP Mask]	598	[Reference Owner]	604
		[Start Mask]	592	[Local Mask]	599	[Accel Owner]	605
		[Jog Mask]	593	[Decel Mask]	631	[Fault Clr Owner]	606
		[Direction Mask]	594	[Stop Owner]	600	[MOP Owner]	607
		[Reference Mask]	595	[Start Owner]	601	[Local Owner]	608
		[Accel Mask]	596	[Jog Owner]	602	[Decel Owner]	609
		[Fault Clr Mask]	597	[Direction Owner]	603		
	Datalinks	[Data In A1]	610	[Data In D1]	616	[Data Out C1]	622
		[Data In A2]	611	[Data In D2]	617	[Data Out C1]	623
		[Data In B1]	612	[Data Out A1]	618	[Data Out D1]	624
		[Data In B2]	613	[Data Out A2]	619	[Data Out D2]	625
		[Data In C1]	614	[Data Out B1]	620	[Data In Val Sel]	1319
		[Data In C2]	615	[Data Out B2]	621	[Data In SelData]	1320
	Security	[Logic Mask]	591	[Write Mask Act]	1377	[Port Mask Act]	1379
		[Logic Mask Act]	1376	[Write Mask Cfg]	1378		

File	Group	Parameters					
Input / Output	**Analog Inputs**	[Anlg In1 Sel]	70	[Anlg In2 Offset]	79	[Anlg In2 Target]	296
		[Anlg In1 Config]	71	[Anlg In2 Tune]	260	[Anlg In3 Target]	297
		[Anlg In1 Scale]	72	[Anlg In2 Filter]	801	[Anlg In1 Cmp]	1042
		[Anlg1 Tune Scale]	73	[Anlg In3 Sel]	80	[Anlg In1 Cmp Err]	1043
		[Anlg In1 Offset]	74	[Anlg In3 Config]	81	[Anlg In1 Cmp Dly]	1044
		[Anlg In1 Tune]	259	[Anlg In3 Scale]	82	[Anlg In1 Cmp Eq]	1045
		[Anlg In1 Filter]	792	[Anlg3 Tune Scale]	83	[Analog In1 Value]	1404
		[Anlg In2 Sel]	75	[Anlg In3 Offset]	84	[Analog In2 Value]	1405
		[Anlg In2 Config]	76	[Anlg In3 Tune]	261	[Analog In3 Value]	1406
		[Anlg In2 Scale]	77	[Anlg In3 Filter]	802		
		[Anlg2 Tune Scale]	78	[Anlg In1 Target]	295		
	Analog Outputs	[Anlg Out1 Sel]	66	[Anlg Out4 Sel]	69	[Analog Out3 Scale]	64
		[Anlg Out2 Sel]	67	[Analog Out1 Scale]	62	[Analog Out4 Scale]	65
		[Anlg Out3 Sel]	68	[Analog Out2 Scale]	63		
	Digital Inputs	[ContactorControl]	1391	[Digital In12 Sel]	144	[Dig In Term 1]	565
		[Dig In Status]	564	[Inversion In 1]	1276	[Dig In Term 2]	566
		[Digital In1 Sel]	133	[Inversion In 2]	1277	[Dig In Term 3]	567
		[Digital In2 Sel]	134	[Inversion In 3]	1278	[Dig In Term 4]	568
		[Digital In3 Sel]	135	[Inversion In 4]	1279	[Dig In Term 5]	569
		[Digital In4 Sel]	136	[Inversion In 5]	1280	[Dig In Term 6]	570
		[Digital In5 Sel]	137	[Inversion In 6]	1281	[Dig In Term 7]	571
		[Digital In6 Sel]	138	[Inversion In 7]	1282	[Dig In Term 8]	572
		[Digital In7 Sel]	139	[Inversion In 8]	1283	[Dig In Term 9]	573
		[Digital In8 Sel]	140	[Inversion In 9]	1387	[Dig In Term 10]	574
		[Digital In9 Sel]	141	[Inversion In 10]	1388	[Dig In Term 11]	575
		[Digital In10 Sel]	142	[Inversion In 11]	1389	[Dig In Term 12]	576
		[Digital In11 Sel]	143	[Inversion In 12]	1390		
	Digital Outputs	[Dig Out Status]	581	[Digital Out7 Sel]	151	[Inversion Out 4]	1270
		[Digital Out1 Sel]	145	[Digital Out8 Sel]	152	[Inversion Out 5]	1271
		[Digital Out2 Sel]	146	[Relay Out 1 Sel]	1392	[Inversion Out 6]	1272
		[Digital Out3 Sel]	147	[Relay Out 2 Sel]	629	[Inversion Out 7]	1273
		[Digital Out4 Sel]	148	[Inversion Out 1]	1267	[Inversion Out 8]	1274
		[Digital Out5 Sel]	149	[Inversion Out 2]	1268	[Inversion Relay1]	1393
		[Digital Out6 Sel]	150	[Inversion Out 3]	1269	[Inversion Relay2]	1275
	DPI Inputs	[DPI P1 Select]	1323	[DPI P3 Select]	1325	[DPI P5 Select]	1327
		[DPI P2 Select]	1324	[DPI P4 Select]	1326		

Monitor File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MONITOR	Speed Meters	44	**[Speed Ref A]** Displays the first speed reference of the drive in rpm. This parameter can be sourced from many signals and is the factory default selection for Par 70 [Anlg In1 Sel]. See block diagram Speed Reference Selection on page 313 for possible source signals. Note: The maximum value of this parameter was changed from –/+ Par 45 to –/+ 1.3 x Par 45 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+ 1.3 x Par 45 [Max Ref Speed] (1) rpm (1) The value of [Max Ref Speed] cannot exceed 6000 rpm.	16-bit Int	45
		47	**[Speed Ref A Pct]** Displays the first speed reference of the drive as a percentage of Par 45 [Max Ref Speed]. This parameter can be sourced from many signals. See block diagram Speed Reference Selection on page 313 for possible source signals. Notes: This parameter can be assigned to an analog input. The min. and max. values of this parameter were changed from –/+100.0 to –/+130.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+130.0 %	Real	45
		48	**[Speed Ref B]** Displays the second speed reference of the drive in rpm. This parameter can be sourced from many signals. See block diagram Speed Reference Selection on page 313 for possible source signals. Note: The maximum value of this parameter was changed from –/+ Par 45 to –/+ 1.3 x Par 45 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+ 1.3 x Par 45 [Max Ref Speed] (1) rpm (1) The value of [Max Ref Speed] cannot exceed 6000 rpm.	16-bit Int	45
		49	**[Speed Ref B Pct]** Displays the second speed reference of the drive as a percentage of Par 45 [Max Ref Speed]. This parameter can be sourced from many signals. See block diagram Speed Reference Selection on page 313 for possible source signals. Note: The min. and max. values of this parameter were changed from –/+100.0 to –/+130.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+130.0 %	Real	45
		110	**[Ramp In]** Total reference value input to the ramp in rpm. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		111	**[Ramp In Pct]** Total reference value input to the ramp as a percentage of Par 45 [Max Ref Speed]. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+100.0 to –/+200.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	45
		113	**[Ramp Out]** Output of the ramp in rpm. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		114	**[Ramp Out Pct]** Output of the ramp as a percentage of Par 45 [Max Ref Speed]. Note: The min. and max. values of this parameter were changed from –/+100.0 to –/+200.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	45

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MONITOR	**Speed Meters**	**117**	**[Speed Reg In Pct]** Total reference value input to the Speed Regulator as a percentage of Par 45 [Max Ref Speed]. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+100.0 to –/+200.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	
		118	**[Speed Reg In]** Total reference value input to the Speed Regulator in rpm. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		121	**[Spd Feedback Pct]** Actual speed as a percentage of the Par 162 [Max Feedback Spd]. Notes: This parameter can be assigned to an analog output and is the factory default selection for Par 66 [Anlg Out1 Sel]. The min. and max. values of this parameter were changed from –/+100.0 to –/+200.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	66, 162
		122	**[Spd Feedback]** Actual speed in rpm. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		384	**[Spd Ref Out Pct]** Output of the Speed Reference selection as a percentage of Par 45 [Max Ref Speed]. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+100.0 to –/+200.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	45
		385	**[Speed Ref Out]** Output of the Speed Reference selection. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		420	**[Encoder Speed]** Actual speed measured by the digital encoder.	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		924	**[Actual Speed]** Filtered value of Par 122 [Spd Feedback]. Par 923 [Act Spd Filter] can be used to provide limited (first order low pass) filtering of this value. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+32766 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	121, 222, 923
		1006	**[Droop Out]** Displays the output of the Droop Compensation function. The [Droop Out] signal (if enabled by Par 699 [Enable Droop]) is summed with Par 1018 [Speed Draw Out] and 43 [Trim Speed]. Droop compensation specifies the amount of adjustment in speed reference when operating at full load current. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+ Par 45 [Max Ref Speed] rpm	16-bit Int	45
		1007	**[Droop Out Pct]** The value of Par 1006 [Droop Out] shown as a percentage of Par 45 [Max Ref Speed]. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+100.0 %	Real	45

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MONITOR	Speed Meters	1008	**[Spd Reg Fdbk]** Speed Regulator Feedback signal after all filtering has been applied. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	
		1009	**[Spd Reg Fdbk Pct]** Par 1008 [Spd Reg Fdbk] shown as a percentage of Par 162 [Max Feedback Spd]. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	162
		1010	**[Spd Reg Err]** Speed Regulator Error signal, the difference between Par 118 [Speed Reg In] and 1008 [Spd Reg Fdbk]. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+8192 rpm	16-bit Int	118, 1008
		1011	**[Spd Reg Err Pct]** Par 1010 [Spd Reg Err] shown as a percentage of Par 45 [Max Ref Speed]. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+200.0 %	Real	45
		1018	**[Speed Draw Out]** Speed draw output value. Notes: This parameter can be assigned to an analog output. See Speed Draw Function on page 289 for more information.	Default: Min/Max: Units: (1) The value of [Max Ref Speed] cannot exceed 8192 rpm.	Read Only –/+ Par 45 [Max Ref Speed] [1] rpm	16-bit Int	45
		1019	**[Spd Draw Out Pct]** Speed draw output as a percentage of Par 45 [Max Ref Speed]. Notes: This parameter can be assigned to an analog output. The min. and max. values of this parameter were changed from –/+100.00 to –/+100.0 with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+100.0 %	Real	45
		1408	**[Tachometer Speed]** Actual speed measured by the DC analog tachometer. Note: The min. and max. values of this parameter were changed from –/+32770 to –/+8192 with firmware version 3.001	Default: Min/Max: Units:	Read Only –/+8192 rpm	Real	
	Current Meters	10	**[Cur Lim Pos Out]** Displays the value of the current limit for the positive torque direction as a percentage of the value in Par 179 [Nom Mtr Arm Amps].	Default: Min/Max: Units:	Read Only 0 / 200 %	Real	179
		11	**[Cur Lim Neg Out]** Displays the value of the current limit for the negative torque direction as a percentage of the value in Par 179 [Nom Mtr Arm Amps].	Default: Min/Max: Units:	Read Only 0 / 200 %	Real	179
		14	**[Selected TorqRef]** Displays the selected torque reference based on Par 241 [Spd Trq Mode Sel] value. Scaled as a percentage of Par 179 [Nom Mtr Arm Amps]. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200 %	Real	179, 241
		17	**[Motor Trq Ref]** Displays the total motor torque reference. Scaled as a percentage of Par 179 [Nom Mtr Arm Amps]. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	Read Only –/+200 %	Real	179
		41	**[Current Reg In]** Total current reference value expressed as a percentage of the value in Par 179 [Nom Mtr Arm Amps]. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	Read Only –/+200 %	Real	179

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MONITOR	Current Meters	**199**	**[Arm Current Pct]** Armature current expressed as a percentage of the value in Par 179 [Nom Mtr Arm Amps]. Note: This parameter can be assigned to an analog output and is the default selection for Par 67 [Anlg Out2 Sel].	Default: Min/Max: Units:	Read Only –/+250 %	16-bit Int	179
		200	**[Arm Current]** Armature current in Amperes. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	Read Only –/+2.5 x [Nom Mtr Arm Amps] A	Real	
		232	**[Inertia Comp Out]** Displays the output of the Inertia Compensation function. The [Inertia Comp Out] signal (if selected by Par 1016 [SpdFuncSelect]) is summed with Pars 14 [Selected TorqRef] and 40 [Trim Torque]. Inertia compensation provides a torque feed forward signal during changes in motor speed reference. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only –/+200 %	Real	
		234	**[Fld Current Pct]** Field current (present value) as a percentage of Par 280 [Nom Mtr Fld Amps]. Note: This parameter can be assigned to an analog output and is the default value for Par 68 [Anlg Out3 Sel].	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	280
		236	**[Spd Reg Out Pct]** Output value of the speed regulator, as a percentage of Par 179 [Nom Mtr Arm Amps], used as the reference for the current regulator.	Default: Min/Max: Units:	Read Only –/+200 %	Real	179
		351	**[Field Current]** Present value of the field current. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	Read Only 0.00 / 99.90 A	Real	
		476	**[Field Curve Out]** Displays the output value of the field current used as a reference to the field current regulator. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	
		500	**[Flux Ref Pct]** Field flux (reference) as a percentage of Par 280 [Nom Mtr Fld Amps]. Notes: This parameter can be assigned to an analog output. This name of this parameter was changed from [Field Ref Pct] to [Flux Ref Pct] with firmware version 3.001.	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	280
		928	**[Filt TorqCur Pct]** Filtered value of Par 1193 [Torq Current Pct]. The amount of filtering is set by Par 926 [Torq Cur Filter].	Default: Min/Max: Units:	Read Only –/+200 %	16-bit Int	926, 1193
	Drive Data	**57**	**[FaultCode]** A code that represents the fault that tripped the drive. Refer to Fault Descriptions on page 198 for a list of fault codes and descriptions.	Default: Min/Max:	Read Only 0 / 65535	16-bit Int	
		233	**[Output Voltage]** Measured output armature voltage. Note: This parameter can be assigned to an analog output and is the default selection for Par 69 [Anlg Out4 Sel].	Default: Min/Max: Units:	Read Only -/+999.00 Vdc	Real	
		235	**[Elapsed Lifetime]** Shows the operating time of the drive. This parameter counts the time for which the drive is energized (even if the drive is disabled).	Default: Min/Max: Units:	Read Only 0.00 / 65535.0 H.m	Real	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MONITOR	Drive Data	300	**[Drive Type]** Displays of the drive type. "10" = Non-Regenerative "11" = Regenerative	Default: Min/Max:	Read Only 10 / 11	16-bit Int	
		331	**[Software Version]** Displays the Major and Minor (Major.Minor) firmware version numbers active in the drive.	Default: Min/Max:	Read Only 1.00 / 999.00	Real	
		465	**[Drive Size]** Armature current rating (as indicated by the configuration of DIP switch S15 on the Control board). This value is used to determine the Drive Overload fault (F64). Note: S15 is set to the appropriate value at the factory. However, if the Control board was supplied separate from the drive and installed as a replacement part, S15 must be manually set to the appropriate drive size. Refer to DIP Switch and Jumper Settings on page 68.	Default: Min/Max: Units:	Read Only 0 / Based on drive current rating A	16-bit Int	
		466	**[AC Line Voltage]** AC input voltage.	Default: Min/Max: Units:	Read Only 0 / 960 Vac	16-bit Int	
		588	**[AC Line Freq]** AC input frequency.	Default: Min/Max: Units:	Read Only 0.00 / 70.00 Hz	Real	
		1052	**[Output Power]** Output power. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	Read Only 0.00 / 9999.99 kW	Real	

Motor Control File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	Motor Data	**45** ○	**[Max Ref Speed]** Highest speed reference that can be commanded. The value of this parameter also scales external speed reference values (rpm) to internal units (counts), including analog inputs (10V = Par 45 rpm). Notes: If a speed feedback device is used (encoder or tachometer), refer to Drive Reference and Feedback Scaling on page 265 for instructions. The maximum value was changed from "16383" to "6000" with firmware version 3.001.	Default: Min/Max: Units:	1750 1 / 6000 rpm	32-bit Int	2
		162 ○	**[Max Feedback Spd]** Specifies the scaling between internal (counts) and external speed feedback values. Typically, this parameter is set to the same value as Parameter 45 [Max Ref Speed]. If an analog (DC) tachometer is used, this parameter's value must be set to be compatible with the S4 switches on the control board (see DIP Switch and Jumper Settings on page 68). If armature voltage feedback is used or Par 458 [SpdReg FB Bypass] is enabled, this parameter must be set to the motor nameplate base speed. Par 585 [Overspeed Val] should be set 10% higher than the value entered into Par 162. Notes: If a speed feedback device is used (encoder or tachometer), refer to Drive Reference and Feedback Scaling on page 265 for instructions. The maximum value was changed from "16383" to "6000" with firmware version 3.001.	Default: Min/Max: Units:	1750.00 1.00 / 6000 rpm	Real	169, 414, 458, 585
		175 ○	**[Rated Motor Volt]** Maximum armature voltage of the drive. Typically, this value is set to the Motor Nameplate Armature voltage. When Par 469 [Field Mode Sel] is set to 1 = "Field Weaken", the value in this parameter equals the voltage at which the field weakening phase begins. Note: This parameter affects the threshold of an overvoltage condition, as indicated by an "Arm Overvoltage" fault (F5).	Default: Min/Max: Units:	240.0 20.0 / 999.0 V	Real	162, 169, 469, 481
		179 ○	**[Nom Mtr Arm Amps]** Rated motor nameplate armature current. The settings for the current limit and the overload function are based on this current value.	Default: Min/Max: Units:	Based on drive current rating 0.10 / Based on drive current rating A	Real	465
		201 ○ A	**[Drive Type Sel]** **Important:** This parameter is only applicable to non-regenerative (2-quadrant) drives. Allows non-regenerative drives to use an external 4-quadrant controller. • "On" = Ramp, Speed, Torque current references and Speed measurement have the same behavior as a four quadrant drive. ⚠ **ATTENTION:** Failure to set this parameter to a value appropriate for the intended application could result in equipment damage and/or personal injury.	Default: Options:	0 = "Off" 0 = "Off" 1 = "On"	16-bit Int	
		280 ○	**[Nom Mtr Fld Amps]** Rated motor nameplate field current (I_{dFN}).	Default: Min/Max: Units:	Par 374 [Drv Fld Brdg Cur] x 0.33 0.00 / [Drv Fld Brdg Cur] A	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	Motor Data	**374** ○	**[Drv Fld Brdg Cur]** Drive rated field bridge current (I_{dFN}). The value in this parameter must be set equal to the value chosen with DIP switch S14 on the Control board (refer to Table 14 on page 55 for DIP switch configuration).	Default: Min/Max: Units:	1.00 0.50 / 80.00 A	Real	
		376 ○ A	**[MtrOvrld Type]** Allows selection of the type of motor overload calculation based on Par 179 [Motor Arm Amps]. • StandardDuty = 150% load for 1 minute or 200% load for 3 seconds before a motor overload condition is indicated. • HeavyDuty = 200% load for 1 minute before a motor overload condition is indicated. This selection requires that the drive be oversized relative to the motor in order to be able to provide the necessary current without faulting from a “Drive Overload” (F.64). Note: This parameter was added with firmware version 3.001.	Default: Options:	0 = “StandardDuty” 0 = “StandardDuty” 1 = “HeavyDuty”	16-bit Int	179, 479, 1290
		464	**[SAR Volts Scale]** Scales the following parameters so that they show actual voltage values rather than drive calculated values when in Stand-Alone Regulator (SAR) mode: 175 [Motor Rated Volt] 233 [Output Voltage] 466 [AC Line Voltage] 481 [Undervolt Thresh] 495 [Arm Volt Kp Base] 496 [Arm Volt Ki Base] 1052 [Output Power] 1374 [Fault Voltage] Notes: This parameter was added with firmware version 4.001. See Appendix H PowerFlex DC Stand-Alone Regulator Installation on page 345 for more information. **Important**: When the drive is not in SAR mode, this parameter is clamped to the default value (1.0).	Default: Min/Max:	1.0 0.5 / 10.0	Real	
	Field Config	**91** A	**[Fld Reg Kp]** Proportional gain (K_P) of the flux regulator expressed as a percentage of Par 97 [Fld Reg Kp Base].	Default: Min/Max: Units:	2.00 0.00 / 100.00 %	Real	97
		92 A	**[Fld Reg Ki]** Integral gain (K_I) of the flux regulator expressed as a percentage of Par 98 [Fld Reg Ki Base].	Default: Min/Max: Units:	1.00 0.00 / 100.00 %	Real	98
		97 ○ A	**[Fld Reg Kp Base]** The proportional gain (K_{P0}) of the field current regulator (base value).	Default: Min/Max:	3276.70 0.10 / 32767.00	Real	91
		98 ○ A	**[Fld Reg Ki Base]** Integral gain (K_{I0}) of the field current regulator in (base value).	Default: Min/Max:	3276.70 0.10 / 32767.00	Real	92
		456 ○	**[Fld Weaken Ratio]** The ratio of Motor Nameplate Base Speed to Par 45 [Max Ref Speed] when Par 469 [Field Mode Sel] = 1 "Field Weaken". This value is the percentage of the maximum application speed when field weakening will begin: "Motor Base Speed" / Par 45 [Max Ref Speed] x 100. If Par 469 [Field Mode Sel] = 0 “Base Speed”, this parameter must be = 100%.	Default: Min/Max: Units:	100 0 / 100 %	16-bit Int	921, 469

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MOTOR CONTROL	Field Config	462 A	**[Flux Divide]** Selects division by flux for Inertia Compensation or Torque Reference. Note: Added with firmware version 3.001.	Default: Options:	0 = "Torque Ref" 0 = "Torque Ref" 1 = "Inertia Comp"	16-bit Int	
		463 A	**[Flux Filter BW]** Adjustable low pass filter on the value of Par 500 [Flux Ref Pct]. The filtered result is used by the Torque Reference divide by flux function. Note: Added with firmware version 3.001.	Default: Min/Max: Units:	50 0 / 2000 ms	16-bit Int	
		467	**[Max Fld Curr Pct]** Maximum allowable field current. The maximum value (100%) corresponds to the value set in Par 280 [Nom Mtr Fld Amps]. The value of this field linearly affects the field current, unless a flux curve is set in Pars 916, 917, and 918 [Fld Const xx Pct]. Note: This parameter can be assigned to an analog input or output. ⚠ **ATTENTION:** Failure to set this parameter to a value appropriate for the intended application could result in excessive motor speed, equipment damage, and/or bodily injury.	Default: Min/Max: Units:	100 Par 468 [Min Fld Curr Pct] / 100 %	16-bit Int	468
		468	**[Min Fld Curr Pct]** Minimum allowable field current. The value set in this parameter also influences the threshold at which the "Fld Current Loss" (F6) fault occurs. The threshold is half of the value of Par 468 [Min Fld Curr Pct]. The value of Par 351 [Field Current] equals the value of this parameter when Par 499 [Field Economy En] = 1 "Enabled" and Field Economy becomes active. ⚠ **ATTENTION:** Failure to set this parameter to a value appropriate for the intended application could result in excessive motor speed, equipment damage, and/or personal injury.	Default: Min/Max: Units:	30 0 / Par 467 [Max Fld Curr Pct] %	16-bit Int	467, 499
		469 ○	**[Field Mode Sel]** Operating mode of the field controller. • "Base Speed" = The motor field is regulated with constant current and controls the motor from zero to base speed. If a curve is defined through Pars 916, 917 and 918 [Fld Const xx Pct], this value will change linearly through Par 467 [Max Fld Curr Pct] (which is a percentage of the nominal flux value set in Par 280 [Nom Mtr Fld Amps]). • "Field Weaken" = The motor field is regulated with a combination of torque and constant power (armature and field regulation -- field weakening). The maximum armature voltage is configured in Par 175 [Rated Motor Volt]. • "External" = The motor field power is supplied by an external rectifier/converter (the drive's field output is disabled).	Default: Options:	0 = "Base Speed" 0 = "Base Speed" 1 = "Field Weaken" 2 = "External"	16-bit Int	456, 916, 917, 918, 921
		497 ○	**[Field Reg Enable]** Enables/Disables the field regulator. • "Enabled" = The field regulator is enabled and controlling the field output. • "Disabled" = The field regulator is disabled (the field current is zero).	Default: Options:	1 = "Enabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	Field Config	**498** ○ A	**[Force Min Field]** Enables/Disables the minimum field current value. • "Enabled" = The field current corresponds to the value set via Par 468 [Min Fld Curr Pct]. • "Disabled" = The field current is regulated based on the quadrant mode and situation in which the drive is operating. Note: This parameter can be assigned to a digital input (35 "Force MinFld"). ⚠ **ATTENTION:** Enabling (forcing) the minimum field current while the drive is running could result in excessive motor speed, equipment damage, and/or bodily injury.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		499	**[Field Economy En]** When this parameter is set to 1 = "Enabled" and the value in Par 107 [Speed Zero Level] is reached (after the amount of time specified in Par 1407 [Field Econ Delay] has elapsed), the minimum field current (set via Par 468 [Min Fld Curr Pct]) is produced. • "Disabled" = Disables field economy • "Enabled" = Enables field economy	Default: Options:	1 = "Enabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	395, 468, 1407
		916 ○ A	**[Fld Const 40 Pct]** Current value at 40% of the rated field flux.	Default: Min/Max: Units:	40.00 0.00 / 100.00 %	Real	469
		917 ○ A	**[Fld Const 70 Pct]** Current value at 70% of the rated field flux.	Default: Min/Max: Units:	70.00 0.00 / 100.00 %	Real	469
		918 ○ A	**[Fld Const 90 Pct]** Current value at 90% of the rated field flux.	Default: Min/Max: Units:	90.00 0.00 / 100.00 %	Real	469
		919 ○ A	**[Set Fld Curve]** When set to "0", this parameter controls the motor field current to field reference curve according to the values specified in the [Fld Const xx Pct] parameters. With this curve is defined, the result of [Max Fld Curr Pct] / [Flux Ref Pct] equals the percentage of field current according to the characteristic of the curve. This field is Write Only. After the value of this field is set to "0", it will automatically return to "1". Note: See Tuning the Field Current Curve on page 307 for more information.	Default: Min/Max:	1 0 / 1	16-bit Int	916, 917, 918
		920 ○ A	**[Reset Fld Curve]** when set to "1", resets the drive to use a linear field curve. When this parameter is set, Par 280 [Nom Mtr Fld Amps] is linearly changed through [Max Fld Curr Pct] / [Flux Ref Pct]. This field is Write Only. After the value of this field is set to "1", it will automatically return to "0".	Default: Min/Max: Units:	0 0 / 1	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MOTOR CONTROL	Field Config	921 A	**[Out Volt Level]** The percentage of maximum output voltage based on the value in Par 175 [Rated Motor Volt]. In regenerative, field-weakened applications (hoist, elevator, unwinder, etc.) the value of this parameter should be set less than 100% to allow operation when overcoming gravity). The value of this parameter also determines the voltage where the drive begins field de-fluxing while Field Weaken mode is active (Par 469 [Field Mode Sel] = "Field Weaken"). Notes: This parameter can be assigned to an analog output or analog input (by selecting "Out Volt Lvl"). The maximum value of this parameter was changed from "100" to "110" with firmware version 3.001.	Default: Min/Max: Units:	100.0 0.0 / 110.0 %	Real	469
		1407	**[Field Econ Delay]** Amount of time to elapse once the drive reaches zero speed (as determined by Par 107 [Speed Zero Level]) before field economy becomes active.	Default: Min/Max: Units:	300 0 / 1800 s	16-bit Int	107, 499
	Torq Attributes	7	**[Current Limit]** Symmetrical current limit expressed as a percentage of the value in Par 179 [Nom Mtr Arm Amps]. This value applies to both current directions for four quadrant drives. • If Par 7 [Current Limit] is changed, Pars 8 [Current Lim Pos] and 9 [Current Lim Neg] are set to the same value. If either the value of Pars 8 [Current Lim Pos] or 9 [Current Lim Neg] is changed later, the last change is valid.	Default: Min/Max: Units:	150 0 / 200 %	16-bit Int	8, 9, 179
		8	**[Current Lim Pos]** The drive current limit for the positive current direction expressed as a percentage of the value in Par 179 [Nom Mtr Arm Amps]. Note: This parameter can be assigned to an analog input.	Default: Min/Max: Units:	150 0 / 200 %	Real	7
		9	**[Current Lim Neg]** The drive current limit for the negative current direction expressed as a percentage of the value in Par 179 [Nom Mtr Arm Amps]. This parameter is not active for two quadrant drives. Note: This parameter can be assigned to an analog input.	Default: Min/Max: Units:	150 0 / 200 %	Real	7
		39	**[Torque Ref]** First current reference value, before any trim signals are incorporated, as a percentage of the value set in Par 179 [Nom Mtr Arm Amps]. For firmware version 2.005 or lower, this parameter is only used when Par 242 [Speed Reg En] = 0 "Disabled". Note: The current reference value is proportional to the armature current of the motor and determines the torque. The polarity determines the torque direction.	Default: Min/Max: Units:	0 – / +200 %	Real	
		40	**[Trim Torque]** Second current reference value as a percentage of the value set in Par 179 [Nom Mtr Arm Amps]. [Trim Torque] is added to Torque Reference and can be used as a correction value for the torque reference (regardless of the value of Par 242 [Speed Reg En]).	Default: Min/Max: Units:	0 – / +200 %	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**			Data Type	Related
MOTOR CONTROL	Torq Attributes	**342**	**[Torque Reduction]** Selection for torque reduction. When the torque reduction function is active (1 "Active"), the current limit changes accordingly by the percentage defined in Par 13 [Torq Red CurLim]. When this parameter is set to 0 "Not Active", torque reduction is not active. For example: Par 7 [Current Limit] (or Pars 8 [Current Lim Pos] and 9 [Current Lim Neg]) = 80 % Par 13 [Torq Red CurLim] = 70% If Par 342 [Torque Reduction] = 0 "Not Active", the current limit = 80 % If Par 342 [Torque Reduction] = 1 "Active", the current limit = 70 % Note: This parameter can be assigned to a digital input.	Default: Options:	0 = 0 = 1 =	"Not Active" "Not Active" "Active"	16-bit Int	13
		353	**[Zero Torque]** Sets the reference value for the armature current (Par 41 [Current Reg In]) to zero so that the drive has no torque. • "Not Active" = Par 41 [Current Reg In] is not set to zero. • "Active" = Par 41 [Current Reg In] is set zero. The drive has no torque.	Default: Options:	1 = 0 = 1 =	"Not Active" "Active" "Not Active"	16-bit Int	41
		750 ○ A	**[TrqTpr Enable]** Enables/Disables the current/speed curve function. • "Disabled" = The limits current /speed curve is disabled • "Enabled" = The limits current /speed curve is enabled Note: See Current / Speed Curve on page 264 for more information.	Default: Options:	0 = 0 = 1 =	"Disabled" "Disabled" "Enabled"	16-bit Int	751, 752, 753, 754, 755, 756
		751 ○ A	**[TrqTpr Lim0]** The current limit of the current/speed curve that operates constantly up to the speed set in Par 756 [TrqTpr Spd]. When the current/speed curve function is enabled (set in Par 750 [TrqTpr Enable]), this parameter will override the current limits set in Pars 10 [Cur Lim Pos Out] and 11 [Cur Lim Neg Out].	Default: Min/Max: Units:	0 0 / 200 %		16-bit Int	750, 756
		752 ○ A	**[TrqTpr Lim1]** First reduced current limit of the current/speed curve. The value defined in this parameter must be less than the value in Par 751 [TrqTpr Lim0] and greater than the values in Pars 753 [TrqTpr Lim2], 754 [TrqTpr Lim3] and 755 [TrqTpr Lim4].	Default: Min/Max: Units:	0 0 / 200 %		16-bit Int	750, 756
		753 ○ A	**[TrqTpr Lim2]** Second reduced current limit of the current/speed curve. The value defined in this parameter must be less than the value in Par 752 [TrqTpr Lim1] and greater than the values in Pars 754 [TrqTpr Lim3] and 755 [TrqTpr Lim4].	Default: Min/Max: Units:	0 0 / 200 %		16-bit Int	750, 756
		754 ○ A	**[TrqTpr Lim3]** Third reduced current limit of the current/speed curve. The value defined in this parameter must be less than the value in Par 753 [TrqTpr Lim2] and greater than the value in Par 755 [TrqTpr Lim4].	Default: Min/Max: Units:	0 0 / 200 %		16-bit Int	750, 756
		755 ○ A	**[TrqTpr Lim4]** Last reduced current limit of the current/speed curve. The value defined in this parameter must be less than the value in Par 754 [TrqTpr Lim3]. The drive will operate at this current limit up to the value set in parameter 162 [Max Feedback Spd].	Default: Min/Max: Units:	0 0 / 200 %		16-bit Int	750, 756

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MOTOR CONTROL	Torq Attributes	**756** ○ A	**[TrqTpr Spd]** Threshold speed at which torque reduction begins, as determined by the current/speed curve.	Default: Min/Max: Units:	0 0 / Par 162 rpm	16-bit Int	750, 756
		926 A	**[Torq Cur Filter]** First rate low-pass filter for Par 1193 [Torq Current Pct]. Note: The name of this parameter was changed from [Filt Torq Cur] to [Torq Cur Filter] with firmware version 3.001.	Default: Min/Max: Units:	0.100 0.001 / 0.250 s	Real	1193
	Speed Feedback	**169** ○ A	**[Encoder PPR]** Number of pulses per revolution of the digital encoder. The value of Pars 169 [Encoder PPR] and 162 [Max Feedback Spd] must be set as indicated in Speed Feedback on page 279.	Default: Min/Max:	1024.00 100.00 / 32770.00	Real	162
		414 ○	**[Fdbk Device Type]** The source of speed feedback. • 1 "Encoder" = Digital encoder (jumpers S20, S21) • 2 "DC Tach" = DC analog tachometer (jumper S4) • 3 "Armature" = Internal measurement of the armature voltage	Default: Options:	3 = "Armature" 1 = "Encoder" 2 = "DC Tach" 3 = "Armature"	16-bit Int	
		455 A	**[Spd Fdbk Error]** The maximum allowable speed feedback error expressed as a percentage of the maximum output voltage set in Par 175 [Rated Motor Volt]. By means of Par 175 [Rated Motor Volt], Par 456 [Fld Weaken Ratio] and the motor nominal speed, a relationship between motor speed and armature voltage is obtained. If the difference is larger than the value set in Par 455 [Spd Fdbk Error], a "Feedback Loss" condition (set in Par 478 [Spd Loss Flt Cfg]) will be activated.	Default: Min/Max: Units:	22 0 / 100 %	16-bit Int	457, 478
		457	**[Spd Fdbk Control]** Enables/Disables speed feedback control. This function affects the comparison made between the armature voltage and the speed value measured by the encoder or tachometer. When the value set in Par 455 [Spd Fdbk Error] is exceeded, a "Feedback Loss" condition (set in Par 478 [Spd Loss Flt Cfg]) will be activated. The speed feedback control function is automatically disabled when armature voltage feedback is selected (Par 414 [Fdbk Device Type] = 3 "Armature").	Default: Options:	1 = "Enabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	414, 455, 478
			⚠ **ATTENTION:** If speed feedback control is disabled (Par 457 [Spd Fdbk Control] set to 0 "Disabled") and Par 414 [Device Type] is set to 1 "Encoder" or 2 "DC Tach", the motor could run at excessive speed or become damaged, which could result in personal injury or destruction of equipment.				
		458 ○	**[SpdReg FB Bypass]** Enables/Disables an automatic switch to armature voltage feedback when a "Feedback Loss" (F91) condition occurs due to an encoder or tachometer feedback signal loss. When this parameter is set to "Enable", Par 478 [Spd Loss Flt Cfg] must be set to 1 "Alarm" to allow the motor to continue to run with no speed feedback signal. Also, Par 162 [Max Feedback Spd] must be set to motor base speed, because field weakened operation is not permitted. After an automatic switch to armature feedback, the speed regulator works with Pars 459 [SpdReg Kp Bypass] and 460 [SpdReg Ki Bypass] and the D derivative part of the speed regulator is automatically excluded. Pars [SpdReg Kp Bypass] and [SpdReg Ki Bypass] must be properly tuned. Note: This parameter cannot be set to 1 "Enabled" when Par 469 [Field Mode Sel] is set to 1 "Field Weaken".	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	162, 459, 460, 469, 478

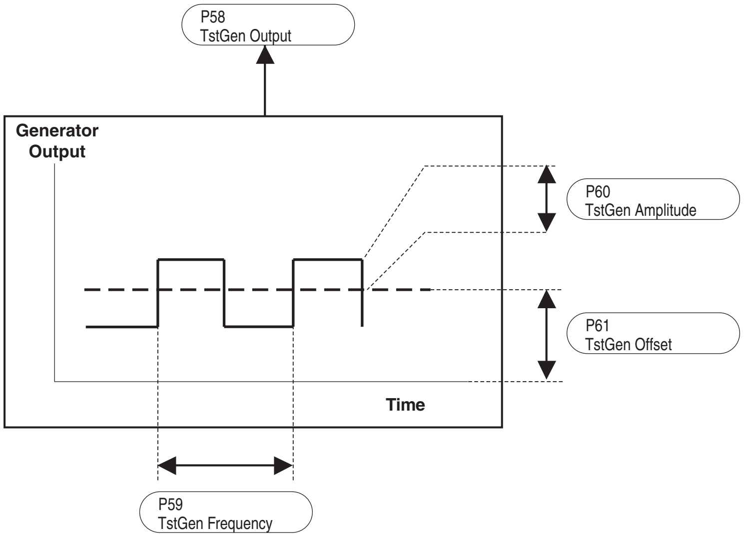
File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
MOTOR CONTROL	Speed Feedback	**461**	**[Spd Fdbk Invert]**	Default:	0 = “Disabled”	16-bit Int	
		○ A	Enables / Disables speed feedback negation. Note: This parameter was added with firmware version 3.001.	Options:	0 = “Disabled” 1 = “Enabled”		
			⚠ **ATTENTION:** The Drive can overspeed if Par 461 [Spd Fdbk Invert] is set incorrectly for your application. Failure to observe this precaution could result in damage to, or destruction of, the equipment.				
		562	**[Anlg Tach Gain]**	Default:	1.0000	Real	
			Fine scaling of the speed feedback received from the DC analog tachometer (Par 414 [Fdbk Device Type] = 2 “DC Tach”). The voltage feedback value received from the tachometer is multiplied by this value. To maximize the feedback speed resolution, this parameter can be used to scale the voltage setting selected with DIP switch S4 to Par 162 [Max Feedback Spd].	Min/Max:	0.9000 / 3.0000		
		563	**[Feedback Offset]**	Default:	0.00	Real	
			Offset scaling of the feedback circuit. The value of this parameter applies regardless of the type of feedback device selected in Par 414 [Fdbk Device Type]. Note: The name of this parameter was changed from [Anlg Tach Zero] to [Feedback Offset] with firmware version 3.001.	Min/Max: Units:	–/+20.00 rpm		
		652	**[Encoder Err Chk]**	Default:	0 “Disabled”	16-bit Int	457
		A	Enables/Disables monitoring of the digital encoder connection status. This parameter should be set to “Enabled” when using an encoder with a Z channel and monitoring is on (S20 on Control board is set to “OFF”) or a differential encoder. Set this parameter to “Disabled” when using a single-ended encoder. When an alarm is detected, the HIM displays the “Feedback Loss” (F91) fault. This parameter can be programmed on a digital output. This function is activated by setting Par 457 [Spd Fdbk Control] = “Enabled”	Options:	0 = “Disabled” 1 = “Enabled”		
		911	**[Z Channel Enable]**	Default:	0 = “Disabled”	16-bit Int	
		A	Determines whether the encoder zero pulse (qualification signal or “zero cam”) will be read by the drive. This parameter is used for systems implementing position control. • “Enabled” = The encoder zero pulse is read. • “Disabled” = The encoder zero pulse is not read.	Options:	0 = “Disabled” 1 = “Enabled”		
		912	**[Z Capture Pos En]**	Default:	0	16-bit Int	
		A	Control register of the zero pulse and of the encoder qualification signal.	Min/Max:	0 / 6553		
		913	**[Z Captured Pos]**	Default:	Read Only	32-bit Int	
		A	Data and function status register.	Min/Max:	0 / 2^{31}–1		
		914	**[Spd FB Filt Gain]**	Default:	1.000	Real	915
		A	First order lead/lag filter gain on the speed feedback signal. Note: This parameter was added with firmware version 3.001.	Min/Max:	0.000 / 2.000		
		915	**[Spd FB Filt BW]**	Default:	0	16-bit Int	914
		A	First order lead/lag filter bandwidth on the speed feedback signal. Note: This parameter was added with firmware version 3.001.	Min/Max: Units:	0 / 2000 ms		
		923	**[Act Spd Filter]**	Default:	0.100	Real	924
		A	First order low pass filter time constant for Par 924 [Actual Speed].	Min/Max: Units:	0.001 / 1.000 s		

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	**Speed Feedback**	**1021** ○ A	**[Encoder Out Sel]** Defines the speed reference to which the encoder signal can be input. This parameter is typically set to 0 "Off" and the encoder is used for speed feedback only. When set to other than 0 "Off", the choice of the speed reference destination must be made according to the configuration of the speed regulator (for example "Speed Ref A" cannot be used with an active ramp).	Default: Options:	0 = "Off" 0 = "Off" 1 = "Trim Speed" 2 = "Trim Ramp" 3 = "Speed Ref A" 4 = "Speed Ref B"	16-bit Int	
		1022 A	**[Encoder Counts]** Displays an accumulated pulse count (32-bit integer) from the Encoder. Each edge is counted, so a 1024 PPR device would produce 4096 counts per revolution. Movement in either the forward or reverse direction results in an increase in the counter value. Note: This parameter was added with firmware version 3.001.	Default: Min/Max:	Read Only –/+ 2^{32}	32-bit Int	
	Autotune	**452** ○	**[CurrReg Autotune]** Setting this parameter to 1 "On" and pressing "Start" on the HIM keypad initiates the current regulator auto tuning procedure. When the auto tuning procedure is complete, this parameter automatically resets to 0 "Off". The resulting armature resistance and inductance values are set in parameters 453 [Arm Resistance] and 454 [Arm Inductance], respectively.	Default: Options:	0 = "Off" 0 = "Off" 1 = "On"	16-bit Int	
		453	**[Arm Resistance]** Motor armature resistance. This parameter can be manually changed to a value other than the value obtained when the current regulator auto tuning is completed.	Default: Min/Max: Units:	0.50 Based on drive current rating Ohm	Real	452
		454	**[Arm Inductance]** Motor armature inductance. This parameter can be manually changed to a value other than the value obtained when the current regulator auto tuning is completed.	Default: Min/Max: Units:	4.00 Based on drive current rating mH	Real	452
		587 A	**[I Reg Error]** Current Regulator tuning status parameter that is used as part of the manual tuning process. See Fine Tuning the Regulators on page 297 for details.	Default: Min/Max: Units:	Read Only –/+80 V	16-bit Int	452
		1012 A	**[Inertia C Filter]** First order low–pass filter used to reduce noise caused by the speed differentiation process in the Inertia/Loss compensation block.	Default: Min/Max: Units:	0 0 / 1000 ms	16-bit Int	
		1013 A	**[Torque Const]** The Motor torque constant used to calculate inertia and friction compensation. The value in this parameter is automatically adapted in the field weakening mode. This value is determined during speed auto tuning.	Default: Min/Max: Units:	Based on drive current rating 0.01 / 99.99 N–m/A	Real	
		1014 A	**[Inertia]** Motor inertia value. 1 Kg–m^2 = 23.76 lb–ft^2	Default: Min/Max: Units:	Based on drive current rating 0.001 / 999.999 Kg–m^2	Real	
		1015 A	**[Friction]** Motor friction value. 1 N–m = 0.738 lb–ft	Default: Min/Max: Units:	Based on drive current rating 0.000 / 99.990 N–m	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	**Autotune**	**1027** ○	**[Spd Reg Autotune]** Starts the auto tuning procedure for the speed regulator. Setting this parameter to 1 "On" and pressing "Start" on the HIM keypad initiates the speed regulator auto tuning procedure. When the auto tuning procedure is complete, this parameter automatically resets to 0 "Off". This test should be run with inertia connected to the motor (if present), but without process load (i.e., material). Note: Non-default values for Par 107 [Speed Zero Level] or Par 108 [Speed Zero Delay] can interfere with successful Speed Loop autotuning. **ATTENTION:** The motor will rotate during the Speed Regulator tuning procedure. A hazard of personal injury exists due to motor shaft rotation and/or machinery motion.	Default: Options:	0 = "Off" 0 = "Off" 1 = "On"	16-bit Int	
		1029 ○	**[Speed Tune Dir]** Choice of the rotation direction of the motor shaft (rotation, as seen from the motor shaft side) for the speed regulator auto tuning procedure. • "Forward" = Clockwise rotation • "Reverse" = Counter-clockwise rotation	Default: Options:	1 = "Forward" 1 = "Forward" 2 = "Reverse"	16-bit Int	
		1030	**[Spd Tune Inertia]** Motor inertia value identified during the speed regulator auto tuning procedure.	Default: Min/Max: Units:	Read Only 0.001 / 999.990 Kg x m²	Real	
		1031	**[SpdTune Friction]** Motor friction value identified during the speed regulator auto tuning procedure.	Default: Min/Max: Units:	Read Only 0.00 / 99.99 N-m	Real	
		1032	**[Speed Tune Kp]** Proportional gain value of the speed regulator identified during the speed regulator auto tuning procedure.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1033	**[Speed Tune Ki]** Integral gain value of the speed regulator identified during the speed regulator auto tuning procedure.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1048 ○	**[Autotune Cur Lim]** Value of the torque current limit applied during the speed regulator auto tuning procedure.	Default: Min/Max: Units:	20 0 / Based on drive current rating %	16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	Test Generator	58 ○ A	**[TstGen Output]** Allows you to select a simulated parameter as the output for the test generator. The test generator is used to manually tune the regulators. It consists of a square wave generator whose frequency, offset and amplitude can be manipulated. • "NotConnected" - No internal parameters defined by the generator. • "Reserved" - Not used. • "Torq Cur Ref" - The output of the generator defines the reference value of the torque current. 100% corresponds to "full load torque current" (FLT). • "Field Ref" - The output of the generator defines the field reference value. 100% corresponds to the rated field current based on the motor nameplate data parameters. • "Ramp Ref" - The output of the generator defines the ramp reference value. 100% corresponds to the value specified in Par 45 [Max Ref Speed]. This is the value immediately before the Ramp function. • "Speed Ref" - The output of the generator defines the speed reference value. This is the value immediately before the Speed Regulator function.	Default: Options:	0 = "NotConnected" 0 = "NotConnected" 1 = "Reserved" 2 = "Torq Cur Ref" 3 = "Field Ref" 4 = "Ramp Ref" 5 = "Speed Ref"	16-bit Int	59, 60, 61

ATTENTION: Uncontrolled machine operation could result with a motor connected during these tests and may cause personal injury and/or equipment damage. Verify that the drive is not connected to a motor armature circuit before enabling these test modes.



File	Group	No.	**Parameter Name & Description**	**Values**		Data Type	Related
		59 A	**[TstGen Frequency]** Output frequency of the test generator.	Default: Min/Max: Units:	0.10 0.10 / 62.50 Hz	Real	58
		60 A	**[TstGen Amplitude]** Amplitude of the delta signal produced by the test generator.	Default: Min/Max: Units:	0.00 0.00 / 200.00 %	Real	58
		61 A	**[TstGen Offset]** Offset of the test generator.	Default: Min/Max: Units:	0.00 –/+200.00 %	Real	58

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
MOTOR CONTROL	Test Generator	**166** ○ A	**[Alpha Test]** Diagnostic test mode that selects the SCR bridge to activate. The SCR firing angles are specified by Pars 167 [Arm Test Angle] and 168 [Fld Test Angle]. **Important:** Alpha Test is an open loop diagnostic tool that requires a hardware Enable input be wired and functional at the terminal block. Reading Alpha Test Mode on page 259 is required before completing this test. 0 = Off 1 = Armature Fwd 2 = Armature Rev 3 = Field Fwd Note: This parameter was added with firmware version 3.001.	Default: Options:	0 = "Off" 0 = "Off" 1 = "Armature Fwd" 2 = "Armature Rev" 3 = "Field Fwd"	16-bit Int	167, 168

⚠ **ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should perform this test. Failure to observe this precaution could result in equipment damage and/or bodily injury.

⚠ **ATTENTION:** This is an open loop test, disconnect the motor armature and field leads and replace them with dummy loads. Failure to observe this precaution could result in machine damage and/or bodily injury.

⚠ **ATTENTION:** Uncontrolled machine operation could result with a motor connected during these tests and may cause personal injury and/or equipment damage. Verify that the drive is not connected to a motor armature circuit before enabling these test modes.

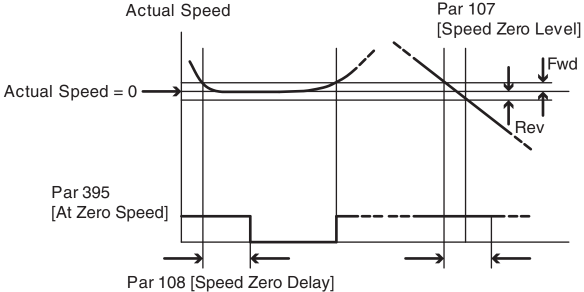
File	Group	No.	**Parameter Name & Description**	**Values**		Data Type	Related
MOTOR CONTROL	Test Generator	**167** A	**[Arm Test Angle]** Sets the armature SCR firing angle for the Armature Forward and Armature Reverse tests. 180 deg = minimum voltage, 5 deg = maximum voltage. This parameter is only changeable while the Armature Alpha Test is selected. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	180 0 / 180 deg	Real	166
		168 A	**[Fld Test Angle]** Sets the field SCR firing angle for the Field Forward test. 180 deg = minimum voltage, 5 deg = maximum voltage. This parameter is only changeable while the Field Alpha Test is selected. Notes: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	180 0 / 180 deg	Real	166

Speed Command File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
SPEED COMMAND	Limits	1 ○	**[Minimum Speed]** Defines the minimum speed of the drive. This value applies to both directions of motor rotation for four quadrant drives. A speed below the value set in [Minimum Speed] is not possible, regardless of the set speed reference value. If the value of [Minimum Speed] is changed, Pars 5 [Min Speed Fwd] and 6 [Min Speed Rev] are set to the same value. If either Par 5 [Min Speed Fwd] or Par 6 [Min Speed Rev] is changed later, the last change is valid.	Default: Min/Max: Units:	0 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	5, 6
		2 ○	**[Maximum Speed]** Defines the maximum speed of the drive. This value applies to both directions of motor rotation for four quadrant drives. The value of this parameter is input to the speed regulator and therefore takes into account the reference value that comes from the ramp as well as the direction of rotation. If the value of [Maximum Speed] is changed, Pars 3 [Max Speed Fwd] and 4 [Max Speed Rev] are set to the same value. If either Par 3 [Max Speed Fwd] or Par 4 [Max Speed Rev] is changed later, the last change is valid.	Default: Min/Max: Units:	1750 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	3, 4
		3 ○	**[Max Speed Fwd]** Defines the maximum speed for forward (clockwise) rotation of the motor. The value of [Max Speed Fwd] affects the input of the speed regulator and therefore takes into account both the reference values that come from the ramp as well as the direction of motor rotation.	Default: Min/Max: Units:	1750 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	2
		4 ○	**[Max Speed Rev]** Defines the maximum speed for reverse (counterclockwise) rotation of the motor for four quadrant drives only. The value of [Max Speed Rev] affects the input of the speed regulator and therefore takes into account both the reference values that come from the ramp as well as the direction of rotation.	Default: Min/Max: Units:	1750 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	2
		5 ○	**[Min Speed Fwd]** Defines the minimum speed for forward (clockwise) rotation of the motor. Speed reference values below the value in this parameter are clamped until the reference exceeds this limit.	Default: Min/Max: Units:	0 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	1
		6 ○	**[Min Speed Rev]** Defines the minimum speed for reverse (counterclockwise) rotation of the motor for four quadrant drives only. Speed reference values below the value in this parameter are clamped until the reference exceeds this limit.	Default: Min/Max: Units:	0 0 / Par 45 [Max Ref Speed] rpm	32-bit Int	1
	Discrete Speeds	154 155 156 157 158 159 160	**[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. Notes: [Preset Speed 1] cannot be directly selected by the Speed Sel digital inputs. However, Par 154 [Preset Speed 1] can be directed to Par 42 [Trim Ramp] via the Scale Block parameters. See Reference Control on page 277 for more information.	Default: Default: Default: Default: Default: Default: Default: Min/Max: Units:	150 300 600 900 1200 1500 1750 -/+6000 rpm	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
SPEED COMMAND	Discrete Speeds	266	**[Jog Speed]** Reference value for jog mode. Notes: This parameter can be assigned to an analog input. See Reference Control on page 277 for more information.	Default: Min/Max: Units:	100 -/+6000 rpm	16-bit Int	
		267	**[TB Manual Ref]** Reference value for the drive when the Terminal Block asserts Manual reference control. Notes: This parameter can be assigned to an analog input. See Reference Control on page 277 for more information.	Default: Min/Max: Units: (1) The value of [Max Ref Speed] cannot exceed 6000 rpm.	0 –/+ Par 45 [Max Ref Speed] (1) rpm	16-bit Int	45
		1409	**[Jog Off Delay]** Specifies the amount of time that will elapse between removing the Jog input and commanding the main contactor to open. The amount of time specified in [Jog Off Delay] will not begin to elapse until the measured speed feedback is less than or equal to the value of parameter 107 [Speed Zero Level]. This delay reduces the wear on the contactor when repeatedly opening and closing the Jog input over a short period of time. Note: This parameter was added with firmware version 2.001.	Default: Min/Max: Units:	1 0 - 10 s	16-bit Int	
	Speed References	42	**[Trim Ramp]** This value is added to the speed reference just before the Speed Ramp function. Notes: This parameter can be assigned to an analog input. See Reference Control on page 277 for more information.	Default: Min/Max: Units: (1) The value of Par 45 [Max Ref Speed] cannot exceed 6000 rpm.	0 –/+Par 45 [Max Ref Speed] (1) rpm	16-bit Int	45, 378
		43	**[Trim Speed]** This value is added to the speed reference just before the speed regulator (and after the Speed Ramp function). Notes: This parameter can be assigned to an analog input. See Reference Control on page 277 for more information.	Default: Min/Max: Units: (1) The value of Par 45 [Max Ref Speed] cannot exceed 6000 rpm.	0 –/+ Par 45 [Max Ref Speed] (1) rpm	16-bit Int	45, 379
		378	**[Trim Ramp Pct]** Trim ramp value defined as a percentage of the value defined in Par 45 [Max Ref Speed].	Default: Min/Max: Units:	0.00 –/+100.00 %	Real	42
		379	**[Trim Speed Pct]** Trim speed reference value defined as a percentage of the of the value defined in Par 45 [Max Ref Speed].	Default: Min/Max: Units:	0.00 –/+100.00 %	Real	43
		1017	**[Speed Ratio]** Determines the speed ratio value for the Speed-Draw function. Notes: This value can be input to the drive digitally, or via an analog input. See Speed Draw Function on page 289 for more information.	Default: Min/Max:	10000 0 / 32767	16-bit Int	
	Speed Regulator	87	**[Spd Reg Kp]** Proportional gain of the speed regulator that can be adjusted while the drive is running.	Default: Min/Max: Units:	3.00 0.00 / 100.00 %	Real	93, 99
		88	**[Spd Reg Ki]** Integral gain of the speed regulator that can be adjusted while the drive is running.	Default: Min/Max: Units:	0.30 0.00 / 100.00 %	Real	94, 100
		93 ○ A	**[Spd Reg Kp Base]** The proportional gain (K_{P0}) of the speed regulator (base value). Typically, this parameter does not need to be modified because it is automatically set by the drive during autotune.	Default: Min/Max: Units:	0.30 x Par 93$_{max}$ 0.001 / Based on drive current rating A / rpm	Real	87, 99

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
SPEED COMMAND	Speed Regulator	**94** ○ A	**[Spd Reg Ki Base]** The integral gain (K_{I0}) of the speed regulator (base value). Typically, this parameter does not need to be modified because it is automatically set by the drive during autotune.	Default: Min/Max: Units:	0.30 x Par 94_{max} 0.001 / Based on drive current rating A/ rpm x ms	Real	88, 100
		95 A	**[Spd Reg Pos Lim]** Positive Speed Regulator output limit. When this limit is active the positive integrator portion of the PI regulator is held to prevent windup. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	200.00 –/+200.00 %	Real	96
		96 A	**[Spd Reg Neg Lim]** Negative Speed Regulator output limit. When this limit is active the negative integrator portion of the PI regulator is held to prevent windup. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	–200.00 –/+200.00 %	Real	95
		99 A	**[Spd Reg Kp Outpt]** Displays the active proportional coefficient of the speed regulator as a percentage of the value defined in Par 93 [Spd Reg Kp Base].	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	87, 93
		100 A	**[Spd Reg Ki Outpt]** Displays the active integral coefficient of the speed regulator as a percentage of the value defined in Par 94 [Spd Reg Ki Base].	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	88, 94
		101 A	**[Speed Thresh Pos]** Threshold speed for the drive above or below which the value of Par 393 [Speed Threshold] changes. When the speed of the drive exceeds the value of this parameter, Par 393 [Speed Threshold] displays "Above Thresh" (0). When the speed of the drive is below the value of this parameter, Par 393 [Speed Threshold] displays "Below Thresh" (1). Note: See Speed Threshold Indicators on page 286 for more information.	Default: Min/Max: Units:	1000 1 / 6000 rpm	16-bit Int	393
		102 A	**[Speed Thresh Neg]** Threshold speed for the drive above or below which the value of Par 393 [Speed Threshold] changes. When the speed of the drive exceeds the value specified in this parameter, Par 393 [Speed Threshold] displays "Above Thresh" (0). When the speed of the drive is below this threshold, Par 393 [Speed Threshold] displays "Below Thresh" (1). Note: See Speed Threshold Indicators on page 286 for more information.	Default: Min/Max: Units:	1000 1 / 6000 rpm	16-bit Int	393
		103 A	**[Threshold Delay]** Amount of time that must elapse before indication that the drive speed is above the value set in Par 101 [Speed Thresh Pos] or below the value set in Par 102 [Speed Thresh Neg]. Note: See Speed Threshold Indicators on page 286 for more information.	Default: Min/Max: Units:	100 0 / 65535 ms	16-bit Int	393

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
SPEED COMMAND	Speed Regulator	**104** A	**[At Speed Error]** Defines the speed above and below the speed reference (in Par 118 [Speed Reg In]) at which the value of Par 394 [At Speed] changes. When the difference between the speed reference and the actual speed is greater than the value of this parameter, Par 394 [At Speed] displays “Not Equal” (0). When the difference between the speed reference and the actual speed is less than the value of this parameter, Par 394 [At Speed] displays “Equal” (1). Note: See Speed Threshold Indicators on page 286 for more information.	Default: Min/Max: Units:	100 1 / 6000 rpm	16-bit Int	394
		105 A	**[At Speed Delay]** Amount of time that must elapse before indication that the drive speed reference is within the range specified in Par 104 [At Speed Error] occurs. Note: See Speed Threshold Indicators on page 286 for more information.	Default: Min/Max: Units:	100 0 / 65535 ms	16-bit Int	394
		106 A	**[Ref Zero Level]** Speed below which speed references are equal to zero speed. Switch used in the Speed Zero function. Note: See Speed Zero Function on page 288 for more information.	Default: Min/Max: Units:	20 1 / 6000 rpm	16-bit Int	123, 124, 125, 126
		107 A	**[Speed Zero Level]** Speed below which the actual speed is considered equal to zero. When a Stop command is issued and actual speed goes below this value, drive output is disabled. The value applies to both rotation directions for four quadrant drives. Notes: Setting the value of this parameter too low could prevent the proper functioning of field economy. If Par 107 and/or Par 108 are changed from their default values it can affect the Speed Loop autotune function (Par 1027). Ideally, these parameters should be set to defaults when autotuning the Speed Loop. Values substantially different from defaults will result in a autotuning fault. Note: See Speed Zero Function on page 288 for more information. 	Default: Min/Max: Units:	20 1 / 6000 rpm	16-bit Int	395, 1027
		108 A	**[Speed Zero Delay]** Amount of time that must elapse after the actual speed goes below the value set in Par 107 [Speed Zero Level] before Par 395 [At Zero Speed] changes state. Note: See Speed Zero Function on page 288 for more information.	Default: Min/Max: Units:	100 0 / 65535 ms	16-bit Int	395, 1027

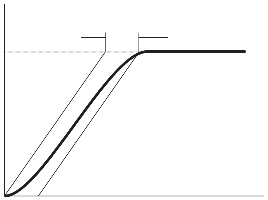
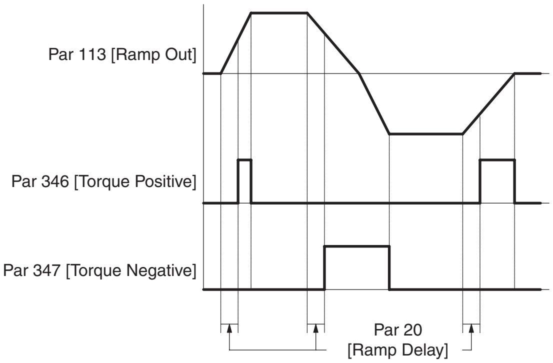
File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
SPEED COMMAND	Speed Regulator	**123** ○ A	**[Spd Zero I En]** Enables/Disables the output of the integral section of the speed regulator. Used in the Zero Speed function. • "Enabled" = The output of the integral section of the speed regulator is set to zero when the speed reference and the speed feedback are equal to zero. The I component is enabled when a reference value is entered to restart acceleration. • "Disabled" = Disables the output of the integral section of the speed regulator. Note: See Speed Zero Function on page 288 for more information.	Default: Options:	0 = "Disable" 0 = "Disable" 1 = "Enable"	16-bit Int	
		124 ○ A	**[Spd Ref Zero En]** This parameter is only active when Par 125 [Spd Zero P En] = 1 "Enabled". Used in the Zero Speed function. • "Enabled" = The proportional gain, equal to Par 126 [Spd Zero P Gain] at zero speed, is equal to Par 87 [Spd Reg Kp] when the speed reference is higher than the value defined in Par 106 [Ref Zero Level]. • "Disabled" = The proportional gain, equal to Par 126 [Spd Zero P Gain] at zero speed, is equal to the value in Par 87 [Spd Reg Kp] when the speed reference or the actual speed is higher than the value defined in Par 106 [Ref Zero Level]. Note: See Speed Zero Function on page 288 for more information.	Default: Options:	0 = "Disable" 0 = "Disable" 1 = "Enable"	16-bit Int	
		125 ○ A	**[Spd Zero P En]** "Enabled" = When both the speed reference value and the actual speed value = 0, the proportional gain value in Par 126 [Spd Zero P Gain] is active after the delay time defined in Par 108 [Speed Zero Delay]. Used in the Zero Speed function. "Disabled" = The speed regulator keeps its proportional gain component when the drive is stopped. Note: See Speed Zero Function on page 288 for more information.	Default: Options:	0 = "Disable" 0 = "Disable" 1 = "Enable"	16-bit Int	
		126 A	**[Spd Zero P Gain]** The proportional gain of the speed regulator that is only active when the value of the speed reference and actual speed = 0. This parameter is only active when Par 125 [Spd Zero P En] = 1 "Enabled". Used in the Zero Speed function. Note: See Speed Zero Function on page 288 for more information.	Default: Min/Max: Units:	3.00 0.00 / 100.00 %	Real	
		238	**[SpdOut FiltGain]** First order lead/lag filter gain on the speed regulator output signal. Note: This parameter was added with firmware version 3.001.	Default: Min/Max:	1.000 0.000 / 2.000	Real	239
		239	**[SpdOut FiltBW]** First order lead/lag filter bandwidth on the speed regulator output signal. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	0 0 / 2000 ms	16-bit Int	238

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**			Data Type	Related
SPEED COMMAND	Speed Regulator	**242** ○	**[Speed Reg En]** Enables/Disables the speed regulator output to the torque/current regulator. • "Enabled" = The speed regulator output is connected to the input of the torque/current regulator. • "Disabled" = The speed regulator output is not connected to the input of the torque/current regulator. Par 39 [Torque Ref] is connected to the input of the current regulator. Note: This parameter is only available for use with firmware version 2.005 and lower.	Default: Options:	1 = 0 = 1 =	"Enabled" "Disabled" "Enabled"	16-bit Int	39, 41, 236
			⚠ **ATTENTION:** Failure to correctly set speed and voltage parameters or provide overspeed protection when operating as a torque/current regulator could result in high motor speeds, equipment damage, and/or personal injury.					
		348 A	**[Lock Speed Integ]** Enables or disables the integral (I) function of the speed regulator. • "Not active" = The integral component of the speed regulator is enabled. • "Active" = The integral component of the speed regulator is disabled.	Default: Options:	1 = 0 = 1 =	"Not active" "Active" "Not active"	16-bit Int	
		388 A	**[Flying Start En]** Enables/Disables the ability of the drive to connect to a spinning motor at actual rpm when a start command is issued. • "On" = When the drive is turned on, the speed of the motor is measured and the ramp output is set accordingly. The drive then runs at the set reference value. • "Off" = When the drive is turned on, the ramp starts from zero. Main uses: • To connect to a motor that is already spinning due to its load (for example, in the case of a pump, the flowing medium). • Re–connection to a spinning motor after a fault or alarm. Note: If the Flying Start function is disabled (off), ensure that the motor is not spinning when the drive is turned on, or harsh motor deceleration in current limit may occur.	Default: Options:	0 = 0 = 1 =	"Off" "Off" "On"	16-bit Int	
		444 A	**[Spd Reg P Filter]** Time constant used by the filter for the Speed Feedback circuit. Filtering of the high frequency components of the speed feedback signal is useful in the case of elastic coupling between the motor and load (i.e., joints or belts). Note: This parameter was renamed for firmware version 4.001.	Default: Min/Max: Units:	0 0 / 1000 ms		16-bit Int	121, 122
		445 A	**[Spd Up Gain Pct]** The Speed Up function gain as a percentage of Par 446 [Speed Up Base]. Note: See Speed Up Function on page 285 for more information.	Default: Min/Max: Units:	0.00 0.00 / 100.00 %		Real	446
		446 A	**[Speed Up Base]** The Speed Up function maximum gain. This value corresponds to 100% of Par 445 [Spd Up Gain Pct]. Note: See Speed Up Function on page 285 for more information.	Default: Min/Max: Units:	1000.00 0.00 / 16000.00 ms		Real	445
		447 A	**[Speed Up Filter]** The time constant of the filter for the D (derivative) component of the Speed Up function. Note: See Speed Up Function on page 285 for more information.	Default: Min/Max: Units:	0 0 / 1000 ms		16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
SPEED COMMAND	Speed Regulator	**459** A	**[SpdReg Kp Bypass]** The proportional gain (K_P) of the speed regulator, expressed as a percentage of Par 93 [Spd Reg Kp Base], when an encoder or tachometer feedback signal is changed to armature feedback (Par 458 [SpdReg FB Bypass] = "Enabled").	Default: Min/Max: Units:	0.90 x P459$_{max}$ 0.01 / Based on drive current rating %	Real	458
		460 A	**[SpdReg Ki Bypass]** The integral gain (K_I) of the speed regulator, expressed as a percentage of Par 94 [Spd Reg Ki Base], when an encoder or tachometer feedback signal is changed to armature feedback (Par 458 [SpdReg FB Bypass] = "Enabled").	Default: Min/Max: Units:	0.30 0.00 / 100.00 %	Real	458
		493	**[Arm Volt Kp]** Proportional gain (K_P) of the field voltage regulator expressed as a percentage of the value defined in Par 495 [Arm Volt Kp Base].	Default: Min/Max: Units:	30.00 0.00 / 100.00 %	Real	495
		494	**[Arm Volt Ki]** Integral gain (K_I) of the field voltage regulator expressed as a percentage of the value defined in Par 496 [Arm Volt Ki Base].	Default: Min/Max: Units:	40.00 0.00 / 100.00 %	Real	496
		495 ○ A	**[Arm Volt Kp Base]** The proportional gain (K_{P0}) of the field voltage regulator (base value).	Default: Min/Max: Units:	Based on drive current rating 0.10 / Based on drive current rating A / V	Real	493
		496 ○ A	**[Arm Volt Ki Base]** The integral coefficient (K_{I0}) of the field voltage regulator (base value).	Default: Min/Max: Units:	0.90 x P496$_{max}$ 0.01 / Based on drive current rating A / V / ms	Real	494
		643	**[SpdReg AntiBckup]** Allows control of over-shoot/under-shoot in the step response of the speed regulator. Over-shoot/under-shoot can be effectively eliminated with a setting of 0.3, which will remove backup of the motor shaft when zero speed is reached. This parameter has no affect on the drive's response to load changes. A value of zero disables this feature. Note: This parameter was added with firmware version 4.001.	Default: Min/Max:	0.0 0.0 / 0.50	Real	
		1016 ○ A	**[SpdFuncSelect]** Selection of the "Speed Up" or "Inertia/Loss compensation" function. Notes: See Speed Up Function on page 285 for more information. Option 2 "Off" added with firmware version 4.001.	Default: Options:	2 = "Off" 0 = "Speed Up" 1 = "Inertia/loss" 2 = "Off"	16-bit Int	444, 445, 447, 1012, 1013, 1014, 1015

Dynamic Control File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
DYNAMIC CONTROL	**Control Config**	**15** A	**[SLAT Err Stpt]** Configures the condition for transfer between Speed and Torque operation during “SLAT Min” or “SLAT Max” mode. If the Speed Error is greater than the value of [SLAT Err Stpt] for the amount of time specified in Par 16 [SLAT Dwell Time], then the “forced speed” mode is turned off. Max. value setting example where Par 45 = 1750: 1750/5 = 350 rpm. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	0.000 0.000 / Par 45/5 (see description) rpm	Real	16, 241
		16 A	**[SLAT Dwell Time]** Amount of time that the speed error must be greater than the value of Par 15 [SLAT Err Stpt] in order to return to “SLAT Min” or “SLAT Max” mode. Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	0 0 / 5 s	16-bit Int	15, 241
		241	**[Spd Trq Mode Sel]** Configures the drive for a Speed or Torque mode of operation. • "Zero Trq Ref" = The drive operates as a torque regulator with the torque reference (Par 14 [Selected TorqRef]) forced to zero. • "Speed Reg" = The drive operates as a speed regulator with the reference = Par 236 [Spd Reg Out Pct] + inertia compensation. • "Torque Reg" = The drive operates as a torque regulator with the reference equal to the value of Par 39 [Torque Ref]. • "SLAT Min" = The drive operates in Speed Limited Adjustable Torque (SLAT) - Minimum mode. The drive operates as a torque regulator when the value of Par 39 [Torque Ref] is algebraically smaller in value than the speed regulator’s output. The drive may automatically enter speed regulation mode based on conditions within the speed regulator and the magnitude of the speed regulator’s output relative to the torque reference. • “SLAT Max” = The drive operates in SLAT – Maximum mode. The drive operates as a torque regulator when the value of Par 39 [Torque Ref] is algebraically larger in value than the speed regulator’s output. The drive may automatically enter speed regulation mode based on conditions within the speed regulator and the magnitude of the speed regulator’s output relative to the torque reference. • “Sum” = The drive operates as a speed regulator. The reference is derived from the sum of the speed regulator output (Par 236 [Spd Reg Out Pct]) and the torque reference (Par 39 [Torque Ref]). Notes: Refer to Speed / Torque Mode Selection on page 290 in Appendix C for more detailed information. This parameter was added and is only available with firmware version 3.001 and higher.	Default: Options:	1 = “Speed Reg” 0 = “Zero Trq Ref” 1 = “Speed Reg” 2 = “Torque Reg” 3 = “SLAT Min” 4 = “SLAT Max” 5 = “Sum”	16-bit Int	39, 236, 382
	Ramp Rates	**18** ○	**[Ramp Type Select]** Determines the type of ramp used. • 0 “Linear” = Linear ramp • 1 “S shaped” = S–shaped ramp	Default: Options:	0 = “Linear” 0 = “Linear” 1 = “S shaped”	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
DYNAMIC CONTROL	Ramp Rates	19	**[S Curve Time]** S-shaped curve time constant. The value of Par 19 [S Curve Time] is added to the ramp time of linear ramps, regardless of speed changes. If the value of [S Curve Time] is changed, Pars 665 and 667 [S Curve Accel x] and 666 and 668 [S Curve Decel x] are set to the same value. If any of parameters 665-668 are changed later, the last change is valid. S Curve Time 	Default: Min/Max: Units:	1.00 0.10 / 60.00 s	Real	18, 665, 666, 667, 668
		20 A	**[Ramp Delay]** Defines a ramp delay time when the ramp is active. Works with par [Digital Outx Sel] set to 6 "Ramp Pos" or 7 "Ramp Neg".  	Default: Min/Max: Units:	100 0 / 65535 ms	16-bit Int	113, 346, 347
		22	**[MOP Accel Time]** The acceleration rate for the MOP reference in response to a digital input. The MOP acceleration rate = Par 2 [Maximum Speed] / Par 22 [MOP Accel Time]. If "0" is entered in this parameter, the ramp output directly follows the reference value.	Default: Min/Max: Units:	10 0 / 65535 s	16-bit Int	2
		24	**[Accel Time 2]** Sets the rate of acceleration for Ramp 2. Acceleration rate for Ramp 2 = Par 2 [Maximum Speed] / Par 24 [Accel Time 2].	Default: Min/Max: Units:	10 0 / 65535 s	16-bit Int	2
		30	**[MOP Decel Time]** The deceleration rate for the MOP reference in response to a digital input. The MOP deceleration rate = Par 2 [Maximum Speed] / Par 30 [MOP Decel Time].	Default: Min/Max: Units:	10 0 / 65535 s	16-bit Int	2
		32	**[Decel Time 2]** Sets the rate of deceleration for Ramp 2. Deceleration rate for Ramp 2 = Par 2 [Maximum Speed] / Par 30 [Decel Time 2].	Default: Min/Max: Units:	10 0 / 65535 s	16-bit Int	2

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**			Data Type	Related
DYNAMIC CONTROL	**Ramp Rates**	**245** ○	**[Speed Ramp En]** Enables or disables the ramp function. The Ramp Reference block is bypassed when this parameter is set to 0 “Disabled”.	Default: Options:	1 = 0 = 1 =	“Enabled” “Disabled” “Enabled”	16-bit Int	
		344 A	**[Zero Ramp Output]** Activates either the ramp output (1) or the brake function (0). When this parameter is set to 0 “Active”, the drive brakes through the maximum available torque and the motor will perform a Current Limit Stop. Two quadrant drives do not support a brake option. • “Active” = The ramp output is disabled and Pars 113 [Ramp Out] and 114 [Ramp Out Pct] are immediately set to zero. • “Not Active” = The ramp output is enabled. and Pars 113 [Ramp Out] and 114 [Ramp Out Pct] follow the Ramp Reference block commands.	Default: Options:	1 = 0 = 1 =	“Not Active” “Active” “Not Active”	16-bit Int	
		345 A	**[Zero Ramp Input]** Activates or deactivates the ramp input. • “Active” = The ramp input is not active and Pars 110 [Ramp In] and 111 [Ramp In Pct] = 0. • “Not Active” = The ramp input is activated and Pars 110 [Ramp In] and 111 [Ramp In Pct] correspond to the set reference.	Default: Options:	1 = 0 = 1 =	“Not Active” “Active” “Not Active”	16-bit Int	110, 111
		373 A	**[Freeze Ramp]** Determines whether the last ramp output reference value is retained or whether the ramp output reference value is active. • “Active” = The value of the ramp output at the time of activation is retained irrespective of any possible reference value changes at the ramp input. • “Not Active” = The ramp output value follows the ramp input value according to the Ramp Reference Block commands.	Default: Options:	1 = 0 = 1 =	“Not Active” “Active” “Not Active”	16-bit Int	
		660	**[Accel Time 1]** Sets the rate of acceleration for Ramp 1. Acceleration rate for Ramp 1 = Par 2 [Maximum Speed] / Par 660 [Accel Time 1].	Default: Min/Max: Units:	10 0 / 65535 s		16-bit Int	2
		662	**[Decel Time 1]** Sets the rate of deceleration for Ramp 1. Deceleration rate for Ramp 1 = Par 2 [Maximum Speed] / Par 662 [Decel Time 1].	Default: Min/Max: Units:	10 0 / 65535 s		16-bit Int	2
		665 A	**[S Curve Accel 1]** Defines the acceleration curve for S–shaped ramp 1.	Default: Min/Max: Units:	1.00 0.10 / 60.00 s		Real	
		666 A	**[S Curve Decel 1]** Defines the deceleration curve for S–shaped ramp 1.	Default: Min/Max: Units:	1.00 0.10 / 60.00 s		Real	
		667 A	**[S Curve Accel 2]** Defines the acceleration curve for S–shaped ramp 2.	Default: Min/Max: Units:	1.00 0.10 / 60.00 s		Real	
		668 A	**[S Curve Decel 2]** Defines the deceleration curve for S–shaped ramp 2.	Default: Min/Max: Units:	1.00 0.10 / 60.00 s		Real	
		1410	**[Jog Ramp Time]** Sets the rate of acceleration and deceleration while the Jog function is active. The Jog rate = Par 2 [Maximum Speed] / Par 1410 [Jog Ramp Time]. Note: This parameter was added with firmware version 2.001.	Default: Min/Max: Units:	10 0 / 65535 s		16-bit Int	2

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
DYNAMIC CONTROL	Load Limits	13 A	**[Torq Red CurLim]** The armature current limit, defined as a percentage of the value defined in Par 179 [Nom Mtr Arm Amps] when Par 342 [Torque Reduction] is set to 1 "Active".	Default: Min/Max: Units:	100 0 / 200 %	16-bit Int	342
		696 A	**[Droop Percent]** Droop function gain is a percentage of the ratio between Par 45 [Max Ref Speed] and the difference of Par 698 [Load Comp] – Par 41 [Current Reg In]. Therefore, when the difference between Par 698 [Load Comp] and Par 41 [Current Reg In] = 100% and Par 696 [Droop Percent] = 100%, the speed reference correction signal is equal to Par 45 [Max Ref Speed]. Note: See Droop Compensation on page 269 for more information.	Default: Min/Max: Units:	0.00 0.00 / 100.00 %	Real	41, 45, 698
		697 A	**[Droop Filter]** Droop filter time constant for the Droop function. Note: See Droop Compensation on page 269 for more information.	Default: Min/Max: Units:	0 0 / 1000 ms	16-bit Int	
		698 A	**[Load Comp]** The load compensation signal. This value is typically equal to the "master" drive's current. The load compensation signal is a percentage of I_{dn}.	Default: Min/Max: Units:	0 + / –200 %	16-bit Int	
		699 A	**[Enable Droop]** Enables/Disables the Droop function. • "Enabled" = The Droop function is enabled. • "Disabled" = The Droop function is disabled. Notes: This parameter can be assigned to a digital input. See Droop Compensation on page 269 for more information.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		700 A	**[Droop Limit]** The speed reference correction range within which the droop function becomes active. Note: See Droop Compensation on page 269 for more information.	Default: Min/Max: Units:	1750 0 / Par 45 [Max Ref Speed] rpm	16-bit Int	
		715 ○ A	**[Torq Limit Type]** This parameter determines the response of the drive during a current limiting condition. • "T Lim PosNeg" = The active positive torque limit is set by the value defined in Par 7 [Current Limit] and the active negative torque limit is set by the value defined in Par 9 [Current Lim Neg]. • "T Lim MtrGen" = With this option the following three conditions apply: 1.If the motor speed is greater than +1% of Par 162 [Max Feedback Spd], the active positive torque limit is set by the value defined in Par 8 [Current Lim Pos] and the active negative torque limit is set by the value defined in Par 9 [Current Lim Neg]. 2.If the motor speed is less than –1% of Par 162 [Max Feedback Spd] the active positive torque limit is set by the value defined in Par 9 [Current Lim Neg] and the active negative torque limit is set by the value defined in Par 8 [Current Lim Pos]. 3.If the motor speed is greater than –1% of Par 162 [Max Feedback Spd] and less than +1% of Par 162 [Max Feedback Spd] the active positive and negative torque limits are set by the value defined in Par 8 [Current Lim Pos]. Note: The option names were corrected to those shown above for firmware version 4.001.	Default: Options:	0 = "T Lim PosNeg" 0 = "T Lim PosNeg" 1 = "T Lim MtrGen"	16-bit Int	7, 8, 9, 162
	Stop Modes	38 A	**[Fast Stop Time]** The amount of time to decelerate the drive to a complete stop and disable the drive. The deceleration rate for Fast stop = [Maximum Speed] / [Fast Stop Time]. This feature can be used when [Digital Inx Sel] is set to 30 "Fast Stop" or when certain alarms are configured for "Fast Stop". See Pars 354 [Aux Inp Flt Cfg] and 365 [OverTemp Flt Cfg].	Default: Min/Max: Units:	10 0 / 65535 s	16-bit Int	354, 365

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
DYNAMIC CONTROL	Stop Modes	627 A	**[Spd 0 Trip Delay]** The amount of time that will elapse after the drive reaches zero speed before it is disabled.	Default: Min/Max: Units:	0 0 / 40000 ms	16-bit Int	
		1262 A	**[Closing Speed]** Motor speed at which the brake is closed. Used with External Brake Control.	Default: Min/Max: Units:	30 0 / 200 rpm	16-bit Int	
		1263 A	**[Opening Delay]** Amount of time before the brake will open after the drive has been enabled. Used with External Brake Control.	Default: Min/Max: Units:	0 0 / 30000 ms	16-bit Int	
		1265 A	**[Ramp In Zero En]** Enables/Disables the setting of the ramp input to zero. Used with External Brake Control.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		1266 A	**[Actuator Delay]** Amount of time before the actuator releases the load. Used with External Brake Control.	Default: Min/Max: Units:	0 0 / 30000 ms	16-bit Int	
	Restart Modes	1344	**[Start At Powerup]** Enables/Disables the ability to issue a "Run" command and automatically resume running at commanded speed after drive input power is restored and the time in Par 1345 [Powerup Delay] has elapsed. Requires a digital input configured for "Run" and a valid start condition. Note: See Start At Powerup on page 296 for more 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: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	1345
		1345	**[Powerup Delay]** Defines the programmed delay time, in seconds, before a start command is accepted after a power up. If a "Start", "Run" or "Stop" command is asserted before the time in this parameter expires, the "Start At Powerup" function will be aborted. Note: See Start At Powerup on page 296 for more information.	Default: Min/Max: Units:	1 1 / 10800 s	16-bit Int	1344
	Adaptv Regulator	181 ○ A	**[Adaptive Spd En]** Enables/Disables adaptive speed regulation. The adaptive speed regulator function enables different gains of the speed regulator depending on the speed or another variable (Par 183 [Adaptive Ref]). This allows optimum adaptation of the speed regulator to your specific application. When adaptive speed regulation is disabled, the regulator operates based on the settings in the individual regulation parameters. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	182, 183
		182 ○ A	**[Adaptive Reg Typ]** Selects the type of regulation used. • "Speed" = The regulator parameters follow a speed reference. • "Adaptive Ref" = The regulator parameters follow the reference produced by Par 183 [Adaptive Ref]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Options:	0 = "Speed" 0 = "Speed" 1 = "Adaptive Ref"	16-bit Int	183

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
DYNAMIC CONTROL	Adaptv Regulator	183 A	**[Adaptive Ref]** The variable reference that the speed regulator parameter will follow when Par 182 [Adaptive Reg Typ] = 1 "Adaptive Ref". Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	1000 –/+6000 rpm	16-bit Int	182
		184 A	**[Adaptive Spd 1]** A percentage of Par 45 [Max Ref Speed] or the maximum value of Par 183 [Adaptive Ref]. Parameter set 1 is valid below the value set in this parameter and parameter set 2 is valid above the value set in this parameter. The transition between the values is defined by Par 186 [Adaptive Joint 1]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	20.34 0.00 / 200.00 %	Real	183, 186
		185 A	**[Adaptive Spd 2]** A percentage of Par 45 [Max Ref Speed] or the maximum value of Par 183 [Adaptive Ref]. Parameter set 2 is valid below the value set in this parameter and parameter set 3 is valid above the value set in this parameter. The transition between the values is defined by Par 187 [Adaptive Joint 2]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	40.69 0.00 / 200.00 %	Real	183, 187
		186 A	**[Adaptive Joint 1]** Defines a range above and below the value set in Par 184 [Adaptive Spd 1] within which there is a linear change in gain from parameter set 1 to parameter set 2 in order to prevent jumps in the adaptive speed regulator. The value in this parameter is defined as percentage of the value defined Par 45 [Max Ref Speed]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	6.11 0.00 / 200.00 %	Real	184
		187 A	**[Adaptive Joint 2]** Defines a range above and below the value set in Par 185 [Adaptive Spd 2] with in which there is a linear change in gain from parameter set 2 to parameter set 3 in order to prevent jumps in the adaptive speed regulator. The value in this parameter is defined as percentage of the value defined Par 45 [Max Ref Speed]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	6.11 0.00 / 200.00 %	Real	185
		188 A	**[Adaptive P Gain1]** Proportional gain for the range from zero to the value set in Par 184 [Adaptive Spd 1]. The value in this parameter is defined as percentage of the value defined in Par 93 [Spd Reg Kp Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	10.00 0.00 / 100.00 %	Real	93, 184
		189 A	**[Adaptive I Gain1]** Integral gain for the range from zero to Par 184 [Adaptive Spd 1]. The value in this parameter is defined as percentage of the value defined Par 94 [Spd Reg Ki Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	1.00 0.00 / 100.00 %	Real	94, 184
		190 A	**[Adaptive P Gain2]** Proportional gain for the range of values defined beginning with the value of Par 184 [Adaptive Spd 1] to the value defined in Par 185 [Adaptive Spd 2]. The value in this parameter is defined as percentage of the value defined Par 93 [Spd Reg Kp Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	10.00 0.00 / 100.00 %	Real	93, 184, 185

File	**Group**	**No.**	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		**Data Type**	**Related**
DYNAMIC CONTROL	**Adaptv Regulator**	**191** A	**[Adaptive I Gain2]** Integral gain for the range of values defined beginning with the value of Par 184 [Adaptive Spd 1] to the value defined in Par 185 [Adaptive Spd 2]. The value in this parameter is defined as percentage of the value defined Par 94 [Spd Reg Ki Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	1.00 0.00 / 100.00 %	Real	94, 184, 185
		192 A	**[Adaptive P Gain3]** Proportional gain for the range of values beginning above the value defined in Par 185 [Adaptive Spd 2]. The value in this parameter is defined as percentage of the value defined Par 93 [Spd Reg Kp Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	10.00 0.00 / 100.00 %	Real	93, 185
		193 A	**[Adaptive I Gain3]** Integral gain for the range of values beginning above the value defined in Par 185 [Adaptive Spd 2]. The value in this parameter is defined as percentage of the value defined Par 94 [Spd Reg Ki Base]. Note: See Adaptive Speed Regulator on page 282 for more information.	Default: Min/Max: Units:	1.00 0.00 / 100.00 %	Real	94, 185

Applications File

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	PI Control	**695** A	**[PI Steady Thrsh]** Feed–forward threshold for PI. • If the value if Par 758 [Feed Fwd PID] is less than the value of Par 695 [PI Steady Thrsh] the integral regulation will be locked and the proportional gain assumes the value set in Par 793 [PI Init Prop Gn]. • When the value of Par 758 [Feed Fwd PID] exceeds the value of Par 695 [PI Steady Thrsh], the integral regulation with the gain set in Par 734 [PI Init Intgl Gn] will be enabled. • The Proportional / Integral (PI) block will maintain the gain values specified in Pars 793 [PI Init Prop Gn] and 734 [PI Init Intgl Gn] for the time specified in Par 731 [PID Steady Delay]; once this time delay has elapsed, the values of [PI Init Prop Gn] and [PI Init Intgl Gn] will be brought automatically to the values specified in Pars 765 [PI Prop Gain PID] and 764 [PI Integral Gain], respectively.	Default: Min/Max:	0 0 / 10000	16-bit Int	758
		731 A	**[PID Steady Delay]** The amount of time for which the gains in Pars 793 [PI Init Prop Gn] and 734 [PI Init Intgl Gn] will remain enabled after feed–forward has exceeded the threshold value defined in Par 695 [PI Steady Thrsh].	Default: Min/Max: Units:	0 0 / 60000 ms	16-bit Int	695, 734, 793
		734 A	**[PI Init Intgl Gn]** The initial value of the integral gain. This parameter is active when feed–forward is greater than the value defined in Par 695 [PI Steady Thrsh], or Par 769 [Enable PI] transitions from “0” (low) to “1” (high) and the amount of time defined in Par 731 [PID Steady Delay] has elapsed.	Default: Min/Max:	10.00 0.00 / 100.00	Real	695, 731, 769
		764 A	**[PI Integral Gain]** Integral gain of the PI block.	Default: Min/Max:	10.00 0.00 / 100.00	Real	
		765 A	**[PI Prop Gain PID]** Proportional gain of the PI block.	Default: Min/Max:	10.00 0.00 / 100.00	Real	
		769 A	**[Enable PI]** Enables/Disables the PI portion of the PID regulator. If assigned to a digital input, this parameter must be brought at a high logical level (+24V).	Default: Options:	0 = “Disabled” 0 = “Disabled” 1 = “Enabled”	16-bit Int	
		771 A	**[PI Output]** Output value of the PI block, adapted to the value between the values defined in Pars 784 [PI Upper Limit] and 785 [PI Lower Limit]. When the drive is turned on, the value of this parameter is acquired automatically based on the value of Par 779 [PI Central v sel] x 1000.	Default: Min/Max:	Read Only 0 / 10000	16-bit Int	784, 785, 779
		776 A	**[PI Central v1]** The first value that can be selected, via Par 779 [PI Central v sel], as the initial output of the PID regulator’s integral component (corresponding to initial diameter 1). The value entered in this parameter must be less than the value set in Par 784 [PI Upper Limit] and greater than the value set in Par 785 [PI Lower Limit].	Default: Min/Max:	0.00 Par 785 [PI Lower Limit] / Par 784 [PI Upper Limit]	Real	784, 785, 779
		777 A	**[PI Central v2]** The second value that can be selected, via Par 779 [PI Central v sel], as the initial output of the PID regulator’s integral component (corresponding to initial diameter 2). The value entered in this parameter must be less than the value set in Par 784 [PI Upper Limit] and greater than the value set in Par 785 [PI Lower Limit].	Default: Min/Max:	0.00 Par 785 [PI Lower Limit] / Par 784 [PI Upper Limit]	Real	784, 785, 779

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 102 for symbol descriptions</th><th colspan="2">Values</th><th>Data Type</th><th>Related</th></tr>
<tr><td>APPLICATIONS</td><td>PI Control</td><td>778
A</td><td>[PI Central v3]
The third value that can be selected, via Par 779 [PI Central v sel], as the initial output of the PID regulator’s integral component (corresponding to initial diameter 3). The value entered in this parameter must be less than the value set in Par 784 [PI Upper Limit] and greater than the value set in Par 785 [PI Lower Limit].
Note: This parameter can be assigned to an analog input.</td><td>Default:
Min/Max:</td><td>0.00
Par 785 [PI Lower Limit] / Par 784 [PI Upper Limit]</td><td>Real</td><td>784,
785,
779</td></tr>
<tr><td></td><td></td><td>779
A</td><td>[PI Central v sel]
Selects one of the four possible initial output values of the PID regulator integral component (corresponding to the initial diameter) of the PI block.
• “0” = When the PI block is disabled (Par 769 [Enable PI] = “Disabled”), the last value of the integral component calculated (corresponding to roll diameter) is stored in Par 771 [PI Output]. This value is used by the PID regulator when the PI block is enabled again and the drive is restarted. This function is useful when for any reason the drive must be turned off or if incoming power is removed from the drive.
• “1”, “2”, or “3” = When the PI block is disabled (Par 769 [Enable PI] = “Disabled”), the value of [PI Output] will be set to the value of the selected parameter (“1” = 776 [PI Central v1], “2” = 777, [PI Central v2], or “3” = 778 [PI Central v3] x1000). This value is only used by the PID regulator when the drive is powered up and Par 769 [Enable PI] is already enabled.
Note: Par 779 [PI Central v sel] can be set directly from the HIM or through two digital inputs set respectively as “PI central vs0” and “PI central vs1”. Refer to Pars 780 [PI Central vs0] and 781 [PI Central vs1] for more information on this configuration.</td><td>Default:
Min/Max:</td><td>1
0 / 3</td><td>16-bit Int</td><td>769,
776,
777,
778,
780,
781</td></tr>
<tr><td></td><td></td><td>780
A</td><td>[PI Central vs0]
When assigned to a digital input and used in combination with Par 781 [PI Central vs1], through binary selection, determines which of the four possible output values is used as the initial level of the integral component (corresponding to the initial diameter) of the PI block.
<table>
<tr><th>Par 780</th><th>Par 781</th><th>Selects the value in . . .</th></tr>
<tr><td>0</td><td>0</td><td>Par 771 [PI Output]</td></tr>
<tr><td>0</td><td>1</td><td>Par 776 [PI Central v1]</td></tr>
<tr><td>1</td><td>0</td><td>Par 777 [PI Central v2]</td></tr>
<tr><td>1</td><td>1</td><td>Par 778 [PI Central v3]</td></tr>
</table></td><td>Default:
Min/Max:</td><td>0
0 / 1</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>781
A</td><td>[PI Central vs1]
The output selector of the initial PI block. With the value of Par 780 [PI Central vs0] determined, through binary selection, what between the four possible settings of the integral initial level (correspondent to initial diameter) can be used. See Par 780 [PI Central vs0] for binary selections.</td><td>Default:
Min/Max:</td><td>0
0 / 1</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>783
A</td><td>[PI integr freeze]
Locks the selections made for the integral component of the PID regulator.</td><td>Default:
Options:</td><td>0 = “Off”
0 = “Off”
1 = “On”</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>784
A</td><td>[PI Upper Limit]
Defines the upper limit of the adapting block for correction of the PI block.</td><td>Default:
Min/Max:</td><td>10.00
Par 785 [PI Lower Limit] / 10.00</td><td>Real</td><td></td></tr>
<tr><td></td><td></td><td>785
A</td><td>[PI Lower Limit]
Defines the lower limit of the adapting block for correction of the PI block.</td><td>Default:
Min/Max:</td><td>0.00
–10.00 / Par 784 [PI Upper Limit]</td><td>Real</td><td></td></tr>
</table>

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
APPLICATIONS	**PI Control**	**793** A	**[PI Init Prop Gn]** The initial value of the proportional gain. This parameter is active when, • its value has exceeded the value of Par 695 [PI Steady Thrsh], • the amount of time defined in Par 731 [PID Steady Delay] has elapsed, and feed–forward is less than the value defined in Par 695 [PI Steady Thrsh], or • Par 769 [Enable PI] transitions from "0" (low) to "1" (high) and the amount of time defined in Par 731 [PID Steady Delay] has elapsed.	Default: Min/Max:	10.00 0.00 / 100.00	Real	695, 731, 769
	PD Control	**421** A	**[PD Output PID]** Proportional / Derivative (PD) block output.	Default: Min/Max:	Read Only –/+10000	16-bit Int	
		766 A	**[PD Deriv Gain 1]** First derivative gain of the PD block. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	1.00 0.00 / 100.00	Real	181
		767 A	**[PD Deriv Filter]** Time constant of the filter from the derivative portion of the PD block.	Default: Min/Max: Units:	0 1 / 1000 ms	16-bit Int	
		768 A	**[PD Prop Gain 1]** First proportional gain of the block PD. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	10.00 0.00 / 100.00	Real	181
		770 A	**[Enable PD]** Enables/disables the PD portion of the PID regulator. Note: This parameter can be assigned to a digital input.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		788 A	**[PD Prop Gain 2]** Second proportional gain of the block PD. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	10.0 0.0 / 100.0	Real	181
		789 A	**[PD Deriv Gain 2]** Second derivative gain of the PD block. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	10.0 0.0 / 100.0	Real	181
		790 A	**[PD Prop Gain 3]** Third proportional gain of the block PD. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	10.0 0.0 / 100.0	Real	181
		791 A	**[PD Deriv Gain 3]** Third derivative gain of the PD block. The value specified in this field depends on the enabling and configuration of Par 181 [Adaptive Spd En].	Default: Min/Max:	1.00 0.00 / 100.00	Real	181
	PID Control	**418**	**[Real FF PID]** Represents the feed–forward value which has been recalculated according to the PI correction. It will be calculated with the following formula: Par 418 [Real FF PID] = (Par 758 [Feed Fwd PID] / 1000) x Par 771 [PI Output] When either the negative or positive limit of this parameter has been reached, further increases in the value of Par 771 [PI Output] will be blocked in order to avoid undesirable saturation of the PID regulator. For example: When Par 758 [Feed Fwd PID] = +8000, the positive limit of Par 771 [PI Output] will be automatically set at 10000 / (8000 / 1000) = 1250.	Default: Min/Max:	Read Only –/+10000	16-bit Int	758, 771

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	**PID Control**	**757** A	**[PID Clamp]** The PID "clamp" allows a smooth tension setting of a controlled system winder/unwinder when the calculation of the initial diameter function cannot be used. • When enabling the drive, the dancer is at the lowest point of its full scale. In this case, with Par 759 [PID Error] at its maximum value, the motor could accelerate too fast to properly configure the dancer for its central operating position. By setting the value of Par 757 [PID Clamp] sufficiently low. e.g, = 1000, when the drive starts and Par 770 [Enable PD] = 1 "Enable", the value of Par 759 [PID Error] is limited to 1000 until the signal coming from the dancer (via Par 763 [PID Feedback]) goes above the value in this field. Then, the value of [PID Clamp] is automatically returned to its maximum value of 10000. The PID clamp is kept at 10000 until the drive stops or Par 770 [Enable PD] = 0 "Disabled".	Default: Min/Max:	10000 0 / 10000	16-bit Int	759, 763, 770
		758 A	**[Feed Fwd PID]** Feedback from the transducer position (dancer) or tension.	Default: Min/Max:	Read Only –/+10000	16-bit Int	
		759 A	**[PID Error]** Error value input to the PID function (output of the PID Clamp block).	Default: Min/Max:	Read Only –/+10000	16-bit Int	
		760 A	**[PID Setpoint 0]** First offset value added to Par 763 [PID Feedback]. This parameter can be assigned to an analog input, for example, for the tension setting when a load cell must be used as feedback.	Default: Min/Max:	0 –/+10000	16-bit Int	763
		761 A	**[PID Setpoint 1]** Second offset value added to Par 763 [PID Feedback].	Default: Min/Max:	0 –/+10000	16-bit Int	763
		762 A	**[PID Setpoint Sel]** Selects the offset value added to Par 763 [PID Feedback]. This parameter can be assigned to a digital input.	Default: Options:	0 = "Setpoint 0" 0 = "Setpoint 0" 1 = "Setpoint 1"	16-bit Int	763
		763 A	**[PID Feedback]** Analog input feedback value received from the transducer position (dancer) or tension (load cell).	Default: Min/Max:	0 –/+10000	16-bit Int	
		772 A	**[PID Output Sign]** Determines whether the output of the PID regulator is bipolar or positive (clamp of the negative side).	Default: Options:	1 = "Bipolar" 0 = "Positive" 1 = "Bipolar"	16-bit Int	
		773 A	**[PID Output Scale]** Scale factor for Par 774 [PID Output]. The value of this parameter depends on to which parameter you want to send the PID regulator output.	Default: Min/Max:	1.00 –/+100.00	Real	774
		774 A	**[PID Output]** Displays the PID regulator output. Note: This parameter can be assigned to an analog output in order to provide a cascaded reference in multi-drive systems.	Default: Min/Max:	Read Only –/+10000	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	PID Control	782 A	**[PID Target]** Parameter number to which the PID Output value will be written. Options:	Default:	0 = "Not Used"	16-bit Int	

0 =	"Not Used"	16 =	"Reserved"	32 =	"UsrDefined13" (Par 516)
1 =	"Cur Lim Pos" (Par 8)	17 =	"Max Fld Pct" (Par 467)	33 =	"UsrDefined14" (Par 517)
2 =	"Cur Lim Neg" (Par 9)	18 =	"Reserved"	34 =	"UsrDefined15" (Par 518)
3 =	"Reserved"	19 =	"UsrDefined0" (Par 503)	35 =	"Load Comp" (Par 698)
4 =	"Reserved"	20 =	"UsrDefined1" (Par 504)	36 =	"Out Volt Lvl" (Par 921)
5 =	"TrqRedCurLim" (Par 13)	21 =	"UsrDefined2" (Par 505)	37 =	"Reserved"
6 =	"Torque Ref" (Par 39)	22 =	"UsrDefined3" (Par 506)	38 =	"Speed Ratio" (Par 1017)
7 =	"Trim Torque" (Par 40)	23 =	"UsrDefined4" (Par 507)	39 =	"Reserved"
8 =	"Reserved"	24 =	"UsrDefined5" (Par 508)	40 =	"Reserved"
9 =	"Trim Ramp" (Par 42)	25 =	"UsrDefined6" (Par 509)	41 =	"Tension Red" (Par 1179)
10 =	"Trim Speed" (Par 43)	26 =	"UsrDefined7" (Par 510)	42 =	"Reserved"
11 =	"Reserved"	27 =	"UsrDefined8" (Par 511)	43 =	"Reserved"
12 =	"Reserved"	28 =	"UsrDefined9" (Par 512)	44 =	"CloseLp Comp" (Par 1208)
13 =	"Reserved"	29 =	"UsrDefined10" (Par 513)	45 =	"Reserved"
14 =	"Adaptive Ref" (Par 183)	30 =	"UsrDefined11" (Par 514)	46 =	"Reserved"
15 =	"Reserved"	31 =	"UsrDefined12" (Par 515)	47 =	"Reserved"

		786 A	**[PID Source]** Parameter number from which the PID source value will be read. Note: Added option 47 "Encoder Spd" for firmware version 4.001. Options:	Default:	0 "Not Used"	16-bit Int	

0 =	"Not Used"	16 =	"SpdRegOutPct" (Par 236)	32 =	"UsrDefined13" (Par 516)
1 =	"Cur Lim Pos" (Par 8)	17 =	"Max Fld Pct" (Par 467)	33 =	"UsrDefined14" (Par 517)
2 =	"Cur Lim Neg" (Par 9)	18 =	"Fld Ref Pct" (Par 500)	34 =	"UsrDefined15" (Par 518)
3 =	"CurLimPosOut" (Par 10)	19 =	"UsrDefined0" (Par 503)	35 =	"Load Comp" (Par 698)
4 =	"CurLimNegOut" (Par 11)	20 =	"UsrDefined1" (Par 504)	36 =	"Out Volt Lvl" (Par 921)
5 =	"TrqRedCurLim" (Par 13)	21 =	"UsrDefined2" (Par 505)	37 =	"Filt Trq Cur" (Par 928)
6 =	"Torque Ref" (Par 39)	22 =	"UsrDefined3" (Par 506)	38 =	"Speed Ratio" (Par 1017)
7 =	"Trim Torque" (Par 40)	23 =	"UsrDefined4" (Par 507)	39 =	"Spd Draw Out" (Par 1018)
8 =	"TorqueReg In" (Par 41)	24 =	"UsrDefined5" (Par 508)	40 =	"Roll Diam" (Par 1154)
9 =	"Trim Ramp" (Par 42)	25 =	"UsrDefined6" (Par 509)	41 =	"Tension Red" (Par 1179)
10 =	"Trim Speed" (Par 43)	26 =	"UsrDefined7" (Par 510)	42 =	"Torq Cur Pct" (Par 1193)
11 =	"Ramp In" (Par 110)	27 =	"UsrDefined8" (Par 511)	43 =	"Ten Ref Pct" (Par 1194)
12 =	"Ramp Out" (Par 113)	28 =	"UsrDefined9" (Par 512)	44 =	"CloseLp Comp" (Par 1208)
13 =	"Speed Reg In" (Par 118)	29 =	"UsrDefined10" (Par 513)	45 =	"Actual Comp" (Par 1213)
14 =	"Adaptive Ref" (Par 183)	30 =	"UsrDefined11" (Par 514)	46 =	"W Reference" (Par 1217)
15 =	"Arm Cur Pct" (Par 199)	31 =	"UsrDefined12" (Par 515)	47 =	"Encoder Spd" (Par 420)

		787 A	**[PID Source Gain]** Gain of the input value to Par 786 [PID Source].	Default: Min/Max:	1.00 –/+100.00	Real	786
		1046 A	**[PID Accel Time]** Ramp acceleration time after the block PID offset.	Default: Min/Max: Units:	0.00 0.00 / 900.00 s	Real	
		1047 A	**[PID Decel Time]** Ramp deceleration time after the block PID offset.	Default: Min/Max: Units:	0.00 0.00 / 900.00 s	Real	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	PID Control	1254 A	**[PID Error Gain]** Gain percentage of Par 759 [PID Error].	Default: Min/Max: Units:	1.005 0.000 / 32.005 %	Real	759
		1258 A	**[Enable PI PD]** Indicates the combined status of Par 769 [Enable PI] and 770 [Enable PD]. If both Par 769 and Par 770 are enabled then Par 1258 [Enable PI PD] displays "Enabled". If either of Par 769 or Par 770 is disabled, Par 1258 [Enable PI PD] displays "Disabled".	Default: Min/Max:	Read Only Disabled / Enabled	16-bit Int	769, 770
	Init Diam Calc	794 ○ A	**[Diameter Calc]** Enables/Disables the diameter calculation function. If this parameter has been programmed via a digital input, it must be brought to a logical high level. • "0" = The diameter calculation is disabled. • "1" = The diameter calculation is enabled.	Default: Min/Max:	0 0 / 1	16-bit Int	
		795 A	**[DncrPosSpd]** Desired motor speed when the dancer is positioned in its central working position.	Default: Min/Max:	0 –/+100	16-bit Int	
		796 A	**[Max Deviation]** A value, expressed in counts of D/A, that corresponds to the position of maximum shift admitted by the dancer. This value is considered the starting measurement of the dancer movement during the initial diameter calculation phase.	Default: Min/Max:	8000 –/+10000	16-bit Int	
		797 A	**[Gear Box Ratio]** Ratio reduction between the motor and the roll (< = 1).	Default: Min/Max:	1.000 0.001 / 1.000	Real	
		798 A	**[Dancer Constant]** The measurement corresponding to the total bunching of the material in the dancer.	Default: Min/Max: Units:	1 1 / 10000 mm	16-bit Int	
		799 ○ A	**[Minimum Diameter]** Minimum value of the roll diameter.	Default: Min/Max: Units:	100 1 / 2000 mm	16-bit Int	
		800 A	**[Diameter Calc St]** Status of the initial diameter calculation. • "0" = The initial diameter calculation has not completed. • "1" = The initial diameter calculation has completed. Note: This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
	Diameter Calc	799 ○ A	**[Minimum Diameter]** Minimum value of the roll diameter.	Default: Min/Max: Units:	100 1 / 2000 mm	16-bit Int	
		1153 ○ A	**[Max Diameter]** Maximum roll diameter.	Default: Min/Max: Units:	1.00 0.00 / 32.00 m	Real	
		1154 A	**[Roll Diameter]** Displays the calculated roll diameter. Note: This parameter can be assigned to an analog output as a percentage of Par 1153 [Max Diameter].	Default: Min/Max: Units:	Read Only 0.00 / 32.00 m	Real	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	Diameter Calc	1155 A	**[Line Spd Thresh]** Line speed detecting threshold. When the value of Par 1286 [Ref Line Speed] is lower than the value of [Line Spd Thresh], the diameter calculation stops and the diameter is kept at a constant value. When the value of [Ref Line Speed] overcomes the threshold, the diameter calculation is enabled with an initial filter corresponding to the value in Par 1206 [Diam Init Filter] for the time set in Par 1207 [Diam Stdy Delay]. At the end of this time the filter will be set to the value of Par 1162 [Diameter Filter].	Default: Min/Max: Units:	5.00 0.00 / 150.00 %	Real	1162, 1206, 1207, 1286
		1156 A	**[Line Spd Gain]** Calibration value used to obtain Par 1160 [Line Speed Pct] = 100% at its maximum value. The value of this parameter depends on the value of Par 1284 [Ref Spd Source]: [Line Spd Gain] = [32768 x 16384 / (maximum value of [Ref Spd Source] x 8)] -1	Default: Min/Max:	0 0 / 32767	16-bit Int	1160, 1284
		1157 A	**[Diameter Reset]** Diameter reset. When this parameter is set to “1”, the diameter starting value is set to the value in Par 1168 [Diam Preset Sel].	Default: Min/Max:	0 0 / 1	16-bit Int	1168
		1158 A	**[Diam Threshold]** Diameter threshold as a percentage of Par 1153 [Max Diameter]. Par 1159 [Diameter Reached] is set to “1” when the value in this parameter is exceeded.	Default: Min/Max: Units:	10.00 0.00 / 150.00 %	Real	1153, 1159
		1159 A	**[Diameter Reached]** Indication that the diameter threshold set in Par 1158 [Diam Threshold] has been exceeded. • “0” = The diameter threshold has not been exceeded. • “1” = The diameter threshold has been exceeded.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	1158
		1160 A	**[Line Speed Pct]** Line speed.	Default: Min/Max: Units:	Read Only 0.00 / 150.00 %	Real	
		1161 A	**[Diam Calc Dis]** Enables/Disables the diameter calculation (see also Par 1155 [Line Spd Thresh]). The last calculated diameter value is saved if this parameter is changed to 0 “Off” while the diameter is being calculated.	Default: Options:	1 = “On” 0 = “Off” 1 = “On”	16-bit Int	1155
		1162 A	**[Diameter Filter]** Diameter calculation filter.	Default: Min/Max: Units:	100 0 / 5000 ms	16-bit Int	
		1163 A	**[Base Omega]** Winder speed at the maximum line speed and minimum diameter of the winder/unwinder (motor shaft side).	Default: Min/Max: Units:	1500 0 / 8191 rpm	16-bit Int	
		1164 A	**[Diam Preset 0]** First preset starting diameter. The value of this parameter must be set between the value of Pars 799 [Minimum Diameter] and 1153 [Max Diameter].	Default: Min/Max: Units:	1.00 0.00 / 32.00 m	Real	799, 1153
		1165 A	**[Diam Preset 1]** Second preset starting diameter. The value of this parameter must be set between the value of Pars 799 [Minimum Diameter] and 1153 [Max Diameter].	Default: Min/Max: Units:	1.00 0.00 / 32.00 m	Real	799, 1153
		1166 A	**[Diam Preset 2]** Third preset starting diameter. The value of this parameter must be set between the value of Pars 799 [Minimum Diameter] and 1153 [Max Diameter].	Default: Min/Max: Units:	1.00 0.00 / 32.00 m	Real	799, 1153

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 102 for symbol descriptions</th><th colspan="2">Values</th><th>Data Type</th><th>Related</th></tr>
<tr><td rowspan="6">APPLICATIONS</td><td rowspan="6">Diameter Calc</td><td>1167
A</td><td>**[Diam Preset 3]**
Fourth preset starting diameter. The value of this parameter must be set between the value of Pars 799 [Minimum Diameter] and 1153 [Max Diameter]. This parameter can be assigned to an analog input. If an analog input is used, +10V corresponds to the value of [Max Diameter] and the voltage corresponding to the minimum diameter = 10 x ([Minimum Diameter] / [Max Diameter]).</td><td>Default:
Min/Max:
Units:</td><td>1.00
0.00 / 32.00
m</td><td>Real</td><td>799, 1153</td></tr>
<tr><td>1168
A</td><td>**[Diam Preset Sel]**
Selects the starting diameter for the Diameter Calculation function.
• 0 = Par 1164 [Diam Preset 0]
• 1 = Par 1165 [Diam Preset 1]
• 2 = Par 1166 [Diam Preset 2]
• 3 = Par 1167 [Diam Preset 3]
This parameter can also be set via two digital inputs programmed as 57 “Diam Preset0” and 58 “Diam Preset1”; the selection in this case is carried out with binary logic.
<table>
<tr><th>“Diam Preset1”</th><th>“Diam Preset0”</th><th>Selection</th></tr>
<tr><td>0</td><td>0</td><td>Par 1164 [Diam Preset 0]</td></tr>
<tr><td>0</td><td>1</td><td>Par 1165 [Diam Preset 1]</td></tr>
<tr><td>1</td><td>0</td><td>Par 1166 [Diam Preset 2]</td></tr>
<tr><td>1</td><td>1</td><td>Par 1167 [Diam Preset 3]</td></tr>
</table></td><td>Default:
Min/Max:</td><td>0
0 / 3</td><td>16-bit Int</td><td>1164, 1165, 1166, 1167</td></tr>
<tr><td>1187
A</td><td>**[Winder Type]**
Winder/unwinder selection. If the selection is carried out via a digital input: 0V = “Winder” , +24V = “Unwinder”.</td><td>Default:
Options:</td><td>0 = “Winder”
0 = “Winder”
1 = “Unwinder”</td><td>16-bit Int</td><td></td></tr>
<tr><td rowspan="2">1204
○
A</td><td>**[Line Spd Source]**
Parameter number from which the line speed source for the winder function value will be read.
Note: All option selections added to this parameter with firmware version 4.001.</td><td>Default:</td><td>0 = “Not Used”</td><td rowspan="2">16-bit Int</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Options:
<table>
<tr><td>0 =</td><td>“Not Used”</td><td>16 =</td><td>“SpdRegOutPct” (Par 236)</td><td>32 =</td><td>“UsrDefined13” (Par 516)</td></tr>
<tr><td>1 =</td><td>“Cur Lim Pos” (Par 8)</td><td>17 =</td><td>“Max Fld Pct” (Par 467)</td><td>33 =</td><td>“UsrDefined14” (Par 517)</td></tr>
<tr><td>2 =</td><td>“Cur Lim Neg” (Par 9)</td><td>18 =</td><td>“Fld Ref Pct” (Par 500)</td><td>34 =</td><td>“UsrDefined15” (Par 518)</td></tr>
<tr><td>3 =</td><td>“CurLimPosOut” (Par 10)</td><td>19 =</td><td>“UsrDefined0” (Par 503)</td><td>35 =</td><td>“Load Comp” (Par 698)</td></tr>
<tr><td>4 =</td><td>“CurLimNegOut” (Par 11)</td><td>20 =</td><td>“UsrDefined1” (Par 504)</td><td>36 =</td><td>“Out Volt Lvl” (Par 921)</td></tr>
<tr><td>5 =</td><td>“TrqRedCurLim” (Par 13)</td><td>21 =</td><td>“UsrDefined2” (Par 505)</td><td>37 =</td><td>“Filt Trq Cur” (Par 928)</td></tr>
<tr><td>6 =</td><td>“Torque Ref” (Par 39)</td><td>22 =</td><td>“UsrDefined3” (Par 506)</td><td>38 =</td><td>“Speed Ratio” (Par 1017)</td></tr>
<tr><td>7 =</td><td>“Trim Torque” (Par 40)</td><td>23 =</td><td>“UsrDefined4” (Par 507)</td><td>39 =</td><td>“Spd Draw Out” (Par 1018)</td></tr>
<tr><td>8 =</td><td>“TorqueReg In” (Par 41)</td><td>24 =</td><td>“UsrDefined5” (Par 508)</td><td>40 =</td><td>“Roll Diam” (Par 1154)</td></tr>
<tr><td>9 =</td><td>“Trim Ramp” (Par 42)</td><td>25 =</td><td>“UsrDefined6” (Par 509)</td><td>41 =</td><td>“Tension Red” (Par 1179)</td></tr>
<tr><td>10 =</td><td>“Trim Speed” (Par 43)</td><td>26 =</td><td>“UsrDefined7” (Par 510)</td><td>42 =</td><td>“Torq Cur Pct” (Par 1193)</td></tr>
<tr><td>11 =</td><td>“Ramp In” (Par 110)</td><td>27 =</td><td>“UsrDefined8” (Par 511)</td><td>43 =</td><td>“Ten Ref Pct” (Par 1194)</td></tr>
<tr><td>12 =</td><td>“Ramp Out” (Par 113)</td><td>28 =</td><td>“UsrDefined9” (Par 512)</td><td>44 =</td><td>“CloseLp Comp” (Par 1208)</td></tr>
<tr><td>13 =</td><td>“Speed Reg In” (Par 118)</td><td>29 =</td><td>“UsrDefined10” (Par 513)</td><td>45 =</td><td>“Actual Comp” (Par 1213)</td></tr>
<tr><td>14 =</td><td>“Adaptive Ref” (Par 183)</td><td>30 =</td><td>“UsrDefined11” (Par 514)</td><td>46 =</td><td>“W Reference” (Par 1217)</td></tr>
<tr><td>15 =</td><td>“Arm Cur Pct” (Par 199)</td><td>31 =</td><td>“UsrDefined12” (Par 515)</td><td>47 =</td><td>“Encoder Spd” (Par 420)</td></tr>
</table></td></tr>
<tr><td>1205
A</td><td>**[Diam Inc Dec En]**
This parameter It is used to improve system stability for winder/unwinder applications. If this parameter is enabled and if applied to a winder, the calculated diameter can never decrease; if applied to an unwinder, the calculated diameter can never increase.</td><td>Default:
Options:</td><td>1 = “Enabled”
0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
</table>

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	Diameter Calc	1206 A	**[Diam Init Filter]** Initial filter on the diameter calculation.	Default: Min/Max: Units:	100 0 / 5000 ms	16-bit Int	
		1207 A	**[Diam Stdy Delay]** The amount of time during which the value of Par 1206 [Diam Init Filter] is kept active after the value defined in Par 1155 [Line Spd Thresh] has been overcome.	Default: Min/Max: Units:	0 0 / 60000 ms	16-bit Int	1155, 1206
	Winder Functions	1171 A	**[Variable J Comp]** Torque compensation due to the wound material as a percentage of the drive rated current.	Default: Min/Max: Units:	0.00 0.00 / 199.99 %	Real	
		1172 A	**[Constant J Comp]** Compensation of the fixed section (motor, reducer, pin) as a percentage of the drive rated current.	Default: Min/Max: Units:	1.00 – / +100.00 %	Real	
		1173 A	**[Materl Width Pct]** Width of the wound material as a percentage of the maximum width.	Default: Min/Max: Units:	100.00 0.00 / 100.00 %	Real	
		1174 A	**[Static Friction]** Compensation for static friction as a percentage of the drive rated current.	Default: Min/Max: Units:	0.00 0.00 / 199.99 %	Real	
		1175 A	**[Dynamic Friction]** Compensation for dynamic friction as a percentage of the drive rated current.	Default: Min/Max: Units:	0.00 0.00 / 199.99 %	Real	
		1176 A	**[Taper Enable]** Enables/Disables the Taper function.	Default: Options:	0 = "Disabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		1177 A	**[Initial Diameter]** Diameter that starts the taper tension reduction.	Default: Min/Max: Units:	0.10 0.00 / 32.00 m	Real	
		1178 A	**[Final Diameter]** Diameter that ends the taper tension reduction.	Default: Min/Max: Units:	1.00 0.00 / 32.00 m	Real	
		1179 A	**[Tension Reduct]** Taper tension reduction as a percentage of Par 1180 [Tension Ref].	Default: Min/Max: Units:	0.00 0.00 / 199.99 %	Real	1180
		1180 A	**[Tension Ref]** Tension reference. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	0.00 0.00 / 199.99 %	Real	
		1181 A	**[Tension Scale]** Scale factor of the torque current. This parameter is used when the value of the maximum winding torque must be limited or when a closed loop control is used in order to adjust the torque current value to the real tension on the material measured by the load cell.	Default: Min/Max: Units:	100 0 / 200 %	16-bit Int	
		1182 A	**[Time AccDec Min]** The amount of time corresponding to the lower acceleration, deceleration and fast deceleration time.	Default: Min/Max: Units:	9.00 0.15 / 300 s	Real	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	Winder Functions	**1183** ○ A	**[Int Acc Calc En]** Enables/Disables the calculation for coil acceleration. • "Enabled" = This function carries out the calculation of the angular acceleration inside the drive. In this case it is necessary to set just the value of Par 1182 [Time AccDec Min]. • "Disabled" = It is necessary to set Pars 1184 [Line Accel Pct], 1185 [Line Decel Pct], 1186 [Line FastStp Pct] and 1182 [Time AccDec Min] and to supply the corresponding status indication to the digital inputs.	Default: Options:	1 = "Enabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	1182, 1184, 1185, 1186
		1184 A	**[Line Accel Pct]** Acceleration time as a percentage Par 1182 of [Time AccDec Min].	Default: Min/Max: Units:	100.00 0.00 / 100.00 %	Real	1182
		1185 A	**[Line Decel Pct]** Deceleration time as a percentage of Par 1182 [Time AccDec Min].	Default: Min/Max: Units:	100.00 0.00 / 100.00 %	Real	1182
		1186 A	**[Line FastStp Pct]** Fast deceleration time as a percentage of Par 1182 [Time AccDec Min].	Default: Min/Max: Units:	100.00 0.00 / 100.00 %	Real	1182
		1188 A	**[Accel Status]** Indicates the drive acceleration status. • "0" = Off - Drive not accelerating • "1" = "On" - Drive accelerating Note: This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		1189 A	**[Decel Status]** Indicates the drive deceleration status. • "0" = "Off" - Drive not decelerating • "1" = "On" - Drive decelerating Note: This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		1190 A	**[Fast Stop Status]** Indicates the drive fast stop status. • "0" = "Off" - Drive is not fast stopping • "1" = "On" - Drive is fast stopping	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		1191 A	**[InertiaCompCnst]** Displays the active compensation of the fixed section as a percentage of the drive rated current.	Default: Min/Max: Units:	Read Only 0.00 / 200.00 %	Real	
		1192 A	**[InertiaCompVar]** Displays the active compensation of the variable section as a percentage of the drive rated current.	Default: Min/Max: Units:	Read Only 0.00 / 200.00 %	Real	
		1193 A	**[Torq Current Pct]** Displays the amount of torque current required. Note: This parameter can be assigned to an analog output.	Default: Min/Max: Units:	Read Only 0.00 / 200.00 %	Real	
		1194 A	**[Act Ten Ref Pct]** Displays the percentage of tension reference less the Taper percentage set via Par 1179 [Tension Reduct]. If the Taper function is not enabled, it corresponds to the value displayed in Par 1180 [Tension Ref].	Default: Min/Max: Units:	Read Only 0.00 / 199.99 %	Real	1179, 1180
		1195 A	**[Speed Match]** Coil "launching" phase command for automatic switching. Note: This parameter can be assigned to a digital input.	Default: Options:	0 = "Off" 0 = "Off" 1 = "On"	16-bit Int	
		1196 A	**[Spd Match Acc]** Motor acceleration time during the launching phase.	Default: Min/Max: Units:	83.88 0.30 / 300.00 s	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
APPLICATIONS	Winder Functions	**1197** A	**[Spd Match Dec]** Motor deceleration time. If the motor decelerates during the launching phase a stop command is issued.	Default: Min/Max: Units:	83.88 0.30 / 300.00 s	Real	
		1198 A	**[Offs Accel Time]** Ramp time for the initial phase when the machine is stopped. It refers to Par 45 [Max Ref Speed].	Default: Min/Max: Units:	83.88 0.30 / 300.00 s	Real	
		1199 A	**[W Offset]** Speed reference offset for the initial phase of the winder/unwinder when the line is stopped.	Default: Min/Max: Units:	0 0 / 1000 rpm	16-bit Int	
		1200 A	**[Spd Match Gain]** Speed reference gain during the launching phase. 100% corresponds to a peripheral speed equal to the line speed.	Default: Min/Max: Units:	100 0 / 150 %	16-bit Int	
		1201 A	**[Winder Side]** Selection of the winding/unwinding side. • “0” = Up • “1” = Down Note: This parameter can be assigned to a digital input.	Default: Min/Max:	0 0 / 1	16-bit Int	
		1202 A	**[W Gain]** Sets the speed reference gain used to saturate the speed loop. This parameter is a percentage of the increasing/decreasing value of the angular speed reference.	Default: Min/Max: Units:	0 0 / 100 %	16-bit Int	
		1203 A	**[Spd Match Compl]** Indicates a completed launching ramp. If this parameter is assigned to a programmed digital output, it can be used to indicate that the coil can be changed. • “1” = Launching ramp completed • “0” = Launching ramp not completed	Default: Min/Max:	Read Only 0 / 32767	16-bit Int	
		1208 A	**[Close Loop Comp]** Active compensation status (output of the PID regulator).	Default: Min/Max:	Read Only – / +32767	16-bit Int	
		1209 A	**[Torque Winder En]** Enables/disables the center winder function.	Default: Options:	0 = “Disabled” 0 = “Disabled” 1 = “Enabled”	16-bit Int	

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 102 for symbol descriptions</th><th>Values</th><th>Data Type</th><th>Related</th></tr>
<tr><td>APPLICATIONS</td><td>Winder Functions</td><td>1210
○
A</td><td>[W Target]
Number of the parameter to which the winder speed reference is written. Note: Added all options with firmware version 4.001.
Options:
<table>
<tr><td>0 =</td><td>“Not Used”</td><td>16 =</td><td>“Reserved”</td><td>32 =</td><td>“UsrDefined13” (Par 516)</td></tr>
<tr><td>1 =</td><td>“Cur Lim Pos” (Par 8)</td><td>17 =</td><td>“Max Fld Pct” (Par 467)</td><td>33 =</td><td>“UsrDefined14” (Par 517)</td></tr>
<tr><td>2 =</td><td>“Cur Lim Neg” (Par 9)</td><td>18 =</td><td>“Reserved”</td><td>34 =</td><td>“UsrDefined15” (Par 518)</td></tr>
<tr><td>3 =</td><td>“Reserved”</td><td>19 =</td><td>“UsrDefined0” (Par 503)</td><td>35 =</td><td>“Load Comp” (Par 698)</td></tr>
<tr><td>4 =</td><td>“Reserved”</td><td>20 =</td><td>“UsrDefined1” (Par 504)</td><td>36 =</td><td>“Out Volt Lvl” (Par 921)</td></tr>
<tr><td>5 =</td><td>“TrqRedCurLim” (Par 13)</td><td>21 =</td><td>“UsrDefined2” (Par 505)</td><td>37 =</td><td>“Reserved”</td></tr>
<tr><td>6 =</td><td>“Torque Ref” (Par 39)</td><td>22 =</td><td>“UsrDefined3” (Par 506)</td><td>38 =</td><td>“Speed Ratio” (Par 1017)</td></tr>
<tr><td>7 =</td><td>“Trim Torque” (Par 40)</td><td>23 =</td><td>“UsrDefined4” (Par 507)</td><td>39 =</td><td>“Reserved”</td></tr>
<tr><td>8 =</td><td>“Reserved”</td><td>24 =</td><td>“UsrDefined5” (Par 508)</td><td>40 =</td><td>“Reserved”</td></tr>
<tr><td>9 =</td><td>“Trim Ramp” (Par 42)</td><td>25 =</td><td>“UsrDefined6” (Par 509)</td><td>41 =</td><td>“Tension Red” (Par 1179)</td></tr>
<tr><td>10 =</td><td>“Trim Speed” (Par 43)</td><td>26 =</td><td>“UsrDefined7” (Par 510)</td><td>42 =</td><td>“Reserved”</td></tr>
<tr><td>11 =</td><td>“Reserved”</td><td>27 =</td><td>“UsrDefined8” (Par 511)</td><td>43 =</td><td>“Reserved”</td></tr>
<tr><td>12 =</td><td>“Reserved”</td><td>28 =</td><td>“UsrDefined9” (Par 512)</td><td>44 =</td><td>“CloseLp Comp” (Par 1208)</td></tr>
<tr><td>13 =</td><td>“Reserved”</td><td>29 =</td><td>“UsrDefined10” (Par 513)</td><td>45 =</td><td>“Reserved”</td></tr>
<tr><td>14 =</td><td>“Adaptive Ref” (Par 183)</td><td>30 =</td><td>“UsrDefined11” (Par 514)</td><td>46 =</td><td>“Reserved”</td></tr>
<tr><td>15 =</td><td>“Reserved”</td><td>31 =</td><td>“UsrDefined12” (Par 515)</td><td>47 =</td><td>“Reserved”</td></tr>
</table></td><td>Default: 0
Min/Max: 0 / 65535</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1212</td><td>[Acc Dec Filter]
Internal acceleration/deceleration calculation filter for the Torque Winder line speed reference.</td><td>Default: 30
Min/Max: 0 / 5000
Units: ms</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1213
A</td><td>[Actual Comp]
Active compensation status (sums up the static, dynamic and inertial frictions) as a percentage of the drive rated current.
Note: This parameter can be assigned to an analog output.</td><td>Default: Read Only
Min/Max: –/+200
Units: %</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1214
○
A</td><td>[Closed Loop En]
Enables/Disables closed loop tension control (used with a load cell).</td><td>Default: 0 = “Disabled”
Options: 0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1215
A</td><td>[Speed Demand En]
Enables/Disables the speed reference calculation for the Torque Winder application.</td><td>Default: 0 = “Disabled”
Options: 0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1216
A</td><td>[Spd Match Torque]
Sets the torque current during the launching and change phase.</td><td>Default: 100
Min/Max: 0 / 200
Units: %</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1217
A</td><td>[W Reference]
Angular speed reference.
Note: This parameter can be assigned to an analog output; 10V = 100% of Par 45 [Max Ref Speed].</td><td>Default: Read Only
Min/Max: –/+8192
Units: rpm</td><td>16-bit Int</td><td>1160</td></tr>
<tr><td></td><td></td><td>1255
A</td><td>[Jog TW Speed]
Torque Winder jog reference. The parameter is entered as a percentage of Par 1160 [Line Speed Pct].</td><td>Default: 0
Min/Max: 0 / 100
Units: %</td><td>16-bit Int</td><td>1160</td></tr>
<tr><td></td><td></td><td>1256
A</td><td>[Jog TW Enable]
Enables/Disables the Torque Winder jog function.
Note: This parameter can be assigned to a digital input.</td><td>Default: 0 = “Disabled”
Options: 0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
</table>

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**	Data Type	Related
APPLICATIONS	Winder Functions	**1284** ○ A	**[Ref Spd Source]** Parameter number from which the line speed reference (used for inertia compensation and line speed reference) will be read. Note: All option selections added to this parameter with firmware version 4.001. Options:	Default: 0 = "Not Used"	16-bit Int	

0 =	"Not Used"	16 =	"SpdRegOutPct" (Par 236)	32 =	"UsrDefined13" (Par 516)
1 =	"Cur Lim Pos" (Par 8)	17 =	"Max Fld Pct" (Par 467)	33 =	"UsrDefined14" (Par 517)
2 =	"Cur Lim Neg" (Par 9)	18 =	"Fld Ref Pct" (Par 500)	34 =	"UsrDefined15" (Par 518)
3 =	"CurLimPosOut" (Par 10)	19 =	"UsrDefined0" (Par 503)	35 =	"Load Comp" (Par 698)
4 =	"CurLimNegOut" (Par 11)	20 =	"UsrDefined1" (Par 504)	36 =	"Out Volt Lvl" (Par 921)
5 =	"TrqRedCurLim" (Par 13)	21 =	"UsrDefined2" (Par 505)	37 =	"Filt Trq Cur" (Par 928)
6 =	"Torque Ref" (Par 39)	22 =	"UsrDefined3" (Par 506)	38 =	"Speed Ratio" (Par 1017)
7 =	"Trim Torque" (Par 40)	23 =	"UsrDefined4" (Par 507)	39 =	"Spd Draw Out" (Par 1018)
8 =	"TorqueReg In" (Par 41)	24 =	"UsrDefined5" (Par 508)	40 =	"Roll Diam" (Par 1154)
9 =	"Trim Ramp" (Par 42)	25 =	"UsrDefined6" (Par 509)	41 =	"Tension Red" (Par 1179)
10 =	"Trim Speed" (Par 43)	26 =	"UsrDefined7" (Par 510)	42 =	"Torq Cur Pct" (Par 1193)
11 =	"Ramp In" (Par 110)	27 =	"UsrDefined8" (Par 511)	43 =	"Ten Ref Pct" (Par 1194)
12 =	"Ramp Out" (Par 113)	28 =	"UsrDefined9" (Par 512)	44 =	"CloseLp Comp" (Par 1208)
13 =	"Speed Reg In" (Par 118)	29 =	"UsrDefined10" (Par 513)	45 =	"Actual Comp" (Par 1213)
14 =	"Adaptive Ref" (Par 183)	30 =	"UsrDefined11" (Par 514)	46 =	"W Reference" (Par 1217)
15 =	"Arm Cur Pct" (Par 199)	31 =	"UsrDefined12" (Par 515)	47 =	"Encoder Spd" (Par 420)

File	Group	No.	**Parameter Name & Description**	**Values**	Data Type	Related
APPLICATIONS	Winder Functions	**1285** A	**[Ref Speed Gain]** Gain value for the line speed reference. The value of this parameter depends on the value of Par 1284 [Ref Spd Source]. The value of [Ref Speed Gain] is used to obtain a line speed reference = 100% at its maximum value.	Default: 0 Min/Max: 0 / 32767	16-bit Int	1284
		1286 A	**[Ref Line Speed]** Line speed percentage.	Default: Read Only Min/Max: 0.00 / 150.00 Units: %	Real	
		1287 A	**[Static F Zero]** Enables/Disables friction compensation. • "Enabled" = The fiction compensation value is added to all speed values. • "Disabled" = The static friction compensation value is added to Par 1286 [Ref Line Speed] = 1.5%.	Default: 0 = "Disabled" Options: 0 = "Disabled" 1 = "Enabled"	16-bit Int	1286
	Scale Blocks	**484** **553** **1218** **1227** **1236** **1245** A	**[Scale1 Input]** **[Scale2 Input]** **[Scale3 Input]** **[Scale4 Input]** **[Scale5 Input]** **[Scale6 Input]** Parameter number from which the value is read and used as the input quantity to the Scale block. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: 0 Min/Max: 0 / 1410	16-bit Int	
		485 **554** **1219** **1228** **1237** **1246** A	**[Scale1 Output]** **[Scale2 Output]** **[Scale3 Output]** **[Scale4 Output]** **[Scale5 Output]** **[Scale6 Output]** Parameter number to which the value of the Scale block output is written. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: 0 Min/Max: 0 / 1410	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
APPLICATIONS	**Scale Blocks**	**486** **555** **1220** **1229** **1238** **1247** A	**[Scale1 Mul]** **[Scale2 Mul]** **[Scale3 Mul]** **[Scale4 Mul]** **[Scale5 Mul]** **[Scale6 Mul]** Multiplier of the input quantity (after a possible limitation). Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	1.00 –/+10000.00	Real	
		487 **556** **1221** **1230** **1239** **1248** A	**[Scale1 Div]** **[Scale2 Div]** **[Scale3 Div]** **[Scale4 Div]** **[Scale5 Div]** **[Scale6 Div]** Divisor, through which it is possible to divide the input quantity already multiplied and limited. Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	1.00 –/+10000.00	Real	
		488 **557** **1222** **1231** **1240** **1249** A	**[Scale1 In Max]** **[Scale2 In Max]** **[Scale3 In Max]** **[Scale4 In Max]** **[Scale5 In Max]** **[Scale6 In Max]** Maximum limit of the input quantity. Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	0.00 $-2^{31}/+2^{31}-1$	Real	
		489 **558** **1223** **1232** **1241** **1250** A	**[Scale1 In Min]** **[Scale2 In Min]** **[Scale3 In Min]** **[Scale4 In Min]** **[Scale5 In Min]** **[Scale6 In Min]** Minimum limit of the input quantity. Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	0.00 $-2^{31}/+2^{31}-1$	Real	
		490 **559** **1224** **1233** **1242** **1251** A	**[Scale1 In Off]** **[Scale2 In Off]** **[Scale3 In Off]** **[Scale4 In Off]** **[Scale5 In Off]** **[Scale6 In Off]** Offset to be added to the input quantity. Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	0.00 $-2^{31}/+2^{31}-1$	Real	
		491 **560** **1225** **1234** **1243** **1252** A	**[Scale1 Out Off]** **[Scale2 Out Off]** **[Scale3 Out Off]** **[Scale4 Out Off]** **[Scale5 Out Off]** **[Scale6 Out Off]** Offset to be added to the output quantity. Resolution: 5 digits. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Min/Max:	0.00 $-2^{31}/+2^{31}-1$	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
APPLICATIONS	**Scale Blocks**	**492** **561** **1226** **1235** **1244** **1253** A	**[Scale1 In Abs]** **[Scale2 In Abs]** **[Scale3 In Abs]** **[Scale4 In Abs]** **[Scale5 In Abs]** **[Scale6 In Abs]** Controls how the input value is processed. • “Off” = The input quantity is processed with its sign. • “On” = The input quantity is processed with a positive sign (absolute value). It is possible to have the polarity change with the signs of the [ScalexMul] or [ScalexDiv] parameters. Refer to the Scale Blocks block diagram on page 327 for more information.	Default: Options:	0 = “Off” 0 = “Off” 1 = “On”	16-bit Int	

Utility File

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 102 for symbol descriptions</th><th>Values</th><th>Data Type</th><th>Related</th></tr>
<tr><td rowspan="7">UTILITY</td><td rowspan="5">Reference Config</td><td>209</td><td colspan="3">[Save HIM Ref]
Enables a feature to save the present reference value issued by the HIM to drive memory when a power loss occurs. The value is restored to the HIM at power up.
Bit 0 - “At Pwr Down” 0 = Do not save, 1 = Save at power down
<table>
<tr><td>Options</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>At Pwr Down</td></tr>
<tr><td>Default</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>1</td></tr>
<tr><td>Bit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table></td><td></td></tr>
<tr><td>210</td><td>[Man Ref Preload]
Enables/disables a feature to automatically load the present “Auto” reference value into the HIM when “Manual” is selected. Allows smooth speed transition from “Auto” to “Manual.”</td><td>Default: 1 = “Enabled”
Options: 0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
<tr><td>249</td><td colspan="3">[Save MOP Ref]
Enables/Disables the feature that saves the present MOP reference at power down or at stop.
Note: This parameter can be assigned to a digital input.
• Bit 0 “At Pwr Down” - When set to “0” = Do not save, “1” = Save
• Bit 1 “At Stop” - When set to “0” = Do not save, “1” = Save
<table>
<tr><td>Options</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>At Stop</td><td>At Pwr Down</td></tr>
<tr><td>Default</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>0</td><td>0</td></tr>
<tr><td>Bit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table></td><td></td></tr>
<tr><td>1322
○</td><td>[Direction Mode]
Selects the method that will be used for changing direction.
• “Unipolar” - Drive Logic determines the direction.
• “Bipolar” - The sign of the reference determines the direction.
• “Rev Disable” - Forward direction only (not changeable).</td><td>Default: 0 = “Unipolar”
Options: 0 = “Unipolar”
1 = “Bipolar”
2 = “Rev Disable”</td><td>16-bit Int</td><td></td></tr>
<tr><td>1375
○</td><td>[MOP Select]
Selects the destination of the MOP signal.</td><td>Default: 0 = “OFF”
Options: 0 = “OFF”
1 = “Speed Ref A”
2 = “Speed Ref B”
3 = “Trim Speed”
4 = “TB Man Ref”</td><td>16-bit Int</td><td></td></tr>
<tr><td rowspan="2">Drive Memory</td><td>211</td><td>[Param Access Lvl]
Selects the parameter display level.
• “Basic” = Reduced parameter set.
• “Advanced” = Full parameter set.</td><td>Default: 0 = “Basic”
Options: 0 = “Basic”
1 = “Advanced”</td><td>16-bit Int</td><td></td></tr>
<tr><td>258
○</td><td>[Reset Defaults]
Setting this parameter to 1 “Factory” will load the default settings in the drive firmware.</td><td>Default: 0 = “Ready”
Options: 0 = “Ready”
1 = “Factory”</td><td>16-bit Int</td><td></td></tr>
</table>

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
UTILITY	Drive Memory	**302**	**[Language]** Selects the operating language of the drive. Only two languages are available in the drive at any given time, English and one of the following: French, German, Italian, Portuguese, or Spanish. The drive ships with the default language options of English and Spanish only. The additional language files can be downloaded at: http://www.ab.com/support/abdrives/webupdate/powerflexdc.html# Note: This parameter was added with firmware version 3.001.	Default: Options:	0 = "Not Selected" 0 = "Not Selected" 1 = "English" 2 = "French" 3 = "Spanish" 4 = "Italian" 5 = "German" 6 = "Reserved" 7 = "Portuguese"	16-bit Int	
	Diagnostics	**346** A	**[Torque Positive]** Indicates whether the drive is operating with a positive torque reference. • 1 "Active" = The drive is operating with a positive torque reference. The motor is accelerating in the forward direction or decelerating in the negative direction and Par 20 [Ramp Delay] has timed out. • 0 "Not Active" = The drive is not operating with a positive torque reference. Note: This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	20
		347 A	**[Torque Negative]** Indicates whether the drive is operating with a negative torque reference. • 1 "Active" = The drive is operating with negative torque reference. The motor is accelerating in the reverse direction or decelerating in the forward direction and Par 20 [Ramp Delay] has timed out. • 0 "Not Active" = The drive is not operating with negative torque reference. Note: This parameter can be assigned to a digital output and is used for four quadrant drives only.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	20
		349	**[CurrLimit Active]** Indicates whether or not the drive is working within the set current limits. • 1 "Active" = The drive is currently in a current limited state. • 0 "Not Active" =The drive is not in a current limited state. Note: This parameter is assigned to digital output 4 (Par 148 [Digital Out4 Sel]) by default.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		372	**[Spd Limit Active]** Indicates whether the current speed reference value is limited by the defined minimum and maximum limit values. • 1 "Active" = The reference value is currently limited since the value entered is out of range of the limit values defined. • 0 "Not Active" = The reference value is within the defined limit values. Note: This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values	Data Type	Related
UTILITY	Diagnostics	381	**[Drive Status 1]** Present operating condition of the drive. Bit 0 “Ready” - When set (= “1”), the drive is ready Bit 1 “Active” - When set, the drive is active Bit 2 “Command Dir” - The direction of commanded rotation, 0 = Reverse, 1 = Forward Bit 3 “Actual Dir” - The actual direction of the motor, 0 = Reverse, 1 = Forward Bit 4 “Accelerating” - When set, the drive is accelerating Bit 5 “Decelerating” - When set , the drive is decelerating Bit 6 “Alarm” - When set, the drive is in an alarm state Bit 7 “Fault” - When set, the drive is faulted Bit 8 “At Speed” -When set, the drive is at the commanded speed Bit 9 - 11 “Local ID 0-2” (1) Bit 12-15 “Spd Ref ID 0-3” (2)	Read Only		

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

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

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

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	Diagnostics	382	**[Drive Status 2]** Present operating condition of the drive. Bit 0 "Ready" - When set (= "1"), the drive is ready Bit 1 "Active" - When set, the drive is active Bit 2 "Running" - When set, the drive is running Bit 3 "Jogging" - When set, the drive is being jogged Bit 4 "Stopping" - When set, the drive is stopping Bit 6 "Auto Tuning" - When set, the drive is auto tuning Bit 7 "Forced Spd" - When set, the drive is in forced speed mode Bit 8 "Speed Mode" - When set, the drive is in speed mode Bit 9 "Torque Mode" - When set, the drive is in torque mode Bit 10 "SpdRegPosLim" - When set, the Speed Regulator PI positive limit is active Bit 11 "SpdRegNegLim" - When set, the Speed Regulator PI negative limit is active Bit 12 "ArmAlphaTest" - When set, the Armature Alpha test is active Bit 13 "FldAlphaTest" - When set, the Field Alpha test is active Notes: Added bits 7…13 with firmware version 3.001. See Torque Mode Selection Status Bits on page 295 for more information.		Read Only		
		393 A	**[Speed Threshold]** Indicates if the drive is above or below the threshold speed specified in parameters 101 [Speed Thresh Pos] (clockwise rotation) and 102 [Speed Thresh Neg] (counter-clockwise rotation). • "0 Above Thresh" = The speed has exceeded the set speed threshold. • "1 Below Thresh" = The speed has not exceeded the set speed threshold. Notes: This parameter can be assigned to a digital output. See Speed Threshold Indicators on page 286for more information.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	101, 102, 103
		394	**[At Speed]** Indicates whether or not the current speed of the drive corresponds to the speed reference (specified in Par 118 [Speed Reg In]) before the speed regulator and the ramp reference (if enabled) are applied. The speed above and below the speed reference at which [At Speed] will indicate "1 Equal" is set in Par 104 [At Speed Error]. • "0 Not Equal" - The drive is not working at the set speed reference. • "1 Equal" - The drive is working at the set speed reference. Notes: This parameter can be assigned to a digital output. It also corresponds to the "At Speed" indication on the Status Line of the HIM. See Speed Threshold Indicators on page 286for more information.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	104, 105
		395	**[At Zero Speed]** Indicates whether or not the actual speed of the motor is below the zero speed threshold as specified in Par 107 [Speed Zero Level]. • "0 Equal" - The actual speed is below the value of Par 107 [Speed Zero Level] and Par 108 [Speed Zero Delay] has timed out. • "1 Not Equal" - The actual speed is above the value of Par 107 [Speed Zero Level]. Notes: This parameter can be assigned to a digital output. See Speed Threshold Indicators on page 286for more information.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	107, 108

Options	Reserved	Reserved	FldAlphaTest	ArmAlphaTest	SpdRegNegLim	SpdRegPosLim	Torque Mode	Speed Mode	Forced Spd	Auto Tuning	Curr Limit	Stopping	Jogging	Running	Active	Ready
Default	x	x	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
UTILITY	Diagnostics	**396** A	**[MOP Inc Active]** Indicates whether or not the drive is accelerating using the preselected ramp. • 0 "No Accel" = the drive is not accelerating using a preselected ramp • 1 "Accel" = the drive is accelerating using a preselected ramp	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		397 A	**[MOP Dec Active]** Indicates whether the drive is decelerating using the preselected ramp. • 0 "No Decel" = The drive is not decelerating using a preselected ramp • 1 "Decel" = The drive is decelerating using a preselected ramp	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		400 A	**[Spd Select 0]** Indicates the state of the assigned digital input, [Digital Inx Sel], set to 17 "Speed Sel 1". Refer to Option Definitions for [Digital Inx Sel] on page 180 for instructions on how to set digital input speed selects to different speed references. • "0" = Digital input [Digital Inx Sel] set to 17 "Speed Sel 1" not asserted • "1" = Digital input [Digital Inx Sel] set to 17 "Speed Sel 1" asserted Note: By default, the state of this parameter is determined by digital input 5.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	401, 402
		401 A	**[Spd Select 1]** Indicates the state of the assigned digital input, [Digital Inx Sel], set to 18 "Speed Sel 2". Refer to Option Definitions for [Digital Inx Sel] on page 180 for instructions on how to set digital input speed selects to different speed references. • "0" = Digital input [Digital Inx Sel] set to 18 "Speed Sel 2" not asserted • "1" = Digital input [Digital Inx Sel] set to 18 "Speed Sel 2" asserted Note: By default, the state of this parameter is determined by digital input 6.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	400, 402
		402 A	**[Spd Select 2]** Indicates the state of the assigned digital input, [Digital Inx Sel], set to 19 "Speed Sel 3". Refer to Option Definitions for [Digital Inx Sel] on page 180 for instructions on how to set digital input speed selects to different speed references. • "0" = Digital input [Digital Inx Sel] set to 19 "Speed Sel 3" not asserted • "1" = Digital input [Digital Inx Sel] set to 19 "Speed Sel 3" asserted Note: By default, the state of this parameter is determined by digital input 7.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	400, 401
		403 A	**[Ramp Select 0]** Indicates the state of the assigned digital input, [Digital Inx Sel], set to 25 "Acc2 & Dec2" or 26 "Accel 2". • "0" = Accel 1 ramp rate is selected • "1" = Accel 2 ramp rate is selected Note: This parameter can be assigned to indicate the state of a digital input.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	404
		404 A	**[Ramp Select 1]** Indicates the state of the assigned digital input, [Digital Inx Sel], set to 25 "Acc2 & Dec2" or 27 "Decel 2". • "0" = Decel 1 ramp rate is selected • "1" = Decel 2 ramp rate is selected Note: This parameter can be assigned to indicate the state of a digital input.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	403

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	Diagnostics	**651** A	**[Encoder State]** Indicates the connection status of the digital encoder or tachometer. • "0" = Fault • '1" = OK This parameter can be assigned to a digital output.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	
		1290 A	**[MtrOvrld Status]** Current percentage of motor overload (100% = motor overload). The current percentage displays regardless of the configuration of the motor overload condition (Par 479 [MtrOvrld Flt Cfg] = Fault, Alarm, or Ignore). Note: This parameter was added with firmware version 3.001.	Default: Min/Max: Units:	Read Only 0 / 100 %	Real	376, 479
		1328	**[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. For each bit, 1=Condition true and 0=Condition false.

Bit 0 "Stop" - Stop command
Bit 1 "Start" - Start command
Bit 2 "Jog" - Jog command
Bit 3 "Clear Faults" - Clear faults command
Bit 4 "Forward" - Forward direction command
Bit 5 "Reverse" - Reverse direction command
Bit 6 "Local" - Local control command"
Bit 7 "MOP Inc" - MOP Increment command
Bit 8 "Accel 1" - Acceleration Rate 1 command
Bit 9 "Accel 2" - Acceleration Rate 2 command
Bit 10 "Decel 1" - Deceleration Rate 1 command
Bit 11 "Decel 2" - Deceleration Rate 2 command
Bit 12-14 "Spd Ref ID 0-2" - Speed reference source(1)
Bit 15 "MOP Dec" - MOP Decrement command

Options	MOP Dec	Spd Ref ID 2	Spd Ref ID 1	Spd Ref ID 0	Decel 2	Decel 1	Accel 2	Accel 1	MOP Inc	Local	Reverse	Forward	Clear Faults	Jog	Start	Stop
Default	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

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

File	Group	No.	Parameter Name & Description	Values		Data Type	Related
UTILITY	Diagnostics	**1381** A	**[TestPoint Sel]** Selects the function whose value is displayed in [TestPoint Val]. These are internal values that are not accessible through any other parameters. Typically, these are internal drive variables and registers. Refer to Testpoint Codes and Functions on page 209 for more information.	Default: Min/Max:	566 566 / 574	16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		**Data Type**	**Related**
UTILITY	Diagnostics	**1382** A	**[TestPoint Data]** The present value of the function selected in Par 1381 [Testpoint Sel].	Default: Min/Max:	Read Only $-2^{31} / 2^{31} - 1$	16-bit Int	
		1383 A	**[TaskLoad 32 ms]** The load percentage of the 32 ms task in the firmware.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1384 A	**[TaskLoad 1 ms]** The load percentage of the 1 ms task in the firmware.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1385 A	**[TaskLoad 2 ms]** The load percentage of the 2 ms task in the firmware.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1386 A	**[TaskLoad 8 ms]** The load percentage of the 8 ms task in the firmware.	Default: Min/Max:	Read Only 0.00 / 100.00	Real	
		1402	**[Last Stop Source]** Displays the source that initiated the most recent stop sequence.	Default: Options:	Read Only 0 = "Pwr Removed" 1 - 5 = "DPI Port 1-5" 6 = "Reserved" 7 = "Digital In" 8 = "Fault" 9 = "Not Enabled" 10 = "Reserved" 11 = "Jog" 12 = "Selftune" 13 = "Reserved"	16-bit Int	
		1403	**[Start Inhibits]** Displays the inputs currently preventing the drive from starting. For each bit, 1=Inhibit condition true and 0=Inhibit condition false.				

Options	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In	Reserved	Startup Actv	Reserved	Stop Assertd	Reserved	Enable	Type 2 Alarm	Fault
Default	x	x	x	0	0	0	0	0	x	0	0	1	x	0	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	**Parameter Name & Description**	**Values**		**Data Type**	**Related**
UTILITY	Faults	**263** ○	**[Clear Fault Que]** Allows you to clear the fault queue. Refer to Chapter 4 Troubleshooting on page 195 for information on clearing the fault queue.	Default: Options:	0 = "Ready" 0 = "Ready" 1 = "Clr Flt Que"	16-bit Int	
		1347	**[Fault Clear]** Allows you to reset drive faults and/or clear the fault queue.	Default: Options:	0 = "Ready" 0 = "Ready" 1 = "Clear Faults" 2 = "Clr Flt Que"	16-bit Int	
		1348	**[Fault Clr 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: Options:	1 = "Enabled" 0 = "Disabled" 1 = "Enabled"	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	Faults	**1349**	**[Status1 at Fault]** Captures and displays Par 381 [Drive Status 1] bit pattern at the time of the last fault. 0=Condition False, 1=Condition True.				381

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

File	Group	No.	Parameter Name & Description	Values		Data Type	Related
UTILITY	Faults	**1350**	**[Status2 at Fault]** Captures and displays Par 382 [Drive Status 2] bit pattern at the time of the last fault. 0=Condition False, 1=Condition True.				382

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Auto Tuning	Curr Limit	Stopping	Jogging	Running	Active	Ready
Default	x	x	x	x	x	x	x	x	x	0	0	0	1	1	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description	Values		Data Type	Related
UTILITY	Faults	**1351** **1352** **1353** **1354** **1355** **1356** **1357** **1358** **1359** **1360** A	**[Fault 1 Code]** **[Fault 2 Code]** **[Fault 3 Code]** **[Fault 4 Code]** **[Fault 5 Code]** **[Fault 6 Code]** **[Fault 7 Code]** **[Fault 8 Code]** **[Fault 9 Code]** **[Fault 10 Code]** A code that represents the fault that tripped the drive. The codes will appear in these parameters in the order they occur (i.e., [Fault 1 Code] = the most recent fault). Refer to Fault Descriptions on page 198 for a list of possible codes. Note: Par 1351 [Fault 1 Code] is accessible via the Basic Parameter view.	Default: Min/Max:	Read Only 0 / 32768	16-bit Int	
		1361 **1362** **1363** **1364** **1365** **1366** **1367** **1368** **1369** **1370** A	**[Fault 1 Time]** **[Fault 2 Time]** **[Fault 3 Time]** **[Fault 4 Time]** **[Fault 5 Time]** **[Fault 6 Time]** **[Fault 7 Time]** **[Fault 8 Time]** **[Fault 9 Time]** **[Fault 10 Time]** The time between initial drive power up and the occurrence of the associated trip fault.	Default: Min/Max: Units:	Read Only 0.000 / 134000000.000 hr.	Real	
		1371	**[Fault Arm Amps]** Captures and displays the armature current (as a percentage of rated current) at the time of the last fault.	Default: Min/Max: Units:	Read Only –/+200 %	16-bit Int	
		1372	**[Fault Speed]** Captures and displays the output speed (rpm) of the drive at the time of the last fault.	Default: Min/Max: Units:	Read Only – / +8192 rpm	16-bit Int	
		1373	**[Fault Field Amps]** Captures and displays the field current (as a percentage of rated current) at the time of the last fault.	Default: Min/Max: Units:	Read Only 0.00 / 100.00 %	Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
UTILITY	Faults	1374	**[Fault Voltage]** Captures and displays the armature voltage at the time of the last fault.	Default: Min/Max: Units:	Read Only - / + 999.00 Vdc	Real	
	Alarms	203 ○ A	**[OverVolt Flt Cfg]** Determines the response of the drive to an overvoltage condition (F5 "Arm Overvoltage"). Note: Refer to Chapter 4 for a list of alarm and fault descriptions.	Default: Options:	2 = "Fault" 0 = "Ignore" 1 = "Alarm" 2 = "Fault"	16-bit Int	
			⚠ **ATTENTION:** Setting this parameter to 0 "Ignore" or 1 "Alarm", could result in motor and/or equipment damage. If set to "Ignore" or "Alarm", it is strongly recommended that an external means of protecting against this condition be provided.				
		354 ○ A	**[Aux Inp Flt Cfg]** Determines the response of the drive to an external fault condition (F2 "Auxiliary Input"), i.e., no voltage at the digital input terminal assigned to [Digital Inx Sel] with a value of 14 "Aux Fault". Notes: Refer to Chapter 4 for a list of alarm and fault descriptions. Option 3 was changed from "Quick Stop " to "Fast Stop" with firmware version 2.001.	Default: Options:	2 = "Fault" 1 = "Alarm" 2 = "Fault" 3 = "Fast Stop" 4 = "Normal Stop" 5 = "CurrLim Stop"	16-bit Int	
			⚠ **ATTENTION:** Setting this parameter to 1 "Alarm", could result in motor and/or equipment damage. If set to "Alarm", it is strongly recommended that an external means of protecting against this condition be provided.				
		365 ○ A	**[OverTemp Flt Cfg]** Determines the response of the drive to a motor over temperature condition (F16 "Motor Over Temp"). Notes: Refer to Chapter 4 for a list of alarm and fault descriptions. Option 3 was changed from "Quick Stop " to "Fast Stop" with firmware version 2.001.	Default: Options:	2 = "Fault" 0 = "Ignore" 1 = "Alarm" 2 = "Fault" 3 = "Fast Stop" 4 = "Normal Stop" 5 = "CurrLim Stop"	16-bit Int	
			⚠ **ATTENTION:** Setting this parameter to 0 "Ignore" or 1 "Alarm", could result in motor and/or equipment damage. If set to "Ignore" or "Alarm", it is strongly recommended that an external means of protecting against this condition be provided.				
		473 ○ A	**[FldLoss Flt Cfg]** Determines the response of the drive to a field loss condition (F6 "Fld Current Loss"). If Par 497 [Field Reg Enable] is set to 0 "Disabled", this parameter should be set to 0 "Ignore". Note: Refer to Chapter 4 for a list of alarm and fault descriptions.	Default: Options:	2 = "Fault" 0 = "Ignore" 1 = "Alarm" 2 = "Fault"	16-bit Int	497
			⚠ **ATTENTION:** Setting this parameter to 0 "Ignore" or 1 "Alarm", could result in motor and/or equipment damage. If set to "Ignore" or "Alarm", it is strongly recommended that an external means of protecting against this condition be provided.				

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	Alarms	478 ○ A	**[Spd Loss Flt Cfg]** Determines the response of the drive to a speed feedback loss condition. Note: Refer to Chapter 4 for a list of fault and alarm descriptions. ⚠ **ATTENTION:** Par 478 [Spd Loss Flt Cfg] must be set to 1 "Fault" if Par 458 [SpdReg FB Bypass] is set to 0 "Disabled". Failure to observe this precaution could result in high motor speeds, equipment damage, and/or bodily injury if an Feedback Loss alarm condition were encountered.	Default: Options:	2 = "Fault" 1 = "Alarm" 2 = "Fault"	16-bit Int	458
		479 ○ A	**[MtrOvrld Flt Cfg]** Determines the response of the drive to a motor overload condition (F7 "Motor Overload"). Notes: Refer to Chapter 4 for a list of fault and alarm descriptions. This parameter was added with firmware version 3.001. ⚠ **ATTENTION:** Setting Par 479 [MtrOvrld Flt Cfg] to 0 "Ignore" or 1 "Alarm", could result in motor and/or equipment damage. Ensure that the motor is properly sized for the application and that a separate device is installed that monitors for and signals a motor overload condition.	Default: Options:	2 = "Fault" 0 = "Ignore" 1 = "Alarm" 2 = "Fault"	16-bit Int	376, 1290
		481 A	**[UnderVolt Thresh]** The AC input voltage level below which an undervoltage fault (F4 "AC Undervoltage") will be detected. A typical value is 85% of the nominal AC line voltage (Par 466 [AC Line Voltage]). This fault can only occur while the drive is running. Note: Refer to Chapter 4 for a list of fault descriptions.	Default: Min/Max: Units:	230 0 / 1000 Vac	16-bit Int	
		584 A	**[OverCurrent Thr]** Value at which an overcurrent condition (F13 "Overcurrent") will be detected. Note: Refer to Chapter 4 for a list of fault descriptions.	Default: Min/Max: Units:	175 0 / 250 %	16-bit Int	
		585 ○ A	**[Overspeed Val]** Speed value (rpm) at which an "Overspeed" fault (F25) will occur. Notes: Typically set at 110% of Par 162 [Max Feedback Spd]. Refer to Chapter 4 for a list of fault and alarm descriptions. This parameter was added with firmware version 3.001. ⚠ **ATTENTION:** Verify that you have correctly set this parameter appropriately for your application. Incorrectly setting this parameter may cause a hazard of personal injury and/or equipment damage.	Default: Min/Max: Units:	1925 0 / 7800 rpm	16-bit Int	162

File	**Group**	**No.**	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		**Data Type**	**Related**
UTILITY	Alarms	**1380**	**[Drive Alarm 1]** Alarm conditions that currently exist in the drive. For each bit, 1 = Condition true and 0 = Condition false. Bit 0 "DigInCflctA" - Digital input functions are in conflict. Bit 1 "DigInCflctB" - A digital Start input has been configured without a Stop input or other functions are in conflict. Bit 2 "DigInCflctC" - More than one physical input has been configured to the same input function. Bit 3 "BipolarCflct" - Parameter 1322 [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." Bit 4 "AnalogCflct" - Analog input functions are in conflict. Bit 5 "CntactrCflct" - Contactor input functions are in conflict. Bit 6 "Encoder Cflc" - Indicates an encoder configuration conflict. Bit 7 "Overvoltage" - There is an overvoltage on the armature circuit. Bit 8 "Over Temp" - The motor has exceeded its temperature rating (as signaled by the thermistor connected to the drive terminals 78 and 79). Bit 9 "Aux Input" - An auxiliary input interlock is open or a voltage (15 - 30 V) or reference signal is missing for the digital input set to 14 "Aux Fault". Bit 10 "Field Loss" - The field current is too low. Bit 11 "Feedback Loss" - The drive is not receiving a speed feedback signal. Bit 12 "PwrUp Start" - Indicates that the drive is starting or has automatically resumed running at commanded speed after drive input power is restored. Bit 13 "Mtr Overload" - Indicates when the Motor Overload alarm level has been reached. Bit 14 "FldCfg Cflct" - Indicates a field configuration conflict. Notes: Refer to Chapter 4 Troubleshooting on page 195 for information. Changed bit 11 name from "Encoder Loss" to "Feedback Loss" and added bits 13 and 14 with firmware version 3.001.			16-bit Int	1322

Options	Reserved	FldCfg Cflct	Mtr Overload	PwrUp Start	Feedback Loss	Field Loss	Aux Input	Over Temp	Overvoltage	Encoder Cflc	CntactrCflct	AnalogCflct	BipolarCflct	DigInCflctC	DigInCflctB	DigInCflctA
Default	x	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	**Group**	**No.**	**Parameter Name & Description**	**Values**		**Data Type**	**Related**
UTILITY	User Defined	**50** ○ A	**[UsrDsplyMult0]** Numerator in the calculation for user-defined, drive speed display units. Note: This parameter is not used.	Default: Min/Max:	1 1 / 1073741823	32-bit Int	
		51 ○ A	**[UsrDsplyDiv0]** Denominator in the calculation for user-defined, drive speed display units. Note: This parameter is not used.	Default: Min/Max:	1 1 / 1073741823	32-bit Int	
		53 A	**[UsrValMult1]** Numerator in the calculation for scaling the user-defined, drive speed display units. Note: This parameter is not used.	Default: Min/Max:	1 1 / 32767	16-bit Int	
		54 A	**[UsrValDiv1]** Denominator in the calculation for scaling the user-defined, drive speed display units. Note: This parameter is not used.	Default: Min/Max:	1 1 / 32767	16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
UTILITY	User Defined	**503** **504** **505** **506** **507** **508** **509** **510** **511** **512** **513** **514** **515** **516** **517** **518** A	**[UserDefined0]** **[UserDefined1]** **[UserDefined2]** **[UserDefined3]** **[UserDefined4]** **[UserDefined5]** **[UserDefined6]** **[UserDefined7]** **[UserDefined8]** **[UserDefined9]** **[UserDefined10]** **[UserDefined11]** **[UserDefined12]** **[UserDefined13]** **[UserDefined14]** **[UserDefined15]** General use signed 16 bit variables used for data exchange. Note: Pars 503–506 can be assigned to analog inputs. The values of Pars 503, 504, and 507 - 509 can be assigned to an analog output.	Default: Min/Max:	0 –32768/+32767	16-bit Int	
		519 A	**[UsrDefBitWrdA]** A bitmap of Pars 520 [UsrDefBitWrdA0] through 535 [UsrDefBitWrdA15]. With a parameter it is possible to read or write all of the bits inside a word. Example: [UsrDefBitWrdA0] 0 [UsrDefBitWrdA1] 1 = 2^1 =2 [UsrDefBitWrdA2] 0 [UsrDefBitWrdA3] 0 [UsrDefBitWrdA4] 0 [UsrDefBitWrdA5] 1 = 2^5 = 32 [UsrDefBitWrdA6] 1 = 2^6 = 64 [UsrDefBitWrdA7] 0 [UsrDefBitWrdA8] 0 [UsrDefBitWrdA9] 0 [UsrDefBitWrdA10] 1 = 2^{10} = 1024 [UsrDefBitWrdA11] 0 [UsrDefBitWrdA12] 1 = 2^{12} = 4096 [UsrDefBitWrdA13] 0 [UsrDefBitWrdA14] 0 [UsrDefBitWrdA15] 0 [UsrDefBitWrdA] = 2 + 32 + 64 + 1024 + 4096 = 5218 Note: This parameter can be assigned to a digital input or output. The bit number corresponds to the digital input/output number (for example, digital input 3 uses [UsrDefBitWrdA3]). Relay Outputs 1 and 2 use bits 14 and 15, respectively.	Default: Min/Max:	0 0 / 65535	16-bit Int	520 - 535

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	User Defined	**520** **521** **522** **523** **524** **525** **526** **527** **528** **529** **530** **531** **532** **533** **534** **535** A	**[UsrDefBitWrdA0]** **[UsrDefBitWrdA1]** **[UsrDefBitWrdA2]** **[UsrDefBitWrdA3]** **[UsrDefBitWrdA4]** **[UsrDefBitWrdA5]** **[UsrDefBitWrdA6]** **[UsrDefBitWrdA7]** **[UsrDefBitWrdA8]** **[UsrDefBitWrdA9]** **[UsrDefBitWrdA10]** **[UsrDefBitWrdA11]** **[UsrDefBitWrdA12]** **[UsrDefBitWrdA13]** **[UsrDefBitWrdA14]** **[UsrDefBitWrdA15]** Bit variables. The individual "User Defined" bits can be read or written to. It is possible to process a word with Par 519 [UsrDefBitWrdA] (see example). Note: You can read bits 0-7 of a digital input with Par 519 [UsrDefBitWrdA] and write all of the bits associated with [UsrDefBitWrdA] to a digital output.	Default: Min/Max:	0 0 / 1	16-bit Int	519
		536 A	**[UsrDefBitWrdB]** A bitmap of Pars 537 [UsrDefBitWrdB0] through 552 [UsrDefBitWrdB15]. With a parameter it is possible to read or write all of the bits inside a word. Example: [UsrDefBitWrdB0] 0 [UsrDefBitWrdB1] 1 = 2^1 =2 [UsrDefBitWrdB2] 0 [UsrDefBitWrdB3] 0 [UsrDefBitWrdB4] 0 [UsrDefBitWrdB5] 1 = 2^5 = 32 [UsrDefBitWrdB6] 1 = 2^6 = 64 [UsrDefBitWrdB7] 0 [UsrDefBitWrdB8] 0 [UsrDefBitWrdB9] 0 [UsrDefBitWrdB10] 1 = 2^{10} = 1024 [UsrDefBitWrdB11] 0 [UsrDefBitWrdB12] 1 = 2^{12} = 4096 [UsrDefBitWrdB13] 0 [UsrDefBitWrdB14] 0 [UsrDefBitWrdB15] 0 [UsrDefBitWrdB] = 2 + 32 + 64 + 1024 + 4096 = 5218 Note: This parameter can be assigned to a digital input or output. The bit number corresponds to the digital input/output number (for example, digital input 3 uses [UsrDefBitWrdA3]). Relay Outputs 1 and 2 use bits 14 and 15, respectively.	Default: Min/Max:	0 0 / 65535	16-bit Int	537 - 552

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	Values		Data Type	Related
UTILITY	User Defined	**537** **538** **539** **540** **541** **542** **543** **544** **545** **546** **547** **548** **549** **550** **551** **552** A	**[UsrDefBitWrdB0]** **[UsrDefBitWrdB1]** **[UsrDefBitWrdB2]** **[UsrDefBitWrdB3]** **[UsrDefBitWrdB4]** **[UsrDefBitWrdB5]** **[UsrDefBitWrdB6]** **[UsrDefBitWrdB7]** **[UsrDefBitWrdB8]** **[UsrDefBitWrdB9]** **[UsrDefBitWrdB10]** **[UsrDefBitWrdB11]** **[UsrDefBitWrdB12]** **[UsrDefBitWrdB13]** **[UsrDefBitWrdB14]** **[UsrDefBitWrdB15]** Bit variables. The individual “User Defined” bits can be read or written to. It is possible to process a word with Par 536 [UsrDefBitWrdB]. See the example in Par 536 [UsrDefBitWrdB]. Note: You can read bits 0-7 of a digital input with Par 536 [UsrDefBitWrdB] and write all of the bits associated with [UsrDefBitWrdB] to a digital output.	Default: Min/Max:	0 0 / 1	16-bit Int	536

Communications File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
COMMUNICATIONS	Comm Control	589	**[DPI Baud Rate]** Shows the data transfer rate for attached drive peripherals. "1" - 500 kbps	Default: Min/Max:	Read Only 1 / 1	16-bit Int	
		590	**[DPI Port Sel]** Selects which DPI port reference value (unscaled) will appear in Par 1343 [DPI Port Value].	Default: Options:	1 "DPI Port 1" 1 = "DPI Port 1" 2 = "DPI Port 2" 3 = "DPI Port 3" 4 = "DPI Port 4" 5 = "DPI Port 5"	16-bit Int	1343
		1321 ○	**[DPI Fdbk Select]** Selects the feedback variable and DPI units displayed on the feedback line of the HIM. • 0 "Speed" = Speed feedback units are in rpm • 1 "Current" = Current feedback units are in %	Default: Options:	0 = "Speed" 0 = "Speed" 1 = "Current"	16-bit Int	
		1343	**[DPI Port Value]** Unscaled value of the DPI reference selected in Par 590 [DPI Port Sel].	Default: Min/Max:	Read Only –/+32767	16-bit Int	590
	Masks & Owners	591 ○	**[Logic Mask]** Determines which ports can control the drive. If the bit for a port is set to "0," the port will have no control functions except for stop. 0 = Control Masked, 1 = Control Permitted, x = Reserved.				

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	x	x	x	x	x	x	x	x	x	x	1	1	1	1	1	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

		592 ○	**[Start Mask]** Controls which adapters can issue start commands.		See [Logic Mask]		
		593 ○	**[Jog Mask]** Controls which adapters can issue jog commands.		See [Logic Mask]		
		594 ○	**[Direction Mask]** Controls which adapters can issue forward/reverse direction commands.		See [Logic Mask]		
		595 ○	**[Reference Mask]** Controls which adapters can select a manual reference.		See [Logic Mask]		
		596 ○	**[Accel Mask]** Controls which adapters can select the acceleration ramp rates (Pars 660 [Accel Time 1] and 24 [Accel Time 2]) of the drive.		See [Logic Mask]		24, 660
		597 ○	**[Fault Clr Mask]** Controls which adapters can clear a fault.		See [Logic Mask]		
		598 ○	**[MOP Mask]** Controls which adapters can issue MOP commands to the drive.		See [Logic Mask]		

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
COMMUNICATIONS	Masks & Owners	599 ○	**[Local Mask]** Controls which adapters are allowed to take exclusive control of drive logic commands (except stop). Exclusive "local" control can only be taken while the drive is stopped.		See [Logic Mask]		
		600	**[Stop Owner]** The adapters that are presently issuing a valid stop command. 0 = No Command, 1 = Issuing Command, x = Reserved.				

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	x	x	x	x	x	x	x	x	x	x	0	0	0	0	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
COMMUNICATIONS	Masks & Owners	601	**[Start Owner]** The adapters that are presently issuing a valid start command.		See [Stop Owner]		
		602	**[Jog Owner]** The adapters that are presently issuing a valid jog command.		See [Stop Owner]		
		603	**[Direction Owner]** The adapter that currently has exclusive control of direction changes.		See [Stop Owner]		
		604	**[Reference Owner]** The adapter that has the exclusive control of the reference source selection.		See [Stop Owner]		
		605	**[Accel Owner]** The adapter that has exclusive control of the acceleration ramp rate (Pars 660 [Accel Time 1] and 24 [Accel Time 2]) for the drive.		See [Stop Owner]		24, 660
		606	**[Fault Clr Owner]** Adapter that is presently clearing a fault.		See [Stop Owner]		
		607	**[MOP Owner]** Adapters that are currently issuing increases or decreases in MOP referenced.		See [Stop Owner]		
		608	**[Local Owner]** Adapter that has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non–functional. Local control can only be obtained when the drive is not running.		See [Stop Owner]		
		609	**[Decel Owner]** The adapter that has exclusive control of the deceleration ramp rate (Pars 662 [Decel Time 1] and 32 [Decel Time 2]) for the drive.		See [Stop Owner]		32, 662
		631 ○	**[Decel Mask]** Controls which adapters can select the deceleration ramp rate (Pars 662 [Decel Time 1] and 32 [Decel Time 2]) of the drive.		See [Logic Mask]		32, 662
	DataLinks	610 611 ○	**[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. The value will not be updated until the drive is stopped. Refer to your communications option manual for datalink information.	Default: Min/Max:	0 (0 = "Disabled") 0 / 1410	16-bit Int	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values	Data Type	Related
COMMUNICATIONS	**Datalinks**	**612** **613** ○	**[Data In B1] – Link B Word 1** **[Data In B2] – Link B Word 2**	See [Data In A1] – Link A Word 1.	16-bit Int	
		614 **615** ○	**[Data In C1] – Link C Word 1** **[Data In C2] – Link C Word 2**	See [Data In A1] – Link A Word 1.	16-bit Int	
		616 **617** ○	**[Data In D1] – Link D Word 1** **[Data In D2] – Link D Word 2**	See [Data In A1] – Link A Word 1.	16-bit Int	
		618 **619**	**[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 / 1410	16-bit Int	
		620 **621**	**[Data Out B1] – Link B Word 1** **[Data Out B2] – Link B Word 2**	See [Data Out A1] – Link A Word 1.	16-bit Int	
		622 **623**	**[Data Out C1] – Link C Word 1** **[Data Out C2] – Link C Word 2**	See [Data Out A1] – Link A Word 1.	16-bit Int	
		624 **625**	**[Data Out D1] – Link D Word 1** **[Data Out D2] – Link D Word 2**	See [Data Out A1] – Link A Word 1.	16-bit Int	
		1319	**[Data In Val Sel]** Selects the Datalink parameter register to display in Par 1320 [Data In Sel Data].	Default: 610 Min/Max: 610 / 617	16-bit Int	1320
		1320	**[Data In SelData]** Displays the value selected in Par 1319 [Data In Val Sel].	Default: Read Only Min/Max: 0 / 2^{31}	32-bit Int	1319
	Security	**591** ○	**[Logic Mask]** Determines which ports can control the drive. If the bit for a port is set to "0," the port will have no control functions except for stop. 0 = Control Masked, 1 = Control Permitted, x = Reserved.			

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	x	x	x	x	x	x	x	x	x	x	1	1	1	1	1	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description	Values	Data Type	Related
COMMUNICATIONS	**Security**	**1376** A	**[Logic Mask Act]** Indicates the status of the logic mask for the DPI ports. When bit 15 is set, network security is controlling the logic mask instead of Par 591 [Logic Mask]. 0 = Control Masked, 1 = Control Permitted, x = Reserved.	Read Only		591

Options	Security	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	0	x	x	x	x	x	x	x	x	x	1	1	1	1	1	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values	Data Type	Related
COMMUNICATIONS	Security	**1377** A	**[Write Mask Act]** The status of write access for the DPI ports. When bit 15 is set, network security is controlling the write mask instead of Par 1378 [Write Mask Cfg]. 0 = Read Only, 1 = Write Permitted, x = Reserved.	Read Only		1378

Options	Security	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Reserved
Default	0	x	x	x	x	x	x	x	x	x	1	1	1	1	1	x
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description	Values	Data Type	Related
COMMUNICATIONS	Security	**1378** ○ A	**[Write Mask Cfg]** Enables/Disables parameter write access for the DPI ports. Masking of the Port that is writing to this parameter is prohibited. Changes to this parameter only become effective after power is cycled, the drive is reset, or bit 15 of [Write Mask Actv] transitions from “1” to “0”. 0 = Read Only, 1 = Write Permitted, x = Reserved.			1377

Options	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Reserved
Default	x	x	x	x	x	x	x	x	x	x	1	1	1	1	1	x
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description	Values	Data Type	Related
COMMUNICATIONS	Security	**1379** A	**[Port Mask Act]** Bits 0–5 indicate status for DPI port communication. Bit 15 indicates when security software is controlling the parameter. 0 = Not Active, 1 - Active, x - Reserved.	Read Only		

Options	Security	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	DPI Port 5	DPI Port 4	DPI Port 3	DPI Port 2	DPI Port 1	Digital In
Default	0	x	x	x	x	x	x	x	x	x	1	1	1	1	1	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input / Output File

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**			Data Type	Related
INPUT / OUTPUT	**Analog Inputs**	**70** **75** **80** ○	**[Anlg In1 Sel]** **[Anlg In2 Sel]** **[Anlg In3 Sel]** Selects the parameter to which a value will be written from the analog input. Note: See Analog Input Configuration on page 262 for more information. Options:	Default: Default: Default:	1 = 0 = 0 =	“Speed Ref A” “Off” “Off”	16-bit Int	

0 =	“Off” (No signal)	9 =	“Neg Cur Lim” (Par 9)	18 =	“PI CentralV3” (Par 778)
1 =	“Speed Ref A” (Par 44)	10 =	“Jog Ref” (Par 266)	19 =	“PID Feedback” (Par 763)
2 =	“Speed Ref B” (Par 48)	11 =	“Adaptive Ref” (Par 183)	20 =	“Fld Cur Max” (Par 467)
3 =	“Trim Ramp” (Par 42)	12 =	“UserDefined0” (Par 503)	21 =	“OutVoltLevel” (Par 233)
4 =	“Trim Speed” (Par 43)	13 =	“UserDefined1” (Par 504)	22 =	“Speed Ratio” (Par 1017)
5 =	“Torque Ref” (Par 39)	14 =	“UserDefined2” (Par 505)	23 =	“Tension Red” (Par 1179)
6 =	“Trim Torque” (Par 40)	15 =	“UserDefined3” (Par 506)	24 =	“Tension Ref” (Par 1180)
7 =	“TB Man Ref” (Par 267)	16 =	“Load Comp” (Par 698)	25 =	“Diam Preset3” (Par 1167)
8 =	“Pos Cur Lim” (Par 8)	17 =	‘PID Setpt 0” (Par 760)		

File	Group	No.	**Parameter Name & Description**	**Values**			Data Type	Related
		71 **76** **81** ○	**[Anlg In1 Config]** **[Anlg In2 Config]** **[Anlg In3 Config]** Selects the signal input (voltage or current) mode for the analog input. Configure switches S9, S10, and S11 on the Control board according to the input signal used. The inputs of the drive are factory set for voltage signals. Refer to DIP Switch and Jumper Settings on page 68 for information on switch configuration. • “+/–10V” = A maximum voltage of ±10V is connected to the analog input. If the signal is used as a reference value, a polarity reversal can be used to reverse the rotation direction of the drive (four quadrant only) when Par 1322 [Direction Mode] = 1 “Bipolar”. Two quadrant drives accept only positive references as the speed reference. Negative references are not accepted and the drive will run at zero speed. • “0-10V” = A maximum voltage of 10V is connected to the analog input. For reference values, only positive references are allowed. • “0 - 20mA” = A maximum current signal of 0 – 20 mA is connected to the analog input. The signal must be positive. • “4 to 20mA” = A current signal of 4 – 20 mA is connected to the analog input. The signal must be positive. Note: See Analog Input Configuration on page 262 for more information.	Default: Options:	0 = 0 = 1 = 2 = 3 =	“+/–10V” “+/–10V” “0-10V” “0 - 20mA” “4 to 20mA”	16-bit Int	1322
		72 **77** **82** A	**[Anlg In1 Scale]** **[Anlg In2 Scale]** **[Anlg In3 Scale]** Scales the value in the corresponding [Anlg Inx Sel] parameter. Note: See Analog Input Configuration on page 262 for more information.	Default: Min/Max:	1.00 –/+10.00		Real	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**		Data Type	Related
INPUT / OUTPUT	**Analog Inputs**	**73** **78** **83** A	**[Anlg1 Tune Scale]** **[Anlg2 Tune Scale]** **[Anlg3 Tune Scale]** Fine tuning of the analog input when the maximum signal does not correspond exactly to the rated value. Scales according to the following equation: [Anlg Inx Sel] – [Anlg Inx Offset] x [Anlg Inx Scale] x [Ainx Tune Scale] Note: See Analog Input Configuration on page 262 for more information.	Default: Min/Max:	1.00 0.10 / 10.00	Real	
		74 **79** **84** A	**[Anlg In1 Offset]** **[Anlg In2 Offset]** **[Anlg In3 Offset]** Offset value for the analog inputs. If the input has an offset or if the variable assigned to the input already has a value although there is no input signal present, this can be compensated for via the value in this parameter.	Default: Min/Max:	0 –32768/+32767	16-bit Int	
		259 **260** **261** A	**[Anlg In1 Tune]** **[Anlg In2 Tune]** **[Anlg In3 Tune]** Automatic fine tuning of the analog inputs. If this command is given, parameter [Ainx Tune Scale] is automatically selected so that the input signal present, normally full scale, corresponds to the maximum variable value, such as the value of Par 45 [Max Ref Speed]. Two conditions are necessary for automatic fine tuning: • An input voltage greater than 1V or an input current greater than 2 mA. • Positive polarity. The value found is automatically set for the opposite direction for four quadrant drives. Note: The automatically calculated value can, if necessary, be modified manually via parameter [Ainx Tune Scale]. When using analog input tuning, Pars [Analog Inx Scale] are normally set to 1.0.	Default: Options:	0 = “Ready” 0 = “Ready” 1 = “Tune”	16-bit Int	
		295 **296** **297**	**[Anlg In1 Target]** **[Anlg In2 Target]** **[Anlg In3 Target]** Enables sampling for the analog inputs.	Default: Options:	0 = “Assigned” 0 = “Assigned” 1 = “Not Assigned”	16-bit Int	
		792 A	**[Anlg In1 Filter]** Analog input 1 filter.	Default: Min/Max: Units:	0 0 / 1000 ms	16-bit Int	
		801 A	**[Anlg In2 Filter]** Analog input 2 filter. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	0 0 / 1000 ms	16-bit Int	
		802 A	**[Anlg In3 Filter]** Analog input 3 filter. Note: This parameter was added with firmware version 4.001.	Default: Min/Max: Units:	0 0 / 1000 ms	16-bit Int	
		1042	**[Anlg In1 Cmp]** Defines a reference point for the signal of analog input 1 around which a comparison range can be set (via Par 1043 [Anlg In1 Cmp Err]) and monitored. [Anlg In1 Cmp] = (comparison value) x 10000 / (max. reference value), where the values of “comparison” and “max. reference” are determined by the min/max of the related parameter selected via Par 70 [Anlg In1 Sel]. Note: See Analog Input Signal Comparison on page 263 for more information.	Default: Min/Max:	0 – / +10000	16-bit Int	1043, 1044, 1045

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	Values		Data Type	Related
INPUT / OUTPUT	**Analog Inputs**	**1043**	**[Anlg In1 Cmp Err]** Defines a value above and below the value set in parameter 1042 [Anlg In1 Cmp] at which Par 1045 [Anlg In1 Cmp Eq] will transition. [Anlg In1 Cmp Err] = (tolerance value) x 10000 / (max. reference value), where the values of "tolerance" and "max. reference" are determined by the min/max of the parameter selected via Par 70 [Anlg In1 Sel]. Note: See Analog Input Signal Comparison on page 263 for more information.	Default: Min/Max:	0 0 / 10000	16-bit Int	1042, 1044, 1045
		1044	**[Anlg In1 Cmp Dly]** Amount of time that must elapse, after the value in Par 1043 [Anlg In1 Cmp Err] has been reached, before Par 1045 [Anlg In1 Cmp Eq] transitions.	Default: Min/Max: Units:	0 0 / 65000 ms	16-bit Int	1042, 1043, 1045
		1045	**[Anlg In1 Cmp Eq]** Provides an indication, after the amount of time specified in Par 1044 [Anlg In1 Cmp Dly] has elapsed, when the value set in parameter 1043 [Anlg In1 Cmp Err] has been reached. • "0" = The value of analog input 1 is above or below the value set in Par 1043 [Anlg In1 Cmp Err]. • "1" = The value of analog input 1 is within the range set in Par 1043 [Anlg In1 Cmp Err]. Notes: This parameter can be assigned to a digital output. See Analog Input Signal Comparison on page 263 for more information.	Default: Min/Max:	Read Only 0 / 1	16-bit Int	1042, 1043, 1044
		1404	**[Analog In1 Value]** Value of the signal at analog input 1. Units based on the value set in Par 71 [Anlg In1 Config].	Default: Min/Max: Units:	Read Only -/+20.00 V or mA	Real	71
		1405	**[Analog In2 Value]** Value of the signal at analog input 2. Units based on the value set in Par 76 [Anlg In2 Config].	Default: Min/Max: Units:	Read Only -/+20.00 V or mA	Real	76
		1406	**[Analog In3 Value]** Value of the signal at analog input 3. Units based on the value set in Par 81 [Anlg In3 Config].	Default: Min/Max: Units:	Read Only -/+20.00 V or mA	Real	81
	Analog Outputs	**62** **63** **64** **65**	**[Anlg Out1 Scale]** **[Anlg Out2 Scale]** **[Anlg Out3 Scale]** **[Anlg Out4 Scale]** Scaling of the analog outputs.	Default: Min/Max:	1.00 –/ +10.00	Real	

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values		Data Type	Related
INPUT / OUTPUT	Analog Outputs	**66** **67** **68** **69**	**[Anlg Out1 Sel]** **[Anlg Out2 Sel]** **[Anlg Out3 Sel]*** **[Anlg Out4 Sel]*** Selects the source of the value that drives the analog output. *This parameter is used to configure an analog output on the I/O Expansion circuit board. Refer to Appendix F - Optional Analog and Digital I/O Expansion Circuit Board. Options:	Default: Default: Default: Default:	12 = "Motor Speed" 13 = "Motor Curr" 18 = "Fld Current" 14 = "Motor Volts"	16-bit Int	

No.	Option (Par)	Scaling of Analog Output Value	No.	Option (Par)	Scaling of Analog Output Value
0 =	"Off" (Not used)	n/a	18 =	"Fld Current" (Par 234)	0-10V = 0-100% of Par 280 [Nom Mtr Fld Amps]
1 =	"Spd Ref Out" (Par 385)	±10V = ±100% of Par 45 [Max Ref Speed]	19 =	"UserDefined0" (Par 503)	±10V = ±2047 in Par 503 [UserDefined0]
2 =	"Trim Ramp" (Par 42)	±10V = ±100% of Par 45 [Max Ref Speed]	20 =	"UserDefined1" (Par 504)	±10V = ±2047 in Par 504 [UserDefined1]
3 =	"Ramp In" (Par 110)	±10V = ±100% of Par 45 [Max Ref Speed]	21 =	"UserDefined4" (Par 507)	±10V = ±2047 in Par 507 [UserDefined4]
4 =	"Ramp Out" (Par 113)	±10V = ±100% of Par 45 [Max Ref Speed]	22 =	"UserDefined5" (Par 508)	±10V = ±2047 in Par 508 [UserDefined5]
5 =	"Spd Draw Out" (Par 1018)	±10V = ±100% of Par 45 [Max Ref Speed]	23 =	"UserDefined6" (Par 509)	±10V = ±2047 in Par 509 [UserDefined6]
6 =	"Trim Speed" (Par 43)	±10V = ±100% of Par 45 [Max Ref Speed]	24 =	"Field Ref" (Par 500)	0-10V = 0-100% of Par 280 [Nom Mtr Fld Amps]
7 =	"Spd Reg In" (Par 118)	±10V = ±100% of Par 45 [Max Ref Speed]	25 =	"PID Output" (Par 774)	±10V = ±10000 in Par 774 [PID Output]
8 =	"Spd Reg Out" (Par 236)	±10V = ± 100% of Par 179 [Nom Mtr Arm Amps]	26 =	"Out Volt Lvl" (Par 921)	±10V = ±100% Par 175 [Rated Motor Volt]
9 =	"Torque Ref" (Par 14)	±10V = ± 100% of Par 179 [Nom Mtr Arm Amps]	27 =	"Fld Cur Max" (Par 467)	0-10V = 0-100% of Par 280 [Nom Mtr Fld Amps]
10 =	"Trim Torque" (Par 40)	±10V = ± 100% of Par 179 [Nom Mtr Arm Amps]	28 =	"Filtered Spd" (Par 924)	±10V = ±100% of Par 45 [Max Ref Speed]
11 =	"Torq Reg In" (Par 41)	±10V = ± 100% of Par 179 [Nom Mtr Arm Amps]	29 =	"Filtered Cur" (Par 928)	±10V = ± 200% of Par 179 [Nom Mtr Arm Amps]
12 =	"Motor Speed" (Par 121)	±10V = ±100% of Par 45 [Max Ref Speed]	30 =	"Output Power" (Par 1052)	±10V = ± 200% of Par 179 [Nom Mtr Arm Amps] x Par 175 [Rated Motor Volt]
13 =	"Motor Curr" (Par 199)	±10V = ± 200% of Par 179 [Nom Mtr Arm Amps]	31 =	"Roll Diam" (Par 1154)	0-10V = 0-100% of Par 1153 [Max Diameter]
14 =	"Motor Volts" (Par 233)	±10V = ±100% of Par 175 [Rated Motor Volt]	32 =	"Tension Ref" (Par 1180)	0-10V = 0-100% of Par 1153 [Max Diameter]
15 =	"Analog In 1" (Par 70)	±10V = ±10V on Analog Input 1	33 =	"Torque Curr" (Par 1193)	±10V = ± 200% of Par 179 [Nom Mtr Arm Amps]
16 =	"Analog In 2" (Par 75)	±10V = ±10V on Analog Input 2	34 =	"Winder Ref" (Par 1217)	±10V = ±100% of Par 45 [Max Ref Speed]
17 =	"Analog In 3" (Par 80)	±10V = ±10V on Analog Input 3	35 =	"Active Comp" (Par 1213)	±10V = ± 200% of Par 179 [Nom Mtr Arm Amps]

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values			Data Type	Related
INPUT / OUTPUT	**Digital Inputs**	**133**	**[Digital In1 Sel]**	Default:	2 =	"Stop/CF"	16-bit Int	
		134	**[Digital In2 Sel]**	Default:	3 =	"Start"		
		135	**[Digital In3 Sel]**	Default:	11 =	"Jog"		
		136	**[Digital In4 Sel]**	Default:	1 =	"Enable"(1)		
		137	**[Digital In5 Sel]**	Default:	17 =	"Speed Sel 1"		
		138	**[Digital In6 Sel]**	Default:	18 =	"Speed Sel 2"		
		139	**[Digital In7 Sel]**	Default:	19 =	"Speed Sel 3"		
		140	**[Digital In8 Sel]**	Default:	31 =	"Contactor"		
		141	**[Digital In9 Sel]***	Default:	0 =	"Not Used"		
		142	**[Digital In10 Sel]***	Default:	0 =	"Not Used"		
		143	**[Digital In11 Sel]***	Default:	0 =	"Not Used"		
		144	**[Digital In12 Sel]***	Default:	0 =	"Not Used"		
		○	Selects the function driven by the digital input. Refer to Option Definitions for [Digital Inx Sel] on page 180. *These parameters are used to configure the digital inputs on the I/O Expansion circuit board. Notes: Option 35 was changed from "Fld Weaken En" to "Force MinFld" and option 64 "Invert Flt" was added with firmware version 2.001. Option 34 "Field Reg En" was changed to "Reserved" with firmware version 3.001. Options:					

0 =	"Not Used"	17 =	"Speed Sel 1"	34 =	"Reserved"	51 =	"Diam Reset"
1 =	"Enable"(1)(2)	18 =	"Speed Sel 2"	35 =	"Force MinFld" (3)	52 =	"DiamCalc Dis"
2 =	"Stop/CF" (2)	19 =	"Speed Sel 3"	36 =	"Freeze Ramp"	53 =	"Torq Wind En"
3 =	"Start" (2)	20 =	"PI Enable"	37 =	"UsrDefinedA0"	54 =	"Speed Match"
4 =	"Fwd/Reverse" (2)	21 =	"PI Hold"	38 =	"UsrDefinedA1"	55 =	"Diam I/D En"
5 =	"Run" (2)	22 =	"PI Reset"	39 =	"UsrDefinedA2"	56 =	"Wind/Unwind"
6 =	"Run Forward" (2)	23 =	"PI Invert"	40 =	"UsrDefinedA3"	57 =	"Diam Preset0"
7 =	"Run Reverse" (2)	24 =	"Local"	41 =	"UsrDefinedA4"	58 =	"Diam Preset1"
8 =	"Run Level" (2)	25 =	"Acc2 & Dec2"	42 =	"UsrDefinedA5"	59 =	"Taper Enable"
9 =	"RunFwd Level" (2)	26 =	"Accel 2"	43 =	"UsrDefinedA6"	60 =	"Spd DemandEn"
10 =	"RunRev Level" (2)	27 =	"Decel 2"	44 =	"UsrDefinedA7"	61 =	"Winder Side"
11 =	"Jog" (2)	28 =	"MOP Inc"	45 =	"Droop Enable"	62 =	"PI-PD Enable"
12 =	"Jog Forward" (2)	29 =	"MOP Dec"	46 =	"PD Enable"	63 =	"Jog TW En"
13 =	"Jog Reverse" (2)	30 =	"Fast Stop"	47 =	"PID SetptSel"	64 =	"Invert Flt"
14 =	"Aux Fault"	31 =	"Contactor" (4)	48 =	"PI Cent vs0"		
15 =	"Clear Faults"	32 =	"MOP Reset"	49 =	"PI Cent vs1"		
16 =	"Auto/Manual"	33 =	"TorqueReduce"	50 =	"Diam Calc"		

1 A digital input (1…8 only) must be configured for "Enable".

2 For digital inputs 9…12, this option displays as "Reserved", indicating that it is not available for use - do not select "Reserved" options.

3

ATTENTION: Enabling (forcing) the minimum field current while the drive is running could result in excessive motor speed, equipment damage and/or bodily injury.

4

ATTENTION: Contactor status should only be used by the drive. It should not be used to initiate any external action (e.g., mechanical braking), or equipment damage and/or bodily injury may occur.

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values	Data Type	Related
INPUT / OUTPUT	Digital Inputs					

Option Definitions for [Digital Inx Sel]

Note: When assigning digital inputs to certain options that are associated with parameters, those parameter values may be overwritten by the state of the digital input.

Option	Description
Enable[1][2]	Removing the enable input causes the motor to coast-to-stop without generating a fault.
Stop/CF[2]	Stops the drive if running or jogging or clears a fault if the drive is already stopped.
Start[2]	Issues a Start command, removal does not Stop the drive (3-wire control).
Fwd/Reverse[2]	Selects the operating direction of the drive.
Run[2]	Issues a Start command, removal causes the drive to Stop (2-wire control).
Run Forward[2]	Issues a Run command in the Forward direction.
Run Reverse[2]	Issues a Run command in the Reverse direction.
Run Level[2]	Level sensitive Run command (no off-to-on transition required).
RunFwd Level[2]	Run Level command in the Forward direction.
RunRev Level[2]	Run Level command in the Reverse direction.
Jog[2]	Starts the drive and runs at the speed in Par 266 [Jog Speed], removal causes the drive to Stop.
Jog Forward[2]	Issues a Jog command in the Forward direction.
Jog Reverse[2]	Issues a Jog command in the Reverse direction.
Aux Fault	Asserting causes an Auxiliary Input fault (F2).
Clear Faults	Issues a Clear Faults command.
Auto/Manual	Selects between Automatic and Manual speed reference values.
Speed Sel 1 - 3	Selects one of eight speed references. Bit enumerations: 000 = Par 44 [Speed Ref A], 001 = Par 48 [Speed Ref B], 010 = Par 155 [Preset Speed 2], 011 = Par 156 [Preset Speed 3], 100 = Par 157 [Preset Speed 4], 101 = Par 158 [Preset Speed 5], 110 = Par 159 [Preset Speed 6], 111 = Par 160 [Preset Speed 7]
PI Enable	Enables/disables the PI block of the PID regulator (Par 769 [Enable PI]).
PI Hold	Enables/disables a hold on the PI output.
PI Reset	Asserting causes a reset of the PI output.
PI Invert	Asserting causes an inversion of the PI output.
Local	Enables exclusive drive control via the I/O Terminal Block only.
Acc2 & Dec2	Switches between the Accel/Decel 1 and Accel/Decel 2 ramp rates.
Accel 2	Switches between the Accel 1 and Accel 2 ramp rates.
Decel 2	Switches between the Decel 1 and Decel 2 ramp rates.
MOP Inc	Asserting causes the MOP reference to increment at the rate set in Par 22 [MOP Accel Time].
MOP Dec	Asserting causes the MOP reference to decrement at the rate set in Par 30 [MOP Decel Time].
Fast Stop	Causes the drive to Stop at the rate set in Par 38 [Fast Stop Time].
Contactor	Indicates the status of the main contactor/DB contactor. Must be assigned and asserted in order to run drive when Par 1391 [ContactorControl] = “Contactor” or “Contactor+DB”.
MOP Reset	Asserting resets the MOP reference to zero.
TorqueReduce	Turns on /off Torque Reduction using the reduced current limit set in Par 13 [Torq Red CurLim].
Force MinFld	When asserted, the field current is set to the value specified in Par 498 [Force Min Field]. **Important**: See Attention statement on page 3-179 for this option.
Freeze Ramp	Holds the speed ramp at the present value (Par 373 [Freeze Ramp]).
UsrDefinedA0-7	Writes the value of the digital input to Pars 520 [UsrDefBitWrdA0] - 527 [UsrDefBitWrdA7].
Droop Enable	Enables/disables the Droop function (699 [Enable Droop]).
PD Enable	Enables/disables the PD block of the PID regulator (Par 770 [Enable PD]).
PI Cent vs0 - 1	In combination, the digital inputs set to “PI Central vs0” and “PI Central vs1”, through binary selection, determine which of the four possible output values is used as the initial level of the integral component (corresponding to the initial diameter) of the PI block. Refer to Par 780 [PI Central vs0] for binary selection values.
Diam Calc	When asserted initiates the diameter calculation (Par 794 [Diameter Calc]).
Diam Reset	Sets the diameter starting value to the value in Par 1168 [Diam Preset Sel].
DiamCalc Dis	Enables/disables the diameter calculation (Par 1161 [Diameter Calc Dis]).
Torq Wind En	Enables/disables the Center wind function (Par 1209 [Torque Winder En]).
Speed Match	When asserted, issues the coil 'launch phase' command for automatic switching (Par 1195 [Speed Match]).
Diam I/D En	Enables/disables the ability of the diameter calculation to increase for an unwider or decrease for a winder (Par 1205 [Diam Inc Dec En]).
Wind/Unwind	Sets the value of Par 1187 [Winder Type] to “0” Winder or “1” Unwinder .
Diam Preset0 - 1	Selects the value of Par 1164 [Diam Preset 0], 1165 [Diam Preset 1], Par 1166 [Diam Preset 2], or Par 1167 [Diam Preset 3] See Par 1168 [Diam Preset Sel].
Taper Enable	Enables/disables the Taper function (Par 1176 [Taper Enable]).
Spd DemandEn	Enables/disables the speed reference calculation (winder operation), (Par 1215 [Speed Demand En]).
Winder Side	Selection of the winding/unwinding side (0 = up, 1 = down).
PI-PD Enable	Selection between PI and PD (winder operation), (Par 1201 [Winder Side]).
Jog TW En	Enables/disables the Torque Winder jog function (Par 1256 [Jog TW Enable]).
Invert Flt	Must be used when the digital input is wired to the status of an inverting fault device (fuse, circuit breaker, etc.). When asserted, causes an “Inverting Fault” (F37). Refer to Figure 13 on page 45 for more information.

[1] A digital input (1-8 only) must be configured for “Enable”.

[2] For digital inputs 9 - 12, this option is not available (displays as “Reserved”).

<table>
<tr><th>File</th><th>Group</th><th>No.</th><th>Parameter Name & Description
See page 102 for symbol descriptions</th><th colspan="2">Values</th><th>Data Type</th><th>Related</th></tr>
<tr><td>INPUT / OUTPUT</td><td>Digital Inputs</td><td>564</td><td colspan="3">[Dig In Status] Read Only
Status of the digital inputs.
<table>
<tr><td>Options</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Digital In12</td><td>Digital In11</td><td>Digital In10</td><td>Digital In9</td><td>Digital In8</td><td>Digital In7</td><td>Digital In6</td><td>Digital In5</td><td>Digital In4</td><td>Digital In3</td><td>Digital In2</td><td>Digital In1</td></tr>
<tr><td>Default</td><td>x</td><td>x</td><td>x</td><td>x</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Bit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table></td><td></td><td></td></tr>
<tr><td></td><td></td><td>565
566
567
568
569
570
571
572
573
574
575
576</td><td>[Dig In Term 1]
[Dig In Term 2]
[Dig In Term 3]
[Dig In Term 4]
[Dig In Term 5]
[Dig In Term 6]
[Dig In Term 7]
[Dig In Term 8]
[Dig In Term 9]
[Dig In Term 10]
[Dig In Term 11]
[Dig In Term 12]
Status of the digital inputs.
0 = Low
1 = High</td><td>Default:
Min/Max:</td><td>Read Only
0 / 1</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1276
1277
1278
1279
1280
1281
1282
1283
1387
1388
1389
1390
○
A</td><td>[Inversion In 1]
[Inversion In 2]
[Inversion In 3]
[Inversion In 4]
[Inversion In 5]
[Inversion In 6]
[Inversion In 7]
[Inversion In 8]
[Inversion In 9]
[Inversion In 10]
[Inversion In 11]
[Inversion In 12]
inverts the digital input signal.</td><td>Default:
Options:</td><td>0 “Disabled”
0 = “Disabled”
1 = “Enabled”</td><td>16-bit Int</td><td></td></tr>
<tr><td></td><td></td><td>1391
○
A</td><td>[ContactorControl]
Selects the type of contactor to be controlled by the drive. Either style of contactor (AC or DC) can be used, with or without dynamic braking (DB) contactor.
• “AC Cntctr” indicates an AC contactor is used
• “AC Cntctr+DB” indicates that an AC contactor and dynamic brake resistor is used
• “DC Cntctr” indicates a DC contactor is used
• “DC Cntctr+DB” indicates that a DC contactor and dynamic brake resistor is used
The type of control selected determines how many I/O points will be required for contactor control and status.
• “AC Cntctr” or “DC Cntctr” = 1 (relay) digital output, 1 digital input is used
• “AC Cntctr+DB” or “DC Cntctr+DB” = 2 (relay) digital outputs, 1 digital input is used
Note: Options 1 and 2 changed from “Contactor” and “Contactor+DB” to “AC Cntctr” and AC Cntctr+DB”, respectively, and options 3 and 4 added with firmware version 2.001.</td><td>Default:
Options:</td><td>1 = “AC Cntctr”
0 = “None”
1 = “AC Cntctr”
2 = “AC Cntctr+DB”
3 = “DC Cntctr”
4 = “DC Cntctr+DB”</td><td>16-bit Int</td><td></td></tr>
</table>

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values			Data Type	Related
INPUT / OUTPUT	Digital Outputs	**145** **146** **147** **148** **149** **150** **151** **152** ○	**[Digital Out1 Sel]** **[Digital Out2 Sel]** **[Digital Out3 Sel]** **[Digital Out4 Sel]** **[Digital Out5 Sel]*** **[Digital Out6 Sel]*** **[Digital Out7 Sel]*** **[Digital Out8 Sel]*** Selects the source of the value that drives the digital output. Refer to "Option Definitions" on Option Definitions for [Digital Outx Sel], [Relay Out 1 Sel] and [Relay Out 2 Sel] on page 183. *These parameters are used to configure the digital outputs on the I/O Expansion circuit board. Options:	Default: Default: Default: Default: Default: Default: Default: Default:	5 = 9 = 2 = 4 = 26 = 0 = 0 = 0 =	"Ready" "Fault" "Spd Thresh" "CurrentLimit" "Alarm" "Not Used" "Not Used" "Not Used"	16-bit Int	

0 =	"Not Used"	8 =	"Spd Limited"	16 =	"Encoder Err"	24 =	"Reserved"
1 =	"Spd Zero Thr"	9 =	"Fault"	17 =	"Diam Calc"	25 =	"Reserved"
2 =	"Spd Thresh"	10 =	"Power Loss"	18 =	"Input1 Cmp"	26 =	"Alarm"
3 =	"At Speed"	11 =	"UserDefinedA"	19 =	"Diam Reached"	27 =	"Running"
4 =	"CurrentLimit"	12 =	"UserDefinedB"	20 =	"Speed Match"	28 =	"Jogging"
5 =	"Ready"	13 =	"Stop Control"	21 =	"Accelerating"	29 =	"Active"
6 =	"Ramp Pos"	14 =	"Field Loss"	22 =	"Decelerating"		
7 =	"Ramp Neg"	15 =	"Spd Fbk Loss"	23 =	"Brake Cmd"		

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	Values	Data Type	Related
INPUT / OUTPUT	Digital Outputs					

Option Definitions for [Digital Outx Sel], [Relay Out 1 Sel] and [Relay Out 2 Sel]

Option	Description
Spd Zero Thr	"0" indicates that the drive is operating below the value set in Par 107 [Speed Zero Level] , "1" indicates that the drive is operating above Par 107 [Speed Zero Level].
Spd Thresh	"0" indicates that the drive is operating above the value set in Par 101 [Speed Thresh Pos], "1" indicates that the drive is operating below Par 101 [Speed Thresh Pos].
At Speed	"0" indicates that the actual speed is within the range specified in Par 104 [At Speed Error], "1" indicates that the actual speed is outside the range specified in Par 104 [At Speed Error].
CurrentLimit	"0" indicates that the drive is not limiting output current, "1" indicates that the drive is limiting the output current.
Ready	"1" indicates that the drive is powered, Enabled and no Start Inhibits exist. The state of the assigned digital output matches the state of bit 2 "Ready" of Par 381 [Drive Status 1].
Ramp Pos	"1" indicates that the actual speed of the drive is going positive. Follows the state of Par 346 [Torque Positive]. Not asserted until after the amount of time in Par 20 [Ramp Delay] has elapsed.
Ramp Neg	"1" indicates that the actual speed of the drive is going negative. Follows the state of Par 347 [Torque Negative]. Not asserted until after the amount of time in Par 20 [Ramp Delay] has elapsed.
Spd Limited	"1" indicates that the speed is being limited to the value of Par 3 [Max Speed Fwd], "0" indicates that the speed is not being limited.
Fault	"0" indicates that a drive fault has occurred. Refer to Par 57 [Fault Code].
Power Loss	"0" indicates that the drive has detected a loss of the internal power supply.
UserDefinedA	Indicates the status of Par 519 [UsrDefBitWrdA] (digital output 1 uses bit 0, digital output 2 uses bit 1, etc.). Par 1392 [Relay Out 1 Sel] uses bit 14 (only). Par 629 [Relay Out 2 Sel] uses bit 15 (only).
UserDefinedB	Indicates the status of Par 536 [UsrDefBitWrdB] (digital output 1 uses bit 0, digital output 2 uses bit 1, etc.). Par 1392 [Relay Out 1 Sel] uses bit 14 (only). Par 629 [Relay Out 2 Sel] uses bit 15 (only).
Stop Control	Energized ("1") at run and de-energized ("0") based on the value of Par 627 [Spd 0 Trip Delay].
Field Loss	"0" indicates the loss of the field voltage/current while the drive is running.
Spd Fbk Loss	"0" indicates the loss of Speed Feedback/Encoder due to an excessive calculated error, as determined by the drive firmware.
Encoder Err	"0" indicates a loss of the DC tachometer or encoder. Matches the state of Par 651 [Encoder State].
Diam Calc	Energized ("1") when Par 800 [Diameter Calc St] = 1 and de-energized ("0") when [Diameter Calc St] = 0.
Input1 Cmp	"1" indicates that the value of analog input 1 is inside the comparison window,"0" indicates that the value of analog input 1 is outside the comparison window (Par 1045 [Anlg In1 Cmp Eq]).
Diam Reached	Energized ("1") when the value of Par 1158 [Diam Threshold] has been exceeded.
Speed Match	Energized ("1") when the value of Par 1203 [Spd Match Compl] = "1" (launching ramp completed).
Accelerating	"1" indicates that the drive is actively accelerating. The state of the assigned digital output matches the state of bit 4 "Accelerating" of Par 381 [Drive Status 1] and the state of Par 1188 [Accel Status].
Decelerating	When set to "1" the drive is actively decelerating. The state of the assigned digital output matches the state of bit 5 "Decelerating" of Par 381 [Drive Status 1] and the state of Par 1189 [Decel Status].
Brake Cmd	Energized ("1") at run (opens the brake) after the value in Par 1263 [Opening Delay] has been exceeded. De-energized ("0") at stop (closes the brake) after the drive speed goes below the value of Par 1262 [Closing Speed].
ContactorDB	"1" issues the close command to the main contactor and dynamic brake contactor.
Contactor	"1" issues the close command to the main contactor.
Alarm	"0" indicates that a drive alarm has occurred. Refer to Par 1380 [Drive Alarm 1].
Running	"1" indicates that the drive is active in Run mode. The state of the assigned digital output matches the state of bit 2 "Running" of Par 381 [Drive Status 1].
Jogging	"1" indicates that the drive is active in Jog mode. The state of the assigned digital output matches the state of bit 3 "Jogging" of Par 381 [Drive Status 1].
Active	"1" indicates that the drive is active in Run or Jog mode. The state of the assigned digital output matches the state of bit 1 "Active" of Par 381 [Drive Status 1].

File	Group	No.	Parameter Name & Description See page 102 for symbol descriptions	Values	Data Type	Related
INPUT / OUTPUT	Digital Outputs	581	**[Dig Out Status]** Status of the standard digital outputs and relay outputs on the drive and on the optional I/O Expansion circuit board (if present).	Read Only		

Options	Relay Out2	Relay Out1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Digital Out8	Digital Out7	Digital Out6	Digital Out5	Digital Out4	Digital Out3	Digital Out2	Digital Out1
Default	0	0	x	x	x	x	x	x	0	0	0	0	0	0	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

File	Group	No.	Parameter Name & Description	Values	Data Type	Related
INPUT / OUTPUT	Digital Outputs	629 ○	**[Relay Out 2 Sel]** Selects the source of the value that drives the N.O. relay between the terminals 75 and 76. Refer to "Option Definitions" on page 183. Options:	Default: 5 = "Ready"	16-bit Int	

0 =	"Not Used"	8 =	"Spd Limited"	16 =	"Encoder Err"	24 =	"ContactDB"
1 =	"Spd Zero Thr"	9 =	"Fault"	17 =	"Diam Calc"	25 =	"Contactor"
2 =	"Spd Thresh"	10 =	"Power Loss"	18 =	"Input1 Cmp"	26 =	"Alarm"
3 =	"At Speed"	11 =	"UserDefinedA"	19 =	"Diam Reached"	27 =	"Running"
4 =	"CurrentLimit"	12 =	"UserDefinedB"	20 =	"Speed Match"	28 =	"Jogging"
5 =	"Ready"	13 =	"Stop Control"	21 =	"Accelerating"	29 =	"Active"
6 =	"Ramp Pos"	14 =	"Field Loss"	22 =	"Decelerating"		
7 =	"Ramp Neg"	15 =	"Spd Fbk Loss"	23 =	"Brake Cmd"		

File	Group	No.	Parameter Name & Description	Values	Data Type	Related
INPUT / OUTPUT	Digital Outputs	1267 1268 1269 1270 1271 1272 1273 1274 ○ A	**[Inversion Out 1]** **[Inversion Out 2]** **[Inversion Out 3]** **[Inversion Out 4]** **[Inversion Out 5]** **[Inversion Out 6]** **[Inversion Out 7]** **[Inversion Out 8]** Reverses the digital output signal.	Default: 0 = "Disabled" Options: 0 = "Disabled" 1 = "Enabled"	16-bit Int	
		1275 ○ A	**[Inversion Relay2]** Inverts the signal for Relay Output 2.	Default: 0 = "Disabled" Options: 0 = "Disabled" 1 = "Enabled"	16-bit Int	

File	Group	No.	**Parameter Name & Description** See page 102 for symbol descriptions	**Values**	Data Type	Related
INPUT / OUTPUT	Digital Outputs	**1392** ○	**[Relay Out 1 Sel]** Selects the source of the value that drives the N.O. relay between the terminals 35 and 36. Refer to “Option Definitions” on page 183. Options: 0 = “Not Used” 1 = “Spd Zero Thr” 2 = “Spd Thresh” 3 = “At Speed” 4 = “CurrentLimit” 5 = “Ready” 6 = “Ramp Pos” 7 = “Ramp Neg” 8 = “Spd Limited” 9 = “Fault” 10 = “Power Loss” 11 = “UserDefinedA” 12 = “UserDefinedB” 13 = “Stop Control” 14 = “Field Loss” 15 = “Spd Fbk Loss” 16 = “Encoder Err” 17 = “Diam Calc” 18 = “Input1 Cmp” 19 = “Diam Reached” 20 = “Speed Match” 21 = “Accelerating” 22 = “Decelerating” 23 = “Brake Cmd” 24 = “ContactDB” 25 = “Contactor” 26 = “Alarm” 27 = “Running” 28 = “Jogging” 29 = “Active”	Default: 25 = “Contactor”	16-bit Int	
		1393 ○ A	**[Inversion Relay1]** Inverts the signal for Relay Output 1.	Default: 0 = “Disabled” Options: 0 = “Disabled” 1 = “Enabled”	16-bit Int	
	DPI Inputs	**1323** ○	**[DPI P1 Select]** Selects the destination of the reference value from DPI Port 1 (HIM on drive cover, when installed).	Default: 0 = “OFF” Options: 0 = “OFF” 1 = “Speed Ref A” (Par 44) 2 = “Speed Ref B” (Par 48) 3 = “Trim Ramp” (Par 42) 4 = “Trim Speed” (Par 43) 5 = “Torque Ref” (Par 39) 6 = “Trim Torque” (Par 40) 7 = “Pos Cur Lim” (Par 8) 8 = “Neg Cur Lim” (Par 9)	16-bit Int	
		1324 ○	**[DPI P2 Select]** Selects the destination of the reference value from DPI Port 2 (handheld and remote option, when installed).	Refer to Par 1323 [DPI P1 Select].	16-bit Int	
		1325 ○	**[DPI P3 Select]** Selects the destination of the reference value from DPI Port 3 (handheld and remote option, when installed).	Refer to Par 1323 [DPI P1 Select].	16-bit Int	
		1326 ○	**[DPI P4 Select]** Selects the destination of the reference value from DPI Port 4.	Refer to Par 1323 [DPI P1 Select].	16-bit Int	
		1327 ○	**[DPI P5 Select]** Selects the destination of the reference value from DPI Port 5 (communications adapter, when installed).	Refer to Par 1323 [DPI P1 Select].	16-bit Int	

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Notes:

Troubleshooting

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

Faults and Alarms

A fault is a condition that always stops the drive and prevents it from starting until the fault condition is corrected. There are two fault types.

Type	Description	
①	User Configurable	This type of fault allows you to configure the drive's response to the condition that caused the error. • When configured for a fault, the drive will be stopped, the error condition will be annunciated on the HIM or a via digital output (if programmed) and the drive will not be allowed to start until the fault condition is corrected. • When configured for an alarm, the error condition will be annunciated on the HIM or via a digital output (if programmed) and the drive will continue to run and/or be allowed to start. • When configured for ignore or disabled, the error condition will not be recognized by the drive or be indicated on the HIM or via a programmed digital output.
②	Non-Configurable	This type of fault is always enabled and will cause the drive to stop running in order to protect the drive and/or motor from damage. In some cases, drive or motor repair may be required. The cause of the fault must be corrected before the fault can be cleared (via a fault reset using the HIM or programmed digital input). The fault will be reset on power up after repair.

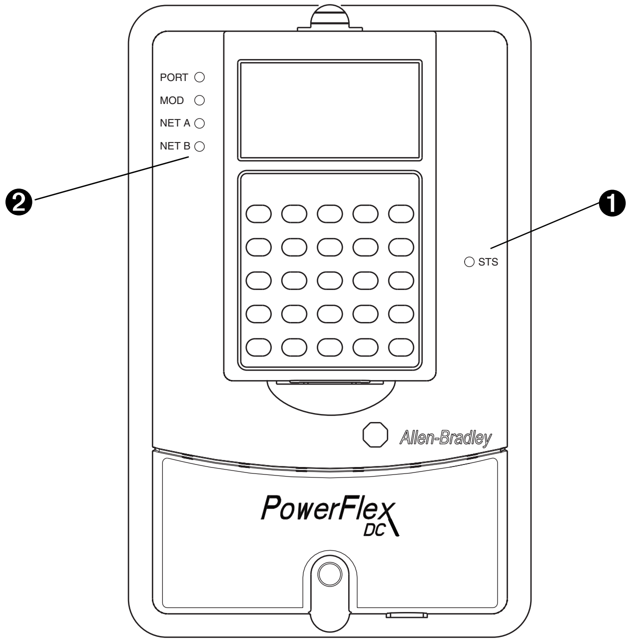
An alarm indicates a drive error condition that does not stop the drive, but may prevent it from starting. There are two types of alarms.

Type	Description	
①	User Configurable	This type of alarm indicates a drive error condition but does not stop the drive from starting or running. However, if this type of alarm is left uncorrected, a fault condition may eventually occur.
②	Non-Configurable	This type of alarm is always enabled and will prevent the drive from starting until the alarm condition is corrected.

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).

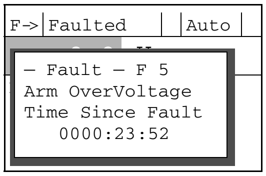
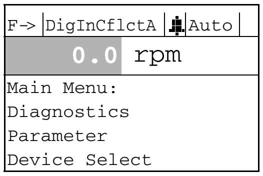
Figure 49 - Drive Status Indicators



#	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	Flashing, Drive Stopped	A condition exists that is preventing the drive from starting. Check parameters 1403 [Start Inhibits] and/or 1380 [Drive Alarm 1].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 1380 [Drive Alarm 1]. Refer to Fault Descriptions on page 198 and/or Alarm Descriptions on page 203.
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 1380 [Drive Alarm 1]. Refer to Fault Descriptions on page 198 and/or Alarm Descriptions on page 203.
		Red	Flashing	A fault has occurred. Check [Fault x Code] or view the Fault Queue on the HIM. Refer to Fault Descriptions on page 198.
			Steady	A non-resettable, non-configurable fault has occurred. Check [Fault x Code] or view the Fault Queue on the HIM. Refer to Fault Descriptions on page 198.
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).

HIM Indicators

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

Condition	Display
The 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 the fault occurred Press "Esc" to regain HIM control.	 F-> Faulted Auto — Fault — F 5 Arm OverVoltage Time Since Fault 0000:23:52
The drive is indicating an alarm. The LCD HIM immediately reports the alarm condition by displaying the following: • Alarm name • Alarm bell graphic	 F-> DigInCflctA 🔔 Auto 0.0 rpm Main Menu: Diagnostics Parameter Device Select

Manually Clearing Faults

Step	Key(s)
1. Press "Esc" to acknowledge the fault. The fault information will be removed so that you can use the HIM.	Esc
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.	
3. After corrective action has been taken, clear the fault by **one** of these methods. • Press "Stop" • Cycle drive power • Set parameter 1347 [Fault Clear] to 1 "Clear Faults" • "Clear Faults" on the HIM Diagnostic menu	○

Fault Descriptions

Table 37 - Fault Types, Descriptions and Actions

Fault	No.	Type(1)	Description/Possible Cause(s)	Action(s)
AC Undervoltage	4	①	There is an undervoltage on the power circuit (can only occur while the drive is active, i.e., running or jogging). Possible causes include:	
			• Par 481 [UnderVolt Thresh] is set incorrectly (possibly set to 400V when the drive is rated for 230V input power).	Set Par 481 [UnderVolt Thresh] correctly and then reset the drive via Par 1347 [Fault Clear].

			• The incoming voltage to the power terminals (U/V/W) of the drive is too low due to:
			  • The AC input voltage is too low or one phase is missing (< 100 Vac)
			  • There are poor cable connections (for example terminals on contactor, choke, filter, etc., is not properly connected).
				• Verify AC input power level.
				• Check all connections.

			• The line fuses have tripped. • The AC input voltage dips or there is a high disturbance in the supply voltage.	1. Remove power from the drive. 2. Eliminate AC input voltage dips and/or disturbances. 3. Replace any blown fuses.
			• A fuse(s) on the overvoltage clipping board has blown (frame D drives only).	Check the fuses on the overvoltage clipping board and replace as necessary.
			Note: This fault will also occur if the control board is separately powered and started without AC input voltage.	
Arm Overvoltage	5	①	There is an overvoltage on the armature circuit (125% of Par 175). Possible causes include:	
			• Par 175 [Rated Motor Volt] is set too low.	Set Par 175 [Rated Motor Volt] correctly.
			• The drive is not configured to use field weakening, but the motor can only reach the set speed when the drive is in field weakening mode.	Check the value of Par 469 [Field Mode Sel] and set accordingly.
			Note: Configure with Par 203 [OverVolt Flt Cfg].	
Auxiliary Input	2	①	An auxiliary input interlock is open or a voltage (+15 - 30 V) or reference signal is missing for the digital input set to 14 "Aux Fault". Note: Configure with Par 354 [Aux Inp Flt Cfg].	Check remote wiring.
Drive Overload	64	②	The rated drive current (Par 465 [Drive Size]) has been exceeded by 150% for 1 minute.	Reduce the drive current limits.
Dsp Error	132	②	A non-resettable software error exists on the Control board.	Cycle power to the drive. If the problem persists, replace the Control board.
EEPROM Error	100	②	One of the following has occurred: • There was a problem saving parameter values or there has been a control board change. • You have upgraded from one major firmware revision to another (e.g., v2.xxx to v3.xxx). Note: When this fault occurs, all parameters will be reset to their default values.	1. Reset the fault. 2. If this fault occurs again, cycle power to the drive. 3. If the problem persists, replace the Control board.

Fault	**No.**	**Type**[1]	**Description/Possible Cause(s)**	**Action(s)**
Feedback Loss	91	①	Possible causes include:	
			The drive is not receiving a speed feedback signal due to:	
			- The conductors of the feedback signal have been interrupted.	Current from one or more of the feedback device wires is not reaching the drive. Check the feedback device wiring.
			- One or several encoder channels are missing (conductor interruption, no encoder power supply).	Check the encoder connections and power supply.
			The measured speed (from an encoder or analog tach) differs from the calculated speed (based on armature voltage) by more than the value in Par 455 [Spd Fdbk Error] due to:	
			- The motor voltage is incorrect.	1. Verify that Par 175 [Rated Motor Volt] is set correctly 2. Tune the motor.
			- The ramp rate is too fast for the connected load.	1. Reduce the load. 2. Reduce the ramp rate.
			- Field Weakening is set incorrectly.	Verify the that the value of Par 456 [Fld Weaken Ratio] is set properly.
			The encoder configuration is incorrect.	1. Verify the setting of DIP switch S20 (see page 69) and parameters 652 [Encoder Err Chk] and 911 [Z Channel Enable]. 2. Verify that the connected encoder is capable of the input and output voltage as determined by DIP switch S21 (see page 69).
			Note: Par 455 [Spd Fdbk Error] can be adjusted, if needed, to reduce fault occurrences. Configure with Par 478 [Spd Loss Flt Cfg].	
Fld Current Loss	6	①	The field current is too low. Possible causes include:	
			- The field current regulator is currently not enabled.	Enable the field current regulator via Par 497 [Field Reg Enable].
			- The conductors in the field circuit have been interrupted.	Check the motor field wiring. Measure the resistance of the motor and verify that it matches motor nameplate data.
			- The field fuses are currently open.	Check the field fuses and replace as necessary.
			Note: Configure with Par 473 [FldLoss Flt Cfg].	
Hardware Fault	130	②	A non-resettable hardware error has occurred.	Cycle power to the drive. If the problem persists, replace the Control board.
Heatsink OvrTemp	8	②	The heatsink temperature is too high Possible causes include:	
			- The surrounding air temperature is too high.	Lower the surrounding air temperature.
			- The drive's cooling fans have failed (drives > 110 A).	Check the fan fuses and fans. - If the fan fuses have failed, replace the fuses. (The fans are protected by the fuses in the power supply circuit and are contained on the Switching Power Supply circuit board in frame A and B drives only. See Control Power Circuit Protection Fuses on page 233.) - If the fans have failed, replace the fans.
			- The heatsink is dirty.	Clean the heatsink.
Interrupt Error	131	②	A non-resettable software error has occurred in the main application.	Report this error to the manufacturer.
Inverting Fault	37	②	A digital input (Pars 133-144) configured as 64 "Invert Flt" has been asserted.	Check the status of the inverting fault device connected to the digital input.
Main Contactor	10	②	One of the following has occurred: - The Main and/or Dynamic Brake (DB) contactor failed to open or close in the proper amount of time. - A digital input and/or relay output 1 is incorrectly wired and/or configured. - Wiring to a digital input configured for contactor has opened.	- Check all contactor wiring and drive jumpers. Repair or replace the contactor(s) if the problem(s) persist. - Check the digital input and/or relay output 1 (terminals 35 and 36) wiring and configuration using Pars 1391 [ContactorControl], 1392 [Relay Out 1 Sel] and [Digital Inx Sel]. Refer to Using Contactors on page 31 for more information.

Fault	No.	Type(1)	Description/Possible Cause(s)	Action(s)
Motor Overload	7	①	The selected motor overload current level (set in Par 179 [Nom Mtr Arm Amps]) has been exceeded. The limits are based on the value of Par 376 [MtrOvrld Type]. 0 "StandardDuty" is 150% for 60 sec. or 200% for 3 sec. 1 "HeavyDuty" is 200% for 1 minute.	Reduce the motor load, current limits, and/or ramp times.
			Note: Configurable with Par 479 [MtrOvrld Flt Cfg].	
Motor Over Temp	16	①	The motor has exceeded its temperature rating (as signaled by the thermistor connected to the drive terminals 78 and 79). Possible causes include:	
			• The motor does not have a thermistor and there is no resistor between terminals 78 and 79 on the drive.	Refer to Thermistors and Thermal Switches on page 56 for configuration information.
			• The cable between the thermistor connection on the motor and terminals 78 and 79 on the drive has been broken.	Check and repair any damage to or loss of connection of the thermistor cables between the motor and drive.
			• The overheating of the motor may have been caused by one of the following: • The Load cycle is too extreme. • The surrounding air temperature at the site of motor is too high. • The motor has an external fan and the fan failed. • The motor does not have an external fan and the load is too large at low speeds. The cooling effect of the internal fan on the motor shaft is too low for this load cycle.	Reduce the load. Reduce the surrounding air temperature. Replace the motor fan. Reduce the load cycle or fit the motor with an external fan.
			Note: Configure with Par 365 [OverTemp Flt Cfg].	
No Fault	0	–	There are currently no faults in the drive.	Informational only.
Overcurrent	13	①	An overcurrent has occurred in the motor circuit. Possible causes include:	
			• There is a short-circuit or ground fault at the output of the drive.	Verify the armature circuit wiring is correct.
			• The current regulator was not properly fine tuned.	Refer to Tune the Current Regulator: on page 2-92.
			• The value of Par 584 [OverCurrent Thr] is too low.	Increase the value of Par 584 [OverCurrent Thr] accordingly.
Overspeed	25	②	The Encoder or Tachometer feedback indicated a speed that is more than the value of Par 585 [Overspeed Val].	Remove the excessive load or overhauling conditions or increase the value of Par 585 [Overspeed Val].
			Note: Configurable with Par 585 [Overspeed Val].	
Params Defaulted	48	②	User parameters have been reset to their default values.	Informational only.
Port 1-5 Adapter	71 - 75	②	The communications card has a fault.	Check the DPI device event queue and corresponding fault information for the device.
Port 1-5 DPI Loss	81 - 85	②	The DPI port stopped communicating.	1. Check the HIM connection. 2. If adapter was not intentionally disconnected, check the wiring to the port. Replace the wiring, port expander, adapters, Control Board or complete drive as required. 3. If an adapter was intentionally disconnected and the bit for that adapter in Par 591 [Logic Mask] is set to "1", this fault will occur. To disable this fault, set the appropriate bit in [Logic Mask] for the adapter to "0."

Fault	**No.**	**Type(1)**	**Description/Possible Cause(s)**	**Action(s)**
Power Failure	3	②	Possible causes include:	
			IMPORTANT Remove power from the drive before removing the I/O terminal blocks and/or fuses.	
			There is a fault in the 24V Control board supply - the voltage is below the permitted value. In most cases the cause is in the external I/O wiring.	• Pull the plug-in I/O terminal blocks out of the control circuit board and reset the drive via 1347 [Fault Clear]. If there are no other faults, check the I/O wiring for a short-circuit including the cable shielding. • Check fuses F1 and F2 located on the Switching Power Supply circuit board (frame A size drives only have one fuse - F1). Replace as necessary.* • Check varistor fuses F1, F2, and F3 on the Pulse Transformer or Transient Noise Filter circuit boards for Frame C size drives. Replace as necessary.* • If this fault occurs again, an internal fault may be present. Contact your Rockwell Automation sales office. *Note: Refer to Control Power Circuit Protection Fuses on page 233 for fuse sizing information.
			The incoming voltage to the control power terminals (U2, V2) is too low due to: • The AC input voltage is too low • There are poor cable connections. • The fuse(s) on the Switching Power Supply circuit board have blown.	• Verify AC input power level. • Check all connections. • Check and replace the fuse(s) if necessary.
STune Aborted	62	②	The speed regulator auto tuning procedure has been stopped by the user.	Informational only.
STune CurLimit	59	②	One of the following has occurred:	
			• The value of Par 1048 [Autotune Cur Lim] for auto tuning the speed regulator is set too high.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
			• Par 107 [Speed Zero Level] and/or 108 [Speed Zero Delay] is set too high.	Set Pars 107 and 108 to their default values when performing the Speed Loop Autotuning function.
STune FrictionLo	60	②	The friction value attained during the auto tuning procedure is zero or lower than the control precision limit.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune LoadHi	58	②	One of the following has occurred:	
			• The loading torque value is too high at zero speed to complete the speed regulator auto tuning procedure.	Decrease the load torque, where applicable, and repeat the auto tune procedure.
			• Par 107 [Speed Zero Level] and/or 108 [Speed Zero Delay] is set too high.	Set Pars 107 and 108 to their default values when performing the Speed Loop Autotuning function.
STune Overspeed	56	②	The measured motor speed is too high during the speed regulator auto tuning procedure.	Decrease the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune Stalled	57	②	The drive stalled during the speed regulator auto tuning procedure.	Increase the value of Par 1048 [Autotune Cur Lim] and repeat the auto tune procedure.
STune Timeout	61	②	The speed regulator auto tuning procedure did not complete within the available time or the current regulator auto tuning procedure did not complete within 15 minutes.	Verify the value in Par 1048 [Autotune Cur Lim]. If this value is set to low, the motor will not be able to reach a maximum speed of 33% of the lower of the values in Par 45 [Max Ref Speed] or Par 3 [Max Speed Fwd] or Par 4 [Max Speed Rev] and not be able to complete the test. Set these values appropriately and repeat the auto tuning procedure.
Sustained Curr	70	②	One of the following has occurred: • The motor CEMF is too high or the line voltage is too low • A current bridge change command has not completed within 1 second	• Check the line voltage and frequency. • Check the motor brushes and connections. • Check the Main and DB Contactor connections if present. • Verify that there are no overhauling loads present.

(1) See page 4-195 for a description of fault types.

Table 38 - Fault Cross Reference by Number

No.(1)	Fault
2	Auxiliary Input
3	Power Failure
4	AC Undervoltage
5	Arm Overvoltage
6	Fld Current Loss
7	Motor Overload
8	Heatsink OvrTemp
10	Main Contactor
13	Overcurrent
16	Motor Over Temp
25	Overspeed
37	Inverting Fault
48	Params Defaulted
56	STune Overspeed
57	STune Stalled
58	STune LoadHi
59	STune CurLimit
60	STune FrictionLo
61	STune Timeout
62	STune Aborted
64	Drive Overload
70	Sustained Curr
71 - 75	Port 1 Adaptor
	Port 2 Adaptor
	Port 3 Adaptor
	Port 4 Adaptor
	Port 5 Adaptor
81 - 85	Port 1 DPI Loss
	Port 2 DPI Loss
	Port 3 DPI Loss
	Port 4 DPI Loss
	Port 5 DPI Loss
91	Feedback Loss
100	EEPROM Error
130	Hardware Fault
131	Interrupt Error
132	Dsp Error

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

Clearing Alarms

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

Alarm Descriptions

The status of the alarms can be viewed in 1380 [Drive Alarm 1].

Table 39 - Alarm Descriptions and Actions

Alarm	Type	Description
AnalogCflct	②	More than one of the drive's reference inputs (Pars 70, 75 and 80 [Anlg Inx Sel], Pars 1323-1327 [DPI Px Select], or Par 1021 [Encoder Out Sel]) are set to “Speed Ref A” or “Speed Ref B”. This alarm takes precedence over the “EncoderCflct” alarm when both are present. Refer to Figure 69 or Speed Reference Selection on page 313 for a graphical representation of the drive's reference selections.
Arm Overvoltage	①	There is a possible overvoltage on the armature circuit or Par 175 [Rated Motor Volt] is set too low for the application. Refer to the “Arm Overvoltage” fault description on page 198 for more information.
Auxiliary Input	①	An auxiliary input interlock is open or a voltage (+15 - 30 V) or reference signal is missing for the digital input set to 14 “Aux Fault”. Refer to the “Auxiliary Input” fault description on page 198 for more information.
BipolarCflct	②	Par 1322 [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.”
CntactrCflct	②	Contactor input functions are in conflict: • When Par 1391 [ContactorControl] is set to “None”, both relay outputs (Pars 1392 [Relay Out 1 Sel] and 629 [Relay Out 2 Sel] and all digital inputs ([Digital Inx Sel]) cannot be set to “Contactor” or “ContactorDB”. • With [ContactorControl] set to “AC Cntcr” or “DC Cntcr”, one relay output and one digital input must be set to “Contactor”. No relay or digital output can be defined as “ContactorDB”. • With [ContactorControl] set to “AC Cntcr+DB” or “DC Cntcr+DB”, both relay outputs and one digital input must be set to “Contactor”, “ContactorDB” and “Contactor”, respectively. Because any relay output can be configured as contactor or DB control and any digital input as contactor status, care must be taken to correctly wire the terminal blocks to match the parameter selections.
DigInCflctA	②	Digital input functions are in conflict. Combinations marked with a “🔔” will cause an alarm.

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

<table>
<tr><th>Alarm</th><th>Type</th><th>Description</th></tr>
<tr><td>DigInCflctB</td><td>②</td><td>One of the following digital input conflicts exists:
• A digital Start input has been configured without a Stop input
• None of the digital inputs are configured for “Enable”
• Other digital input functions are in conflict. Combinations that conflict are marked with a “🔔” and will cause an alarm.
<table>
<tr><th></th><th>Start</th><th>Stop-CF</th><th>Run</th><th>Run Fwd</th><th>Run Rev</th><th>Jog 1/2</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/Rev</th></tr>
<tr><td>Start</td><td></td><td></td><td>🔔</td><td>🔔</td><td>🔔</td><td></td><td>🔔</td><td>🔔</td><td></td></tr>
<tr><td>Stop-CF</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run</td><td>🔔</td><td></td><td></td><td>🔔</td><td>🔔</td><td></td><td>🔔</td><td>🔔</td><td></td></tr>
<tr><td>Run Fwd</td><td>🔔</td><td></td><td>🔔</td><td></td><td></td><td>🔔</td><td></td><td></td><td>🔔</td></tr>
<tr><td>Run Rev</td><td>🔔</td><td></td><td>🔔</td><td></td><td></td><td>🔔</td><td></td><td></td><td>🔔</td></tr>
<tr><td>Jog 1/2</td><td></td><td></td><td></td><td>🔔</td><td>🔔</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td>🔔</td><td></td><td>🔔</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td>🔔</td><td></td><td>🔔</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd/Rev</td><td></td><td></td><td></td><td>🔔</td><td>🔔</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>DigInCflctC</td><td>②</td><td>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
Run Forward
Jog Forward
Jog Reverse
Speed Select 1
Speed Select 2
Speed Select 3
Acc2 / Dec2
Accel 2
Decel 2
Run</td></tr>
<tr><td>EncoderCflct</td><td>②</td><td>One of the following has occurred:
• Par 414 [Fdbk Device Type] is set to 1 “Encoder” and Par 1021 [Encoder Out Sel] is not set to 0 “Off”. If you are using an encoder, set Par 1021 [Encoder Out Sel] to 0 “Off”.
• More than one of the following parameters contains the same value: Pars 1021 [Encoder Out Sel], 70, 75 and 80 [Anlg Inx Sel], and/or 1323 - 1327 [DPI Px Select].</td></tr>
<tr><td>Feedback Loss</td><td>①</td><td>The drive is not receiving a speed feedback signal from the encoder. Refer to the “Feedback Loss” fault description on page 4-199 for more information.</td></tr>
<tr><td>FldCfg Cflct</td><td>②</td><td>The selected operating mode of the field controller is in conflict with another setting in the drive. This alarm displays under the following conditions:
• Par 469 [Field Mode Sel] = “Field Weaken” or “External” and Par 458 [SpdReg FB Bypass] = “Enabled”
• Par 469 [Field Mode Sel] = “Field Weaken” or “External” and Par 414 [Fdbk Device Type] = “Armature”
• Par 469 [Field Mode Sel] = “Field Weaken” or “External” and Par 478 [Spd Loss Flt Cfg] = “Alarm”
• Par 469 [Field Mode Sel] = “Field Weaken” or “Base Speed” and Par 497 [Field Reg En] = “Disabled”
• Par 469 [Field Mode Sel] = “Base Speed” and Par 498 [Force Min Field] = “Enabled”
• Par 469 [Field Mode Sel] = “Base Speed” and Par 133…144 [Digital Inx Sel] = “Force Min Fld”</td></tr>
<tr><td>Fld Current Loss</td><td>①</td><td>The field current is too low. Refer to the “Fld Current Loss” fault description on page 199 for more information.</td></tr>
<tr><td>Motor Overload</td><td>①</td><td>The selected motor overload current level has been exceeded. Refer to the “Motor Overload” fault description on page 200 for more information.</td></tr>
<tr><td>Motor Over Temp</td><td>①</td><td>The motor has exceeded its temperature rating (as signaled by the thermistor connected to the drive terminals 78 and 79). Refer to the “Motor Over Temp” fault description on page 200 for more information.</td></tr>
<tr><td>Start At PowerUp</td><td>①</td><td>Par 1344 [Start At Powerup] is enabled. The drive may start at any time after drive power up and the time specified in Par 1345 [Powerup Delay] has elapsed.</td></tr>
</table>

Common Drive Symptoms and Corrective Actions

Drive will not start

Drive Symptom	Action
An external "Start" command was issued, but the drive does not start.	• Verify that no faults or alarms are displayed. If a fault or alarm is displayed, follow the corrective action provided (refer to Fault Descriptions on page 198 or Alarm Descriptions on page 203). • The external wiring to the programmed Start terminal block connection is missing. • Verify that +24V DC is present at terminal block connection. • Verify that 24V Supply Common is connected between terminals 18 and 16. • Verify that the configuration for Pars 133…144 [Digital Inx Sel] matches the switch wiring.
The drive is not in a "Ready" state, is not "Enabled" or a "Stop" is asserted.	Check the Enable and Stop inputs. Verify that the wiring is correct (refer to I/O Wiring Examples on page 75).
External AC Input or DC Output contactor, if used, has not closed.	If using an AC Input contactor: • Verify that the drive is "Ready", then verify that the required coil voltage is present at terminals 35 and 36 (Relay Output 1). If the coil voltage is present at terminals 35 or 36, then verify that proper voltage is at the AC Input contactor coil. • Inspect the contactor for mechanical problems. • Verify that Par 1391 [ContactorControl] is set properly. • Verify that the contactor and/or auxiliary contact is properly wired to a digital input on the drive and that the appropriate digital input selection parameter (133…144 [Digital Inx Sel]) is set to 31 "Contactor". • Verify that parameter 1392 [Relay Out 1 Sel] is set to 25 "Contactor". If using an external DC Output contactor: • Verify that the drive is "Ready", then verify that the required coil voltage is present at terminals 35 and 36 (Relay Output 1). If the coil voltage is present at terminals 35 or 36, then verify that the proper voltage is at the DC Output contactor coil. • Inspect the contactor for mechanical problems. • Verify that parameter 1391 [ContactorControl] is set properly. • Verify that the contactor and/or auxiliary contact is properly wired to a digital input on the drive and that the appropriate digital input selection parameter (133…144 [Digital Inx Sel]) is set to 31 "Contactor". • Verify that parameter 1392 [Relay Out 1 Sel] is set to 25 "Contactor".

Drive Symptom	Action
The external DB resistor contactor, if used, has not closed.	• Verify that the drive is "Ready", then verify that the required coil voltage is present at terminals 75 and 76 (Relay Output 2). If the coil voltage is present at terminals 75 or 76, then verify that proper voltage is at the DB contactor coil. • Inspect contactor for mechanical problems. • Verify that parameter 1391 [ContactorControl] is set properly. • Verify that the auxiliary contacts for the AC Input or DC Output contactor and DB contactor are properly wired in series to a digital input on the drive. • Verify that the appropriate digital input selection parameter (133…144 [Digital Inx Sel]) is set to 31 “Contactor”. • Verify that parameter 629 [Relay Out 2 Sel] is set to 24 “ContactorDB”.
The drive starts from the HIM but will not start from the terminal block.	Check masks for Terminal Block control (see parameters 591 [Logic Mask] and 592 [Start Mask]).

Drive starts but motor does not turn and no armature current

Drive Symptom	Action
The drive starts but there is no armature current and the motor does not respond to a speed signal.	• Verify the wiring to the analog input(s) selected for speed reference (refer to I/O Wiring Examples on page 75). • Verify the setting(s) of switch S9 and Par 71 [Anlg In1 Config]; or S10 and Par 76 [Anlg In2 Config]; or S11 and Par 81 [Anlg In3 Config] (refer to DIP Switch and Jumper Settings on page 68). • Verify the speed selection digital input(s) and the respective input terminal voltage(s), if used. • Verify the analog input(s) voltage(s) displayed in parameters 1404 [Analog In1 Value], 1405 [Analog In2 Value] or 1406 [Analog In3 Value].

The drive starts and armature current is present but the motor does not turn.	• The Load may be too great for the motor and drive.
	  • Remove the load from the motor and test for motor rotation. If the motor rotates, then verify that the measured armature current, using an in-line current meter or DC clamp on meter, equals the armature current feedback value displayed in parameters 200 [Arm Current] and 199 [Arm Current Pct]. Increase the value of parameter 7 [Current Limit], 8 [Current Lim Pos] or 9 [Current Lim Neg].
	  • Verify that the measured motor field current, using an in-line current meter or DC clamp on meter, equals the feedback value displayed in parameter 351 [Field Current].
	  • Verify that the motor nameplate value equals the value displayed in parameter 280 [Nom Mtr Field Amps].
	  • Measure the DC voltage supplied to the motor field. Verify that the value of parameter 374 [Drv Fld Brdg Cur] equals the setting of DIP Switch S14.
	• If the motor does not rotate with the load removed, check the motor.
	  • Verify that parameter 353 [Zero Torque] is not enabled.

The motor does not reach commanded speed

Drive Symptom	Action
The drive starts and the motor turns but does reach the commanded speed.	The load may be too great for the motor and drive. • Remove the load from the motor and test for the correct commanded speed. If the motor reaches the commanded speed, then verify that the measured armature current, using an in-line current meter or DC clamp on meter, equals the armature current feedback value displayed in parameters 200 [Arm Current] and 199 [Arm Current Pct]. Increase the value of parameter 7 [Current Limit], 8 [Current Lim Pos] or 9 [Current Lim Neg]. • Verify that the measured motor field current, using an in-line current meter or DC clamp on meter, equals the feedback value displayed in parameter 351 [Field Current]. If the motor does not achieve commanded speed continue with following tests: • Check the speed parameter limits: parameters 2 [Maximum Speed], 3 [Max Speed Fwd], 4 [Max Speed Rev] and 122 [Spd Feedback]. • Check the analog voltage input and speed reference values: parameters 1404 [Analog In1 Value], 1405 [Analog In2 Value], 44 [Speed Ref A], 48 [Speed Ref B] • Check the setting of switch S9 and parameter 71 [Anlg In1 Config], S10 and 76 [Anlg In2 Config] or S11 and 81 [Anlg In3 Config]. • Tune the analog input(s) using parameters 259…261 [Anlg Inx Tune] with the potentiometer set at max. • The encoder pulse per revolution (PPR) parameter (169 [Encoder PPR]) value is too high. • The DC Tach Scaling is incorrect or the jumpers are not properly set. Check parameter 562 [Anlg Tach Gain] and check the setting of the DC Analog Tachometer DIP Switch S4 (see Figure 41 on page 70).

The motor is turning in the wrong direction

Drive Symptom	Action
The motor is rotating in the wrong direction.	The motor is incorrectly wired. • Change the armature or field connections to the drive.
	• The Polarity of the analog speed reference signal is incorrect for the required direction.

ATTENTION: If the motor is turning the wrong direction and the drive is using an encoder or DC analog tachometer for feedback and the speed feedback is correct, then the feedback wiring must be changed. If using an encoder, then two encoder connections must be reversed (A with A-Not or B with B-Not). If using a DC analog tachometer, then the tachometer leads must be reversed.

The motor reaches maximum speed immediately

Drive Symptom	Action
The motor accelerates to maximum speed and cannot be controlled.	Check the analog input voltage and speed reference values: • Parameters 1404 [Analog In1 Value], 1405 [Analog In2 Value], 44 [Speed Ref A] and 48 [Speed Ref B] • Check the setting of switch S9 and parameter 71 [Anlg In1 Config], S10 and 76 [Anlg In2 Config] or S11 and 81 [Anlg In3 Config]. The feedback device, encoder or DC analog tachometer is not connected, incorrectly connected or has failed. • Change parameter 414 [Fdbk Device Type] to 3 "Armature" to test the encoder or DC analog tachometer feedback.

Testpoint Codes and Functions

Select a testpoint with Par 1381 [TestPoint Sel]. Values can be viewed with Par 1382 [TestPoint Data].

		Values		
No.[1]	Description	Minimum	Maximum	Default
566	Rx count	0	65535	0
567	Tx count			
568	BusLoss count			
569	Port 1 Timeout			
570	Port 2 Timeout			
571	Port 3 Timeout			
572	Port 4 Timeout			
573	Port 5 Timeout			
574	Port 6 Timeout			

(1) Enter in [TestPoint Sel].

Notes:

Appendix A

Supplemental Drive Information

Specifications

Category	Specification	
Agency Certification	c UL us	According to file E59272 for the series of the approved devices.
	CE	In conformity with the following European Directives: EMC Directive (2004/108/EC) Low Voltage Directive (2006/95/EC) Standards applied: EN 50178: 1997 EN 61800-3: 2004
	✓	Australian Communications and Media Authority In conformity with the following: Radio communications Act: 1992 Radio communications Standard: 2008 Radio communications Labelling Notice: 2008 Standards applied: EN 61800-3:2004
	The drive is also designed to meet the following specifications: NFPA 70 - US National Electrical Code	

Category	Specification	
Drive Type	Full Wave Regen, 6 Pulse, Regulated Field Supply	
Protection	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip:	 200% of rated current (typical) 220-300% of rated current (dependent on drive rating)
	Line transients:	Up to 2000 volts peak per IEC 6100-4-5
	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(1)	Altitude:	1000 m (3300 ft) max. without derating. De-rate output power by 1.2% for every 100 meters (328ft) above 1000 meters (3300ft).
	Maximum Surrounding Air Temperature IP20, NEMA Type Open:	0…50° C (32…122° F), typical. De-rate 1.25% for every 1° C over 50° C (122° F), to 55° C (131° F). Additional cooling is required for temps. above 55° C.
	Storage Temp. (all const.):	–25 to 55 degrees C (–13 to 131 degrees F)
	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
	Relative Humidity:	Operating: 5 to 85% non-condensing Storage: 5 - 95% non-condensing
	Shock:	15G peak for 11ms duration (±1.0 ms)
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak

(1) PowerFlex DC drives must be installed in a Pollution Degree 2 environment.

Category	Specification		
Electrical	Input Voltages:	230 to 690V AC +/- 10%, 3 Phase	
	Input Frequency:	50/60 Hz +/- 5%	
	Max. Rate of Change of Input Frequency:	2 Hz/Sec.	
	Armature Output Voltage:	Two Quadrant Drives	Four Quadrant Drives
		260V DC @ 230V AC	240V DC @ 230V AC
		470V DC @ 400V AC	420V DC @ 400V AC
		530V DC @ 440V AC	460V DC @ 440V AC
		560V DC @ 460V AC	480V DC @ 460V AC
		580V DC @ 480V AC	500V DC @ 480V AC
		680V DC @ 575V AC	600V DC @ 575V AC
		810V DC @ 690V AC	720V DC @ 690V AC
	Output Horsepower (Cont.)	1.5…300 HP @ 230V AC 2…900 HP @ 460V AC 50…1250 HP @ 575V AC 400…1400 HP @ 690V AC	
	Output Current:	4.1…1688A	
	Overload Capability:	100% rated continuous current 150% rated current for one minute then fault 200% rated current for three seconds then fault	
	Field Output Voltage	200V DC @ 230V AC 310V DC @ 400V AC 360V DC @ 460V AC Maximum field output voltage is 0.85 x AC input line voltage.	
	Controller Current Overload:	150% rated current for one minute 200% rated current for three seconds	
	Max. Short Circuit Rating:	100,000 A	
Control	Speed Regulation:(1)	All operating modes: Max. speed: 8000 rpm Digital reference resolution: 0.25 rpm Analog reference resolution: ≥ 0.25 rpm	
		with Digital Incremental Encoder Speed feedback resolution 0.5 rpm Operating range better than 1000:1 rpm, bi-directional Performance Accuracy ±0.02% typical 170 rad/sec bandwidth	
		with DC Analog Tachometer Speed feedback resolution better than 2000:1 rpm Operating range better than 1000:1 rpm, bi-directional Performance accuracy ±0.1% 170 rad/sec bandwidth	
		with Armature Voltage Feedback Voltage feedback resolution better than 2000:1 rpm Operating range better than 100:1 rpm, bi-directional Performance accuracy: ±2.0% typical 80 rad/sec bandwidth	
	Torque Regulation	Current feedback resolution better than 2000:1 rpm	
		Performance accuracy: 1.0% typical	
		500 rad/sec bandwidth	

(1) Subject to motor specs, current loop tuning.

Category	Specification	
Feedback Devices	Encoder	Type: Incremental, dual channel, two channel optional (with jumper), differential (recommended) or single-ended
		Input Voltage: Configurable for +2.5V…5.2V (switch S21 in ENC_5 position) or +5.4V…15.2V (switch S21 in ENC_12 position). Note: The encoder must be capable of the same power supply (input) and feedback level (output) voltage (see page 69).
		Input Current: 3 mA…10.9 mA each channel
		Quadrature: 90° ± 27° @ 25° C
		Duty cycle: 50% ± 10% Source/Sink capable
		Pulses Per Revolution: 100 to 32770
		Maximum Frequency: 150 kHz
		Maximum Cable Length: Shielded, 150m (0.75 mm^2), 125m (0.5 mm^2), 55m (0.22 mm^2)
	DC Analog Tachometer	Input Voltage: 22.7, 45.4, 90.7, 181.6, & 302.9V max.
		Input Current: 8 mA full scale
		Maximum Cable Length: Shielded, depends on the installation, typical 150m.
Inputs	Analog Inputs	Three configurable, isolated, differential
		±10V, 0-10V, 0-20mA or 4-20mA.
		Resolution: 11 Bit + sign
	Digital Inputs	Eight standard configurable, four additional configurable with the I/O Expansion circuit board.
		Max Voltage +30V DC input, 200mA (total current draw is the sum of encoder power, digital outputs and any other loads connected to terminal 19)
Outputs	Analog Outputs	Two standard configurable, two additional configurable with the I/O Expansion circuit board. Sampling rate 2 ms.
		± 10V, 5mA, bipolar (current is not bipolar)
		Resolution: 11 Bit + sign
	Digital Outputs	Four standard configurable, four additional configurable with the I/O Expansion circuit board.
		+ 30V, 50mA
	Relay Outputs	Two configurable, N.O. contacts
		Max. 250V AC, 1A AC1

IP20 NEMA UL/Type Open Watts Loss

Watts loss data shown below is based on the rated current of the drive.

Table 40 - Frame A Drives Watts Loss and Fan Capacity

Drive Current Rating Code(1)		Total Watts Loss	Fan		
@ 230 VAC	**@ 460 VAC**		**Input Voltage**	**Rated Current**	**Air Flow Capacity (m³/h)**
7P0	4P1	131	(no fan)		
9P0	6P0				
012	010				
020	014				
–	019				
029	027	186			
038	035	254	(Internal power supply)		80
055	045				
–	052				
073	073	408			160
093	086	476			
110	–				
–	100	553			
–	129				

(1) Refer to Standard Drive Catalog Number Explanation on page 15, positions 8-10 for corresponding drive HP rating, armature amp rating and field amp rating.

Table 41 - Frame B Drives Watts Loss and Fan Capacity

Drive			Fans		
Current Rating Code(1)	**AC Input Voltage**	**Total Watts Loss**	**Input Voltage**	**Rated Current**	**Air Flow Capacity (m³/h)**
146	230	781	(Internal power supply)		320
180					
218		939			
265		1038			
360		1693			680
434					
167	460	781			320
207		939			
250		1038			
330		1248			
412		1693			680
067	575	400			320
101		553			
135		700			
270		1038			
405		1693			680

(1) Refer to Standard Drive Catalog Number Explanation on page 15, positions 8-10 for corresponding drive HP rating, armature amp rating and field amp rating.

Table 42 - Frame C Drives Watts Loss and Fan Capacity

Drive			Fans (2)		
Current Rating Code(1)	AC Input Voltage	Total Watts Loss	Input Voltage (VAC)	Rated Current (A)	Air Flow Capacity (m^3/h)
521	230	2143	230	0.75	1050
700		2700			
495	460	2143			
667		2590			
540	575	2300			
675		2620			
452	690	1700			
565		2300			

(1) Refer to Standard Drive Catalog Number Explanation on page 15, positions 8-10 for corresponding drive HP rating, armature amp rating and field amp rating.

(2) Fans on frames C drives must be powered by an external 230 V AC, 50/60 Hz power supply, connected to terminals U3 and V3.

Table 43 - Frame D Drives Watts Loss and Fan Capacity

Drive			Fans (2)		
Current Rating Code(1)	AC Input Voltage	Total Watts Loss	Input Voltage (VAC)	Rated Current	Air Flow Capacity (m^3/h)
875	230	2694	230	2.4A@50Hz and 3.3A@60Hz	2400
1K0		3284			
830	480	3200			
996R		3568			
1K1		4189			
1K3		5229			
1K4		5117			
810	575	3122			
1K0		3819			
1K2		4679			
1K3		4879			
1K6		5720			
678	690	3174			
791		3582			
904		4028			
1K0		4064			
1K1		4509			
1K2		5368			
1K4		5543			
1K5		5886			

(1) Refer to Standard Drive Catalog Number Explanation on page 15, positions 8-10 for corresponding drive HP rating, armature amp rating and field amp rating.

(2) Fans on frames D drives must be powered by an external 230 V AC, 50/60 Hz power supply, connected to terminals U3 and V3.

Communication Configurations

Typical Programmable Controller Configurations

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

Logic Command/Status Words

Refer to parameter 1328 [Drive Logic Rslt] for more information.

Figure 50 - Logic Command Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Command**	**Description**
															x	Stop[1]	0 = Not Stop 1 = Stop
														x		Start[1][2]	0 = Not Start 1 = Start
													x			Jog	0 = Not Jog 1 = Jog
												x				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										x	x					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									x							Local Control	0 = No Local Control 1 = Local Control
								x								MOP Increment	0 = Not Increment 1 = Increment
						x	x									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				x	x											Decel Rate	00 = No Command 01 = Use Decel Time 1 10 = Use Decel Time 2 11 = Use Present Time
	x	x	x													Reference Select[3]	000 = No Command 001 = Ref. 1 (Spd Ref A) 010 = Ref. 2 (Spd Ref B) 011 = Ref. 3 (Preset Spd 3) 100 = Ref. 4 (Preset Spd 4) 101 = Ref. 5 (Preset Spd 5) 110 = Ref. 6 (Preset Spd 6) 111 = Ref. 7 (Preset Spd 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 131- 144) is programmed for 2-Wire Control (option 5 "Run", 6 "Run Forward" or 7 "Run Reverse").

(3) This Reference Select will not function if a digital input (parameters 131- 144) is programmed for “Speed Sel 1, 2 or 3” (option 17, 18 or 19). Note that Reference Selection is “Exclusive Ownership” see [Reference Owner] on page 172.

Figure 51 - Logic Status Word

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

(1) Refer to Masks & Owners on page 171 for further information.

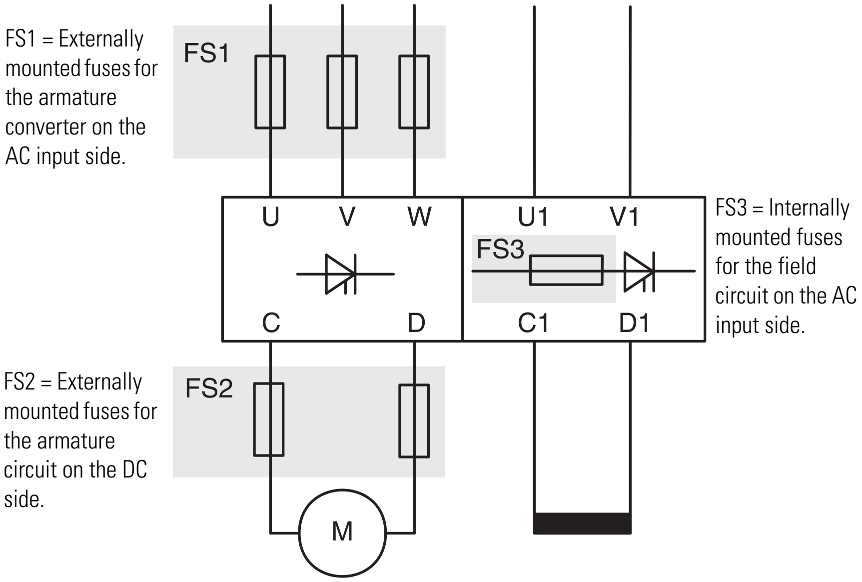
Drive Power Circuit Protection

The tables on the following pages provide the recommended fuses for protecting the armature and field circuits of the drive. Externally mounted fuses (as indicated in Figure 52 below) must be sourced separately when installing the drive. Internally mounted fuses (as indicated in Figure 52 below and Figure 55 on page 225) are provided with the drive.

See page 225 for frames C and D fuse information.

Frame A and B Fuse Information

Figure 52 - Frame A and B Fuse Table Designations



Frame A and B Recommended AC Input Line Fuses

AC input line fuses are externally mounted for frame A and B drives and must be sourced separately. See Fuse Code FS1 in Figure 52 on page 219.

Table 44 - 230V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann				Ferraz Shawmut (Gould Shawmut)	
				Ferrule FWP Type	**Ferrule Fuse Block**	**North American FWP Type**	**North American Fuse Block**	**Ferrule A70QS Type**	**North American A70P / A70QS Type**
A	7P0	7	5.7	FWP-10A14F	CH143D	FWP-10B	–	A70QS10-14F	A70P10-4
	9P0	9	7.4	FWP-15A14F		FWP-15B	–	A70QS16-14F	A70P15-4
	012	12	9.8	FWP-20A14F		FWP-20B	–	A70QS20-14F	A70P20-4
	020	20	16	FWP-25A14F		FWP-25B	–	A70QS25-14F	A70QS25-4
	029	29	24	FWP-40A22F	CH223D	FWP-40B	–	A70QS40-22F	A70QS40-4
	038	38	31	FWP-63A22F		FWP-60B	–	A70QS63-22F	A70QS60-4
	055	55	45	FWP-80A22F		FWP-80B	–	A70QS80-22F	A70QS80-4
	073	73	60	–	–	FWP-100A	ST14	–	A70QS100-4K
	093	93	76	–	–	FWP-150A		–	A70QS150-4K
	110	110	90	–	–	FWP-175A		–	A70QS175-4K
B	146	146	119	–	–	FWP-250A		–	A70QS250-4
	180	180	147	–	–	FWP-300A		–	A70QS300-4
	218	218	178	–	–	FWP-350A		–	A70QS350-4
	265	265	217	–	–	FWP-400A	ST38-72612	–	A70QS400-4
	360	360	294	–	–	FWP-600A		–	A70QS600-4K
	434	434	355	–	–	FWP-600A		–	A70QS600-4

Table 45 - 460V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann				Ferraz Shawmut (Gould Shawmut)	
				Ferrule FWP Type	**Ferrule Fuse Block**	**North American FWP Type**	**North American Fuse Block**	**Ferrule A70QS Type**	**North American A70P / A70QS Type**
A	4P1	4.1	3.3	FWP-10A14F	CH143D	FWP-10B	–	A70QS10-14F	A70P10-4
	6P0	6	4.9	FWP-10A14F		FWP-10B	–	A70QS10-14F	A70P10-4
	010	10	8.2	FWP-20A14F		FWP-20B	–	A70QS20-14F	A70P25-4
	014	14	11.4	FWP-25A14F		FWP-25B	–	A70QS25-14F	A70P25-4
	019	19	15.5	FWP-25A14F		FWP-25B	–	A70QS25-14F	A70P25-4
	027	27	22.1	FWP-40A22F	CH223D	FWP-40B	–	A70QS40-22F	A70QS40-4
	035	35	28.6	FWP-63A22F		FWP-60B	–	A70QS63-22F	A70QS60-4
	045	45	36.8	FWP-80A22F		FWP-80B	–	A70QS80-22F	A70QS80-4
	052	52	42.5	FWP-80A22F		FWP-80B	–	A70QS80-22F	A70QS80-4
	073	73	59.6	–	–	FWP-100A	ST14	–	A70QS100-4K
	086	86	70.3	–	–	FWP-150A		–	A70QS150-4K
	100	100	81.7	–	–	FWP-175A		–	A70QS175-4K
	129	129	105.4	–	–	FWP-175A		–	A70QS175-4K
B	167	167	136.4	–	–	FWP-300A		–	A70QS300-4
	207	207	169.1	–	–	FWP-350A		–	A70QS350-4
	250	250	204.3	–	–	FWP-400A	ST38-72612	–	A70QS400-4
	330	330	269.6	–	–	FWP-600A		–	A70QS600-4K
	412	412	336.6	–	–	FWP-600A		–	A70QS600-4

Table 46 - 575V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann	Ferraz Shawmut (Gould Shawmut)
				North American FWP Type	**North American A70QS Type**
B	067	67.5	55.1	FWP-100A	A70QS100-4
	101	101.3	82.7	FWP-175A	A70QS175-4K
	135	135	110.3	FWP-225A	A70QS225-4
	270	270	220.6	FWP-450A	A70QS450-4
	405	405	330.9	FWP-600A	A70QS600-4K

Frame A and B Recommended Armature DC Output Fuses

Armature DC output fuses are externally mounted for frame A and B drives and must be sourced separately. These fuses are required on four quadrant drives only, but highly recommended on two quadrant drives. See Fuse Code FS2 in Figure 52 on page 219.

Table 47 - 230V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann				Ferraz Shawmut (Gould Shawmut)	
				Ferrule FWP Type	**Ferrule Fuse Block**	**North American FWP Type**	**North American Fuse Block**	**Ferrule A70QS Type**	**North American A70P / A70QS Type**
A	7P0	7	5.7	FWP-15A14F	CH142D	FWP-15B	–	A70QS16-14F	A70P15-4
	9P0	9	7.4	FWP-20A14F		FWP-20B	–	A70QS20-14F	A70P20-4
	012	12	9.8	FWP-25A14F		FWP-25B	–	A70QS25-14F	A70P25-4
	020	20	16	FWP-40A14F		FWP-40B	–	A70QS40-14F	A70QS40-4
	029	29	24	FWP-63A22F	CH222D	FWP-60B	–	A70QS63-22F	A70QS60-4
	038	38	31	FWP-80A22F		FWP-80B	–	A70QS80-22F	A70QS80-4
	055	55	45	–	–	FWP-125A	ST14	–	A70QS125-4K
	073	73	60	–	–	FWP-150A		–	A70QS150-4K
	093	93	76	–	–	FWP-200A		–	A70QS200-4K
	110	110	90	–	–	FWP-225A		–	A70QS250-4
B	146	146	119	–	–	FWP-300A		–	A70QS300-4
	180	180	147	–	–	FWP-350A			A70QS350-4
	218	218	178	–	–	FWP-450A	ST38-72612	–	A70QS450-4
	265	265	217	–	–	FWP-600A		–	A70QS600-4K
	360	360	294	–	–	FWP-700A		–	A70QS700-4
	434	434	355	–	–	FWP-900A	–	–	A70P900-4

Table 48 - 460V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann				Ferraz Shawmut (Gould Shawmut)	
				Ferrule FWP Type	Ferrule Fuse Block	North American FWP Type	North American Fuse Block	Ferrule A70QS Type	North American A70P / A70QS Type
A	4P1	4.1	3.3	FWP-10A14F	CH142D	FWP-10B	–	A70QS10-14F	A70P10-4
	6P0	6	4.9	FWP-15A14F		FWP-15B	–	A70QS16-14F	A70P15-4
	010	10	8.2	FWP-20A14F		FWP-20B	–	A70QS20-14F	A70P20-4
	014	14	11.4	FWP-30A14F		FWP-30B	–	A70QS32-14F	A70P30-4
	019	19	15.5	FWP-40A14F		FWP-40B	–	A70QS40-14F	A70QS40-4
	027	27	22.1	FWP-63A22F	CH222D	FWP-60B	–	A70QS63-22F	A70QS60-4
	035	35	28.6	FWP-80A22F		FWP-70B	–	A70QS80-22F	A70QS70-4
	045	45	36.8	FWP-100A22F		FWP-90B	–	–	A70QS90-4
	052	52	42.5	FWP-100A22F		FWP-100B	–	–	A70QS100-4
	073	73	59.6	–	–	FWP-150A	ST14	–	A70QS150-4K
	086	86	70.3	–	–	FWP-175A		–	A70QS175-4K
	100	100	81.7	–	–	FWP-200A		–	A70QS200-4K
	129	129	105.4	–	–	FWP-250A		–	A70QS250-4
B	167	167	136.4	–	–	FWP-350A		–	A70QS350-4
	207	207	169.1	–	–	FWP-400A		–	A70QS400-4
	250	250	204.3	–	–	FWP-500A	ST38-72612	–	A70QS500-4K
	330	330	269.6	–	–	FWP-700A		–	A70QS700-4
	412	412	336.6	–	–	FWP-800A		–	A70QS800-4

Table 49 - 575V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Bussmann	Ferraz Shawmut (Gould Shawmut)
				North American FWP Type	North American A70P / A70QS Type
B	067	67.5	55.1	FWP-125A	A70QS125-4K
	101	101.3	82.7	FWP-200A	A70QS200-4K
	135	135	110.3	FWP-250A	A70QS250-4
	270	270	220.6	FWP-600A	A70QS600-4K
	405	405	330.9	FWP-800A	A70QS800-4

Frame A and B Recommended Field Circuit Fuses

Field circuit fuses are internally mounted and provided with the drive. See Fuse Code FS3 in Figure 52 on page 219. Also, see Figure 53 on page 224 and Figure 54 on page 224 for fuse locations.

Table 50 - 230V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Type	Quantity	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
A	7P0	10	6 x 32 mm	2	FWH-016A6F	E085449	70 125 40.16
	9P0						
	012						
	020						
	029						
	038						
	055						
	073	14					
	093						
	110						
B	146	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	60 033 05.25
	180						
	218						
	265						
	360						
	434						

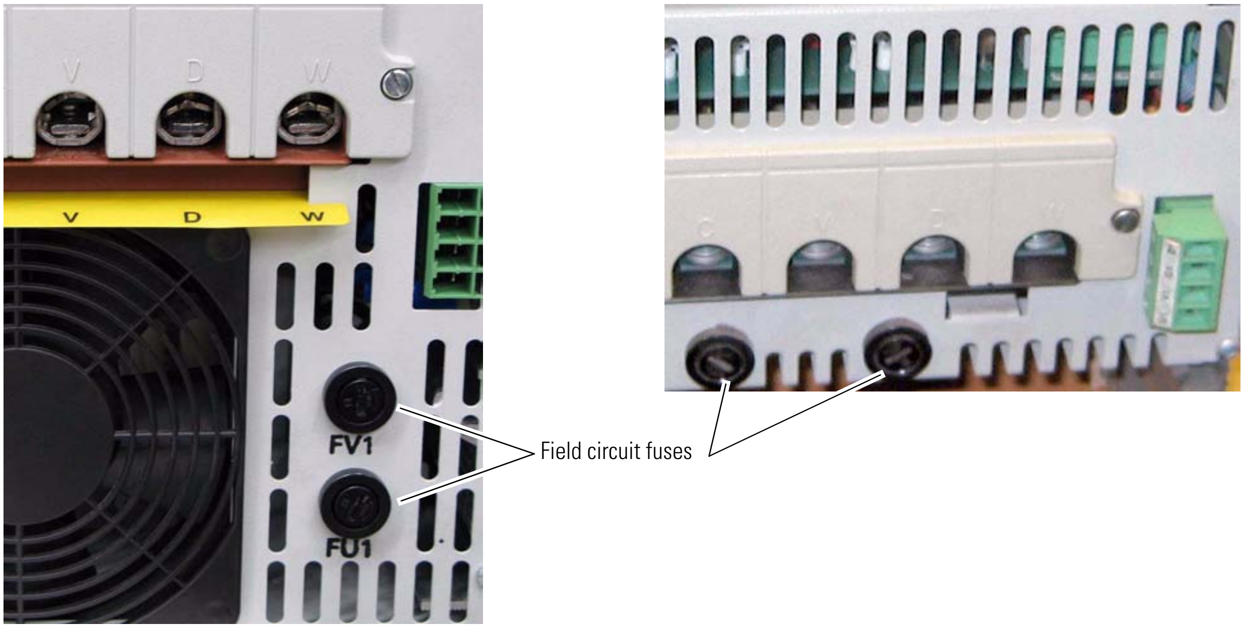
Table 51 - 460V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Type	Quantity	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
A	4P1	10	6 x 32 mm	2	FWH-016A6F	E085449	70 125 40.16
	6P0						
	010						
	014						
	019						
	027						
	035						
	045						
	052						
	073	14					
	086						
	100						
	129						
B	167	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	60 033 05.25
	207						
	250						
	330						
	412						

Table 52 - 575V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Quantity	Type	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
B	067	20	2	10 x 38 mm	FWC-25A10F	A60Q25-2	60 033 05.25
	101						
	135						
	270						
	405						

Figure 53 - Frame A Field Circuit Fuses Location

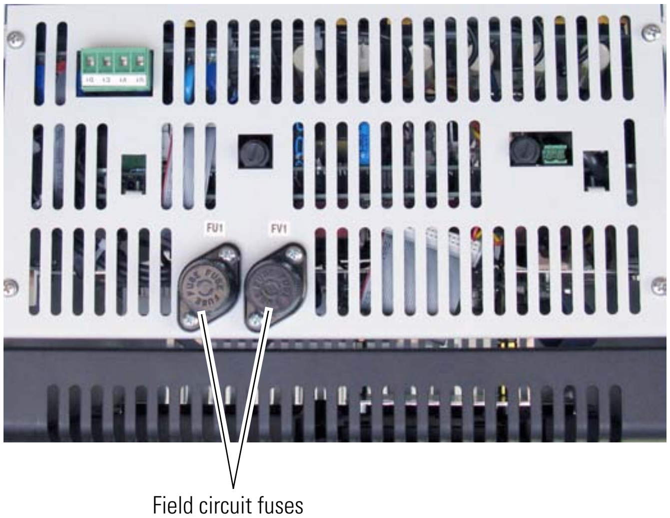


Bottom View of Drive with Fan

Bottom View of Drive without Fan

Figure 54 - Frame B Field Circuit Fuses Location

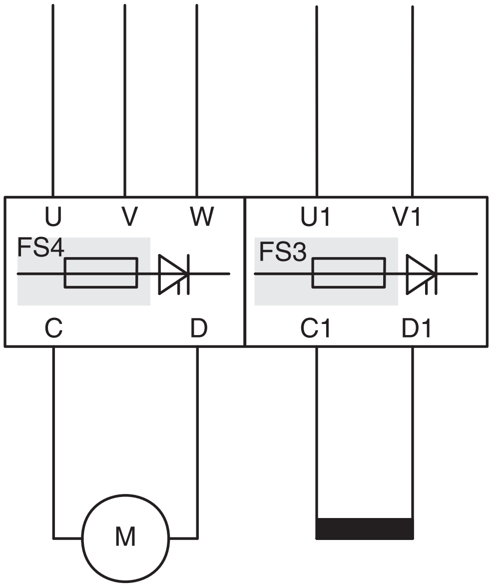
Top View of Drive



Frame C and D Fuse Information

All fuses for armature and field circuit protection are internally mounted and provided with frame C and D drives.

Figure 55 - Frame C and D Fuse Table Designations



FS4 = Internally mounted fuses for the armature converter on the AC input side.

FS3 = Internally mounted fuses for the field circuit on the AC input side.

Frame C and D Recommended Field Circuit Fuses

Field circuit fuses for frames C and D drives are internally mounted (labeled FU1 and FV1) and provided with the drive. See Fuse Code FS3 in Figure 55 above. Also, see Figure 56 on page 227 and Figure 57 on page 227 below for locations.

Table 53 - 230V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Type	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
C	521	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	6003305.25
D	875	40	22 x 58 mm		FWP-50A22F	A70QS50-22F	5014006.50
	1K0						

Table 54 - 460V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Type	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
C	495	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	6003305.25
	667					A60Q25-8	
D	830	40	22 x 58 mm		FWP-50A22F	A70QS50-22F	5014006.50
	996						
	1K1	70			FWP-100A22F	A70QS100-22F	5014006.100
	1K3						
	1K4						

Table 55 - 575V AC Input Drives

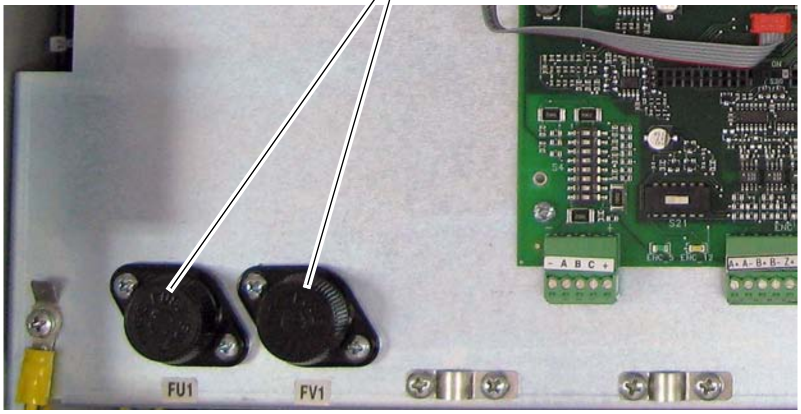
Frame	Drive Current Rating Code	Field Amps	Type	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
C	540	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	6003305.25
	675					A60Q25-8	
D	810	40	22 x 58 mm		FWP-50A22F	A70QS50-22F	5014006.50
	1K0						
	1K2						
	1K3						
	1K6						

Table 56 - 690V AC Input Drives

Frame	Drive Current Rating Code	Field Amps	Type	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
C	452	20	10 x 38 mm	2	FWC-25A10F	A60Q25-2	6003305.25
	565					A60Q25-8	
D	678	40	22 x 58 mm		FWP-50A22F	A70QS50-22F	5014006.50
	791						
	904						
	1K0						
	1K1	70			FWP-100A22F	A70QS100-22F	5014006.100
	1K2						
	1K4						
	1K5						

Figure 56 - Frame C Field Circuit Fuse Location

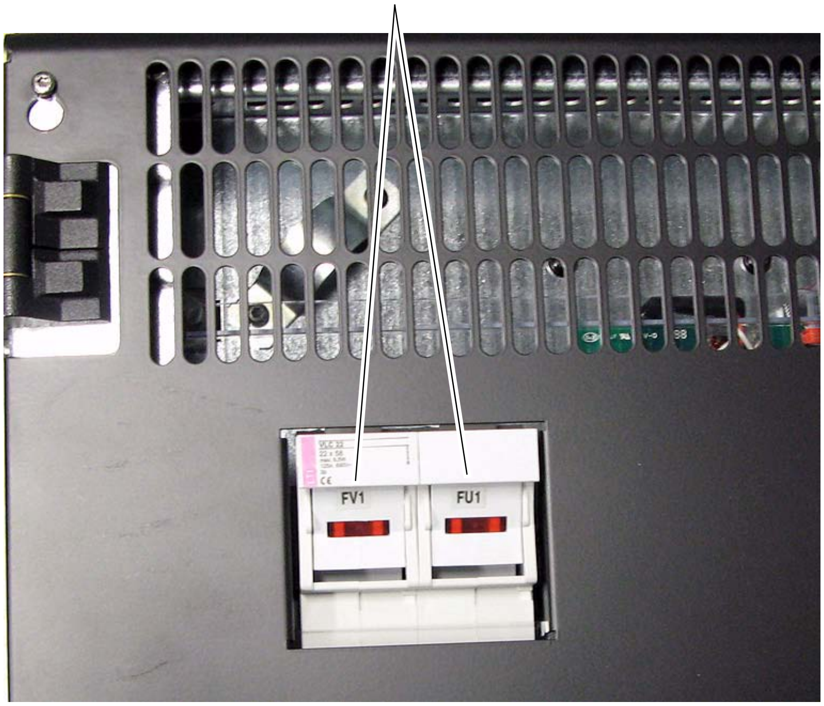
Field circuit fuses are located on the Control board EMI shield next to the Control board.



Note: Drive shown with front covers removed.

Figure 57 - Frame D Field Circuit Fuse Location

Top, left side of drive control panel.



Fuses for Regenerative Frame C and D Drives

Leg fuses are internally mounted and provided with frames C and D drives. See Fuse Code FS4 in Figure 55 on page 225. Also, see Figure 58 on page 229 location.

Table 57 - Recommended Leg Fuses - 230V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	521	521	426	6	170M5464 + switch 170H0069	6,9 URD 32 TTF 800 + switch MS 3-V1-5 BS	20 671 32.800 + switch 28 001 04
	700	700	571	6	170M5464 + switch 170H0069	6,9 URD 32 TTF 800 + switch MS 3V 1-5 BS	20 671 32.800 + switch 28 001 04

Table 58 - Recommended Leg Fuses - 230V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	875	875	715	6	170M6263 + switch 170H0069	Y300263 + switch MS 3V 1-5 UR	20 635 32.900 + switch 28 001 04
	1K0	1050	858	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04

Table 59 - Recommended Leg Fuses - 460V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	495	495	404.4	6	170M5462 + switch 170H0069	6,9 URD 32 TTF 630 + switch MS 3-V1-5 BS	20 671 32.630 + switch 28 001 04
	667	667	544.9	6	170M5464 + switch 170H0069	6,9 URD 32 TTF 800 + switch MS 3-V1-5 BS	20 671 32.800 + switch 28 001 04

Table 60 - Recommended Leg Fuses - 460V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	830	830	678.1	6	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04
	996	996	813.7	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04
	1K1	1162	949.4	6	170M6265 + switch 170H0069	A300262 + switch MS 3V 1-5 UR	20 635 32.1100 + switch 28 001 04
	1K3	1328	1085.0	6	170M6266 + switch 170H0069	B300266 + switch MS 3V 1-5 UR	20 635 32.1250 + switch 28 001 04
	1K4	1494	1220.6	6	170M6267 + switch 170H0069	C300267 + switch MS 3V 1-5 UR	20 635 32.1400 + switch 28 001 04

Table 61 - Recommended Leg Fuses - 575V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	540	540	441	6	–	11 URD 72 TTF 0800 + switch MS 3V 1-5 BS	20 771 32.800 + switch 28 001 04
	675	675	551	6	–	11 URD 72 TTF 0800 + switch MS 3V 1-5 BS	20 771 32.800 + switch 28 001 04

Table 62 - Recommended Leg Fuses - 575V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	810	810	661	6	170M6246 + switch 170H0069	J300572 + switch MS 3V 1-5 UR	20 735 32.800 + switch 28 001 04
	1K0	1080	881	6	170M6248 + switch 170H0069	L300574 + switch MS 3V 1-5 UR	20 735 32.1000 + switch 28 001 04
	1K2	1215	991	12	170M6244 + switch 170H0069	G300570 + switch MS 3V 1-5 UR	20 735 32.630 + switch 28 001 04
	1K3	1350	1102	12	170M6245 + switch 170H0069	H300571 + switch MS 3V 1-5 UR	20 735 32.700 + switch 28 001 04
	1K6	1688	1377	12	170M6246 + switch 170H0069	J300572 + switch MS 3V 1-5 UR	20 735 32.800 + switch 28 001 04

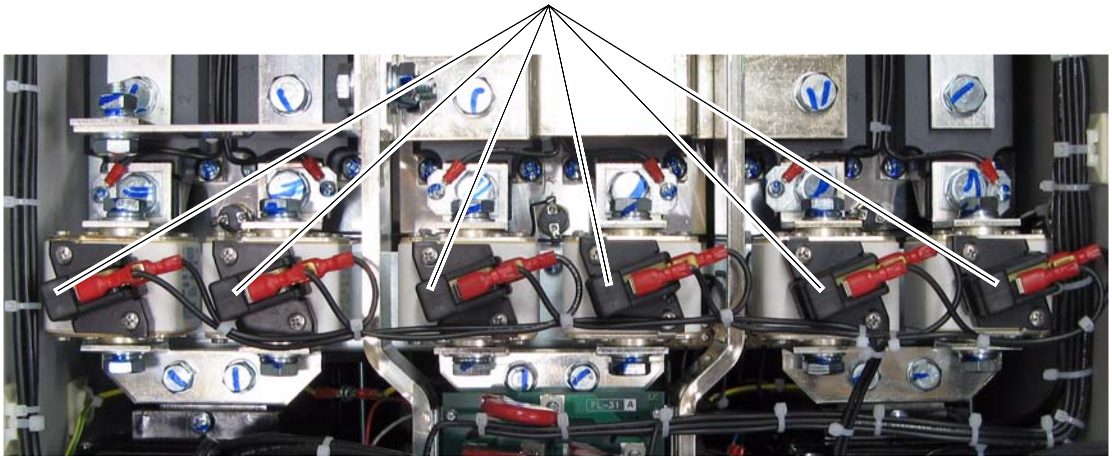
Table 63 - Recommended Leg Fuses - 690V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	452	452	369	6	170M5394 + switch 170H0069	12,5 URD 72 TTF 0500 + switch MS 3V 1-5 BS	20 771 32.500 + switch 28 001 04
	565	565	461	6	–	12,5 URD 72 TTF 0630 + switch MS 3V 1-5 BS	20 771 32.630 + switch 28 001 04

Table 64 - Recommended Leg Fuses - 690V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	678	678	553	6	170M6244 + switch 170H0069	G300570 + switch MS 3V 1-5 UR	20 735 32.630 + switch 28 001 04
	791	791	645	6	170M6246 + switch 170H0069	J300572 + switch MS 3V 1-5 UR	20 735 32.800 + switch 28 001 04
	904	904	738	6	170M6247 + switch 170H0069	K300573 + switch MS 3V 1-5 UR	20 735 32.900 + switch 28 001 04
	1K0	1017	830	6	170M6248 + switch 170H0069	L300574 + switch MS 3V 1-5 UR	20 735 32.1000 + switch 28 001 04
	1K1	1130	922	12	170M6244 + switch 170H0069	G300570 + switch MS 3V 1-5 UR	20 735 32.630 + switch 28 001 04
	1K2	1243	1014	12	170M6244 + switch 170H0069	G300570 + switch MS 3V 1-5 UR	20 735 32.630 + switch 28 001 04
	1K4	1413	1153	12	170M6245 + switch 170H0069	H300571 + switch MS 3V 1-5 UR	20 735 32.700 + switch 28 001 04
	1K5	1582	1291	12	170M6246 + switch 170H0069	J300572 + switch MS 3V 1-5 UR	20 735 32.800 + switch 28 001 04

Figure 58 - Frame C Regenerative Drive - Leg Fuse Location

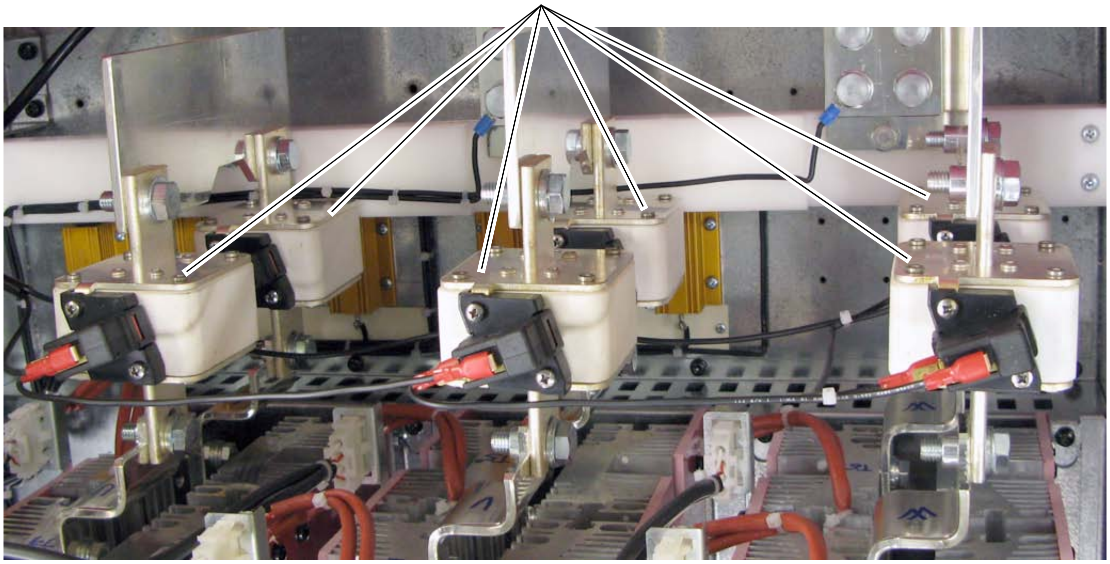


Leg fuses and switches are located on the bus bars behind the Control board EMI shield.

Note: Drive shown with front covers removed and Control board EMI shield lowered.

Figure 59 - Frame D Regenerative Drive - Leg Fuse Location

Leg fuses and switches are located on the bus bars behind the control panel, which holds the circuit boards.



Fuses for Non-Regenerative Frame C and D Drives

AC input line and/or leg fuses are internally mounted and provided with frames C and D drives. See Fuse Code FS4 in Figure 55 on page 225. Also, see Figure 60 on page 231 location.

Table 65 - Recommended AC Input Line Fuses - 230V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	521	521	426	3	170M5466 + switch 170H0069	6,9 URD 32 TTF 1000 + switch MS 3-V1-5 BS	20 671 32.1000 + switch 28 001 04
	700	700	571	3	170M5466 + switch 170H0069	6,9 URD 32 TTF 1000 + switch MS 3V 1-5 BS	20 671 32.1000 + switch 28 001 04

Table 66 - Recommended Leg Fuses - 230V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	875	875	715	6	170M6263 + switch 170H0069	Y300263 + switch MS 3V 1-5 UR	20 635 32.900 + switch 28 001 04
	1K0	1050	858	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04

Table 67 - Recommended AC Input Line Fuses - 460V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	495	495	404.4	3	170M5464 + switch 170H0069	6,9 URD 32 TTF 800 + switch MS 3-V1-5 BS	20 671 32.800 + switch 28 001 04
	667	667	544.9	3	170M5466 + switch 170H0069	6,9 URD 32 TTF 1000 + switch MS 3-V1-5 BS	20 671 32.1000 + switch 28 001 04

Table 68 - Recommended Leg Fuses - 460V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	830	830	678.1	6	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04
	996	996	813.7	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04
	1K1	1162	949.4	6	170M6265 + switch 170H0069	A300262 + switch MS 3V 1-5 UR	20 635 32.1100 + switch 28 001 04
	1K3	1328	1085.0	6	170M6266 + switch 170H0069	B300266 + switch MS 3V 1-5 UR	20 635 32.1250 + switch 28 001 04
	1K4	1494	1220.6	6	170M6267 + switch 170H0069	C300267 + switch MS 3V 1-5 UR	20 635 32.1400 + switch 28 001 04

Table 69 - Recommended AC Input Line Fuses - 575V AC Input Frame C Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	540	540	441	3	170M5466 + switch 170H0069	6,9 URD 32 TTF 1000 + switch MS 3V 1-5 BS	20 671 32.1000 + switch 28 001 04
	675	675	551	3	170M5466 + switch 170H0069	6,9 URD 32 TTF 1000 + switch MS 3V 1-5 BS	20 671 32.1000 + switch 28 001 04

Table 70 - Recommended Leg Fuses - 575V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	810	810	661	6	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04
	1K0	1080	881	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04
	1K2	1215	991	6	170M6265 + switch 170H0069	A300262 + switch MS 3V 1-5 UR	20 635 32.1100 + switch 28 001 04
	1K3	1350	1102	6	170M6266 + switch 170H0069	B300266 + switch MS 3V 1-5 UR	20 635 32.1250 + switch 28 001 04
	1K6	1688	1377	12	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04

Table 71 - Recommended AC Input Line Fuses - 690V AC Input Frame C Drives

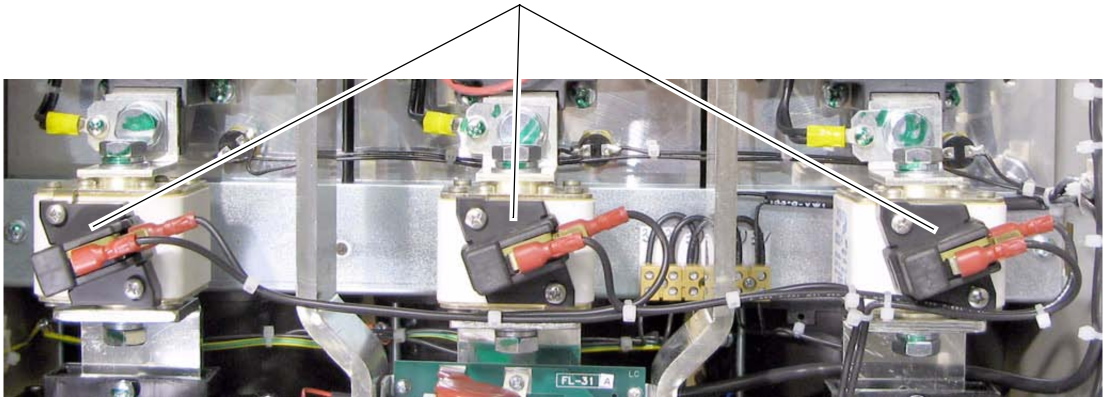
Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - Flush End Contact		
C	452	452	369	6	170M5463 + switch 170H0069	6,9 URD 32 TTF 0700 + switch MS 3V 1-5 BS	20 671 32.700 + switch 28 001 04
	565	565	461	6	170M5465 + switch 170H0069	6,9 URD 32 TTF 0900 + switch MS 3V 1-5 BS	20 671 32.900 + switch 28 001 04

Table 72 - Recommended Leg Fuses - 690V AC Input Frame D Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	Qty	Bussmann	Ferraz Shawmut (Gould Shawmut)	SIBA
					Square Body - DIN 43653 Stud-Mount		
D	678	678	553	6	170M6260 + switch 170H0069	V300260 + switch MS 3V 1-5 UR	20 635 32.630 + switch 28 001 04
	791	791	645	6	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04
	904	904	738	6	170M6263 + switch 170H0069	Y300263 + switch MS 3V 1-5 UR	20 635 32.900 + switch 28 001 04
	1K0	1017	830	6	170M6264 + switch 170H0069	Z300264 + switch MS 3V 1-5 UR	20 635 32.1000 + switch 28 001 04
	1K1	1130	922	6	170M6265 + switch 170H0069	A300262 + switch MS 3V 1-5 UR	20 635 32.1100 + switch 28 001 04
	1K2	1243	1014	6	170M6266 + switch 170H0069	B300266 + switch MS 3V 1-5 UR	20 635 32.1250 + switch 28 001 04
	1K4	1413	1153	6	170M6267 + switch 170H0069	C300267 + switch MS 3V 1-5 UR	20 635 32.1400 + switch 28 001 04
	1K5	1582	1291	12	170M6262 + switch 170H0069	X300262 + switch MS 3V 1-5 UR	20 635 32.800 + switch 28 001 04

Figure 60 - Frame C Non-Regenerative Drive - AC Input Line Fuse Location

AC Input fuses and switches are located on the bus bars behind the Control board EMI shield.



Note: Drive shown with front covers removed and Control board EMI shield lowered.

Control Power Circuit Protection Fuses

Switching Power Supply Circuit Board Fuses

The following fuses are used to protect the Switching Power Supply circuit.

IMPORTANT Verify the circuit board revision prior to ordering and installing fuses.

Frame	Circuit Board ID / Revision	Designation	Fuse (5 x 20 mm)
A	SW1-31 / H & below	F1	1 A, 250V, slow
	SW1-31 / I & above	F1	2.5 A, 250V, slow
B	SW2-32 / H & below	F1	3.15 A, 250V fast
		F2	2.5 A, 250V slow
	SW2-32 / I & above	F1	2.5 A, 250V slow
		F2	
C	SW3-32 / H & below	F1	3.15 A, 250V fast
		F2	2.5 A, 250V slow
	SW3-32 / I & above	F1	2.5 A, 250V slow
		F2	
D	SW1-31 / I & above	F1	2.5 A, 250V, slow

Figure 61 - Frame A Switching Power Supply Circuit Board Fuse Location

Top View of Drive

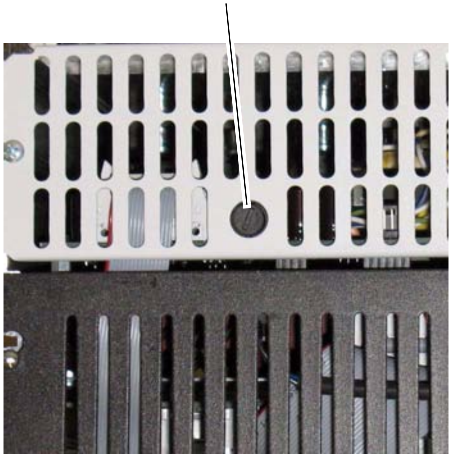

Switching Power Supply circuit board fuse holder.

Figure 62 - Frame B Switching Power Supply Circuit Board Fuse Location

Top View of Drive Switching Power Supply circuit board fuse holders.

F1 = 3.15 A fuse
Rev. "H" and below only.

F2 = 2.5 A fuse
Rev. "H" and below only.

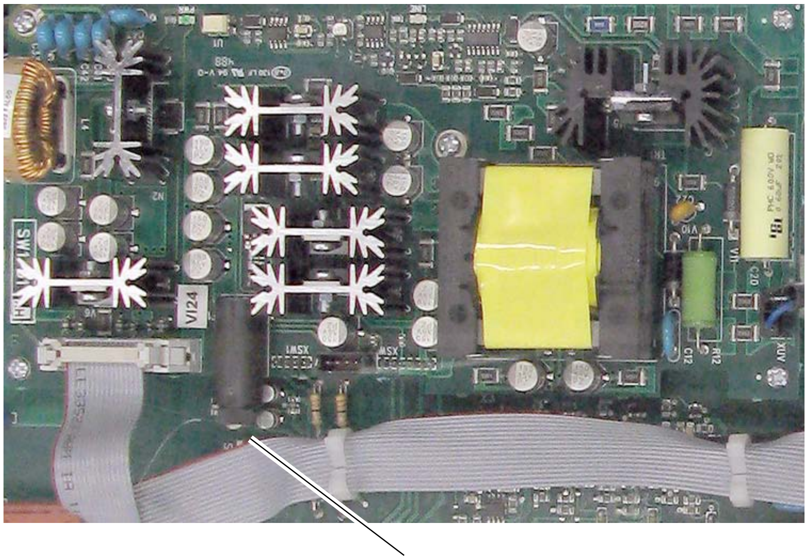
Figure 63 - Frame C Switching Power Supply Circuit Board Fuse Location

F1 = 3.15 A fuse
Rev. "H" and below only.

F2 = 2.5 A fuse
Rev. "H" and below only.

The Switching Power Supply circuit board is located on the back of the Control board EMI shield.

Figure 64 - Frame D Switching Power Supply Circuit Board Fuse Location



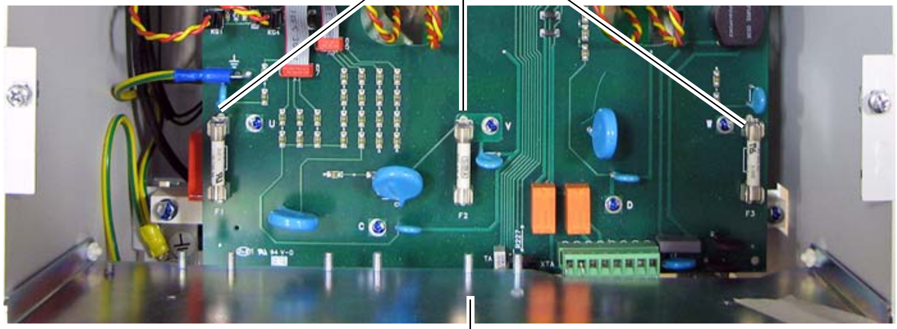
The Switching Power Supply circuit board is located on the control panel.

Frame B Pulse Transformer Circuit Board Fuses

The following fuses are used to protect the MOVs on the Pulse Transformer circuit board on frame B drives only.

Circuit Board ID / Revision	Designation	Fuse (6 x 32 mm)
FIR2-xx / M &below	F1/F2/F3	16 A, 500V fast

Figure 65 - Frame B Pulse Transformer Circuit Board Fuse Location

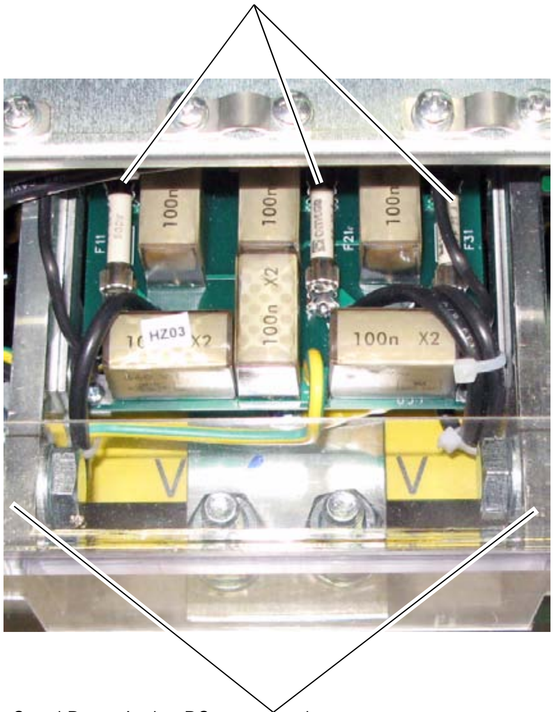


Frame C Transient Noise Filter Circuit Board Fuses

The following fuses are used to protect the MOVs on the Transient Noise Filter circuit board for frame C drives only.

Board ID / Revision	Designation	Fuse (6 x 32 mm)
FL-31 / All	F11/F21/F31	25 A, 500V fast

Figure 66 - Frame C Transient Noise Filter Circuit Board Fuse Locations



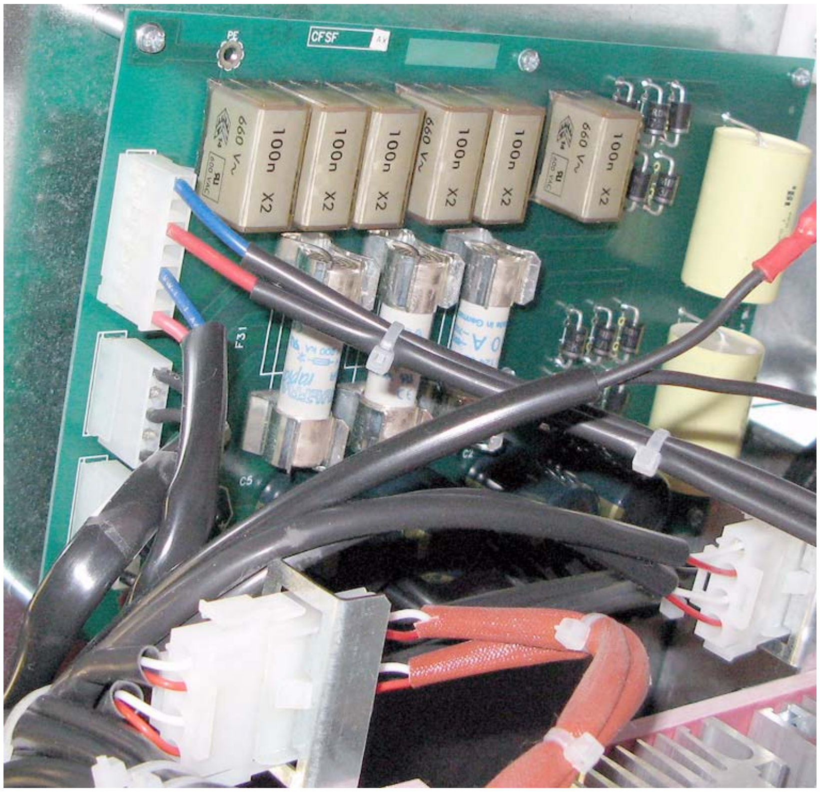
Frame D Overvoltage Clipping Circuit Board Fuses

The following fuses are used to protect the resistors and capacitors on the Overvoltage Clipping circuit board for frame D drives only. The Overvoltage Clipping circuit board is located on the left side wall inside the drive enclosure, behind the control panel.

Circuit Board ID / Revision	Designation	Fuse (14 x 51 mm)
CFSFxxx / All	F11/F21/F31	10 A, 690V fast

Figure 67 - Frame D Overvoltage Clipping Circuit Board Fuse Locations

Overvoltage Clipping board fuse locations
(shown with control panel open).



AC Input Line Reactors and AC Input Contactors

If a DC contactor is used, an AC input contactor is not needed.

Table 73 - 230V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW (HP)	AC Input Contactor Cat. No.
A	7P0	7	5.7	1.5	1321-3R8-A	0.75 (1)	100-C12D10
	9P0	9	7.4	2	1321-3R12-A	1.49 (2)	100-C12D10
	012	12	9.8	3	1321-3R18-A	0.75…3.7 (1…5)	100-C12D10
	020	20	16	5	1321-3R18-A	0.75…3.7 (1…5)	100-C23D10
	029	29	24	7.5	1321-3R55-A	5.5…11 (7.5…15)	100-C30D10
	038	38	31	10	1321-3R55-A	5.5…11 (7.5…15)	100-C37D10
	055	55	45	15	1321-3R55-A	5.5…11 (7.5…15)	100-C60D10
	073	73	60	20	1321-3R80-A	15 (20)	100-C60D10
	093	93	76	25	1321-3R100-A	18.5…22 (25…30)	100-C85D10
	110	110	90	30	1321-3R100-A	18.5…22 (25…30)	100-D110D11
B	146	146	119	40	1321-3R160-A	30…37 (40…50)	100-D140D11
	180	180	147	50	1321-3R160-A	30…37 (40…50)	100-D180D11
	218	218	178	60	1321-3RB250-A	45…56 (60…75)	100-D180D11
	265	265	217	75	1321-3RB250-A	45…56 (60…75)	100-D250ED11
	360	360	294	100	1321-3RB320-A	75 (100)	100-D300ED11
	434	434	355	125	1321-3RB400-A	93 (125)	100-D420ED11
C	521	521	426	150	1321-3R500-A	112 (150)	100-D630ED11
	700	700	572	200	1321-3R600-A	149 (200)	100-D630ED11
D	875	875	715	250	1321-3R750-A	186 (250)	100-D860ED11
	1K0	1050	858	300	1321-3R850-A	224 (300)	100-D860ED11

Table 74 - 460V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW (HP)	AC Input Contactor Cat. No.
A	4P1	4.1	3.3	2	1321-3R4-A	0.55 (0.75)	100-C12D10
	6P0	6	4.9	3	1321-3R8-A	0.75 (1)	100-C12D10
	010	10	8.2	5	1321-3R18-B	1.5…7.5 (2…10)	100-C12D10
	014	14	11.4	7.5	1321-3R18-B	1.5…7.5 (2…10)	100-C12D10
	019	19	15.5	10	1321-3R18-B	1.5…7.5 (2…10)	100-C23D10
	027	27	22.1	15	1321-3R55-B	11…22 (15…30)	100-C23D10
	035	35	28.6	20	1321-3R55-B	11…22 (15…30)	100-C30D10
	045	45	36.8	25	1321-3R55-B	11…22 (15…30)	100-C37D10
	052	52	42.5	30	1321-3R55-B	11…22 (15…30)	100-C43D10
	073	73	59.6	40	1321-3R80-B	30 (40)	100-C60D10
	086	86	70.3	50	1321-3R100-B	37…45 (50…60)	100-C85D10
	100	100	81.7	60	1321-3R100-B	37…45 (50…60)	100-C85D10
B	129	129	105.4	75	1321-3R160-B	56…75 (75…100)	100-D110D11
	167	167	136.4	100	1321-3R160-B	56…75 (75…100)	100-D140D11
	207	207	169.1	125	1321-3RB250-B	93…112 (125…150)	100-D180D11
	250	250	204.3	150	1321-3RB250-B	93…112 (125…150)	100-D210ED11
	330	330	269.6	200	1321-3RB320-B	149 (200)	100-D300ED11
	412	412	336.6	250	1321-3RB400-B	186.4 (250)	100-D420ED11
C	495	495	404.4	300	1321-3R500-B	223.7 (300)	100-D420ED11
	667	667	544.9	400	1321-3R600-B	298.3 (400)	100-D630ED11
D	830	830	678.1	500	1321-3R750-B	372.8 (500)	100-D860ED11
	996	996	813.7	600	1321-3R850-B	447,4 (600)	100-D860ED11
	1K1	1162	949.4	700	1321-3R1000-B	552 (700)	100-G860KD22
	1K3	1328	1085.0	800	2 x1321-3R600-B	596.6 (800)	100-G860KD22
	1K4	1494	1220.6	900	2 x1321-3R600-B	671.1 (900)	100-G1200KD12

Table 75 - 575V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW (HP)	AC Input Contactor Cat. No.
B	067	67.5	55.1	50	1321-3R55-B	37 (50)	100-C60D10
	101	101.25	82.7	75	1321-3R100-B	56 (75)	100-C85D10
	135	135	110.3	100	1321-3R130-B	75 (100)	100-D110D11
	270	270	220.6	200	1321-3RB250-B	149 (200)	100-D250ED11
	405	405	330.9	300	1321-3RB320-B	224 (300)	100-D420ED11
C	540	540	441.2	400	1321-3RB500-B	298 (400)	100-D630ED11
	675	675	551.5	500	1321-3R600-B	373 (500)	100-D630ED11
D	810	810	661.8	600	1321-3R750-B	447 (600)	100-D860ED11
	1K0	1080	882.4	800	1321-3R1000-B	597 (800)	100-G700KD22
	1K2	1215	992.7	900	1321-3R1000-B	671 (900)	100-G860KD22
	1K3	1350	1103.0	1000	2 x 1321-3R600-B	746 (1000)	100-G1000KD12
	1K6	1687.5	1378.7	1250	2 X 1321-3R750-B	–	(1)

(1) No AC Input Contactor available for this drive rating - must be sourced locally.

Table 76 - 690V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	IP00 (Open Style) Line Reactor Cat No.	Line Reactor kW (HP)	AC Input Contactor Cat. No.
C	452	452	369	400	1321-3RB500-C	–	100-D420ED11
	565	565	462	500	1321-3RB600-C	–	100-D630ED11
D	678	678	554	600	1321-3R750-C	–	100-D630ED11
	791	791	646	700	1321-3R750-C	–	100-D860ED11
	904	904	739	800	1321-3R1000-C	–	100-D860ED11
	1K0	1017	831	900	1321-3R1000-C	–	100-D860ED11
	1K1	1130	923	1000	2 X 1321-3R600-C	–	100-G700KD22
	1K2	1243	1016	1100	2 X 1321-3R600-C	–	100-G860KD22
	1K4	1412.5	1154	1250	2 X 1321-3R750-C	–	100-G1200KD12
	1K5	1582	1292	1400	2 X 1321-3R750-C	–	100-G1200KD12

Isolation Transformers

Three Phase Primary Voltage			Three Phase Secondary Voltage		
kVA	**kW (HP)**	**Voltage**	**230V AC Catalog Number**	**460V AC Catalog Number**	**575V AC Catalog Number**
5	1.2 - 2.2 (1.5 - 3)	230	1321-3TW005-AA	1321-3TW005-AB	N/A
		460	1321-3TW005-BA	1321-3TW005-BB	N/A
		575	1321-3TW005-CA	1321-3TW005-CB	N/A
7.5	3.7 (5)	230	1321-3TW007-AA	1321-3TW007-AB	N/A
		460	1321-3TW007-BA	1321-3TW007-BB	N/A
		575	1321-3TW007-CA	1321-3TW007-CB	N/A
11	5.5 (7.5)	230	1321-3TW011-AA	1321-3TW011-AB	N/A
		460	1321-3TW011-BA	1321-3TW011-BB	N/A
		575	1321-3TW011-CA	1321-3TW011-CB	N/A
14	7.5 (10)	230	1321-3TW014-AA	1321-3TW014-AB	N/A
		460	1321-3TW014-BA	1321-3TW014-BB	N/A
		575	1321-3TW014-CA	1321-3TW014-CB	N/A
20	11 (15)	230	1321-3TW020-AA	1321-3TW020-AB	N/A
		460	1321-3TW020-BA	1321-3TW020-BB	N/A
		575	1321-3TW020-CA	1321-3TW020-CB	N/A
27	15 (20)	230	1321-3TW027-AA	1321-3TW027-AB	N/A
		460	1321-3TW027-BA	1321-3TW027-BB	N/A
		575	1321-3TW027-CA	1321-3TW027-CB	N/A
34	18.5 (25)	230	1321-3TW034-AA	1321-3TW034-AB	N/A
		460	1321-3TW034-BA	1321-3TW034-BB	N/A
		575	1321-3TW034-CA	1321-3TW034-CB	N/A
40	22 (30)	230	1321-3TW040-AA	1321-3TW040-AB	N/A
		460	1321-3TW040-BA	1321-3TW040-BB	N/A
		575	1321-3TW040-CA	1321-3TW040-CB	N/A
51	30 (40)	230	1321-3TW051-AA	1321-3TW051-AB	N/A
		460	1321-3TW051-BA	1321-3TW051-BB	N/A
		575	1321-3TW051-CA	1321-3TW051-CB	N/A
63	37 (50)	230	1321-3TH063-AA	1321-3TH063-AB	1321-3TH063-AC
		460	1321-3TH063-BA	1321-3TH063-BB	1321-3TH063-BC
		575	1321-3TH063-CA	1321-3TH063-CB	1321-3TH063-CC
75	45 (60)	230	1321-3TH075-AA	1321-3TH075-AB	1321-3TH075-AC
		460	1321-3TH075-BA	1321-3TH075-BB	1321-3TH075-BC
		575	1321-3TH075-CA	1321-3TH075-CB	1321-3TH075-CC
93	56 (75)	230	1321-3TH093-AA	1321-3TH093-AB	1321-3TH093-AC
		460	1321-3TH093-BA	1321-3TH093-BB	1321-3TH093-BC
		575	1321-3TH093-CA	1321-3TH093-CB	1321-3TH093-CC
118	75 (100)	230	1321-3TH118-AA	1321-3TH118-AB	1321-3TH118-AC
		460	1321-3TH118-BA	1321-3TH118-BB	1321-3TH118-BC
		575	1321-3TH118-CA	1321-3TH118-CB	1321-3TH118-CC
145	93 (125)	230	1321-3TH145-AA	1321-3TH145-AB	1321-3TH145-AC
		460	1321-3TH145-BA	1321-3TH145-BB	1321-3TH145-BC
		575	1321-3TH145-CA	1321-3TH145-CB	1321-3TH145-CC
175	112 (150)	230	1321-3TH175-AA	1321-3TH175-AB	1321-3TH175-AC
		460	1321-3TH175-BA	1321-3TH175-BB	1321-3TH175-BC
		575	1321-3TH175-CA	1321-3TH175-CB	1321-3TH175-CC
220	145 (200)	230	1321-3TH220-AA	1321-3TH220-AB	1321-3TH220-AC
		460	1321-3TH220-BA	1321-3TH220-BB	1321-3TH220-BC
		575	1321-3TH220-CA	1321-3TH220-CB	1321-3TH220-CC

Three Phase Primary Voltage			**Three Phase Secondary Voltage**		
kVA	**kW (HP)**	**Voltage**	**230V AC Catalog Number**	**460V AC Catalog Number**	**575V AC Catalog Number**
275	187 (250)	230	1321-3TH275-AA	1321-3TH275-AB	1321-3TH275-AC
		460	1321-3TH275-BA	1321-3TH275-BB	1321-3TH275-BC
		575	1321-3TH275-CA	1321-3TH275-CB	1321-3TH275-CC
330	224 (300)	230	1321-3TH330-AA	1321-3TH330-AB	1321-3TH330-AC
		460	1321-3TH330-BA	1321-3TH330-BB	1321-3TH330-BC
		575	1321-3TH330-CA	1321-3TH330-CB	1321-3TH330-CC
440	298 (400)	230	N/A	1321-3TH440-AB	1321-3TH440-AC
		460	N/A	1321-3TH440-BB	1321-3TH440-BC
		575	N/A	1321-3TH440-CB	1321-3TH440-CC
550	373 (500)	230	N/A	1321-3TH550-AB	1321-3TH550-AC
		460	N/A	1321-3TH550-BB	1321-3TH550-BC
		575	N/A	1321-3TH550-CB	1321-3TH550-CC
660	448 (600)	230	N/A	1321-3TH660-AB	1321-3TH660-AC
		460	N/A	1321-3TH660-BB	1321-3TH660-BC
		575	N/A	1321-3TH660-CB	1321-3TH660-CC
770	522 (700)	230	N/A	1321-3TH770-AB	1321-3TH770-AC
		460	N/A	1321-3TH770-BB	1321-3TH770-BC
		575	N/A	1321-3TH770-CB	1321-3TH770-CC
880	597 (800)	230	N/A	1321-3TH880-AB	1321-3TH880-AC
		460	N/A	1321-3TH880-BB	1321-3TH880-BC
		575	N/A	1321-3TH880-CB	1321-3TH880-CC

Dynamic Brake Resistor Kits and DC Output Contactors

See Table 81 on page 245 and Table 82 on page 245 for recommended alternate DC Output Contactors for 575V and 690V AC input drives, respectively.

Table 77 - 230V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(3)	DC Contactor Crimp Lugs Cat. No.(4)
A	7P0	7	5.7	1.5	1370-DBL62	240	20	420	12.00	1370-DC56	1370-LG40
	9P0	9	7.4	2	1370-DBL63	240	20	420	12.00	1370-DC56	1370-LG40
	012	12	9.8	3	1370-DBL64	240	15	420	16.00	1370-DC56	1370-LG40
	020	20	16	5	1370-DBL65	240	8.6	420	27.91	1370-DC56	1370-LG40
	029	29	24	7.5	1370-DBL66	240	6	345	40.00	1370-DC56	1370-LG40
	038	38	31	10	1370-DBL67	240	5	330	48.00	1370-DC56	1370-LG40
	055	55	45	15	1370-DBL68	240	3.5	385	68.57	1370-DC56	1370-LG56
	073	73	60	20	1370-DBL69	240	2.6	385	92.31	1370-DC110	1370-LG92
	093	93	76	25	1370-DBL70	240	2	330	120.00	1370-DC110	1370-LG92
	110	110	90	30	1370-DBL71	240	2	330	120.00	1370-DC110	1370-LG110
B	146	146	119	40	1370-DBL72	240	0.7	280	342.86	1370-DC180	1370-LG160
	180	180	147	50	1370-DBL73	240	0.5	365	480.00	1370-DC180	1370-LG180
	218	218	178	60	1370-DBL74	240	0.5	365	480.00	1370-DC280	1370-LG228
	265	265	217	75	1370-DBL75	240	2	330	120.00	1370-DC280	1370-LG268
	360	360	294	100	1370-DBL76	240	1.4	290	171.43	(1)	(5)
	434	434	355	125	(1)	240	0.5	1458	651	(1)	(5)
C	521	521	426	150	(1)	240	0.322	6221	781	(1)	(5)
	700	700	572	200	(2)	240	–	–	–	(1)	(5)
D	875	875	715	250	(2)	240	–	–	–	(1)	(5)
	1K0	1050	858	300	(2)	240	–	–	–	(1)	(5)

(1) See Alternate Dynamic Brake Resistor Kits and DC Output Contactors on page 244.

(2) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(3) Coil voltage = 115V AC, 50/60Hz.

(4) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(5) Wire and Lug size dependant on enclosure dimensions and local codes.

Table 78 - 460V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(3)	DC Contactor Crimp Lugs Cat. No.(4)
A	4P1	4.1	3.3	2	1370-DBH63	500	81	255	6.17	1370-DC56	1370-LG40
	6P0	6	4.9	3	1370-DBH64	500	62	245	8.06	1370-DC56	1370-LG40
	010	10	8.2	5	1370-DBH65	500	45	245	11.11	1370-DC56	1370-LG40
	014	14	11.4	7.5	1370-DBH66	500	27	350	18.52	1370-DC56	1370-LG40
	019	19	15.5	10	1370-DBH67	500	20	420	25.00	1370-DC56	1370-LG40
	027	27	22.1	15	1370-DBH68	500	12	405	41.67	1370-DC56	1370-LG40
	035	35	28.6	20	1370-DBH69	500	5	330	100.00	1370-DC56	1370-LG40
	045	45	36.8	25	1370-DBH70	500	4.5	330	111.11	1370-DC56	1370-LG52
	052	52	42.5	30	1370-DBH71	500	3.5	385	142.86	1370-DC56	1370-LG52
	073	73	59.6	40	1370-DBH72	500	2.6	345	192.31	1370-DC110	1370-LG92
	086	86	70.3	50	1370-DBH73	500	2	345	250.00	1370-DC110	1370-LG92
	100	100	81.7	60	1370-DBH74	500	2	345	250.00	1370-DC110	1370-LG110
	129	129	105.4	75	1370-DBH75	500	1	270	500.00	1370-DC180	1370-LG140

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(3)	DC Contactor Crimp Lugs Cat. No.(4)
B	167	167	136.4	100	1370-DBH76	500	0.7	280	714.29	1370-DC180	1370-LG180
	207	207	169.1	125	1370-DBH77	500	0.7	280	714.29	1370-DC280	1370-LG228
	250	250	204.3	150	1370-DBH78	500	0.5	365	1000.00	1370-DC280	1370-LG268
	330	330	269.6	200	1370-DBH79	500	0.7	280	714.29	(1)	(5)
	412	412	336.6	250	(1)	500	0.808	7292	–	(1)	(5)
C	495	495	404.4	300	(1)	500	0.595	6069	–	(1)	(5)
	667	667	544.9	400	(1)	500	0.542	6439	–	(1)	(5)
D	800	830	678.1	500	(2)	500	0.463	6338	–	(1)	(5)
	960	996	813.7	600	(2)	500	0.322	6221	–	(1)	(5)
	1K1	1162	949.4	700	(2)	500	0.322	6221	–	(1)	(5)
	1K3	1328	1085.0	800	(2)	500	0.255	5718	–	(1)	(5)
	1K4	1494	1220.6	900	(2)	500	0.255	5718	–	(1)	(5)

(1) See Alternate Dynamic Brake Resistor Kits and DC Output Contactors on page 244.

(2) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(3) Coil voltage = 115V AC, 50/60Hz.

(4) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(5) Wire and Lug size dependant on enclosure dimensions and local codes.

DC Contactor Crimp Lug Kit Specifications

Use the information provided in the table below to assist you in ordering the correct Lug kit for your application.

Rated Motor Armature Current (1) *A DC*	DC Contactor Rating *A DC*	Armature Conductor Size (2) *AWG*	DB Conductor Size (3) *AWG*	Armature Conductor Crimp Lug Hole Size	DB Conductor Crimp Lug Hole Size	Lug Kit Catalog Number
4.1…35	56	8	8	#10	#10	1370-LG40
45…52	56	6	8	#10	#10	1370-LG52
55	56	4	8	#10	#10	1370-LG56
60…86	110	2	6	0.25 in.	0.25 in.	1370-LG92
100…110	110	1/0	4	0.25 in.	0.25 in.	1370-LG110
129	180	2/0	2	0.3125 in.	0.3125 in.	1370-LG140
146	180	3/0	2	0.3125 in.	0.3125 in.	1370-LG160
147…167	180	4/0	2	0.3125 in.	0.3125 in.	1370-LG180
207…218	280	300MCM	1/0	0.5 in.	0.375 in.	1370-LG228
250…265	280	400MCM	2/0	0.5 in.	0.375 in.	1370-LG268
266…280	280	500MCM	3/0	0.5 in.	0.375 in.	1370-LG280

(1) The Rated Motor Armature Current is taken directly from the motor nameplate or motor data. The current listed in this column is the maximum current allowed for the Armature Conductor Size (column 3) and the DC Contactor Rating (column 2).

(2) The armature conductors are sized by multiplying the Rated Motor Armature Current by 1.25 as provided for in NEC 420-22 (1987). The DC lug ratings are determined from NEC Table 310-16 (1987) for copper conductors, insulation temperature rated at 75° C (167° F) at an ambient temperature of 30° C (86° F). If conditions are other than shown in NEC Table 310-16, then refer to application codes.

(3) The dynamic braking (DB) conductors are sized as in footnote 2 above, but at half ampacity due to the short time duration of current flow in these conductors, and has been sized to satisfy NEMA Standard ICS 3-302.62 - Dynamic Braking. If the load inertia is larger than that of the motor, calculations must be made to determine correct conductor sizing and DB resistor wattage per NEMA Standard ICS 3-302.62.

Alternate Dynamic Brake Resistor Kits and DC Output Contactors

The following alternate dynamic brake resistor kits and/or DC output contactors may be used with the corresponding PowerFlex DC drives but must be sourced separately from the drive.

Table 79 - 230V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(2)		DC Contactor Crimp Lugs Cat. No.(3)
										Drive w/No Dynamic Brake	Drive w Dynamic Brake	
B	360	360	294	100	1370-DBL76	240	1.4	290	171.43	ABB_EHDB360C2P-1L2S	ABB_EHDB360C-1L22SS	(4)
	434	434	355	125	CUTLER-HAMMER_G3AP50 (Qty 4 - two in series, two in parallel)	240	0.5	1458	651	ABB_EHDB520C2P-1L2S	ABB_EHDB520C-1L22SS	
C	521	521	426	150	HUBBELL_Y139W322GB	240	0.322	6221	781			
	700	700	572	200	(1)	240	–	–	–	ABB_EHDB800C2P-1L2S	ABB_EHDB800C-1L22SS	
D	875	875	715	250		240	–	–	–	ABB_EHDB960C2P-1L2S	ABB_EHDB960C-1L22SS	
	1K0	1050	858	300		240	–	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	

(1) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(2) Coil voltage = 115V AC, 50/60Hz.

(3) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(4) Wire and Lug size dependant on enclosure dimensions and local codes.

Table 80 - 460V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(2)		DC Contactor Crimp Lugs Cat. No.(3)
										Drive w/No Dynamic Brake	Drive w Dynamic Brake	
B	330	330	269.6	200	1370-DBH79	500	0.7	280	714.29	ABB_EHDB360C2P-1L2S	ABB_EHDB360C-1L22SS	(4)
	412	412	336.6	250	HUBBELL_Y95W808GB	500	0.808	7292	–	ABB_EHDB520C2P-1L2S	ABB_EHDB520C-1L22SS	
C	495	495	404.4	300	HUBBELL_Y101W595GB	500	0.595	6069	–	ABB_EHDB520C2P-1L2S	ABB_EHDB520C-1L22SS	
	667	667	544.9	400	HUBBELL_Y109W542GB	500	0.542	6439	–	ABB_EHDB800C2P-1L2S	ABB_EHDB800C-1L22SS	
D	800	830	678.1	500	(1)	500	0.463	6338	–	ABB_EHDB960C2P-1L2S	ABB_EHDB960C-1L22SS	
	960	996	813.7	600		500	0.322	6221	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K1	1162	949.4	700		500	0.322	6221	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K3	1328	1085.0	800		500	0.255	5718	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	
	1K4	1494	1220.6	900		500	0.255	5718	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	

(1) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(2) Coil voltage = 115V AC, 50/60Hz.

(3) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(4) Wire and Lug size dependant on enclosure dimensions and local codes.

Table 81 - 575V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(2)		DC Contactor Crimp Lugs Cat. No.(3)
										Drive w/No Dynamic Brake	Drive w Dynamic Brake	
B	067	67.5	55.1	50	(1)	600	5.93	–	–	ABB_EHDB220C2P-1L2S	ABB_EHDB220C-1L22SS	(4)
	101	101	83	75		600	3.95	–	–	ABB_EHDB220C2P-1L2S	ABB_EHDB220C-1L22SS	
	135	135	110	100		600	2.96	–	–	ABB_EHDB220C2P-1L2S	ABB_EHDB220C-1L22SS	
	270	270	221	200		600	1.48	–	–	ABB_EHDB360C2P-1L2S	ABB_EHDB360C-1L22SS	
	405	405	331	300		600	0.988	–	–	ABB_EHDB520C2P-1L2S	ABB_EHDB520C-1L22SS	
C	540	540	441	400		600	0.741	–	–	ABB_EHDB650C2P-1L2S	ABB_EHDB650C-1L22SS	
	675	675	551	500		600	0.593	–	–	ABB_EHDB800C2P-1L2S	ABB_EHDB800C-1L22SS	
D	810	810	662	600		600	0.494	–	–	ABB_EHDB960C2P-1L2S	ABB_EHDB960C-1L22SS	
	1K0	1080	882	800		600	0.370	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K2	1215	993	900		600	0.329	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K3	1350	1103	1000		600	0.296	–	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	
	1K6	1688	1379	1250		600	0.237	–	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	

(1) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(2) Coil voltage = 115V AC, 50/60Hz.

(3) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(4) Wire and Lug size dependant on enclosure dimensions and local codes.

Table 82 - 690V AC Input Drives

Frame	Drive Current Rating Code	DC Amps	AC Line Amps	HP	Dynamic Brake Resistor Kit Cat. No.	Armature Voltage (Volts)	DB Resistor Size (ohms)	DB Resistor Size (Watts)	Brake Amps Required	DC Loop Contactor Cat. No.(2)		DC Contactor Crimp Lugs Cat. No.(3)
										Drive w/No Dynamic Brake	Drive w Dynamic Brake	
C	452	452	369	400	(1)	700	1.03	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	(4)
	565	565	462	500		700	0.826	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
D	678	678	554	600		700	0.688	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	791	791	646	700		700	0.590	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	904	904	739	800		700	0.516	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K0	1017	831	900		700	0.459	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K1	1130	923	1000		700	0.413	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K2	1243	1016	1100		700	0.375	–	–	SIEMENS-MFG_14-193-101-58-2 (Qty 2)	SIEMENS-MFG_14-193-101-58-2 (Qty 1)	
	1K4	1413	1154	1250		700	0.330	–	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	
	1K5	1582	1292	1400		700	0.295	–	–	CUTLER-HAMMER_6702ED636-2 (Qty 2)	CUTLER-HAMMER_6702ED636-2 (Qty 1)	

(1) No Dynamic Brake Resistor kit available for this drive rating - must be sourced locally.

(2) Coil voltage = 115V AC, 50/60Hz.

(3) See DC Contactor Crimp Lug Kit Specifications on page 243 for more information.

(4) Wire and Lug size dependant on enclosure dimensions and local codes.

Alternate EMC Filters

The following recommended filters can be used in place of the Rasmi filters listed in the table in the Installation Requirements Related to EN 61800-3 and the EMC Directive section on page 36.

IMPORTANT Not all of the following filters have been certified with the PowerFlex DC drive. All filters should be verified in the application.

Table 83 - Rasmi and Rasmi Alternative Filters

Frame	Drive Current Rating Code	Voltage Class	Rasmi Filters	Rasmi Alternative Type Filters	
			Part Number	Part Number	Part Number
A	7P0	230V AC	EMI-FFP-480-9, Code 8270 (was RF 3009-SIEI)	RF 3007-FTF, Code 7670 (Rasmi / EuroTek)	RF 3010-MHU
	9P0		EMI-FFP-480-9, Code 8270 (was RF 3009-SIEI)	RF 3016-FTF, Code 7671 (Rasmi / EuroTek)	RF 3010-MHU
	012		EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3016-FTF, Code 7671 (Rasmi / EuroTek)	RF 3016-MHU
	020		EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3025-MHU
	029		EMI-FFP-480-30, Code 8272 (was RF 3030-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3040-MHU
	038		EMI-FFP-480-40, Code 8273 (was RF 3040-SIEI)	RF 3042-FTF, Code 7672 (Rasmi / EuroTek)	RF 3040-MHU
	055		RF 3055-FLP, Code 8078 (Rasmi / EuroTek)	RF 3055-FTF, Code 7673 (Rasmi / EuroTek)	RF 3070-MHU
	073		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3075-FTF, Code 7674 (Rasmi / EuroTek)	RF 3100-MHU
	093		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3100-FTF, Code 7675 (Rasmi / EuroTek)	RF 3100-MHU
	110		RF 3150-FLP, Code 8076 (Rasmi / EuroTek)	RF 3130-FTF, Code 7676 (Rasmi / EuroTek)	RF 3130-MHU
B	146		RF 3150-FLP, Code 8076 (Rasmi / EuroTek)	RF 3180-FTF, Code 7677 (Rasmi / EuroTek)	RF 3180-MHU
	180		RF 3180-FLP, Code 8077 (Rasmi / EuroTek)	RF 3180-FTF, Code 7677 (Rasmi / EuroTek)	RF 3180-MHU
	218		RF 3250-MHU	–	–
	265		RF 3320-MHU	–	–
	360		RF 3400-MHU	–	–
	434		RF 3600-MHU	–	–
C	521		RF 3600-MHU	–	–
	700		RF 3800-MHU	–	–
D	875		RF 31k0-MHU	–	–
	1K0		RF 31k6-MHU	–	–

Frame	Drive Current Rating Code	Voltage Class	Rasmi Filters	Rasmi Alternative Type Filters	
			Part Number	**Part Number**	**Part Number**
A	4P1	460V AC	EMI-FFP-480-9, Code 8270 (was RF 3009-SIEI)	RF 3007-FTF, Code 7670 (Rasmi / EuroTek)	RF 3010-MHU
	6P0		EMI-FFP-480-9, Code 8270 (was RF 3009-SIEI)	RF 3007-FTF, Code 7670 (Rasmi / EuroTek)	RF 3010-MHU
	010		EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3016-FTF, Code 7671 (Rasmi / EuroTek)	RF 3010-MHU
	014		EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3016-FTF, Code 7671 (Rasmi / EuroTek)	RF 3016-MHU
	019		EMI-FFP-480-24, Code 8271 (was RF 3024-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3025-MHU
	027		EMI-FFP-480-30, Code 8272 (was RF 3030-SIEI)	RF 3030-FTF, Code 8082 (Rasmi / EuroTek)	RF 3040-MHU
	035		EMI-FFP-480-40, Code 8273 (was RF 3040-SIEI)	RF 3042-FTF, Code 7672 (Rasmi / EuroTek)	RF 3040-MHU
	045		RF 3045-FLP, Code 8073 (Rasmi / EuroTek)	RF 3055-FTF, Code 7673 (Rasmi / EuroTek)	RF 3050-MHU
	052		RF 3055-FLP, Code 8078 (Rasmi / EuroTek)	RF 3055-FTF, Code 7673 (Rasmi / EuroTek)	RF 3070-MHU
	073		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3075-FTF, Code 7674 (Rasmi / EuroTek)	RF 3100-MHU
	086		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3100-FTF, Code 7675 (Rasmi / EuroTek)	RF 3100-MHU
	100		RF 3100-FLP, Code 8075 (Rasmi / EuroTek)	RF 3100-FTF, Code 7675 (Rasmi / EuroTek)	RF 3100-MHU
	129		RF 3150-FLP, Code 8076 (Rasmi / EuroTek)	RF 3130-FTF, Code 7676 (Rasmi / EuroTek)	RF 3130-MHU
B	167		RF 3180-FLP, Code 8077 (Rasmi / EuroTek)	RF 3180-FTF, Code 7677 (Rasmi / EuroTek)	RF 3180-MHU
	207		RF 3250-MHU	–	–
	250		RF 3250-MHU	–	–
	330		RF 3400-MHU	–	–
	412		RF 3600-MHU	–	–
C	495		RF 3600-MHU	–	–
	667		RF 3800-MHU	–	–
D	830		RF 31k0-MHU	–	–
	996		RF 31k6-MHU	–	–
	1K1		RF 31k6-MHU	–	–
	1K3		RF 31k6-MHU	–	–
	1K4		RF 31k6-MHU	–	–

Table 84 - Schaffner and Schaffner Alternative Filters

Frame	Drive Current Rating Code	Voltage Class	Schaffner Filters	Schaffner Alternative Type Filters	
			Part Number	**Part Number**	**Part Number**
A	7P0	230V	FN 258-7-29	FN 3258-7-44	FN 3270H-10-44
	9P0		FN 258-16-29	FN 3258-16-44	FN 3270H-10-44
	012		FN 258-16-29	FN 3258-16-44	FN 3270H-20-44
	020		FN 258-30-33	FN 3258-30-33	FN 3270H-20-44
	029		FN 258-30-33	FN 3258-30-33	FN 3270H-35-33
	038		FN 258-42-33	FN 3258-42-33	FN 3270H-50-34
	055		FN 258-55-34	FN 3258-55-34	FN 3270H-65-34
	073		FN 258-75-34	FN 3258-75-34	FN 3270H-80-35
	093		FN 258-100-35	FN 3258-100-35	FN 3270H-100-35
	110		FN 258-130-35	FN 3258-130-35	FN 3270H-150-99
B	146		FN 258-180-40	FN 3258-180-40	FN 3270H-150-99
	180		FN 258-180-40	FN 3258-180-40	FN 3270H-200-99
	218		FN 258-250-40	FN 3359-250-28	FN 3270H-250-99
	265		FN 258-250-40	FN 3359-320-99	FN 3270H-320-99
	360		–	FN 3359-400-99	FN 3270H-400-99
	434		–	FN 3359-400-99	FN 3270H-600-99
C	521		–	FN 3359-600-99	FN 3270H-600-99
	700		–	FN 3359-800-99	FN 3270H-800-99
D	875		FN 3359-1000-99	–	FN 3270H-1000-99
	1K0		FN 3359-1000-99	–	FN 3270H-1000-99

Frame	Drive Current Rating Code	Voltage Class	Schaffner Filters	Schaffner Alternative Type Filters	
			Part Number	Part Number	Part Number
A	4P1	460	FN 258HV-7-29	–	FN 3270H-10-44
	6P0		FN 258HV-7-29	–	FN 3270H-10-44
	010		FN 258HV-16-29	–	FN 3270H-10-44
	014		FN 258HV-16-29	–	FN 3270H-20-44
	019		FN 258HV-30-33	–	FN 3270H-20-44
	027		FN 258HV-30-33	–	FN 3270H-35-33
	035		FN 258HV-42-33	–	FN 3270H-35-33
	045		FN 258HV-55-34	–	FN 3270H-50-34
	052		FN 258HV-55-34	–	FN 3270H-65-34
	073		FN 258HV-75-34	–	FN 3270H-80-35
	086		FN 258HV-100-35	–	FN 3270H-100-35
	100		FN 258HV-100-35	–	FN 3270H-100-35
	129		FN 258HV-130-35	–	FN 3270H-150-99
B	167		FN 3359HV-180-28	–	FN 3270H-200-99
	207		FN 3359HV-250-28	–	FN 3270H-250-99
	250		FN 3359HV-320-99	–	FN 3270H-250-99
	330		FN 3359HV-320-99	–	FN 3270H-320-99
	412		FN 3359HV-400-99	–	FN 3270H-400-99
C	495		FN 3359HV-600-99	–	FN 3270H-600-99
	667		FN 3359HV-800-99	–	FN 3270H-800-99
D	830		FN 3359HV-800-99	–	FN 3270H-1000-99
	996		FN 3359HV-1000-99	–	FN 3270H-1000-99
	1K1		FN 3359HV-1600-99	–	–
	1K3		FN 3359HV-1600-99	–	–
	1K4		FN 3359HV-1600-99	–	–
B	067	575	FN 258HV-75-34	–	–
	101		FN 258HV-100-35	–	–
	135		FN 258HV-130-35	FN 3359HV-150-28	–
	270		FN 3359HV-320-99	–	–
	405		FN 3359HV-400-99	–	–
C	540		FN 3359HV-600-99	–	–
	675		FN 3359HV-800-99	–	–
D	810		FN 3359HV-800-99	–	–
	1K0		FN 3359HV-1000-99	–	–
	1K2		FN 3359HV-1600-99	–	–
	1K3		FN 3359HV-1600-99	–	–
	1K6		FN 3359HV-1600-99	–	–
C	452	690	FN3359HV-600-99		
	565		FN3359HV-600-99		
D	678		FN3359HV-800-99		
	791		FN3359HV-800-99		
	904		FN3359HV-1000-99		
	1K0		FN3359HV-1600-99		
	1K1		FN3359HV-1600-99		
	1K2		FN3359HV-1600-99		
	1K4		FN3359HV-1600-99		
	1K5		FN3359HV-1600-99		

Table 85 - EPCOS and EPCOS Alternative Filters

Frame	Drive Current Rating Code	Voltage Class	EPCOS Filters	EPCOS Alternative Type Filters	
			Part Number	Part Number	Part Number
D	875	230	B84143B1000S080	B84143B1000S020	–
	1K0		B84143B1600S080	B84143B1600S020	–
D	830	460	B84143B1000S081	B84143B1000S020	B84143B1000S021
	996		B84143B1600S081	B84143B1600S020	B84143B1600S021
	1K1		B84143B1600S081	B84143B1600S020	B84143B1600S021
	1K3		B84143B1600S081	B84143B1600S020	B84143B1600S021
	1K4		B84143B1600S081	B84143B1600S020	B84143B1600S021
B	135	575	B84143B0180S081	B84143B0150S021	–
	270		B84143B0320S081	B84143B0320S021	–
	405		B84143B0600S081	B84143B0600S021	–
C	540		B84143B0600S081	B84143B0600S021	–
	675		B84143B1000S081	B84143B1000S021	–
D	810		B84143B1000S081	B84143B1000S021	–
	1K0		B84143B1600S081	B84143B1600S021	–
	1K2		B84143B1600S081	B84143B1600S021	–
	1K3		B84143B1600S081	B84143B1600S021	–
	1K6		B84143B2500S021	–	–
C	452	690	B84143B0600S081	B84143B0600S021	–
	565		B84143B0600S081	B84143B0600S021	–
D	678		B84143B1000S081	B84143B1000S021	–
	791		B84143B1000S081	B84143B1000S021	–
	904		B84143B1000S081	B84143B1000S021	–
	1K0		B84143B1600S081	B84143B1600S021	–
	1K1		B84143B1600S081	B84143B1600S021	–
	1K2		B84143B1600S081	B84143B1600S021	–
	1K4		B84143B1600S081	B84143B1600S021	–
	1K5		B84143B1600S081	B84143B1600S021	–

Terminal Adapter Kits for Frame D Drives

The following frame D drives require the listed terminal adapter kits in order to meet UL installation requirements.

Voltage Class	Drive Current Rating Code	U, V, W Terminal Adapter Kit Number	C, D Terminal Adapter Kit Number
230	1K0	SK-20P-S726172	–
460	1K1	SK-20P-S726171	–
	1K3		–
	1K4		–
575	1K0	SK-20P-S726172	–
	1K2	SK-20P-S726171	–
	1K3		–
	1K6		SK-20P-S726173
690	1K0	SK-20P-S726172	–
	1K1	SK-20P-S726171	–
	1K2		–
	1K4		–
	1K5		–

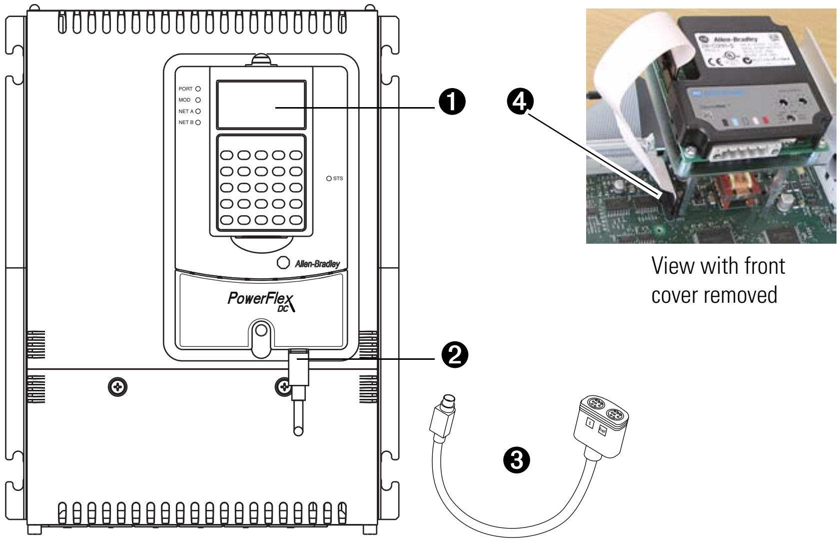
Notes:

Appendix B

HIM Overview

External and Internal Connections

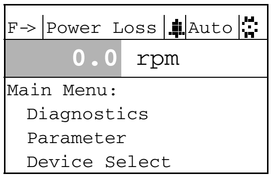
The PowerFlex DC drive provides a number of cable connection points for the HIM (Frame A shown).



View with front cover removed

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

LCD Display Elements



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

The top line of the HIM display can be configured with parameter 1321 [DPI Fdbk Select].

ALT Functions

To use an ALT function, press the ALT key, release it, then press the programming key associated with the function printed on the HIM above the key:

Table 86 - ALT Key Functions

Press the ALT Key and then …		Performs this function …
ALT	S.M.A.R.T. Esc	Displays the S.M.A.R.T. list screen. See Using the S.M.A.R.T. List Screen below for more information.
	View Sel	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	Lang ▲	Displays the language selection screen.
	Auto / Man ▼	Switches between Auto and Manual Modes.
	Remove ↵	Allows HIM removal without causing a fault if the HIM is not the last controlling device and does not have Manual control of the drive.
	Exp .	Allows value to be entered as an exponent (Not available on the PowerFlex DC drive).
	Param # +/–	Allows entry of a parameter number for viewing/editing.

Using the S.M.A.R.T. List Screen

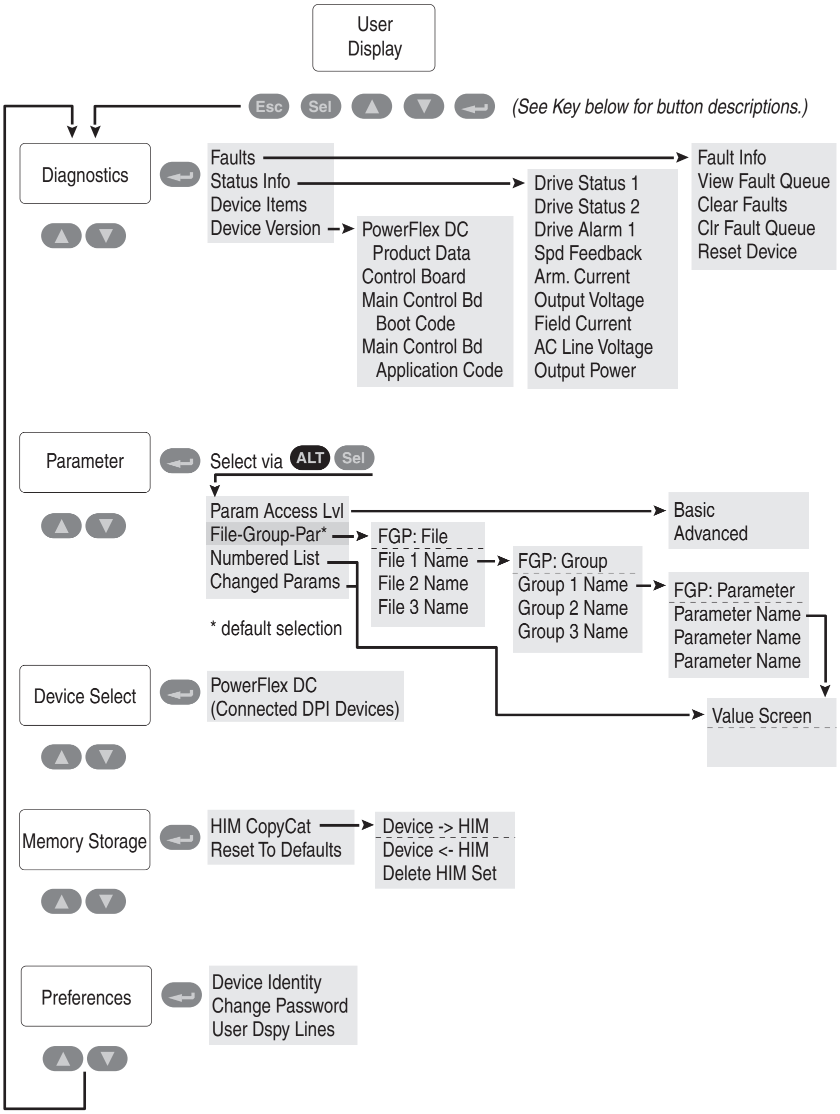
The LCD HIM provides the S.M.A.R.T. list screen which contains some of the most commonly changed parameters, including the following:

Parameter Name / Number	Description
[Max Ref Speed] (45)	The nameplate base motor speed.
[Rated Motor Volt] (175)	The maximum armature voltage of the drive output.
[Nom Mtr Arm Amps] (179)	Corresponds to 100% of the current limit.
[Nom Mtr Fld Amps] (280)	Rated motor nameplate field current.
[Anlg In1 Sel] (70)	Selects the parameter to which a value will be written from analog input 1 (default = "Speed Ref A")
[Maximum Speed] (2)	Defines the maximum speed of the drive.
[Current Limit] (7)	Symmetrical current limit for both current directions for four quadrant drives, expressed as a percentage of the value in parameter 179 [Nom Mtr Arm Amps].
[Accel Time 1] (660)	Sets the rate of acceleration for Ramp 0.
[Fdbk Device Type] (414)	The source of speed feedback.

Some important Start Up parameters are not included in this screen. Refer to Drive Start Up on page 83 for detailed instructions.

Menu Structure

Figure 68 - HIM Menu Structure



Key:

Press ▲ ▼ *to move between menu items*

Press ↵ *to select a menu item*

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

Press ALT Sel *to select how to view parameters*

Diagnostics Menu

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

Option	Description
Faults	View fault queue or fault information, clear faults or reset drive.
Status Info	View parameters that display status information about the drive.
Device Items	View statistics associated with DPI Communications.
Device Version	View the firmware version and hardware series of components.

Parameter Menu

Use this menu to view and edit parameters for the drive. When you enter the the Parameter menu, by default the File–Group–Parameter view is displayed. To access other views for the Parameter menu, with "Parameter" highlighted in the Main menu, press Alt then Sel (View), select the desired view in the list and press Enter. The following selections are available:

Option	Description
Param Access Lvl	Displays parameter 211 [Param Access Level]. The PowerFlex DC drive is initially set to the Basic Parameter view. To view all parameters, set parameter 211 [Param Access Lvl] to option 1 "Advanced".
File-Group-Par (FGP)	Displays all parameters in a File - Group - Parameter structure. This simplifies programming by grouping parameters that are used for similar functions.
Numbered List	Displays all parameters in numerical order.
Changed Params	Displays the most recently changed parameter. You can scroll through the list of all changed parameters to the least recently changed. The new and default values are listed for each parameter.

Refer to Viewing and Editing Parameters on page 256 for more information.

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, HIM sets.
HIM sets are files stored in permanent nonvolatile HIM memory.

⚠ **ATTENTION:** It is recommended that you stop the drive before performing a download to the drive using the HIM CopyCat function, DriveExecutive™, or DriveExplorer™.

Option	Description
HIM CopyCat	
Device -> HIM	Save data to a HIM set.
Device <- HIM	Load data from a HIM set to active drive memory.
Delete HIM Set	Delete a HIM set.
Reset To Defaults	Restore the drive to its factory default settings.

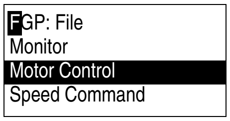
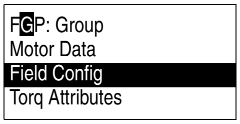
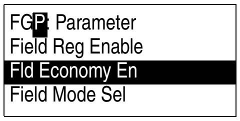
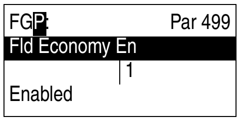
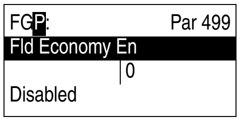
Preferences Menu

The HIM and drive have features that you can customize.

Option	Description
Drive Identity	Add text to identify the drive.
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.

Viewing and Editing Parameters

LCD HIM

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to "Parameter."	▲ or ▼	
2. Press Enter. "FGP File" appears on the top line and the first three files appear below it.	↵	 FGP: File Monitor Motor Control Speed Command
3. Press the Up Arrow or Down Arrow to scroll through the files.	▲ or ▼	
4. Press Enter to select a file. The groups in the file are displayed under it.	↵	 FGP: Group Motor Data Field Config Torq Attributes
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		 FGP: Parameter Field Reg Enable Fld Economy En Field Mode Sel
6. Press Enter to edit the parameter.	↵	
7. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit, letter to letter, or bit to bit. The digit or bit that you can change will be highlighted.	▲ or ▼ Sel	 FGP: Par 499 Fld Economy En 1 Enabled
8. Press Enter to save the value. If you want to cancel a change, press Esc.	↵	 FGP: Par 499 Fld Economy En 0 Disabled
9. Press the Up Arrow or Down Arrow to scroll through the parameters in the group, or press Esc to return to the group list.	▲ or ▼ Esc	

Numeric Keypad Shortcut

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

Removing/Installing the HIM

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

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

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

Notes:

Application Notes

Alpha Test Mode

The Alpha Test is a diagnostic function that allows you to activate the Armature or Field power module in an open loop mode. By commanding a SCR firing angle (specified in Par 167 [Arm Test Angle] or Par 168 [Fld Test Angle]) a voltage is produced at the output of the selected power module. A load greater than 500 mA is required for proper SCR operation - typically, an incandescent bulb or inductive load (never a motor) is used.

The Alpha Test is started as soon as Par 166 [Alpha Test] is set to 1 “Arm Fwd” (armature forward), 2 “Arm Rev” (armature reverse), or 3 “Fld Fwd” (field forward). The HIM displays "ArmAlphaTest" or "FldAlphaTest" while active. Start and Jog commands have no affect and a motor contactor is not closed when the test mode is initiated.

The Alpha Test ends when Par 166 [Alpha Test] is set to 0 “Off”. Otherwise, only a digital input Enable or a Fault will stop the test - a HIM Stop has no affect. Changing the Alpha Test Mode (set in Par 166 [Alpha Test]) resets both test angles to their minimum firing value (180 deg).

Note: Overcurrent and Overvoltage fault protections are active during these tests. Also, the Autotune function is disabled while Alpha test is enabled.

Alpha Test Setup and Operation

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should perform this test. Failure to observe this precaution could result in equipment damage and/or bodily injury.

ATTENTION: This is an open loop test, disconnect the motor armature and field leads and replace them with dummy loads. Failure to observe this precaution could result in machine damage and/or bodily injury.

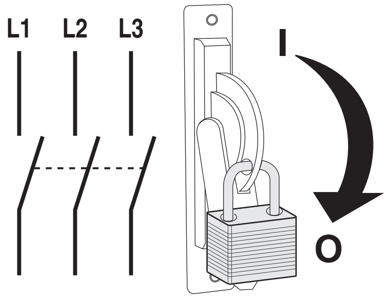
ATTENTION: Uncontrolled machine operation could result with a motor connected during these tests and may cause personal injury and/or equipment damage. Verify that the drive is not connected to a motor armature circuit before enabling these test modes.

ATTENTION: Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

1. Remove and lock-out all incoming power to the drive.



2. Disconnect the motor armature leads and mechanically lock the rotor.

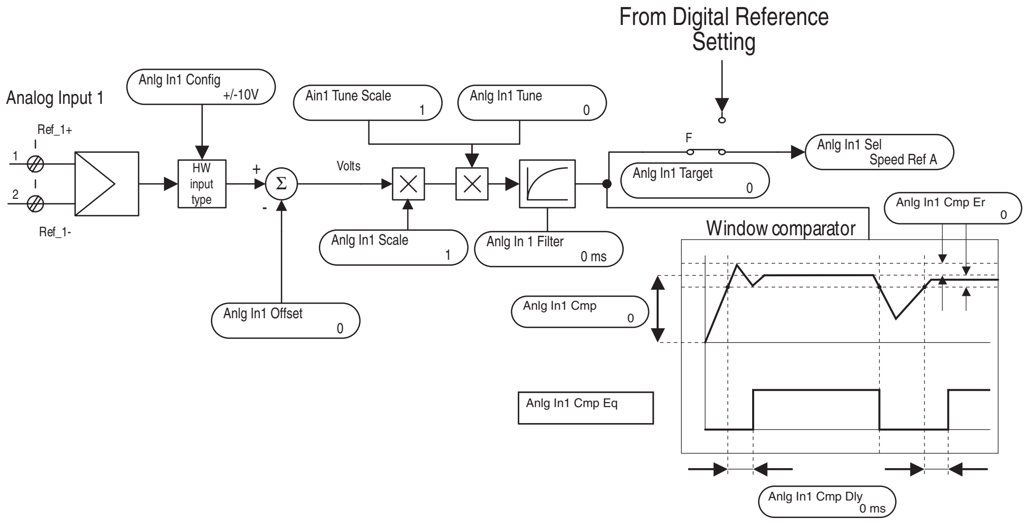
IMPORTANT The Alpha Test requires the use of an isolated oscilloscope and leads that will be attached to the armature or field terminals of the drive.

3. Attach the isolated oscilloscope leads to the appropriate drive terminals (based on test to be performed).
4. Reapply power to drive.

5. Verify the no faults or alarms present. If an alarm or fault code displays, refer to Chapter 4 - Troubleshooting on page 4-195.
6. Open the Enable input on the drive.
7. Set Par 166 [Alpha Test] to the desired value (1 = "Arm Fwd", 2 = "Arm Rev" or 3 = "Fld Fwd").
8. Close the Enable input.
9. Slowly decrease the appropriate angle parameter (Par 167 [Arm Test Angle] or Par 168 [Fld Test Angle]) until a steady pattern of voltage pulses display on the oscilloscope. If all Thyristors in the selected bridge are operating, there will be six pulses per AC line cycle. If not all Thyristors in the selected bridge are operating, one or more pulses will be missing. Note that conduction (or output voltage) will not typically begin until the angle is below about 120 degrees.
10. Open the Enable input and set Par 166 [Alpha Test] to 0 "Off".
11. Remove power from the drive.
12. Remove the oscilloscope from the leads of the drive and unlock the rotor.
13. If necessary, replace the defective firing board in the drive.
14. Reconnect the motor armature and field leads to the drive.
15. Reapply power to the motor and drive.

Analog Input Configuration

The analog inputs default to ±10V. To configure the analog inputs for 0-10V, set parameters [Anlg Inx Config] to 1, “0-10V”. To configure the analog inputs for a current signal, set parameters [Anlg Inx Config] to 2, “0 - 20mA” or 3, “4 to 20mA”. In addition, switches S9, S10 and S11 must be properly configured (refer to Table 24 - on page 1-69 for more information).



Refer to the “Analog Inputs / Outputs & Mapping” block diagram on page 312 for more information.

Example 1:

The speed reference value of a drive is defined with an external voltage of 5V. With this value the drive should reach the maximum allowable speed set in Par 45 [Max Ref Speed]. Enter a scaling factor of 2 in [Anlg Inx Scale] to scale the input voltage from 5V to 10V.

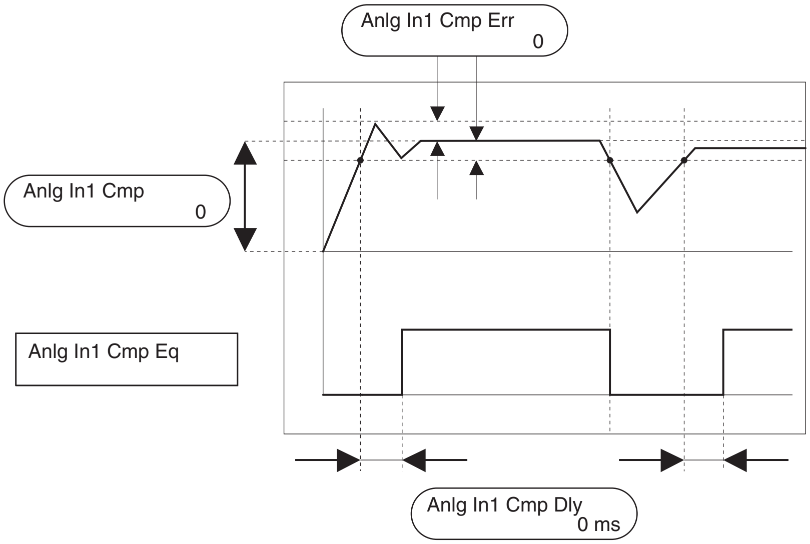
Example 2:

An external analog reference reaches a maximum value of 9.8V. Enter a scaling factor of 1.020 in [Anlg Inx Scale] to scale the maximum voltage from 9.8V to 10V.

The same result could be obtained via parameter [Anlgx Tune Scale], by entering the values of the appropriate parameters via the HIM. The maximum possible analog value (in this case 9.8V) would have to be present at the terminal with a positive polarity.

Analog Input Signal Comparison

This feature provides an indication via the HIM or a digital output when the signal of analog input 1 has reached a limit above or below a set reference point.



Calculations used to determine Pars1042 [Anlg In1 Cmp] and 1043 [Anlg In1 Cmp Err]:

- [Anlg In1 Cmp] = (comparison value) x 10000 / (max. reference value)
- [Anlg In1 Cmp Err] = (tolerance value) x 10000 / (max. reference value)

Example 1:

An application requires an indication via a digital output that the motor speed is within 100 rpms of 700 rpm.

- Par 45 [Max Ref Speed] = 1500 rpm (maximum reference value)
- For Analog Input 1, 10V or 20mA sets the maximum value of Par 44 [Speed Ref A] = Par 45 [Max Ref Speed]

Configure the following:

- Set Par 70 [Anlg In1 Sel] = “Speed Ref A”
- Set [Digital Outx Sel] = “Input1 Cmp” (Par 1045 [Anlg In1 Cmp Eq])
- Set Par 1042 [Anlg In1 Cmp] = 4667 (700 x 10000 / 1500)
- Set Par 1043 [Anlg In1 Cmp Err] = 666 (100 x 10000 / 1500)

- Par 1045 [Anlg In1 Cmp Eq] = “1” (high) when the signal on Analog Input 1 is within the range specified in Par 1043 [Anlg In1 Cmp Err]. Par 1045 [Anlg In1 Cmp Eq] = “0” (low) when the signal on Analog Input 1 is outside the range specified in Par 1043 [Anlg In1 Cmp Err].

Example 2:

An application requires an indication via a digital output that the output current is within ±2% of 50% of the maximum current limit.

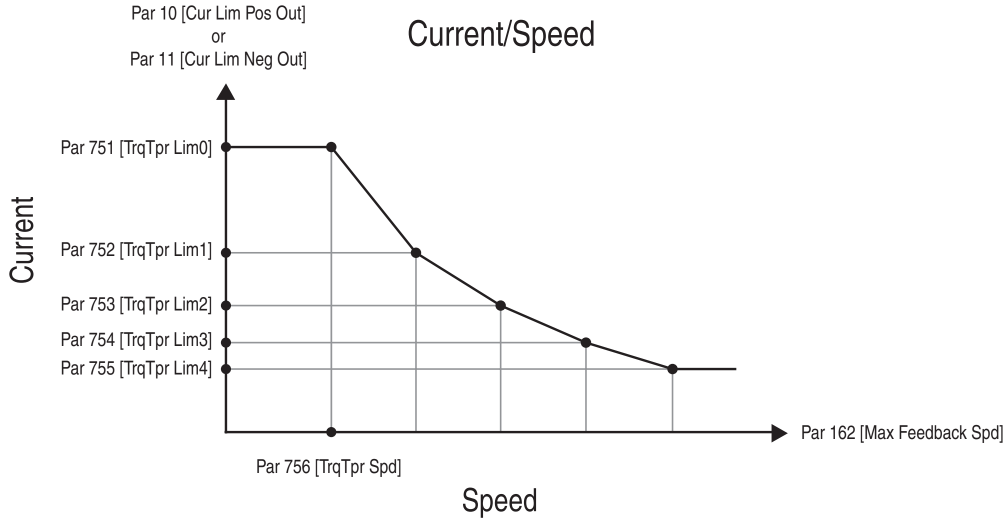
- Par 7 [Current Limit] = 100% (maximum reference value)
- For Analog Input 1, 10V or 20mA sets the maximum value = Par 7 [Current Limit]

Configure the following:

- Set Par 70 [Anlg In1 Sel] = “Pos Cur Lim”
- Set [Digital Outx Sel] = “Input1 Cmp” (Par 1045 [Anlg In1 Cmp Eq])
- Set Par 1042 [Anlg In1 Cmp] = 5000 (50 x 10000 / 100)
- Set Par 1043 [Anlg In1 Cmp Err] = 200 (2 x 10000 / 100)

Current / Speed Curve

The current/speed curve function allows you to establish a current limit lower than the standard current limits of the drive (specified in parameters 8 [Current Lim Pos] and 9 [Current Lim Neg]) and reduce the output current (torque) of the drive through a defined curve of five equally divided set points as the speed increases based on a threshold speed, effectively reducing torque.



- Enable the current/speed curve function by setting parameter 750 [TrqTpr Enable] to 1 "Enabled".
- Set the current limit (for both directions of rotation in four quadrant drives) in parameter 751 [TrqTpr Lim0]. The value specified in this parameter overrides the value of parameters 8 [Current Lim Pos] and 9 [Current Lim Neg].
- Set the threshold speed at which current (torque) reduction begins in parameter 756 [TrqTpr Spd].
- Set the first reduced current limit in parameter 752 [TrqTpr Lim1]. The value defined in this parameter must be less than the value in parameter 751 [TrqTpr Lim0] and greater than the values in parameters 753 [TrqTpr Lim2], 754 [TrqTpr Lim3] and 755 [TrqTpr Lim4].
- Set the second, third and final reduced current limits in parameters 753 [TrqTpr Lim2], 754 [TrqTpr Lim3] and 755 [TrqTpr Lim4], respectively. The value of each subsequent parameter must be less than the previous parameter's value. The drive will maintain the value specified in parameter 755 [TrqTpr Lim4] up to the value set in parameter 162 [Max Feedback Spd].

Drive Reference and Feedback Scaling

With firmware version 3.001, external reference and feedback speed values are each normalized to 25,000 counts (for firmware version 2.005 and lower, external reference and feedback speed values are scaled to "rpm x 4" counts).

The value of parameter 45 [Max Ref Speed] (rpm) will determine the correlation (scaling) between DPI speed reference counts and rpm as well as the analog input reference values (10V = Par 45 rpm). All speed reference values are based on the value of [Max Ref Speed]. The value of [Max Ref Speed] represents the maximum speed the motor can attain (also known as Gear-in Speed). If field weakening is used, [Max Ref Speed] would be set to the field weakened speed. Otherwise, the motor base speed is typically used.

The value of parameter 162 [Max Feedback Spd] (rpm) will determine the correlation (scaling) between DPI speed feedback counts and rpm as well as the DC tachometer values (if configured). All speed feedback values are based on [Max Feedback Spd]. Typically, [Max Feedback Spd] is set to the same value as parameter 45 [Max Ref Speed], but this is not required (because each is separately scaled to 25000 counts). See Speed Feedback on page 279 for limitations for parameter 162 [Max Feedback Spd] and 169 [Encoder PPR].

When armature voltage feedback is configured (either directly, Par 414 [Fdbk Device Type] = 3 "Armature" or indirectly, Par 458 [SpdReg FB Bypass] = 1 "Enabled"), Par 162 [Max Feedback Spd] must be set to the motor base speed (rpm) value associated with Par 175 [Rated Motor Volt].

When DC tachometer feedback is configured (Par 414 [Fdbk Device Type] = 2 “DC Tach”), Par 162 [Max Feedback Spd] must be set to the rpm value indicated by the maximum tachometer input voltage as determined by DIP switch S4 on the control board (see DIP Switch and Jumper Settings on page 68). To maximize the feedback speed resolution, Par 562 [Anlg Tach Gain] can be used to scale the voltage setting selected with DIP switch S4 to Par 162 [Max Feedback Spd].

Par 562 [Anlg Tach Gain] = (S4 Maximum DC Input Voltage) x (1000 rpm/ volts Tach Voltage) / Par 45 [Max Ref Speed].

When Encoder feedback is configured, it has the same limitations as above except that no scaling or switch setting is needed because Par 169 [Encoder PPR] is used instead.

If Par 458 [Spd Reg FB Bypass] = 1 “Enabled”, then Par 162 [Max Speed Feedback] must be set to motor base speed (rpm). Refer to Speed Feedback on page 279 for more information on setting parameters 162 [Max Speed Feedback] and 169 [Encoder PPR]. Note that setting Par 458 [SpdReg FB Bypass] = 1 “Enabled” is not permitted when field weakening is enabled (Par 469 [Field Mode Sel] - 1 “Field Weaken”).

The examples below are based on the following data:

- 500V motor, with base speed = 1750 rpm
- Weakened spd = 2500 rpm
- Weakened ratio = 70% (1750/2500 = 0.7)
- 50V / 1000 rpm tachometer
- 240 ppr encoder
- 7500 fpm application (field weakened or gear-in speed)

Examples 2, 3, and 4 indicate how the value of Par 162 [Max Speed Feedback] is derived from the required analog tachometer hardware scaling set by DIP switch S4.

Example 1: Armature Voltage (Overvoltage Fixed at 20%)

Because armature voltage feedback is being used the maximum reference and feedback speeds must be equal and set to the rated speed of the motor (in other words, field weakening is not permitted).

- Par 175 [Rated Motor Volt] = 500V (default)
- Par 45 [Max Ref Speed] = 1750 rpm (default)
- Par 162 [Max Feedback Spd] = 1750 rpm (default)
- The reference and feedback resolution = 0.21 fpm/count (5250 fpm/25000 counts)

Example 2: DC Tachometer with No Feedback Bypass

When a DC tachometer is configured, the maximum feedback speed must be scaled to the maximum voltage of DC tachometer. Leaving Par 562 [Anlg Tach Gain] at its default value (1.0000) will result in a loss of feedback resolution because the drive is only using 1750 rpm out of the maximum 3600 rpm.

- Par 175 [Rated Motor Volt] = 500V (default)
- Par 45 [Max Ref Speed] = 1750 rpm (default)
- Par 562 [Anlg Tach Gain] = 1.0000 (default)
- Par 585 [Overspeed Val] = 1925 rpm (default)
- Set DIP switch S4 = 180V
  This value is set to the next highest DIP switch setting available based on the result of the following calculation:

Tachometer	x	Max Motor Speed	x	Overspeed Percentage	=	Scaled Tach Input Volts
(50V/1000 rpm)		(1750 rpm)		(1.1)		96.25V

- Set Par 162 [Max Feedback Spd] = 3600 rpm
  This value is based on (180V/50V) =3.6 (1000)
- The reference resolution = (5250 fpm/25000 counts) = 0.21 fpm/count
- The feedback resolution = 0.62 fpm/count

Example 3: DC Tachometer with Feedback Bypass (No Field Weakening)

This example is similar to example 2 except that it compensates for the loss in feedback resolution by setting parameter 562 [Anlg Tach Gain].

- Par 175 [Rated Motor Volt] = 500V (default)
- Par 45 [Max Ref Speed] = 1750 rpm (default)
- Set Par 562 [Anlg Tach Gain] = 2.057 (3600/1750)
- Par 585 [Overspeed Val] = 1925 rpm (default)
- Set DIP switch S4 = 180V
  This value is set to the next highest DIP switch setting available based on the result of the following calculation:

Tachometer	x	Max Motor Speed	x	Overspeed Percentage	=	Scaled Tach Input Volts
(50V/1000 rpm)		(1750 rpm)		(1.1)		96.25V

- Par 162 [Max Feedback Spd] = 1750 rpm (default)
  This value is based on: (180V/50V/2.057) =1.750 (1000)
- The reference and feedback resolution = (5250 fpm/25000 counts) = 0.21 fpm/count

Example 4: DC Tachometer with Field Weakening (Feedback Bypass Not Allowed)

This example is similar to example 3 except that a field weakening speed of 2500 rpm is configured rather than a base speed of 1750 rpm.

- Par 175 [Rated Motor Volt] = 500V (default)
- Set Par 45 [Max Ref Speed] = 2500 rpm
- Set Par 562 [Anlg Tach Gain] = 1.44
- Set Par 585 [Overspeed Val] = 2750 rpm
- Set DIP switch S4 = 180V
  This value is set to the next highest DIP switch setting available based on the result of the following calculation:

Tachometer	x	Max Motor Speed	x	Overspeed Percentage	=	Scaled Tach Input Volts
(50V/1000 rpm)		(2500 rpm)		(1.1)		137.5V

- Set Par 162 [Max Feedback Spd] = 2500 rpm
  This value is based on: (180V/50V/1.44) = 2.5 (1000)
- The reference and feedback resolution = (7500 fpm/25000 counts) = 0.3 fpm/count

Example 5: Encoder with Field Weakening (Feedback Bypass Not Allowed)

This example is similar to example 4 except that an encoder is configured so there is no feedback scaling required.

- Par 175 [Rated Motor Volt] = 500V (default)
- Set Par 45 [Max Ref Speed] = 2500 rpm
- Set Par 162 [Max Feedback Spd] = 2500 rpm
- Set Par 169 [Encoder PPR] = 240 ppr
- Set Par 585 [Overspeed Val] = 2750 rpm
- The reference and feedback resolution = (7500 fpm/25000 counts) = 0.3 fpm/count

Droop Compensation

The Droop function is used when the current must be balanced between two drives. A typical situation is when two motors are mechanically coupled and must run at the same speed. If, because of differences in the drives speed regulators, one of the motors runs at a higher speed, it will be overloaded and the second motor will function, essentially, as a brake.

The Droop function allows you to overcome this difference by adding a load compensation component to the speed reference, which is proportional to the actual load differences of the drives.

For Example (see the block diagram for Droop Compensation - Inertia / Loss Compensation on page 318 for more information):

Master Drive		Slave Drive	
[Anlg In1 Sel]	= "Speed Ref A"	[Anlg In1 Sel]	= "Speed Ref A"
[Anlg Out1 Sel]	= "Torque Ref"	[Anlg In2 Sel]	= "Load Comp"
		[Enable Droop]	= "Enabled"
		[Droop Percent]	= 5%
		[Droop Filter]	= 100 ms
		[Droop Limit]	= 1000

Field Weakening Mode Configuration (v1.006)

IMPORTANT This configuration applies only to firmware version 1.006. For instructions on configuring a drive with firmware version 2.001 for use with an AC or DC contactor, with or without a dynamic brake, refer to Using Contactors on page 31.

The following configuration is required when operating the drive in field weakening mode with a DC contactor and/or inverting fault device installed in the armature circuit.

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.

When operating the PowerFlex DC drive in field weakening mode (parameter 469 [Field Mode Sel] set to 1 - "Field Weaken") and using a DC contactor and/or an inverting fault device in the armature circuit, you must complete the appropriate installation and programming requirements detailed below.

Using a DC Contactor Only

1. Set parameter 1391 [ContactorControl] to "Contactor" (default value).
2. Set one [Relay Out x Sel] parameter and one [Digital Inx Sel] parameter to "Contactor" (default value for parameters 1392 [Relay Out 1 Sel] and 140 [Digital In8 Sel]).
3. Connect the DC contactor auxiliary (status) contact to a second digital input.
4. Set the corresponding second [Digital Inx Sel] parameter (133-144) to "Fld Weak En".
5. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) for the second digital input to "Enabled".

Using a DC Contactor and a Dynamic Brake

1. Set parameter 1391[ContactorControl] to "Contactor+DB".
2. Set one relay output parameter (1392 [Relay Out 1 Sel] or 629 [Relay Out 2 Sel]) to "Contactor" and the other relay output parameter to "ContactorDB".
3. Set one [Digital Inx Sel] parameter to "Contactor" (default value for parameter 140 [Digital In8 Sel]).
4. Connect the DC contactor auxiliary (status) contact to a second digital input.
5. Set the corresponding second [Digital Inx Sel] parameter (133-144) to "Fld Weak En".
6. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) for the second digital input to "Enabled".

Using an Inverting Fault Device Only

1. Connect the inverting fault device contact to two separate digital inputs. If using two inverting fault devices, the device contacts must be wired in series.
2. Set one corresponding [Digital Inx Sel] parameter (133-144) to 35 - “Fld Weak En”.
3. Set the other corresponding [Digital Inx Sel] parameter (133-144) to 14 - "Aux Fault".
4. Set both of the corresponding [Inversion In x] parameters (1276-1283 or 1387-1390) to 1 - “Enabled”.

Using a DC Contactor and an Inverting Fault Device

DC Contactor Configuration

1. Set parameter 1391[ContactorControl] to "Contactor" (default value).
2. Set one [Relay Out x Sel] parameter and one [Digital Inx Sel] parameter to "Contactor" (default value for parameters 1392 [Relay Out 1 Sel] and 140 [Digital In8 Sel]).
3. Connect the DC contactor auxiliary (status) contact to a digital input.
4. Set the corresponding [Digital Inx Sel] parameter (133-144) to 35 - “Fld Weak En”.
5. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) to 1 - “Enabled”.

Inverting Fault Device Configuration

1. Connect the inverting fault device contact to a digital input.
2. Set the corresponding [Digital Inx Sel] parameter (133-144) to 14 - "Aux Fault".
3. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) to 1 - “Enabled”.

Using a DC Contactor, a Dynamic Brake and an Inverting Fault Device

DC Contactor and Dynamic Brake Configuration

1. Set parameter 1391[ContactorControl] to "Contactor+DB".
2. Set one [Relay Out x Sel] parameter (1392 [Relay Out 1 Sel] or 629 [Relay Out 2 Sel]) to "Contactor" and the other relay output to "ContactorDB".
3. Set one [Digital Inx Sel] parameter to "Contactor" (default value for parameter 140 [Digital In8 Sel]).
4. Connect the DC contactor auxiliary (status) contact to a second digital input.
5. Set the corresponding second [Digital Inx Sel] parameter (133-144) to "Fld Weak En".
6. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) for the second digital input to "Enabled".

Inverting Fault Device Configuration

1. Connect the inverting fault device contact to a digital input.
2. Set the corresponding [Digital Inx Sel] parameter (133-144) to 14 - "Aux Fault".

3. Set the corresponding [Inversion In x] parameter (1276-1283 or 1387-1390) to 1 - “Enabled”.

ATTENTION: If a dynamic brake resistor is used with one of the configurations detailed above, dynamic braking stop time will be extended when the digital input configured as 35 - “Fld Weak En” is asserted. Equipment damage and/or personal injury may result if one of these configurations is used in an inappropriate application. Do not use one of these configurations without considering applicable local, national and international codes, standards, regulations or industry guidelines.

PID Function

The PID function is used to increase or reduce the reference signal output to the speed or current regulator of the drive. The PID function can be used for nip-roll, winder/unwinder, roll doctor/salvage machine, pump and extruder pressure control and extruder temperature control applications. (Refer to the complete “PID Control” block diagram on page 326.)

Examples are included below for configuring the following applications:

- Speed winder with a load cell and tension control
  - ☐ Line speed signal (see Configure a Line Speed Signal on page 273)
  - ☐ Closed loop dancer / load cell feedback (see Configure the Feedback Signal in the Follower Drive(s) on page 274)
  - ☐ Tension set point (see Configure the Tension Set Point Signal in the Follower Drive(s) on page 276)
- Torque winder with a load cell and tension control
  - ☐ Line speed signal (see Configure a Line Speed Signal on page 273)
  - ☐ Closed loop dancer / load cell feedback (see Configure the Feedback Signal in the Follower Drive(s) on page 274)
  - ☐ Tension set point (see Configure the Tension Set Point Signal in the Follower Drive(s) on page 276)

Configure a Line Speed Signal

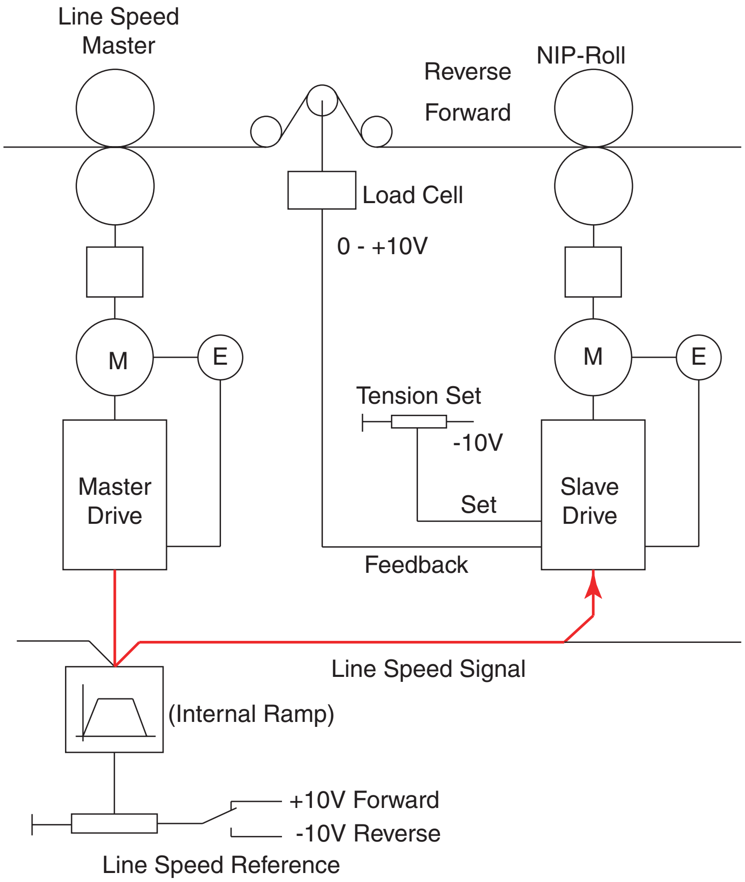
The line speed signal is the main reference for the speed or current regulator in the follower drive(s).

In the Master drive:

- Configure an analog output for the main speed reference (1 “Spd Ref Out”)

In the Follower drive:

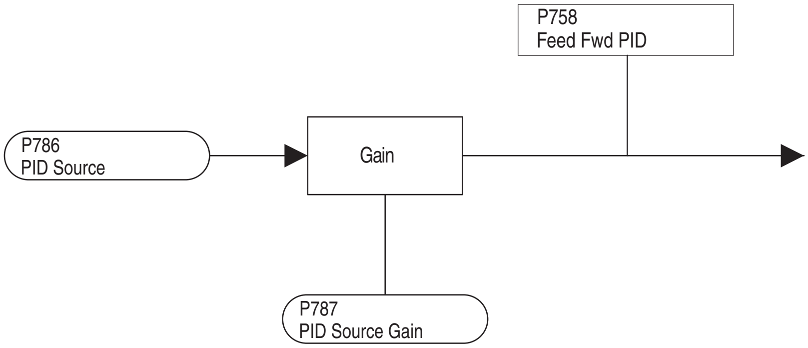
- Set Par 80 [Anlg In3 Sel] to 12 “UserDefined0”
- Set Par 786 [PID Source] to 19 “UsrDefined0” (Par 503).



In addition you can configure the following:

- Enter the gain for the feed-forward signal in Par 787 [PID Source Gain]

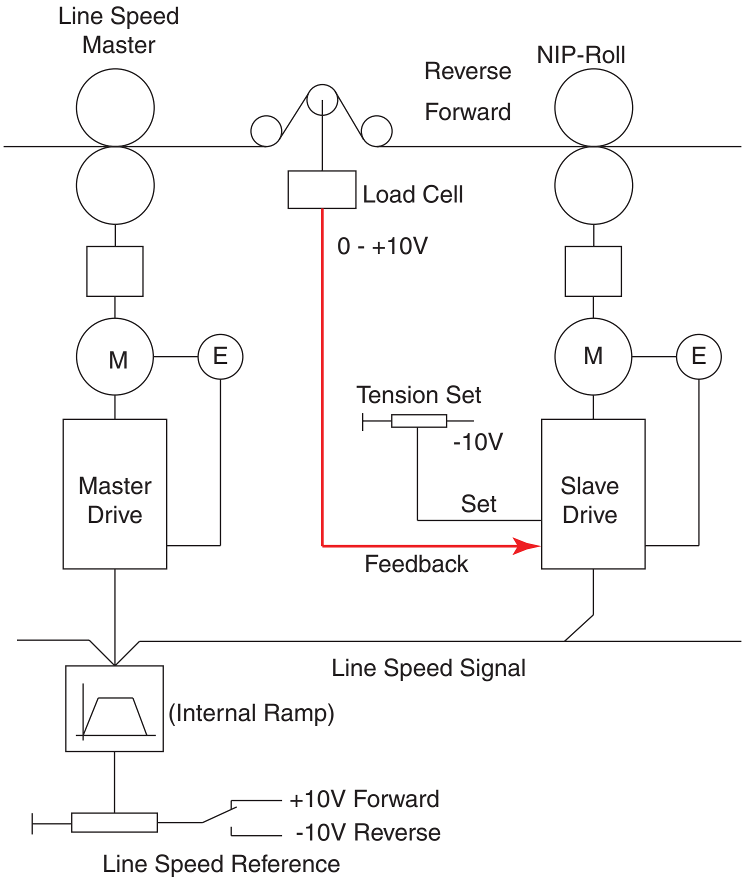
- Monitor the feed-forward signal after the gain is applied in Par 758 [Feed Fwd PID]



Configure the Feedback Signal in the Follower Drive(s)

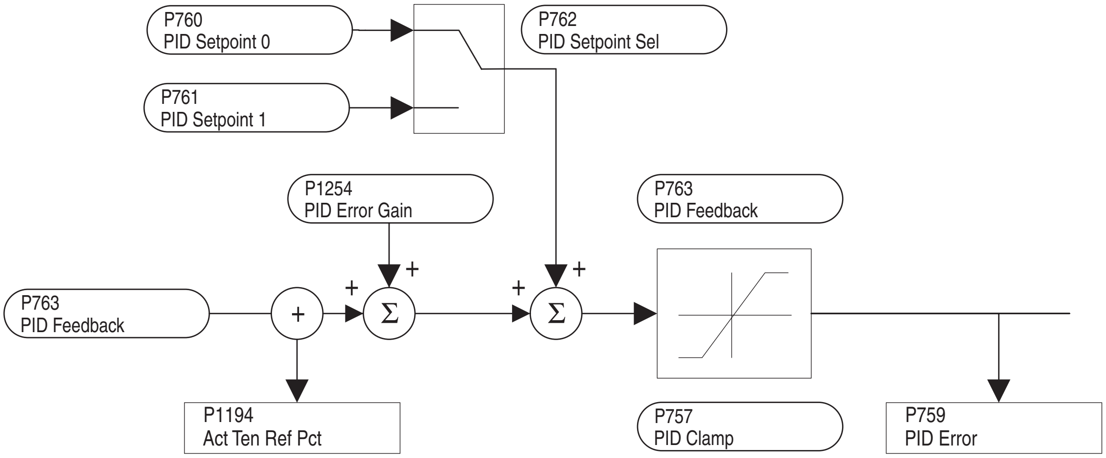
The feedback signal originates from a load cell or a closed loop dancer and is input to the drive via an analog input (typically analog input 1, due to the ability to filter this signal).

- Set Par 70 [Anlg In1 Sel] to 19 "PID Feedback".



In addition you can configure the following:

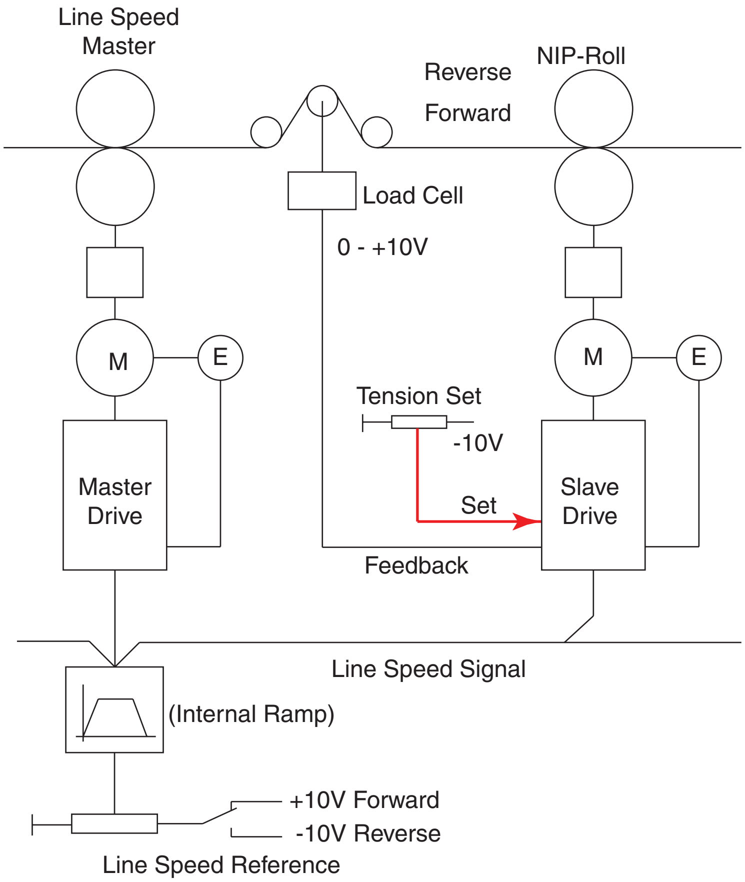
- Par 763 [PID Feedback] contains the raw feedback counts from the analog input signal received from the transducer position (dancer) or tension (load cell)
- Monitor the tension set point for a torque winder application in Par 1194 [Act Ten Ref Pct]
- Configure the PID feedback gain in Par 1254 [PID Error Gain]
- Limit the PID correction error using Par 757 [PID Clamp]
- Monitor the actual error input to the PI and PD blocks in Par 759 [PID Error]



Configure the Tension Set Point Signal in the Follower Drive(s)

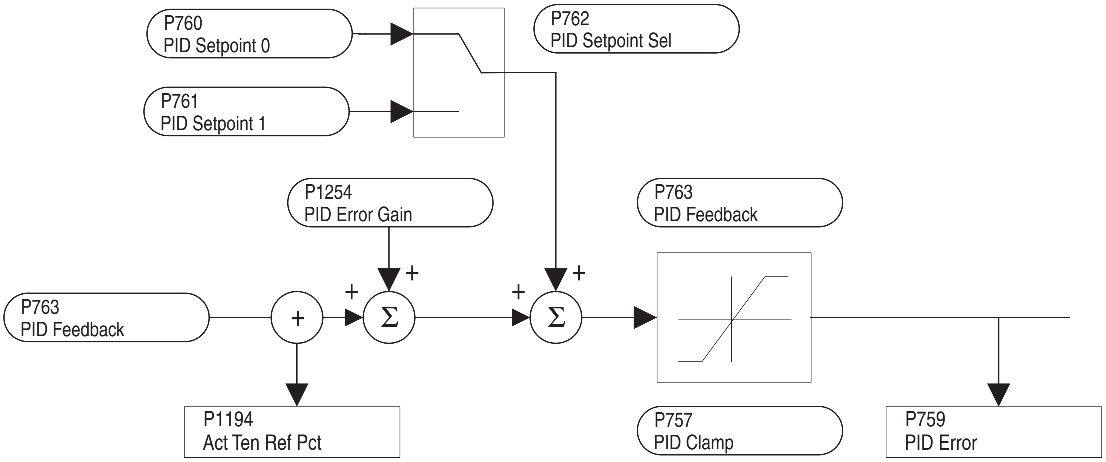
Configure the initial tension for the application in the Follower drive(s):

- Set Par 75 [Anlg In2 Sel] to 17 "PID Setpt 0"



In addition, configure the following in the Follower drive(s):

- Verify that Par 762 [PID Setpoint Sel] is set to 0 "Setpoint 0"



Reference Control

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 digital inputs configured as speed selects, a digital input configured for "Auto/Manual" or Reference Select bits of a command word (see Communication Configurations on page 217 for more information).

"Auto" Speed Sources

The default auto source for a command reference (all speed select digital inputs open or not programmed) is analog input 1 configured for "Speed Ref A" (parameter 44 [Speed Ref A]). If any of the speed select digital inputs are closed, the drive will use other parameters as the auto speed command source.

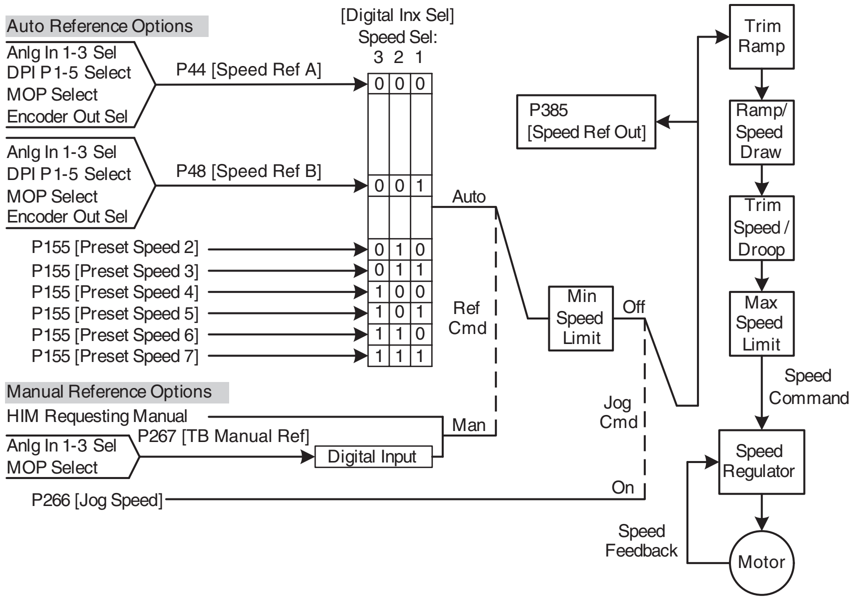
"Manual" Speed Sources

The manual source for speed command to the drive is either the HIM requesting manual control (see ALT Functions on page 252) or the control terminal block (analog input or MOP) if a digital input is programmed to "Auto/Manual".

Changing Speed Sources

The selection of the active speed reference can be made through the digital inputs, DPI command, Jog button or Auto/Manual HIM operation.

Figure 69 - Speed Reference Selection Chart



Torque Reference Source

The torque reference can only be supplied by an analog input, the HIM, or a network reference. Switching between available sources while the drive is running is not available. Digital inputs programmed as "Speed Sel 1, 2, 3" and the HIM Auto/Manual function (see above) do not affect the active torque reference. The HIM, however, cannot acquire Manual Reference control while it is configured to supply the torque reference.

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 speed reference is issued by the PLC through a communications module installed in the drive (Port 5). Therefore, parameter 1327 [DPI P5 Select] is set to "Speed Ref A" with the drive running from the Auto source.

Acquire Manual Control

- Press ALT then Auto/Man on the HIM. When the HIM acquires 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 (Port 5). Therefore, parameter 1327 [DPI P5 Select] is set to "Speed Ref A" with the drive running from the Auto source. Since the Manual speed reference is issued by analog input 2, parameter 75 [Anlg in2 Sel] is set to "TB Man Ref". The value of analog input 2 can be viewed in parameter 267 [TB Manual Ref]. To switch between Auto and Manual, parameter 136 [Digital In4 Sel] is set to "Auto/ Manual".

Acquire Manual Control

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

Release to Auto Control

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

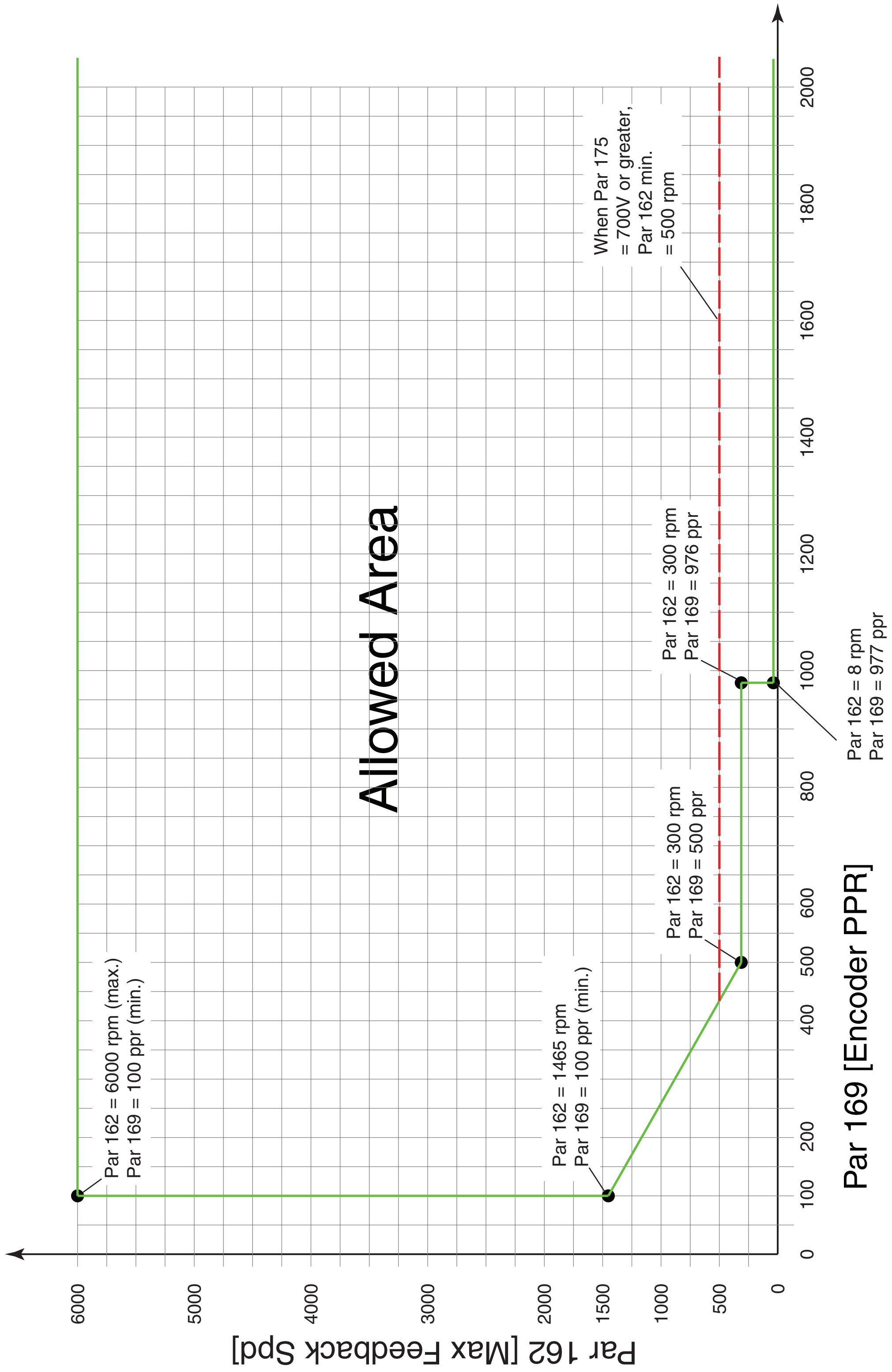
Auto/Manual Notes

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 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.

Speed Feedback

Regardless of the type of speed feedback device used, (selected in Par 414 [Fdbk Device Type]), the value of parameters 162 [Max Feedback Spd] and 169 [Encoder PPR] must be in the allowed area shown in Figure 70 below based on the value of Par 175 [Rated Motor Volt].

Figure 70 - Par 162 and 169 Settings when Par 175 [Rated Motor Volt] = 700V or Lower



Scale Blocks

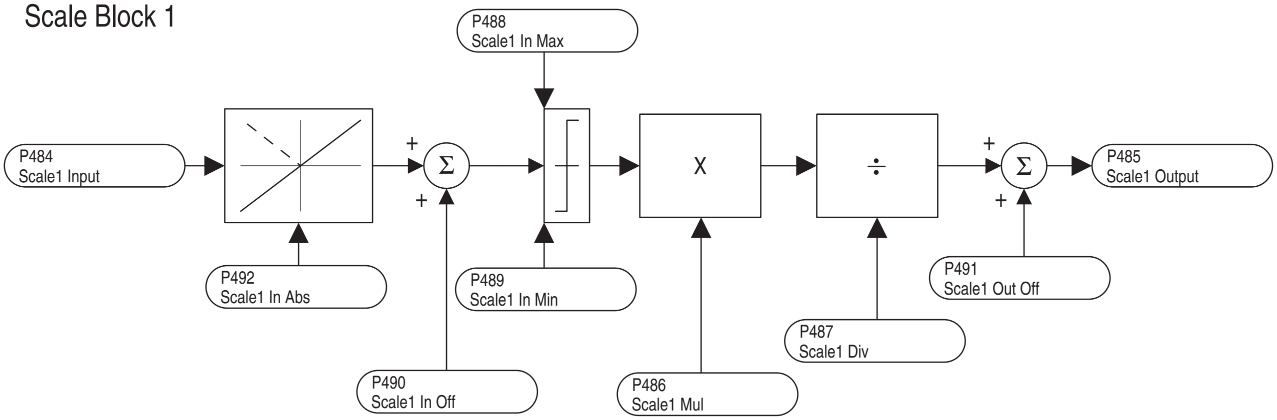
The Scale Blocks function allows you to link or rescale dissimilar parameter types (for example, integer vs. real) though multiply, divide, maximum and minimum limits, input and output offsets and absolute value functions. There are six individually configurable Scale Blocks. A representative block diagram is shown below.

IMPORTANT The Scale Blocks functions are executed sequentially in the background, which can cause a delay in processing data between the input and output values. The amount of delay is dependant on the application.

The following rules apply to Scale Blocks:

- All input [Scalex Input] and output [Scalex Output] values are specified as a parameter number (<u>not</u> parameter values).
- Both Sink (read/write) and Source (read only) parameters can be used as input values ([Scalex Input]).
- Only Sink (read/write) parameters can be used as the output value ([Scalex Output]).
- Configuration parameters (parameters that can only be changed while the drive is stopped) can be used as the output value ([Scalex Output]). However, any value written to a configuration parameter will not take effect in the drive until it is stopped.
- The output value is truncated to a whole number when different parameter types are used (for example, a real input value of 54.97% becomes an integer output value of 54 rpm).
- Dividing by zero (0) does not cause an error, but will result in an output value of zero (0).
- Turning off (setting = “0”) the input parameter or changing the output parameter number does not reset or change the original output value (i.e., the output parameter remains at the last value written).

Scale Block 1



Linking Parameters Via the Scale Block Parameters

Most parameter values are entered directly by the user. However, certain parameters can be "linked," via the Scale Block parameters, so the value of one parameter becomes the value of another.

For example, the value of an analog input 1, parameter 70 [Anlg In1 Sel], can be linked to parameter 660 [Accel Time 1]. In order to do so:

- Set parameter 70 [Anlg In1 Sel] to 12 "UserDefined0".
- Set parameter 484 [Scale1 Input] to "503" (the parameter number of [UserDefined0]).
- Set parameter 485 [Scale1 Output] to "660" (the parameter number of [Accel Time 1]).

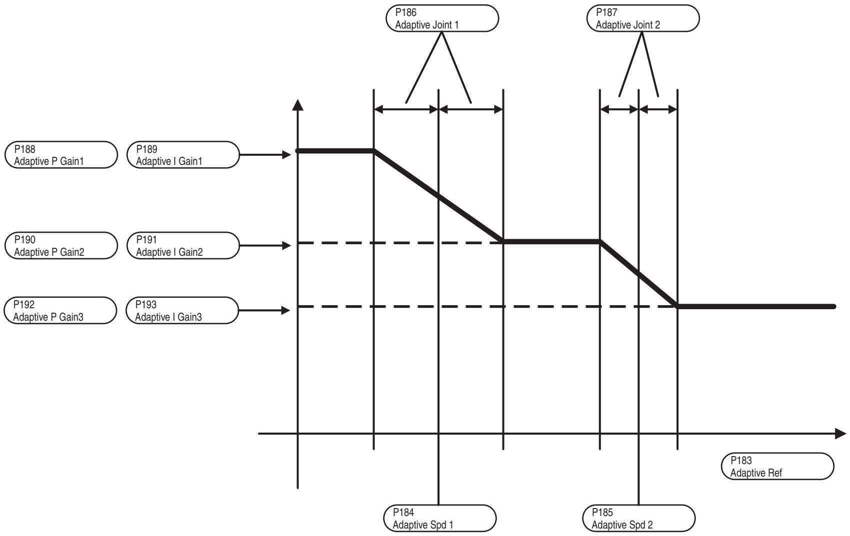
In this way, rather than entering an acceleration time directly (via HIM), the link allows the value to change by varying the analog signal. This can provide additional flexibility for certain applications. This functionality should be tested for the desired response before applying to an application.

Speed Regulation Functions

The PowerFlex DC Digital drive provides a flexible speed regulator circuit that can be adapted to the requirements of a variety of applications. The drive is set to PI regulation by default.

Adaptive Speed Regulator

The adaptive speed regulator function enables different gains of the speed regulator depending on the speed reference or another variable (adaptive reference). This allows optimum adaptation of the speed regulator to the specific application.



The adaptive speed regulator is enabled with parameter 181 [Adaptive Spd En] = "1 Enabled". Normally the gain depends on the speed of the drive. It can, however, vary according to a variable defined in parameter 183 [Adap Ref]. The type of regulation used is selected in parameter 182 [Adaptive Reg Typ]; 0 = "Speed", or 1 = "Adaptive Ref".

Parameters 184 [Adaptive Spd 1] and 185 [Adaptive Spd 2] are used to define the three ranges that may have different gains. A parameter set can be defined for each of these ranges, with each set containing an individually definable P and I component (i.e., Pars 188 [Adaptive P Gain1] and 189 [Adaptive I Gain1], 190 [Adaptive P Gain2] and 191 [Adaptive I Gain2], and 192 [Adaptive P Gain3] and 193 [Adaptive I Gain3]). When the adaptive speed regulator is enabled, the first set of parameters is active until the speed specified in Par 184 [Adaptive Spd 1] or Par 183 [Adap Ref] is reached.

Parameters 186 [Adaptive Joint 1] and 187 [Adaptive Joint 2] ensure a smooth transition between the different parameter sets. The fields must be defined so that [Adaptive Joint 1] and [Adaptive Joint 2] do not overlap.

When the adaptive speed regulator is enabled, parameters 87 [Spd Reg Kp] and [Spd Reg Ki] parameters have no effect on the speed regulator. They do, however, retain their value and are active when the adaptive speed regulator is disabled.

Configuring the Adaptive Speed Regulator

- Set Par 181 [Adaptive Spd En] = "1 Enabled"

- If the gain must be changed on the basis of units other than the drive's speed reference, set Par 182 [Adaptive Reg Typ] = 1 "Adaptive Ref". The adaptive reference is provided to the drive as an analog value via an analog input. For this reason Par 183 [Adaptive Ref] must be assigned to an analog input. The other possibility is to enter the value of Par 183 [Adaptive Ref] via the HIM. In this case the an analog input is not necessary.

- Enter the appropriate values in Par 184 [Adaptive Spd 1] and Par 185 [Adaptive Spd 2] to define the three speed ranges. Values are expressed as a percentage of Par 45 [Max Ref Speed] and the maximum value of Par 183 [Adaptive Ref].

- When Par 182 [Adaptive Reg Typ] = 0 "Speed", tuning is completed via Fine Tuning the Regulators on page 297. In this case the following points must be taken into consideration:

❑ The value entered in Par 61 [TstGen Offset] must be at the low end of the speed range to be tuned, but is also outside the range set in Par [Adaptive Joint x].

❑ Enter the step value in Par 60 [TstGen Amplitude], so that the speed remains inside the range to be tuned.

❑ The optimization is carried out separately for each range and the parameters of the regulator are set for each range with Pars [Adaptive P Gainx] and [Adaptive I Gainx].

❑ After the optimization of the different phases review the entire speed range. By changing the value of [Adaptive Joint x] it is possible to reduce the instabilities present in the transients during the changes from one range to the other. Increasing the values transients are slighter.

- When Par 182 [Adaptive Reg Typ] = 1 "Adaptive Ref", tuning is application specific.

- When the speed zero logic (see page 288) is disabled (factory default setting) and the drive is disabled, the gains of the speed regulator are active. These are set via Pars 188 [Adaptive P Gain1] and 189 [Adaptive I Gain1]. When the speed zero logic is enabled, the values set when the motor is stopped are valid.

Speed Up Function

The Speed-up function is used to avoid oscillations in the presence of loads with a high moment of inertia. When this function is enabled (default value of 0 "Speed Up" in Par 1016 [SpdFuncSelect]), a D (derivative) value is added to the speed feedback circuit, which allows you to increase the integral gain of the speed regulator. It is also useful in the case of cyclical non-constant loads on the motor (for example, cams). The feedback applied to the speed regulator is made of two components:

- the motor speed
- the output signal from the Speed Up function

Figure 71 - Speed-Up function inactive
Oscillation during a speed change due to a high moment of inertia.
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]

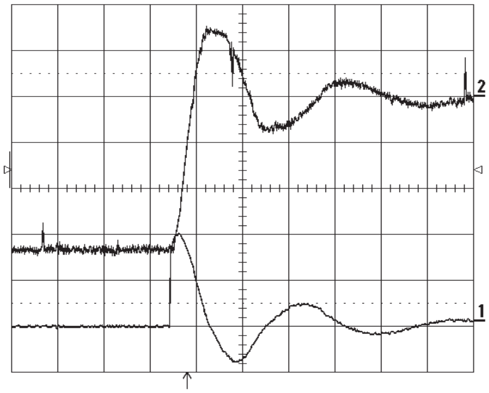
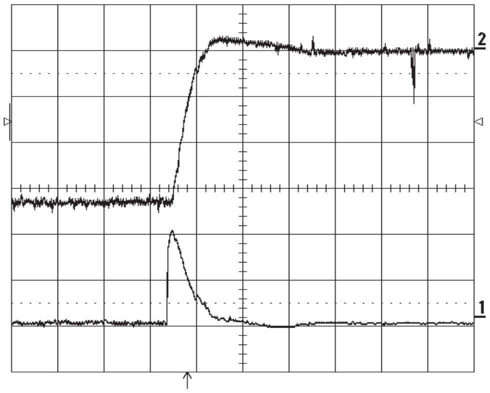


Figure 72 - Speed-up function active
The same drive with Speed-up function active.
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]



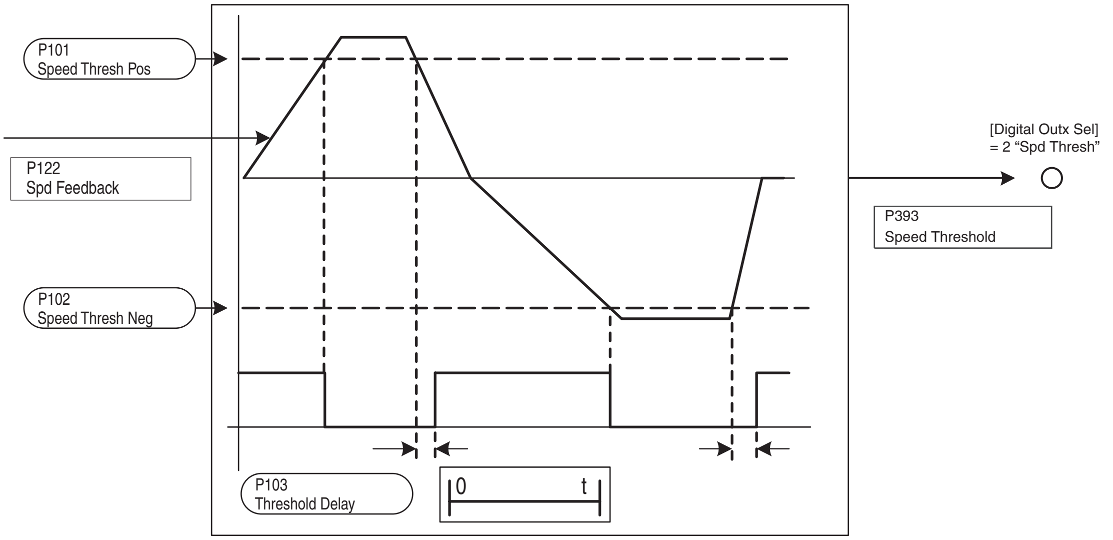
Parameters used in the example:

- Par 445 [Spd Up Gain Pct] = 50%
- Par 446 [Speed Up Base] = 14 rpm/ms
- Par 447 [Speed Up Filter] = 20 ms

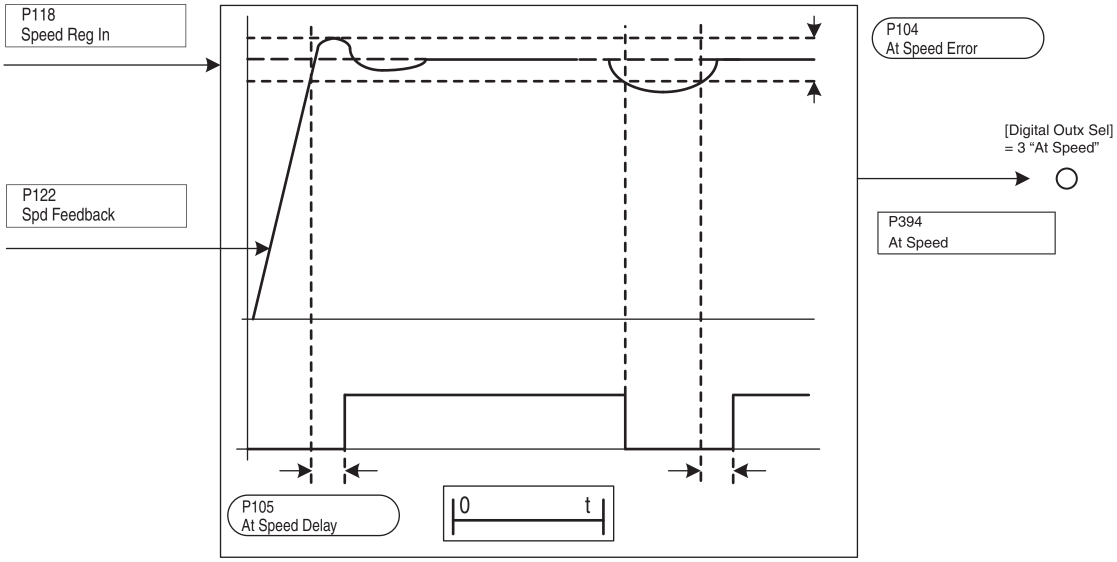
Speed Threshold Indicators

There are two speed threshold functions available that can be programmed via a digital output to provide indication of when the drive has exceeded certain set points.

Par 393 [Speed Threshold] displays whether the speed of the drive is above or below a set speed for clockwise and counter-clockwise rotation. Set the threshold speed for clockwise rotation in Par 101 [Speed Thresh Pos] and set the threshold speed for counter-clockwise rotation in Par 102 [Speed Thresh Neg]. You can specify a delay time before indication that the speed has fallen below the threshold values in Par 103 [Threshold Delay]. Par 393 [Speed Threshold] can be assigned to a digital output. A digital output so assigned will only change state at the clockwise (positive) speed threshold.



Par 394 [At Speed] indicates whether or not the speed of the drive corresponds to the set speed reference (specified in Par 118 [Speed Reg In]) before the speed regulator and the ramp reference (if enabled) are applied. The speed above and below the speed reference at which indication will occur is set in Par 104 [At Speed Error]. You can specify a delay time before indication that the speed reference is within the range set in Par 104 [At Speed Error] will occur using Par 105 [At Speed Delay]. Par 394 [At Speed] can be assigned to a digital output.


P118
Speed Reg In
P122
Spd Feedback
P104
At Speed Error
[Digital Outx Sel]
= 3 “At Speed”
P394
At Speed
P105
At Speed Delay
0
t

Speed Zero Function

The Speed Zero Logic determines the behavior of the drive when the motor is at zero speed. Refer to the Speed Adaptive and Speed Zero Logic block diagram on page 321.

Configuring the Speed Zero Logic

It is possible to avoid drive creep when the motor is at zero speed by disabling the Integral section of the Speed regulator. By default, the output of the Integral portion of the Speed regulator is disabled (Par 123 [Spd Zero I En] = 0 "Disabled").

Important: If the speed regulator is disabled, the motor cannot receive a load when it is stopped. Therefore this function is not suitable for all applications!

Disable the output of the P gain of the Speed regulator by setting Par 126 [Spd Zero P Gain] to one of the following settings:

- If the speed reference is above the value set in Par 106 [Ref Zero Level]: Set Par 124 [Spd Ref Zero En] = 1 "Enabled"

- If the speed reference and/or the reaction are above the value set in Par 106 [Ref Zero Level], set Par 124 [Spd Ref Zero En] = 0 "Disabled"

Par 124 [Spd Ref Zero En] is active only when Par 125 [Spd Zero P En] = 1 "Enabled".

Set the P gain for zero speed:

- If the P gain corresponds to the value set in Par 126 [Spd Zero P Gain], then set Par 125 [Spd Zero P En] = 1 "Enabled"

- If the P gain corresponds to the normal P gain, then set Par 125 [Spd Zero P En] = 0 "Disabled"

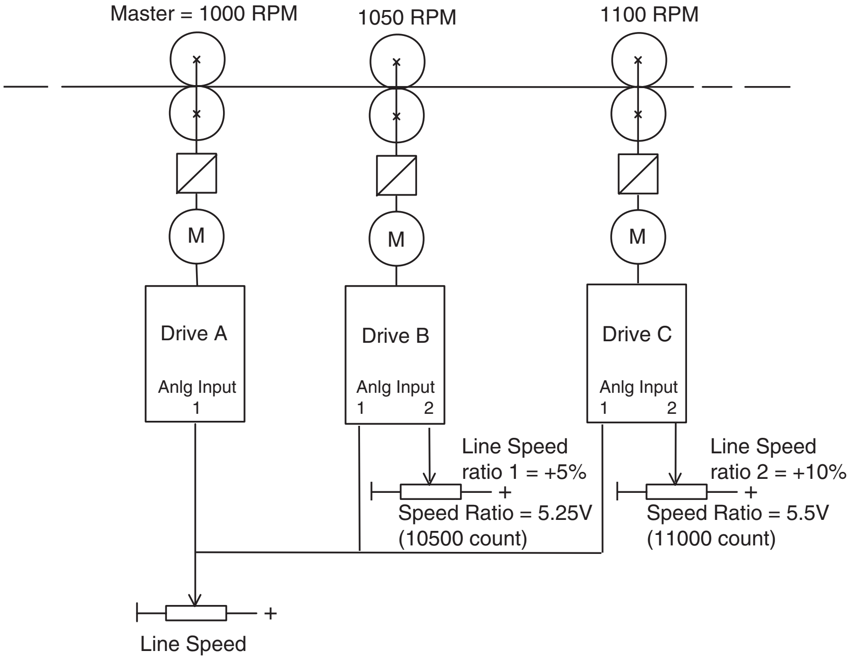
The P gain at zero speed is set via Par 126 [Spd Zero P Gain] when Par 125 [Spd Zero P En] = 1 "Enabled".

The threshold for the recognition of zero speed is determined by the value in Par 106 [Ref Zero Level].

Speed Draw Function

The Speed Draw function can be used to apply a configurable speed ratio (set in Par 1017 [Speed Ratio]) to the main speed reference of the drive. This function is useful in a multi-drive system where a proportional speed increase between the motors is required. The range of parameter 1017 [Speed Ratio] can be set between 0 and 32767 if written in digital form, or can be set from 0 to 20000 (0 to +10V) if assigned via an analog input. The resulting speed value can be viewed in Par 1018 [Speed Draw Out] via an analog output.

Figure 73 - Speed Draw Example



Speed Draw Example Configuration

Drive A:

- Set parameter 70 [Anlg In1 Sel] to 4 "Trim Speed"

Drive B:

- Set parameter 70 [Anlg In1 Sel] to 4 "Trim Speed"
- Set parameter 75 [Anlg In2 Sel] to 22 "Speed Ratio"
- Set parameter 1017 [Speed Ratio] to 10500

Drive C:

- Set parameter 70 [Anlg In1 Sel] to 4 "Trim Speed"
- Set parameter 75 [Anlg In2 Sel] to 22 "Speed Ratio"
- Set parameter 1017 [Speed Ratio] to 11000

Speed / Torque Mode Selection

Parameter 241 [Spd Trq Mode Sel] is used to choose whether the drive operates as a speed regulator, a torque regulator, or a combination of the two. Each mode is discussed in more detail below. Refer to the "Torque Mode Selection" block diagram on page 317 for more information.

Note: This function is only available for firmware version 3.001.

Zero Torque Mode

Zero torque current is allowed when Par 241 [Spd Trq Mode Sel] is set to 0 "Zero Trq Ref". Operation in zero torque mode allows the motor to be fully fluxed and ready to rotate when a speed command or torque command is given. This mode can be used for a cyclical application where throughput is a high priority. The control logic can select zero torque during the "rest" portion of a machine cycle instead of stopping the drive. When the cycle start occurs, instead of issuing a start to the drive, a speed regulation mode can be selected. The drive will then immediately accelerate the motor without the need for "flux up" time.

Important: Zero Torque may excessively heat the motor if operated in this mode for extended periods of time. No load or flux current is still present when the drive is operating in zero torque mode. A motor with an extended speed range or separate cooling methods (blower) may be required.

Speed Regulation Mode

When Par 241 [Spd Trq Mode Sel] is set to 1 "Speed Reg" the drive and motor are operated in speed mode. The torque command changes as needed to maintain the desired speed. This is the default setting. Operating as a speed regulator is the most common and simplest mode to set up. Examples of speed regulated applications are blowers, conveyors, feeders, pumps, saws, and tools.

In a speed regulated application, the speed regulator output generates the torque reference. Note that under steady state conditions the speed feedback is steady while the torque reference is a constantly adjusting signal. This is required to maintain the desired speed. In a transient state, the torque reference changes dramatically to compensate for a speed change. A short duration change in speed is the result of increasing or decreasing the load very rapidly.

Note: Inertia compensation is summed with the output of the speed regulator.

Torque Regulation Mode

Par 241 [Spd Trq Mode Sel] is set to 2 "Torque Reg" for torque mode. In torque regulation mode, the drive controls the desired motor torque. The motor speed is the result of torque command and load present at the motor shaft. The reference signal is equal to the value of Par 39 [Torque Ref]. A torque regulated application can be described as any process requiring some tension control. An example is a winder or unwinder with material being "drawn" or pulled with a specific tension required.

Note: If the material being wound/unwound breaks, the load will decrease dramatically and the motor can potentially go into a "runaway" condition.

Speed Limited Adjustable Torque (SLAT) Min Mode and SLAT Max Mode

SLAT Min Mode (Par 241 [Spd Trq Mode Sel] set to 3) and SLAT Max Mode (Par 241 [Spd Trq Mode Sel] set to 4) are for applications that require a smooth transition from a torque mode to a speed mode of operation; for example: web handling, center winders and center unwinds where the drive is normally following a torque reference, but a break or slippage could occur. Direction of the applied torque and direction of the material movement determine whether SLAT Min or SLAT Max mode should be used.

SLAT Min Mode

In SLAT Min mode, you would typically configure a speed reference that forces the speed regulator into saturation (the speed reference is slightly above the speed feedback). In this case the drive would follow the torque reference until there was a breakage or slippage in the application.

When the drive is following a torque reference (torque mode) in SLAT Min mode, either one of two conditions will force the drive into following the speed reference (speed mode):

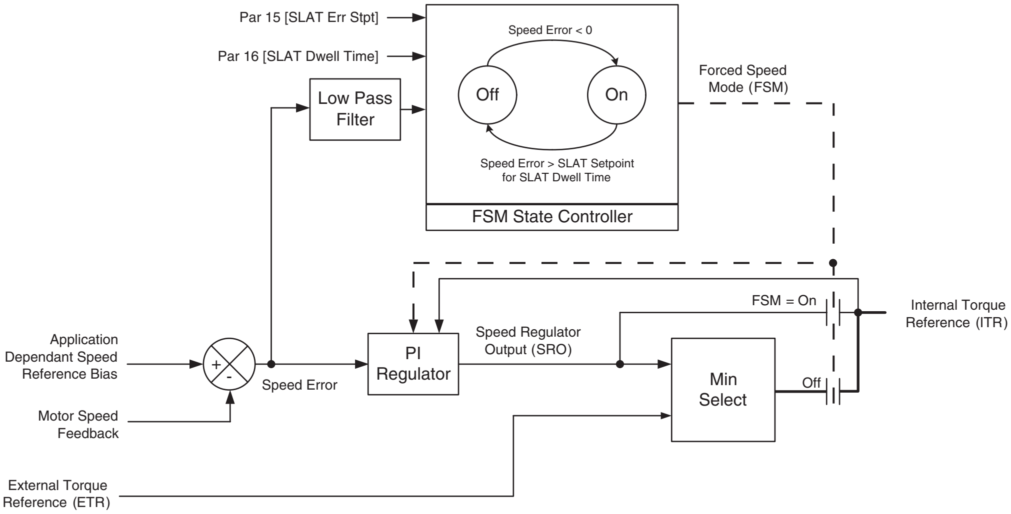
1. The output of the speed regulator becomes less than the torque reference.
2. The speed error becomes negative (the speed feedback becomes greater than the speed reference). This is forced speed mode.

Parameter 15 [SLAT Err Stpt] and parameter 16 [SLAT Dwell Time] allow you to set some hysteresis for turning off the forced speed mode. They are set to "0" as default so that there is no hysteresis. In SLAT Min mode, Par 15 [SLAT Err Stpt] sets how much less the speed feedback should be than the speed reference before turning off the forced speed mode. Par 16 [SLAT Dwell Time] sets how long the speed error must exceed the SLAT error set point before turning off the forced speed mode.

At the time the drive switches from torque mode to forced speed mode, the speed regulator integral part is pre-loaded with the InternalTorque Reference (ITR) or Par 14 [Selected TorqRef] to create a smooth transition.

In order for the drive to switch from speed mode to torque mode, forced speed mode (if active) must first be turned off. Forced speed mode will turn off when the speed error is greater than the SLAT error setpoint for the SLAT dwell time. With default parameter settings, this will occur when the speed error becomes positive.

When Forced Speed Mode is off, the drive will switch back to torque mode when the speed regulator output becomes greater than the torque reference.



SLAT MAX Mode

In SLAT Max mode, the user would typically configure a speed reference that forces the speed regulator into saturation (the speed reference is slightly below the speed feedback). In this case the drive would follow the torque reference until there was a breakage or slippage in the application.

In SLAT Max mode, the drive will switch from torque mode to speed mode when either one of the two following conditions occur:

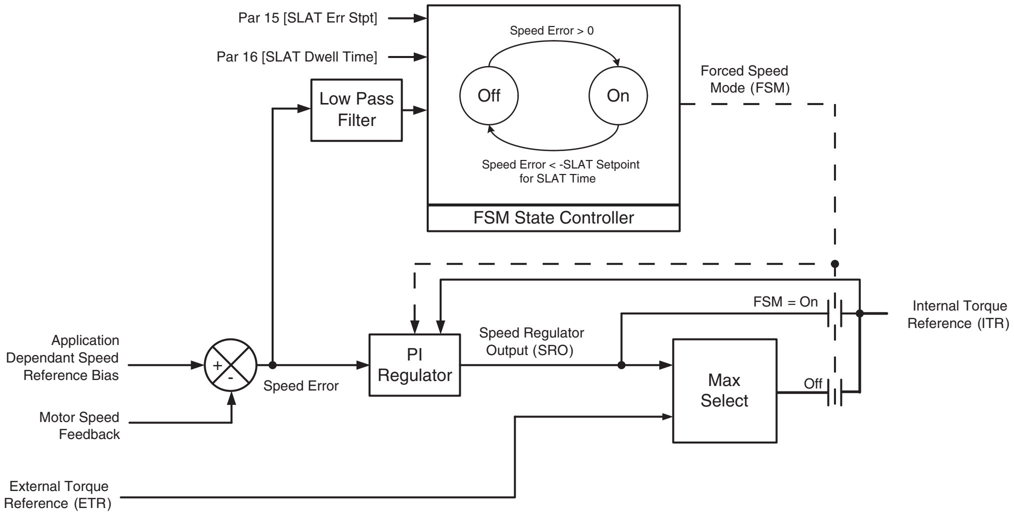
1. The output of the speed regulator becomes more than the torque reference. This is speed mode.
2. The speed error becomes positive (the speed feedback becomes less than the speed reference). This is forced speed mode.

Parameter 15 [SLAT Err Stpt] and parameter 16 [SLAT Dwell Time] allow you to set some hysteresis for turning off the forced speed mode. They are set to “0” as default so that there is no hysteresis. In SLAT Max mode, Par 15 [SLAT Err Stpt] sets how much more the speed feedback should be than the speed reference before turning off the forced speed mode. Par 16 [SLAT Dwell Time] sets how long the speed error must exceed the SLAT error set point before turning off the forced speed mode.

At the time the drive switches from torque mode to forced speed mode, the speed regulator integral part is pre-loaded with the InternalTorque Reference (ITR) or Par 14 [Selected TorqRef] to create a smooth transition.

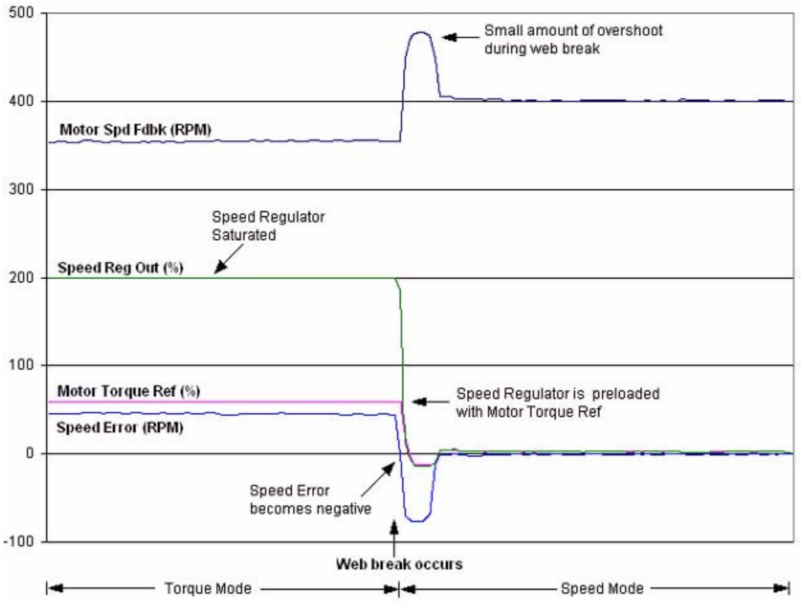
In order for the drive to switch from speed mode to torque mode, forced speed mode (if active) must first be turned off. Forced speed mode will turn off when the speed error is less than the SLAT error setpoint for the SLAT Dwell Time. With default parameter settings, this will occur when the speed error becomes negative.

When Forced Speed Mode is off, the drive will switch back to torque mode when the speed regulator output becomes less than the torque reference.



Example:

The application is a paper winder. The drive is set for SLAT Min mode, so that the drive normally runs in torque mode and follows Par 39 [Torque Ref]. [Torque Ref] comes from an external controller and is approximately 60% of motor torque during the snapshot. The speed reference, also from an external controller, is set just above the speed feedback in order to saturate the speed regulator while in torque mode. The following snapshot captures what occurs in the drive during a break in the web.



Sum Mode

Sum mode is selected when Par 241 [Spd Torq Mode Sel] is set to 5 “Sum”. In this mode, the reference is derived from the sum of the speed regulator output (Par 236 [Spd Reg Out Pct]) and the torque reference (Par 39 [Torque Ref]). This mode can be used for applications that have precise speed changes with critical time constraints.

Torque Mode Selection Status Bits

Bits 7 “Forced Spd”, 8 “Speed Mode”, and 9 “Torque Mode” of parameter 382 [Drive Status 2] display the current status of the speed/torque mode for the drive.

Par 241	**Par 382 [Drive Status 2]**		
[Spd Trq Mode Sel]	**Bit 7 “Forced Spd**	**Bit 8 “Speed Mode”**	**Bit 9 “Torque Mode”** (1)
0 “Zero Trq Ref”	0	0	1
1 “Speed Reg”	0	1	0
2 “Torque Reg”	0	0	1
3 “SLAT Min”	(1)		$\overline{(b7 + b8)}$
4 “SLAT Max”	(2)		$\overline{(b7 + b8)}$
5 “Sum”	0	1	1

(1) b9 = not(b7 + b8), if b7=1 & b8=0, then b9=0.

(1) 3 “SLAT Min”

Bit 7 “Forced Spd	0	Not in Forced Speed Mode (FSM)
	0 -> 1	Speed error < 0 (i.e., Feedback > Reference), preload the speed regulator integrator with the value of Par 14 [Selected Torque Ref]
	1	Forced Speed Mode (FSM), speed error < 0
	1 -> 0	Error (i.e., Reference - Feedback) > Par 15 [SLAT Err Stpt] for more than the value of Par 16 [SLAT Dwell Time]
Bit 8 “Speed Mode”	0	Par 236 [Spd Reg Pct Out] > Par 39 [Torque Ref]
	1	Par 236 [Spd Reg Pct Out] < Par 39 [Torque Ref]

(2) 4 “SLAT Max”

Bit 7 “Forced Spd	0	Not in Forced Speed Mode (FSM)
	0 -> 1	Speed error > 0 (i.e., Feedback < Reference), preload the speed regulator integrator with the value of Par 14 [Selected Torque Ref]
	1	Forced Speed Mode (FSM), speed error > 0
	1 -> 0	Error (i.e., Reference - Feedback) < -Par 15 [SLAT Err Stpt] for more than the value of Par 16 [SLAT Dwell Time]
Bit 8 “Speed Mode”	0	Par 236 [Spd Reg Pct Out] < Par 39 [Torque Ref]
	1	Par 236 [Spd Reg Pct Out] > Par 39 [Torque Ref]

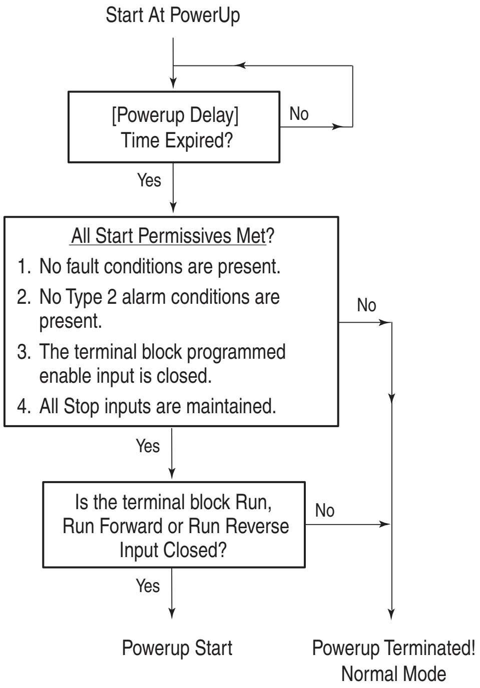
Note: When Par 241 [Spd Trq Mode Sel] is changed to 1 “Speed Reg”, the speed regulator integrator is preloaded with the value of Par 14 [Selected Torque Ref]. When Par 241 [Spd Trq Mode] is changed to 5 “Sum”, the speed regulator is preloaded with the value of Par 14 [Selected Torq Ref] - Par 39 [Torque Ref] (Par 14 - Par 39).

Start At Powerup

The “Start At Powerup” function allows you to automatically resume running at commanded speed after drive input power is restored, a run command is issued and all of the start permissive conditions indicated in the diagram below are met. To enable this feature, parameter 1344 [Start At Powerup] must be set to 1 “Enable”.

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.

In addition, A delay time of up to 10800 seconds (3 hours) can be programmed in parameter 1345 [Powerup Delay]. An automatic drive restart is not possible before the delay time has expired. If a “Start”, “Run” or “Stop” command is asserted before the time in this parameter expires, the “Start At Powerup” function will be aborted.



During the time specified in parameter 1345 [Powerup Delay], the alarm indicator “🔔” is displayed on the HIM and bit 12 “PwrUp Start” of parameter 380 [Drive Status 1] is set to “1”.

Fine Tuning the Regulators

The PowerFlex DC drive control regulators have predefined values meant to provide consistent drive performance without performing any further configuration, with the exception of the armature current regulator, which must always be tuned. When the armature current regulator has been tuned to meet the requirements of the application, the fine tuning procedures for the other regulators are not necessary. However, the fine tuning procedures can be used to optimize the output and control features of the drive.

The drive contains the following regulation circuits:

- Armature current regulator - The armature current auto tuning procedure is run via Par 452 [CurrReg Autotune]. Refer to Chapter 2 - Drive Start Up - Tune the Current Regulator: on page 92.
  - ☐ A manual procedure to adjust the armature inductance when the autotune steps yielded a value outside the recommended setting. Refer to Manually Adjusting the Current Regulator Tune Settings on page 298.
- Field current regulator:
  - ☐ A fine tuning procedure is available below. Refer to Fine Tuning the Field Current Regulator on page 300.
- Speed regulator - The speed auto tuning procedure is run via Par 1027 [Spd Reg Autotune]. Refer to Chapter 2 - Drive Start Up - Tune the Speed Regulator: on page 2-97. A fine tuning procedure is available below. Refer to Fine Tuning the Speed Regulator on page 303.
- Armature voltage regulator - A fine tuning procedure is available below. Refer to Fine Tuning the Voltage Regulator in the Field Converter on page 305.

The fine tuning procedures are included below. In order to obtain a step function, the internal "Test generator" can be used. The goal of the fine tuning procedures is to obtain an optimal step response. For example, it is recommended that you directly measure the step response for the field current regulator.

The field current can be directed to an analog output on the Terminal Block (with a 2ms sampling rate).

Using the Test Generator

The "Test Generator" function creates signals with a rectangular wave form based on a specific frequency and amplitude. The frequency and amplitude can be added to a configurable offset value, if needed. Par 58 [TstGen Output] determines which regulator input signal (reference) is used; torque current, field, ramp, or speed.

Manually Adjusting the Current Regulator Tune Settings

While the drive is operating, the value of Par 587 [I Reg Error] is updated in response to changes in the current output to the motor. By manually applying current steps to the motor, this parameter can be used as an indication whether the current regulator in the drive is correctly tuned. Ideally, the value should be as near to zero as possible, but values between -40 and +40 are acceptable during normal operation (because the drive is responding to changing current demands). Manually tuning the Current Regulator will attempt to have Par 587 [I Reg Error] reach its lowest value in response to applied steps in current to the motor.

Adjustments to Par 587 [I Reg Error] are made by changing Par 454 [Arm Inductance] and stepping the current to the motor. Par 587 [I Reg Error] values are only valid when the drive is operating under at least a 30% current load. The manual tuning procedure will progress through larger current steps up to 100%. Par 454 [Arm Inductance] and Par 453 [Arm Resistance] are the current regulator tuning parameters and typically will not match motor data sheets values.

Manual Current Loop Tuning

When attempting to manually tune the current loop, the current reference will be stepped to values that may cause the motor to rotate even while the field is disabled (residual flux). If possible, the motor armature shaft should be locked to prevent rotation or decrease the maximum amplitude of current applied per step to minimize armature movement. Not locking the armature is optional only when external speed measurement is in use (i.e., encoder or tachometer). Armature rotation will interfere with getting acceptable tuning values. Be sure to record all original parameter values that are changed as part of configuration for this test.

1. Disable the field regulator by setting Par 497 [Field Reg Enable] to 0 “Disabled”.

   Note: For firmware version 3.001 and later: Set Par 469 [Field Mode Sel] to 2 “External” and Par 414 [Fdbk Device Type] to 1 “Encoder” (a Type 2 alarm will be generated if Par 414 is set to 3 “Armature”).
2. Verify that Par 351 [Field Current] is set to zero (0 or < 0.05 A).
3. Disable the speed regulator by setting Par 242 [Speed Reg En] to 0 "Disabled".
4. Set/verify that Parameters 7 [Current Limit], 8 [Current Lim Pos] and 9 [Current Lim Neg] are at 100%.
5. Set Par 453 [Arm Resistance], calculated as:

   (Par 175 [Rated Motor Volt] / Par 179 [Nom Mtr Arm Amps]) x 0.04
6. Set Par 454 [Arm Inductance] to the minimum value (based on drive size).
7. Set Par 39 [Torque Ref] to 30%. (this is a percentage relative to Par 179 [Nom Mtr Arm Amps]).

8. Start the drive and observe the value of Par 587 [I Reg Err] for a few seconds, it should settle to a value. Verify that the motor shaft does not rotate (a small amount of movement, less than a revolution, is OK).
9. Stop the drive.

   Note: If a Feedback Loss fault (F91) occurs, increase the value of Par 455 [Spd Fdbk Error] to its maximum value.

   a. If Par 587 [I Reg Err] is positive, increase the value of Par 454 [Arm Inductance]. The magnitude of change is determined by the value of parameter 587. Generally, make large increases (for example, double) when Par 587 is large (greater than 40) and smaller increases as Par 587 gets closer to zero.
   b. If Par 587 [I Reg Err] is negative, decrease the value of Par 454 [Arm Inductance]. Again, proportional to the magnitude of Par 587.
10. Repeat step 8 until Par 587 [I Reg Err] is made as close to zero as possible. Values less than 20 are acceptable as close to zero. However, with some motors, the minimum value of Par 587 may only be 60 (especially at smaller current steps). With higher current steps, values can be less than 10 or less than 5.
11. Repeat steps 8 and 9 with Par 39 [Torque Ref] set to 60% and then again at 100%. If motor rotation occurs, try lowering the current step value. The higher the current step, the better the tuning results will be. If motor rotation still occurs, experiment with trying to set the highest current step that doesn't cause rotation but is long enough for Par 587 [I Reg Err] to reach a stable value (typically less than 2 seconds).
12. The current loop should be tuned with the final values of Pars 453 [Arm Resistance] and 454 [Arm Inductance] and a small value in Par 587 [I Reg Err].
13. Restore Pars 497 [Field Reg Enable], 469 [Field Mode Sel], 414 [Fdbk Device Type], 242 [Speed Reg En], 7 [Current Limit], 8 [Current Lim Pos], 9 [Current Lim Neg], and 455 [Spd Fdbk Error] to their original values.
14. Unlock the motor armature (if necessary).
15. Verify that the motor is attached to any normal application inertia (not process material) and perform a speed regulator autotune by setting Par 1027 [Spd Reg Autotune] = 1 and pressing the Start button.
16. When autotuning completes, speed regulator tuning values should be automatically updated.

   ☐ If the drive is configured as an armature voltage regulator (Par 414 [Fdbk Device Type] = 3 "Armature"), the calculated gains (Pars 87 [Spd Reg Kp] and 88 [Spd Reg Ki]) may have to be adjusted, because this type of regulator (voltage) is less responsive than a true speed regulator (that uses encoder or tachometer feedback).

Fine Tuning the Field Current Regulator

IMPORTANT In most cases motors with a direct current and an independent excitation work with a constant field (Par 469 [Field Mode Sel] = 0 "Base Speed"). In this case it is not necessary to optimize the field current or armature voltage regulators.

The procedure below is used for drives that use constant torque and power (mixed armature and field regulation). In these cases it is necessary to configure the field converter according to this method.

IMPORTANT Do not issue a "Start" command to the drive during the field current regulator fine tuning procedure.

Follow the procedure below to fine tune and optimize the field current regulator:

1. Configure the following parameters:
   - ☐ Set Par 467 [Max Fld Curr Pct] = 100% of the field rated current of the connected motor
   - ☐ Set Par 468 [Min Fld Curr Pct] = 0
   - ☐ Set Par 91 [Fld Reg Kp] = 0.00
   - ☐ Set Par 92 [Fld Reg Ki] = 0.00
2. Measure the field current using an analog output by setting:
   - ☐ Par 66 [Anlg Out1 Sel] = 18 "Fld Current"
   - ☐ Par 67 [Anlg Out2 Sel] = 24 "Field Ref"
3. Configure the following parameters:
   - ☐ Set Par 497 [Field Reg Enable] = 1 "Enabled" (default)
   - ☐ Set Par 469 [Field Mode Sel] = 1 "Field Weaken"
   - ☐ Set Par 498 [Force Min Field] = 1 "Enabled"
4. Configure the following Test Generator parameters:
   - ☐ Set Par 58 [TstGen Output] = 3 "Field Ref"
   - ☐ Set Par 60 [TstGen Amplitude] = 70% of the field rated current of the motor (this setting allows the system overshoot).

5. Increase the value of the Par 91 [Fld Reg Kp] until the overshoot of the field current (displayed in Par 234 [Fld Current Pct]) is lower than 4%.
6. Increase the value of Par 92 [Fld Reg Ki] until the overshoot is higher than 4%. Then, decrease the value of this parameter until it becomes slightly lower than 4%.

IMPORTANT	Because of the relatively high field time constant, the rising speed of the field current is limited. The rising time with optimal tuning conditions could be up to 100 milliseconds.

7. Set Par 58 [TstGen Output] = 0 “NotConnected”.
8. Set Par 498 [Force Min Field] = 0 “Disabled”.
9. Set Par 468 [Min Fld Curr Pct] to the desired value.
10. Configure the analog outputs according to your application needs.

Field Current Regulator Tuning Examples

Figure 74 - Increase in the field current with oscillation

Non-optimal response of the regulator.
Top: Par 500 [Flux Ref Pct]
Bottom: Par 234 [Fld Current Pct]

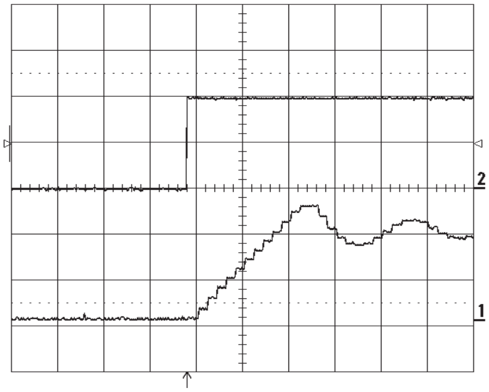


Figure 75 - Too high of a time constant on the field

The reduction of the field current depends on the field time constant. Therefore, the regulator has no influence on the flux current.
Top: Par 500 [Flux Ref Pct]
Bottom: Par 234 [Fld Current Pct]

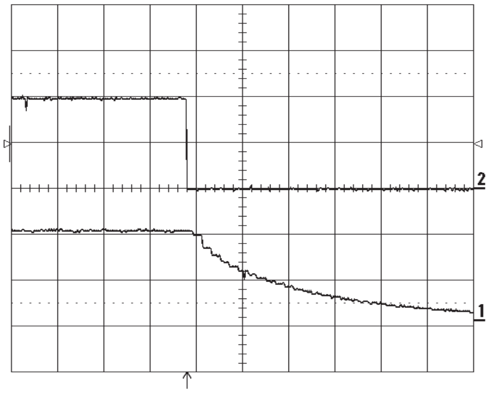
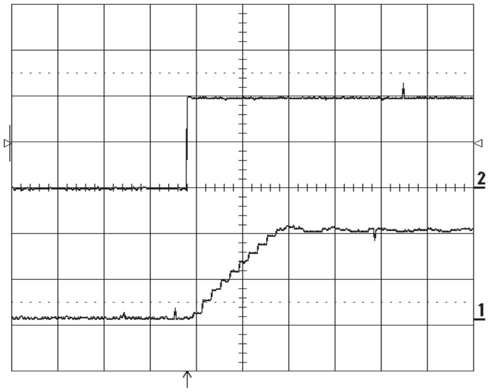


Figure 76 - Increase in the field current without oscillation

This graph, as compared to the graph in Figure C.5, shows an increase in [Fld Reg Kp] from 2% to 10% with [Fld Reg Ki] = 5%.
Top: Par 500 [Flux Ref Pct]
Bottom: Par 234 [Fld Current Pct]



Fine Tuning the Speed Regulator

Follow the procedure below to fine tune and optimize the speed regulator:

1. Configure the following Test Generator parameters:
   - ☐ Set Par 58 [TstGen Output] = 4 “Ramp Ref”
   - ☐ Set Par 59 [TstGen Frequency] = 0.2 Hz
   - ☐ Set Par 60 [TstGen Amplitude] = 10 %
   - ☐ Set Par 61 [TstGen Offset] = 20 %
2. Measure the results on analog outputs 1 and 2 by setting:
   - ☐ Par 66 [Anlg Out1 Sel] = 8 “Spd Reg Out”
   - ☐ Par 67 [Anlg Out2 Sel] = 13 “Motor Curr”.
3. Set Par 660 [Accel Time 1] = 0 sec.
4. Set Par 662 [Decel Time 1] = 0 sec.
5. Set Par 87 [Spd Reg Kp] = 0.00
6. 88 [Spd Reg Ki] = 0.00
7. Start the drive.
8. Increase the value of Par 87 [Spd Reg Kp] until the overshoot is lower than 4% with the shortest possible acceleration or deceleration time.
9. Increase the value of Par 88 [Spd Reg Ki] until the overshoot is higher than 4%. Then, decrease the value of this parameter until its value becomes slightly lower than 4%.
10. Stop the drive.
11. Set Par 58 [TstGen Output] = 0 “NotConnected”.

IMPORTANT When the “Bypass” function is enabled (Par 458 [SpdReg FB Bypass] = 1 “Enabled”) the drive is automatically switched to armature feedback when a “Speed fbk loss” fault occurs due to an encoder or tachometer feedback loss. In this case, you must repeat steps 1 - 9 of the “Fine Tuning the Speed Regulator” procedure when the fault has been cleared. After an automatic switch to armature feedback, the speed regulator works with Pars 459 [SpdReg Kp Bypass] and 460 [SpdReg Ki Bypass] and the D (derivative) part of the speed regulator is automatically excluded.

When it is necessary to have different gains for the speed regulator above the speed range, you can utilize the adaptive speed regulator. For further information about this function refer to the Adaptive Speed Regulator block diagram page 282.

[Spd Reg Kp] and [Spd Reg Ki] curves

Figure 77 - [Spd Reg Kp] too low
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]

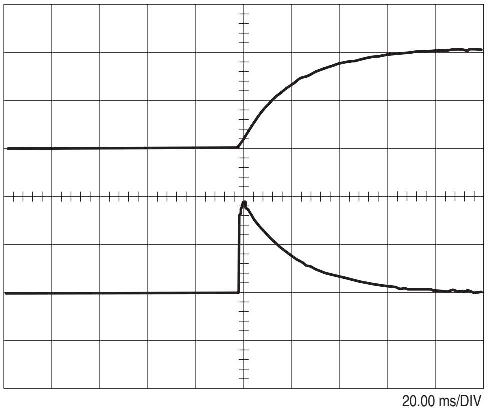


Figure 79 - [Spd Reg Ki] too high
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]

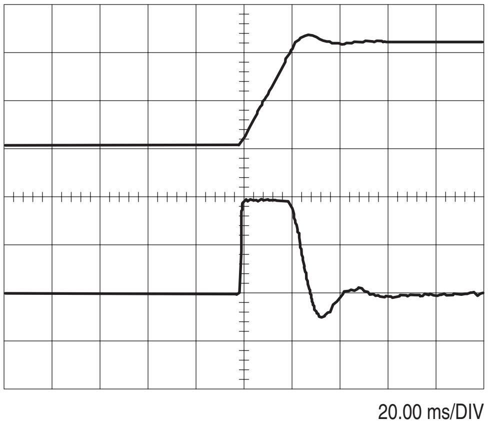


Figure 78 - [Spd Reg Kp] too high
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]

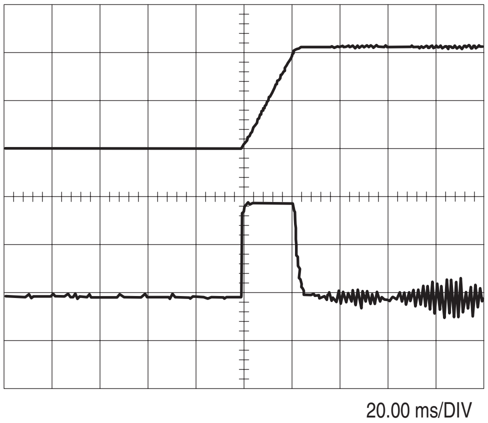
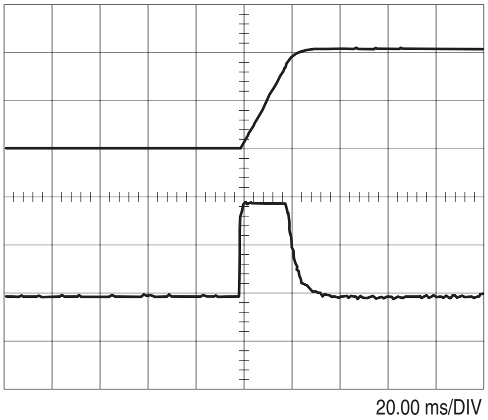


Figure 80 - [Spd Reg Ki] correct
Top: Par 122 [Spd Feedback]
Bottom: Par 199 [Arm Current Pct]



Fine Tuning the Voltage Regulator in the Field Converter

IMPORTANT In most cases, DC motors with independent excitation, work with a constant field (Par 469 [Field Mode Sel] = 0 "Base Speed"). In this case it is not necessary to optimize the regulator of the field current and the regulator of the armature voltage.

When field weakening occurs, the voltage regulator keeps the armature voltage at a constant level. The critical point for this regulator is at the beginning of field weakening, because with the saturation of the motor field the system requires more consistent changes in the field current in order to carry out a flux change. Tune the regulator so that the armature voltage undergoes very small changes.

Important: Before the optimization of the voltage regulator, the speed and field current regulators must have already been tuned. Refer to Tune the Current Regulator: on page 92 and Fine Tuning the Field Current Regulator on page 300.

1. Configure the following Test Generator parameters:
    - ☐ Set Par 58 [TstGen Output] = 4 "Ramp Ref"
    - ☐ Set Par 59 [TstGen Frequency] = 0.2 Hz
    - ☐ Set Par 60 [TstGen Amplitude] = 10 %
    - ☐ Set Par 61 [TstGen Offset] = to the switching point from the armature to the field regulation. For example: If Par 162 [Max Feedback Spd] = 2000 rpm, field weakening starts at 1500 rpm. Therefore, set Par 61 [TstGen Offset] = 75 %.
2. Measure the field current and the armature voltage using analog outputs 1 and 2, by setting:
    - ☐ Par 66 [Anlg Out1 Sel] = 18 "Fld Current"
    - ☐ Par 67 [Anlg Out2 Sel] = 14 "Motor Volts"
3. Start the drive.
4. Check the armature voltage via analog output 2. After a possible short oscillation, the voltage should remain constant. Refer to the Field Voltage Regulator examples below. You can change the Proportional and Integral gains of the Field Voltage regulator via Pars 493 [Arm Volt Kp] and 494 [Arm Volt Ki].
5. Stop the drive.
6. Set Par 58 [TstGen Output] = 0 "NotConnected".

Field Voltage Regulator Tuning Examples

Figure 81 - Field voltage oscillation

Oscillation after a speed change where [Arm Volt Kp] = 10% and [Arm Volt Ki] = 80%.

Top: Par 234 [Fld Current Pct]
Bottom: Par 233 [Output Voltage]

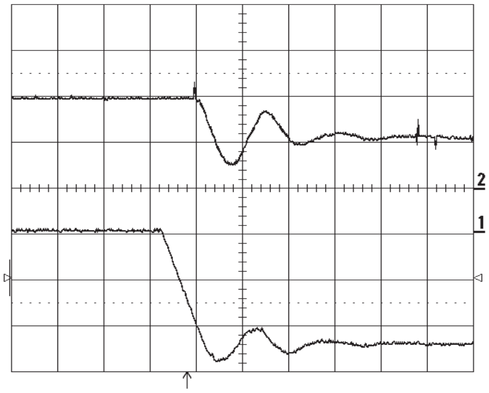


Figure 82 - Too small of a gain

The armature voltage increases where [Arm Volt Kp] = 3% and [Arm Volt Ki] = 5%.

Top: Par 234 [Fld Current Pct]
Bottom: Par 233 [Output Voltage]

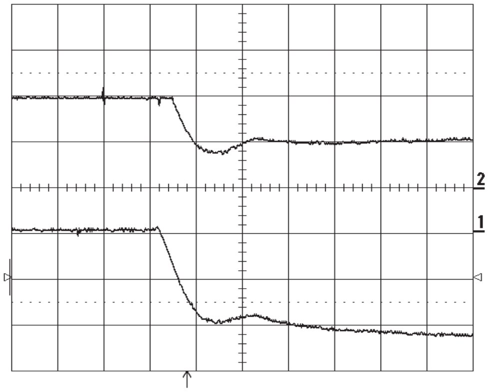
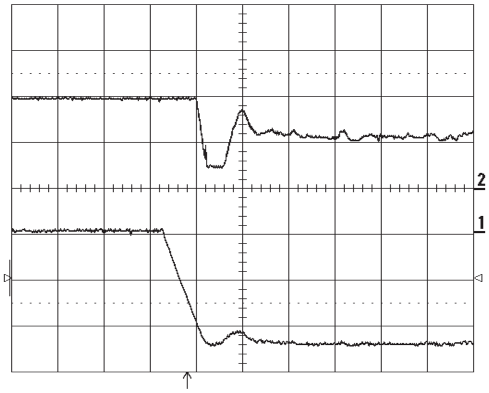


Figure 83 - Optimal field regulation

After a short transient, the field current and armature voltage are constant. [Arm Volt Kp] = 40%, [Arm Volt Ki] = 5%.

Top: Par 234 [Fld Current Pct]
Bottom: Par 233 [Output Voltage]



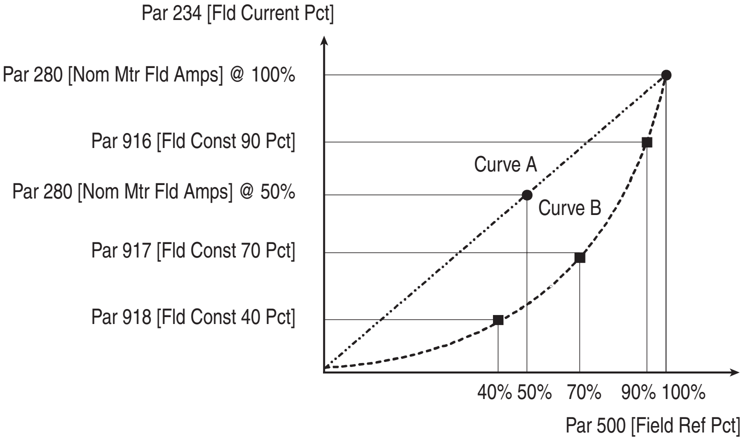
Tuning the Field Current Curve

The function of the field current curve is to control the actual motor flux and, subsequently, motor torque if the field goes into an overvoltage condition. Figure C.15 below illustrates the relationship between flux and flux current when the field current curve is defined versus not defined.

Important: Complete the procedures in the order listed below when tuning the field current curve:

- Field current regulator. Refer to Fine Tuning the Field Current Regulator on page 300.
- Field current curve tuning (Flux / if curve)
- Voltage regulator in the field converter. Refer to Fine Tuning the Voltage Regulator in the Field Converter on page 305.

Figure 84 - Curve Conversion Flux/Current



Examples:

- Curve A - If the default settings of the drive are retained, the flux current to flux reference will remain linear when the value of Par 500 [Flux Ref Pct] changes. For example:
  - o If Par 467 [Max Fld Curr Pct] / Par 500 [Flux Ref Pct] = 100%, then Par 234 [Fld Current Pct] / Par 500 [Flux Ref Pct] = Par 280 [Nom Mtr Fld Amps]
  - o If Par 467 [Max Fld Curr Pct] / Par 500 [Flux Ref Pct] = 50%, then Par 234 [Fld Current Pct] / Par 500 [Flux Ref Pct] = 50% of Par 280 [Nom Mtr Fld Amps]

- Curve B - If the field current curve fine tuning procedure is completed, the flux current to flux reference curve will follow a curve determined by the real flux percentage of Par 500 [Flux Ref Pct] necessary to determine the circulation of the field current for the connected system. Refer to the Current Regulator block diagram on page 322.

Field Current Curve Tuning Procedure:

1. Reset the field current curve by setting Par 920 [Reset Fld Curve] to “1”.
2. Configure the following parameters:
    - ☐ Enter the percentage (100%) of the maximum motor nameplate rated armature voltage in Par 921 [Out Volt Level]
    - ☐ Set Par 469 [Field Mode Sel] = 0 “Base Speed”
    - ☐ Set Par 467 [Max Fld Curr Pct] = 100%
3. Start the drive.
4. Increase the motor speed until the value (electromotive force) displayed in Par 233 [Output Voltage] corresponds to the value previously set in Par 175 [Rated Motor Volt].
5. Decrease the value of Par 467 [Max Fld Curr Pct] until the value displayed in Par 233 [Output Voltage] is equal to 90% of Par 175 [Rated Motor Volt]. When you have reached this value, read the value displayed in Par 234 [Fld Current Pct] and enter the value into Par 918 [Fld Const 90 Pct].
6. Decrease the value of Par 467 [Max Fld Curr Pct] until the value displayed in Par 233 [Output Voltage] is equal to 70% of Par 175 [Rated Motor Volt]. When you have reached this value, read the value displayed in Par 234 [Fld Current Pct] and enter the value into Par 917 [Fld Const 70 Pct].
7. Decrease the value of Par 467 [Max Fld Curr Pct] until the value displayed in Par 233 [Output Voltage] is equal to 40% of Par 175 [Rated Motor Volt]. When you have reached this value, read the value displayed in Par 234 [Fld Current Pct] and enter the value into Par 916 [Fld Const 40 Pct].
8. Stop the drive.
9. Set the desired method of field control in Par 469 [Field Mode Sel] (0 “Base Speed” or 1 “Field Weaken”)
10. Reset the value of 467 [Max Fld Curr Pct] to 100%.

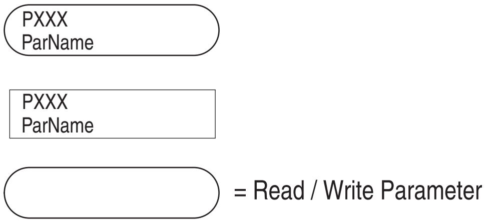
If you change the value of Par 175 [Rated Motor Volt] or par 280 [Nom Mtr Fld Amps], the field current curve will need to be re-tuned.

Appendix D

Control Block Diagrams

Diagram Conventions

Examples:

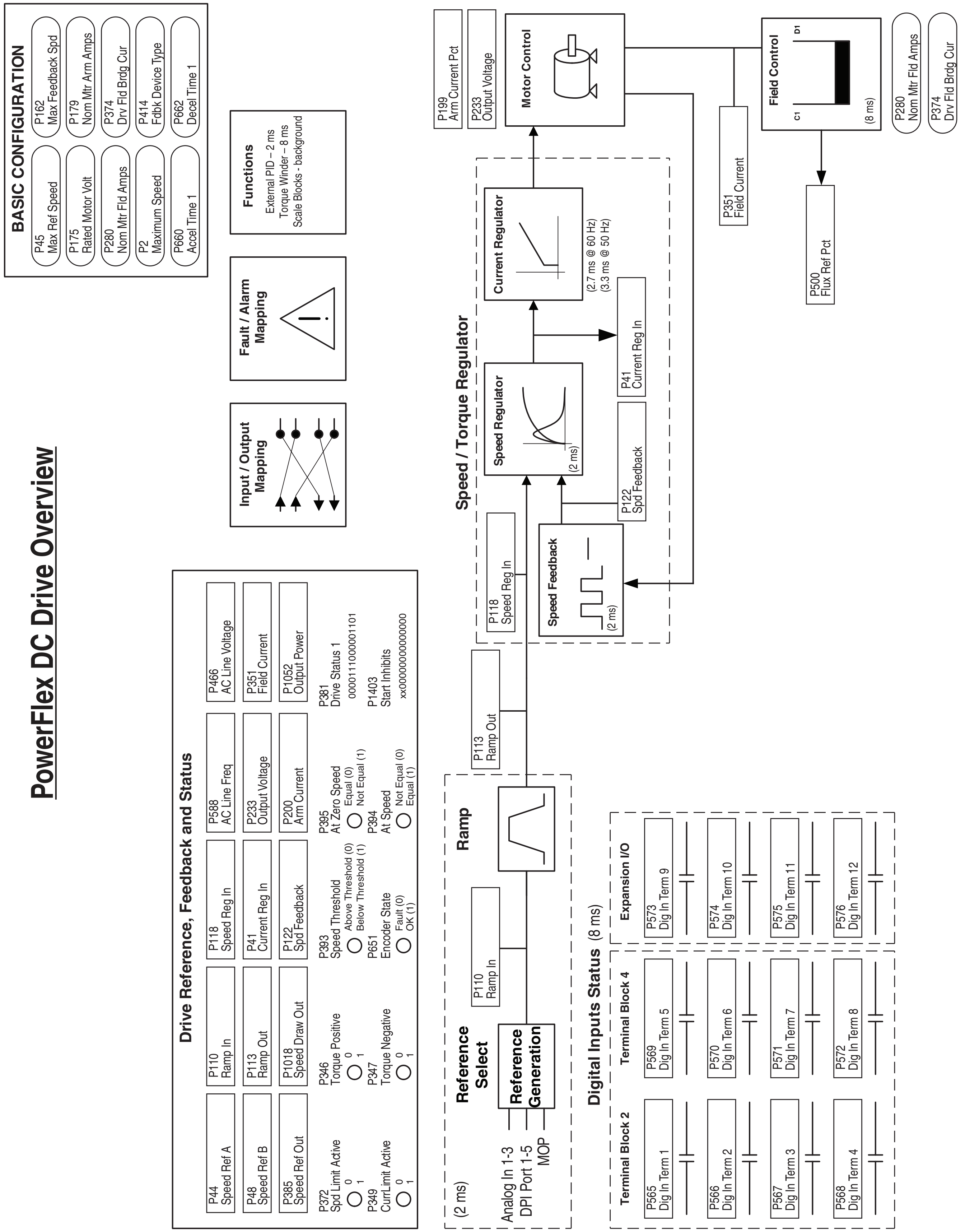


= Read / Write Parameter

= Read Only Parameter

PXXX = Parameter Number
ParName = Parameter Name

PowerFlex DC Drive Overview

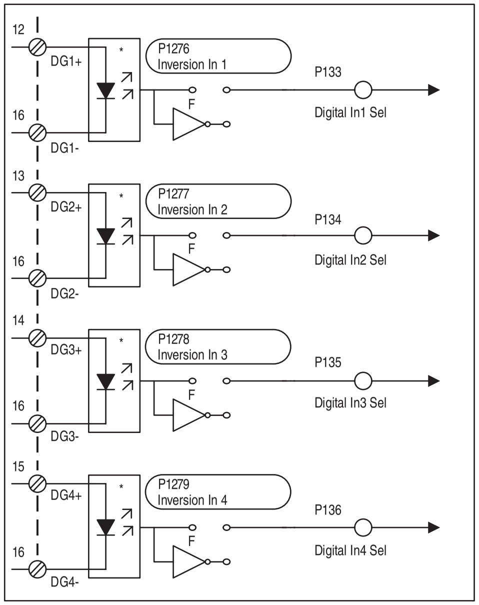


Digital Inputs/Outputs Standard and Expansion I/O

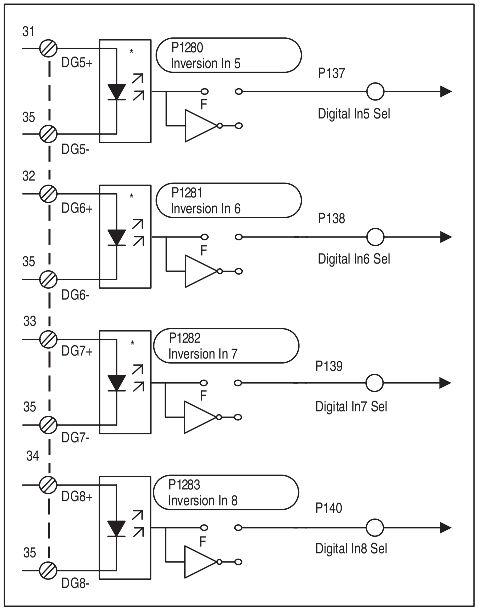
(8 ms)

Digital Inputs

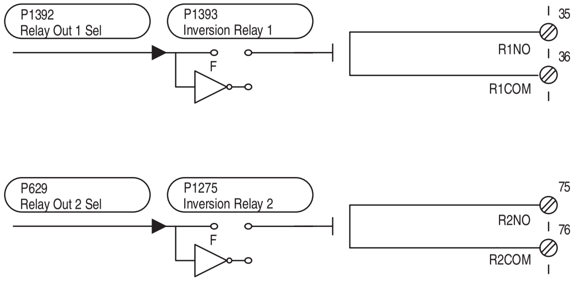
Terminal Block 2



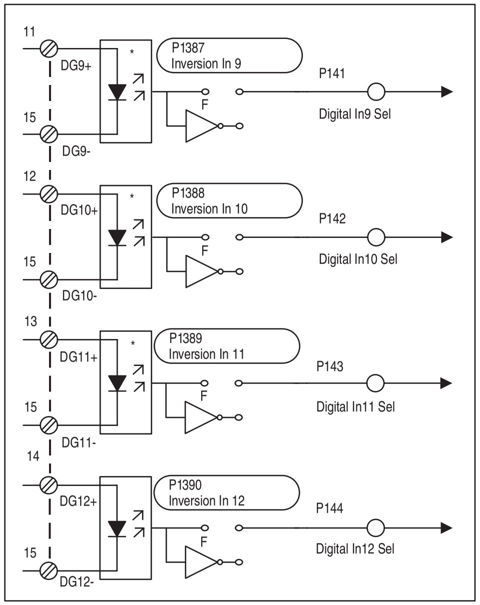
Terminal Block 4



Drive Relay Outputs

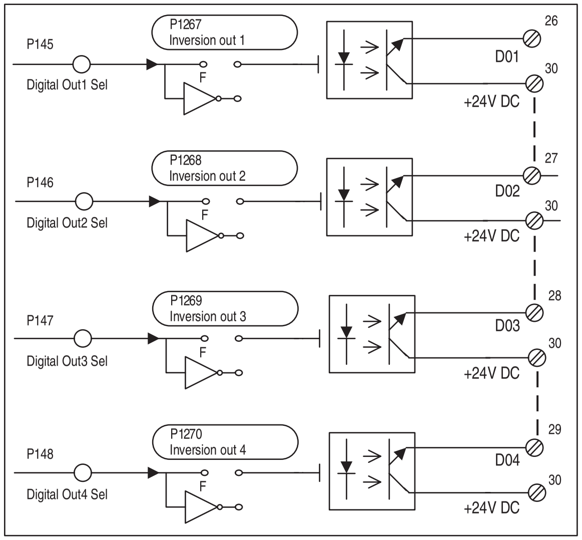


Expansion Digital Inputs (Optional)

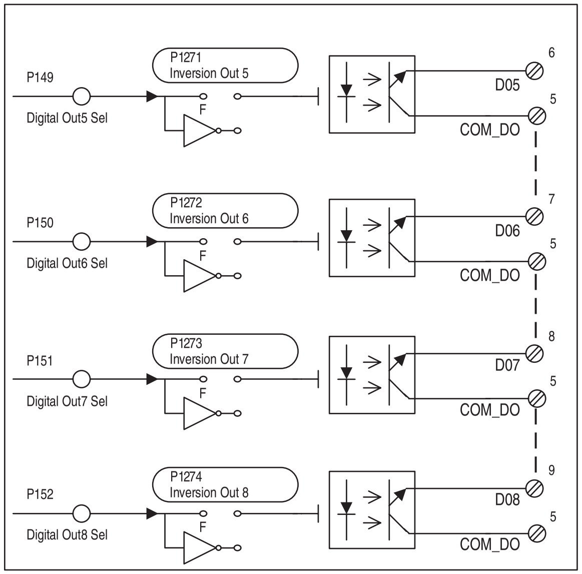


Digital Outputs

Terminal Block 3

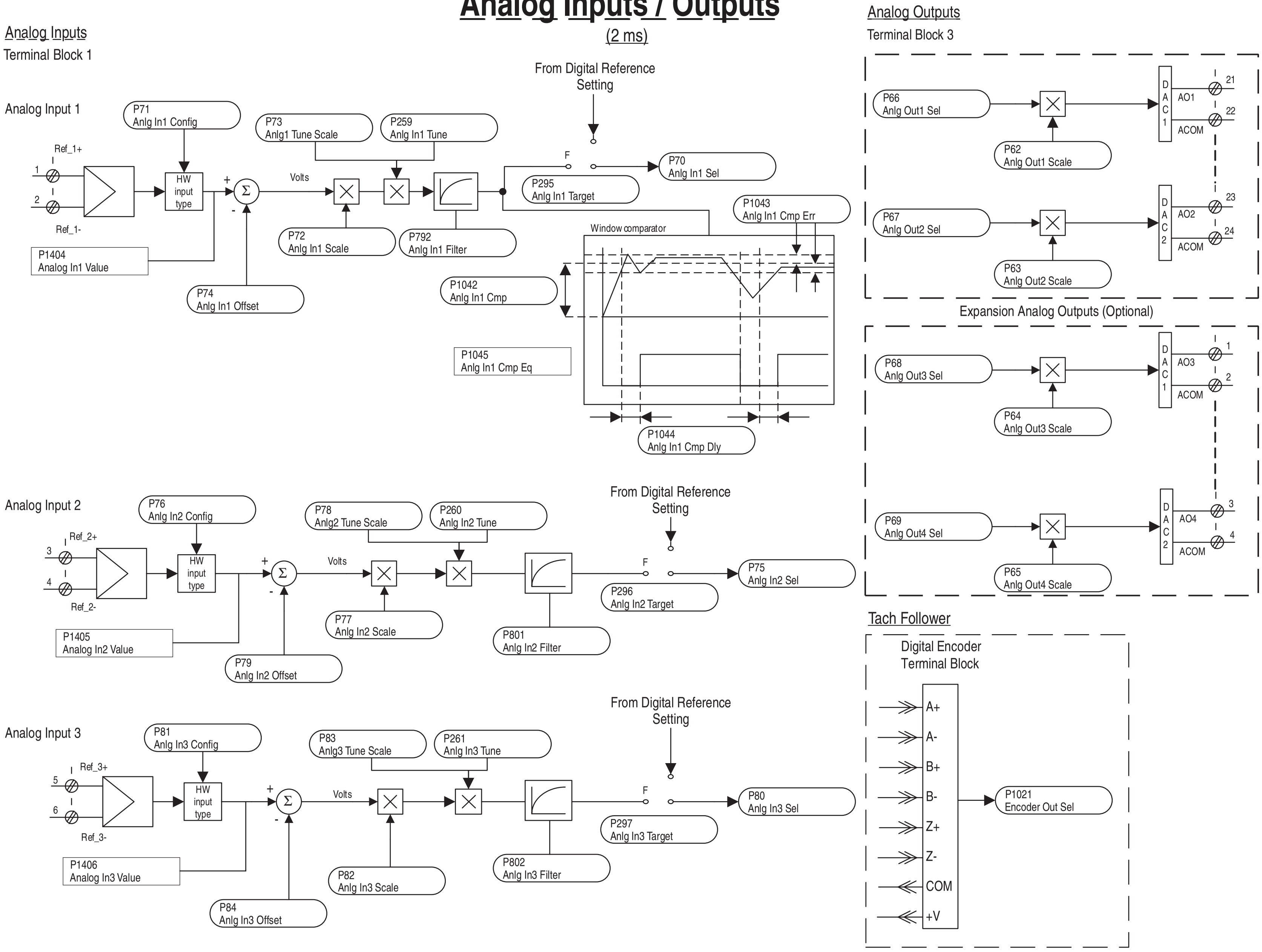


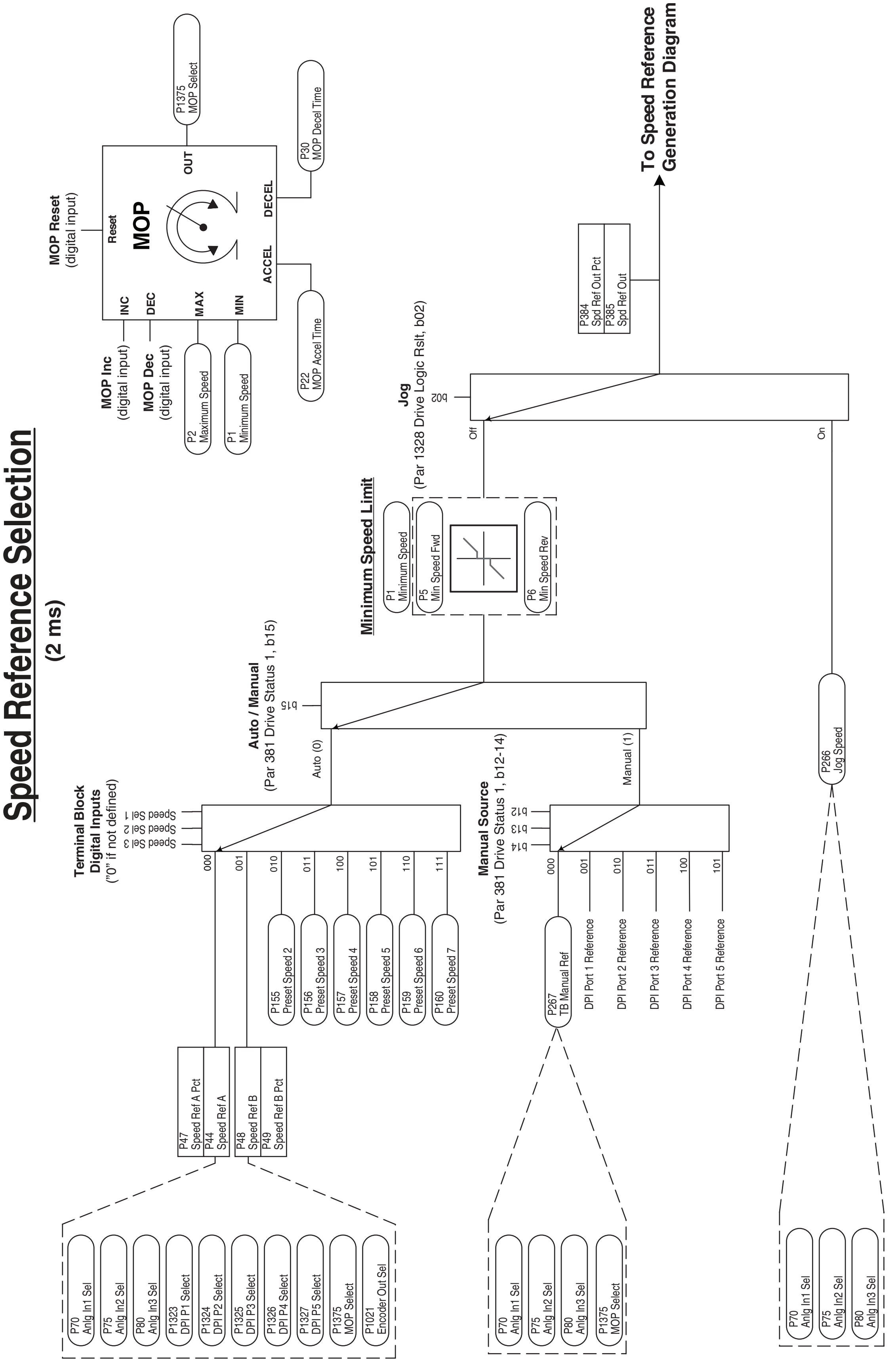
Expansion Digital Outputs (Optional)



Analog Inputs / Outputs

(2 ms)



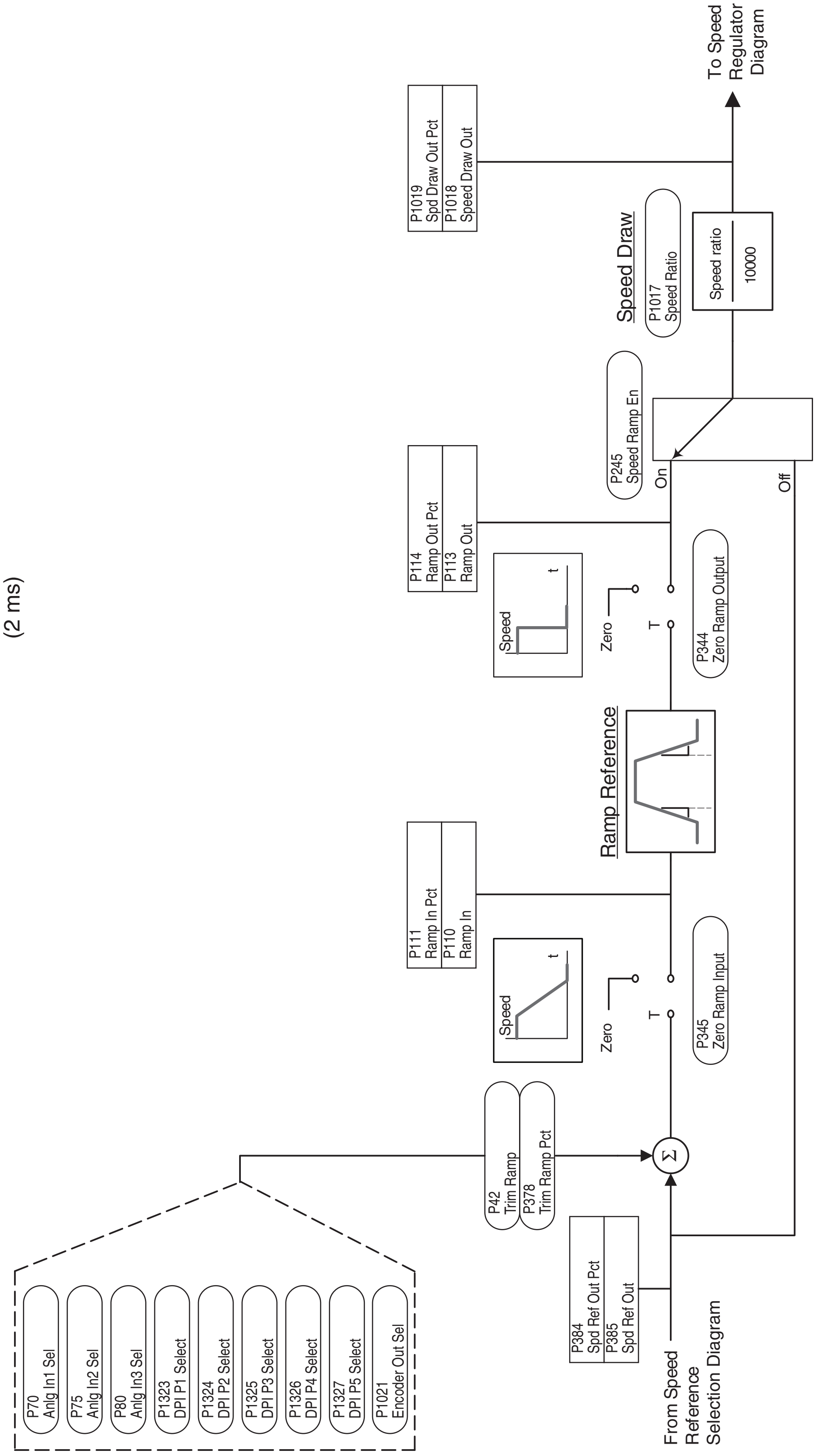


Speed Reference Selection

(2 ms)

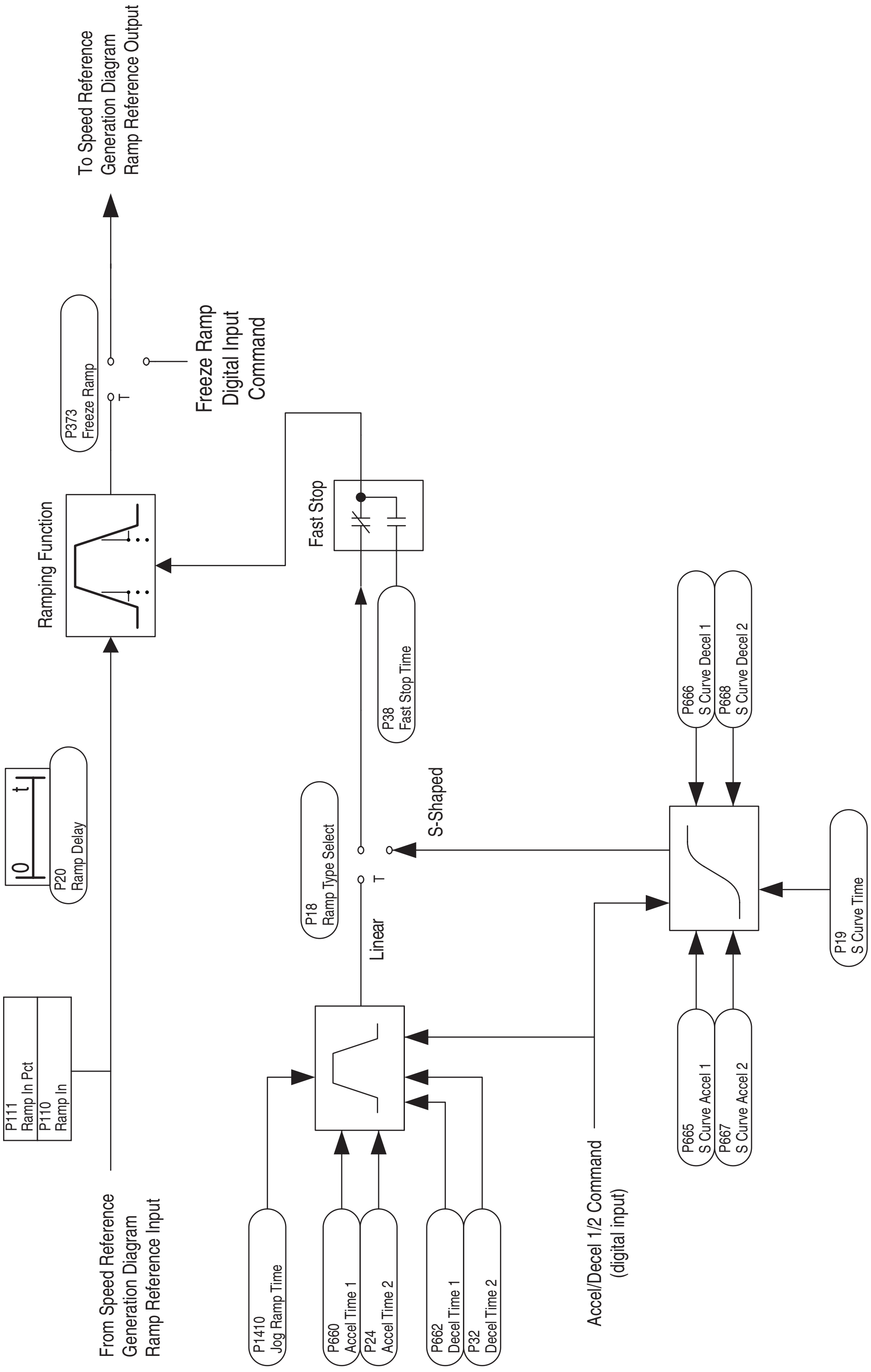
Speed Reference Generation

(2 ms)



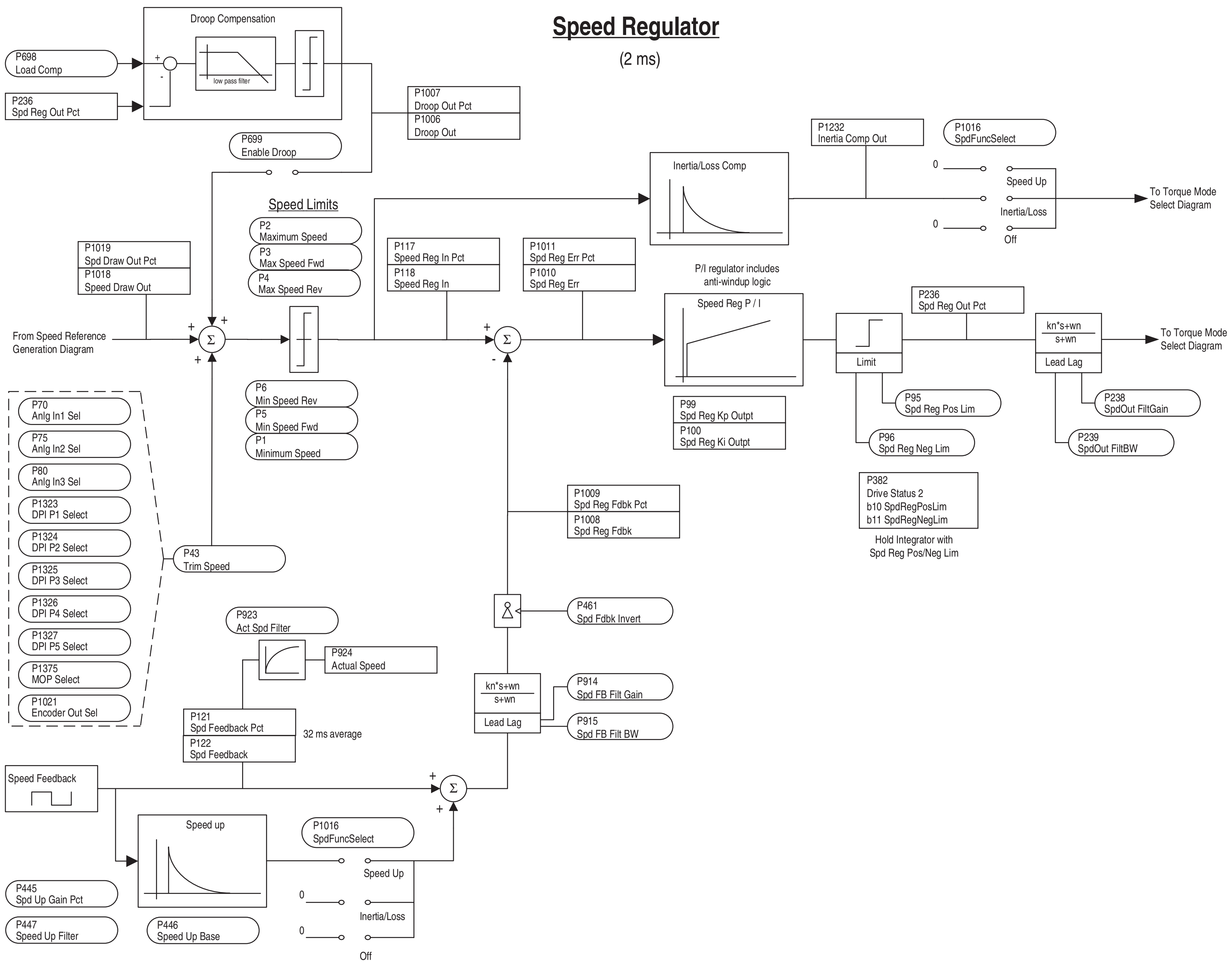
Ramp Reference Block

(2 ms)



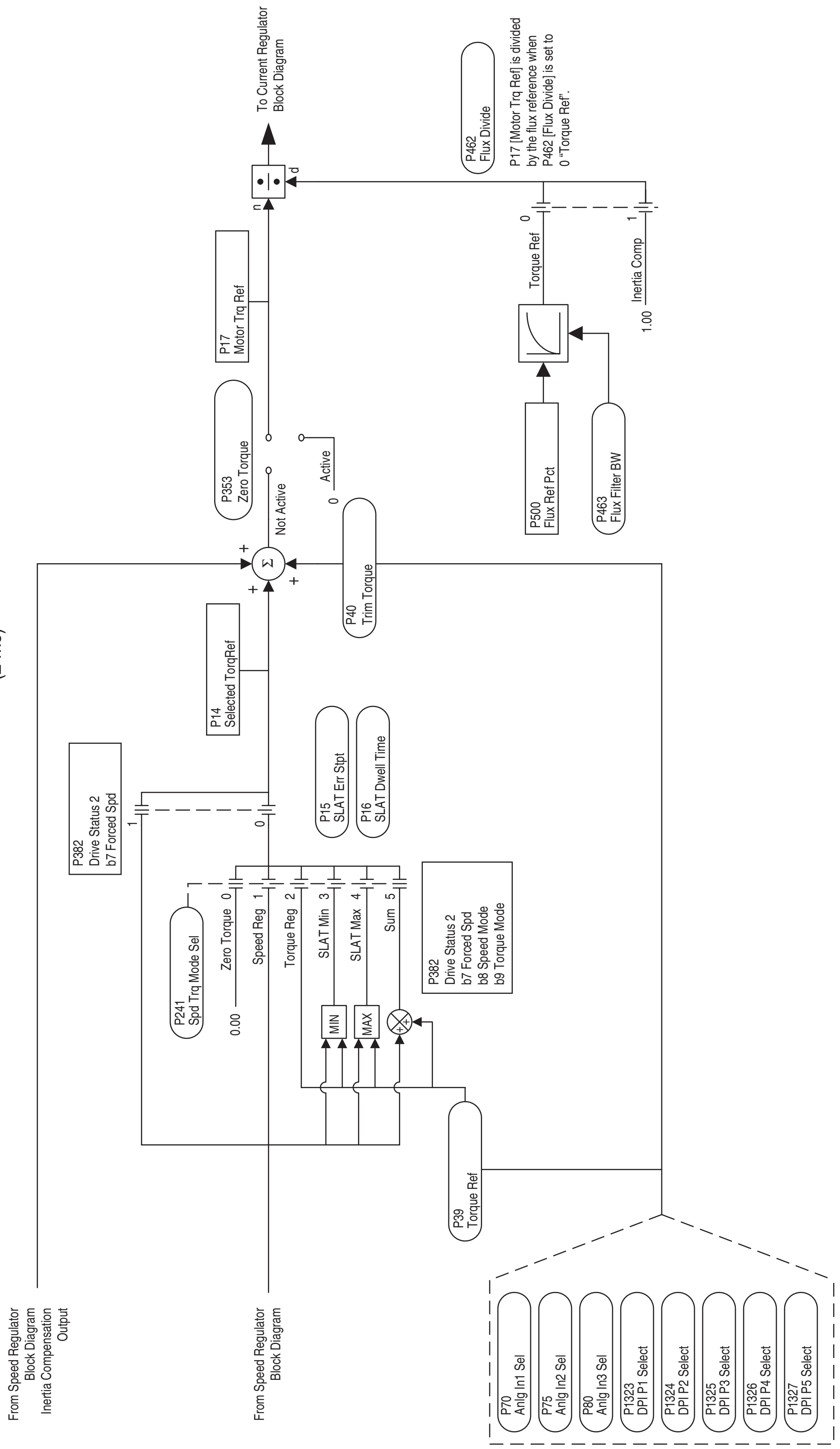
Speed Regulator

(2 ms)



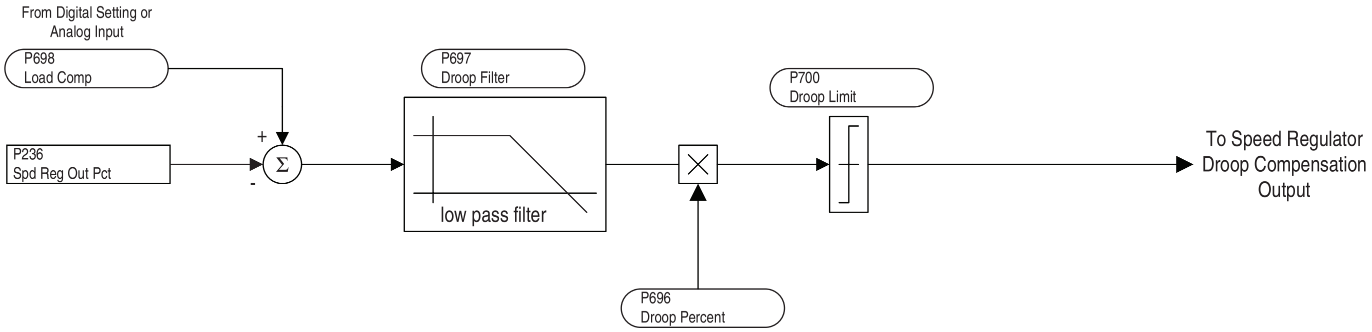
Torque Mode Selection

(2 ms)



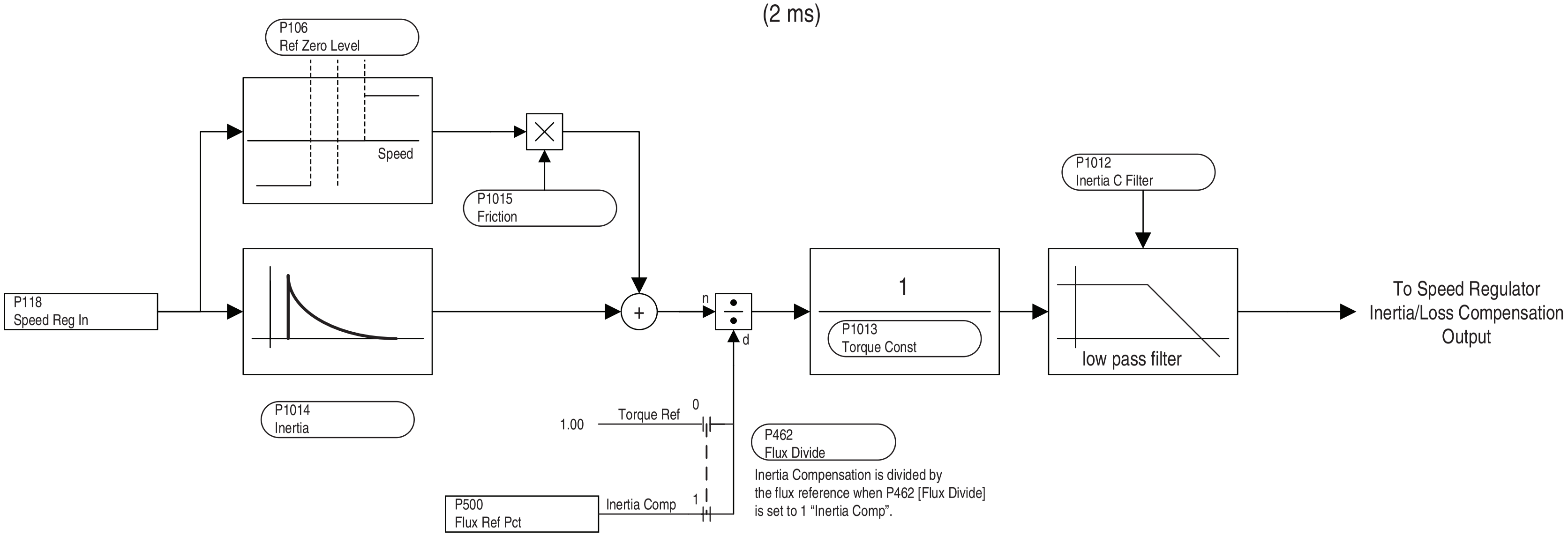
Droop Compensation

(2 ms)



Inertia/Loss Compensation

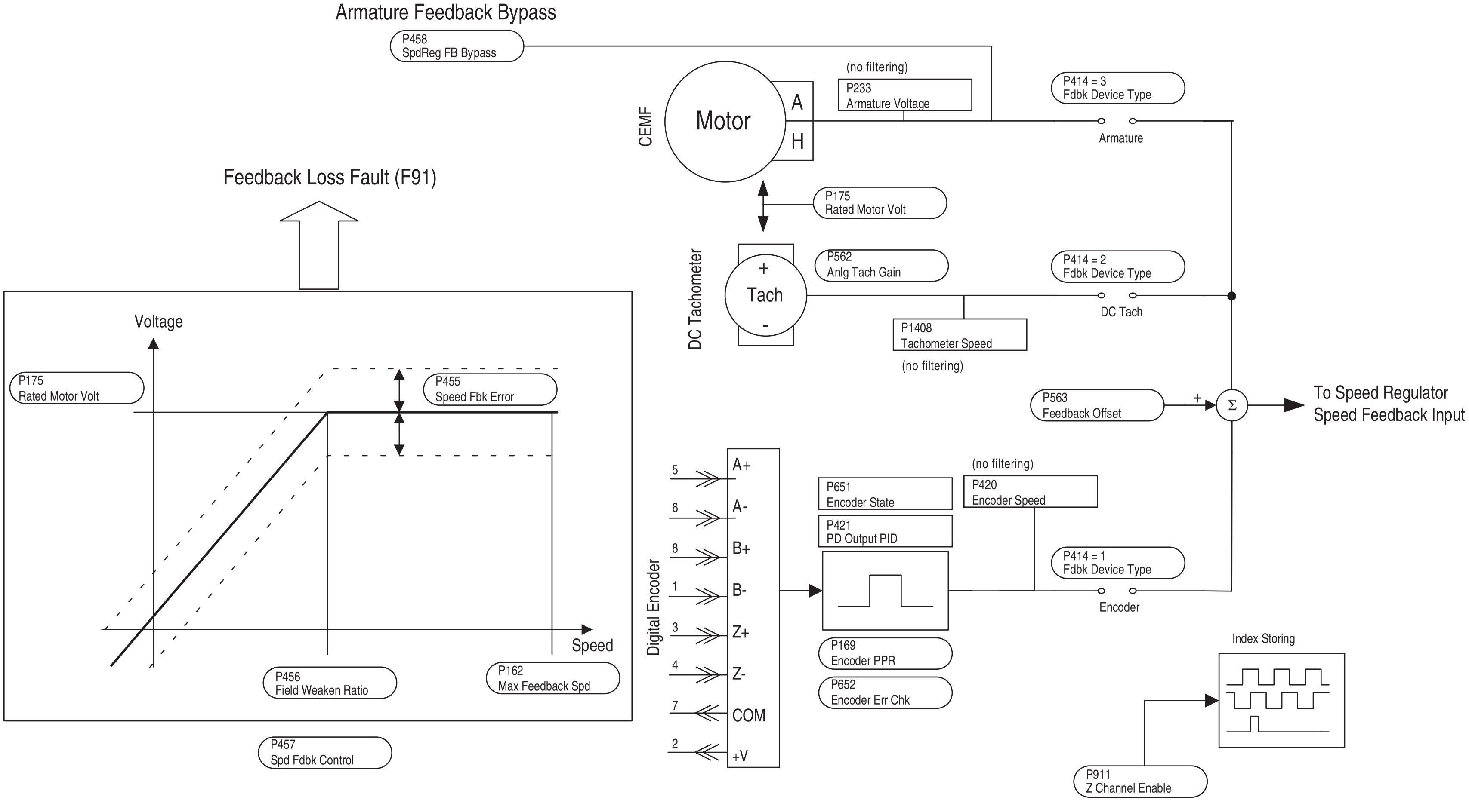
(2 ms)



Inertia Compensation is divided by the flux reference when P462 [Flux Divide] is set to 1 “Inertia Comp”.

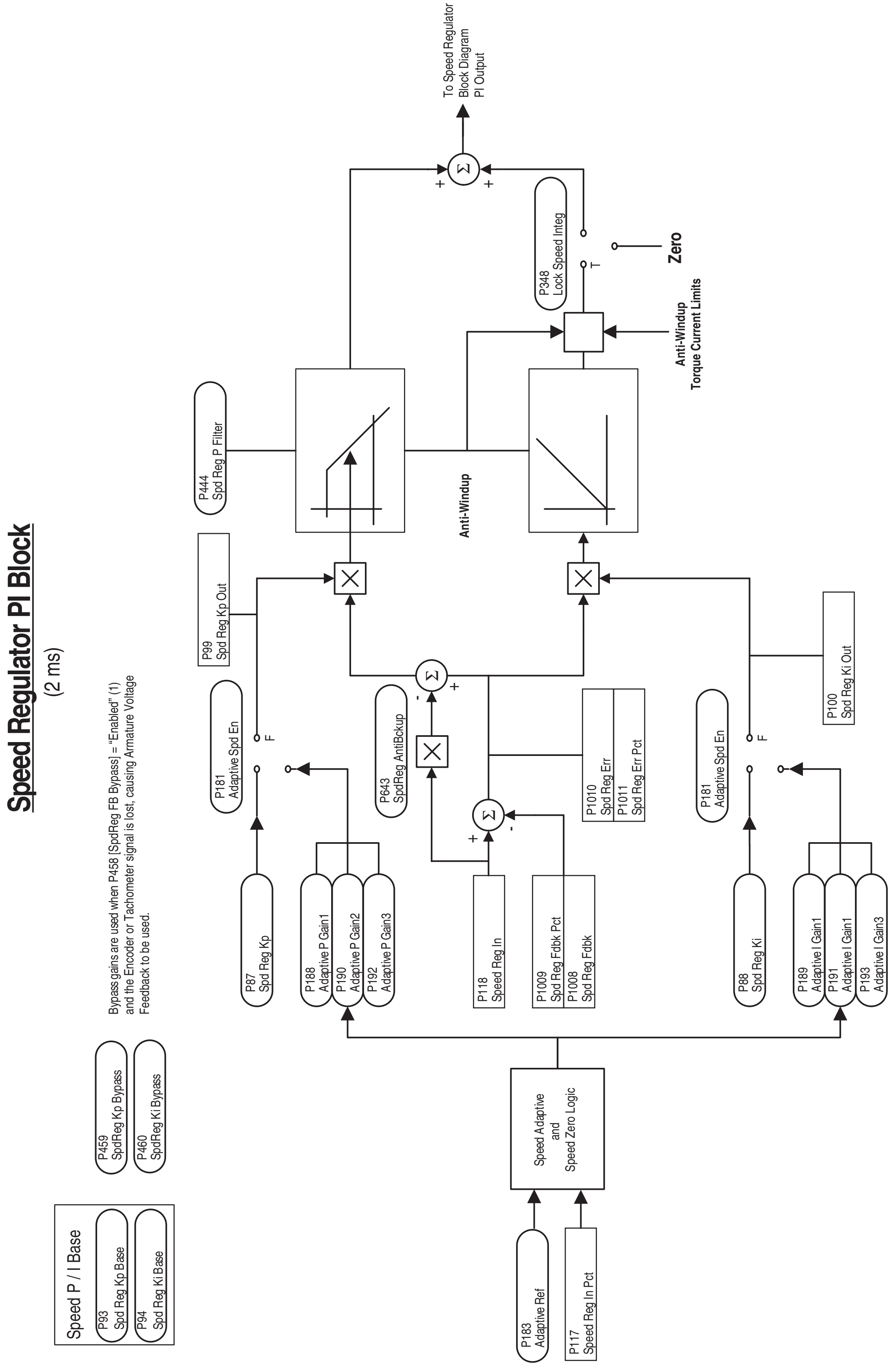
Speed Feedback

(2 ms)



Speed Regulator PI Block

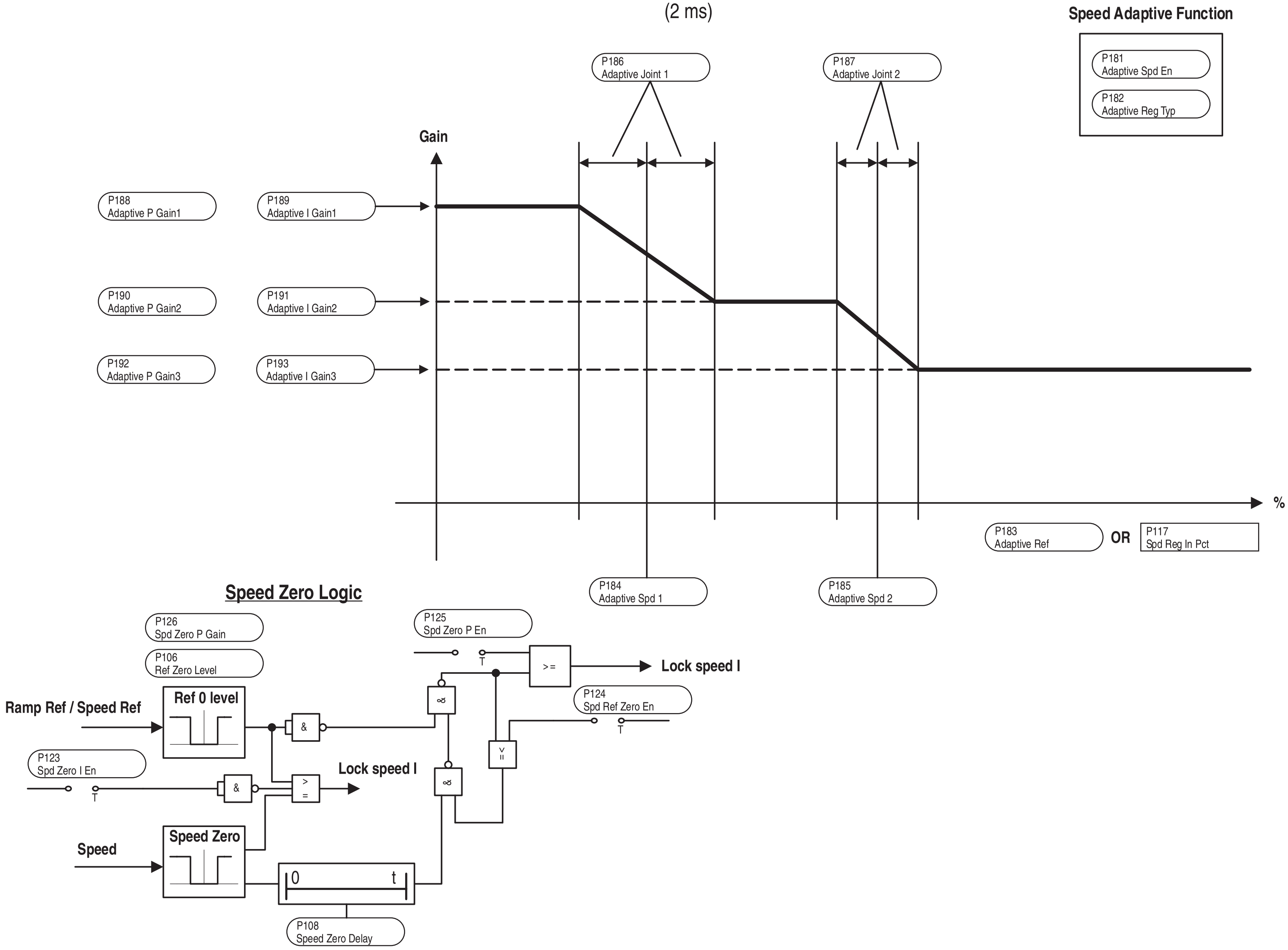
(2 ms)



Bypass gains are used when P458 [SpdReg FB Bypass] = "Enabled" (1) and the Encoder or Tachometer signal is lost, causing Armature Voltage Feedback to be used.

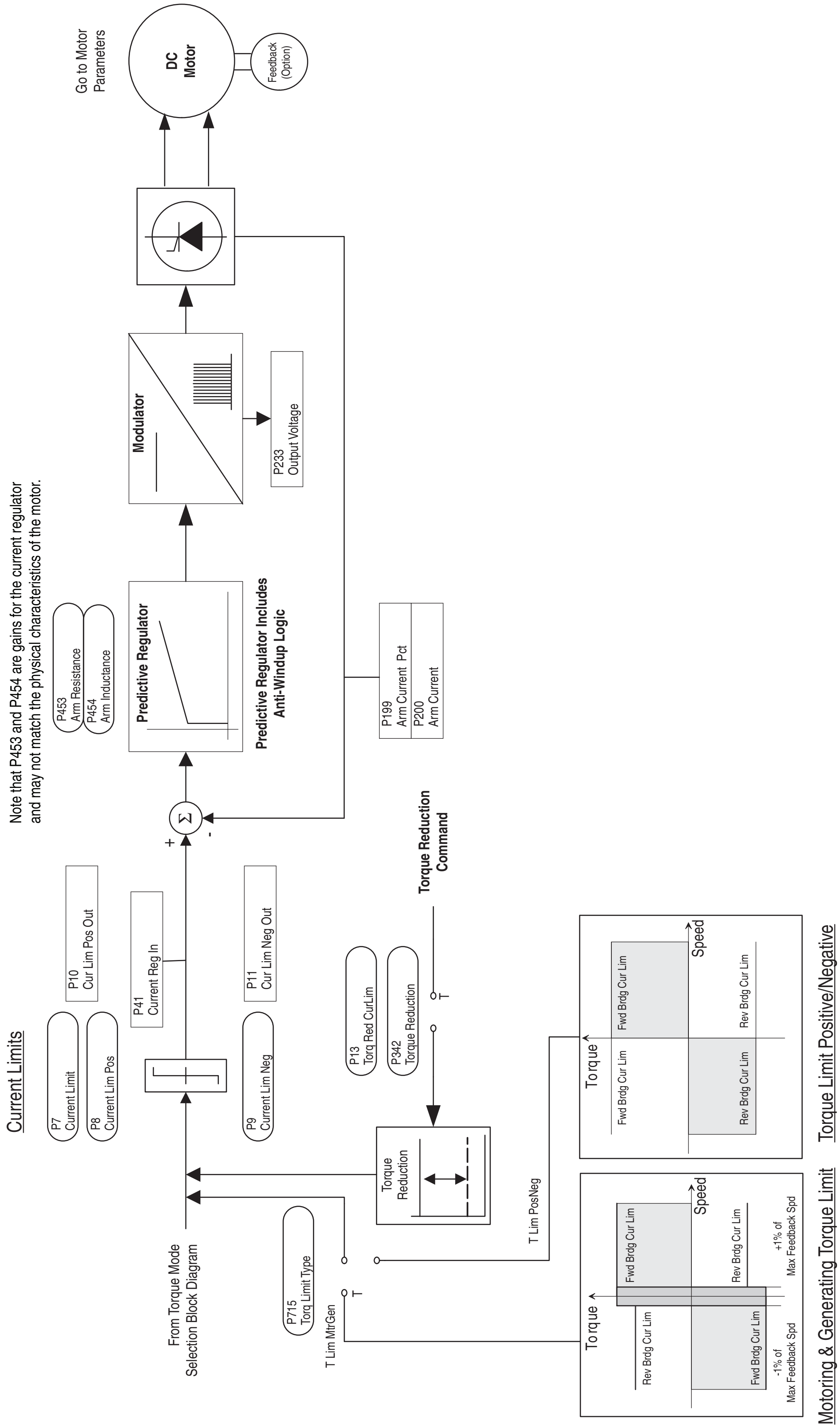
Speed Adaptive and Speed Zero Logic

(2 ms)



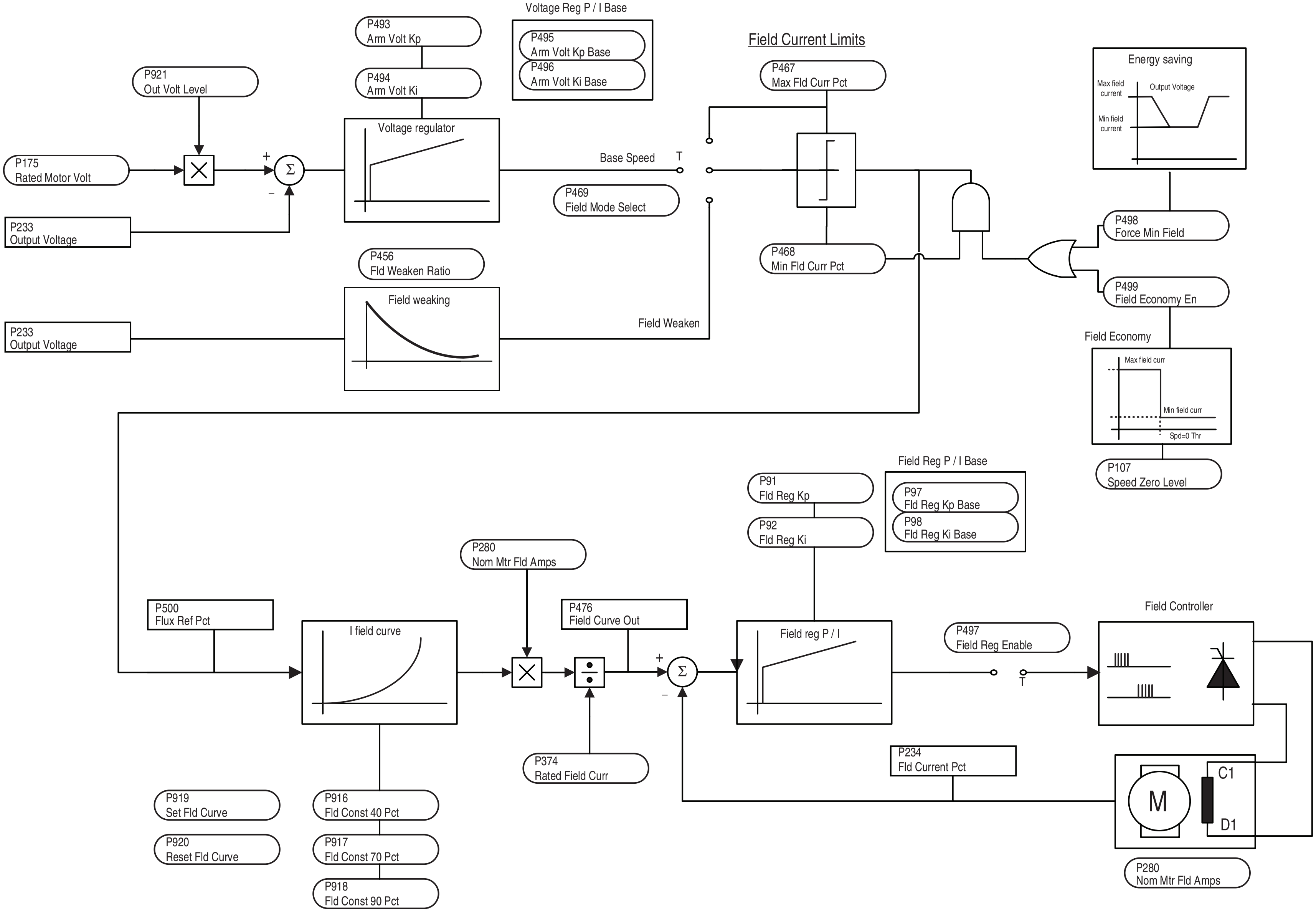
Current Regulator

(3.3 ms @ 50Hz, 2.7 ms @ 60 Hz)

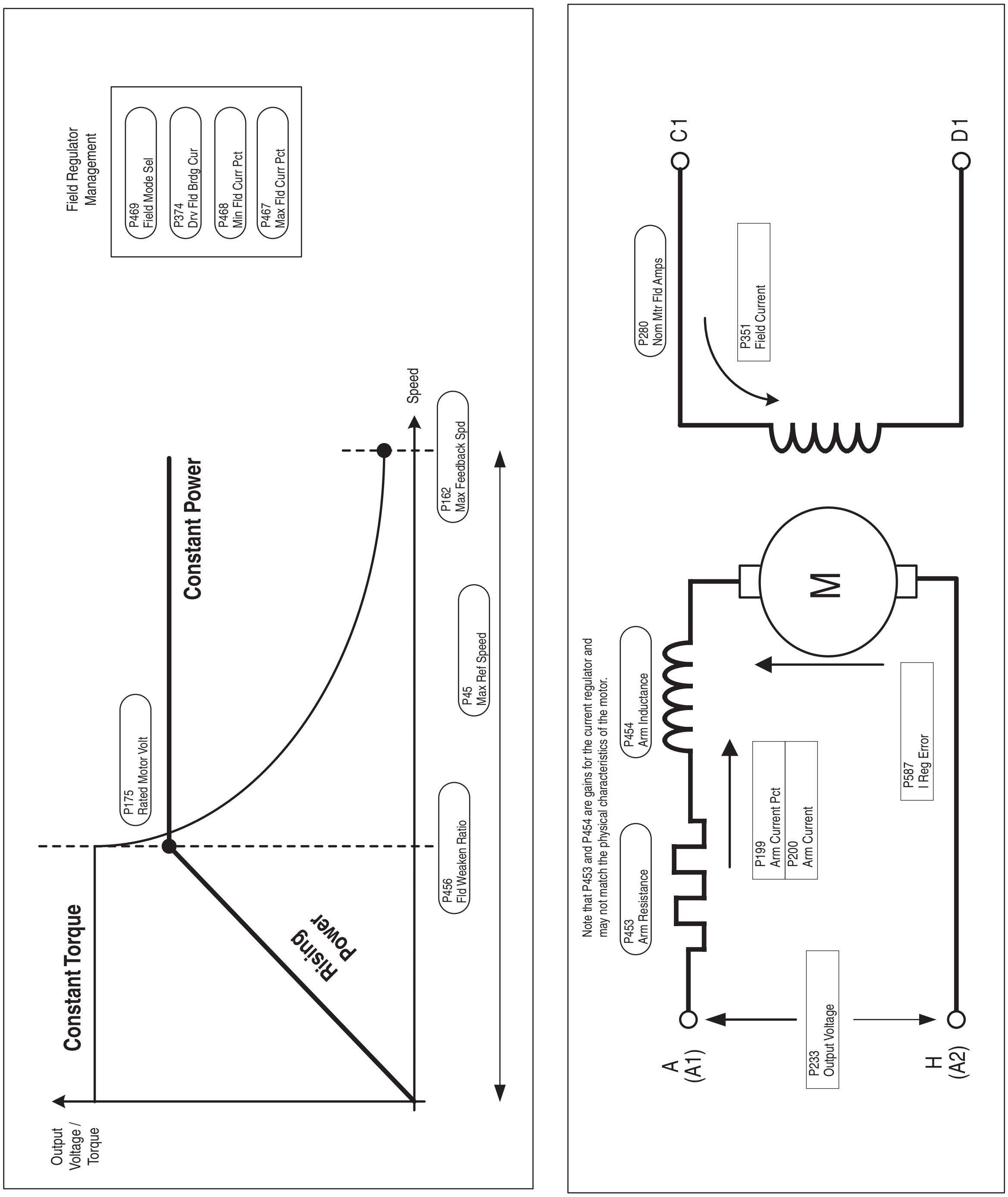


Field Current Regulator

(8 ms)

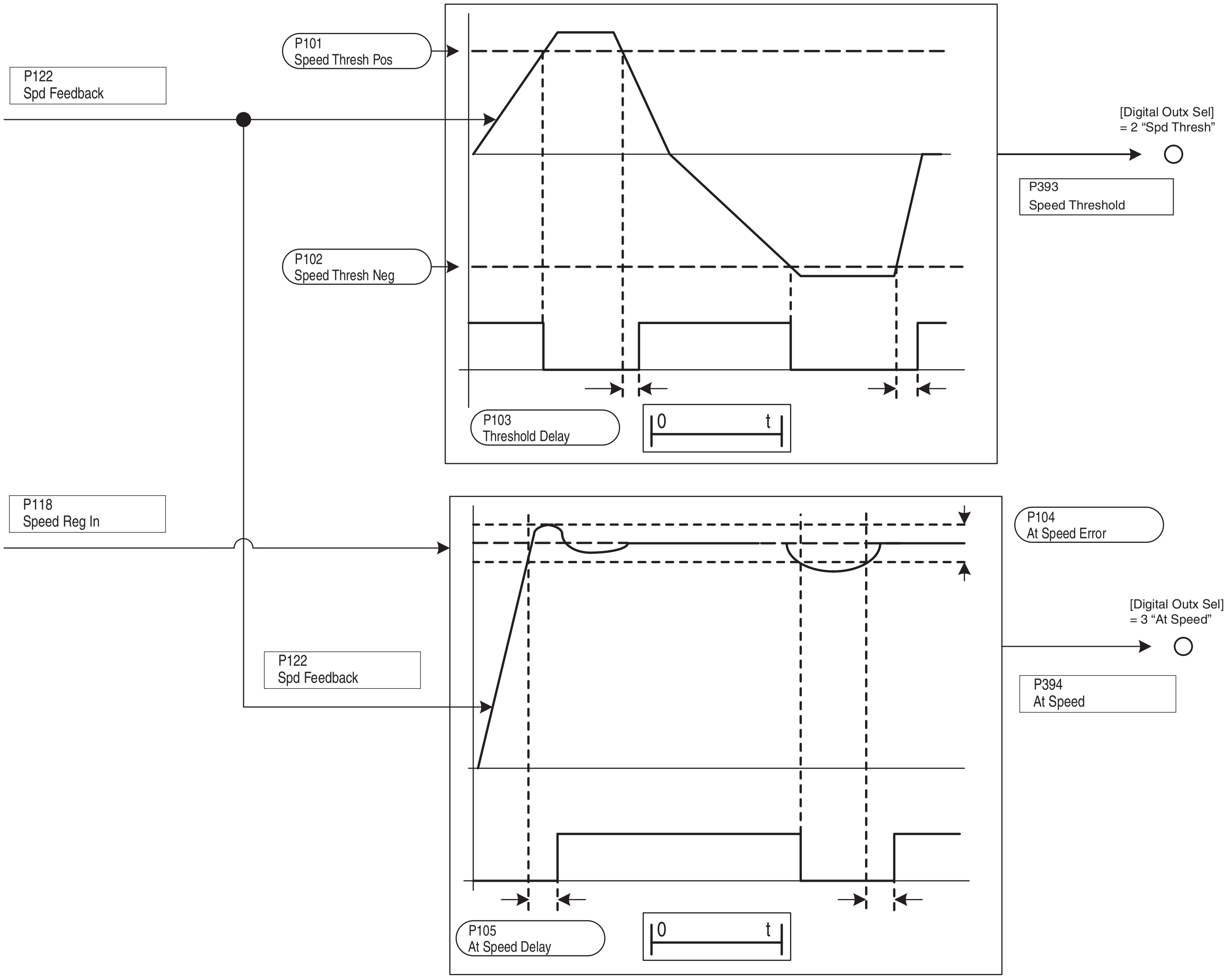


Motor Parameters



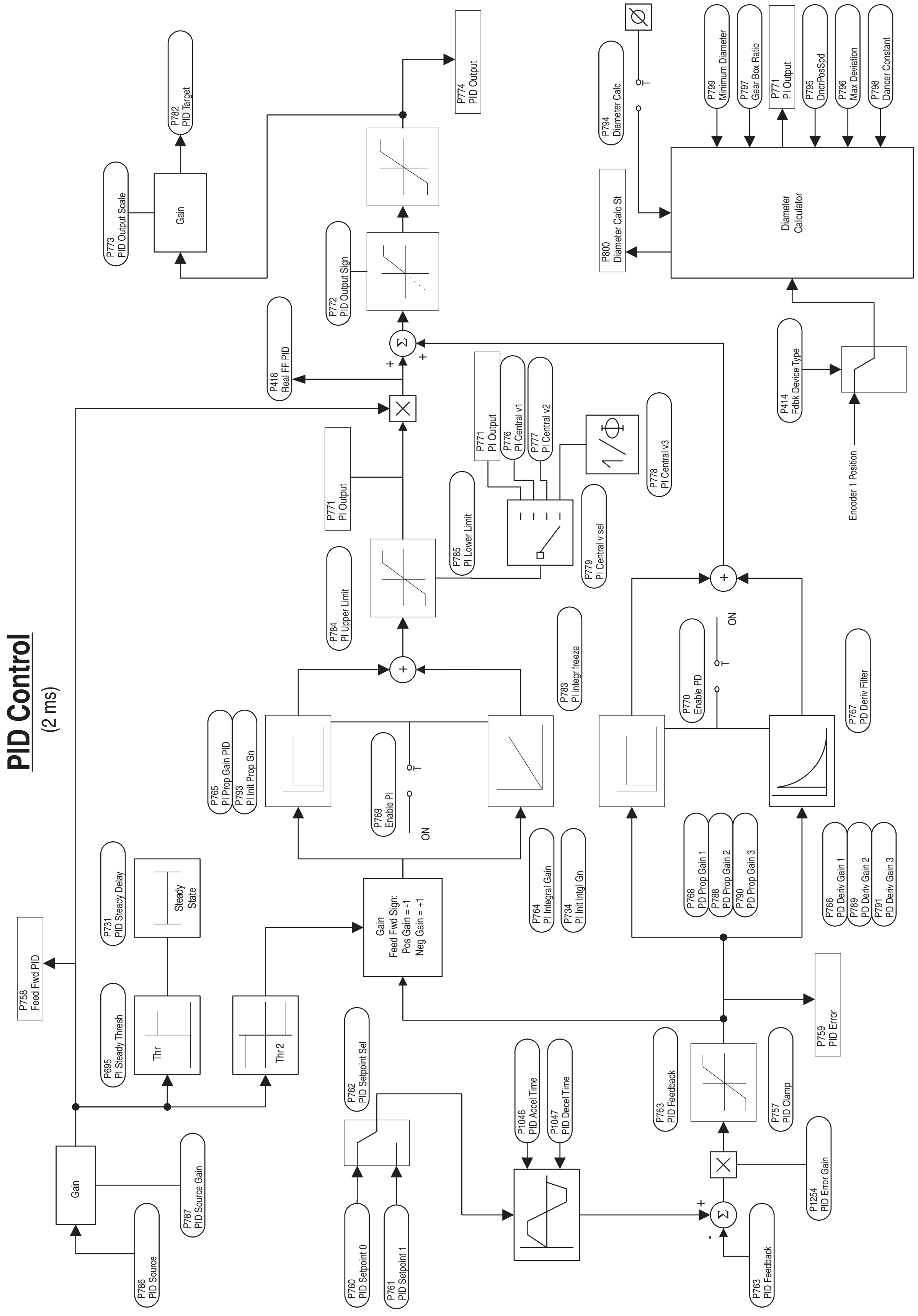
Speed Threshold / Speed Control

(2 ms)



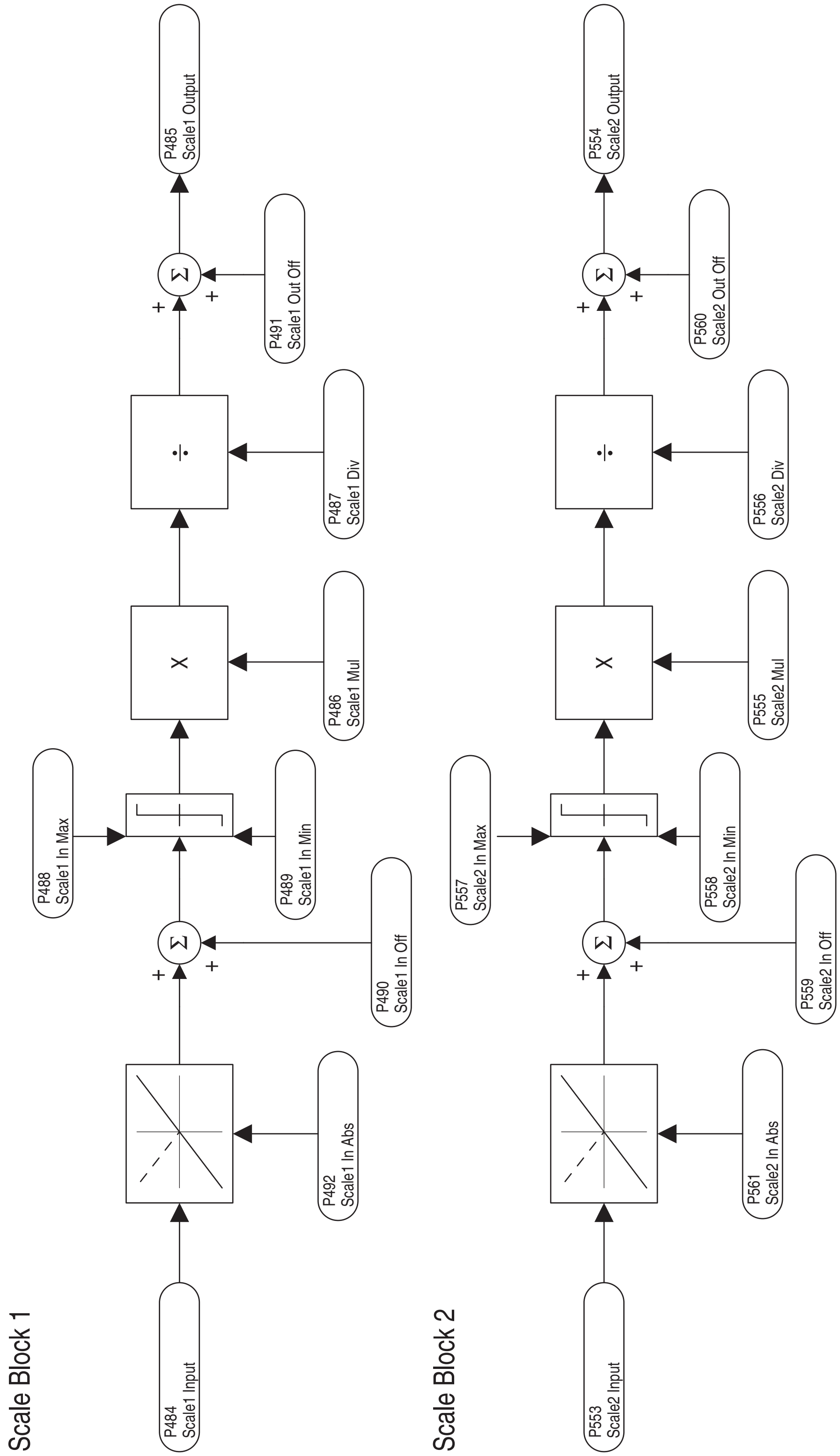
PID Control

(2 ms)



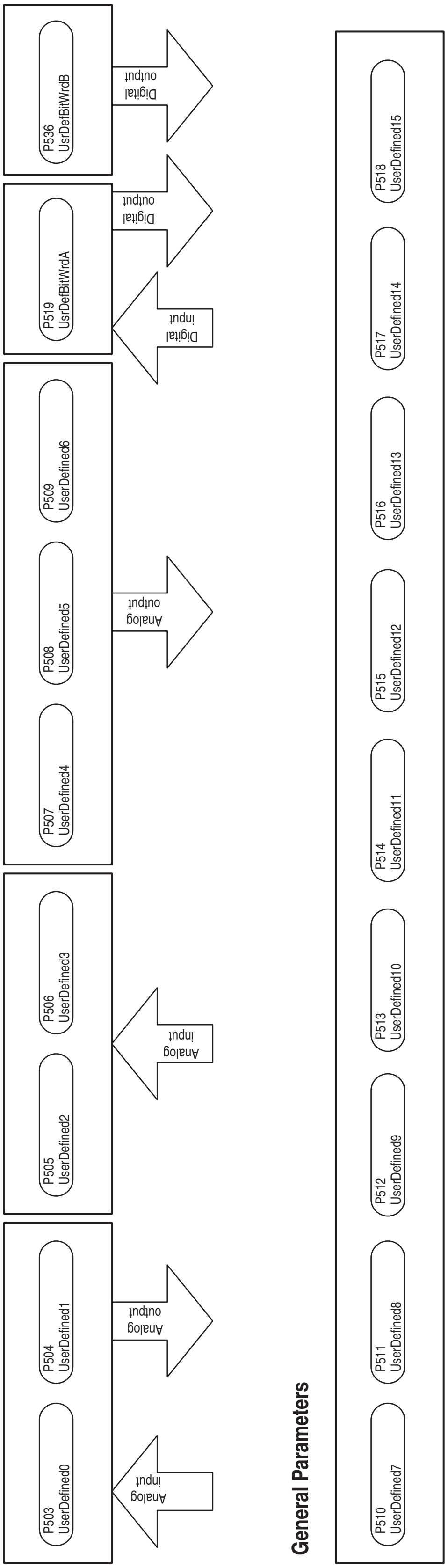
Scale Blocks

(background)

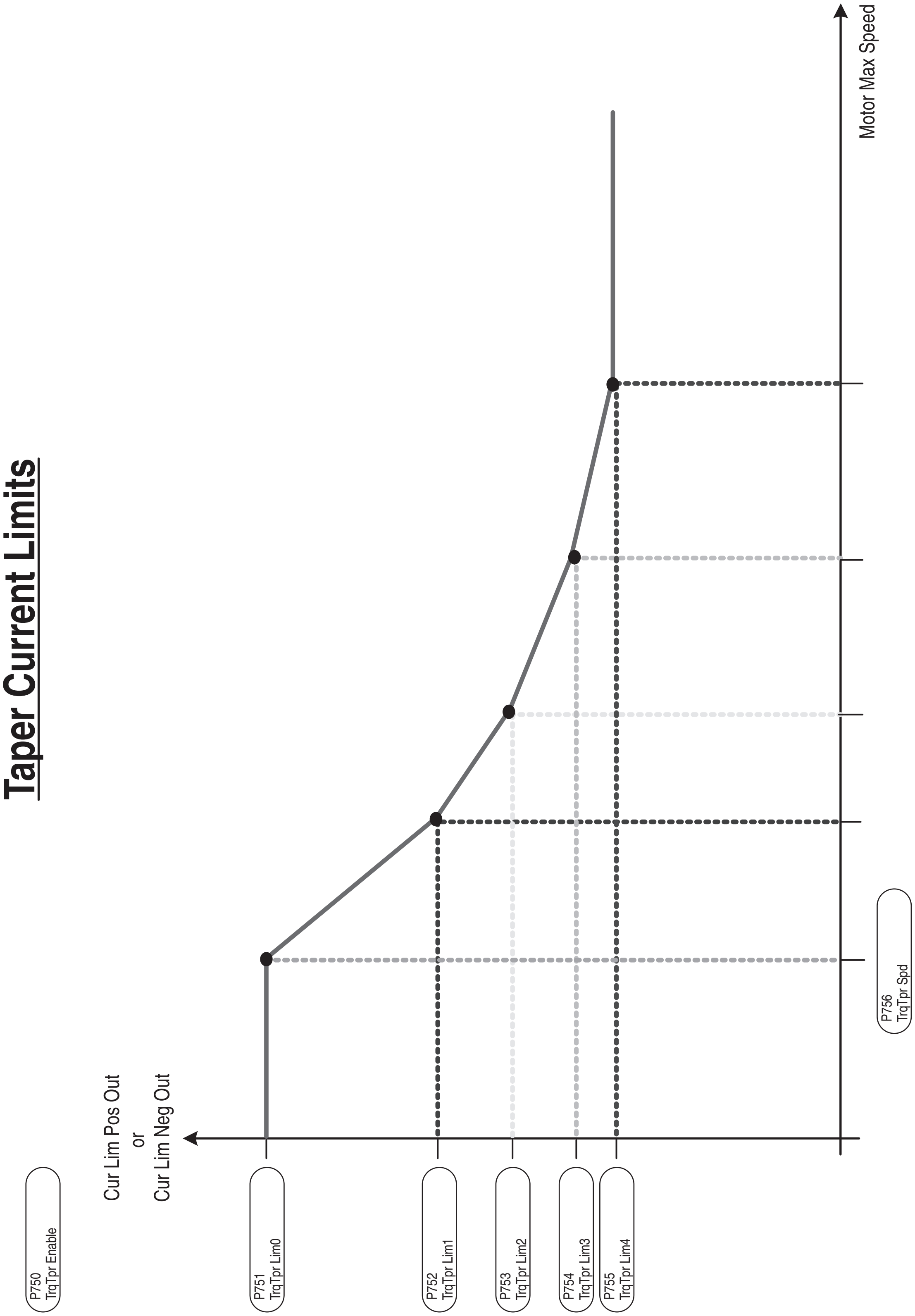


Note: Up to six scale blocks are available. Scale blocks 3-6 follow the same flow as scale blocks 1 and 2, shown here.

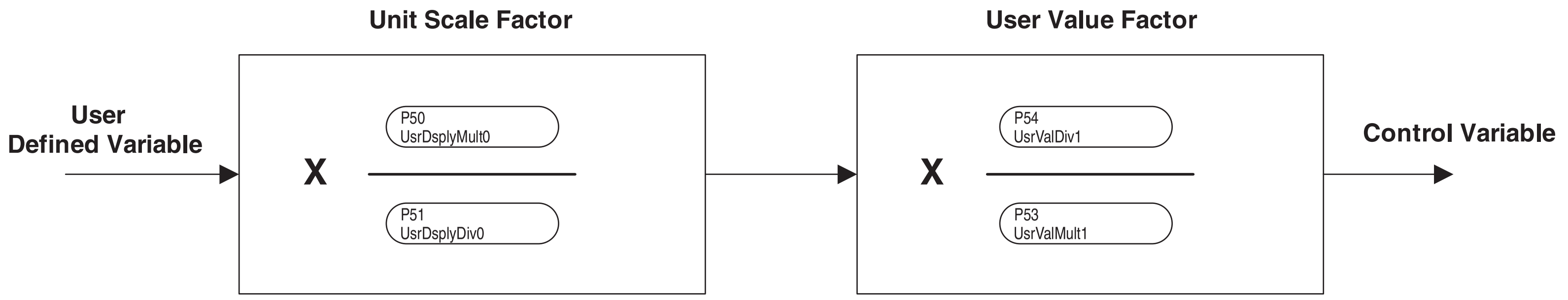
User Defined Parameters



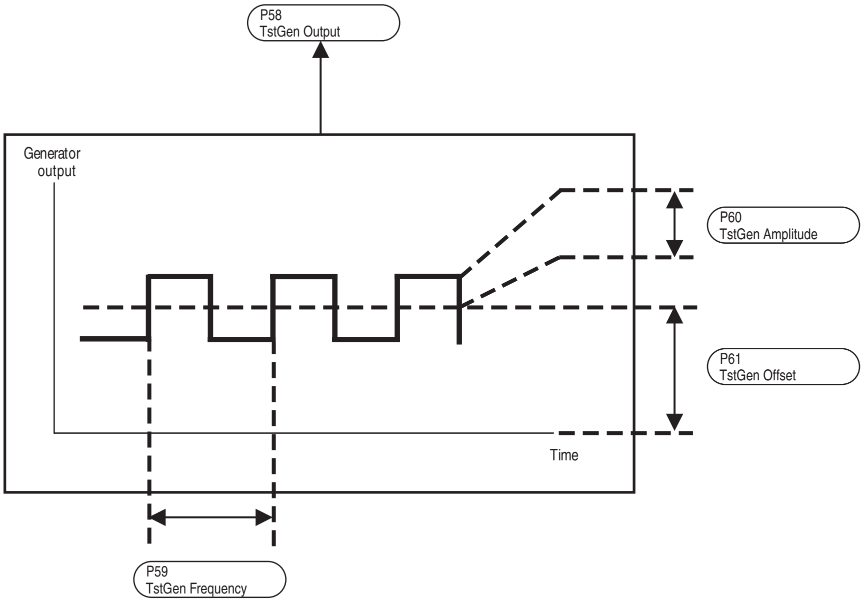
Taper Current Limits



Unit Scaling



Test Generator



Speed Select Settings

P402 Spd Select 2	P401 Spd Select 1	P400 Spd Select 0	Reference
0	0	0	P44 Speed Ref A
0	0	1	P48 Speed Ref B
0	1	0	P155 Preset Speed 2
0	1	1	P156 Preset Speed 3
1	0	0	P157 Preset Speed 4
1	0	1	P158 Preset Speed 5
1	1	0	P159 Preset Speed 6
1	1	1	P160 Preset Speed 7

Fault/Alarm Mapping

“Arm Overvoltage” (F5)

P203
OverVolt Flt Cfg

0 = “Ignore”
1 = “Alarm”
2 = “Fault”

“Fld Current Loss” (F6)

P473
FldLoss Flt Cfg

0 = “Ignore”
1 = “Alarm”
2 = “Fault”

“Auxiliary Input” (F2)

P354
Aux Inp Flt Cfg

1 = “Alarm”
2 = “Fault”
3 = “Fast Stop”
4 = “Normal Stop”
5 = “CurrLim Stop”

“Feedback Loss” (F91)

P478
Spd Loss Flt Cfg

1 = “Alarm”
2 = “Fault”

“Motor Over Temp” (F16)

P365
OverTemp Flt Cfg

0 = “Ignore”
1 = “Alarm”
2 = “Fault”
3 = “Fast Stop”
4 = “Normal Stop”
5 = “CurrLim Stop”

“Motor Overload” (F7)

P479
MtrOvrld Flt Cfg

0 = “Ignore”
1 = “Alarm”
2 = “Fault”

Appendix E

Installing a Communication Adapter

Communication Adapter Kits

The following Communication Adapter kits are available for use with the PowerFlex® DC drive:

Comm Option	Catalog Number
BACnet® MS/TP RS-485 Communication Adapter	20-COMM-B
ControlNet™ Communication Adapter (Coax)	20-COMM-C
DeviceNet™ Communication Adapter	20-COMM-D
EtherNet/IP™ Communication Adapter	20-COMM-E
HVAC Communication Adapter	20-COMM-H
Interbus™ Communication Adapter	20-COMM-I
PROFIBUS™ DP Communication Adapter	20-COMM-P
ControlNet™ Communication Adapter (Fiber)	20-COMM-Q
Remote I/O Communication Adapter	20-COMM-R
RS-485 DF1 Communication Adapter	20-COMM-S
External Comms Power Supply	20-XCOMMAC-PS1
DPI External Communications Kit	20-XCOMMDC-BASE
External DPI I/O Option Board(1)	20-XCOMMIO-OPT1
Compact I/O to DPI/SCANport Module	1769-SM1
Serial Null Modem Adapter	1203-SNM
Smart Self-powered Serial Converter (RS-232) includes 1203-SFC and 1202-C10 Cables	1203-SSS
Universal Serial Bus™ (USB) Converter includes 2m USB, 20-HIM-H10 & 22-HIM-H10 Cables	1203-USB

(1) For use only with External DPI Communications Kits 20-XCOMM-DC-BASE.

What The Communication Adapter Kit Includes

- Communication Adapter module w/captive screws
- Internal Interface cable
- Communication Adapter User Manual
- Additional components, based on the option selected

Tools That You Need

- Phillips® screwdriver

Phillips® is a registered trademark of Phillips Screw Company.

Safety Precautions

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

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

⚠ **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.

Installing the Communication Adapter Module in the Drive

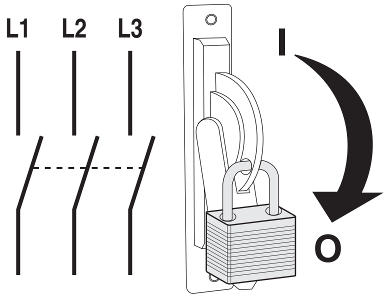
Follow these steps to install a communication adapter module:

⚠ **ATTENTION:** Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system’s field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

1. Remove and lock-out all incoming power to the drive.

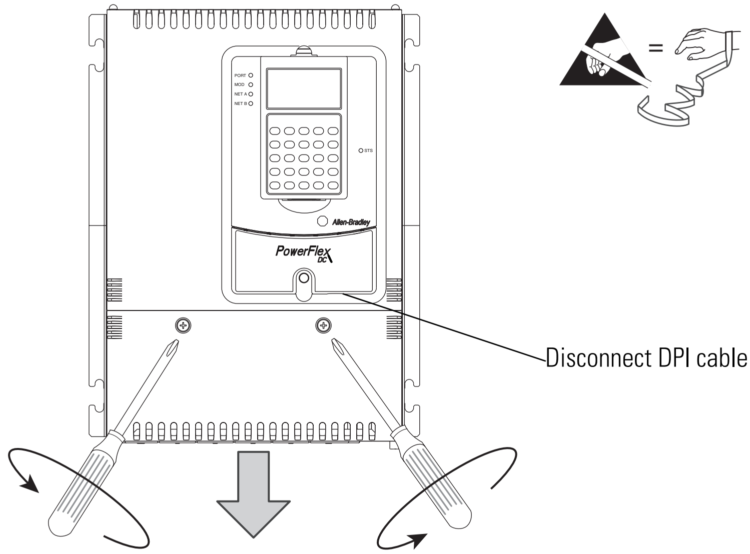


2. Disconnect the DPI cable from the HIM on the drive.

3. Remove the cover(s) from the drive:

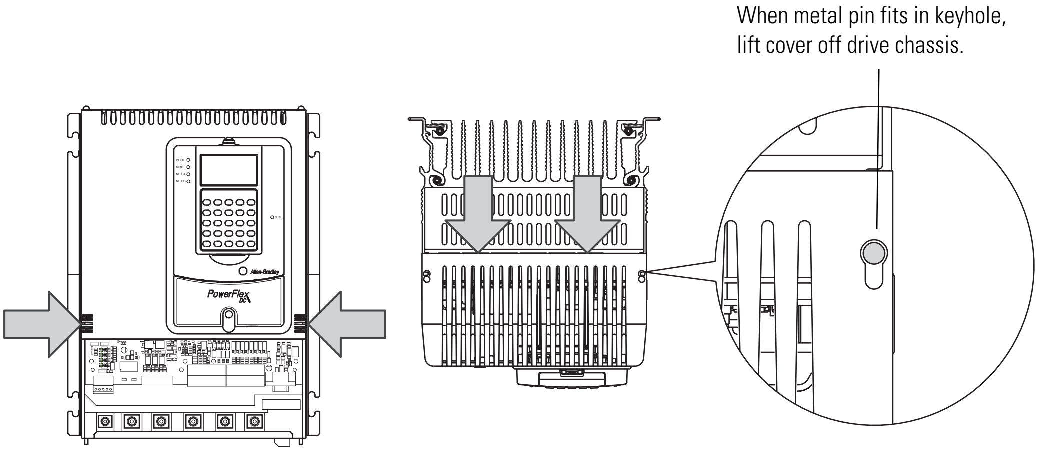
Frame A:

a. Remove the screws that secure the bottom cover to the drive, then slide the cover down and off the drive chassis.



b. Press in on the sides at the bottom edge of the top cover and at the same time pull the cover toward you to pull it partially off the drive chassis. Next, at the top of the drive, pull the cover forward, away from the drive, until the pins fit in the keyhole in the top of the cover, then carefully lift the cover off of the drive chassis.

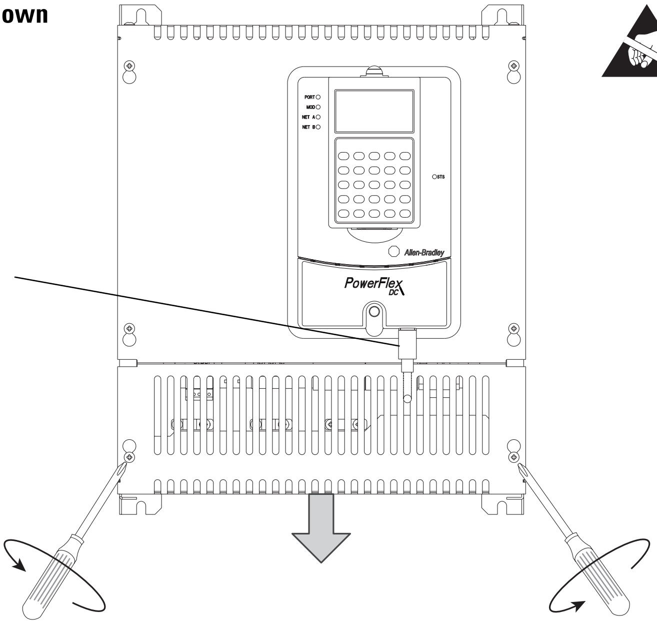
IMPORTANT	The HIM assembly is connected to the Control board by a cable and therefore will not pull free from the drive until disconnected. See step 4 page 337 for instructions.



Frames B and C

a. Loosen, but do not remove, the screws that secure the bottom cover to the drive, then slide the cover down and off the drive chassis.

Frame B shown

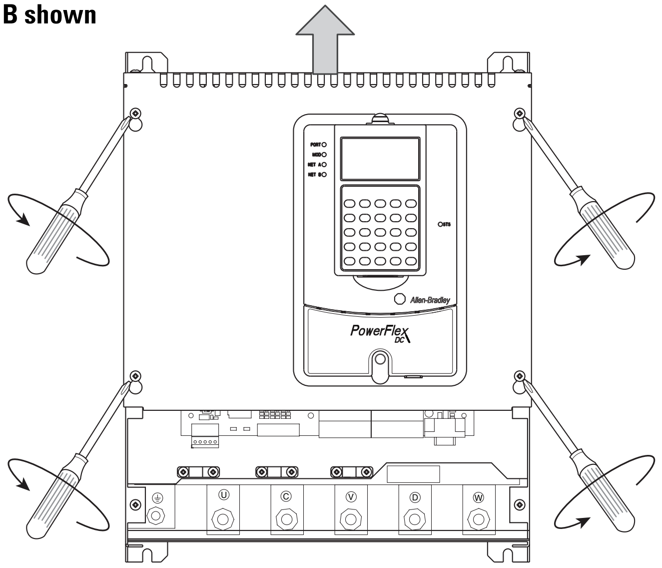


Disconnect DPI cable.

b. Loosen, but do not remove, the screws that secure the top cover to the drive, then slide the cover up and off the drive chassis.

IMPORTANT	The HIM assembly is connected via a cable to the Control board and therefore will not pull free from the drive until disconnected. See step 4 on page 337 for instructions.

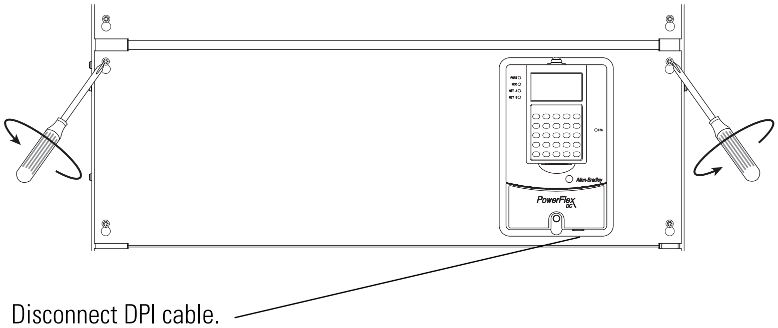
Frame B shown



Frame D

a. Loosen, but do not remove, the Hexalobular head screws that secure the cover, containing the HIM cradle, to the drive frame. Then, slide the cover up until the screw heads line up with the key holes and lift the cover off the chassis.

IMPORTANT	The HIM assembly is connected to the Control board by a cable and therefore will not pull free from the drive until disconnected. See step 4 below for instructions.



Disconnect DPI cable.

4. Disconnect the HIM Communication cable from the connector on the upper right corner of the Control board and set the cover aside.

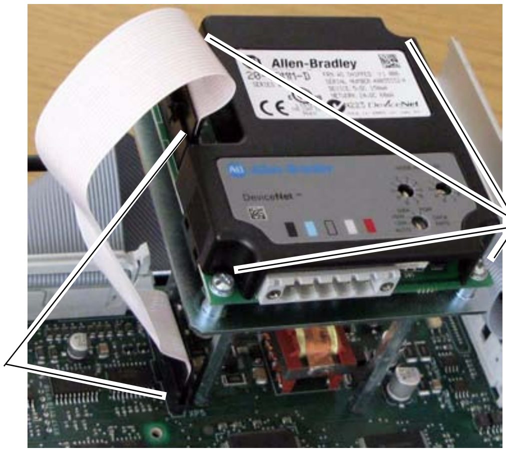
All Frames (Frame A shown)

Pull tabs out to disconnect cable.

5. Secure and ground the Communication Adapter to the EMI Shield on the drive using the four captive screws.

IMPORTANT	All screws must be tightened, because the adapter is grounded through a screw to the EMI shield. Recommended tightening torque is 0.9 N•m (8 lb•in).

6. Connect the Internal Interface cable to the DPI connectors on the Control board and the communication Adapter board.



Secure adapter to EMI Shield with four (4) screws.

Connect cable to DPI connectors on adapter and control board.

7. Refer to the Adapter's User Manual for network connection, commissioning, and configuration information.
8. Install the HIM Communication cable in reverse order or removal.
9. Install the drive covers in reverse order of removal.

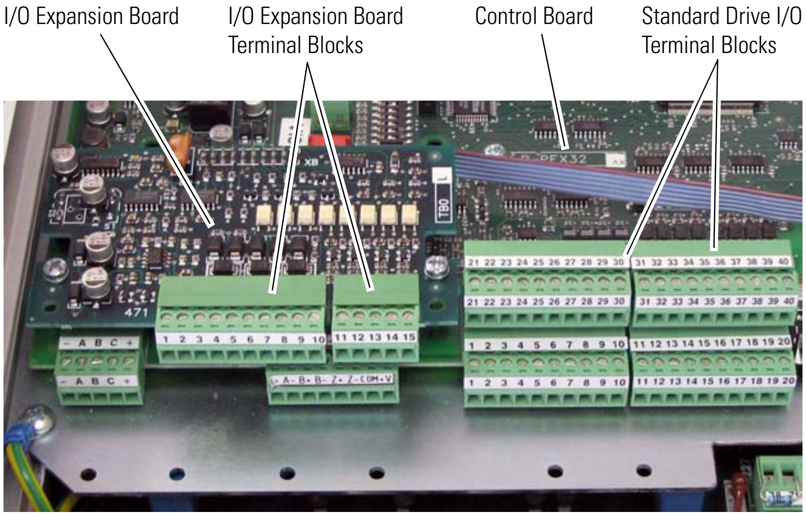
Optional Analog and Digital I/O Expansion Circuit Board

What This Option Board Provides

The optional I/O Expansion circuit board(1) is mounted on the Control board of the drive and provides these additional I/O signals:

- Four (4) Digital Inputs
- Four (4) Digital Outputs
- Two (2) Analog Outputs

Figure 85 - I/O Expansion Board Mounting Location



I/O Expansion Board Wiring

Table 87 - Recommended Signal Wire Size

Wire Type and Size			Tightening Torque N•m (lb•in)
Flexible (mm^2)	multi-core (mm^2)	AWG	
0.14…1.5	0.14…1.5	28…16	0.4 (3.5)

A 75 x 2.5 x 0.4 mm (3.0 x 0.1 x 0.02 in.) flathead screwdriver is recommended for connecting wire to the terminal block inputs. Strip the ends of the cables to a length of 6.5 mm (0.26 in.).

IMPORTANT To improve the noise immunity it is recommended that you connect the common of the outputs (terminals 2, 4, 5 and 15 of the I/O Expansion board) with the ground (terminal 10 or 20) on the standard I/O terminal blocks on the Control board. If this is not possible, these terminals must be grounded by means of a 0.1 mf/250V capacitor.

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(1) The Analog and Digital I/O Expansion circuit board is not factory installed.

Table 88 - I/O Expansion Board Terminal Block 1 Designations

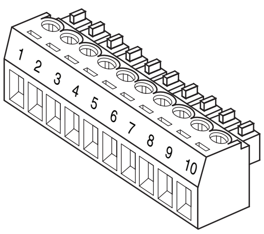
	No.	Signal	Description	Factory Default	Config. Parameter
	1	Analog Output 3 (+)	±10V, 5mA maximum	18 “Fld Current”	68 [Anlg Out3 Sel]
	2	Analog Output 3 (–)			
	3	Analog Output 4 (+)	±10V, 5mA maximum	14 “Motor Volts”	69 [Anlg Out4 Sel]
	4	Analog Output 4 (–)			
	5	Digital Output Common		–	–
	6	Digital Output 5 (+)	Max volt. +30V, max cur. 50mA	26 “Alarm”	149 [Digital Out5 Sel]
	7	Digital Output 6 (+)		–	–
	8	Digital Output 7 (+)		–	–
	9	Digital Output 8 (+)		–	–
	10	+24VDC	Drive supplied power for Digital Outputs. Max volt. +30V, max. cur. 80mA.	–	–

Table 89 - I/O Expansion Board Terminal Block 2 Designations

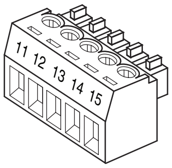
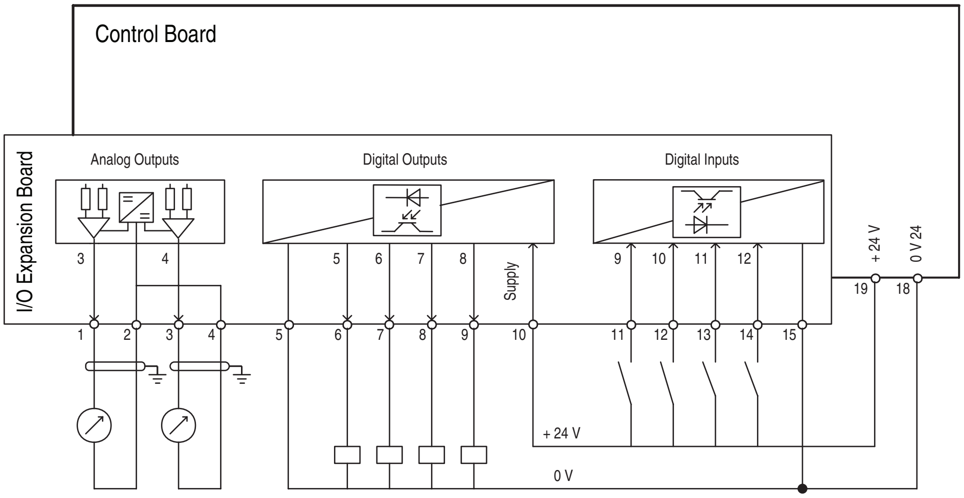
	No.	Signal	Description	Factory Default	Config. Parameter
	11	Digital Input 9	Max volt. +30V, max cur. 15V/3.2mA, 24V/5mA, and 30V/6.4mA.	–	–
	12	Digital Input 10			
	13	Digital Input 11			
	14	Digital Input 12			
	15	Digital Input Common		–	–

Figure 86 - I/O Expansion Board Wiring Diagram



Optional 115V AC to 24V DC I/O Converter Circuit Board

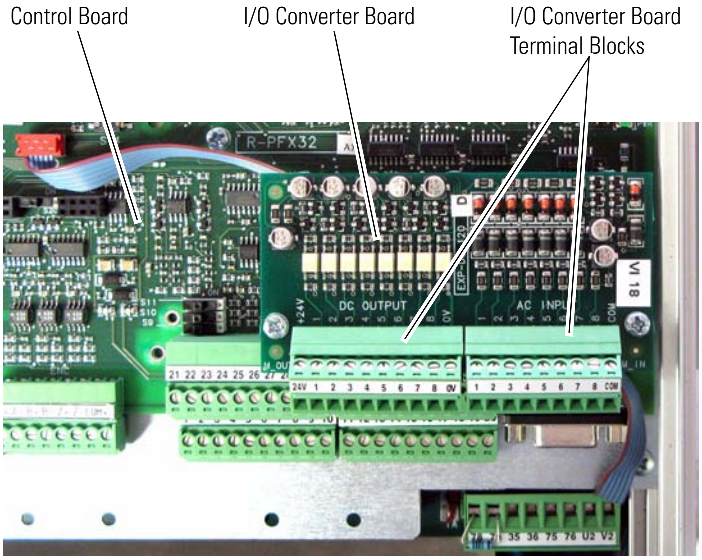
What This Option Board Provides

The 115V AC to 24V DC I/O Converter circuit board(1) allows you to convert 115V AC digital input signals to 24V DC digital input signals in order to interface with the standard digital I/O terminal blocks on the PowerFlex DC drive Control board.

The card consists of:

- Eight (8) opto isolated 115V AC digital inputs
- Eight (8) interface outputs for the digital inputs on Control board of the drive(2)
- Two (2) input terminals for the 24V DC power supply voltage

Figure 87 - 115V AC to 24V DC I/O Converter Circuit Board Mounting Location



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(1) The 115V AC to 24V DC I/O Converter circuit board is not factory installed.

(2) If more than eight 115V AC digital input signals require conversion to 24V DC (i.e., the optional PowerFlex DC drive I/O Expansion circuit board is used - see Appendix F), a second Converter board is required and must be sourced and wired independently from the 115V AC to 24V DC I/O Converter board mounted on the Control board and be mounted in an appropriate enclosure external to the PowerFlex DC drive enclosure.

I/O Converter Board Wiring

Table 90 - Recommended Signal Wire Size

Wire Type and Size			Tightening Torque N•m (lb•in)
Flexible (mm^2)	**multi-core (mm^2)**	**AWG**	
0.14…1.5	0.14…1.5	28…16	0.4 (3.5)

A 75 x 2.5 x 0.4 mm (3.0 x 0.1 x 0.02 in.) flathead screwdriver is recommended for connecting wire to the terminal block inputs. Strip the ends of the cables to a length of 6.5 mm (0.26 in.).

Table 91 - I/O Converter Board M_IN Terminal Block Designations

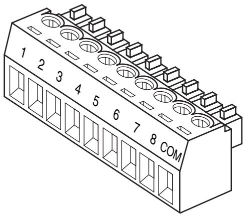
	No.	Signal	Description
	1	Digital Input 1	Rated input voltage:115V AC ±10% 50 - 60Hz. ON input voltage: 115V AC ±10% OFF input voltage: 0 - 70V AC ON input current: 4 - 5.5mA
	2	Digital Input 2	
	3	Digital Input 3	
	4	Digital Input 4	
	5	Digital Input 5	
	6	Digital Input 6	
	7	Digital Input 7	
	8	Digital Input 8	
	Com	Digital Input Common	

Table 92 - I/O Converter Board M_OUT Terminal Block Designations

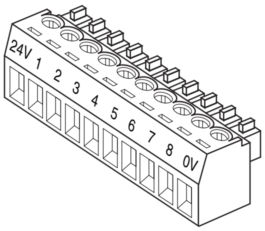
	No.	Signal	Description
	24V	+24VDC Supply	24V DC ±10%, 40mA power supply. Max. load 120mA. Supply power can be provided by the +24V DC supply on the Control board I/O (terminal 19 - see Figure 88 on page 343) or an external source (see Figure 89 on page 343).
	1	Digital Output 1	Output type: Open collector, PNP type with 15kohm pull-down Output current: 10mA max. Delay time hw OFF to ON: 5ms (typ.) Delay time hw ON to OFF: 50ms (typ.)
	2	Digital Output 2	
	3	Digital Output 3	
	4	Digital Output 4	
	5	Digital Output 5	
	6	Digital Output 6	
	7	Digital Output 7	
	8	Digital Output 8	
	0V	24V Common	Common for the power supply. • If an internal supply is used, this terminal must be wired to the digital input common (terminal 16 or 35) on the Control board I/O. See Figure 88 on page 343. • If an external supply is used, this terminal must be wired to the external 24V DC supply common and the digital input common (terminal 16 or 35) on the Control board I/O. See Figure 89 on page 343.

Figure 88 - I/O Converter Board with Internal Supply Wiring Diagram

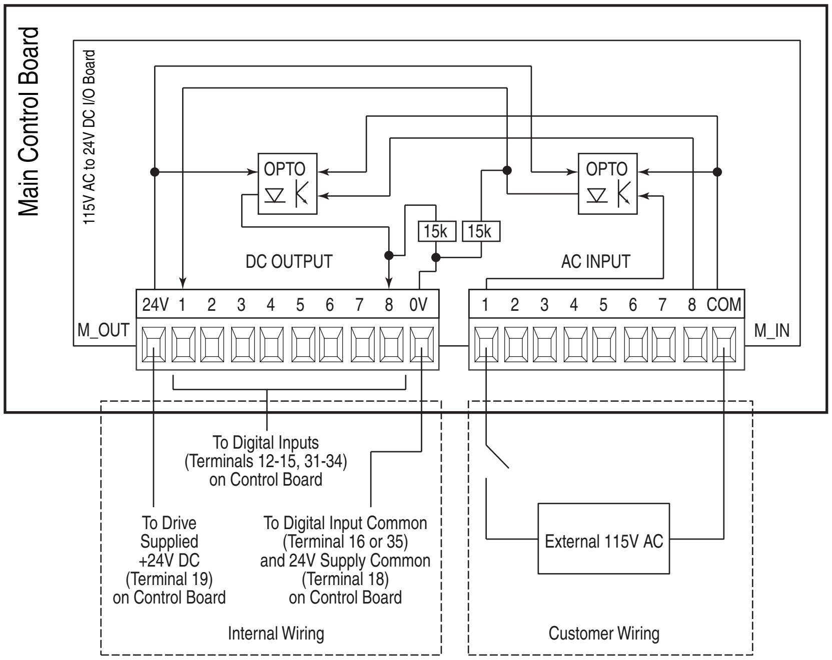
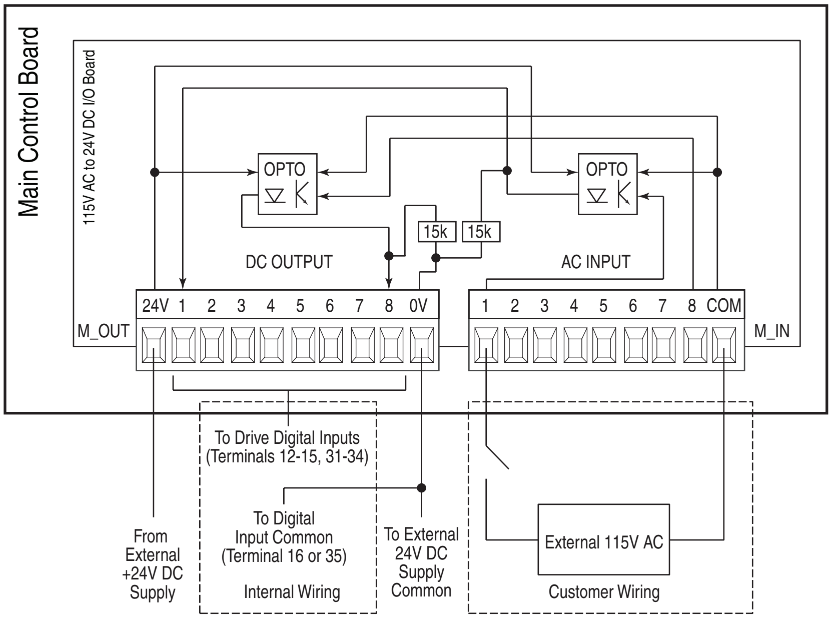


Figure 89 - I/O Converter Board with External Supply Wiring Diagram



Notes:

PowerFlex DC Stand-Alone Regulator Installation

This appendix contains configuration information specific to the PowerFlex DC Stand-Alone Regulator (SAR) installations. The configuration in this appendix must be completed in addition to the installation information contained in Chapter 1 Installation and Wiring of this User Manual.

Note: The PowerFlex DC SAR and Gate Amplifier are currently sold through Rockwell Automation Drive Systems only. Consult the factory for availability.

Installation and Wiring Notes

Complete the following for SAR installation and configuration:

1. Read and complete all I/O wiring instructions and configuration information pertaining to the SAR and Gate Amplifier contained in the Gate Amplifier User Manual, publication number 23P-UM001.
2. Read and complete all mounting, grounding, and power and control wiring instructions in Chapter 1 of this manual pertaining to the frame A PowerFlex DC drive (if they have not already been completed as part of the Gate Amplifier configuration).

IMPORTANT	Do not change (undo) any of the configurations settings made to the SAR (as instructed in the Gate Amplifier User Manual) when completing the instructions from Chapter 1 of this manual.

3. Continue with the remaining instructions for a frame A PowerFlex DC drive in Chapter 2 Drive Start Up of this manual.

Notes:

History of Changes

Changes to This Manual

This appendix briefly summarizes changes that have been made with revisions of this manual. Reference this appendix if you need information to determine what changes have been made across multiple revisions. This may be especially useful if you are deciding to upgrade your hardware or software based on information added with previous revisions of this manual.

The information below summarizes the changes to the PowerFlex Digital DC Drive User Manual, publication 20-UM001 since the June 2009 release.

Change	Page(s)
Updated the Catalog Number Explanation to reflect new drive ratings.	15
Added frame D dimensions and weights.	22
Added lifting instructions for frame D drives.	25
Added instructions for opening frame D drives.	30
Added CE Conformity information for frame D drives and updated the emissions limits table.	36
Added Control Power Protection information for frame D drives and updated information for rev. "I" and above control power circuit boards.	38
Updated the AC Input and DC Output Voltage tables for 575V and 690V drives.	40
Updated the Typical Power Wiring diagrams to include isolation transformer/line reactor requirements.	41
Updated the Armature Converter Connections section for frame D.	46
Updated the Armature Voltage Feedback Connections section for frame D drives.	49
Updated the Field Circuit Connections section for frame D drives.	52
Updated the S14 DIP switch settings for the field current configuration.	55
Updated the frame C heatsink cooling fans connection information.	64
Added frame D heatsink cooling fans connection information.	65
Updated the Armature Fuse Signal Terminals information for frame D drives.	66
Updated Table 24 to include examples of the jumper and switch settings.	69
Updated the S15 DIP Switch Configuration section to include frame D drives.	70
Updated relevant I/O Wiring Examples to include required DIP Switch settings.	75
Added illustration for frame D drive field power and I/O wire routing.	81
Updated the "Heatsink OvrTemp" (F8) fault action to include fuse location information.	199
Updated the possible causes for the "Sustained Curr" (F70) fault.	201
Updated the "Electrical" specifications.	213
Updated the Encoder Pulses Per Revolution range.	214
Added Watts Loss tables for frame D drives.	216
Updated all Drive Power Circuit Protection tables for 575 and 690V AC input and frame D drives.	219
Updated the Control Power Circuit Protection Fuses table for frame D drives and updated information for rev. "I" and above control power circuit boards.	233
Added replacement fuse table for frame D overvoltage clipping board.	237
Added AC Input Line Reactors and AC Input Contactors for frame D drives.	238
Added a table for recommended Isolation Transformers.	240
Added Dynamic Brake Resistor Kits and DC Output Contactors for frame D drives.	242

Change	Page(s)
Added the Alternate EMC Filters tables.	246
Added the Terminal Adapter Kits for frame D drives.	249
Updated the "Installing a Communication Adapter" appendix for frame D drives.	334

The information below summarizes the changes to the PowerFlex Digital DC Drive User Manual, publication 20-UM001 since the November 2008 release.

Change	Page(s)
Added information on how to find your drive frame size and firmware revision level.	12
Updated the Catalog Number Explanation to reflect drive availability.	15
Added CE Conformity information.	35
Updated the "Typical Wiring Diagrams" section to reflect the addition of the new Armature Voltage Feedback terminal block.	41
Added the Armature Voltage Feedback Connections section.	49
Updated the S14 DIP switch settings for the field current configuration.	55
Updated Table 1.L to include examples of the jumper and switch settings.	69
Updated relevant I/O Wiring Examples to include required DIP Switch settings.	75
Updated the Drive Start-Up procedures.	83
Corrected a parameter reference in the definition for parameter 121 [Spd Feedback Pct].	112
Corrected a parameter reference in the definition for parameter 924 [Actual Speed].	112
Added parameter 14 [Selected TorqRef] to the Monitor file, Current Meters group.	113
Added parameter 17 [Motor Trq Ref] to the Monitor file, Current Meters group.	113
Renamed parameter 500 from [Field Ref Pct] to [Flux Ref Pct].	114
Corrected a parameter reference in the definition for parameter 928 [Filt TorqCur Pct].	114
Updated the maximum value of Par 45 [Max Ref Speed].	116
Updated the maximum value for Par 162 [Max Feedback Spd].	116
Added parameter 376 [MtrOvrld Type] to the Motor Control file, Motor Data group.	117
Added parameter 462 [Flux Divide] to the Motor Control file, Field Config group.	118
Added parameter 463 [Flux Filter BW] to the Motor Control file, Field Config group.	118
Changed the name of parameter 926 from [Filt Torq Cur] to [Torq Cur Filter].	122
Added parameter 461 [Spd Fdbk Invert] to the Motor Control file, Speed Feedback group.	123
Changed the name of parameter 563 from [Anlg Tach Zero] to [Feedback Offset].	123
Added parameter 914 [Spd FB Filt Gain] to the Motor Control file, Speed Feedback group.	123
Added parameter 915 [Spd FB Filt BW] to the Motor Control file, Speed Feedback group.	123
Corrected a parameter reference in the definition for parameter 923 [Act Spd Filter].	123
Added parameter 1022 [Encoder Counts] to the Motor Control file, Speed Feedback group.	124
Added option values "Off" (0) and "On (1) to parameter 1027 [Spd Reg Autotune].	125
Added parameters 166 [Alpha Test], 167 [Arm Test Angle] and 168 [Fld Test Angle] to the Motor Control file, Test Generator group.	127
Added parameter 95 [Spd Reg Pos Lim] to the Speed Command file, Speed Regulator group.	130
Added parameter 96 [Spd Reg Neg Lim] to the Speed Comand file, Speed Regulator group.	130
Added parameter 238 [SpdOut FiltGain] to the Speed Comand file, Speed Regulator group.	132
Added parameter 239 [SpdOut FiltBW] to the Speed Comand file, Speed Regulator group.	132

Change	**Page(s)**
Added parameter 15 [SLAT Err Stpt] was added to the Dynamic Control file, Control Config group.	135
Added parameter 16 [SLAT Dwell Time] was added to the Dynamic Control file, Control Config group.	135
Added parameter 241 [Spd Trq Mode Sel] was added to the Dynamic Control file, Control Config group.	135
Added parameter 302 [Language] to the Utility file, Drive Memory group.	158
Added new bits (7…13) to parameter 382 [Drive Status 2].	160
Added parameter 1290 [MtrOvrld Status] to the Utility file, Diagnostics group.	162
Added parameter 479 [MtrOvrld Flt Cfg] to the Utility file, Alarms group.	166
Updated the definition for parameter 481 [UnderVolt Thresh].	166
Added parameter 585 [Overspeed Val] to the Utility file, Alarms group.	166
Renamed bit 11 and added bits 13 and 14 to parameter 1380 [Drive Alarm 1].	167
Changed option 34 to “Reserved” for Digital Input parameters.	179
Renamed Fault 91 “Encoder Loss” to “Feedback Loss”.	199
Added Fault 7 “Motor Overload”.	200
Added note that Fault 25 “Overspeed” is now configurable via Par 585 [Overspeed Val].	200
Added CE and C-Tick certifications to the drive specifications.	212
Added “Maximum rate of change of input frequency” specifications.	213
Updated the ALT Functions to reflect availability of the Language selection.	252
Added new “Alpha Test Mode” section.	259
Added new “Drive Reference and Feedback Scaling” section.	265
Updated the “Speed Feedback” section.	279
Added the “Speed/Torque Mode Selection” section.	290
Updated the Fine Tuning the Regulators section to include new “Manually Adjusting the Current Regulator Tune Settings” procedures.	298
Updated the Speed Regulator block diagram	316
Added the Torque Mode Selection block diagram.	317
Updated the Droop Compensation - Inertia / Loss Compensation block diagram.	318
Updated the Speed Feedback block diagram.	319
Updated the Field Current Regulator block diagram.	323
Updated the Fault / Alarm Mapping block diagram.	332
Added the “Factory Default” and “Config. Parameter” columns to Table F.B. and F.C.	340

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

1S4A42

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Publication 20P-UM001G-EN-P - October 2010
Supersedes Publication 20P-UM001F-EN-P - May, 2010