Allen-Bradley

1336 IMPACT™ Adjustable Frequency AC Drive (Series A)

BP300 – BP450

Troubleshooting Guide

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

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

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❑ SUGGEST / RESPONSIBLE FOR THE PURCHASE OF EQUIPMENT
❑ MAINTAIN / OPERATE PROGRAMMABLE MACHINERY
❑ DESIGN / IMPLEMENT ELECTRICAL SYSTEMS
❑ TRAIN/EDUCATE MACHINE USERS
❑ SUPERVISE FLOOR OPERATIONS

✓ **WHAT LEVEL OF EXPERIENCE DO YOU HAVE WITH EACH OF THE FOLLOWING PRODUCTS?**

	NONE	LITTLE	MODERATE	EXTENSIVE
PROGRAMMABLE CONTROL	❑	❑	❑	❑
AC / DC DRIVES	❑	❑	❑	❑
PERSONAL COMPUTERS	❑	❑	❑	❑
NC / CNC CONTROLS	❑	❑	❑	❑
DATA COMMUNICATIONS / LAN	❑	❑	❑	❑

✓ **RATE THE OVERALL QUALITY OF THIS MANUAL BY CIRCLING YOUR RESPONSE BELOW. (1) = POOR (5) = EXCELLENT**

HELPFULNESS OF INDEX / TABLE OF CONTENTS	1	2	3	4	5
CLARITY	1	2	3	4	5
EASE OF USE	1	2	3	4	5
ACCURACY AND COMPLETENESS	1	2	3	4	5
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Summary of Changes

The information below summarizes the changes to the company-wide templates since the last release.

Updated Information

No changes have been made to this manual.

Table of Contents

Preface

Control Logic Wiring and Adapters

Chapter 1

Troubshooting and Error Codes

Chapter 2

Disassembly and Access Procedures

Chapter 3

Component Test Procedures

Chapter 4

Part Replacement Procedures

Chapter 5

Preface

Manual Objective

The information in this manual is designed to help troubleshoot or repair an Allen-Bradley 1336 IMPACT Adjustable Frequency AC Drive with ratings BP250 – BP450.

Who Should Use This Manual

This manual is intended for qualified service personnel responsible for troubleshooting and repairing the 1336 IMPACT Adjustable Frequency AC Drive. You should:

- Read this entire manual before performing maintenance or repairs to drives.
- Have previous experience with, and basic understanding of, electrical terminology, procedures, required troubleshooting equipment, equipment protection procedures and methods, and safety precautions.

This manual describes equipment, troubleshooting, and disassembly procedures. You begin with general illustrations and end with greater detail concerning replacement parts and part locations on the drives. Later chapters may refer you back to earlier chapters for information on basic equipment and steps necessary to perform detailed diagnostics and part replacement.

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the +DC/–DC brake terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Potentially fatal voltages may result from improper usage of oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground.

ATTENTION: Only personnel familiar with the 1336 IMPACT Adjustable Frequency AC Drive 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.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Damage, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

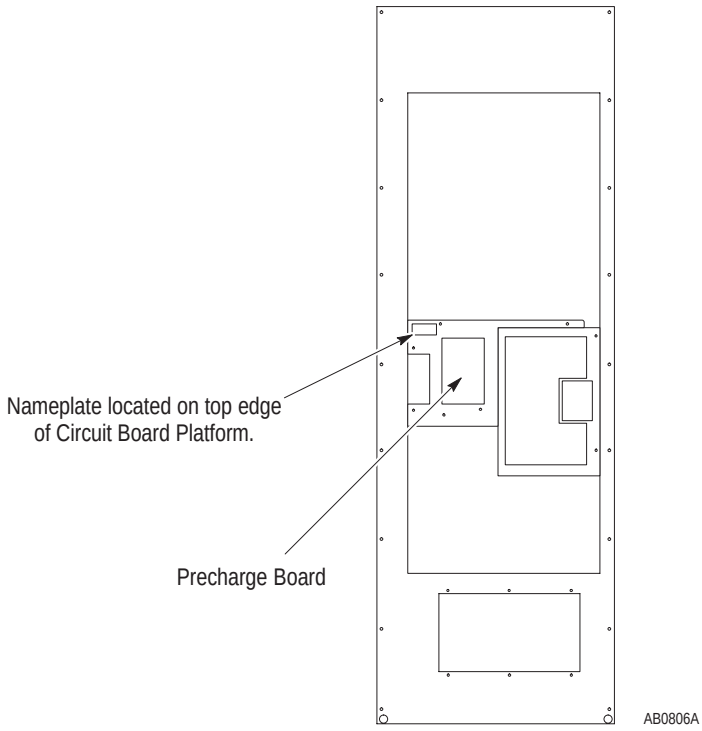
- Wear a wrist-type grounding strap that is grounded to the drive chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

1336 IMPACT Product Identification

Drive Nameplate Location

The drive nameplate is located on the face of the Circuit Board Platform. The drive nameplate contains the drive's catalog number and other important drive information. Reference the catalog number when ordering replacement parts.

Figure P.1 Drive Nameplate Location



Drive and Option Identification

The following is an explanation of the catalog numbering system for 1336 IMPACT Adjustable Frequency AC Drives and options. The catalog number is coded to identify the drive power rating and can be found on the drive shipping carton and nameplate.

1336 IMPACT Drive Catalog Numbers

Table P.A

1336E	– BP350-AN	– EN	– CM	– L6	– HA1	– GM1
Bulletin No.	Rating-Enclosure (Must Be Specified)	Language Module[3] (Must Be Specified)	Common Mode Choice (Must Be Specified)	L Option[3] (Optional)	Human Interface[3] (Optional)	Communication Card[3] (Optional)

380 – 480V AC Input

Drive Rating[1]			Enclosures			
			Open IP00 No Enclosure	NEMA Type 1 IP20 General Purpose	NEMA Type 4 IP65 Resist Water, Dust	NEMA Type 12 IP54 Industrial Use
Frame Designation	Output Amps	Nominal HP	Code	Code	Code	Code
F	406.4	300	BP300–AN	BP300–AA	[4]	BP300C–AJ
	459.2	350	BP350–AN	BP350–AA	[4]	BP350C–AJ
	481.0	400	BP400–AN	BP400–AA	[4]	BP400C–AJ
	531.7	450	BP450–AN	BP450–AA	[4]	[4]

[1] Drive rating is based on a carrier frequency of 4kHz maximum, an altitude of 1,000 meters or less, and a maximum ambient temperature of 40°C.

[2] VT Ratings do not apply to 380V Input.

[3] Refer to the Language Module and Options tables following these Catalog Number tables.

[4] Not available in this rating.

Table P.B

Language Modules

Description	Option Code
English/English	EN
English/French	FR[1]
English/German	DE[1]
English/Italian	IT[1]
English/Spanish	ES[1]

[1] Not available at time of printing.

Table P.C

Options

Code	Description
Human Interface Module, NEMA Type 1 (IP 20)	
HAB	Blank – No Functionality
HAP	Programmer Only
HA1	Programmer/Controller w/Analog Pot
HA2	Programmer/Controller w/Digital Pot
Human Interface Module, NEMA Type 4 (IP 65)	
HJP	Programmer Only
HF1	Programmer, LCD/Analog Pot
HJ2	Programmer/Controller w/Digital Pot
Human Interface Module, NEMA Type 12 (IP 54)	
HJP	Programmer Only
HJ2	Programmer/Controller with Digital Pot

Code	Description
Communication Options	
GM1	Single Point Remote I/O
GM2	RS-232/422/485, DF1 & DH485
GM3	DeviceNet
L Option Boards	
L4	Contact Closure
L7E	Contact Closure & Encoder Feedback
L5	+24V AC/DC
L8E	+24V AC/DC & Encoder Feedback
L6	115V AC
L9E	115V AC & Encoder Feedback

Table P.D 380 – 480V Drives

Catalog Number	Maximum Output Amp Rating[1]	Derate Curve [1][2]	Heat Dissipation Drive Watts[1][2][3]	Heat Sink Watts[1]	Total Watts[1]
BP300	357.0	[4]	[5]	[5]	[5]
BP350	421.0	[4]	[5]	[5]	[5]
BP400	471.0	[4]	[5]	[5]	[5]
BP450	527.0	[4]	[5]	[5]	[5]

[1] Rating is at 4kHz. If carrier frequencies above 4kHz are selected, drive rating must be derated.

[2] Drive Ambient Temperature Rating is 40°C. If ambient exceeds 40°C, the drive must be derated.

[3] Drive Rating is based on altitudes of 1,000m (3,000 ft) or less. If installed at higher altitude, drive must be derated.

[4] Refer to the 1336 IMPACT User Manual.

[5] Not available at time of printing.

Drive Rating Qualifications

Several factors can affect drive rating. If more than one factor exists, consult Rockwell Automation.

Enclosure Type

The first character, A, indicates the Enclosure Code.

The second character indicates the type of enclosure shipped from the factory:

Table P.E Enclosure Type Code Description

Enclosure Type Code	Description
N	Open style (IP 00)
A	NEMA Type 1 (IP 20)
F	NEMA Type 4 (IP 65)
J	NEMA Type 12 (IP 54)

Conventions

To help differentiate parameter names and display text from other text in this manual, the following conventions will be used:

- Parameter Names will appear in *italics*.
- Display Text will appear in “quotes”.

The following is a list of conventions used throughout this manual, and definitions of the conventions. For a list of terminology and definitions, refer to the Glossary in the back of this manual.

Auxiliary Interlock

The Auxiliary Interlock is a user-supplied circuit consisting of reset, overload, or other interlocking circuitry. The Interlock is wired to the drive Not External Fault Input.

Bit

A bit is a single character or status point used in programmable logic. Eight bits form a BYTE, 16 bits form a word. Drive parameters are actually eight bits or 16 bit words.

Check

To check means to examine either the physical condition of something or the setting of some control, such as a Parameter. Checking a drive board or component may also require measurements and tests.

Connector

A connector connects one drive board to another. Connectors come in two designs, male and female. Male connectors are stationary and contain pins, which are sometimes joined by jumpers. Female connectors are at the ends of wires or ribbon cables and plug into male connectors.

Default

When a drive function defaults, it automatically changes to a pre-programmed setting.

Enable Input

The Enable Input is a terminal connection on the L Option Board. This connection provides an external input to enable or disable the Drive Output section. It must be true to permit the drive to operate.

False

False refers to a logical false state. For instance, an L Option signal on TB3 is false when the input contact is open or the appropriate voltage is not applied to the L Option Board.

Jumper

A jumper completes a circuit between two pins within a male connector on a drive board. In the absence of certain optional equipment using female connectors, jumpers are applied to certain pins within a male connector to complete specific and necessary circuits.

L Option Board

An L Option Board plugs into connectors J7 and J9, located on the lower portion of the Main Control Board. This board is identified as L4/L7E, L5/L8E or L6/L9E and provides optional control wiring configurations for a drive.

Not External Fault Input

The Not External Fault Input is a terminal connection on the L Option Board. This connection provides an external input for use as an Auxiliary Interlock. Unless this interlock is closed, the drive will be faulted with an External Fault.

Parameter

Parameters are programmable drive functions that define various operating functions or status displays of a drive. Refer to Bulletin 1336 IMPACT Adjustable Frequency AC Drive User Manual for parameter details.

Press

Press a button on the Human Interface Module to change parameter settings and drive functions.

True

True refers to a logical true state. For instance, an L Option signal on TB3 is true when: L4/L7E contact input is closed, L5/L8E input terminal registers 24V, or L6/L9E input terminal registers 115V AC.

Related Publications

The following lists other Allen-Bradley publications that apply to the 1336 IMPACT Adjustable Frequency AC Drives:

- User Manual (1336 IMPACT-5.0)
- Option Manuals/Instructions
- Renewal Parts List[1]
- Product Data (1336 IMPACT-1.0)
- Bulletin 1201 Graphic Programming Terminal User Manual (1201-5.0)

[1] Current 1336 IMPACT spare parts information, including recommended parts, catalog numbers, and pricing, can be obtained from the following sources.
- Allen-Bradley home page on the World Wide Web at:
http://www.ab.com
Select **Drives**, and the select **Information for Drives, Including Part Lists . . .** Select documents **1060.pdf** (230V drives) and/or **1070.pdf** (460 & 575V drives).
- Standard Drives "AutoFax" service – an automated system that you can call to request a "faxed" copy of the spare parts information (or other technical documentation).
Simply call **444-646-6701** and follow the phone prompts to request document(s) **1060** (230V drives) and/or **1070** (460 & 575V drives).

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Control Logic Wiring and Adapters

Chapter Objectives

This chapter introduces you to terminal block locations and wiring and to adapter locations and functions.

Chapter Overview

This chapter illustrates and describes:

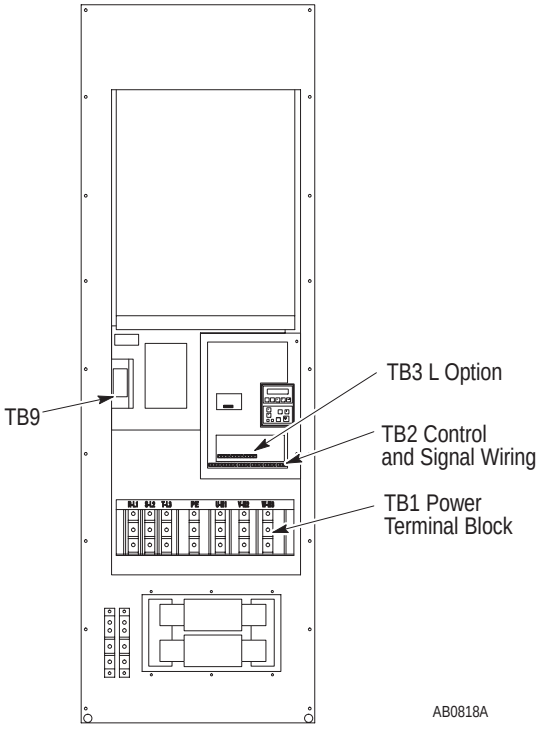
- L Options L4, L5, L6, L7E, L8E, and L9E including Terminal Block TB3
- TB3 L Option mode selections and functions
- TB3 terminal designations

Important: All printed circuit boards, except the Main Control Board assembly, are referenced to negative ground (–bus).

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the +DC/–DC brake terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Figure 1.1 Terminal Block Locations



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

L Option Board

The L Option Board provides a means of interfacing various signals and commands to the 1336 IMPACT drive by using contact closures.

Six different versions of the L Option are available:

L4	Contact Closure Interface[1]
L7E	Contact Closure Interface with Encoder Feedback[1]
L5	+24V AC/DC Interface
L8E	+24V AC/DC Interface with Encoder Feedback
L6	115V AC Interface
L9E	115V AC Interface with Encoder Feedback

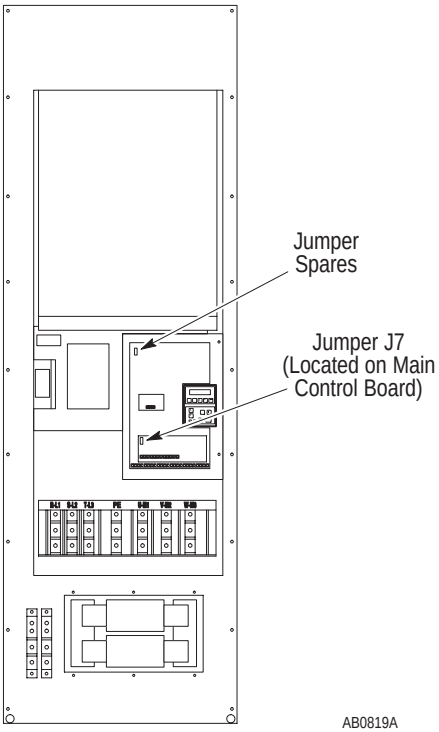
[1] Uses internal +5V DC supply.

The user inputs are connected to the L Option Board through TB3. The L4, L5 and L6 options each have nine inputs: seven user-configurable inputs and two factory-defined control inputs. The function of each input must be selected through programming as explained later in this section. The L7E, L8E, and L9E options are similar to L4, L5 and L6 with the addition of encoder feedback inputs.

L Option Board Jumpers

Important: If the L Option Board is being installed, Main Control Board jumpers at pins 3 & 4 and 17 & 18 of J2 (J7 on 7.5 – 30 HP drives) must be removed. If removed, these jumpers can be stored on the "spares" location on the Main Control Board. If this board is removed, these jumpers must be reinstalled and the *L Option Mode* parameter must be programmed to "1".

Figure 1.2 Jumper Locations



Available Inputs

The L Option allows the combination of the following functions:

Accel/Decl Rates (2)	Process Trim
Digital Potentiometer (MOP)	Ramp
Enable	Reset
Flux Enable	Run Forward
Forward/Reverse	Run Reverse
Jog	Speed Selects
Local Control	Speed/Torque Selections
Not Ext Flt	Start
Not Stop/Clear Fault	Stop Mode Selects

The available combinations are shown in Figure 1.3. Programming the *L Option Mode* parameter to one of the L Option Mode numbers listed selects that combination of input functions.

Important: The *L Option Mode* parameter can be changed at any time, however, programming changes will not take affect until power has been cycled to the drive. When changing an input mode, it is important to note that the corresponding inputs to TB3 may also change.

The programming options of the L Option Board allow the user to select an input combination to meet the needs of a specific installation. Appropriate selection of a combination may be done by using Table 1.A. First determine the type of start/stop/direction control desired. Then select the remaining control functions available. After selecting a group of L Option Modes use Figure 1.3 for specific mode selection. Record the selected mode number below.

Selected Mode Number:_____

Local Programming

For local programming and control information, refer to the 1336 IMPACT User Manual.

Table 1.A L Option Mode Selection

Start/Stop Type	Direction Control	Communication Compatibility	Mode(s) to Use
Stop & Enable Only	None	Control must be provided by HIM or Communication Option.	1
Momentary Pushbutton (3 Wire)	Maintained Switch (Open-Forward, Closed-Reverse)	Start/Stop – works in parallel with HIM and Communication Options. Direction Control will not work in parallel with HIM or Communication Options. User must select direction control from either HIM and Communication Options or TB3 input.	2 – 6, 17, 18, and 27[2]
Momentary Pushbutton (3 Wire)	Momentary Pushbuttons (Forward and Reverse)	Start/Stop – works in parallel with HIM and Communication Options. Direction – works in parallel with HIM or Communication Options.	7 – 11 19 – 22, 28, and 29[2]
Maintained switches for combined run and direction control (2 wire, Run Forward, Run Reverse)		Start/Stop – not compatible with HIM or Communication Options.[1] Direction – not compatible with HIM or Communication Options.[1]	12 – 16, 23 – 25, and 30[2]

[1] Refer to two-, three-wire notes in the user manual.

[2] Diodes 27 – 30 are available with versions 2.02 and later.

Figure 1.3 provides terminal designations for TB3. The maximum and minimum wire sizes accepted by TB3 are 2.1 and 0.30 mm^2 (14 and 22 AWG). Maximum torque for all terminals is 1.36 N-m (12 lb-in.). Use Copper wire only.

Figure 1.3 TB3 Terminal Designations

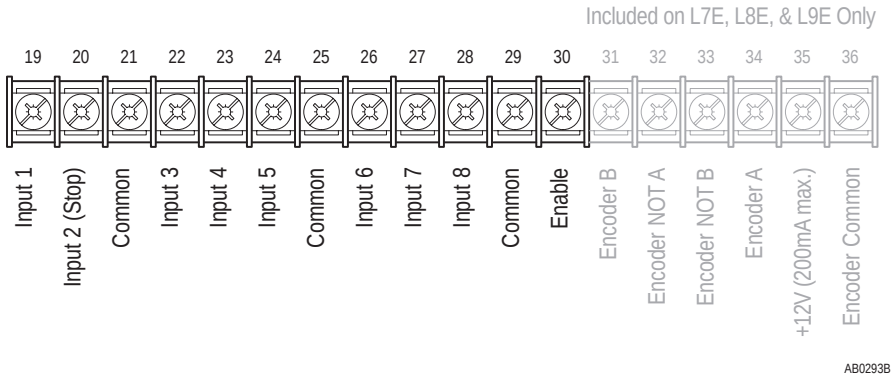
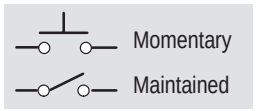
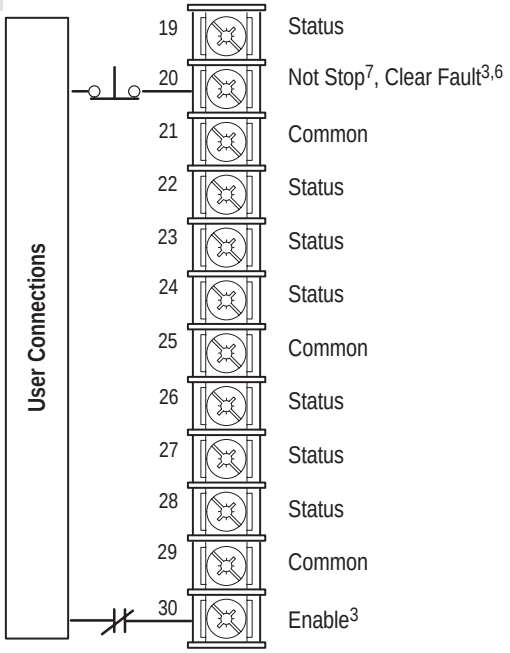


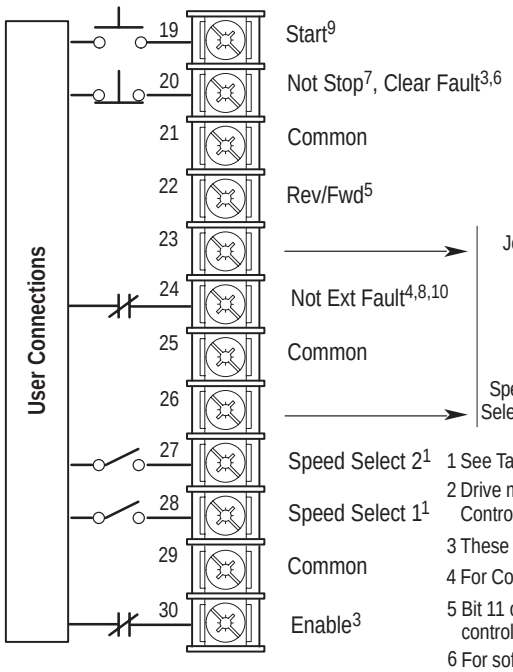
Figure 1.4 L Option Mode Selection and Typical TB3 Connections



L Option Mode **(parameter 116) = 1**
Factory Default



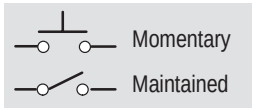
L Option Mode **(parameter 116) = 2 - 6, 17, 18, and 27**
Single-Source, Three-Wire Control



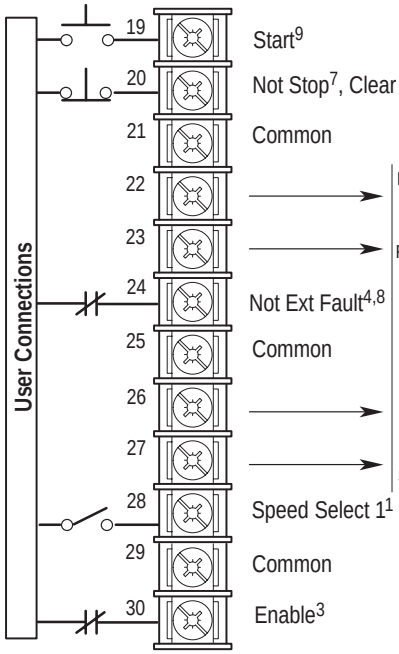
Mode	2	3	4	5[11]	6	17	18	27[11, 12]
Row 23	Jog	Stop Type[7]	2nd/1st Accel	Digital Pot Up	Jog	Proc Trim	Flux En	Digital Pot Up
Row 26	Speed Select 3[1]	Speed Select 3[1]	2nd/1st Decel	Digital Pot Dn	Local Control[2]	Ramp	Reset	Digital Pot Dn

AB0290B

1 See Table 1.B.
2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).
3 These inputs must be present before drive will start.
4 For Common Bus, this becomes Precharge Enable.
5 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.
6 For soft faults only. You need to recycle power to the drive or reset to clear. For hard faults, refer to the troubleshooting chapter.
7 To configure the stop type, refer to *Logic Options* (parameter 17).
8 This input must be present before the fault can be cleared and the drive will start. This can be disabled through *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
9 Latched starts require a stop to stop the drive.
10 This input must be present or masked out before drive will start.
11 In mode 5, the MOP value is not reset to 0 when you stop. In mode 27, the MOP value is reset when you stop.
12 Available in versions 2.02 and later.

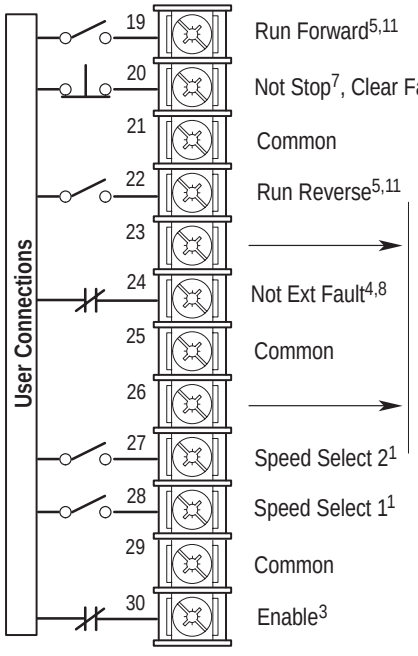


L Option Mode (parameter 116) = 7 – 11, 19 – 22, 28, and 29
Multi–Source, Three–Wire Control



Mode	7	8	9[12]	10[12]	11	19	20	21	22	28[12,13]	29[12,13]
	Reverse[5]	Reverse[5]	Digital Pot Up	Reverse[5]	1st Accel	Speed/ Torque 3[10]	Speed/ Torque 3[10]	Reverse[5]	Speed/ Torque 3[10]	Digital Pot Up	Reverse[5]
	Forward[5]	Forward[5]	Digital Pot Dn	Forward[5]	2nd Accel	Speed/ Torque 2[10]	Speed/ Torque 2[10]	Forward[5]	Speed/ Torque 2[10]	Digital Pot Dn	Forward[5]
	Jog	Speed Select 3[1]	Speed Select 3[1]	Digital Pot Dn	1st Decel	Speed/ Torque 1[10]	Speed/ Torque 1[10]	Ramp	Speed/ Torque 1[10]	Speed Select 3[1]	Digital Pot Up
	Speed Select 2[1]	Speed Select 2[1]	Speed Select 2[1]	Digital Pot Dn	2nd Decel	Process Trim	Flux Enable	Reset	Speed Select 2[1]	Speed Select 2[1]	Digital Pot Dn

L Option Mode (parameter 116) = 12 – 16, 23 – 26, and 30
Single–Source, Two–Wire Control



Mode	12	13	14	15[12]	16	23	24	25	26	30[12,13]
	Local Control[2]	Stop Type[7]	2nd/1st Accel	Digital Pot Up	Local Control[2]	Process Trim	Flux Enable	Process Trim	Jog	Digital Pot Up
	Speed Select 3[1]	Speed Select 3[1]	2nd/1st Decel	Digital Pot Dn	Stop Type	Reset	Reset	Ramp	Speed Select 3	Digital Pot Dn

1 See Table 1.B.
2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).
3 These inputs must be present before drive will start.
4 For Common Bus, this becomes Precharge Enable.
5 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.
6 For soft faults only. You need to recycle power to the drive to clear. For hard faults, refer to the troubleshooting chapter.
7 To configure the stop type, refer to *Logic Options* (parameter 17).
8 This input must be present before the fault can be cleared and the drive will start. This can be disabled through *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
9 Latched starts require a stop to stop the drive.
10 See Speed/Torque Select table.
11 Unlatched start.
12 In modes 9, 10, and 15, the MOP value is not reset to 0 when you stop. In modes 28, 29, and 30, the MOP value is reset when you stop.
13 Available in versions 2.02 and later.

AB0291B

Table 1.B defines the input state of the Speed Select inputs for a desired speed reference source.

Table 1.B Speed Select/Speed Reference

Speed Select 3	Speed Select 2	Speed Select 1	Frequency Source
O	O	O	Speed Ref 1
O	O	X	Speed Ref 2
O	X	O	Speed Ref 3
O	X	X	Speed Ref 4
X	O	O	Speed Ref 5
X	O	X	Speed Ref 6
X	X	O	Speed Ref 7
X	X	X	Last State

O = Open = Removed = 0

X = Closed = Applied = 1

Table 1.C defines the input state of the Speed/torque mode select inputs for a desired Speed/torque mode.

Table 1.C
Speed/Torque Select

Speed/Torque Mode Select 3	Speed/Torque Mode Select 2	Speed/Torque Mode Select 1	Speed/Torque Mode
O	O	O	Zero Torque
O	O	X	Speed Regulate
O	X	O	Torque Regulate
O	X	X	Minimum Torque/Speed
X	O	O	Maximum Torque/Speed
X	O	X	Sum of the Torque and Speed
X	X	O	Zero Torque
X	X	X	Zero Torque

O = Open = Removed = 0

X = Closed = Applied = 1

Human Interface Module (HIM)

Description

When the drive mounted HIM is supplied, it will be connected as SCANport Adapter 1 (refer to Figure 1.6) and will be visible from the front of the drive. The HIM can be divided into two sections; Display Panel and Control Panel. The Display Panel provides a means of programming the drive and viewing the various operating parameters. The Control Panel allows different drive functions to be controlled. Refer to the 1336 IMPACT User Manual for HIM operation.

Important: The operation of HIM functions depends upon drive parameter settings. Default parameter values allow full HIM functionality.

Figure 1.5 Adapter Locations

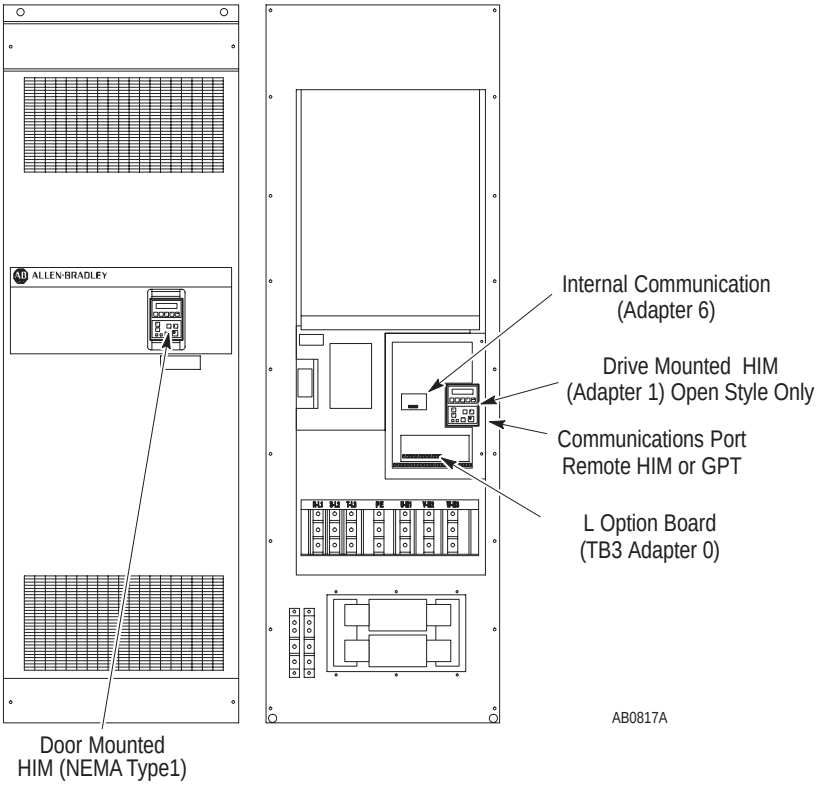
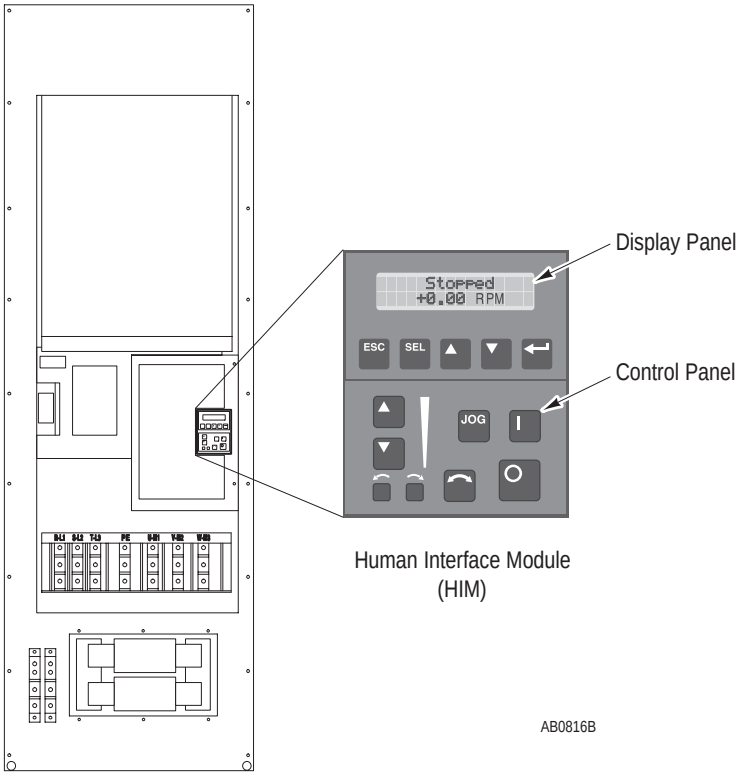


Figure 1.6 Human Interface Module



Removing the HIM

For handheld operation, you can remove the module and place it up to 10 meters (33 feet) from the 1336 IMPACT drive. (You do need a cable to do this).

ATTENTION: Some voltages present behind the drive front cover are at incoming line potential. To avoid an electrical shock hazard, use extreme caution when removing/replacing the HIM.

Important: Removing a HIM (or other SCANport device) from a drive while power is applied causes a Serial Fault, unless *SP Enable Mask* (parameter 124) or *Fault Select 1* (parameter 20) have been set to disable this fault or *Control Logic* (from the *Control Status* menu) has been disabled (only available on a Series A, version 3.0 or Series B HIM). Setting bit 1 of *SP Enable Mask* to 0 disables Serial Fault from a HIM on port 1. It also disables all HIM control functions except Stop. Setting bit 9 of *Fault Select 1* to 0 disables the serial fault from the HIM on port 1 but still allows HIM control.

ATTENTION: Hazard of personal injury or equipment damage exist. If you initiate a command to start motor rotation (command a start or jog) and then disconnect the programming device, the drive will not fault if you have the SCANport communications fault set to be ignored for that port.

To remove the HIM, you need to:

1. Either remove the power or clear the port bit, which corresponds to the port the HIM is attached to, in *SP Enable Mask* (parameter 124) or *Fault Select 1* (parameter 20) to prevent the drive from faulting.
2. Remove the front cover of the drive.
3. Push the release at the bottom of the HIM cradle and slide the module down out of its cradle.

To use the module from anywhere up to 10 meters (33 feet) from your drive, you need to:

1. Connect the appropriate cable between the HIM and the communications port (adapter 2, 3, 4, or 5) or adapter 1 (the HIM cradle).
2. Set *SP Enable Mask* (parameter 124) and/or *Fault Select 1* (parameter 20) to enable the port into which you plugged the HIM.

To replace the module, follow these steps;

1. Slide the module up into its cradle.
2. Replace the front cover of the drive.
3. Apply power, set *SP Enable Mask* or set *Fault Select 1*.

HIM Operation

When power is first applied to the drive, the HIM will cycle through a series of displays. These displays will show drive ID and communication status. Upon completion, the Status Display (refer to Figure 1.7) will be shown. This display shows the current status of the drive (i.e., Stopped, Running, etc.) or any faults that may be present (Not Enabled, etc.).

Refer to the 1336 IMPACT User Manual for HIM operation.

Figure 1.7 Status Display

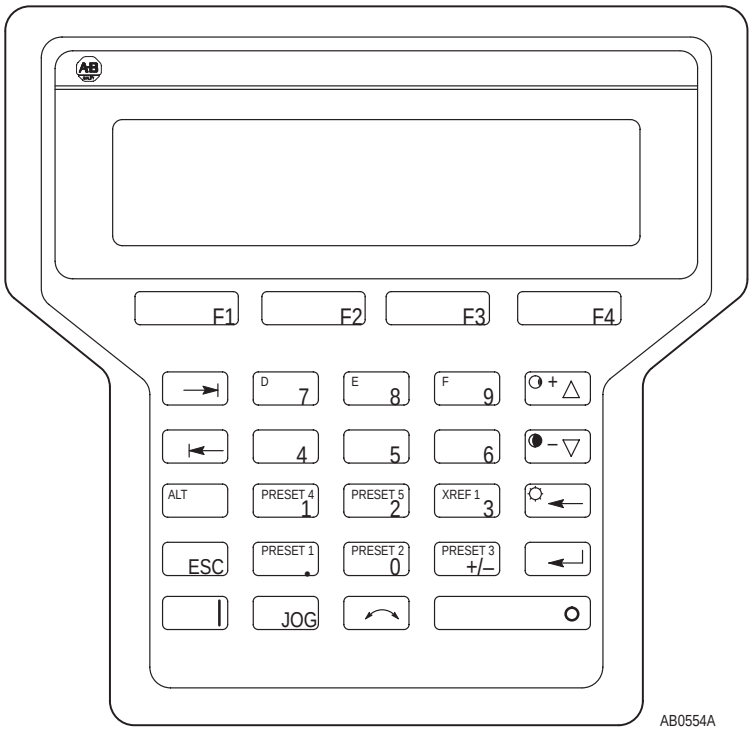
Graphic Programming Terminal

GPT Description

The optional GPT (Figure 1.8) is a remote device with a 1.8 meter (6 foot) long cable. The GPT offers a 40-by-8 character display that can also be used as a graphics display. For GPT operation, refer to the 1201 GPT User Manual.

Important: Main Menu screens are dynamic and will change based on functionality provided by adapter and drive status.

Figure 1.8
Graphic Programming Terminal



DriveTools

DriveTools software is a Windows 3.1 compatible family of application programs allowing the user to perform programming, monitoring, and diagnostic operations on Rockwell Automation AC and DC digital drive products. The software consists of five Windows applications. For operation, refer to the Product Data DriveTools Software manual.

Control Firmware Function

All control functions in the 1336 IMPACT are performed through the use of parameters that can be changed with a programming terminal or DriveTools. Refer to an overview Block Diagram of the Control Firmware Function in the 1336 IMPACT Field Oriented Control User Manual.

Feedback information is derived from hardware devices as part of the process equipment used. Analog signals are converted to digital signals for use by the drive. Control signals are provided to the drive by the Main Control Board.

All setup and operation information used by the drive is stored in a system parameter table. Every parameter, including Setup and Configuration parameters (Sources and Destinations), has an entry in the parameter table. For example, parameter 29 is named the *Speed Ref. 1* parameter and contains a number value representing the speed reference. The speed reference can originate from an external control device such as a potentiometer connected to the analog input of the Main Control board. Refer to the 1336 IMPACT User Manual, Publication 1336 IMPACT-5.0.

Troubleshooting and Error Codes

Chapter Objectives

This chapter provides information to help troubleshoot your 1336 IMPACT drive.

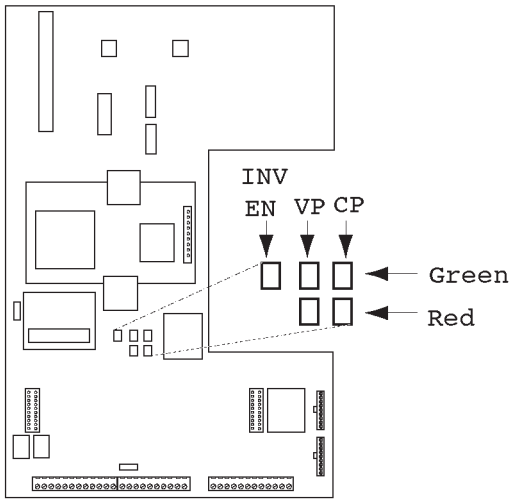
ATTENTION: Do not troubleshoot or maintain the 1336 IMPACT drive unless you are familiar with your drive system and the associated machinery. You may be injured and/or the equipment may be damaged if you do not comply.

During the start-up procedure, you should have recorded board jumper settings for each board, board software version numbers, and the drive and motor nameplate data in Table 6.A of the *1336 IMPACT™ Adjustable Frequency AC Drive User Manual*. If this information was not recorded, record it before beginning any troubleshooting sequences.

Fault/Warning Handling

When a problem occurs with your drive, check the VP and CP lights on your drive on the main control board. Figure 2.1 shows the location of the VP and CP lights.

Figure 2.1
VP and CP LED Locations



Frames B – H

The lights on the motor control board indicate the status of the velocity processor (VP) and current processor (CP):

Table 2.A

If the VP or CP LED is:	Then, for that processor:
Solid green	No fault occurred.
Flashing green	A drive warning occurred.
Flashing red	A drive soft fault occurred.
Solid red	A drive hard fault occurred.

Faults fall into three basic categories:

Table 2.B

This type of fault:	Has the following definition:	To remove this fault, you need to:
Hard	Trips the drive causing it to stop. You cannot regain control until you reset the drive.	Perform a *Drive Reset* command or cycle drive power.
Soft	Trips the drive causing it to stop.	1 Address the condition that caused the fault. 2 Perform a *Clear Faults* command.
Warning	Indicates an undesirable condition. The drive will not stop, but the condition may lead to a fault that will stop the drive.	Address the condition that caused the warning.

Faults are annunciated on the Human Interface Module (HIM) at the time they occur. Warnings are not annunciated on the HIM.

To help troubleshoot your 1336 IMPACT drive, the drive logs any faults or warnings in either the fault or warning queue. The faults and warnings that are contained in the queues are either configurable or non-configurable.

Table 2.C

This fault type:	Refers to faults that you:
Configurable	Can set up to either trip the drive or provide only a visual warning while the drive continues to operate.
Non-configurable	Cannot disable. These faults are the result of a condition that could damage the drive if allowed to persist.

You can reset the soft faults by pressing the stop button on the HIM.

Viewing the Fault and Warning Queues on the HIM

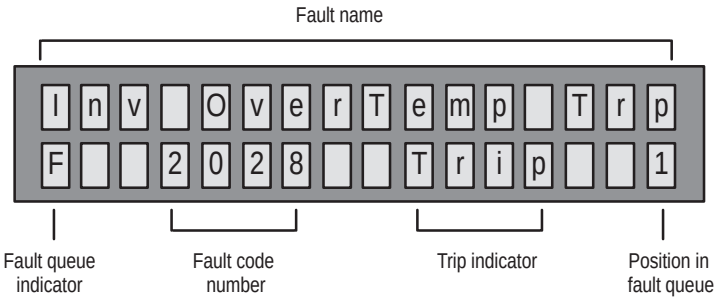
You can use the HIM to view the fault and warning queues. To view the fault queue, you need to:

1. Press the *Escape* key until you reach the *Choose Mode* level.
2. Use the *Increment* or *Decrement* key to scroll through the *Choose Mode* options until *Control Status* is displayed.
3. Press the *Enter* key.

4. Use the *Increment* or *Decrement* key to scroll through the *Control Status* options until *Fault Queue* is displayed.
5. Press the *Enter* key.
6. Press the *Enter* key when *View Queue* is displayed.

The fault queue can contain up to 32 faults. The 1336 IMPACT drive reports the faults using the following format:

Figure 2.2

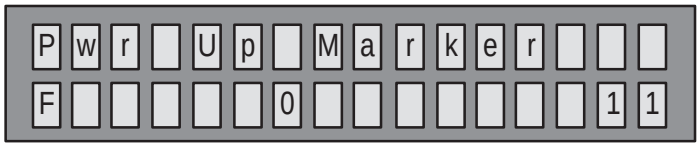


The trip indicator is only present if this fault caused the drive to trip.

The last number (1) indicates the position of this fault within the fault queue.

A marker is placed in the queue when the first fault occurs after a power up sequence. This power up marker is as shown.

Figure 2.3



The 1336 IMPACT drive tracks the time that has elapsed since power up. The drive uses this information as a time stamp so that you can tell when a fault occurred in relation to when the drive was powered up.

To clear the fault queue, select *Clear Queue* from the *Fault Queue* options.

To view the warning queue, select *Warning Queue* from the *Control Status* options. The remaining steps are the same as for the fault queue.

What Are the Fault Descriptions

When a fault occurs, the fault is displayed until you initiate a *Drive Reset* or a *Clear Faults* command. A *Drive Reset* clears all faults, while a *Clear Faults* command only clears soft and warning faults. You can perform a *Drive Reset* and *Clear Faults* either through bits in *Logic Input Sts* (parameter 14) or with a terminal.

The fault codes are defined as shown in Table 2.D.

Table 2.D
Fault Descriptions

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
01027 *Autotune Diag*	VP, Flashing red	Soft	The drive encountered a problem while running the autotune tests. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check *Autotune Errors* (parameter 176). For additional information about *Autotune Errors*, refer to Chapter 13, *Understanding the Autotuning Procedure*, in the user manual.
01051 *MtrOvrld Pnd*	VP, Flashing red	Soft	A motor overload is pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01052).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42 – 45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 2* (parameter 22) to 0.
01052 *MtrOvrld Trp*	VP, Flashing red	Soft	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42 – 45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 2* (parameter 22) to 0.
01053 *Mtr Stall*	VP, Flashing red	Soft	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 2* (parameter 22) to 0.
01083 *MtrOvrld Pend*	VP, Flashing green	Warning	Motor overload pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01084).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42 – 45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 2* (parameter 23) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
01084 *MtrOvrld Trp*	VP, Flashing green	Warning	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42 – 45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 2* (parameter 23) to 0.
01085 *Mtr Stall*	VP, Flashing green	Warning	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 2* (parameter 23) to 0.
02028 *Inv Overtemp Trp*	VP, Flashing red	Soft	Inverter overtemperature trip. There is excessive temperature at the heatsink. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10).
02049 *Inv Overtemp Pnd*	VP, Flashing red	Soft	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 2* (parameter 22) to 0.
02061 *InvOvld Pend*	VP, Flashing red	Soft	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 2* (parameter 22) to 0.
02063 *Inv Overload*	VP, Flashing red	Soft	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 2* (parameter 22) to 0.
02081 *Inv Overtemp Pnd*	VP, Flashing green	Warning	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 2* (parameter 23) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
02093 *InvOvld Pend*	VP, Flashing green	Warning	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 2* (parameter 23) to 0.
02095 *Inv Overload*	VP, Flashing green	Warning	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 2* (parameter 23) to 0.
03008 *HW Malfunction*	VP, Red 1 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03009 *HW Malfunction*	VP, Red 2 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03010 *HW Malfunction*	VP, Red 3 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03011 *HW Malfunction*	VP, Red 4 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03012 *HW Malfunction*	VP, Red 5 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03014 *EE Checksum*	VP, Flashing red	Soft	The parameter database is corrupt.	Initialize parameters or: • Perform a Recall Values operation. • Perform a Save Values operation. • Verify the parameters. • Reset the drive. If the fault still occurs, replace the main control board.
03015 *HW Malfunction*	VP, Flashing red	Soft	A hardware malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03022 *Diff Drv Type*	VP, Flashing red	Soft	The main control board has been initialized on a different size drive.	Issue a *Reset Defaults* command to set the drive parameters back to the default values.
03023 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board. If the fault still occurs, replace the gate driver board.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
03024 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03025 *Absolute Overspd*	VP, Flashing red	Soft	The motor speed has exceeded the speed limit plus *Absolute Overspd* (parameter 24) settings. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	If operating in torque mode, check if the load is allowing excessive motor speed. Check if the setting of *Absolute Overspd* (parameter 24) or the speed limits (parameters 40 and 41) are too low.
03026 *Analog Spply Tol*	VP, Flashing red	Soft	The analog supply tolerance voltage is outside of the 13V to 18V range. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Possible faulty analog 15V power supply. The gate driver board or the main control board may require replacement.
03029 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03030 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03031 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03040 *mA Input*	VP, Flashing red	Soft	A loss of 4 – 20mA input has occurred.	Check your wiring and connections. If the fault does not clear, replace the main control board. If you do not want this condition to be reported as a fault, change bit 8 in *Fault Select 1* (parameter 20) to 0.
03057 *Param Limit*	VP, Flashing red	Soft	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 2* (parameter 22) to 0.
03058 *Math Limit*	VP, Flashing red	Soft	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 2* (parameter 22) to 0.
03072 *mA Input*	VP, Flashing green	Warning	A loss of 4 – 20mA input has occurred.	Check your wiring and connections. If you do not want this condition to be reported as a warning, change bit 8 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
03089 *Param Limit*	VP, Flashing green	Warning	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 2* (parameter 23) to 0.
03090 *Math Limit*	VP, Flashing green	Warning	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 2* (parameter 23) to 0.
05048 *Spd Fdbk Loss*	VP, Flashing red	Soft	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 2* (parameter 22) to 0.
05054 *External Flt In*	VP, Flashing red	Soft	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a fault, change bit 6 in *Fault Select 2* (parameter 22) to 0.
05080 *Spd Fdbk Loss*	VP, Flashing green	Warning	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 2* (parameter 23) to 0.
05086 *External Flt In*	VP, Flashing green	Warning	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a warning, change bit 6 in *Warning Select 2* (parameter 23) to 0.
06041 *SP 1 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06042 *SP 2 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 1* (parameter 20) to 0.
06043 *SP 3 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 11 in *Fault Select 1* (parameter 20) to 0.
06044 *SP 4 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 12 in *Fault Select 1* (parameter 20) to 0.
06045 *SP 5 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 1* (parameter 20) to 0.
06046 *SP 6 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 14 in *Fault Select 1* (parameter 20) to 0.
06047 *SP Error*	VP, Flashing red	Soft	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check the amount of noise on the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06073 *SP 1 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 1* (parameter 21) to 0.
06074 *SP 2 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 1* (parameter 21) to 0.
06075 *SP 3 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 11 in *Warning Select 1* (parameter 21) to 0.
06076 *SP 4 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 12 in *Warning Select 1* (parameter 21) to 0.
06077 *SP 5 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 1* (parameter 21) to 0.
06078 *SP 6 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 14 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06079 *SP Error*	VP, Flashing green	Warning	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check the amount of noise on the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 1* (parameter 21) to 0.
12016 *Overvoltage*	CP, Solid red	Soft	The DC bus voltage has exceeded the maximum value. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Monitor the AC line for high line voltage or transient conditions. Increase the deceleration time or install the dynamic brake option because motor regeneration can also cause bus overvoltages. Refer to the user manual for a description of *Bus Options* (parameter 13) for additional information about bus overvoltages. If you are using flux braking, refer to Chapter 9, *Applications*, in the user manual for information about flux braking.
12017 *Desaturation*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for a shorted motor or motor wiring. Replace the drive.
12018 *Ground Fault*	CP, Solid red	Soft	A current path to earth ground in excess of drive rated current has been detected at one or more of the drive output terminals. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check the motor and external wiring to the drive output terminals for a grounded condition. Replace the drive.
12019 *Overcurrent*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for shorted motor or motor wiring. Replace drive.
12032 *RidethruTime*	CP, Flashing red	Soft	There was a bus voltage drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 1* (parameter 20) to 0.
12033 *Prechrg Time*	CP, Flashing red	Soft	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
12034 *Bus Drop*	CP, Flashing red	Soft	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 2 in *Fault Select 1* (parameter 20) to 0.
12035 *Bus Undervlt*	CP, Flashing red	Soft	The DC bus voltage fell below the trip value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 1* (parameter 20) to 0 or decrease the bus undervoltage setpoint.
12036 *Bus Cycle>5*	CP, Flashing red	Soft	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 1* (parameter 20) to 0.
12037 *Open Circuit*	CP, Flashing red	Soft	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 1* (parameter 20) to 0.
12064 *RidethruTime*	CP, Solid green	Warning	There was a drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 1* (parameter 21) to 0.
12065 *Prechrg Time*	CP, Solid green	Warning	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
12066 *Bus Drop*	CP, Solid green	Warning	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 2 in *Warning Select 1* (parameter 21) to 0.
12067 *Bus Undervlt*	CP, Solid green	Warning	The DC bus voltage fell below the minimum value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 1* (parameter 21) to 0.
12068 *Bus Cycle>5*	CP, Solid green	Warning	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 1* (parameter 21) to 0.
12069 *Open Circuit*	CP, Solid green	Warning	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 1* (parameter 21) to 0.
13000 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13001 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13002 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13003 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13004 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.

Diagnostic Procedures by Symptom

The following charts list drive symptoms, symptom descriptions, and recommended actions.

Figure 2.4
Drive Will Not Start or Jog

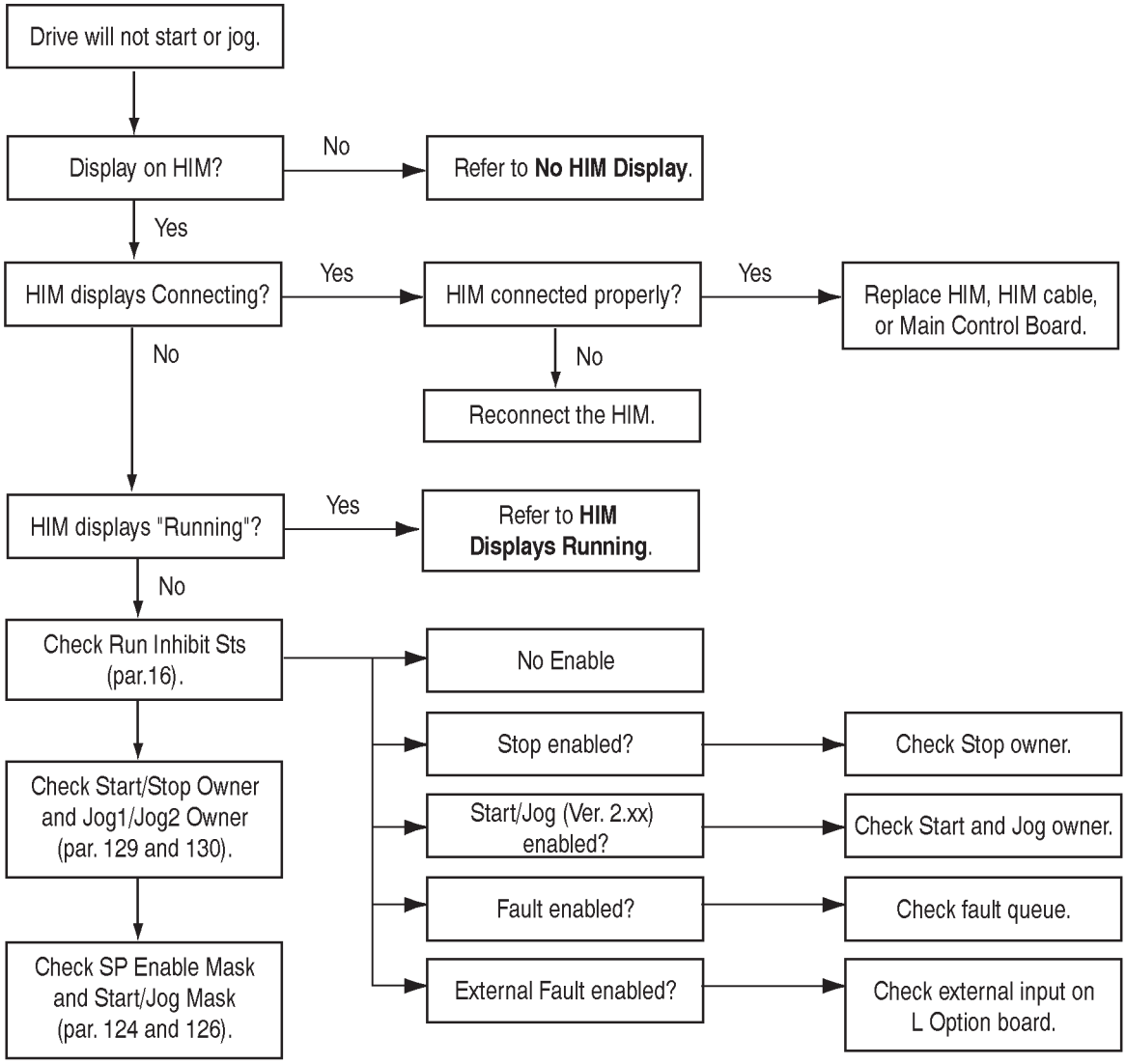


Figure 2.5
No HIM Display

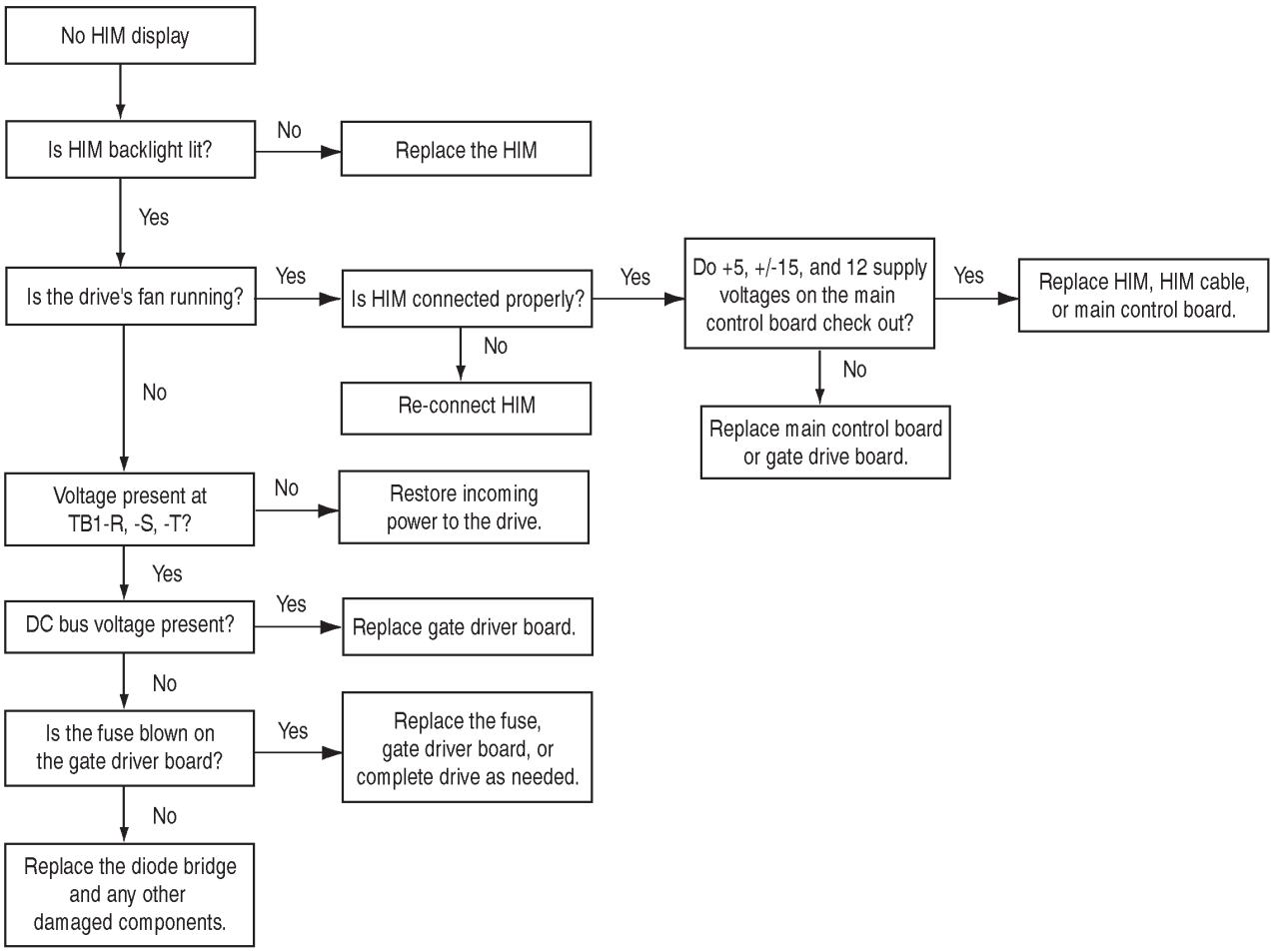


Figure 2.6
HIM Displays “Running”

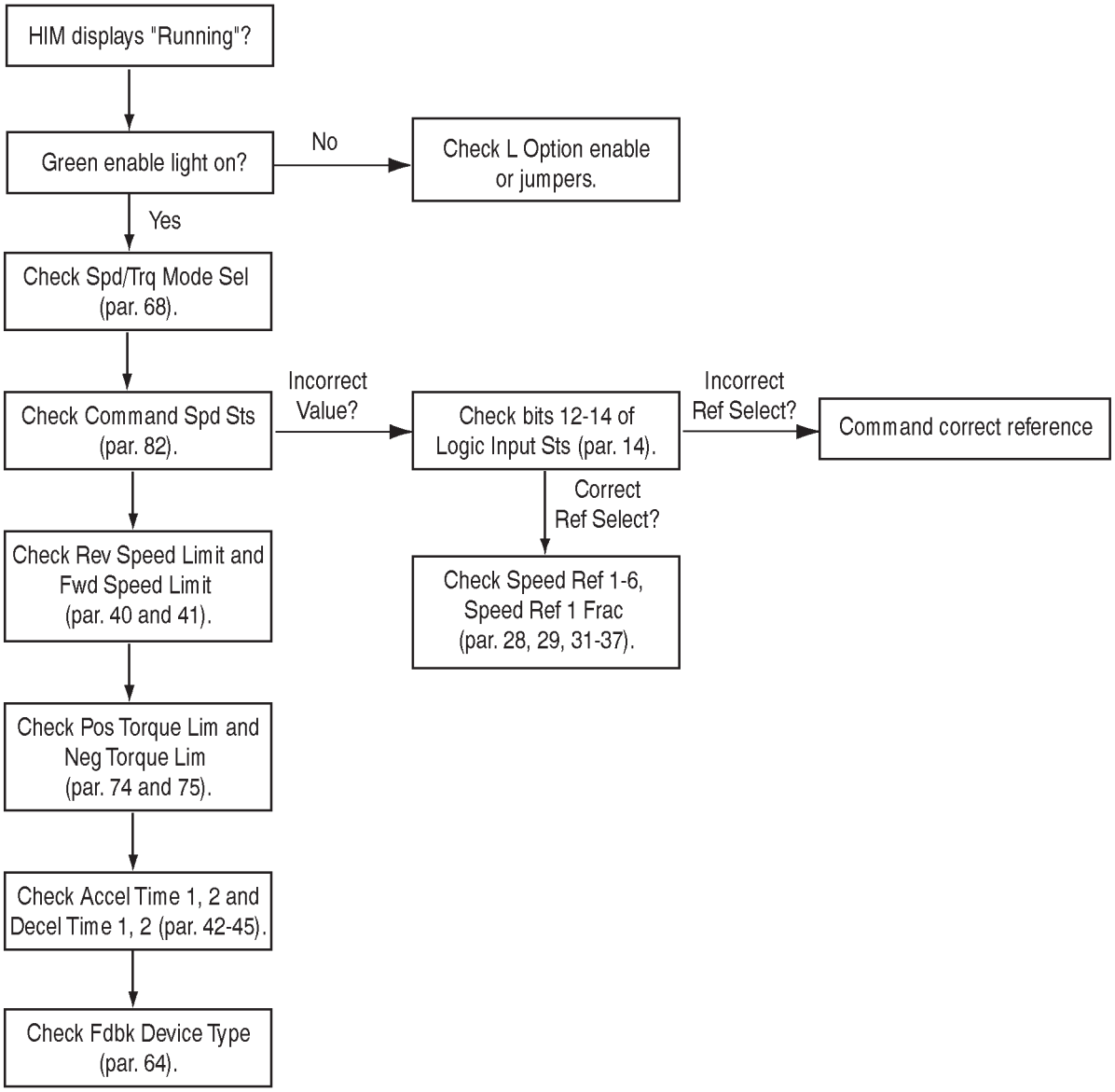
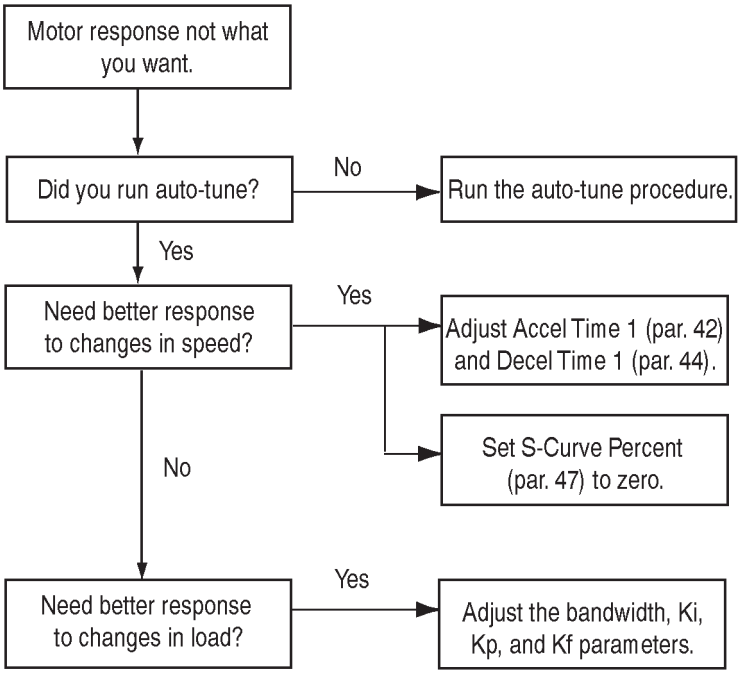


Figure 2.7
Motor Response Not Where You Want It



Start Up Troubleshooting Procedures

If you are having problems with the start up procedure, refer to this table for possible solutions before calling for help.

Table 2.E

If:	Then:
You powered up your drive and cannot access the start up routine.	The start up procedure is not supported on a Series A Human Interface Module (HIM). To verify that you have a Series A HIM, check the series letter located on the back side of the HIM or check the HIM version when you first power up your drive.
You got a *Feedback Loss Fault*.	You have specified that an encoder is on the system but it has been disconnected.
The motor does not turn during the phase rotation test.	Remove the load from the motor and try running the autotune tests again. Afterwards, you will need to attach the load again and run the inertia test manually.
During the phase rotation test you were asked to swap the encoder leads. You changed the leads and ran start up again. You were asked to swap the leads again.	The drive is not getting any speed feedback information. You need to: • Check the connection between the encoder and the motor. • Run the phase rotation test again and escape out to the status display at the first question. Check the motor speed. It should ramp to 3 Hz (90 rpm) for a 60 Hz 4 pole motor. If the motor speed is 0 rpm, you should: • Check the encoder wiring. • Check the encoder itself.

Miscellaneous Troubleshooting Procedures

If you are having problems with how your 1336 IMPACT drive is operating, refer to this table for possible solutions before calling for help.

Table 2.F

If:	Then you should:
The drive starts and then stops.	• Check if the mode specified in *L Option Mode* (parameter 116) is 2 or 3 wire. • Check *SP 2 Wire Enable* (parameter 181). • Check to see if the HIM displays a fault message. • Check the L Option Board wiring. • Check the settings on your gateway (communications module).
There is a delay before the stop command takes effect.	• Check the value of *Stop Dwell Time* (parameter 18).
The motor waits before starting.	• Check *Start Dwell Time* (parameter 194). • Check *Pos Torque Lim* (parameter 74) and *Neg Torque Lim* (parameter 75). • Check *Fast Flux Level* (parameter 78) and bit 8 of *Bus/Brake Opts* (parameter 13). • Check *S-Curve Percent* (parameter 47).
The drive coasts on stop.	• Check the stop type bits in *Logic Options* (parameter 17). • Check *Zero Speed Tol* (parameter 19).
You cannot clear faults.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if clear faults is enabled in *Clr Flt/Res Mask* (parameter 127). • Check if clear fault owners in *Ramp/ClFlt Owner* (parameter 131) is set. If set, check stop owners in *Start/Stop Owner* (parameter 129) and remove stop conditions. • The fault is a hard fault which requires a power cycle or drive reset.
The motor does not turn or run at the correct speed.	• Check which speed reference the drive is following in *Drive/Inv Status* (parameter 15) bits 13 – 15. • Check if *Spd/Trq Mode Sel* (parameter 68) is set correctly. • Check if *Spd Desired BW* (parameter 161) is non-zero. • Set the drive defaults and run start up again to tune the drive.

If:	Then you should:
The HIM pot does not control motor speed.	• Check if *SP An In1 Select* (parameter 133) or *SP An In2 Select* (parameter 136) is set to the HIM port number. • Check if *SP An In1 Scale* (parameter 135) or *SP An In2 Scale* (parameter 138) is 0.125. • Check if a *Speed Ref 1 – 7* (parameters 29 through 36) is linked to *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137). • Check which speed reference the drive is following in *Drive/Inv Status* (parameter 15) bits 13 – 15. The speed reference should be set to the speed reference that *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137) is linked to.
The drive will not change direction.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if Direction is enabled in *Dir/Ref Mask* (parameter 125). • Check if Direction owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command direction. • Check to make sure that bit 11 in *Logic Options* (parameter 17) is clear (0).
You cannot change the speed reference.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if Reference is enabled in *Dir/Ref Mask* (parameter 125). • Check if Reference owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command reference. If bit 0 (for the L Option control) is set, you need to do one of the following to remove ownership: • Clear bit 0 in *Dir/Ref Mask* (parameter 125). • If *L Option Mode* (parameter 116) is 2, 3, 8, 9, 23, 24, or 26, close the L Option inputs for speed references 1, 2, and 3.
The drive does not run correct torque.	• Set the drive defaults and run start up again to tune the drive. • Check *Spd/Trq Mode Sel* (parameter 68) and *Slave Torque %* (parameter 70).
The drive cannot control current and trips on an overcurrent fault.	• If you are using an encoder, check that you have entered the correct PPR into *Encoder PPR* (parameter 8).
The MOP does not work.	• Check *L Option Mode* (parameter 116). • Make sure that *Mop Value* (parameter 119) is linked to a speed reference.
The pulse input does not work.	• Make sure that the pulse input jumper is set correctly. • Make sure that the input is differential and not single ended. • Check the values of *Pulse In PPR* (parameter 120), *Pulse In Scale* (parameter 121), and *Pulse In Offset* (parameter 122). • Check the link on *Pulse In Value* (parameter 123).
The external fault does not work.	• Check the mode in *L Option Mode* (parameter 116). • Check bit 6 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
You keep getting motor overload trips.	• Reduce the load. • Check bits 3 and 4 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23). • Check *Motor Overload %* (parameter 26).
The motor reduced the speed range.	• Check *SP An In1 Scale* (parameter 135) or *SP An In2Scale* (parameter 138) if your speed input is coming from the HIM pot. • Check *An In 1 Offset* (parameter 97), *An In 1 Scale* (parameter 98), *An In 2 Offset* (parameter 100), *An In 2 Scale* (parameter 101), *mA Input Offset* (parameter 103), and *mA Input Scale* (parameter 104) if your speed input is coming from the analog inputs. • Check *Speed Scale 1* (parameter 30) or *Speed Scale 7* (parameter 37). • Check *Absolute Overspd* (parameter 24). • Check *Min Speed Limit* (parameter 215).

Encoderless Troubleshooting Procedures

If you are having problems with encoderless mode, refer to this table for possible solutions before calling for help.

Table 2.G

If:	Then you should:
The motor will not accelerate or does not start smoothly	• Increase the bandwidth in *Spd Desired BW* (parameter 161). If the bandwidth is too low, the motor may not accelerate, although the current increases to current limit. • If the regen power limit is 0, increase it to at least –5%. • Increase the torque and current limits to the maximum. • Increase the value of *Kp Freq Reg* (parameter 178).
The motor oscillates after it is up to speed	• Decrease the bandwidth in *Spd Desired BW* (parameter 161) if the process will allow. If this does not help, depending on your application, you need to either increase or decrease the value of *Error Filter BW* (parameter 162).
The inverter trips on absolute overspeed during starting	• Increase the acceleration time. • If the overspeed occurs during a fast acceleration, increase the value of *Kp Freq Reg* (parameter 178) until the trip stops occurring. • Increase the bandwidth in *Spd Desired BW* (parameter 161). • If the overspeed occurs during a reversal, increase the deceleration time (slower deceleration).shippshippy

Disassembly and Access Procedures

Chapter Objectives

This chapter describes general disassembly procedures required to access internal drive components.

Disassembly and Access Overview

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

You need the following tools to disassemble and assemble the drive:

- Pliers
- Phillips screwdrivers (small, medium, and large)
- Standard screwdrivers (small, medium, and large)
- 25/64-inch or 10 mm socket
- 7/16-inch or 11 mm socket
- 33/64-inch or 13 mm deep-well socket
- 5/16-inch or 8 mm open-end wrench
- Torque wrench, metered in lb-in. or N-m
- Nylon tie wraps

Fastener Torque Specifications

Torque Sequence

When mounting components to a drive's heat sink, component-fastener torque sequences and tolerances are crucial to component-to-heat sink heat dissipation.

ATTENTION: Component can be damaged if temporary tightening procedure is not performed to specification.

The following illustrates temporary and final tightening sequences for components fastened to a heat sink using two, four, and six screws. Temporary torque is 1/3 (33%) of final torque, except six-point mountings, which require 0.5 N-m (4 lb-in.). The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 3.1 Two-Point Mounting

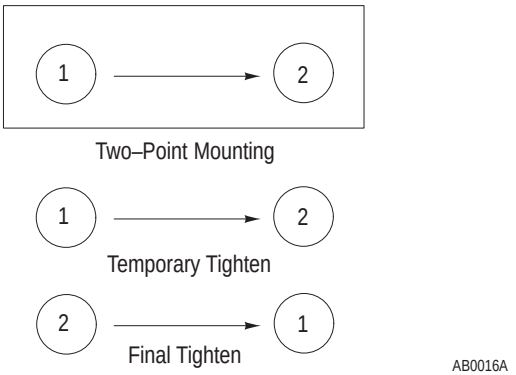


Figure 3.2 Four-Point Mounting

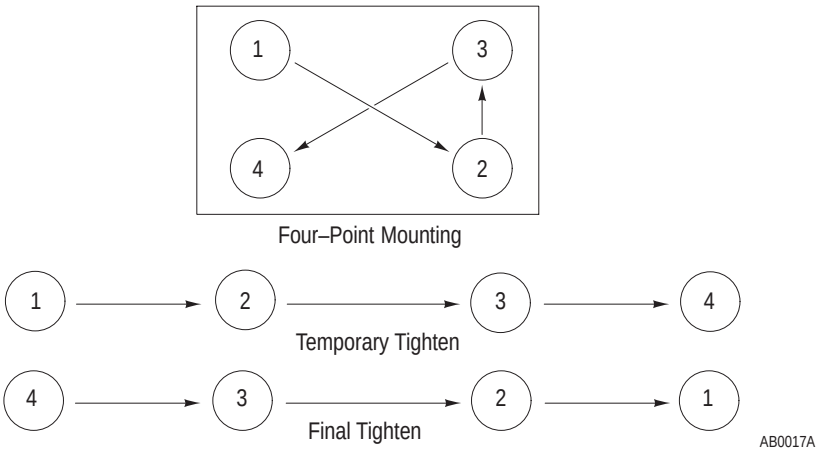
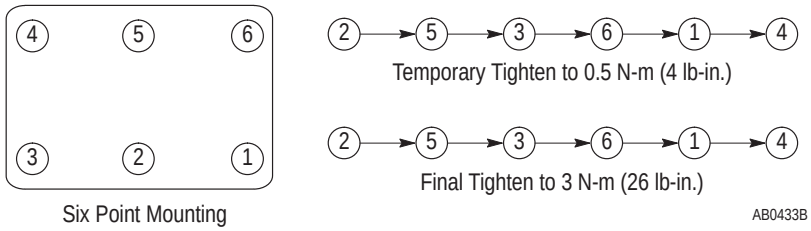


Figure 3.3 Six-Point Mounting



Important: Do not exceed 0.5 Newton-meters (4 lb-in.) on initial torque of all six screws.

Torque Specifications

The following table lists fastener locations by component, how the fasteners are used, and torque specifications. Refer to Torque Sequence in this chapter for fastening two-point, four-point and six-point components to the heat sink.

Table 3.A Fastener Torque Specifications

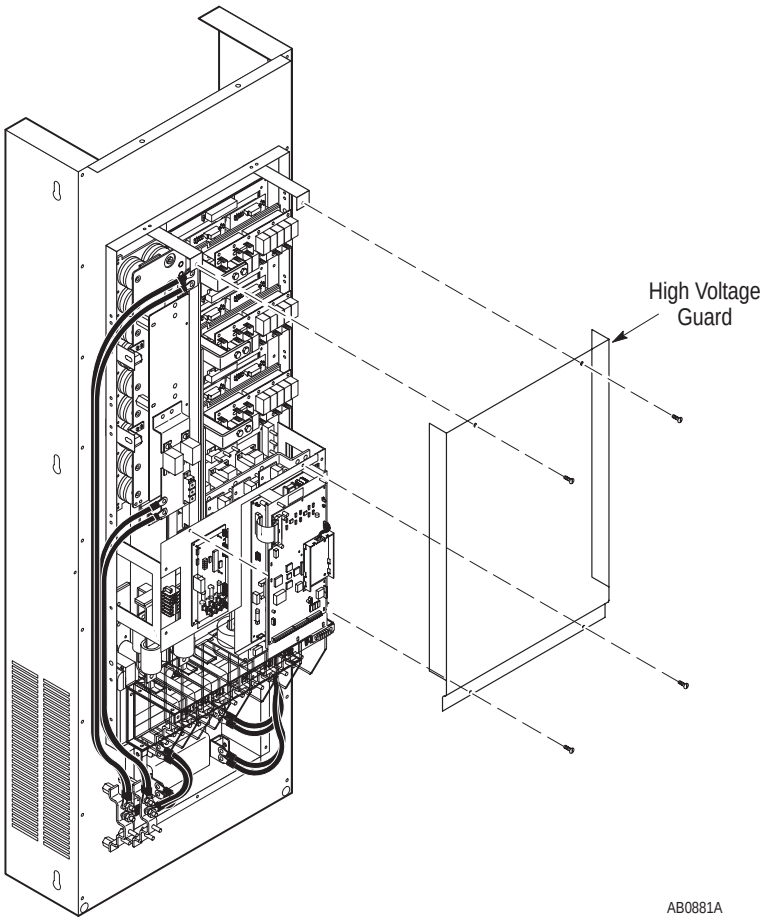
Component	Fastener Application	Torque lb-in.	Torque N-m
Fan Motor	Motor to Fan Cover Assembly	14	2
Fan Cover Assembly	Assembly to chassis	26	3
Fan Transformer	Transformer to chassis	26	3
Fan Capacitor	Capacitor to chassis	Hand-tighten	
MOV Surge Suppressor	MOV to chassis	14	2
Snubber Resistor	Resistor to heat sink	26	3
Snubber Resistor	Wires to Capacitor Bus Bar Assembly	50	6
Snubber Bracket	Bracket to Power Module	80	9
Snubber Board	Board to Brackets	50	6
Snubber Board	Board to Input Rectifier	50	6
Volt Sharing Resistor	Resistor to heat sink	26	3
Volt Sharing Resistor	Wires to Capacitor Bus Bar Assembly	50	6
Thermistor	Thermistor to heatsink	14	2
Bus Capacitor Holder	Holder to Bus Capacitors	26	3
Capacitor Bus Bar Assembly	Assembly to Bus Capacitors	50	6
Power Module Gate Interface Board	Board to Power Modules	14	2
Power Module Bus Bar	Bus Bar to Power Modules	80	9
Power Module	Module to heat sink	Refer to Figure 3.3	
DIN Rail (TB1)	Rail to chassis	50	6
PE Shortening Bar	Bar to TB1	80	9
Input Rectifier	Rectifier to heat sink	50	6
Input Fuse	Fuse to Input Bus Bar	208	23
Transitional Bus Bar Assembly	Assembly to Power Module Bus Bar Assembly	208	23
Bus Fuse F1	Fuse to Transitional Bus Bar Assembly	80	9
DC Bus Inductor L1	Inductor to chassis	50	6
Bus Bar Cable Adaptor	Adaptor to Transitional Bus Bar Assembly and DC Bus Inductor	208	23
Converter Bus and Motor Bus Bars	Bus Bars to all connections	208	23
Wires (PE)	Wires to Ground Stud	80	9
Wires	Wires to TB1	80	9
Wire (TE)	Wire to TB1	50	6
Wires	Wires to TB2	7	0.8
Wires	Wires to TB3	8 – 10	0.9 – 1.1
LEM Mounting Plate	Mounting Plate to LEM Clamping Plate	14	2
Power Cables	Cables to terminals	208	23
Circuit Board Platform	Plates to chassis	26	3
High Voltage Guard	Guard to chassis	26	3

Disassembly and Access Procedures

Removing the High Voltage Guard

The High Voltage Guard is a clear plastic guard covering the Bus Capacitor Bank and the Power Module Assembly.

Figure 3.4 High Voltage Guard



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the four nuts fastening the High Voltage Guard to the standoffs.
5. Pull the guard away from the drive.

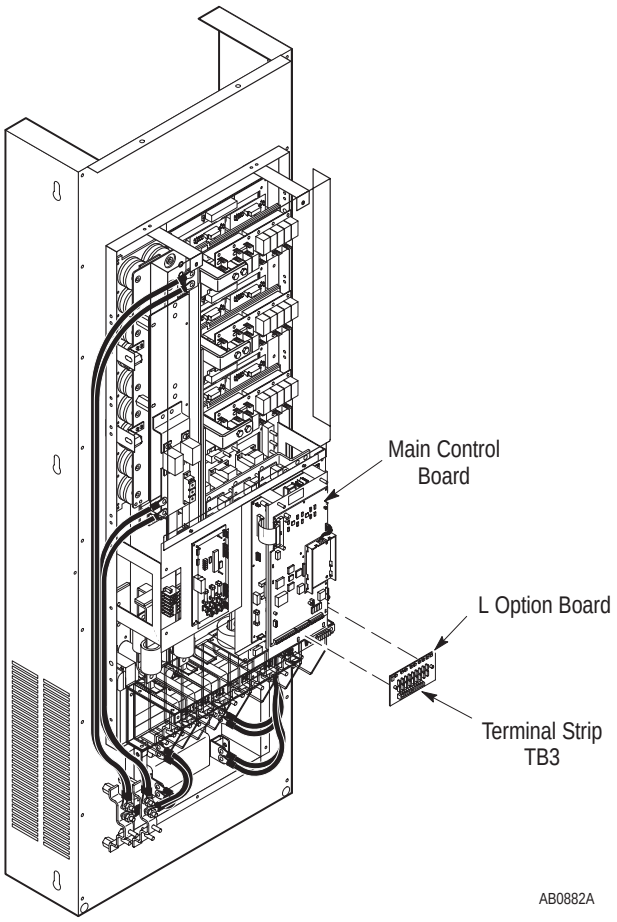
Installation

Install the High Voltage Guard in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the L Option Board

Figure 3.5 L Option Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove all wires from the terminals on TB3.
5. Loosen the two captive screws fastening the L Option Board to the Main Control Board.
6. Grip the right and left sides of the L Option Board and pull the board straight outward from the Main Control Board.

Installation

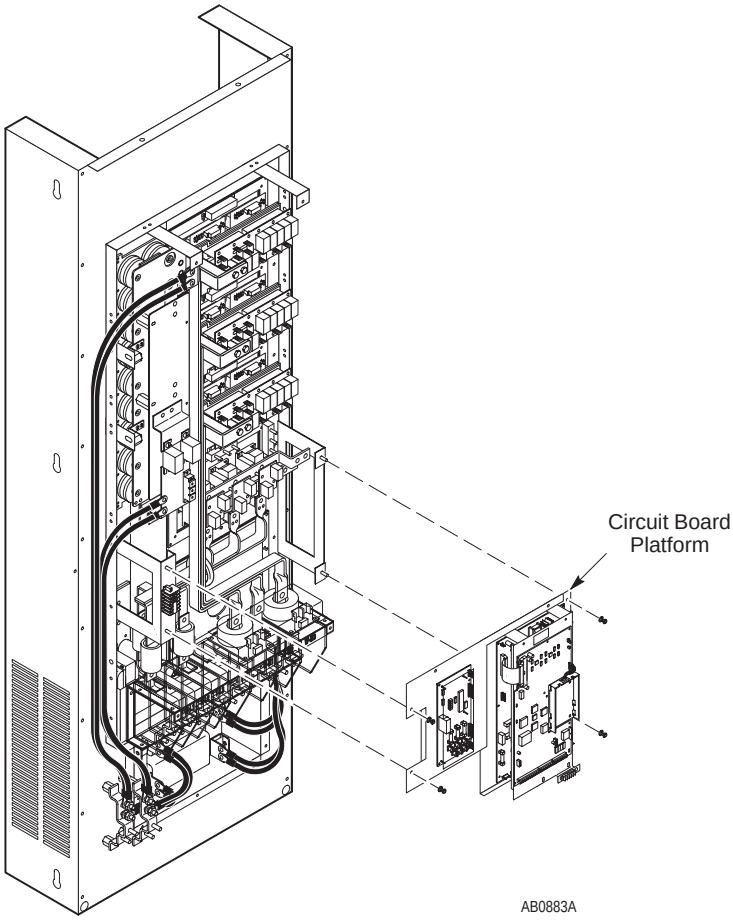
Install the L Option Board in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Circuit Board Platform

The Circuit Board Platform contains the Main Control Board, the Gate Driver Board, and the Precharge Board.

Figure 3.6 Circuit Board Platform



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect both ground wires from TB5 located in the lower right-hand corner of the the Main Control Board Mounting Plate.
5. Disconnect the following from the Main Control Board:
   - J1 connector
   - J2 connector
   - TB3, if L Option Board is used
   - any optional boards
6. Remove the two nuts from the top and the bottom of the Main Control Board Mounting Plate.
7. Pull the Main Control Board Mounting Plate straight out and remove the plate from the drive.
8. Disconnect the following from the Gate Driver Board:
   - J2 connector
   - J7 connector
   - J8 connector
   - J10 connector
9. Disconnect the following from the Precharge Board:
   - J1 connector
   - J2 connector
   - J4 connector

10. Disconnect the two LEM wire harness plugs.

11. Remove the four nuts fastening the Circuit Board Platform to the drive.

12. Pull the Circuit Board Platform straight out and remove the platform from the drive.

Installation

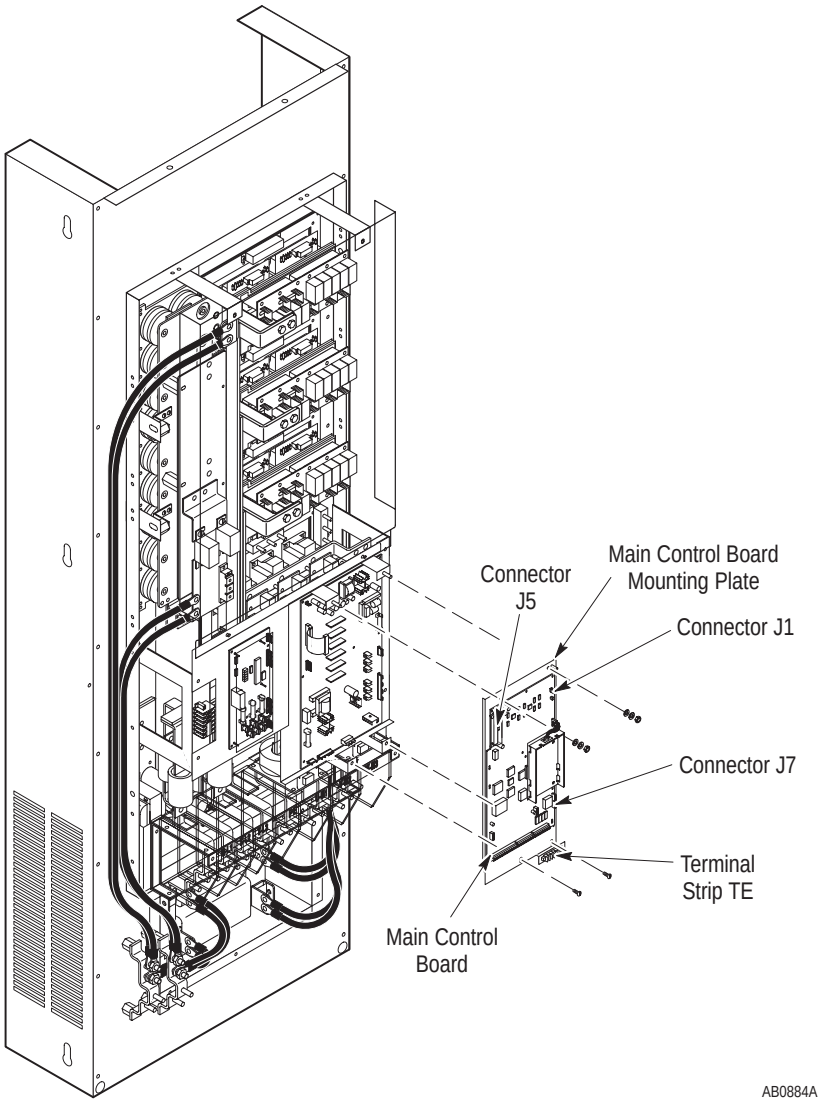
Install the Circuit Board Platform in reverse order of removal.

ATTENTION: When removing the entire wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Main Control Board Mounting Plate

Figure 3.7 Main Control Board Mounting Plate



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect the following from the Main Control Board:
   - J1 connector
   - J5 ribbon cable connector
   - J7 connector
   - Ground wires from terminal strip TE
   - Chassis ground wire at the top-right corner of the Main Control Board Mounting Plate
5. Remove the two screws fastening the bottom of the Main Control Board Mounting Plate to the Circuit Board Platform.
6. Remove the nuts fastening the top of the Main Control Board Mounting Plate to the Circuit Board Platform.
7. Lift the Main Control Board Mounting Plate out of the drive.

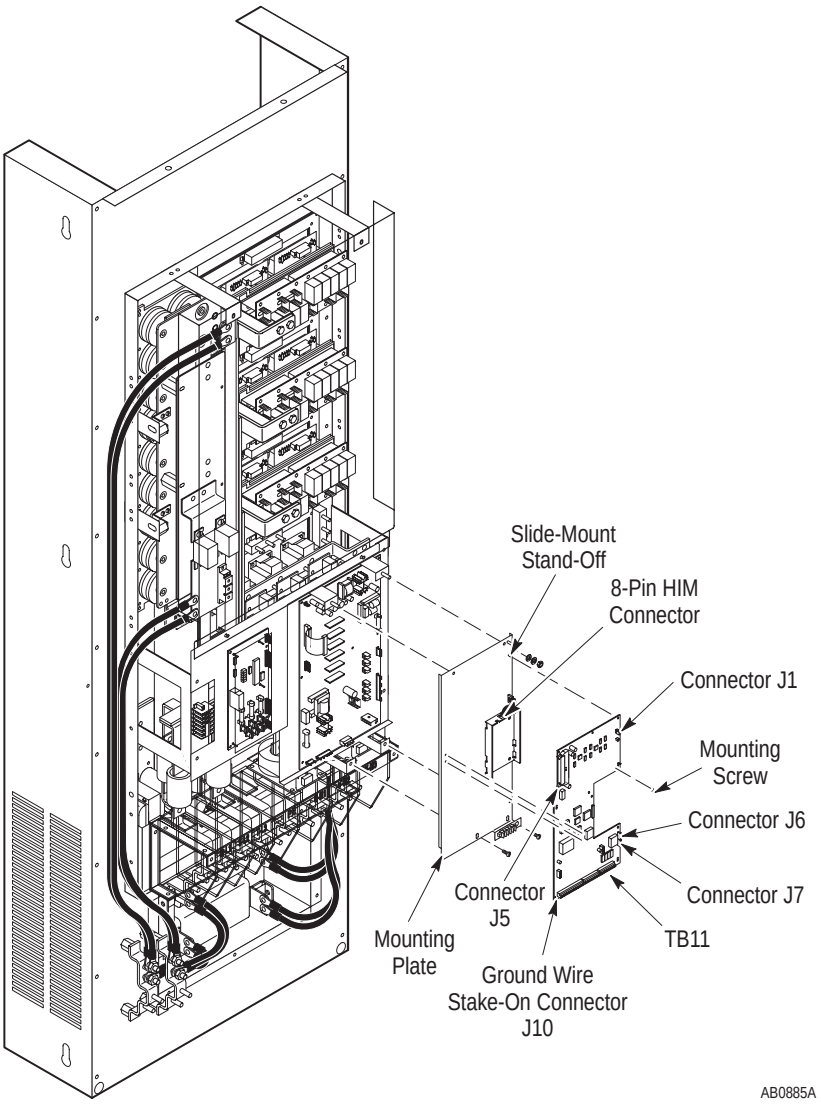
Installation

Install the Main Control Board Mounting Plate in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Main Control Board

Figure 3.8 Main Control Board and Mounting Plate



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove all wires from terminal strip TB3 if an L Option Board is used.
5. Disconnect the following from the Main Control Board:
   - J1 connector
   - J5 ribbon cable connector
   - J6 connector
   - J7 connector
   - Ground wire at stake-on connector
   - All wires from the terminals on TB10 and TB11
6. Remove the five screws fastening the Main Control Board to the mounting plate.
7. Slide the Main Control Board toward the top of the drive to release it from the slide-mount stand-offs.
8. Lift the Main Control Board away from the mounting plate.

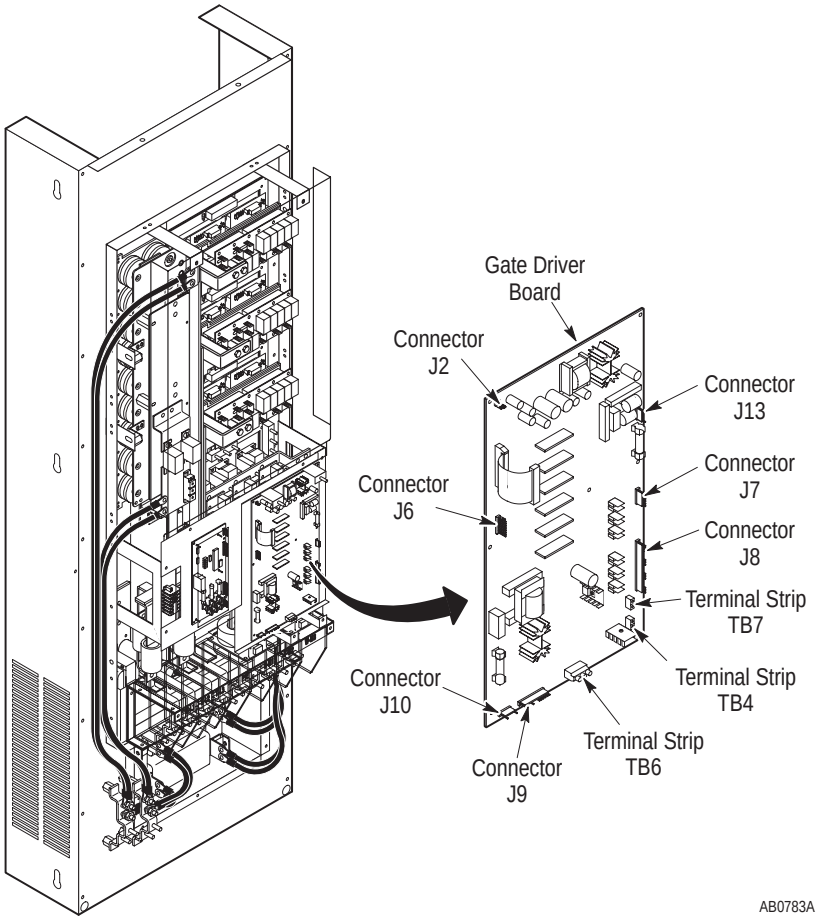
Installation

Install the Main Control Board in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Gate Driver Board from the Mounting Plate

Figure 3.9 Gate Driver Board and Mounting Plate



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Main Control Board Mounting Plate. Refer to Removing the Main Control Board Mounting Plate in this chapter.
5. Disconnect the following from the Gate Driver Board:
   - J2 connector
   - J6 connector
   - J7 connector
   - J8 connector
   - J9 connector
   - J10 connector
   - J13 connector
   - TB4 – 24 VDC Auxiliary Input
   - Ground wire from TB7 on the Gate Driver Board
6. Turn the eight standoff screws, fastening the Gate Driver Board to the mounting plate, 1/4 turn counterclockwise.
7. Pull the Gate Driver Board away from the mounting plate.

Installation

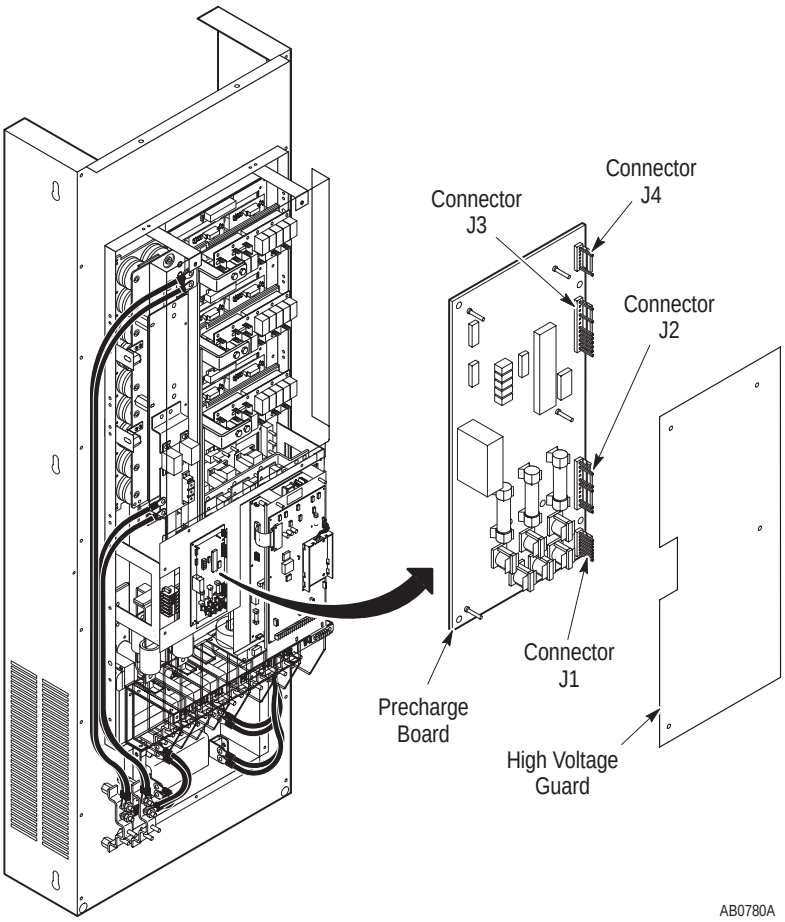
Install the Gate Driver Board in reverse order of removal.

ATTENTION: When removing the entire wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Precharge Board from the Mounting Plate

Figure 3.10 Precharge Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect the following from the Precharge Board:
   - J1 connector
   - J2 connector
   - J3 connector
   - J4 connector
5. Pull the Precharge High Voltage Guard away from the four nylon spacers.
6. Turn the six standoff screws, fastening the Precharge Board to the mounting plate, 1/4 turn counterclockwise.
7. Pull the Precharge Board away from the mounting plate.

Installation

Install the Precharge Board in reverse order of removal.

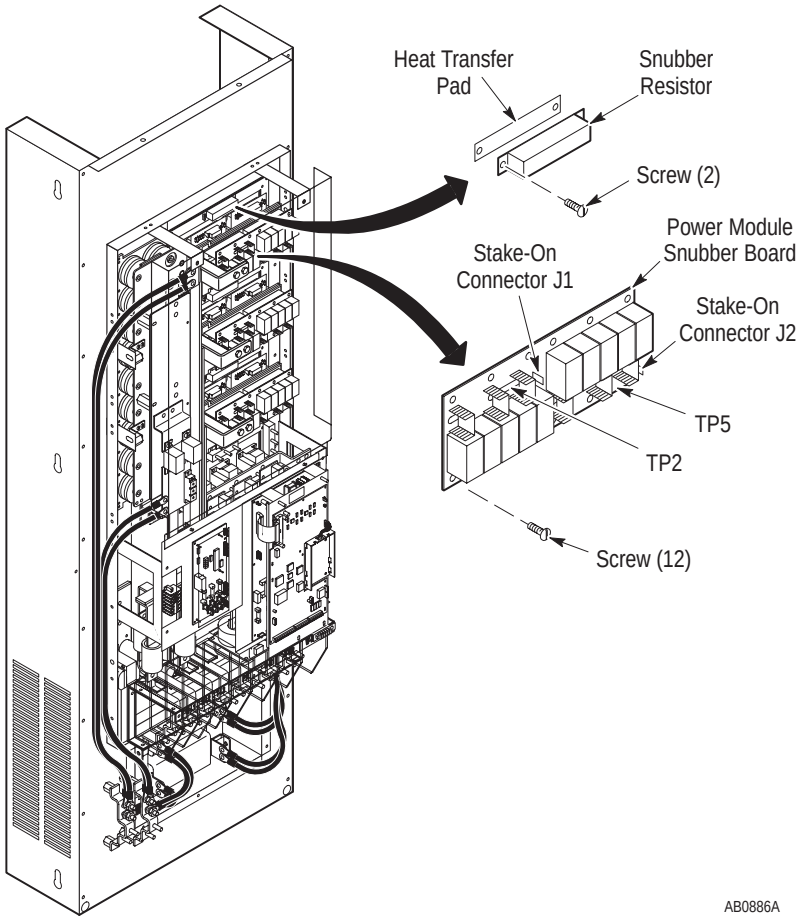
ATTENTION: When removing the entire wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing a Power Module Snubber Board

The Power Module Snubber Boards are located on the upper right side of the chassis.

Figure 3.11 Power Module Snubber Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to IMPACT (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and IMPACT (+) bus to discharge any voltage.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard. Refer to Removing the High Voltage Guard in this chapter.
5. Measure the DC voltage from TP5 on the Power Module Snubber Board to TP2 (–DC Bus). If voltage greater than 50 VDC is still present, follow the directions in the Electric Shock Hazard Attention shown above.
6. Remove the Snubber Resistor wire from the Power Module Snubber Board stake-on connectors J1 and J2.
7. Remove the twelve screws fastening the Power Module Snubber Board to the snubber bracket to remove the snubber boards.
8. Check Snubber Resistor with VOM. The reading should be 8 ohms. If open, replace resistor.

Installation

ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

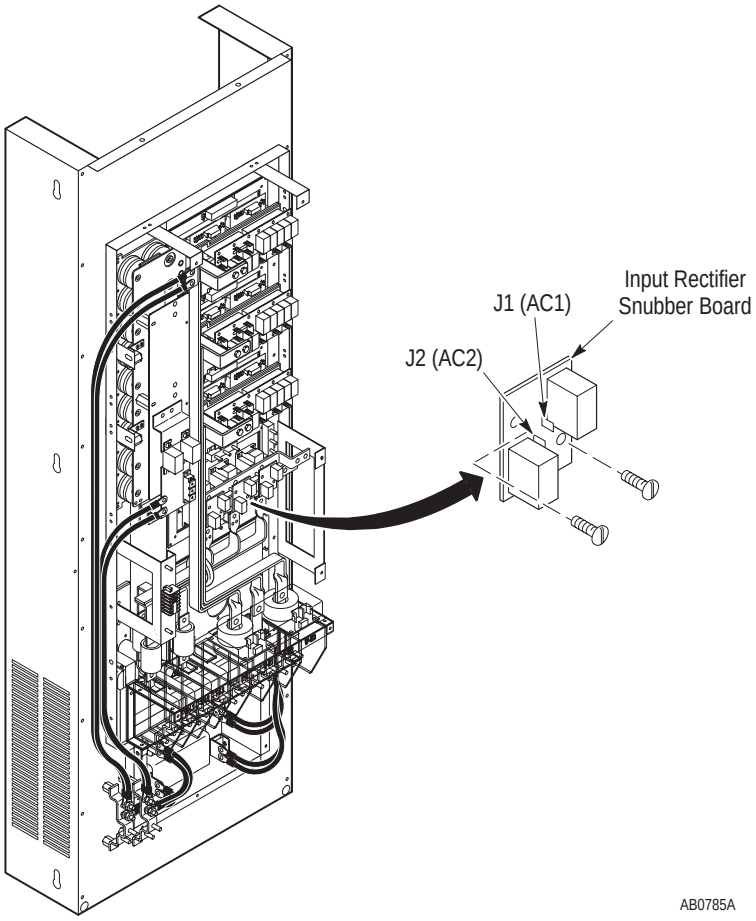
Install the Snubber Board in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing an Input Rectifier Snubber Board

The Input Rectifier Snubber Boards are located under the Circuit Board Platform.

Figure 3.12 Input Rectifier Snubber Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Circuit Board Platform. Refer to Removing the Circuit Board Platform in this chapter.
5. Remove the wire from Input Rectifier Snubber Board stake-on connectors J1 (AC1) and J2 (AC2).
6. Remove the two screws fastening the Snubber Board to the Converter Bus Bar.

Installation

Install the Snubber Board in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

Important: Verify that the snubber resistor wiring is reconnected to the proper phase snubber board.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Accessing Power Plane Components

To access the power plane components located on the chassis, refer to Removing a Power Module Snubber Board in this chapter

Component Test Procedures

Chapter Objectives

The following tests help you troubleshoot BP250 – BP450 drives.

Component Test Overview

In some cases, different tests troubleshoot components of the same name.

These similar tests vary according to the rating of the drive being tested. Verify that the rating on the drive matches the rating for the test you are performing.

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

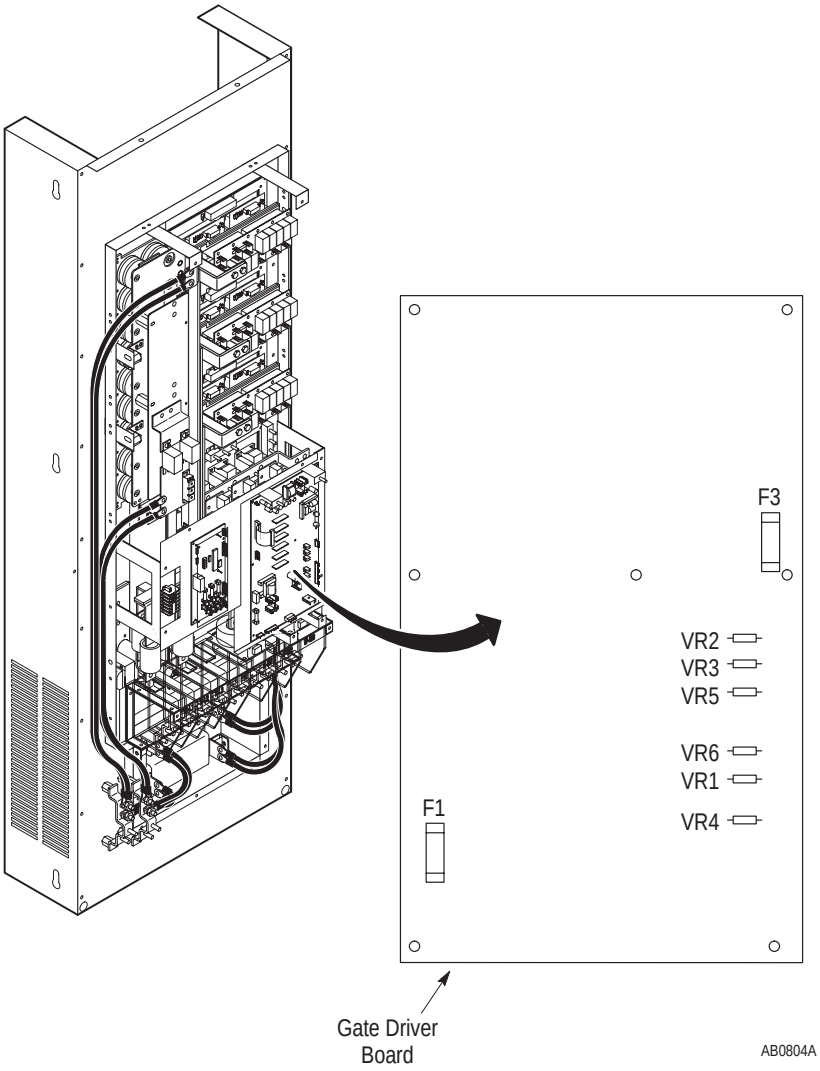
You need the following tools to disassemble and assemble the drive:

- Pliers
- Phillips screwdrivers (medium and large)
- Standard screwdrivers (small, medium, and large)
- 25/64-inch or 10 mm socket
- 7/16-inch or 11 mm socket
- 33/64-inch or 13 mm deep-well socket
- 5/16-inch or 8 mm open-end wrench
- Torque wrench, metered in lb-in. or N-m
- Nylon tie wraps

Test 1 – Testing the Gate Driver Board

The Gate Driver Board is located beneath the Main Control Board. If modules have been replaced, you must test the Gate Driver Board.

Figure 4.1 Gate Driver Board Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Main Control Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Main Control Board Mounting Plate.
5. Unplug the connectors from the Gate Driver Board.
6. Set your meter to test resistance.
7. Test Fuses F1 and F3 for an open condition. Replace the Gate Driver Board if either fuse shows an open condition.
8. Set your meter to test diodes.
9. Test VR1 – VR6. The following table shows meter connections at the components and ideal meter readings for those connections. Refer to Figure 4.1 for component locations.

Table 4.A Gate Driver Board Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading *
VR1	+	–	1.06
	–	+	1.8
VR2	+	–	1.06
	–	+	1.8
VR3	+	–	1.06
	–	+	1.8
VR4	+	–	1.06
	–	+	1.8
VR5	+	–	1.06
	–	+	1.8
VR6	+	–	1.06
	–	+	1.8

Important: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to “Diode” range.

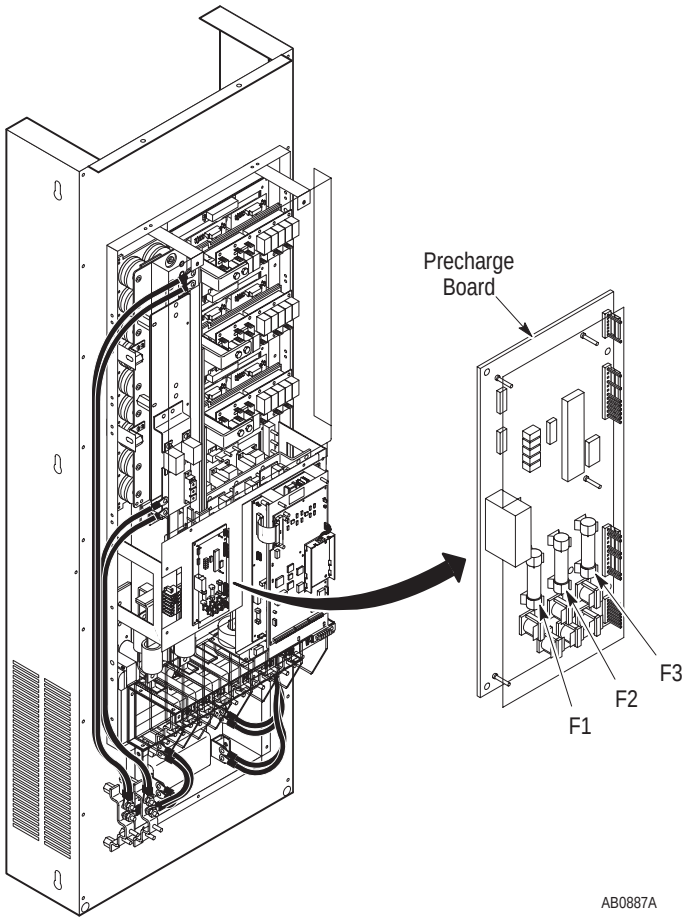
10. Replace the Gate Driver Board if your readings do not match the table readings. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 2 – Testing the Precharge Board

If Input Rectifier modules have been replaced, you must check the Input Rectifier Snubber Board and the Precharge Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing an Input Rectifier Snubber Board and Removing the Precharge Board.

Figure 4.2 Precharge Board Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Set your meter to test resistance.
5. Test fuses F1, F2, and F3 through the access holes in the Precharge Board High Voltage Guard and check for open conditions.
6. Replace the Precharge Board if any fuse shows an open condition. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board.

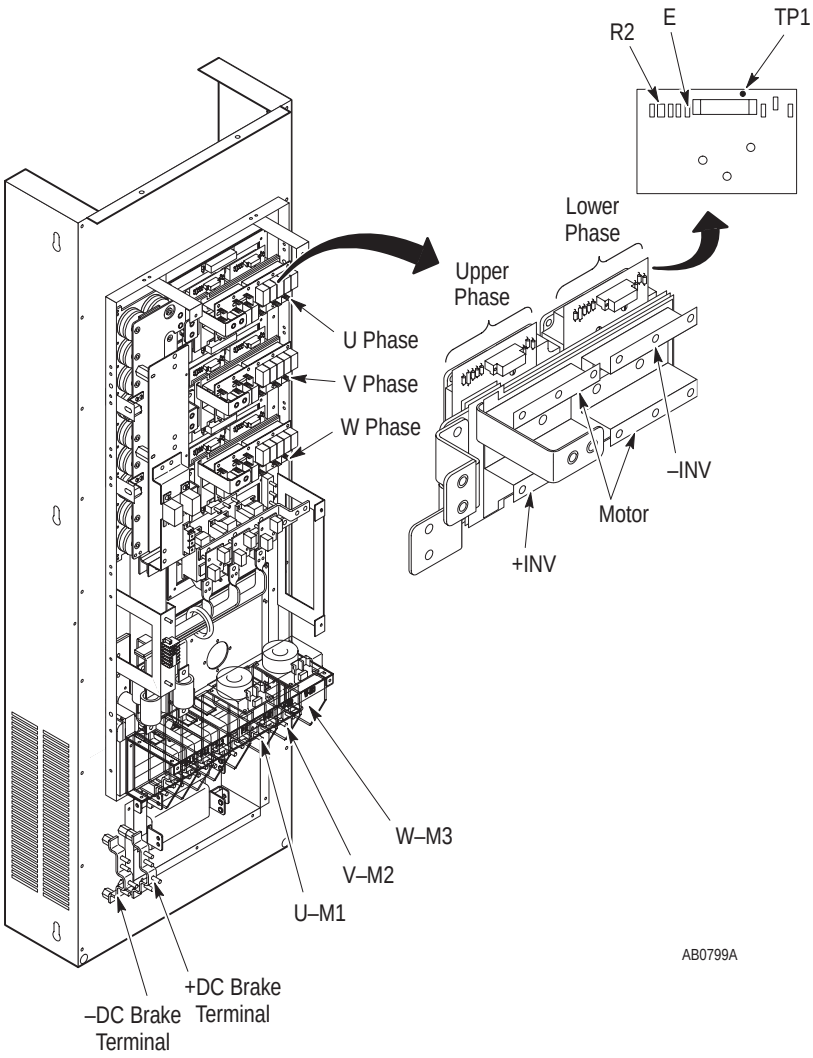
ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 3 – Testing the Power Modules

The Power Modules are located on the upper right side of the heat sink. If modules have been replaced, you must check the Power Module Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to plus (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

Figure 4.3 Power Module Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the motor leads from TB1-U, V and W terminals of the drive.
5. Set your meter to test diodes.
6. Test the output sections of the drive. This should idicate if any of the drive's output phases has a problem. Table 4.B shows meter connections and ideal meter readings for those connections. Refer to Figure 4.3 for meter connection locations.

Table 4.B Output Sections

Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading	Phase with Problem
+DC Brake	U-M1	Infinite	U
+DC Brake	V-M2	Infinite	V
+DC Brake	W-M3	Infinite	W
U-M1	+DC Brake	0.318	U
V-M2	+DC Brake	0.318	V
W-M3	+DC Brake	0.318	W
–DC Brake	U-M1	0.318	U
–DC Brake	V-M2	0.318	V
–DC Brake	W-M3	0.318	W
U-M1	–DC Brake	Infinite	U
V-M2	–DC Brake	Infinite	V
W-M3	–DC Brake	Infinite	W

Important: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to "Diode" range.

7. If the readings are not approximately the same as in Table 4.B, the last column identifies the phase with a potential problem. If the readings are not correct, continue with the test procedure to check the individual phase or phases in question.

8. Remove the High Voltage Guard. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.

9. Remove the Power Module Snubber Boards. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

10. Test the Power Module phases that did not pass the Table 4.B tests. Table 4.C shows meter connections and ideal meter readings for those connections. Refer to Figure 4.3 for meter connection locations.

Table 4.C Power Modules

Upper Phase			
Meter (+) Lead	**Meter (–) Lead**	**Nominal Meter Reading***	**Type of Reading**
Motor	+INV	0.289v	Diode
+INV	Motor	Infinite	Diode
E	TP1	0.289v	Diode
TP1	E	Infinite	Diode
E	Motor	0 ohms	Resistance
TP1	+INV	0 ohms	Resistance
E	R2	10k ohms	Resistance
Lower Phase			
Meter (+) Lead	**Meter (–) Lead**	**Nominal Meter Reading***	**Type of Reading**
–INV	Motor	0.289v	Diode
Motor	–INV	Infinite	Diode
E	TP1	0.289v	Diode
TP1	E	Infinite	Diode
E	–INV	0 ohms	Resistance
TP1	Motor	0 ohms	Resistance
E	R2	10k ohms	Resistance

Important: Typical malfunction for diode test is shorted in both directions.

Important: Select meter to read appropriate type of measurement where needed.

* Meter Used: Fluke® Model 87, set to “Diode” range.

11. Replace the Power Module phase if the meter readings are not approximately as shown. Refer to Chapter 5 – Part Replacement Procedures, Power Modules.

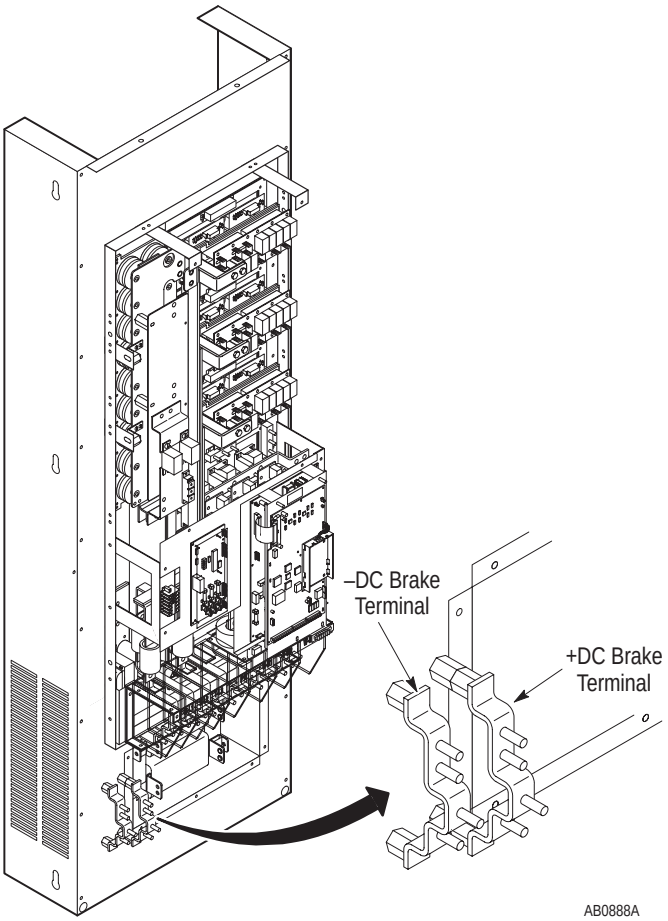
12. If one or more Power Modules is replaced, test the Gate Driver Board. Refer to Testing the Gate Driver Board in this chapter.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 4 – Testing the Bus Capacitors

The Bus Capacitor Bank is located on the upper left side of the Main Chassis.

Figure 4.4 Bus Capacitor Bank Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Set your meter to test DC voltage.
5. Connect the negative lead of your meter to the –DC Brake Terminal on TB1 and the positive lead to the +DC Brake Terminal. Refer to the following tables and Figure 4.4 for meter readings and terminal locations.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

6. Apply power **AFTER** the meter is connected, otherwise your meter will read zero volts. Expand readings for all input voltage ratings.

Table 4.D Bus Capacitor Bank Test

Drive Rating	Input Volts	Meter Reading
A	200	283V DC +/–10%
	230	325V DC +/–10%
	240	339V DC +/–10%
B	380	537V DC +/–10%
	415	587V DC +/–10%
	480	679V DC +/–10%
C	500	707V DC +/–10%
	575	813V DC +/–10%
	600	848V DC+/–10%

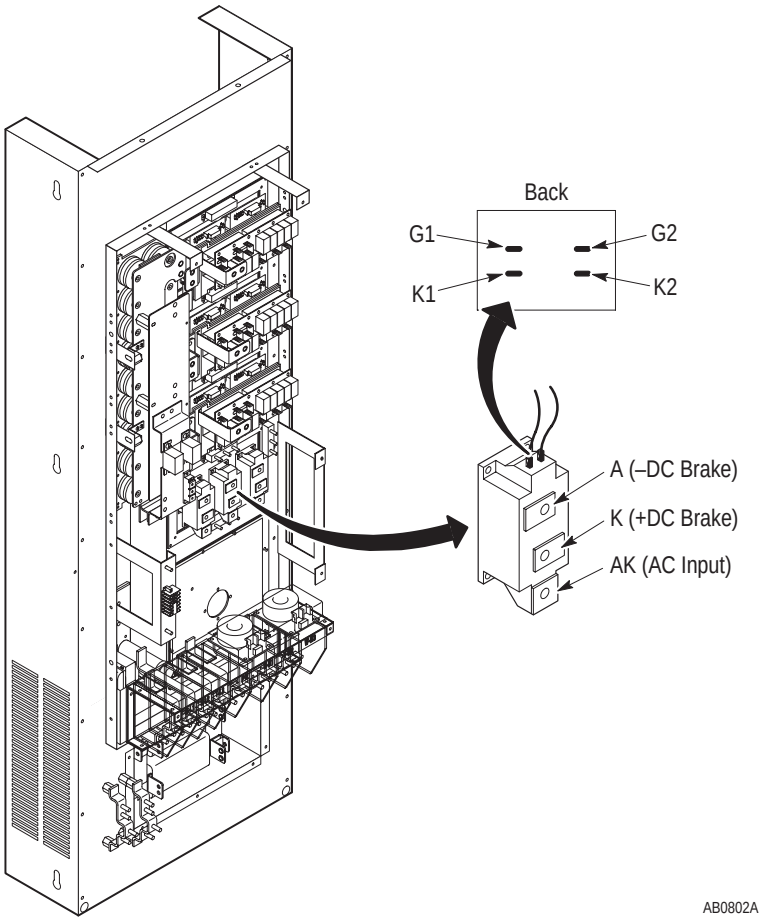
7. If the voltage is out of tolerance, check the following:
   - An open condition at an Input Rectifier.
   - A voltage drop due to Bus Inductor L1 resistance.
   - A voltage drop between an Input Rectifier and the bus capacitors due to loose or resistive wires or connections.
   - Precharge circuit problems.
8. If the above check does not reveal a problem, replace the Bus Capacitor Bank and Load-Sharing Resistors. Refer to Chapter 5 – Part Replacement Procedures, Bus Capacitor Bank.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 5 – Testing the Input Rectifiers

The Input Rectifiers are located on the bottom of the heat sink.

Figure 4.5 Input Rectifier Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.

3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
5. Remove the Input Rectifier Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Input Rectifier Snubber Board.
6. Set your meter to test diodes.
7. The following table shows meter connections and ideal meter readings for those connections. Refer to Figure 4.5 for meter connection locations.

Table 4.E Input Rectifier Test

Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading*
AK	K	Infinite
AK	A	Infinite
K	A	Infinite
K	AK	Infinite
A	AK	Infinite
A	K	Infinite
G1	K1	0.011
K1	G1	0.011
G2	K2	0.011
K2	G2	0.011

Important: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to “Diode” range.

8. Replace the Input Rectifier if any meter readings are not as shown. Refer to Chapter 5 – Part Replacement Procedures, Input Rectifiers.
9. If the Input Rectifier shorted, check the Power Modules for damage. Refer to Testing the Power Modules in this chapter.

Part Replacement Procedures

Chapter Objective

This chapter describes procedures required to replace drive components. This chapter references Chapter 3 – Disassembly and Access Procedures for basic drive component access.

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

You need the following tools to disassemble and assemble the drive:

- Pliers
- Phillips screwdrivers (small, medium, and large)
- Standard screwdrivers (small, medium, and large)
- 25/64-inch or 10 mm socket
- 7/16-inch or 11 mm socket
- 33/64-inch or 13 mm deep-well socket
- 5/16-inch or 8 mm open-end wrench
- Torque wrench, metered in lb-in. or N-m
- Nylon tie wraps

Major Component Replacement

This section explains in detail how to replace the following drive components:

- Bus Capacitor Bank
- Thermistor
- Power Modules
- Bus Fuses F1
- Input Fuses
- Ground Fault CT
- Input Rectifiers
- LEMs
- MOV Surge Suppressor
- Fan and Transformer Assembly
- DC Bus Inductor L1

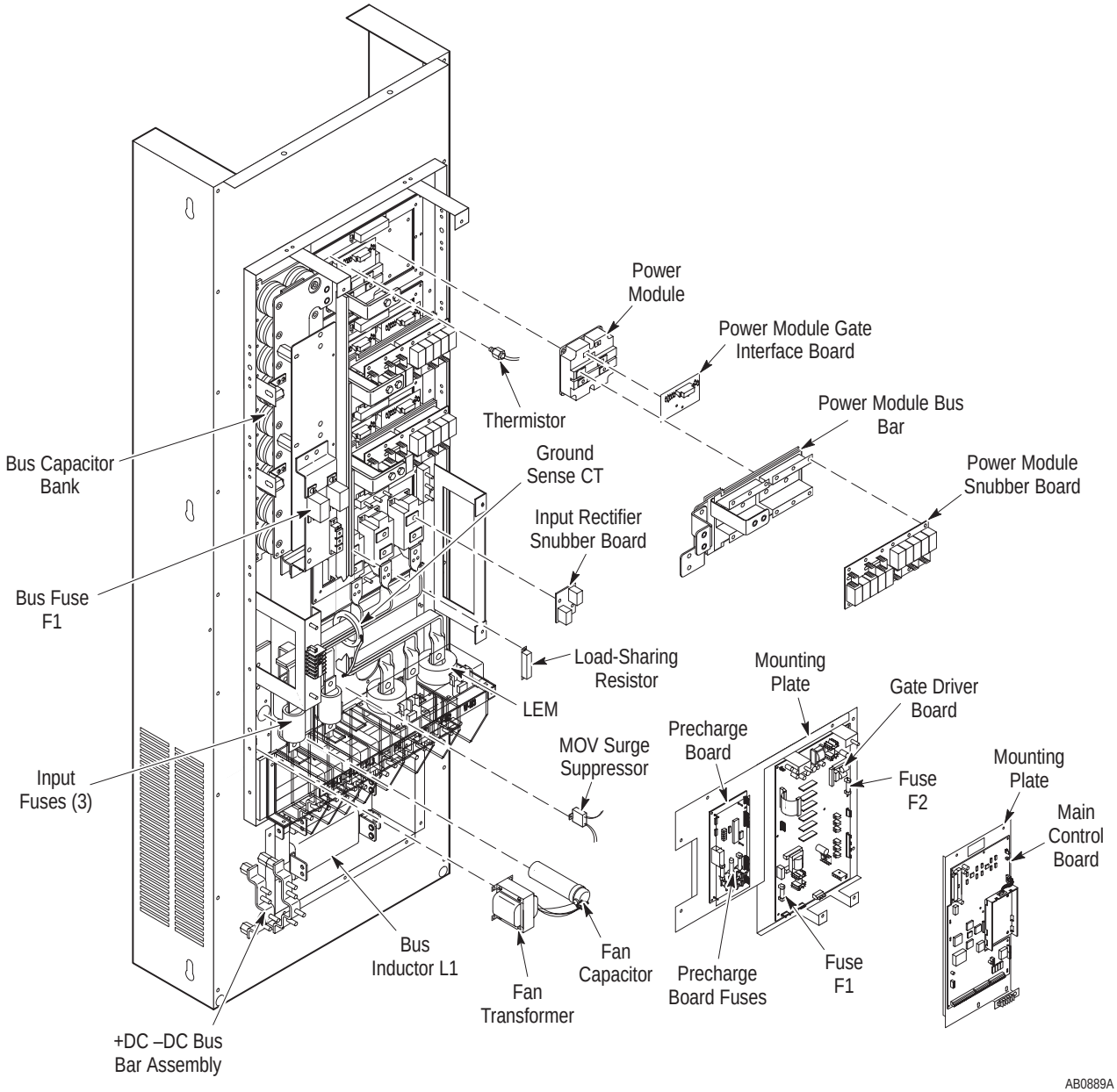
For Main Control Board, Gate Driver Board, Precharge Board, Snubber Boards, and L Option Board installation and removal procedures, refer to Chapter 3.

Detailed Product Identification

Rockwell Automation Adjustable Frequency AC Drives are modular by design to enhance troubleshooting and spare parts replacement, thereby helping reduce production down-time.

The following illustration calls out the main components of a typical drive. Component designs vary slightly among the different drive ratings, but component locations are identical.

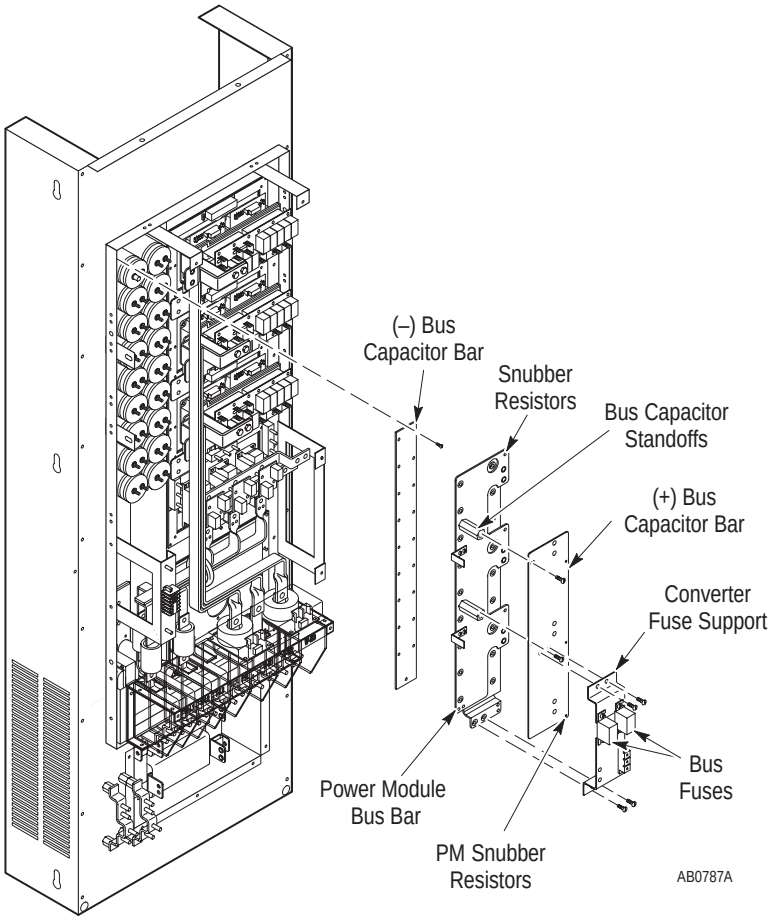
Figure 5.1 Main Drive Components



Bus Capacitor Bank

The Bus Capacitor Bank is located on the upper left side of the Main Chassis.

Figure 5.2 Bus Capacitor Bank



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the Main Chassis:

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.

Access the Bus Capacitor Bank:

1. Remove the (+) Bus Capacitor Bar:
   - **A.** Remove the two sets of bolts fastening the power cables to the top and bottom of the Bus Capacitor Bank.
   - **B.** Remove the four bolts fastening the Converter Fuse Support to the (+) Bus Capacitor Bar and Power Module Bus Bar.
   - **C.** Pull the Converter Fuse Support, with bus fuses attached, from the drive.
   - **D.** Remove the six bolts (2 per phase) fastening the (+) Bus Capacitor Bar to the Power Module Bus Bar.
   - **E.** Remove the two bolts fastening the (+) Bus Capacitor Bar to the Bus Capacitor Inverter Standoffs.
   - **F.** Remove the three screws fastening the (+) Bus Capacitor Bar to the Power Module Snubber Resistors.
   - **G.** Pull the (+) Bus Capacitor Bar from the drive.

2. Remove the Power Module Bus Bar:

   A. Remove the six screws fastening the Power Module Bus Bar to the (–) Bus Capacitor Bar.

   B. Remove the eighteen nuts fastening the Power Module Bus Bars to the (–) Bus Capacitor Bar.

   C. Remove the five screws fastening the Power Module Bus Bar to the Snubber Resistors.

   D. Remove the two bolts fastening the Power Module Bus Bar to the drive.

   E. Pull the Power Module Bus Bar from the drive.

3. Remove the Bus Capacitors:

   A. Remove the eighteen nuts fastening the (–) Bus Capacitor Bar to the Bus Capacitors.

   B. Pull the (–) Bus Capacitor Bar from the drive.

   C. Remove the Bus Capacitors from the drive.

Installation

1. Fasten the capacitor assembly in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

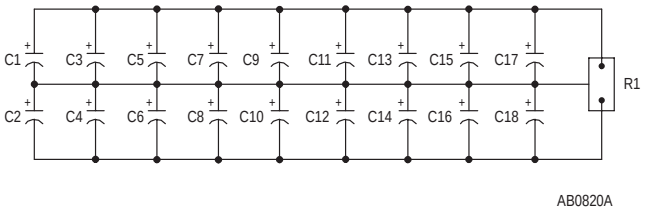
Important: Orient the notch and vent hole on the Bus Capacitors to the top of the drive.

2. Connect the Load-Sharing Resistors to the Bus Capacitors according to the diagram in Figure 5.3. Refer to the schematic diagrams in this manual for more information on component configurations.

Important: Check the Load-Sharing Resistors for an open condition and replace any open resistors.

Important: If the drive is equipped with PEM nuts on the Cap Bus bar, use them instead of capacitor studs to make the electrical connection.

Figure 5.3 Load-Sharing Resistor Connections to Bus Capacitors

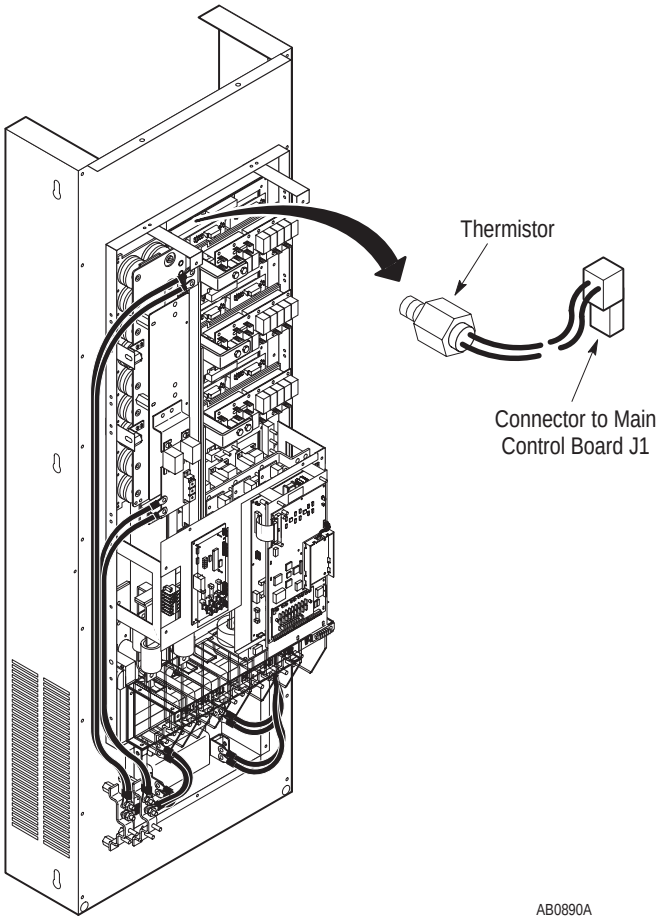


ATTENTION: Capacitors not installed correctly will erupt or vent and could cause injury and equipment damage. Observe correct polarities.

Thermistor

The Thermistor is located on the heat sink at the top-middle of the drive.

Figure 5.4 Thermistor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the screws fastening the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Disconnect the Thermistor connector at J1 on the Main Control Board.
6. Unscrew the Thermistor from the heat sink.

Installation

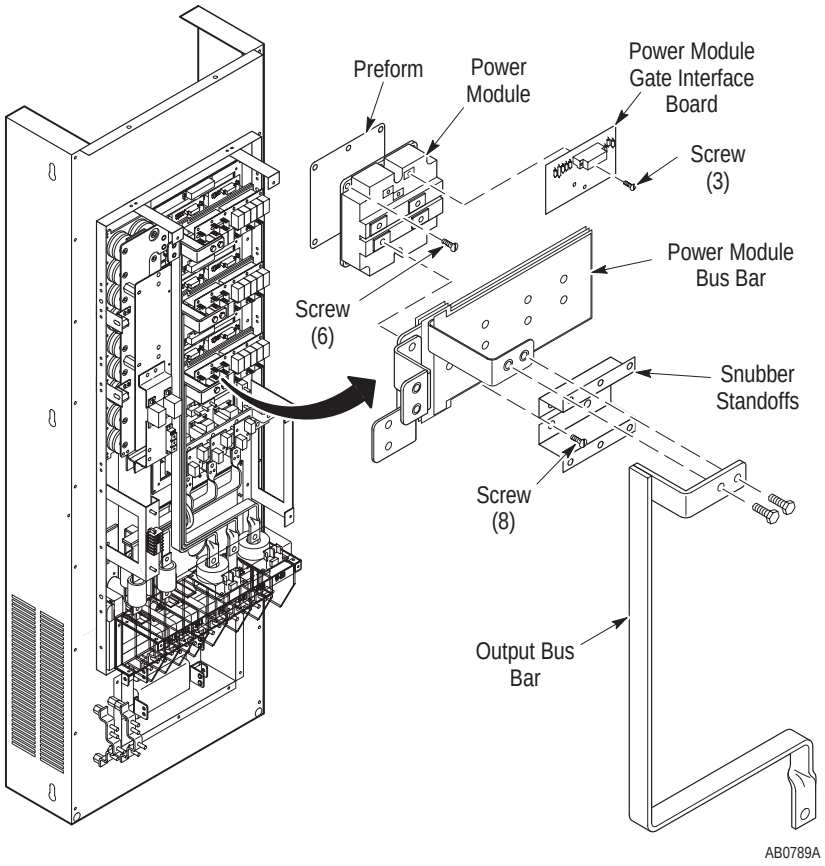
Install the Thermistor in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Power Modules

The Power Modules are located near the top of the heat sink. If one or more Power Modules is replaced, you must check the Power Module Snubber Board and the Precharge Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board.

Figure 5.5 Power Modules



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to IMPACT (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and IMPACT (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the six bolts fastening the three Output Bus Bars to the Power Module Assembly and TB1.
7. Remove the Power Module Snubber Boards. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.
8. Remove the bolts fastening the Power Module Bus Bar to the Bus Capacitor Bank.

9. Remove the eight screws fastening the Snubber Standoffs to the Power Module Bus Bar. Remove the standoffs.
10. Slide the Power Module Bus Bar to the right and remove the bus bar from the drive.
11. Remove the three screws fastening the Power Module Interface Board to the Power Module.
12. Remove the six screws fastening the Power Module to the heat sink.
13. Pull the Power Module away from the heat sink.

Installation

1. Clean all surfaces between the Power Module and the heat sink using a soft, clean cloth.
2. Replace the Preform between the Power Module and the heat sink.
3. Install the Power Module in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

Important: Remove the copper shorting strip from the Power Module before replacing the Power Module Interface Board.

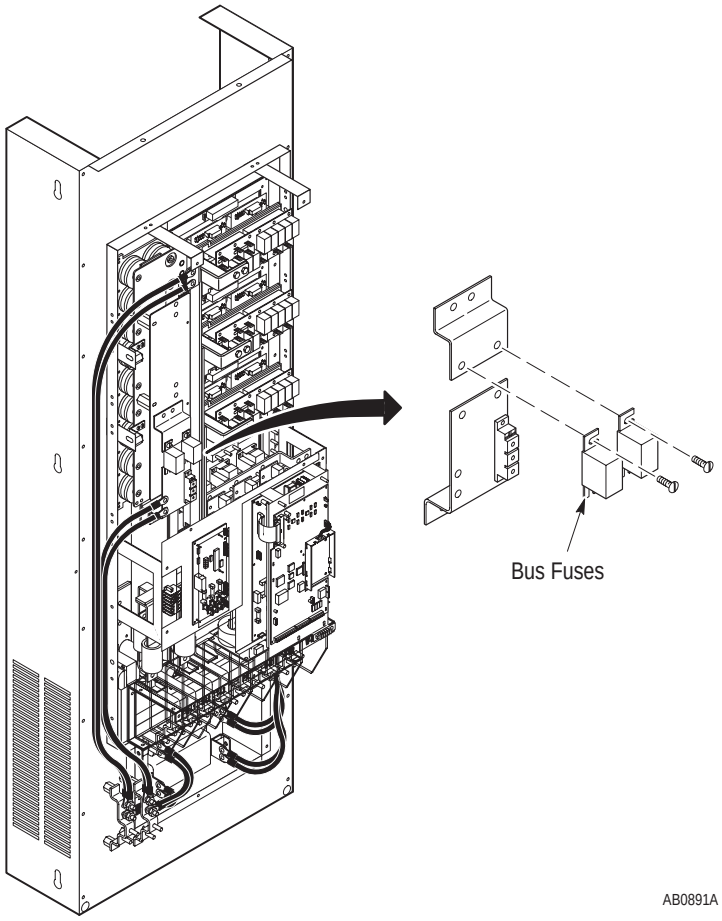
ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Bus Fuses F1

The Bus Fuses are located on the Bus Capacitor Bank Assembly.

Figure 5.6 Bus Fuses F1



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the screws fastening the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the screws fastening the two Bus Fuses to the drive.
6. Pull the fuses out from the drive.

Important: When one fuse blows, you must replace both fuses. Also replace the Bus Fuse Diode Module in parallel.

Installation

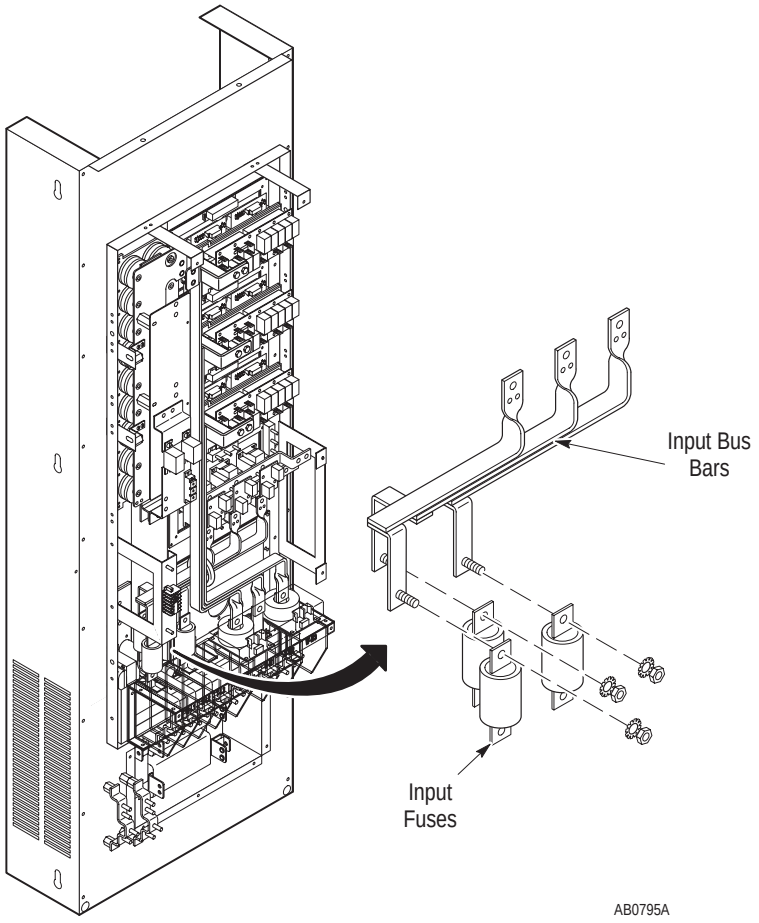
Install the Bus Fuses in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Input Fuses

The Input Fuses are located on the bottom left-hand side of the chassis above TB1.

Figure 5.7 Input Fuses



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the nuts fastening the Input Fuse to the Input Bus Bar and TB1.
5. Pull the blown fuse out from the drive.

Installation

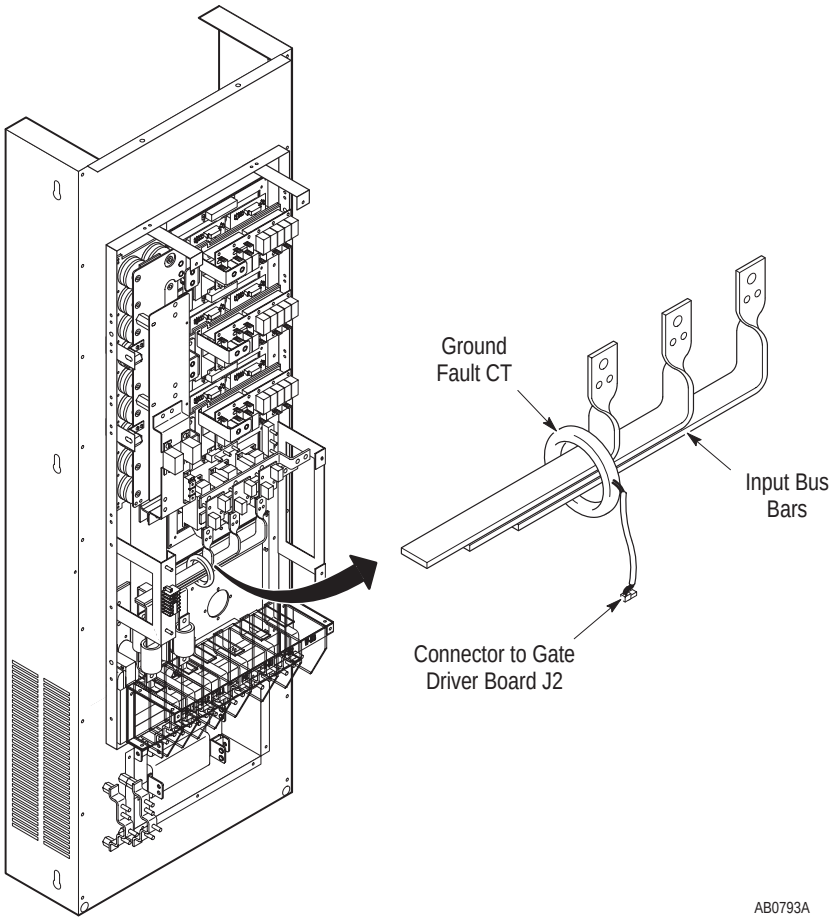
Install the Input Fuse in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Ground Fault CT

The Ground Fault CT encircles the Input Bus Bars and is located between the Input Fuse Assembly and the Input Rectifier Assembly.

Figure 5.8 Ground Fault CT



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the screws fastening the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the six screws fastening the Input Rectifier wiring to the Input Bus Bars.
7. Remove the six bolts fastening the Input Bus Bars to the Input Rectifier Assembly and the Input Fuse Assembly.
8. Slide the Input Bus Bars to the right to remove the bus bars and the Ground Fault CT, which encircles the bus bars, from the drive.
9. Slide the Ground Fault CT off the bus bars.

Installation

Install the Ground Fault CT in reverse order of removal, inserting the Input Bus Bars through the center of the Ground Fault CT. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

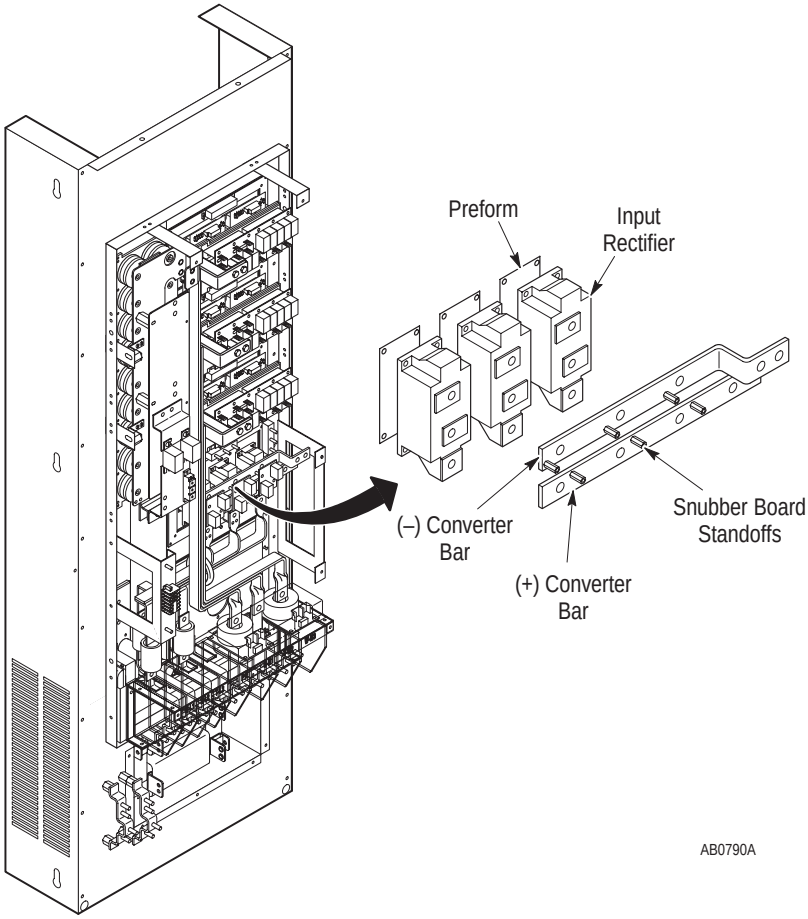
ATTENTION: A possible short-circuit hazard exists. Position the fuse-to-inductor wire with the shrink-wrapped end of the wire connected to the Bus Inductor. Failure to position the wire as illustrated may result in serious injury or equipment damage.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Input Rectifiers

The Input Rectifiers are located toward the bottom of the heat sink.

Figure 5.9 Input Rectifiers



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the Input Rectifier Snubber Boards. Refer to Chapter 3 – Disassembly and Access Procedures, Removing an Input Rectifier Snubber Board.
7. Remove the three bolts fastening the Input Bus Bars to the Input Rectifiers.
8. Remove the six Allen-head screws fastening the positive and negative Converter Bus Bars to the Input Rectifiers.
9. Remove the Precharge Wiring Harness from the top of the rectifiers.
10. Remove four screws fastening the Input Rectifier to the heat sink.
11. Pull the Input Rectifier away from the heat sink.

Installation

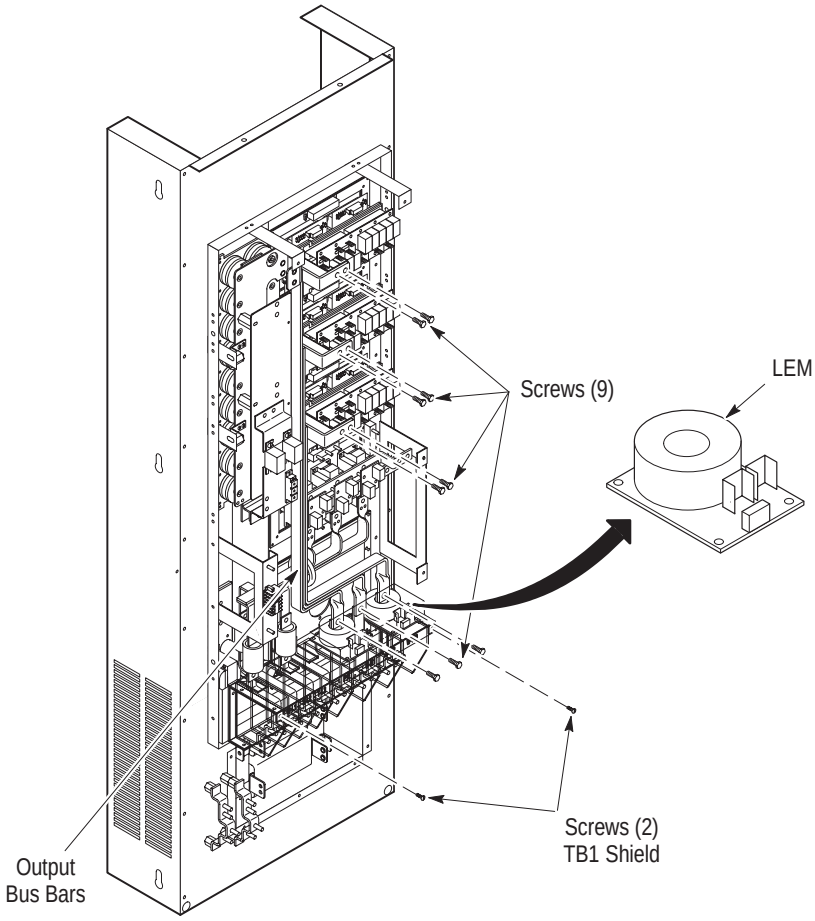
1. Clean all surfaces between the Input Rectifier and the heat sink using a soft, clean cloth.
2. Replace the Preform between the Input Rectifier and the heat sink.
3. Install the Input Rectifier in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

LEMs

The two LEMs are located above TB1 on the right side of the chassis.

Figure 5.10 LEMs



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to IMPACT (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and IMPACT (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the nine bolts fastening the Output Bus Bars to the Power Module Assembly and TB1.
7. Pull the Output Bus Bars out from the drive.
8. Remove the two screws fastening the TB1 shield to the TB1 Assembly.
9. Pull the TB1 shield away from the drive.

10. Remove the four screws fastening the LEM Interface Board to the standoffs.

11. Lift the LEM up and away from the drive.

Installation

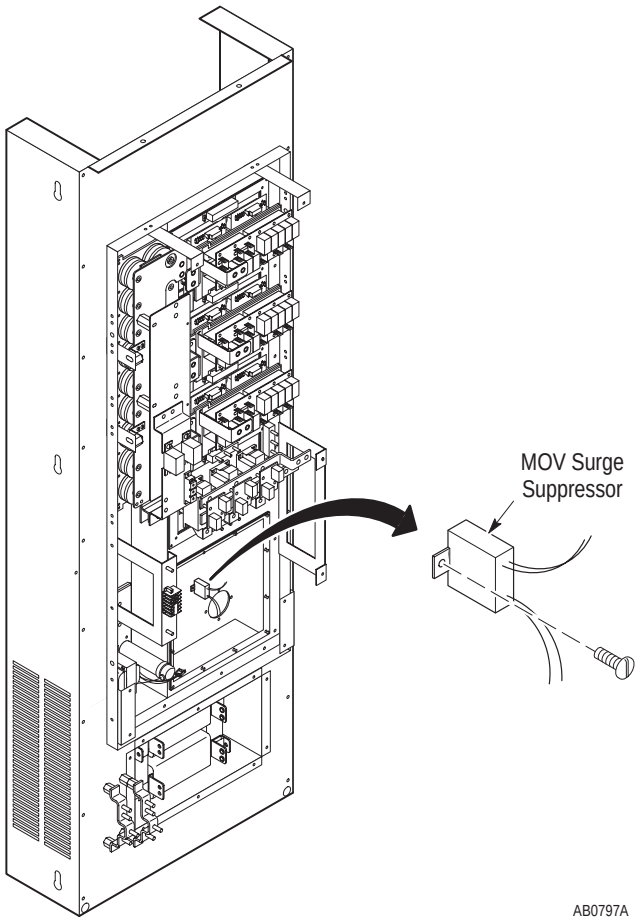
Install the LEMs in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

MOV Surge Suppressor

The MOV Surge Suppressor is located on top of the Fan Cover Plate. The MOV protects the drive from high voltage surges above approximately 1,000 volts. Replace it if it is burned, expanded, or ruptured after such events as a lightning strike, or inadvertent connection of the drive input to a voltage source substantially above nameplate voltage.

Figure 5.11 MOV Surge Suppressor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the three screws fastening the MOV Surge Suppressor wires to the Input Bus Bars.
7. Remove the screw fastening the MOV Surge Suppressor wire to TB1 terminal PE.
8. Remove the screw fastening the MOV Surge Suppressor to the chassis.
9. Pull the MOV Surge Suppressor from the drive.

Installation

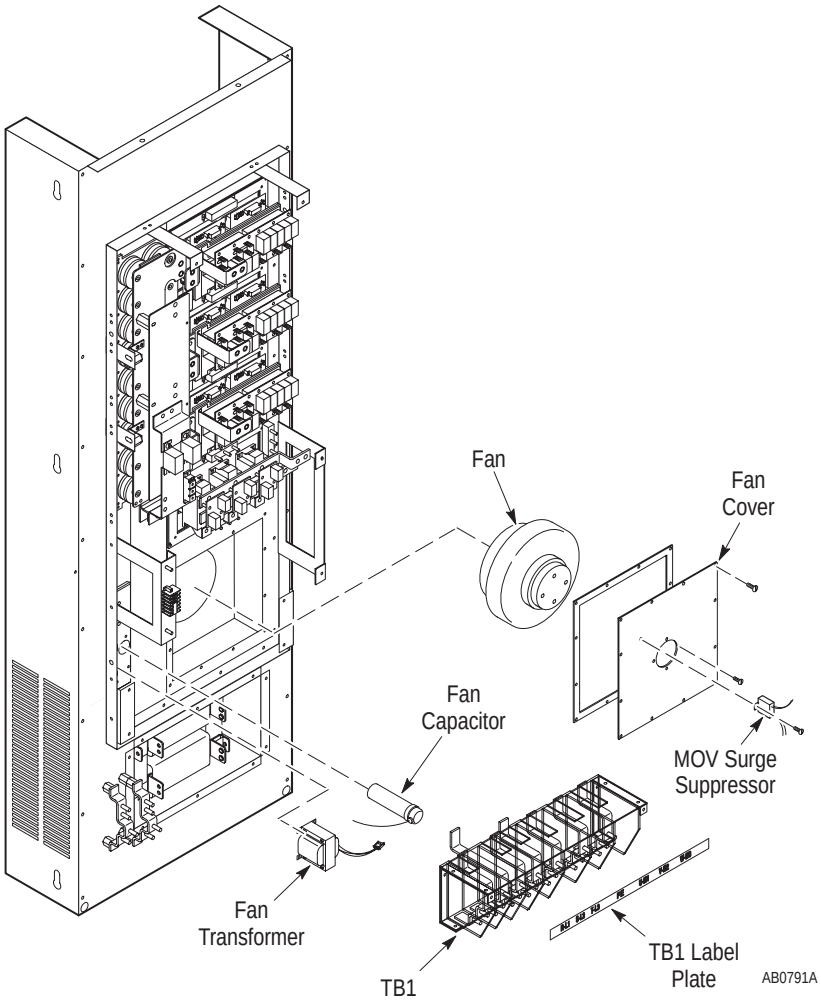
Install the MOV Surge Suppressor in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Fan and Transformer Assembly

The Fan is located in the chassis and under TB1 at the bottom of the heat sink. The Fan Transformer and Fan Capacitor are located in the bottom left corner of the chassis.

Figure 5.12 Fan and Transformer



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to plus (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the Main Chassis:

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the High Voltage Guard from the drive. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the High Voltage Guard.
5. Remove the Circuit Board Platform. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Circuit Board Platform.
6. Remove the nine bolts fastening the Output Bus Bars to the Power Module Assembly and TB1.
7. Pull the Output Bus Bars away from the drive.
8. Remove the Input Fuses. Refer to the removal instructions for Input Fuses in this chapter.
9. Remove the three bolts fastening the Input Bus Bars to the Input Rectifier and remove the six screws on the Input Bus Bars.

10. Remove the Input Bus Bars, with the Ground Fault CT encircling the bars, from the drive.

11. Remove the MOV Surge Suppressor. Refer to the removal instructions for the MOV Surge Suppressor in this chapter.

Remove TB1:

1. Remove the nut located on the lowest stud on Terminal PE.

2. Remove the four screws fastening the TB1 Assembly to the drive.

3. Pull the complete TB1 Assembly, with the shield and LEMS attached, away from the drive.

Access the Fan:

1. Disconnect the Fan Wiring Harness.

2. Remove the screws fastening the Fan Cover to the chassis.

3. Pull the Fan Cover assembly away from the drive.

4. Remove the screws fastening the fan to the Fan Cover to remove the fan.

5. Disconnect the Fan Capacitor from the Fan Wiring Harness.

6. Unscrew the Fan Capacitor from the chassis by hand.

7. Disconnect the Fan Transformer from the Fan Wiring Harness.

8. Remove the screws fastening the Fan Transformer to the chassis.

Installation

Install the Fan Assembly in reverse order of removal, with the following exceptions:

- Thread the fan wiring connector through the hole in the Fan Cover.
- Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.
- Install the Fan Capacitor to the chassis with M8 split washer and hand tighten.
- Connect the Fan Transformer red wire to TB1 terminal S-L2 and the black wire to TB1 terminal R-L1.

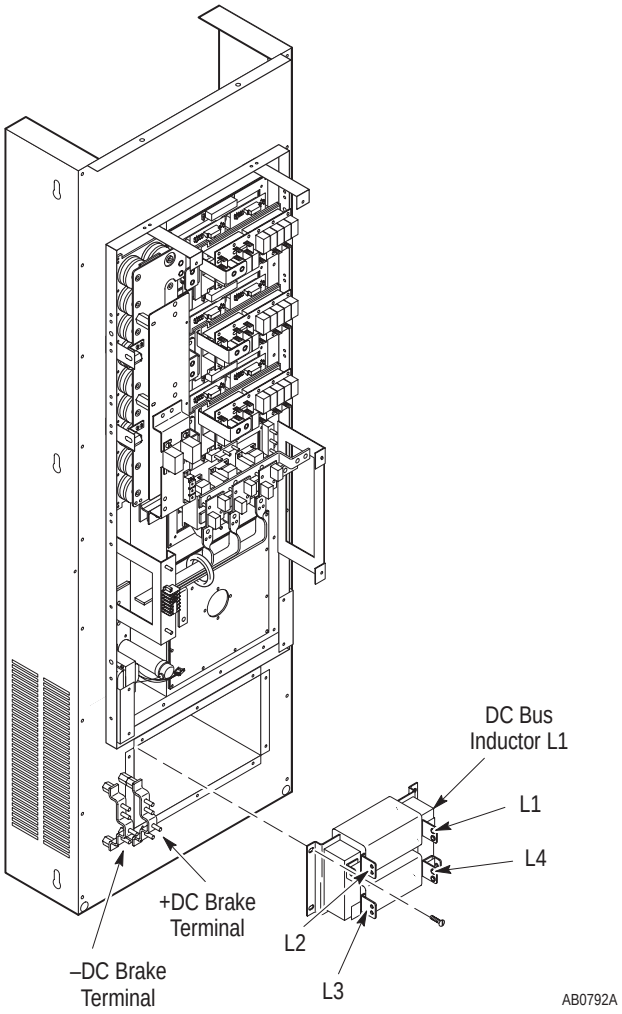
Important: Install washers on TB1 terminals with the serrated side up.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

DC Bus Inductor L1

DC Bus Inductor L1 is located at the bottom of the drive.

Figure 5.13 DC Bus Inductor L1



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the +DC/–DC Brake Terminals. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Check for zero volts at the +DC/–DC Brake Terminals.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect AC input and motor output wiring from TB1 to provide easy access to the DC Bus Inductor enclosure.

ATTENTION: The DC Bus Inductor weighs 100 lbs. Failure to use extreme caution in handling this part may result in serious injury.

5. Remove the eight bolts fastening the Bus Bar Cables to the DC Bus Inductor terminals.
6. Remove the four bolts fastening the DC Bus Inductor to the back panel of the chassis.
7. Remove the Bus Inductor from the drive.

Installation

Install DC Bus Inductor L1 in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: If you mount the inductor remotely, verify the connections between the Bus Inductor, the Input Rectifier Bus Bars and the DC Brake Terminals. L1 of inductor should connect to the (+) Input Rectifier Bus Bar, L2 to the +DC Brake Terminal, L3 to the –DC Brake Terminal, and L4 to the (–) Input Rectifier Bus Bar. Refer to Chapter 4 – Component Test Procedures, Test 5 – Testing the Input Rectifiers.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

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Replacement Parts List

Chapter Objectives

This chapter illustrates and lists replacement parts for the 1336 IMPACT Drives rated BP250 – BP450, and describes replacement parts ordering procedures.

The following illustration and table show you parts, part names, part numbers, locations, and chapters for replacement procedures.

Ordering Replacement Parts

For your convenience, the Rockwell Automation Drives Division and the Rockwell Automation Support Division provide efficient and convenient repair and exchange for eligible equipment.

A product service report number is required to return any equipment for repair. Your local Rockwell Automation distributor or area sales and support office can provide you with a product service report number.

You should return equipment to be repaired to the area sales and support center nearest you. Reference the product service report number on the carton and packing slip. Include:

- Your company name
- Your company address
- The repair purchase order number
- A brief description of the problem

Contact your local Rockwell Automation distributor or sales office for a complete listing of area sales and support centers near you.

For parts catalog numbers, refer to the 1336 IMPACT Spare Parts Pricing publication included with your drive documentation set. See next page for more information.

Spare Parts Information

Current 1336 IMPACT drive spare parts information including recommended parts, catalog numbers and pricing can be obtained from the following sources:

Allen-Bradley home page on the World Wide Web at

http://www.ab.com

then select . . .

"**Drives and Motors**" *followed by . . .*

"**1336 IMPACT" from the Product Directory** *and . . .*

"**Technical Support . . .**"

Select "Parts List"

Replacement Parts Listing

Figure 6.1 Parts for BP250 – BP450 Drives

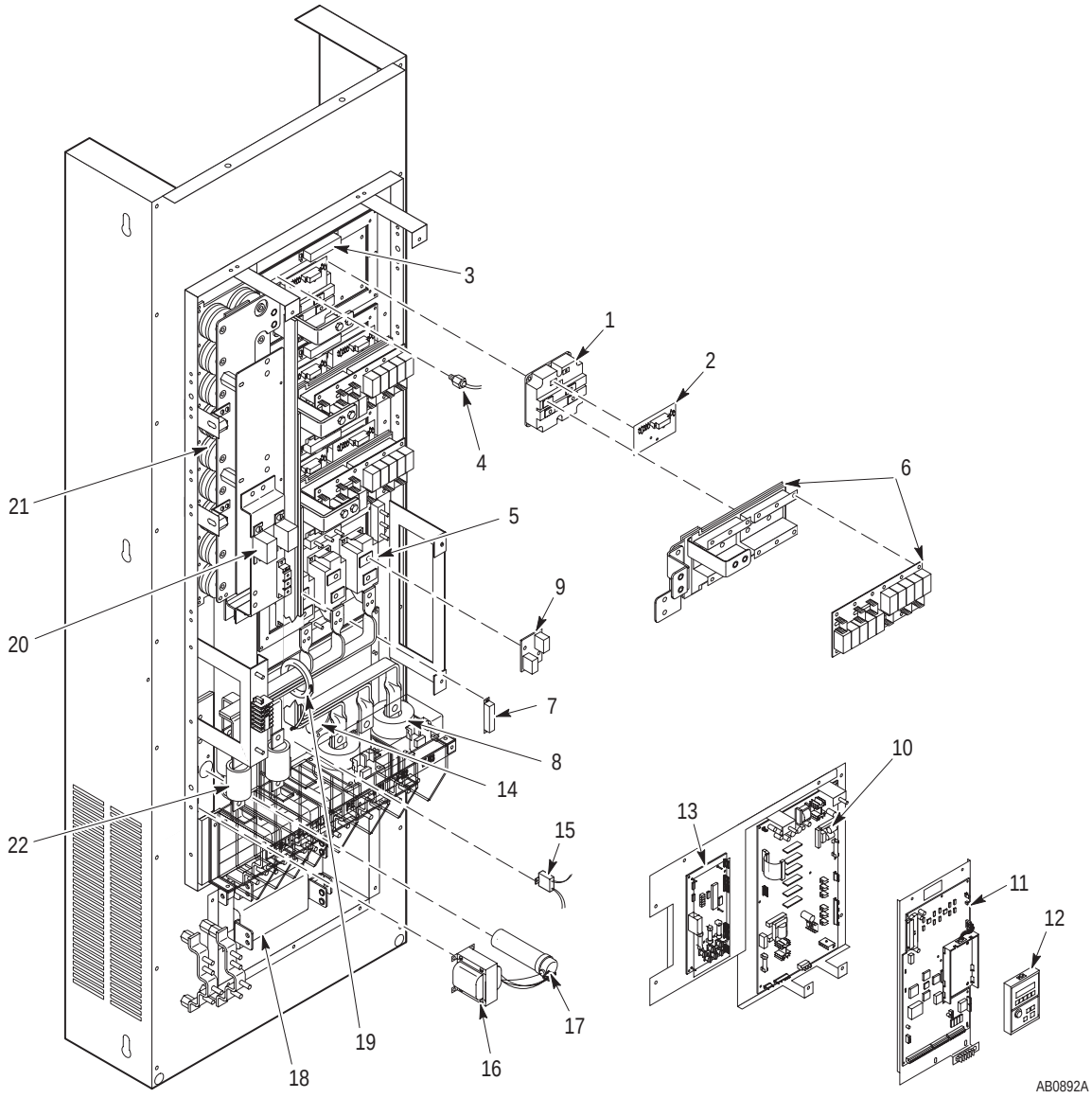

Table 6.A Replacement Parts for BP250 – BP450 Drives

Callout	Symbol	Description	Location	Replacement Procedures
1	Q1 – Q6	Transistor (Power Module)	Heat Sink	Chapter 5, Power Modules
2	A23 – A28	Power Module Gate Interface Board	Power Module	Chapter 5, Power Modules
3	R20 – R22	Power Module Snubber Resistor	Heat Sink	Chapter 3, Removing a Power Module Snubber Board
4	NTC1	Thermistor	Heat Sink	Chapter 5, Thermistor
5	SCR1 – SCR3	Input Rectifier	Heat Sink	Chapter 5, Input Rectifiers
6	A20 – A22	Power Module Bus Bar and Snubber Board	Power Module	Chapter 3, Removing a Power Module Snubber Board
7	R1 – R3	Load-Sharing Resistor	Heat Sink	Chapter 5, Bus Capacitor Bank
8	CT1, CT2	LEM	TB1	Chapter 5, LEMs
9	A11 – A13	Input Rectifier Snubber Board	Input Rectifier	Chapter 3, Removing the Input Rectifier Snubber Board
10	A1	Gate Driver Board	Circuit Board Platform	Chapter 3, Removing the Gate Driver Board from the Mounting Plate
11	MAIN CONTROL BOARD	Main Control Board	Main Control Board Mounting Plate	Chapter 3, Removing the Main Control Board from the Mounting Plate
12	HIM	Human Interface Module	Enclosure Cover	Chapter 1, Module Removal
13	A10	Precharge Board	Circuit Board Platform	Chapter 3, Removing the Precharge Board from the Mounting Plate
14	FAN	Fan	Main Chassis	Chapter 5, Fan and Transformer
15	MOV1	MOV Surge Suppressor	Fan Cover Plate	Chapter 5, MOV Surge Suppressor
16	T1	Fan Transformer	Main Chassis	Chapter 5, Fan and Transformer
17	C-HB1	Fan Capacitor	Main Chassis	Chapter 5, Fan and Transformer
18	L1	DC Bus Inductor	Main Chassis	Chapter 5, DC Bus Inductor L1
19	CT3	Ground Sense CT	Input Bus Bar	Chapter 5, Ground Sense CT
20	F1	Bus Fuses	Capacitor Bus Bank	Chapter 5, Bus Fuses F1
21	C1 – C10	Bus Capacitors	Main Chassis	Chapter 5, Bus Capacitor Bank
22	CF1 – CF3	Input Fuses	Input Bus Bars	Chapter 5, Input Fuses

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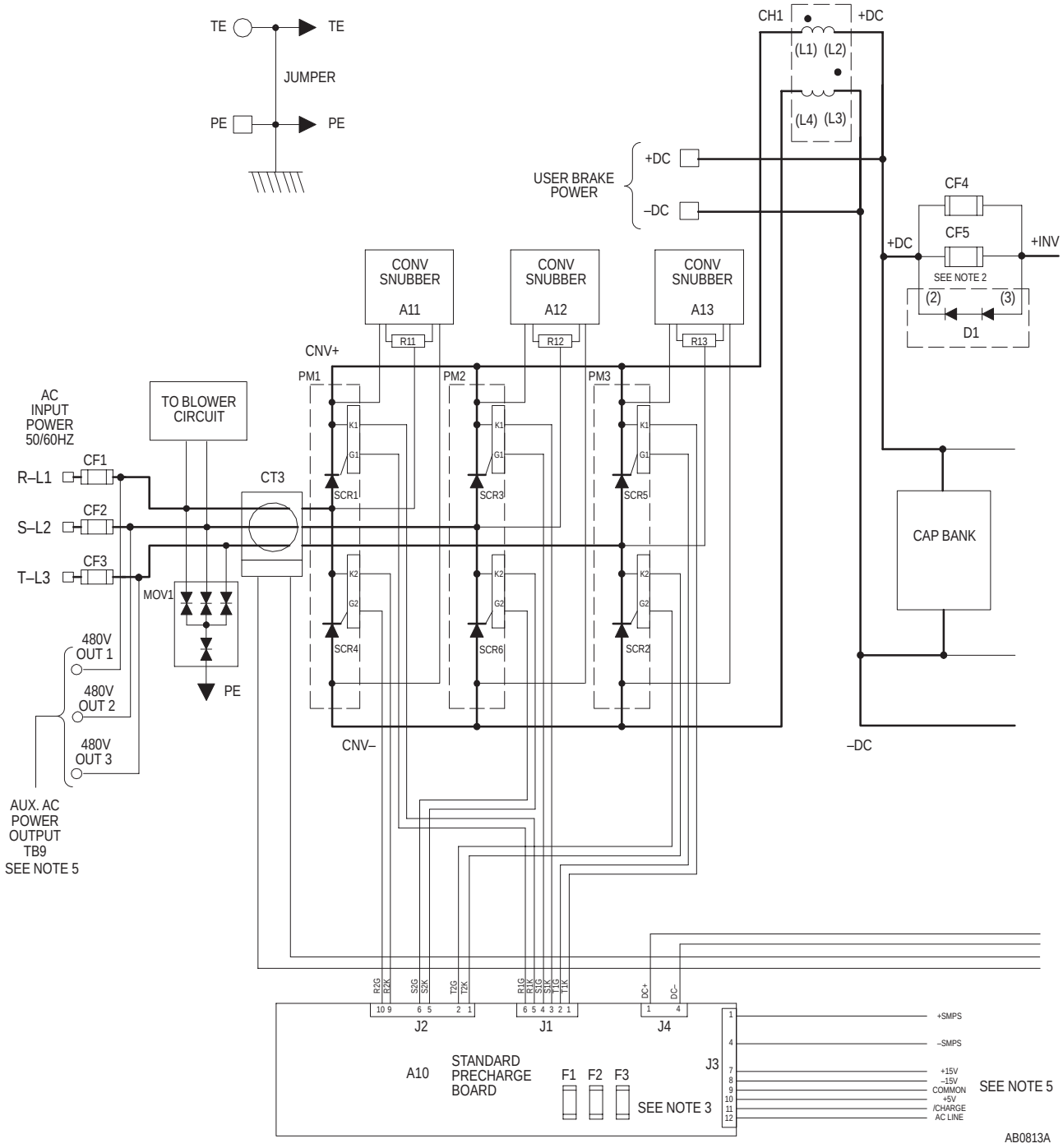
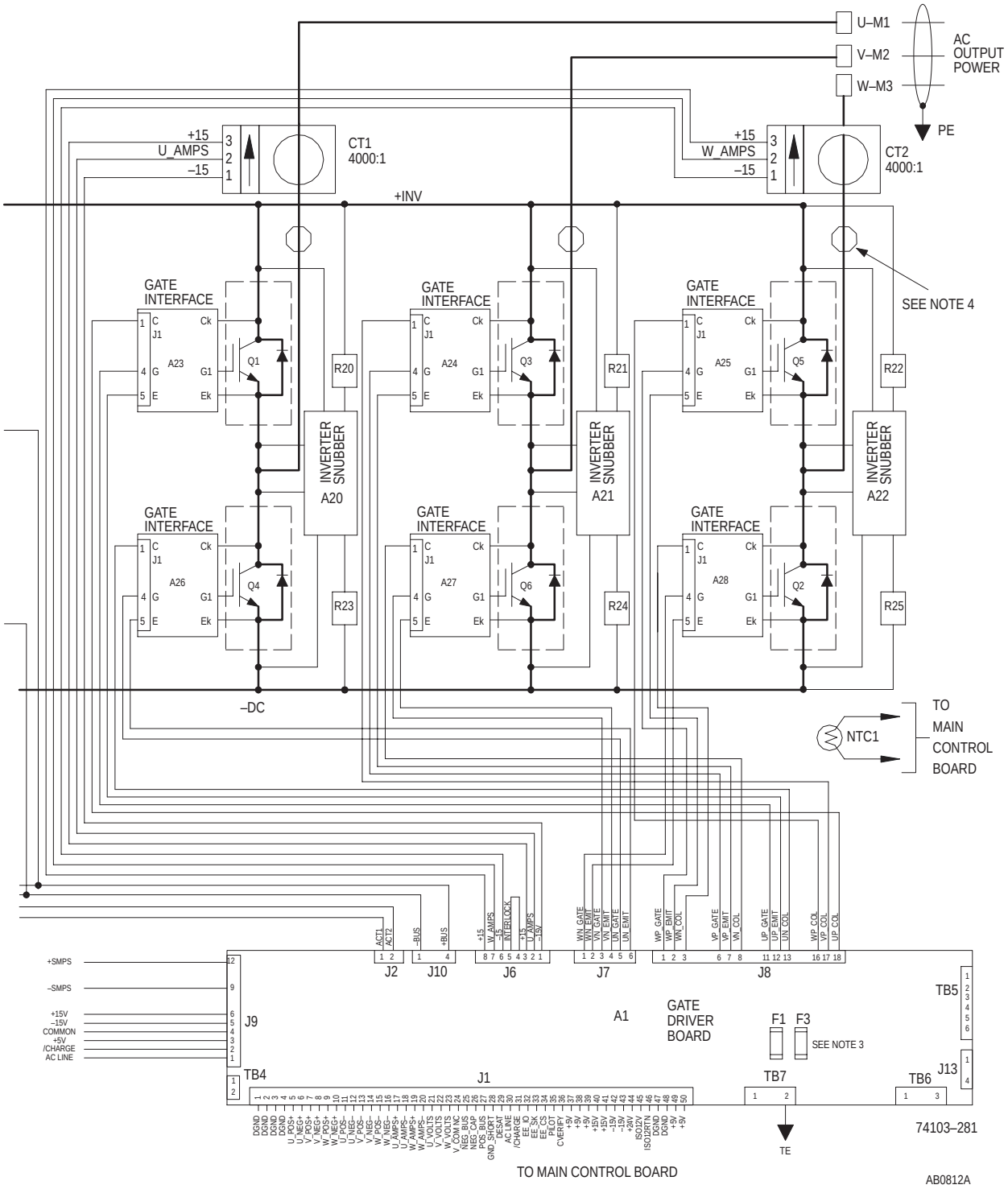
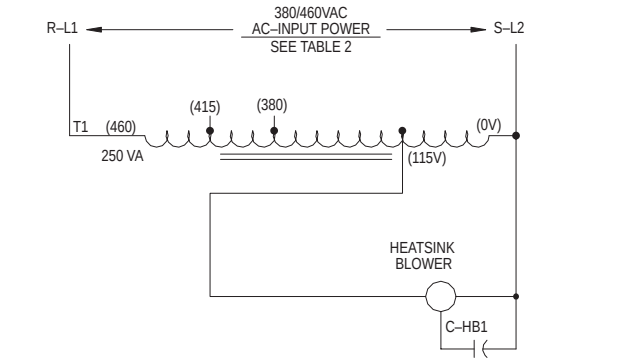
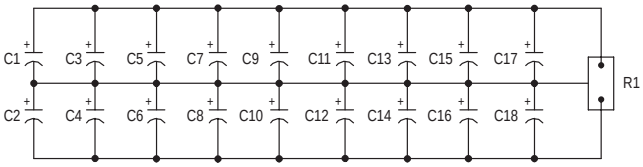
Schematics — 250 – 450 HP 1336 IMPACT Drives


TE
TE
JUMPER
PE
PE
CH1
+DC
(L1) (L2)
(L4) (L3)
USER BRAKE POWER
+DC
–DC
CF4
CF5
SEE NOTE 2
(2)
(3)
D1
+DC
+INV
CONV SNUBBER A11
CONV SNUBBER A12
CONV SNUBBER A13
R11
R12
R13
CNV+
PM1
PM2
PM3
AC INPUT POWER 50/60HZ
TO BLOWER CIRCUIT
CF1
CF2
CF3
R–L1
S–L2
T–L3
CT3
MOV1
PE
K1
G1
K2
G2
SCR1
SCR3
SCR5
SCR4
SCR6
SCR2
CAP BANK
480V OUT 1
480V OUT 2
480V OUT 3
AUX. AC POWER OUTPUT TB9
SEE NOTE 5
CNV–
–DC
R2G
R2K
S2G
S2K
T2G
T2K
R1G
R1K
S1G
S1K
T1G
T1K
DC+
DC-
J2
J1
J4
A10
STANDARD PRECHARGE BOARD
F1
F2
F3
SEE NOTE 3
J3
+SMPS
–SMPS
+15V
–15V
COMMON
+5V
/CHARGE
AC LINE
SEE NOTE 5
AB0813A


U–M1
V–M2
W–M3
AC OUTPUT POWER
PE
+15
U_AMPS
–15
CT1
4000:1
+15
W_AMPS
–15
CT2
4000:1
+INV
SEE NOTE 4
GATE INTERFACE
A23
A24
A25
A26
A27
A28
Q1
Q3
Q5
Q4
Q6
Q2
R20
R21
R22
R23
R24
R25
INVERTER SNUBBER
A20
A21
A22
–DC
NTC1
TO MAIN CONTROL BOARD
ACT1
ACT2
–BUS
+BUS
+15
W_AMPS
–15
INTERLOCK
+15
U_AMPS
–15V
WN_GATE
WN_EMIT
VN_GATE
VN_EMIT
WP_GATE
UN_EMIT
WP_GATE
WP_EMIT
WN_COL
VP_GATE
VP_EMIT
VN_COL
UP_GATE
UP_EMIT
UN_COL
WP_COL
VP_COL
UP_COL
J2
J10
J6
J7
J8
+SMPS
–SMPS
+15V
–15V
COMMON
+5V
/CHARGE
AC LINE
J9
A1
GATE DRIVER BOARD
F1
F3
SEE NOTE 3
TB5
TB4
J1
TB7
TB6
J13
TE
74103–281
TO MAIN CONTROL BOARD
AB0812A



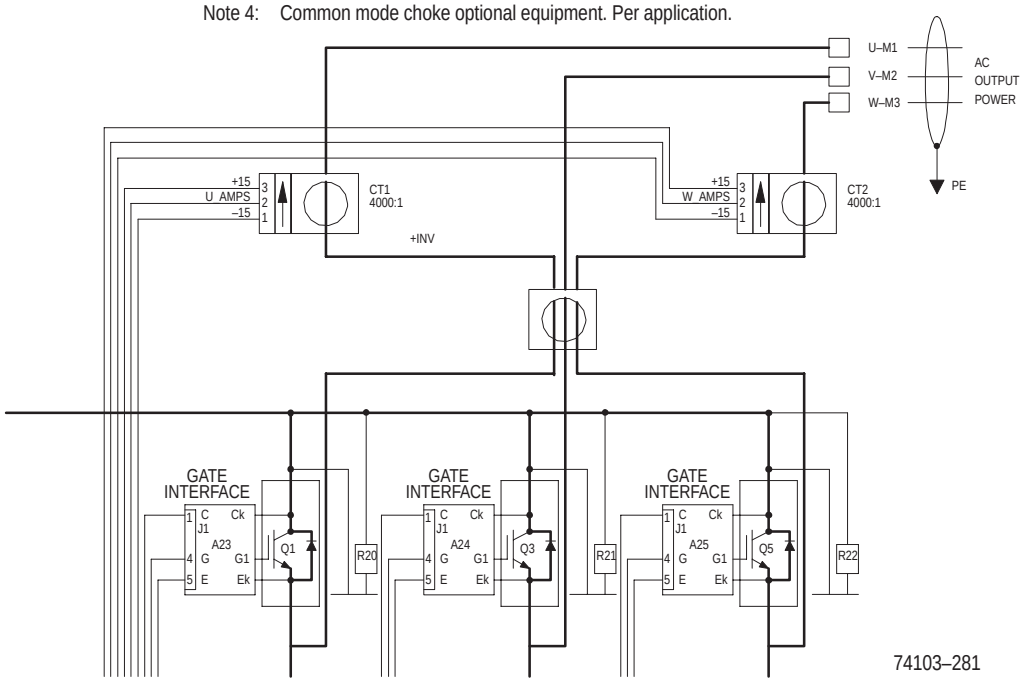


DETAIL 1 – 380/460 VAC

NOTES: – DETAIL 1:

1. C1 THRU C18 ARE 400 VDC CAPACITORS.

Note 4: Common mode choke optional equipment. Per application.



74103–281

AB0814A

Note 1: The Input Line Fuses for this product are supplied in the unit as follows:

HORSEPOWER	380/460VAC FUSE CURRENT/TYPE		
	FUSE INFORMATION		
	RATING	TYPE	P/N
250	450A	A70QS	25178–315–18
300	500A	A70QS	25178–315–19
350	600A	A70QS	25178–315–20
400	600A	A70QS	25178–315–20
450	700A	A70QS	25178–315–21

Note 2: The Inverter Bus Fuse for this product is as follows:

HORSEPOWER	380/460VAC FUSE CURRENT/TYPE		
	FUSE INFORMATION		
	RATING	CATALOG	P/N
ALL	2 x 450A	A65C450–4AB	25178–254–01

Note 3: The following is a listing of all printed circuit assemblies versus fuse and documentation information.

ITEM	B/M	SCHEMATIC DIAGRAM	FUSE INFORMATION			
			DESIGNATOR	RATING	TYPE	P/N
A1	74101–399–XX	74101–167	F1	1.0A/600V	KTK–R–1	25172–260–08
			F3	1.5A/600V	KTK–R–1.5	25172–260–09
A10	74101–181–51	74101–179	F1–F3	1.5A/600V	KTK–R–1.5	25172–260–09
A11–13	74103–867–51	74103–866	NONE			
A20–22	74103–784–51	74103–783	NONE			
A23–28	74103–845–51	74103–844	NONE			

Note 5: The Output Terminal Block (TB9) is only available on F Frame drives. This terminal block provides a three-phase, high voltage connection from the load side of the AC Input Line Fuses. Normally this connection is used to power an external control transformer (user supplied) or other auxiliary circuit. Refer to Figure 1.1 for location.

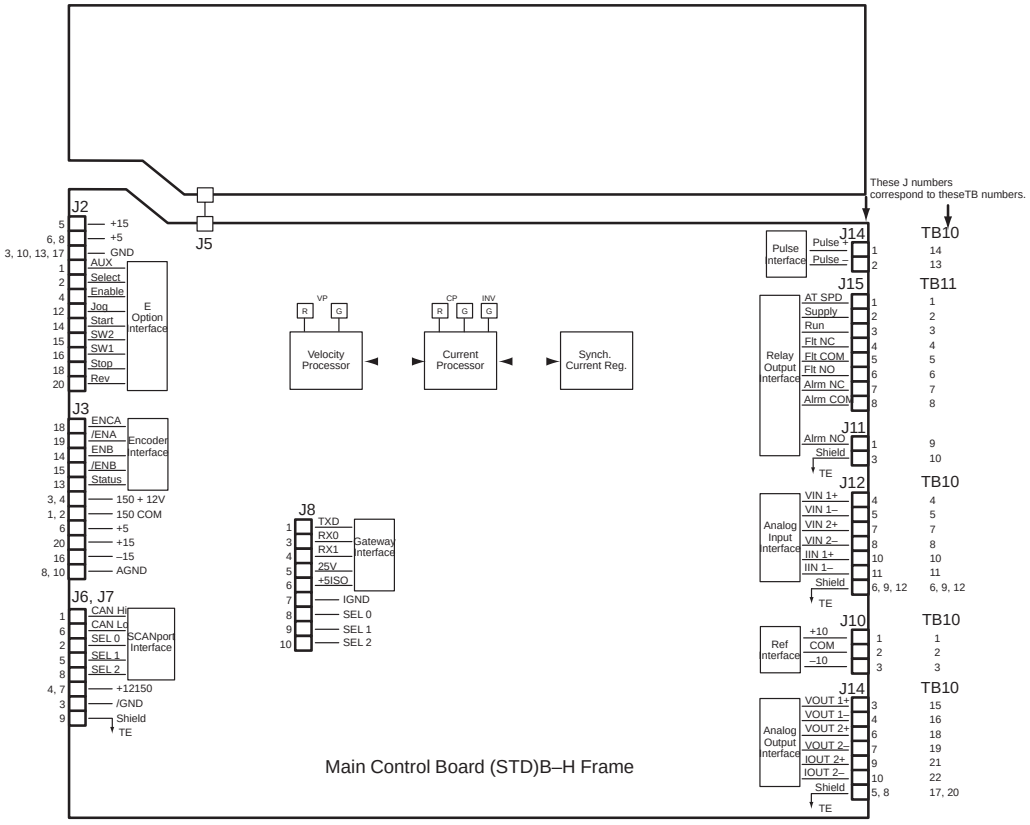
Important: Depending on the circuitry connected, additional fusing may be required.

Attention: The installation of auxiliary circuits must comply with the national codes and standards (NEC, VDE, BSA, etc.) and local codes regarding wire type, conductor size, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

The auxiliary circuit can be utilized to a maximum current capacity of 8 amperes RMS.

The maximum and minimum wire size accepted by TB9 is 4.0 and 0.8 mm (12 and 18 AWG).
Use copper wire only with a minimum temperature rating of 75°C.
Maximum Torque is 0.90 – 1.81 N-m (8 – 16 lb-in.).

AB0815A


These J numbers correspond to these TB numbers.
J2
5 +15
6, 8 +5
3, 10, 13, 17 GND
1 AUX
2 Select
4 Enable
12 Jog
14 Start
15 SW2
16 SW1
18 Stop
20 Rev
E Option Interface
J5
J3
18 ENCA
19 /ENA
14 ENB
15 /ENB
13 Status
Encoder Interface
3, 4 150 + 12V
1, 2 150 COM
6 +5
20 +15
16 –15
8, 10 AGND
J6, J7
1 CAN Hi
6 CAN Lo
2 SEL 0
5 SEL 1
8 SEL 2
SCANport Interface
4, 7 +12150
3 /GND
9 Shield
TE
VP
R G
Velocity Processor
CP INV
R G G
Current Processor
Synch. Current Reg.
J8
1 TXD
3 RX0
4 RX1
5 25V
6 +5ISO
7 IGND
8 SEL 0
9 SEL 1
10 SEL 2
Gateway Interface
Main Control Board (STD)B–H Frame
Pulse Interface
J14
Pulse +
Pulse –
1 14
2 13
TB10
J15
AT SPD
Supply
Run
Flt NC
Flt COM
Flt NO
Alrm NC
Alrm COM
1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
TB11
Relay Output Interface
J11
Alrm NO
Shield
TE
1 9
3 10
J12
VIN 1+
VIN 1–
VIN 2+
VIN 2–
IIN 1+
IIN 1–
Shield
TE
4 4
5 5
7 7
8 8
10 10
11 11
6, 9, 12 6, 9, 12
TB10
Analog Input Interface
J10
+10
COM
–10
1 1
2 2
3 3
TB10
Ref Interface
J14
VOUT 1+
VOUT 1–
VOUT 2+
VOUT 2–
IOUT 2+
IOUT 2–
Shield
TE
3 15
4 16
6 18
7 19
9 21
10 22
5, 8 17, 20
TB10
Analog Output Interface

G

H

I

J

L

M

N

O

P

R

S

T

W

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