Allen-Bradley

1336 IMPACT™
Adjustable Frequency AC Drive
(Series A)

A040 – A060
B060 – B125, BX150
C075 – C125

Troubleshooting Guide
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.

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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.
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.
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    - Installation
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    - Removal
    - Installation
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    - Removal
    - Installation
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    - Removal
    - Installation
  - Removing the Gate Driver Board
    - Removal
    - Installation
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<td>Ordering Replacement Parts</td>
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**Replacement Parts List**

Schematics — 40 – 150 HP 1336 IMPACT Drives

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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 A040 – A060, B060 – B125, BX150, and C075 – C125.

Who Should Use This Manual
This manual is intended for qualified service personnel responsible for 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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
**ATTENTION:** Hazard of electric shock exists. Up to 1,000 VDC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

---

**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.

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**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.

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**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 Main Control Board Mounting Plate. 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

Nameplate located on tab of Main Control Board Mounting Plate.
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

<table>
<thead>
<tr>
<th>Bulletin No.</th>
<th>Rating Enclosure (Must Be Specified)</th>
<th>Language Module (Must Be Specified)</th>
<th>L Option (Optional)</th>
<th>Human Interface (Optional)</th>
<th>Communication Card (Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1336E</td>
<td>– A040 AN</td>
<td>– EN</td>
<td>– L6</td>
<td>– HA1</td>
<td>– GM1</td>
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</table>

#### 200 – 240V AC Input

<table>
<thead>
<tr>
<th>Drive Rating</th>
<th>Enclosures</th>
<th>NEMA Type 1</th>
<th>NEMA Type 4</th>
<th>NEMA Type 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Designation</td>
<td>Output Amps</td>
<td>Nominal HP</td>
<td>Code</td>
<td>Code</td>
</tr>
<tr>
<td>D</td>
<td>120.3</td>
<td>40</td>
<td>A040-AN</td>
<td>A040-AN</td>
</tr>
<tr>
<td></td>
<td>149.2</td>
<td>50</td>
<td>A050-AN</td>
<td>A050-AN</td>
</tr>
<tr>
<td></td>
<td>180.4</td>
<td>60</td>
<td>A060-AN</td>
<td>A060-AN</td>
</tr>
</tbody>
</table>

---

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. Refer to Drive Rating Qualifications on page P–9.
2. Not available.
3. Refer to the Language Module and Options tables following these Catalog Number tables.
### Table P.B

<table>
<thead>
<tr>
<th>Bulletin No.</th>
<th>Rating Enclosure (Must Be Specified)</th>
<th>Language Module (Must Be Specified)</th>
<th>L Option (Optional)</th>
<th>Human Interface (Optional)</th>
<th>Communication Card (Optional)</th>
</tr>
</thead>
</table>

### 380 – 480V AC Input

<table>
<thead>
<tr>
<th>Drive Rating</th>
<th>Enclosures</th>
</tr>
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<tbody>
<tr>
<td><strong>Open</strong> IP00 No Enclosure</td>
<td><strong>NEMA Type 1</strong> IP20 General Purpose</td>
</tr>
<tr>
<td><strong>Frame Designation</strong></td>
<td><strong>Output Amps</strong></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>96.9</td>
</tr>
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<td>120.3</td>
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<td></td>
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<td>180.4</td>
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<td>180.4</td>
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</table>

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. Refer to Drive Rating Qualifications on page P–9.
2. Not available.
3. Refer to the Language Module and Options tables following these Catalog Number tables.
### Table P.C

<table>
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<tr>
<th>Bulletin No.</th>
<th>Rating Enclosure (Must Be Specified)</th>
<th>Language Module(^\text{[3]}) (Must Be Specified)</th>
<th>L Option(^\text{[3]}) (Optional)</th>
<th>Human Interface(^\text{[3]}) (Optional)</th>
<th>Communication Card(^\text{[3]}) (Optional)</th>
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<table>
<thead>
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<th>Frame Designation</th>
<th>Output Amps</th>
<th>Nominal HP</th>
<th>Code</th>
<th>Code</th>
<th>Code</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>D</td>
<td>85.8</td>
<td>75</td>
<td>C075–AN</td>
<td>C075–AA</td>
<td>[2]</td>
<td>[2]</td>
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<tr>
<td></td>
<td>109.1</td>
<td>100</td>
<td>C100–AN</td>
<td>C100–AA</td>
<td>[2]</td>
<td>[2]</td>
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<tr>
<td></td>
<td>138.6</td>
<td>125</td>
<td>C125–AN</td>
<td>C125–AA</td>
<td>[2]</td>
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<table>
<thead>
<tr>
<th>Enclosures</th>
<th>Open IP00 No Enclosure</th>
<th>NEMA Type 1 IP20 General Purpose</th>
<th>NEMA Type 4 IP56 Resist Water, Dust</th>
<th>NEMA Type 12 IP54 Industrial Use</th>
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<tbody>
<tr>
<td>Code</td>
<td>Code</td>
<td>Code</td>
<td>Code</td>
<td>Code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2]</td>
<td>[2]</td>
<td>[2]</td>
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</tbody>
</table>

\[1\] 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. Refer to Drive Rating Qualifications on page P–9.

\[2\] Not available.

\[3\] Refer to the Language Module and Options tables following these Catalog Number tables.
### Table P.D

<table>
<thead>
<tr>
<th>Language Modules</th>
<th>Description</th>
<th>Option Code</th>
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<tr>
<td>English/English</td>
<td>EN</td>
<td></td>
</tr>
<tr>
<td>English/French</td>
<td>FR</td>
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</tr>
<tr>
<td>English/German</td>
<td>DE</td>
<td></td>
</tr>
<tr>
<td>English/Italian</td>
<td>IT</td>
<td></td>
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<tr>
<td>English/Japanese</td>
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<td></td>
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<tr>
<td>English/Spanish</td>
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\[1\] Not available at time of printing.

### Table P.E

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<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>HAB</td>
<td>Blank – No Functionality</td>
<td>GM1</td>
<td>Single Point Remote I/O</td>
</tr>
<tr>
<td>HAP</td>
<td>Programmer Only</td>
<td>GM2</td>
<td>RS-232/422/485, DF1, &amp; DH485 Protocol</td>
</tr>
<tr>
<td>HA1</td>
<td>Programmer, LCD/Analog Pot</td>
<td>GM5</td>
<td>DeviceNet</td>
</tr>
<tr>
<td>HA2</td>
<td>Programmer, LCD/Digital Pot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>HFB</td>
<td>Blank – No Functionality</td>
</tr>
<tr>
<td>HFP</td>
<td>Programmer Only</td>
</tr>
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<td>HF1</td>
<td>Programmer, LCD/Analog Pot</td>
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<tr>
<td>HF2</td>
<td>Programmer, LCD/Digital Pot</td>
</tr>
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<table>
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<th>Description</th>
</tr>
</thead>
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<td>HJP</td>
<td>Programmer Only</td>
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<tr>
<td>HJ1</td>
<td>Programmer, LCD/Analog Pot</td>
</tr>
<tr>
<td>HJ2</td>
<td>Programmer, LCD/Digital Pot</td>
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</table>

\[1\] For a more functionally complete description of each option, refer to Publication 1336 IMPACT-1.0.
### Table P.F
#### 200 – 240 Drives

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<thead>
<tr>
<th>Catalog Number</th>
<th>Maximum Amp Rating</th>
<th>Derate Curve</th>
<th>Heat Dissipation Drive Watts</th>
<th>Heat Sink Watts</th>
<th>Total Watts</th>
</tr>
</thead>
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<tr>
<td>A040</td>
<td>120</td>
<td></td>
<td>361</td>
<td>1708</td>
<td>2069</td>
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<tr>
<td>A050</td>
<td>150</td>
<td></td>
<td>426</td>
<td>1944</td>
<td>2370</td>
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<tr>
<td>A060</td>
<td>180</td>
<td></td>
<td>522</td>
<td>2664</td>
<td>3186</td>
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### Table P.G
#### 380 – 480V Drives

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<th>Catalog Number</th>
<th>Maximum Amp Rating</th>
<th>Derate Curve</th>
<th>Heat Dissipation Drive Watts</th>
<th>Heat Sink Watts</th>
<th>Total Watts</th>
</tr>
</thead>
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<tr>
<td>B060</td>
<td>96</td>
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<td>B075</td>
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<td>B100</td>
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<td>426</td>
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<td>606</td>
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### Table P.H
#### 500 – 600V Drives

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<th>Catalog Number</th>
<th>Maximum Amp Rating</th>
<th>Derate Curve</th>
<th>Heat Dissipation Drive Watts</th>
<th>Heat Sink Watts</th>
<th>Total Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>C075</td>
<td>85</td>
<td></td>
<td>361</td>
<td>1553</td>
<td>1894</td>
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<tr>
<td>C100</td>
<td>109</td>
<td></td>
<td>426</td>
<td>1978</td>
<td>2504</td>
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<tr>
<td>C125</td>
<td>138</td>
<td></td>
<td>522</td>
<td>2162</td>
<td>2683</td>
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</table>

1. Amp Rating is at 4kHz. If carrier frequencies above 4kHz are selected, drive Amp 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. Not available.
5. Refer to 1336 IMPACT User Manual.
Drive Rating Qualifications

Several factors can affect drive rating. If more than one factor exists, derating percentages must be multiplied. For example, if a 14-amp drive is installed at a 2km (6,600 ft.) altitude and has a 2% high-input line voltage, the actual amp rating is:

\[ 14 \times 94\% \text{ altitude derating} \times 96\% \text{ high-input line derating} = 12.6 \text{ amps} \]

Calculate the drive rating using the amp rating of your drive.

Enclosure Type

The first character, A, indicates the Enclosure Code.

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

<table>
<thead>
<tr>
<th>Enclosure Type Code</th>
<th>Description</th>
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<tbody>
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<td>N</td>
<td>Open style (IP00)</td>
</tr>
<tr>
<td>A</td>
<td>NEMA Type 1 (IP20)</td>
</tr>
<tr>
<td>E</td>
<td>NEMA Type 1 (IP20)/EMC</td>
</tr>
<tr>
<td>F</td>
<td>NEMA Type 4 (IP56)</td>
</tr>
<tr>
<td>J</td>
<td>NEMA Type 12 (IP54)</td>
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</tbody>
</table>
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 J10 and J12, located on the lower portion of the Main Control Board. This board is identified as L4, L5, L6, L7E, L8E, or 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 contact input is closed, L5 input terminal registers 24V, or L6 input terminal registers 115V AC.

Related Publications
The following lists other Allen-Bradley publications that apply to the 1336 IMPACT Adjustable Frequency AC Drives.
• Product Pricing Bulletin (1336 IMPACT-3.0)
• User Manual (1336 IMPACT-5.0)
• Renewal Parts List
• Options Manuals/Instructions
• Product Data DriveTools Software (9303-2.0)
• Bulletin 1201 Graphic Programming Terminal User Manual (1201-5.0)

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).
Chapter 1

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 Option Boards 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 +DC and –DC on terminal block TB1. 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.
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
- L7E Contact Closure Interface with Encoder Feedback
- 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 HP and larger drives) must be removed. If these jumpers are removed, they can be stored on the “spares” location of 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”.

![Diagram of jumper locations](image_url)
Available Inputs

The L Option allows a combination of the following functions:

- Accel/Decel Rate
- Digital Potentiometer (MOP)
- Enable
- Flux Enable
- Forward/Reverse
- Jog
- Local Control
- Not Ext Flt
- Not Stop, Clear Fault
- Process Trim
- Ramp
- Reset
- Run Forward
- Run Reverse
- Speed Selects
- Speed Torque Selections
- Start
- 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 effect until power has been cycled to the drive. When changing an L Option 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 Table 1.A 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

<table>
<thead>
<tr>
<th>Start/Stop Type</th>
<th>Direction Control</th>
<th>Communication Compatibility</th>
<th>Mode(s) to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop &amp; Enable Only</td>
<td>None</td>
<td>Control must be provided by HIM or Communication Option.</td>
<td>1</td>
</tr>
<tr>
<td>Momentary Pushbutton (3 Wire)</td>
<td>Maintained Switch (Open-Forward, Closed-Reverse) Single-Source</td>
<td>Start/Stop – works like the HIM and Communication Options. Direction Control will not work with HIM or Communication Options. User must select direction control from either HIM and Communication Options or TB3 input.</td>
<td>2 – 6, 17, 18, and 27(C0019)</td>
</tr>
<tr>
<td>Momentary Pushbutton (3 Wire)</td>
<td>Momentary Pushbuttons (Forward and Reverse) Multi-Source</td>
<td>Start/Stop – works in parallel with HIM and Communication Options. Direction – works in parallel with HIM or Communication Options.</td>
<td>7 – 11, 19 – 22, and 28, 29(C0001)</td>
</tr>
<tr>
<td>Maintained switches for combined run and direction control (2 wire, Run Forward, Run Reverse)</td>
<td></td>
<td>Start – works differently than three-wire control. Direction – works differently than three-wire control. Stop – always works.</td>
<td>12 – 16, 23 – 25, and 30(C0019)</td>
</tr>
</tbody>
</table>

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 the terminal designations for TB3. The maximum and minimum wire sizes accepted by TB3 are 2.1 and 0.30 mm² (14 and 22 AWG). Maximum torque for all terminals is 1.36 N-m (8 – 10 in.-lb). Use copper wire only.

Figure 1.3
TB3 Terminal Designations

Included on L7E, L8E, & L9E Only
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

1. See Table 1.B.
2. Drive must be stopped to take Local Control.
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.
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 the 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

<table>
<thead>
<tr>
<th>Mode</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>2612,13</th>
<th>2912,13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td>Reverse1</td>
<td>Reverse1</td>
<td>Digital</td>
<td>Pot Up</td>
<td>Reverse0</td>
<td>1st Accel</td>
<td>Speed/ Torque 310</td>
<td>Speed/ Torque 310</td>
<td>Speed/ Torque 310</td>
<td>Reverse6</td>
<td>Digital Pot Up</td>
</tr>
<tr>
<td></td>
<td>Forward5</td>
<td>Forward5</td>
<td>Digital</td>
<td>Pot Dn</td>
<td>Forward5</td>
<td>2nd Accel</td>
<td>Speed/ Torque 210</td>
<td>Speed/ Torque 210</td>
<td>Speed/ Torque 210</td>
<td>Forward5</td>
<td>Digital Pot Dn</td>
</tr>
<tr>
<td>Not Ext Fault4,8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common</td>
<td>Jog</td>
<td>Speed Select 31</td>
<td>Speed Select 31</td>
<td>Digital</td>
<td>Pot Up</td>
<td>1st Decel</td>
<td>Speed/ Torque 110</td>
<td>Speed/ Torque 110</td>
<td>Ramp</td>
<td>Speed/ Torque 110</td>
<td>Speed Select 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Digital Pot Up</td>
</tr>
<tr>
<td>Speed Select 21</td>
<td>Speed Select 21</td>
<td>Speed Select 21</td>
<td>Digital</td>
<td>Pot Dn</td>
<td>2nd Decel</td>
<td>Process Trim</td>
<td>Flux</td>
<td>Enable</td>
<td>Reset</td>
<td>Speed Select 21</td>
<td>Speed Select 21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Digital Pot Dn</td>
</tr>
<tr>
<td>Enable3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Single-Source, Two-Wire Control

<table>
<thead>
<tr>
<th>Mode</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>3012,13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td>Local Control2</td>
<td>Stop Type2</td>
<td>2nd/1st Accel</td>
<td>Digital Pot Up</td>
<td>Local Control2</td>
<td>Process Trim</td>
<td>Flux Enable</td>
<td>Process Trim</td>
<td>Jog</td>
<td>Digital Pot Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Ext Fault4,8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common</td>
<td>Speed Select 31</td>
<td>Speed Select 31</td>
<td>2nd/1st Decel</td>
<td>Digital Pot Dn</td>
<td>Stop Type</td>
<td>Reset</td>
<td>Reset</td>
<td>Ramp</td>
<td>Speed Select 3</td>
<td>Digital Pot Dn</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed Select 21</td>
<td>Speed Select 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enable3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
The following table defines the input state of the Speed Select inputs for a desired speed reference source.

<table>
<thead>
<tr>
<th>Speed Select 3</th>
<th>Speed Select 2</th>
<th>Speed Select 1</th>
<th>Frequency Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>Speed Ref 1</td>
</tr>
<tr>
<td>O</td>
<td>O</td>
<td>X</td>
<td>Speed Ref 2</td>
</tr>
<tr>
<td>O</td>
<td>X</td>
<td>O</td>
<td>Speed Ref 3</td>
</tr>
<tr>
<td>O</td>
<td>X</td>
<td>X</td>
<td>Speed Ref 4</td>
</tr>
<tr>
<td>X</td>
<td>O</td>
<td>O</td>
<td>Speed Ref 5</td>
</tr>
<tr>
<td>X</td>
<td>O</td>
<td>X</td>
<td>Speed Ref 6</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>O</td>
<td>Speed Ref 7</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Last State</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Speed / Torque Mode</th>
<th>Speed / Torque Mode</th>
<th>Speed / Torque Mode</th>
<th>Speed / Torque Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select 3</td>
<td>Select 2</td>
<td>Select 2</td>
<td>Speed / Torque Mode:</td>
</tr>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>Zero Torque</td>
</tr>
<tr>
<td>O</td>
<td>O</td>
<td>X</td>
<td>Speed Regulate</td>
</tr>
<tr>
<td>O</td>
<td>X</td>
<td>O</td>
<td>Torque Regulate</td>
</tr>
<tr>
<td>O</td>
<td>X</td>
<td>X</td>
<td>Minimum Torque/Speed</td>
</tr>
<tr>
<td>X</td>
<td>O</td>
<td>X</td>
<td>Maximum Torque/Speed</td>
</tr>
<tr>
<td>X</td>
<td>O</td>
<td>X</td>
<td>Sum of the Torque and Speed</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>O</td>
<td>Zero Torque</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Zero Torque</td>
</tr>
</tbody>
</table>

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 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. For HIM operation, refer to the 1336 IMPACT Field Oriented Control User Manual.

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

```
Stopped
+0.00 RPM
```
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 drive 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 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 may be 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-5.10.
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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
The lights on the motor control board indicate the status of the velocity processor (VP) and current processor (CP):

Table 2.A

<table>
<thead>
<tr>
<th>If the VP or CP LED is:</th>
<th>Then, for that processor:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td>No fault occurred.</td>
</tr>
<tr>
<td>Flashing green</td>
<td>A drive warning occurred.</td>
</tr>
<tr>
<td>Flashing red</td>
<td>A drive soft fault occurred.</td>
</tr>
<tr>
<td>Solid red</td>
<td>A drive hard fault occurred.</td>
</tr>
</tbody>
</table>

Faults fall into three basic categories:

Table 2.B

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

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

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

You can reset the soft faults by pressing the stop button 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**

```
Fault name

Fault queue indicator Fault code number Trip indicator Position in fault queue
```

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**

```
Power Up Marker
```

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.
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 this table.

<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>01027 Autotune Diag</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>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.</td>
<td>Check Autotune Errors (parameter 176). For additional information about Autotune Errors, refer to Chapter 13, Understanding the Autotuning Procedure, in the user manual.</td>
</tr>
<tr>
<td>01051 MtrOvrd Pnd</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A motor overload is pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01052).</td>
<td>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.</td>
</tr>
<tr>
<td>01052 MtrOvrd Trp</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by Motor Overload % (parameter 26).</td>
<td>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.</td>
</tr>
<tr>
<td>01053 Mtr Stall</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>01083 MtrOvrd Pend</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>Motor overload pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01084).</td>
<td>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.</td>
</tr>
<tr>
<td>Fault Code and Text</td>
<td>LED Information</td>
<td>Fault Type</td>
<td>Description</td>
<td>Suggested Action</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------</td>
<td>------------</td>
<td>-------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| 01084 MtrOvld 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. |
<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>02093 InvOvd Pend</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>02095 Inv Overload</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>Inverter (IT) overload. The inverter current has been in excess of 105% of Inverter Amps (parameter 11) too long.</td>
<td>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.</td>
</tr>
<tr>
<td>03008 HW Malfunction</td>
<td>VP, Red 1 blink</td>
<td>Hard</td>
<td>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.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03009 HW Malfunction</td>
<td>VP, Red 2 blink</td>
<td>Hard</td>
<td>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.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03010 HW Malfunction</td>
<td>VP, Red 3 blink</td>
<td>Hard</td>
<td>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.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03011 HW Malfunction</td>
<td>VP, Red 4 blink</td>
<td>Hard</td>
<td>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.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03012 HW Malfunction</td>
<td>VP, Red 5 blink</td>
<td>Hard</td>
<td>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.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03014 EE Checksum</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>The parameter database is corrupt.</td>
<td>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.</td>
</tr>
<tr>
<td>03015 HW Malfunction</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A hardware malfunction has occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03022 Diff Drv Type</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>The main control board has been initialized on a different size drive.</td>
<td>Issue a Reset Defaults command to set the drive parameters back to the default values.</td>
</tr>
<tr>
<td>03023 SW Malfunction</td>
<td>VP, Solid red</td>
<td>Hard</td>
<td>A software malfunction has occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board. If the fault still occurs, replace the gate driver board.</td>
</tr>
<tr>
<td>Fault Code and Text</td>
<td>LED Information</td>
<td>Fault Type</td>
<td>Description</td>
<td>Suggested Action</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------</td>
<td>------------</td>
<td>-------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>03024 SW Malfunction</td>
<td>VP, Solid red</td>
<td>Hard</td>
<td>A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03025 Absolute Overspd</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>03026 Analog Supply Tol</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>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.</td>
<td>Possible faulty analog 15V power supply. The gate driver board or the main control board may require replacement.</td>
</tr>
<tr>
<td>03029 SW Malfunction</td>
<td>VP, Solid red</td>
<td>Hard</td>
<td>A software malfunction has occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03030 SW Malfunction</td>
<td>VP, Solid red</td>
<td>Hard</td>
<td>A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03031 SW Malfunction</td>
<td>VP, Solid red</td>
<td>Hard</td>
<td>A software malfunction has occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>03040 mA Input</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A loss of 4–20mA input has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>03057 Param Limit</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A parameter limit has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>03058 Math Limit</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A math limit has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>03072 mA Input</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>A loss of 4–20mA input has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>Fault Code and Text</td>
<td>LED Information</td>
<td>Fault Type</td>
<td>Description</td>
<td>Suggested Action</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------</td>
<td>------------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td>03089 Param Limit</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>A parameter limit has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>03090 Math Limit</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>A math limit has occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>05048 Spd Fdbk Loss</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>A loss of feedback occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>05054 External Flt In</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>The external fault input from the L Option board is open.</td>
<td>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.</td>
</tr>
<tr>
<td>05080 Spd Fdbk Loss</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>A loss of feedback occurred.</td>
<td>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.</td>
</tr>
<tr>
<td>05086 External Flt In</td>
<td>VP, Flashing green</td>
<td>Warning</td>
<td>The external fault input from the L Option board is open.</td>
<td>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 Warning Select 2 (parameter 23) to 0.</td>
</tr>
<tr>
<td>06041 SP 1 Timeout</td>
<td>VP, Flashing red</td>
<td>Soft</td>
<td>The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).</td>
<td>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.</td>
</tr>
<tr>
<td>Fault Code and Text</td>
<td>LED Information</td>
<td>Fault Type</td>
<td>Description</td>
<td>Suggested Action</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------</td>
<td>------------</td>
<td>-------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| 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. |
<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
</table>
| 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. |
<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
</table>
| 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 Prechg 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. |
<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>12034 Bus Drop</td>
<td>CP, Flashing red</td>
<td>Soft</td>
<td>The bus voltage dropped 150V below the bus tracker voltage.</td>
<td>Monitor the incoming AC line for low voltage or line power interruption. Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
<tr>
<td>12035 Bus Undervlt</td>
<td>CP, Flashing red</td>
<td>Soft</td>
<td>The DC bus voltage fell below the trip value (388V DC at 460V AC input).</td>
<td>Monitor the incoming AC line for low voltage or line power interruption. Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
<tr>
<td>12036 Bus Cycle&gt;5</td>
<td>CP, Flashing red</td>
<td>Soft</td>
<td>At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.</td>
<td>Monitor the incoming AC line for low voltage or line power interruption. Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
<tr>
<td>12037 Open Circuit</td>
<td>CP, Flashing red</td>
<td>Soft</td>
<td>The fast flux up current is less than 50% of commanded.</td>
<td>Make sure the motor is properly connected. Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
<tr>
<td>12064 RidethruTime</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>There was a drop of 150V and power did not return within 2 seconds.</td>
<td>Check the incoming power and fuses. Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
<tr>
<td>12065 Prechg Time</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>The precharge function could not complete within 30 seconds.</td>
<td>Refer to the <em>Understanding Precharge and Ridethrough Faults</em> 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.</td>
</tr>
</tbody>
</table>
### Fault Code and Text

<table>
<thead>
<tr>
<th>Fault Code and Text</th>
<th>LED Information</th>
<th>Fault Type</th>
<th>Description</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>12066 Bus Drop</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>The bus voltage dropped 150V below the bus tracker voltage.</td>
<td>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.</td>
</tr>
<tr>
<td>12067 Bus Undervlt</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>The DC bus voltage fell below the minimum value (388V DC at 460V AC input).</td>
<td>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.</td>
</tr>
<tr>
<td>12068 Bus Cycle&gt;5</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.</td>
<td>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.</td>
</tr>
<tr>
<td>12069 Open Circuit</td>
<td>CP, Solid green</td>
<td>Warning</td>
<td>The fast flux up current is less than 50% of commanded.</td>
<td>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.</td>
</tr>
<tr>
<td>13000 HW Malfunction</td>
<td>CP, Solid red</td>
<td>Hard</td>
<td>A hardware malfunction occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>13001 HW Malfunction</td>
<td>CP, Solid red</td>
<td>Hard</td>
<td>A hardware malfunction occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>13002 HW Malfunction</td>
<td>CP, Solid red</td>
<td>Hard</td>
<td>A hardware malfunction occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>13003 HW Malfunction</td>
<td>CP, Solid red</td>
<td>Hard</td>
<td>A hardware malfunction occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
<tr>
<td>13004 HW Malfunction</td>
<td>CP, Solid red</td>
<td>Hard</td>
<td>A hardware malfunction occurred.</td>
<td>Recycle the power. If the fault does not clear, replace the main control board.</td>
</tr>
</tbody>
</table>
Diagnostic Procedures by Symptom

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

Figure 2.4
Drive Will Not Start or Jog

- Drive will not start or jog.
  - Display on HIM?
    - No → Refer to No HIM Display.
    - Yes → HIM displays Connecting?
      - Yes → HIM connected properly?
        - Yes → Replace HIM, HIM cable, or Main Control Board.
        - No → No
      - No → Reconnect the HIM.
    - Yes → HIM displays “Running”? (par. 16).
      - No → Check Run Inhibit Sts
      - Yes → Refer to HIM Displays Running.
- Check Start/Stop Owner and Jog 1/Jog 2 Owner (par. 129 and 130).
- Check SP Enable Mask and Start/Jog Mask (par. 124 and 126).

- No Enable
  - Stop enabled?
    - Yes → Check Stop owner.
    - No → Check Start and Jog owner.
  - Start/Jog (Ver. 2.xx) enabled?
    - Yes → Check fault queue.
    - No → Check external input on L Option board.
  - Fault enabled?
  - External Fault enabled?
Figure 2.5
No HIM Display

No HIM display

Is HIM backlight lit?  
Yes  
Replace the HIM

No

Is the drive’s fan running?  
Yes  
Is HIM connected properly?  
Yes  
Do +5, +/-15, and 12 supply voltages on the main control board check out?  
Yes  
Replace HIM, HIM cable, or main control board.

No  
Re-connect HIM

No

Voltage present at TB1-R, -S, -T?  
Yes  
Restore incoming power to the drive.

No  
DC bus voltage present?  
Yes  
Replace gate driver board.

No  
Is the fuse blown on the gate driver board?  
Yes  
Replace the fuse, gate driver board, or complete drive as needed.

No  
Replace the diode bridge and any other damaged components.
Figure 2.6
HIM Displays “Running”

HIM displays “Running”?

- Yes
  - Green enable light on?
    - Yes
      - Check Spd/Trq Mode Sel (par. 68).
    - No
      - Check Command Spd Sts (par. 82).

- No
  - Check Rev Speed Limit and Fwd Speed Limit (par. 40 and 41).
  - Check Pos Torque Lim and Neg Torque Lim (par. 74 and 75).
  - Check Accel Time 1, 2 and Decel Time 1, 2 (par. 42-45).
  - Check Fdbk Device Type (par. 64).

Check bits 12-14 of Logic Input Sts (par. 14).

- Incorrect Ref Select?
  - Correct Ref Select?
    - Check Speed Ref 1-6, Speed Ref 1 Frac (par. 28, 29, 31-37).
  - Incorrect Ref Select?
    - Command correct reference.
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

<table>
<thead>
<tr>
<th>If:</th>
<th>Then:</th>
</tr>
</thead>
<tbody>
<tr>
<td>You powered up your drive and cannot access the start up routine.</td>
<td>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.</td>
</tr>
<tr>
<td>You got a Feedback Loss Fault.</td>
<td>You have specified that an encoder is on the system but it has been disconnected.</td>
</tr>
<tr>
<td>The motor does not turn during the phase rotation test.</td>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
<td>The drive is not getting any speed feedback information. You need to: 0. Check the connection between the encoder and the motor. 0. 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: 0. Check the encoder wiring. 0. Check the encoder itself.</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>If:</th>
<th>Then you should:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The drive starts and then stops.</td>
<td>• Check if the mode specified in L Option Mode (parameter 116) is 2 or 3 wire.</td>
</tr>
<tr>
<td></td>
<td>• Check SP 2 Wire Enable (parameter 181).</td>
</tr>
<tr>
<td></td>
<td>• Check to see if the HIM displays a fault message.</td>
</tr>
<tr>
<td></td>
<td>• Check the L Option Board wiring.</td>
</tr>
<tr>
<td></td>
<td>• Check the settings on your gateway (communications module).</td>
</tr>
<tr>
<td>There is a delay before the stop</td>
<td>• Check the value of Stop Dwell Time (parameter 18).</td>
</tr>
<tr>
<td>command takes effect.</td>
<td></td>
</tr>
<tr>
<td>The motor waits before starting.</td>
<td>• Check Start Dwell Time (parameter 194).</td>
</tr>
<tr>
<td></td>
<td>• Check Pos Torque Lim (parameter 74) and Neg Torque Lim (parameter 75).</td>
</tr>
<tr>
<td></td>
<td>• Check Fast Flux Level (parameter 78) and bit 8 of Bus/Brake Opts (parameter 13).</td>
</tr>
<tr>
<td></td>
<td>• Check S-Curve Percent (parameter 47).</td>
</tr>
<tr>
<td>The drive coast on stop.</td>
<td>• Check the stop type bits in Logic Options (parameter 17).</td>
</tr>
<tr>
<td></td>
<td>• Check Zero Speed Tol (parameter 19).</td>
</tr>
<tr>
<td>You cannot clear faults.</td>
<td>• Check which speed reference the drive is following in Drive/Inv Status (parameter 15) bits 13–15.</td>
</tr>
<tr>
<td></td>
<td>• Check if Spd/Tq Mode Sel (parameter 68) is set correctly.</td>
</tr>
<tr>
<td></td>
<td>• Check if Spd Desired BW (parameter 161) is non-zero.</td>
</tr>
<tr>
<td></td>
<td>• Set the drive defaults and run start up again to tune the drive.</td>
</tr>
<tr>
<td>The motor does not turn or run at the</td>
<td>• Check if the port is enabled in SP Enable Mask (parameter 124).</td>
</tr>
<tr>
<td>correct speed.</td>
<td>• Check if clear faults is enabled in Clk Fit/Res Mask (parameter 127).</td>
</tr>
<tr>
<td></td>
<td>• Check if clear fault owners in Ramp/Clk Fit Owner (parameter 131) is set.</td>
</tr>
<tr>
<td></td>
<td>If set, check stop owners in Start/Stop Owner (parameter 129) and remove stop conditions.</td>
</tr>
<tr>
<td></td>
<td>• The fault is a hard fault which requires a power cycle or drive reset.</td>
</tr>
<tr>
<td>The HIM pot does not control motor speed.</td>
<td>• Check if SP An In1 Select (parameter 133) or SP An In2 Select (parameter 136) is set to the HIM port number.</td>
</tr>
<tr>
<td></td>
<td>• Check if SP An In1 Scale (parameter 135) or SP An In2 Scale (parameter 138) is 0.125.</td>
</tr>
<tr>
<td></td>
<td>• 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).</td>
</tr>
<tr>
<td></td>
<td>• 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.</td>
</tr>
<tr>
<td>The drive will not change direction.</td>
<td>• Check if the port is enabled in SP Enable Mask (parameter 124).</td>
</tr>
<tr>
<td></td>
<td>• Check if Direction is enabled in Dir/Ref Mask (parameter 125).</td>
</tr>
<tr>
<td></td>
<td>• Check if Direction owner in Dir/Ref Owner (parameter 128) has any bit set.</td>
</tr>
<tr>
<td></td>
<td>If so, remove the command direction.</td>
</tr>
<tr>
<td></td>
<td>• Check to make sure that bit 11 in Logic Options (parameter 17) is clear (0).</td>
</tr>
<tr>
<td>You cannot change the speed reference.</td>
<td>• Check if the port is enabled in SP Enable Mask (parameter 124).</td>
</tr>
<tr>
<td></td>
<td>• Check if Reference is enabled in Dir/Ref Mask (parameter 125).</td>
</tr>
<tr>
<td></td>
<td>• Check if Reference owner in Dir/Ref Owner (parameter 128) has any bit set.</td>
</tr>
<tr>
<td></td>
<td>If so, remove the command reference.</td>
</tr>
<tr>
<td></td>
<td>If bit 0 (for the L Option control) is set, you need to do one of the following to remove ownership:</td>
</tr>
<tr>
<td></td>
<td>• Clear bit 0 in Dir/Ref Mask (parameter 125).</td>
</tr>
<tr>
<td></td>
<td>• 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.</td>
</tr>
<tr>
<td>The drive does not run correct</td>
<td>• Set the drive defaults and run start up again to tune the drive.</td>
</tr>
<tr>
<td>torque.</td>
<td>• Check Spd/Tq Mode Sel (parameter 68) and Slave Torque % (parameter 70).</td>
</tr>
<tr>
<td>The drive cannot control current and</td>
<td>• If you are using an encoder, check that you have entered the correct PPR into Encoder PPR (parameter 8).</td>
</tr>
<tr>
<td>trips on an overcurrent fault.</td>
<td></td>
</tr>
<tr>
<td>The MOP does not work.</td>
<td>• Check L Option Mode (parameter 116).</td>
</tr>
<tr>
<td></td>
<td>• Make sure that Mop Value (parameter 119) is linked to a speed reference.</td>
</tr>
<tr>
<td>The pulse input does not work.</td>
<td>• Make sure that the pulse input jumper is set correctly.</td>
</tr>
<tr>
<td></td>
<td>• Make sure that the input is differential and not single ended.</td>
</tr>
<tr>
<td></td>
<td>• Check the values of Pulse In PPR (parameter 120), Pulse In Scale (parameter 121), and Pulse In Offset (parameter 122).</td>
</tr>
<tr>
<td></td>
<td>• Check the link on Pulse In Value (parameter 123).</td>
</tr>
</tbody>
</table>
### Troubleshooting and Error Codes

#### Encoderless Troubleshooting Procedures

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

<table>
<thead>
<tr>
<th>If:</th>
<th>Then you should:</th>
</tr>
</thead>
</table>
| 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). | |

**Table 2.G**
Chapter 3

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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

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)
- 10 mm socket
- 13 mm deep-well socket
- 5/16-inch or 8 mm open-end wrench
- Torque wrench, metered in in.-lb or N-m
- Nylon tie wraps
- Side cutters
- 17 mm socket
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.

Two-Point Mounting

The following illustrates temporary and final tightening sequences for components fastened to a heat sink using two screws. Temporary torque is 1/2 (50%) of final torque. The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 3.1
Two-Point Mounting
Four-Point Mounting

The following illustrates temporary and final tightening sequences for components fastened to a heat sink using four screws. Temporary torque is 1/2 (50%) of final torque. The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 3.2
Four-Point Mounting

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 and four-point components to the heat sink.
### Table 3.A

**Fastener Torque Specifications — Parts Common to “D” Frame Drives**

<table>
<thead>
<tr>
<th>Component</th>
<th>Fastener Application</th>
<th>Fastener Used</th>
<th>Torque in.-lb</th>
<th>Torque N-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Sharing Resistor (R1 – R3)</td>
<td>Resistor to Heat Sink</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Snubber Resistor (R20 – R22)</td>
<td>Resistor to Heat Sink</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Power Modules (Q1 – Q6)</td>
<td>Power Modules to Heat Sink</td>
<td>M6 x 16 mm Screw</td>
<td>26</td>
<td>2.9</td>
</tr>
<tr>
<td>Input Rectifiers (SCR1 – SCR6)</td>
<td>Rectifiers to Heat Sink</td>
<td>M6 x 16 mm Screw</td>
<td>52</td>
<td>5.9</td>
</tr>
<tr>
<td>Thermistor</td>
<td>Thermister to Heat Sink</td>
<td>Thermister</td>
<td>14</td>
<td>1.6</td>
</tr>
<tr>
<td>Fan Finger Guard</td>
<td>Guard to Chassis</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Fan Cover</td>
<td>Cover to Fan</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Fan Cover (C1 – C9)</td>
<td>Retainer to Chassis</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Capacitor Retainer (C1 – C9)</td>
<td>Cap to Capacitor Latch</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Capacitor Bus Bar (C1 – C9)</td>
<td>Standoff to Chassis</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>SCR Standoff (SCR1 – SCR6)</td>
<td>Standoff through Converter Bus Bar and Into SCR</td>
<td>SCR Standoff</td>
<td>34</td>
<td>3.8</td>
</tr>
<tr>
<td>Converter Snubber Board (A11)</td>
<td>Board to SCR Standoff</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Power Module Snubber Board (A20 – A22)</td>
<td>Board to IGBT Standoffs</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Bus Fuse (F1)</td>
<td>Fuse to Capacitor Bus Bar</td>
<td>M10 x 20 mm Bolt</td>
<td>97 – 111</td>
<td>11 – 12.5</td>
</tr>
<tr>
<td>TB1 Terminal Block DIN Rail</td>
<td>DIN Rail to Chassis</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Gate Driver Board Mounting Plate</td>
<td>Plate to Chassis</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Main Control Board</td>
<td>Board to Mounting Plate</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>TE Ground Block</td>
<td>TE Ground Block to Gate Driver Board Sheet Metal</td>
<td>M2.5 x 12 mm Screw</td>
<td>6 – 9</td>
<td>0.7 – 1.0</td>
</tr>
<tr>
<td>Control Board Mounting Plate</td>
<td>Plate to Gate Driver Board Mounting Plate</td>
<td>M6 Nut</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Control Board Mounting Plate</td>
<td>Plate to Gate Driver Board Mounting Plate</td>
<td>M4 x 8 mm</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>HIM Holder</td>
<td>HIM Holder to Control Board Sheet Metal</td>
<td>M4 x 20 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Capacitor Guard (C1 – C9)</td>
<td>Cap to Capacitor Brackets</td>
<td>M4 x 20 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td>Link Inductor Guard (L1)</td>
<td>Link Inductor Guard to Link Inductor</td>
<td>M6 Nut</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Enclosure Bottom, Top, and Side Panels</td>
<td>Enclosure Sheet Metal</td>
<td>M5 x 10 mm Screw</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
</tbody>
</table>
### Table 3.B
**Fastener Torque Specifications — Parts Common to “D”**
Frame Drives A040, A050, B060 – B100, C075, C100

<table>
<thead>
<tr>
<th>Component</th>
<th>Fastener Application</th>
<th>Fastener Used</th>
<th>Torque in-lb</th>
<th>Torque N-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBT Standoff</td>
<td>Standoff Through IGBT Busbar and Into IGBT</td>
<td>IGBT Standoff</td>
<td>36 – 44</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Power Module Snubber Board (A20 – A22)</td>
<td>Board to Gate and Emitter Connection on IGBT</td>
<td>M4 x 24 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
</tbody>
</table>

### Table 3.C
**Fastener Torque Specifications — Parts Common to “D”**
Frame Drives A060, B125, BX150, C125

<table>
<thead>
<tr>
<th>Component</th>
<th>Fastener Application</th>
<th>Fastener Used</th>
<th>Torque in-lb</th>
<th>Torque N-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBT Standoff</td>
<td>Standoff Through IGBT Bus Bar and Into IGBT</td>
<td>IGBT Standoff</td>
<td>65 – 79</td>
<td>7.3 – 8.9</td>
</tr>
<tr>
<td>Power Module Snubber Board (A20 – A22) (Present Design)</td>
<td>Board to Gate and Emitter Connection on IGBT</td>
<td>M4 x 35 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td><em>Power Module Snubber Board (A20 – A22) (Original Design)</em></td>
<td>Board to Gate and Emitter “C” Brackets</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
<tr>
<td><em>Gate &amp; Emitter Terminals (Original Design)</em></td>
<td>Gate and Emitter “C” Brackets to IGBTs</td>
<td>M4 x 8 mm Screw</td>
<td>12 – 16</td>
<td>1.4 – 1.8</td>
</tr>
</tbody>
</table>

* Parts pertain only to original Snubber Board design which uses “C” shaped Gate and Emitter brackets. Refer to Power Modules in Chapter 5 – Part Replacement Procedures.

### Table 3.D
**Fastener Torque Specifications — Wires Common to “D”**
Frame Drives

<table>
<thead>
<tr>
<th>Component</th>
<th>Fastener Application</th>
<th>Fastener Used</th>
<th>Torque in-lb</th>
<th>Torque N-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOV Ground Wire (MOV1)</td>
<td>Wire to Chassis</td>
<td>M6 Nut</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Drive Ground Wire</td>
<td>Wire to Chassis</td>
<td>M6 Nut</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
<tr>
<td>Ground Wire TE (Gate Driver Board)</td>
<td>Wire to TB1 Terminal TE</td>
<td>Compression</td>
<td>6 – 8</td>
<td>0.7 – 0.9</td>
</tr>
<tr>
<td>Link Inductor Wires</td>
<td>Wires to Link Inductor</td>
<td>M6 x 12 mm Screw</td>
<td>50 – 72</td>
<td>5.6 – 8.1</td>
</tr>
<tr>
<td>Capacitor Bus Bar Wires</td>
<td>Wires to Capacitor Bus Bar</td>
<td>M6 x 12 mm Screw</td>
<td>50 – 72</td>
<td>5.6 – 8.1</td>
</tr>
<tr>
<td>Converter Bus Bar Wires</td>
<td>Wires to Converter Bus Bar</td>
<td>M6 x 12 mm screw</td>
<td>50 – 72</td>
<td>5.6 – 8.1</td>
</tr>
<tr>
<td>Motor Bus Bar Wires</td>
<td>Wires to Motor Bus Bar</td>
<td>M6 x 12 mm Screw</td>
<td>50 – 72</td>
<td>5.6 – 8.1</td>
</tr>
<tr>
<td>TB1 Wires</td>
<td>Wires to TB1</td>
<td>M8 Nut</td>
<td>52</td>
<td>5.9</td>
</tr>
<tr>
<td>TB3 Wires L–Option Board</td>
<td>Wires to TB3 on L Option Board</td>
<td>Captive Screw</td>
<td>8 – 10</td>
<td>0.9 – 1.1</td>
</tr>
<tr>
<td>Enclosure Door Ground Wire</td>
<td>Wire to Enclosure Door</td>
<td>M6 Nut</td>
<td>23 – 36</td>
<td>2.6 – 4.1</td>
</tr>
</tbody>
</table>
Disassembly and Access Procedures

Opening the Drive Enclosure

Figure 3.3
Drive Enclosure

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 +DC and –DC on Terminal Block TB1. 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. Turn the Enclosure door latches, located on the right side of the Enclosure door, 90 degrees counterclockwise.
3. Open the Enclosure door.
4. Check for zero volts at TB1 terminals +DC and –DC.
5. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)
6. Remove the ground wire from the Enclosure door.
7. Lift the Enclosure door toward the top of the drive to remove the door from the hinges.
8. Remove the customer-supplied wiring from the drive.
9. Remove the screws from the Enclosure top, bottom, and side panels to remove the panels.

**Installation**

Install the Enclosure in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

**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 3.4  
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 +DC and –DC on Terminal Block TB1. 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.

3. Check for zero volts at TB1 terminals +DC and –DC.

4. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)

5. Remove all wires from the terminals on TB3.

6. Loosen the two captive screws fastening the L Option Board to the Main Control Board.

7. Grip the right and left sides of the L Option Board and pull the board straight out from the Main Control Board.

Installation

Install the L Option Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

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 3.5
Control Board/Adapter 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 +DC and –DC on Terminal Block TB1. 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts at TB1 terminals +DC and –DC.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. 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
6. Remove the nuts at the top of the Main Control Board Mounting Plate.
7. Remove the two screws at the bottom of the Main Control Board Mounting Plate.
8. 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 Fastener Torque Specifications in this chapter.

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

**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 +DC and −DC on Terminal Block TB1. 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.

3. Check for zero volts at TB1 Terminals +DC and –DC.

4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if 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 screws fastening the Main Control Board to the Main Control Board Mounting Plate.

7. Slide the Main Control Board upward to release it from the slide-mount stand-offs and connector J7.

8. Lift the Main Control Board away from the mounting plate.

Installation

Install the Main Control Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

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 Mounting Plate

Figure 3.7
Gate Driver 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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 10 ohm and less than 100 ohm, rated for 25 watts minimum, 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts at TB1 terminals +DC and –DC.
4. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)
5. Remove the Main Control Board Mounting Plate. Refer to Removing the Main Control Board Mounting Plate in this chapter.
6. Remove Gate Driver Board connections:
   • TB7 ground wire
   • J2 Ground Sense CT connector
   • J13 connector
   • J7 Power Module connector
   • J8 Power Module connector
   • J10 Bus Capacitor Bank connector
   • J6 connector
   • J9 Precharge Board connector
   • TB6 Fan connector if applicable
7. Remove the screws fastening the bottom of the Gate Driver Board Mounting Plate to the drive.

8. Slide the plate toward the top of the drive until the tabs disengage from the slots.

9. Lift the plate out of the drive.

**Installation**

Install the Gate Driver Board Mounting Plate in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

---

**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 Gate Driver Board

Figure 3.8
Gate Driver 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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts at TB1 terminals +DC and –DC.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the Main Control Board Mounting Plate. Refer to Removing the Main Control Board Mounting Plate in this chapter.
6. Disconnect the following from the Gate Driver Board:
   - J9 Precharge Board connector
   - J10 Bus Capacitor Bank connector
   - J2 Ground Sense CT connector
   - J7 Power Module connector
   - J8 Power Module connector
   - J6 LEM Harness connector
   - TB6 Fan connector
   - J13 connector
   - Ground wire from TB7
7. Turn the eight stand-off screws, fastening the Gate Driver Board to the Mounting Plate, 1/4 turn counterclockwise.

8. Remove the Gate Driver Board from the enclosure.

**Installation**

Install the Gate Driver Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

---

**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 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 +DC and –DC on Terminal Block TB1. 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.

3. Check for zero volts at TB1 terminals +DC and –DC.

4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

5. Remove the Precharge Guard from the Precharge Board.

6. Disconnect the following from the Precharge Board:
   - J1 connector
   - J2 connector
   - J3 connector
   - J4 connector

7. Remove the screws fastening the top of the Mounting Plate to the drive.

8. Lift the Precharge Board and Mounting Plate out of the enclosure.

Installation

Install the Precharge Board Mounting Plate in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

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

Figure 3.10
Precharge Board

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 +DC and –DC on Terminal Block TB1. 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.

3. Check for zero volts at TB1 terminals +DC and –DC.

4. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)

5. Disconnect the following from the Precharge Board:
   • J1 connector
   • J2 connector
   • J3 connector
   • J4 connector

6. Turn the six stand-off screws, fastening the Precharge Board to the Precharge Board Mounting Plate, 1/4 turn counterclockwise.

7. Remove the Precharge Board from the Precharge Board Mounting Plate.

Installation

Install the Precharge Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

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

Figure 3.11  
Power Module Snubber Board

![Diagram of 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 +DC and −DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero V DC across capacitors C2, C3, and C4. Use a resistor greater than 10 ohm and less than 100 ohm, rated for 25 watts minimum, 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts at TB1 terminals +DC and –DC.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the Main Control Board Mounting Plate. Refer to Removing the Main Control Board Mounting Plate in this chapter.
6. Remove the Gate Driver Board Mounting Plate. Refer to Removing the Gate Driver Board Mounting Plate in this chapter.
7. Remove the wires from Power Module Snubber Board stake-on connectors E1 and E2.
8. Remove J1 and J2 connectors.
9. Remove the eight screws fastening the Snubber Board to the Power Module.
10. Lift the Snubber Board out of the enclosure.
Installation

**ATTENTION:** Do not substitute longer or shorter hardware when fastening the Power Module Snubber Boards 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 Power Module Snubber Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.

**Important:** Line up the bottom edge of the Snubber Board with the metal posts on the Power Module Brackets.

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

**Figure 3.12**
Converter 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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1ohm and less than 100 ohm, rated for 25 watts minimum, 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. Open the Enclosure door. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts at TB1 terminals +DC and –DC.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the Gate Driver Board Mounting Plate. Refer to Removing the Gate Driver Board Mounting Plate in this chapter.
6. Remove the Precharge Board Mounting Plate. Refer to Removing the Precharge Board Mounting Plate in this chapter.
7. Remove the nine screws fastening the Converter Snubber Board to the Input Rectifier.
8. Lift the Converter Snubber Board out of the enclosure.

Installation
Install the Converter Snubber Board in reverse order of removal. Refer to Fastener Torque Specifications in this chapter.
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 A040 – A060, B060 – B125, BX150, and C075 – C125 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.

The procedures in this chapter assume that the drive you are servicing either has no enclosure or that the enclosure is opened. For more information on opening the Drive Enclosure, refer to Chapter 3 – Disassembly and Access Procedures, Opening the Drive Enclosure.

**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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

**ATTENTION:** Hazard of electric shock exists. Up to 1,000V DC may be present on Snubber Capacitors. Measure for zero V DC across capacitors C2, C3, and C4. Use a resistor greater than 1ohm and less than 100 ohm, rated for 25 watts minimum, to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

**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)
- 10 mm socket
- 13 mm deep-well socket
- 5/16-inch or 8 mm open-end wrench
- Torque wrench, metered in in.-lb or N-m
- Nylon tie wraps
- Side cutters
- 17 mm socket
Test 1
Testing the Gate Driver Board

The Gate Driver Board is located between the Main Control Board and the Main Chassis. If one or more Power Modules has 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 +DC and –DC on Terminal Block TB1. 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 TB1 terminals +DC and –DC.

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. Set your meter to test resistance.

6. Test Fuses F1 and F3 for an open condition. Replace the Gate Driver Board if either fuse shows an open condition.

7. Set your meter to test diodes.

8. Test VR1 – VR6. The following table shows meter connections at the components and ideal meter readings for those connections. Refer to the former illustration for component locations.

<table>
<thead>
<tr>
<th>Component</th>
<th>Meter (+) Lead</th>
<th>Meter (–) Lead</th>
<th>Nominal Meter Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR1 – VR6</td>
<td>+</td>
<td>–</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>+</td>
<td>1.5</td>
</tr>
</tbody>
</table>

*Important:* Typical Malfunction is shorted in both directions.

9. 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.

10. Assemble the drive in reverse order or disassembly.

**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

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 +DC and –DC on Terminal Block TB1. 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 TB1 terminals +DC and –DC.

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 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 near the top of the heat sink.

**Figure 4.3**
Power Module Test

![Power Module Diagram]

**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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

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 TB1 terminals +DC and –DC.
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. Remove the Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
7. Remove the Inverter Bus Bar. Refer to Chapter 5 – Part Replacement Procedures, Power Modules.
8. Set your meter to test diodes.
9. Test the Power Modules. The following table shows meter connections and ideal meter readings for those connections. Refer to the former illustration for meter connection locations.

<table>
<thead>
<tr>
<th>Meter (+) Lead</th>
<th>Meter (–) Lead</th>
<th>Nominal Meter Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>C</td>
<td>0.318</td>
</tr>
<tr>
<td>E</td>
<td>B</td>
<td>Infinite</td>
</tr>
<tr>
<td>C</td>
<td>E</td>
<td>Infinite</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>Infinite</td>
</tr>
<tr>
<td>B</td>
<td>E</td>
<td>Infinite</td>
</tr>
<tr>
<td>B</td>
<td>C</td>
<td>Infinite</td>
</tr>
</tbody>
</table>
10. Replace both Power Modules in the same phase if meter readings are not as shown. Refer to Chapter 5 – Part Replacement Procedures, Power Modules.

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

12. Assemble the drive in reverse order of disassembly.

**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 Capacitor Bank**

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

**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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
**ATTENTION:** Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

**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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the guard from the bus capacitors.
5. Set your meter to test voltage.
6. Connect the negative (–) lead of your meter to the (–) DC Bus terminal on TB1 and the positive lead to the (+) DC Bus terminal. Refer to the following tables and former illustration 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.

7. Apply power **AFTER** the meter is connected; otherwise, your meter will read zero volts. Expand readings for all input voltage ratings.
Table 4.C
Bus Capacitor Bank Test

<table>
<thead>
<tr>
<th>Drive Rating</th>
<th>Input Volts</th>
<th>Meter Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>200</td>
<td>280V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>230</td>
<td>322V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>336V DC +/-10%</td>
</tr>
<tr>
<td>B</td>
<td>380</td>
<td>535V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>415</td>
<td>580V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>480</td>
<td>650V DC +/-10%</td>
</tr>
<tr>
<td>C</td>
<td>500</td>
<td>700V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>575</td>
<td>800V DC +/-10%</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>850V DC +/-10%</td>
</tr>
</tbody>
</table>

8. 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

9. 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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
5. Remove the Precharge Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board Mounting Plate.
6. Remove the Converter Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Converter Snubber Board.
7. Remove the Converter Bus Bar.
8. Set your meter to test diodes.
9. The following table shows meter connections and ideal meter readings for those connections. Refer to the former illustration for meter connection locations.
Table 4.D
Input Rectifier Test

<table>
<thead>
<tr>
<th>Meter (+) Lead</th>
<th>Meter (−) Lead</th>
<th>Nominal Meter Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>K</td>
<td>Infinite</td>
</tr>
<tr>
<td>AK</td>
<td>A</td>
<td>Infinite</td>
</tr>
<tr>
<td>K</td>
<td>A</td>
<td>Infinite</td>
</tr>
<tr>
<td>K</td>
<td>AK</td>
<td>Infinite</td>
</tr>
<tr>
<td>A</td>
<td>AK</td>
<td>Infinite</td>
</tr>
<tr>
<td>A</td>
<td>K</td>
<td>Infinite</td>
</tr>
<tr>
<td>G1</td>
<td>K1</td>
<td>0.008</td>
</tr>
<tr>
<td>K1</td>
<td>G1</td>
<td>0.008</td>
</tr>
<tr>
<td>G2</td>
<td>K2</td>
<td>0.008</td>
</tr>
<tr>
<td>K2</td>
<td>G2</td>
<td>0.008</td>
</tr>
</tbody>
</table>

10. Replace the Input Rectifier if any meter readings are not as shown. Refer to Chapter 5 – Part Replacement Procedures, Input Rectifiers.

11. If the Input Rectifier shorted, check the Power Modules for damage. Refer to Testing the Power Modules in this chapter.

12. Assemble the drive in reverse order of disassembly.
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.

Part Replacement Overview

The part replacement procedures in this chapter assume that the drive you are servicing either has no enclosure or that the enclosure is open. For more information on opening the Drive Enclosure, refer to Chapter 3 – Disassembly and Access Procedures, Opening the Drive Enclosure.

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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

**ATTENTION:** Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.
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)
  - 10 mm socket
  - 13 mm deep-well socket
  - 5/16-inch or 8 mm open-end wrench
  - Torque wrench, metered in in.-lb or N-m
  - Nylon tie wraps
  - Side cutters
  - 17 mm socket
This section explains in detail how to replace the following drive components:

- Bus Capacitors
- Thermistor
- Power Modules
- Input Rectifiers
- Fan Assembly
- Autotransformer
- DC Bus Inductor L1
- Ground Sense CT
- Bus Fuse
- LEMs
- MOV Surge Suppressor

For Gate Driver Board, Precharge Board, Main Control Board, Snubber Board, and L Option Board installation and removal procedures, refer to Chapter 3 – Disassembly and Access Procedures.
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 left side of the Main Chassis.

**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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 Capacitors:

1. Remove power from the drive.
2. Check for zero volts at TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the screws fastening the Bus Capacitor Guard to the Capacitor Bank.
5. Slide the Capacitor Guard toward the center of the drive to disengage the tabs.
6. Lift the Capacitor Guard out of the Drive.
7. Remove the Bus Fuse. Refer to Bus Fuse in this chapter.

Remove the Capacitors:

1. Remove the bolt and washer assembly fastening the Capacitor Bus Bar to the Transition Bus Bar. The Transition Bus Bar assembly is located under, and attached to, the Bus Fuse.
2. Remove the Load-Sharing Resistor wires and the Capacitor Bus Bar screws.
3. Remove the Bus Inductor L1 cables and Bus Voltage wire harness from the Capacitor Bus Bar.
4. Remove the Capacitor Bus Bar.
5. Loosen the screws on the Capacitor Brackets.
6. Slide the brackets away from the Capacitor Retainers and down to remove.
7. Remove the Capacitor Retainers.
8. Lift the Bus Capacitors out of the Drive.

Installation

   Important: Refer to Bus Fuse in this chapter for correct Bus Fuse fastener size and type.

2. Connect the Load-Sharing Resistors to the Bus Capacitors according to the following diagrams.
Load-sharing resistor R1 has three color coded leads coming out of the resistor body. Connect as shown in Figure 5.4.

**Figure 5.4**
Wiring Detail for A040, A050, B060, B075, and B100 Drives

```
DC+
+ C1 + C3 + C5
+ C2 + C4 + C6

Inv–
```

ATTENTION: The Capacitor Bus must connect a positive (+) capacitor terminal to a negative (–) capacitor terminal. Capacitors not connected correctly will explode and cause death or serious injury.
Load-sharing resistors R1 and R2 have two color coded leads coming out of each resistor body. Connect as shown in Figure 5.5.

**Figure 5.5**
Wiring Detail for A060, B125, and BX150 Drives
Load-sharing resistors R1 and R2 have three color coded leads coming out of each resistor body. Connect as shown in Figure 5.6.

**Figure 5.6**
Wiring Detail for C075 and C100 Drives
Load-sharing resistors R1, R2, and R3 have two color coded leads coming out of each resistor body. Connect as shown in Figure 5.7.

**Figure 5.7**
Wiring Detail for C125 Drives

[Diagram showing wiring details with resistors R1, R2, and R3, color-coded leads, and ohm values.]
Thermistor

The Thermistor is located on the top-left corner of the heat sink.

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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10 and TB11
   - L Option Board (if used)
4. Disconnect Thermistor connector at J1 on Main Control Board.
5. Remove the Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
6. Cut and remove tie wraps along the wire routing path of the Thermistor.
7. Remove the Thermistor from the heat sink.

Installation

Install the Thermistor in reverse order of removal, replacing tie wraps as needed. 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.

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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
5. Remove the Power Module Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.
6. Remove the three screws located at (+), (–), and MTR on the Inverter Bus Bar.
7. Remove the four standoffs from the Inverter Bus Bar.
8. Remove the four screws fastening the Power Module to the Drive.
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.


**Important:** Slide the MTR tab on the Inverter Bus Bar under the corresponding tab on the Transition Bus Bar.

---

**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 at the bottom of the heat sink.

**Figure 5.10**
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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)
4. Remove the Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
5. Remove the Precharge Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board Mounting Plate.
6. Remove the Converter Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Converter Snubber Board.
7. Remove all cable connections from the Converter Bus Bars.
8. Remove the standoffs and the Converter Bus Bar from the rectifiers.
9. Remove the screws fastening the Input Rectifier to the drive.
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.


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

The Fan is located under TB1 at the bottom of the Main Chassis. The Autotransformer and Fan Capacitor are located in the bottom left corner of the Main Chassis.

*Figure 5.11 Fan Assembly*
**Part Replacement Procedures**

**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 +DC and –DC on Terminal Block TB1. 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 Drive:**

1. Remove power from the drive.
2. Check for zero volts at TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect the wiring as follows:
   - Wire harness connecting the Fan to the Autotransformer
   - Ground wire from the ground stud
   - MOV Surge Suppressor wire from the ground stud
   - All wires from TB1

**Remove the Upper DIN Rail:**

1. Loosen the screw fastening the Terminal End Stop to the left side of the Upper DIN Rail to remove the end stop, exposing a screw on the DIN rail.
2. Remove the exposed screw from the DIN rail.
3. Slide the TB1 terminals to the left to expose the other screw on the Upper DIN Rail.
4. Remove the exposed screw from the DIN rail to remove the Upper DIN Rail from the Fan Cover.

Remove the Lower DIN Rail:

1. Loosen the screw fastening the Terminal End Stop to the right side of the Lower DIN Rail to remove the end stop.
2. Slide TB1 terminal W-M3 off the DIN rail to expose a screw on the DIN rail.
3. Remove the exposed screw from the DIN rail.
4. Slide the TB1 terminals to expose the other screw on the lower DIN rail.
5. Remove the exposed screw from the DIN rail to remove the lower DIN rail from the Fan Cover.
6. Remove the screws fastening the Fan Cover to the Main Chassis.
7. Lift the fan and cover from the Drive.
8. Remove the screws fastening the Fan to the Fan Cover to remove the Fan from the cover.
9. Remove the nut fastening the Fan Capacitor to the bracket to remove the capacitor.

Installation

1. Thread the Fan wire through the hole in the Fan Cover.
2. Fasten the Fan to the Fan Cover.

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

The Autotransformer and Fan Capacitor are located in the bottom left corner of the Main Chassis.

Figure 5.12  
Autotransformer
Removal
1. Remove power from the drive.
2. Check for zero volts at TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)
4. Remove the Autotransformer wire from TB1 terminal S-L2.
5. Remove the wire from the Autotransformer stake-on connector. Note the location of the stake-on connector for installation.
6. Disconnect the wire harness connecting the Autotransformer to the Fan.
7. Remove the screws fastening the Autotransformer to the chassis.

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

Important: On the replacement Autotransformer, connect the wire from Removal Step 5, above, to the same stake-on connector from which the wire was removed. Refer to the Fan wiring diagram in the Schematics section of this manual for correct transformer-tap voltage.
DC Bus Inductor L1

DC Bus Inductor L1 is located on the lower left corner of the Drive.

**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 +DC and –DC on Terminal Block TB1. 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Remove the guard.
5. Remove the wires from the Bus Inductor terminals.
6. Remove the four screws fastening the Bus Inductor L1 to the drive.
7. Lift the Bus Inductor out of the drive.

Installation
1. Lower the inductor into the Main Chassis, inserting the inductor into the bottom inductor bracket.

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

The Ground Sense CT is located in the lower left of the Drive.

Figure 5.14
Ground Sense 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 +DC and −DC on Terminal Block TB1. 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
4. Disconnect the Ground Sense CT from Gate Driver Board connector J2.
5. Remove the Bus Capacitor Guard.
6. Remove the following:
   - Bus Capacitor Bus Bar DC+ wire.
   - Bus Capacitor Bus Bar DC– wire.
   - Bus Voltage Wire Harness
7. Cut the tie wraps from the Ground Sense CT.
8. Slide the Ground Sense CT off the Bus Capacitor wires.

Installation

1. Place the Bus Capacitor wires through the center of the Ground Sense CT.
2. Install the Ground Sense CT 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.
Bus Fuse

The Bus Fuse is located at the top-center of the Drive.

Figure 5.15
Bus Fuse

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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.

3. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

4. Remove the Bus Capacitor Guard. Refer to Bus Capacitor Bank in this chapter.

5. Remove the two bolt-and-washer assemblies fastening the Bus Fuse to the drive.

Installation

Install the Bus 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.
**LEMs**

The LEMs are located near the bottom of the heat sink.

**Figure 5.16**
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 +DC and –DC on Terminal Block TB1. Do not attempt to service the drive until the bus voltage has discharged to zero volts.
ATTENTION: Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   • TB10
   • TB11
   • L Option Board (if used)
4. Remove the Precharge Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board Mounting Plate.
5. Remove Gate Driver Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board Mounting Plate.
6. Disconnect the Inverter output wires, running through the LEMs, from Motor Bus Bar terminals:
   • U-M1
   • V-M2
   • W-M3
7. Disconnect the J6 Connector wiring harness from the LEMs.
8. Remove the screws fastening the LEM mounting bracket to the heat sink.
9. Slide the LEM mounting bracket off of Inverter output wires.

10. Compress the tabs on the nylon spacers to remove the LEM from the mounting bracket.

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 in the bottom-left corner of the Drive near the Autotransformer and Fan Capacitor.

The MOV protects the drive from high voltage surges above approximately 1,000 volts. Replace the MOV 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 5.17
MOV Surge Suppressor
Part Replacement Procedures

Removal

**ATTENTION:** Hazard of electric shock exists. Up to 1,000 V DC may be present on Snubber Capacitors. Measure for zero (0) V DC across capacitors C2, C3, and C4. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, 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 TB1 terminals +DC and –DC.
3. Check for the absence of control voltage at:
   - TB10 and TB11
   - L Option Board (if used)
4. Disconnect the MOV wires from TB1 terminals L1, L2, and L3 (R, S, and T).
5. Disconnect the MOV wire from the ground stud.
6. Remove the screw fastening the MOV to the Main Chassis.

Installation

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

**Important:** Install the MOV using the same M4 or M5 screw as was removed.

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

Chapter Objectives

This chapter illustrates and lists replacement parts for the 1336 IMPACT Drives rated A040 – A060, B060 – B125, BX150, and C075 – C125 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"

request document(s) 1060 (230V drives) and/or 1070 (460 & 575V drives).
Replacement Parts Listing

Figure 6.1
Parts for A040 – A060, B060 – B125, BX150, and C075 – C125 Drives
Table 6.A
Replacement Parts for A040 – A060, B060 – B125, BX150, and C075 – C126 Drives

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<th>Symbol</th>
<th>Description</th>
<th>Location</th>
<th>Replacement Procedures</th>
</tr>
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<td>Load-Sharing Resistor</td>
<td>Main Chassis</td>
<td>Chapter 5, Bus Capacitor Bank</td>
</tr>
<tr>
<td>2</td>
<td>Q1 – Q6</td>
<td>IGBT</td>
<td>Heat Sink</td>
<td>Chapter 5, Power Modules</td>
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<tr>
<td>3</td>
<td>F1</td>
<td>Bus Fuse</td>
<td>Cap Bus Bar</td>
<td>Chapter 5, Bus Fuse F1</td>
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<td>4</td>
<td>ST NTCI</td>
<td>Thermistor</td>
<td>Heat Sink</td>
<td>Chapter 5, Thermistor</td>
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<tr>
<td>5</td>
<td>SNUBBER BOARD</td>
<td>Inverter Bus Bar and Snubber Board</td>
<td>Heat Sink</td>
<td>Chapter 3, Removing a Power Module Snubber Board</td>
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<td>BASEDR/PWRSPLY</td>
<td>Gate Driver Board</td>
<td>Gate Driver Board Mounting Plate</td>
<td>Chapter 3, Removing the Gate Driver Board</td>
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<td>7</td>
<td>MAIN CTL</td>
<td>Main Control Board</td>
<td>Main Control Board Mounting Plate</td>
<td>Chapter 3, Removing the Main Control Board</td>
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<td>HIM</td>
<td>Human Interface Module</td>
<td>Main Control Board Mounting Plate</td>
<td>Chapter 1, Removing the HIM</td>
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<td>PRECHARGE</td>
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<td>Precharge Board Mounting Plate</td>
<td>Chapter 3, Removing the Precharge Board</td>
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<td>Heat Sink</td>
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<td>LEM</td>
<td>Main Chassis</td>
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<td>Converter Snubber Board</td>
<td>Heat Sink</td>
<td>Chapter 3, Removing the Converter Snubber Board</td>
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<td>CT3</td>
<td>Ground Sense CT</td>
<td>—</td>
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<tr>
<td>15</td>
<td>FAN</td>
<td>Fan</td>
<td>Main Chassis</td>
<td>Chapter 5, Fan and Transformer</td>
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<td>16</td>
<td>L1</td>
<td>DC Bus Inductor</td>
<td>Main Chassis</td>
<td>Chapter 5, DC Bus Inductor L1</td>
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<td>17</td>
<td>MOV1</td>
<td>MOV Surge Suppressor</td>
<td>Main Chassis</td>
<td>Chapter 5, Autotransformer</td>
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<td>18</td>
<td>T1</td>
<td>Autotransformer</td>
<td>Main Chassis</td>
<td>Chapter 5, Autotransformer</td>
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<td>19</td>
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<td>Fan Capacitor</td>
<td>Main Chassis</td>
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<td>Bus Capacitors</td>
<td>Main Chassis</td>
<td>Chapter 5, Bus Capacitor Bank</td>
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Schematics — 40 – 150 HP 1336 IMPACT Drives
Note 1: Customer fusing.
Based on maximum drive rating the following fuses or approved equivalent must be used:

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<th>230VAC FUSE CURRENT/TYPE</th>
<th>380/460VAC FUSE CURRENT/TYPE</th>
<th>575VAC FUSE CURRENT/TYPE</th>
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<tr>
<td>40</td>
<td>150 AMP, CLASS T, JJS</td>
<td>–</td>
<td>–</td>
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<tr>
<td>50</td>
<td>200 AMP, CLASS T, JJS</td>
<td>–</td>
<td>–</td>
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<tr>
<td>60</td>
<td>250 AMP, CLASS T, JJS</td>
<td>125 AMP, CLASS T, JJS</td>
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<td>75</td>
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<td>100</td>
<td>–</td>
<td>200 AMP, CLASS T, JJS</td>
<td>150 AMP, CLASS T, JJS</td>
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<td>125</td>
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<td>250 AMP, CLASS T, JJS</td>
<td>175 AMP, CLASS T, JJS</td>
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<tr>
<td>150</td>
<td>–</td>
<td>250 AMP, CLASS T, JJS</td>
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Note 2: Based on drive horsepower, the inverter DC + bus fuse will change amp rating. The table below defines the fuse rating.

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<th>FUSE INFORMATION</th>
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<td>RATING</td>
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<td>150 AMP</td>
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<td>50HP, 230VAC</td>
<td>200 AMP</td>
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<tr>
<td>60HP, 230VAC</td>
<td>250 AMP</td>
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<td>60HP, 380VAC</td>
<td>125 AMP</td>
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<tr>
<td>75HP, 380/460VAC</td>
<td>150 AMP</td>
</tr>
<tr>
<td>75HP, 575VAC</td>
<td>125 AMP</td>
</tr>
<tr>
<td>100HP, 380/460VAC</td>
<td>200 AMP</td>
</tr>
<tr>
<td>100HP, 575VAC</td>
<td>175 AMP</td>
</tr>
<tr>
<td>125HP, 380/460VAC</td>
<td>250 AMP</td>
</tr>
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<td>125HP, 575VAC</td>
<td>200 AMP</td>
</tr>
<tr>
<td>150HP, 460VAC</td>
<td>250 AMP</td>
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Note 3: The following is a listing of all printed circuit assemblies versus fuse & documentation information.

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<td>74101–077</td>
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<td>A20–22</td>
<td>74101–032–XX</td>
<td>74101–022</td>
<td>NONE – – –</td>
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