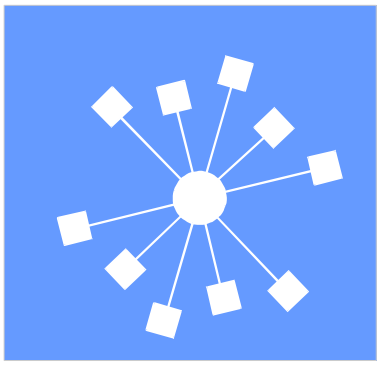
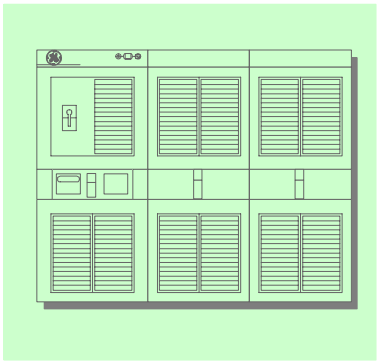
GEH-6388

GE Industrial Systems

Innovation Series



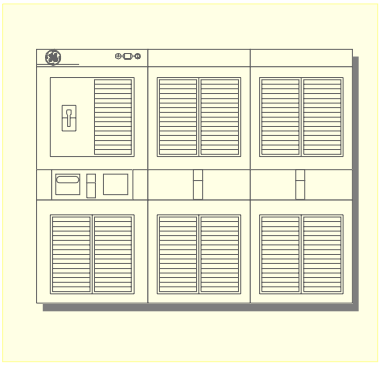


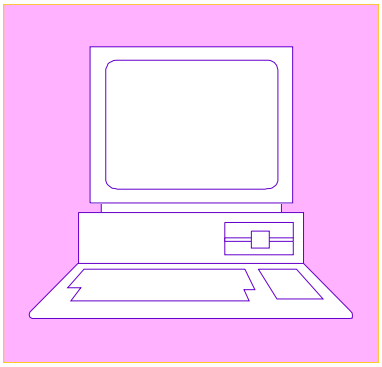
Innovation Series™ Low Voltage Drives

Installation and Startup

Document: GEH-6388
Issued: 1999-09-24

Innovation Series





Innovation Series™ Low Voltage Drives

Installation and Startup

Printed in the United States of America.

These instructions do not purport to cover all details or variations in equipment, nor to provide every possible contingency to be met during installation, operation, and maintenance. If further information is desired or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to GE Industrial Systems, Salem, Virginia, USA.

Document Identification: GEH-6388, original release
Technical Writer/Editor: Teresa Davidson
Technical Responsibility: Anthony Galbraith

Safety Symbol Legend

Warning

Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

Caution

Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

Attention

Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

Note **Indicates an essential or important procedure, condition, or statement.**

This equipment contains a potential hazard of electric shock or burn. Only personnel who are adequately trained and thoroughly familiar with the equipment and the instructions should install, operate, or maintain this equipment.

Isolation of test equipment from the equipment under test presents potential electrical hazards. If the test equipment cannot be grounded to the equipment under test, the test equipment's case must be shielded to prevent contact by personnel.

To minimize hazard of electrical shock or burn, approved grounding practices and procedures must be strictly followed.

To prevent personal injury or equipment damage caused by equipment malfunction, only adequately trained personnel should modify any programmable machine.

Contents

Chapter 1 Overview

Introduction 1-1
How to Use This Document 1-2
    Structure of the Document 1-2
    Text Conventions 1-2
How to Get Help 1-2
Equipment Covered 1-4
Related Documents 1-5
    Document Distribution 1-5
Acronyms and Abbreviations 1-6

Chapter 2 Handling and Mounting Guidelines

Introduction 2-1
Drive Handling Procedures 2-1
    Lifting 2-2
    Moving 2-3
    Unpacking 2-3
Mounting 2-4
    Securing Lineup Sections Together 2-4
    Securing the Drive Lineup to the Floor 2-7

Chapter 3 Cabling and Connections

Introduction 3-1
Drive Connections 3-2
    Control Power 3-4
Grounding 3-6
Power Cabling Guidelines 3-7
Signal and Communications Cabling Guidelines 3-9
Preventing Cable Damage 3-9

Chapter 4 Device Installation

Tachometer Mounting 4-2
Motor Shaft Ground Brush 4-3
    Installing the Ground Brush 4-3
Line Filter Assembly (Non-Regenerative Source) 4-4
    Line Filter Specifications 4-5
Optional Line Reactor (Non-Regenerative Source) 4-6
    Selecting the Line Reactor 4-6
Reactor Assembly (Regenerative Source) 4-8

Contents—continued

Chapter 5 Pre-Powerup Installation Checks

Introduction 5-1
Equipment/Material Needed 5-2
Securing the Equipment for Safety 5-2
Hardware Checks 5-3
Optional Megger Test 5-5
- Pre-Test Power Checks 5-5
- Non-Regenerative Sources 5-6
- Regenerative Sources and Inverters 5-6

Chapter 6 Startup and Commissioning

Introduction 6-1
Before Beginning 6-2
- Order of Startup 6-2
- Information Needed 6-2
- Equipment/Material Needed 6-3

Verifying Control Power 6-6
Checking Processor Start 6-7
Using the Drive Configuration Tools 6-8
- Using Toolbox Online Help 6-8
- Starting the Toolbox 6-9

Configuring Drive Software 6-10
- Open a Drive File 6-10
- Creating a New Drive Configuration File 6-11
- Checking Toolbox/Drive Pattern Compatibility 6-11
- Downloading to the Drive 6-13
- Optional: Upgrading the .icb File 6-13

Checking for Correct Firmware and Hardware 6-15
Checking the Keypad (DDI) 6-17
- Using the Keypad for Startup and Commissioning 6-17
- Adjusting Keypad Display Contrast 6-18

Commissioning the Drive 6-20
- Overview of Drive Parameters/Wizards 6-20
- Running the Commissioning Wizard 6-24
- Running the Cell Test Wizard 6-26
- Optional: Using the Trend Recorder to Observe Cell Test 6-27
- Running the Tuneup Wizards (Inverters Only) 6-29

Contents—continued

Appendix A Understanding Equipment Drawings

Introduction A-1
Data Nameplate A-2
Identifying the Equipment A-2
    Equipment Catalog Number A-2
    Intelligent Part Number A-3
Drawing Numbers A-3
Outline Drawings A-4
Panel Layout Drawings A-4
System Elementary Diagrams A-4
    Equipment Reference Information A-4
    Elementary Drawing Number A-5
    Wire Number Identification A-5
Conventions Used with Other Equipment A-6

Appendix B Cable Separation and Routing

Introduction B-1
Low-Level Signals (Level L) B-2
Medium-Level Signals (Level M) B-2
High-Level Signals (Level H) B-2
Power (Level P) B-2
Class Codes B-2
Cableway Spacing Guidelines B-3
    General Cableway Spacing B-3
    Tray/Tray Spacing B-4
    Tray/Conduit Spacing B-4
    Conduit/Conduit Spacing B-5

Appendix C Printed Wiring Board Reference

Appendix D Pre-Startup Checklist

    Transformer D-1
    Drive Software D-1
    Drive Hardware D-1
    Motor D-1

Contents—continued

Appendix E Configuring an Innovation Series Drive

Introduction....E-1
Creating an Innovation Series Drive....E-2
New Drive....E-2
Pattern and Version....E-3
Verify the Drive IPN....E-3
Enter User Identification....E-4
Configuring the Drive....E-5
Toolbox Work Area....E-5
Enter Job Specific Information....E-7
Upgrading a Configuration....E-7
Select Upgrade Version....E-8
Working with Files and Menus....E-9
File Types....E-9
Pattern Files....E-10
Opening and Closing Files....E-10
Saving Files....E-10
Exporting Configuration Files....E-11
Exporting/Opening Project Files....E-11
Menu Commands....E-12
Concepts....E-18
Configuration....E-19
Parameters....E-19
Toolbox/Drive Communications....E-21
Communication Settings in a Second Drive....E-22
Block Diagram....E-24
Links to Other Pages....E-25
Modify Parameters from Diagram....E-25
Parameter Jumpers....E-26
Live Data Display....E-26
Drag-and-Drop Variables....E-27
Printing Diagrams....E-28
Drive Controls....E-29
Wizards....E-30
Choose Wizard....E-30

Glossary of Terms

Index

Chapter 1 Overview

Introduction

For a list of the drives that may be included in an LV lineup, refer to the "Equipment Covered" section of this document.

This document is an installation and startup guide for Innovation Series™ Low Voltage (LV) ac drive lineups. It assumes the following:

- All receiving, handling, and storage procedures were strictly followed, as defined in document GEI-100256.
- You are ready to move the drive(s) to the installation site.
- The installation site was previously prepared and cables run per GE specifications, and all necessary system parts are at onhand at the site.

Additionally, these instructions require that the user:

- Be adequately trained to thoroughly understand and strictly follow **all safety procedures** necessary for working with and around high voltages.
- Know the physical and electrical requirements of installing high voltage equipment.
- Understand the theory of drive operation.
- Be experienced in using the Innovation Series drive configuration software (the GE Control System Toolbox).
- Understand the structure and conventions of this document in order to follow the instructions exactly as required.

This first chapter provides an overview of how to use this document correctly, as follows:

Section ***Page***

How to Use This Document 1-2
Structure of the Document 1-2
Text Conventions 1-2
How to Get Help 1-2
Equipment Covered 1-4
Related Documents 1-5
Document Distribution 1-5
Acronyms and Abbreviations 1-6

The remainder of the document is organized in the order required for installing and starting the drive lineup (see *How to Use This Document*).

How to Use This Document

Structure of the Document

GE recommends that a detailed installation log is maintained for each drive as these installation and startup steps are completed.

Sections of related procedures are presented in the **order that they should be followed** (see Figure 1-1).

Appendices provide reference information, as follows:

A, *Understanding Equipment Drawings*

B, *Cable Separation and Routing*

C, *Printed Wiring Board Reference*

D, *Pre-Startup Checklist*

E, *Configuring an Innovation Series Drive*

For an exact outline of the document's organization, refer to the *Table of Contents*.

Text Conventions

Convention	Meaning
➢	A procedure follows.
Numbered list	Procedural steps to be followed in order (for example, *1, 2, 3).*
Alphabetized list	Procedural substeps (of numbered steps) to be followed in order (for example, *a, b, c).*
Bulleted (•) list	Related items or procedures, but order does not matter.
◆	A procedure with only one step.
Boxed (☐) list	A checklist.
Arial Bold	When describing software, indicates the actual command or option that is chosen from a menu or dialog box.
`Monospace`	Represents examples of screen text or words and characters that are typed in a text box or at the command prompt.

How to Get Help

If help is needed beyond the instructions provided in the drive system documentation, contact GE as follows:

"+" indicates the international access code required when calling from outside the USA.

GE Industrial Systems
Product Service Engineering
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

Phone: + 1 800 533 5885
Fax: + 1 540 387 8606

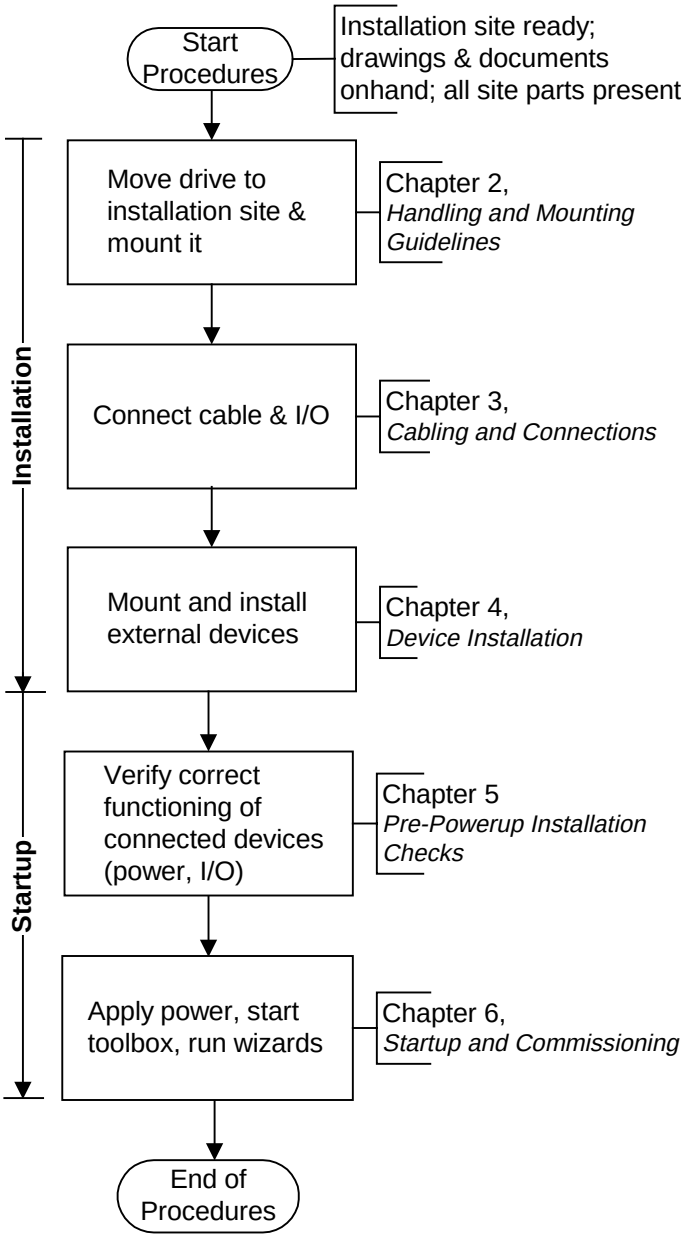


Figure 1-1. Structure of Document for Use in Installation and Startup

Equipment Covered

In this document, the term "drive" includes both sources and inverters.

An ac drive lineup is a combination of a source and one or more inverters that generate ac power to a motor at a required frequency and current. The output requirement determines the lineup structure.

The LV drives used in a lineup include common bus non-regenerative sources, common bus regenerative sources, and dc-fed inverters available in the following frame sizes:

Frame* Size	Inverter	Non-Regen. Source	Regen. Source
65	✓		
92	✓		
125	✓		
180	✓		
250	✓		
375	✓		✓
620	✓	✓	✓
1000	✓	✓	✓
1800	✓	✓	✓

*Frame size indicates the approximate current rating.

In firmware, the pattern (product) number identifies the drive application, as follows:

For additional information about the drive pattern, refer to the "Intelligent Part Number" section of Appendix A.

Pattern	Drive Application
ACDCF-G	ac drive, dc-fed inverter, general industry applications
ACDCF-S	ac drive, dc-fed inverter, system applications
ACDCF-V	ac drive, dc-fed inverter, V/Hz applications
ACCBN-A	ac drive, common bus non-regenerative source, version A
ACCBR-A	ac drive, common bus regenerative source, version A

Related Documents

If needed for supplementary information, refer to the following Innovation Series product documents, as applicable:

Subject	Document	Content
LV drives:		
Elementary drawings	GEH-6389	Standard electrical wiring schematics for all LV drive frames
Standard layout and outline drawings	GEH-6390	Standard drive panel layouts showing internal component locations, and standard outlines showing dimensions and weights, for all frames
User's guide	GEH-6392	Functional description, technical data, customer I/O connections, keypad (DDI) overview; maintenance; component replacement
Firmware application reference and troubleshooting:		Description of faults codes, firmware functions, associated parameters, wizards, and signal mapping for:
ACDCF-G	GEH-6393	dc-fed inverters, general industry applications
ACDCF-S	GEH-6394	dc-fed inverters, system applications
ACDCF-V	GEH-6395	dc-fed inverters, V/Hz applications
ACCBN-A	GEH-6396	common bus non-regenerative sources
ACCBR-A	GEH-6397	common bus regenerative sources
Printed wiring boards	See Appendix C	Board function within the drive, I/O, configuration requirements, and replacement
Related or integral products:		
Installation guidance for Innovation Series equipment	GEH-6380	Drawing content and distribution options; equipment cabling requirements; installation service options
Control system toolbox	GEH-6401	How to use the control system toolbox screens and options for configuring an Innovation Series drive
Trend Recorder	GEH-6408	How to use the Trend Recorder feature of the control system toolbox, including how to record graphical views of drive signals
Receiving, handling, and storage	GEI-100256	Procedures, precautions, and environmental requirements for receiving the drive from the shipper and storing it before installation

Document Distribution

GE Industrial Systems supplies product documents to its customers to support the equipment provided for each requisition. The contract documents define the terms of the document distribution.

If provided (per contract), the following documents contain requisition information about the drive system.

- Requisition drawings, including outlines, layouts, and elementary diagrams
- Renewal Parts listing

Note If differences exist between the general product documentation and the requisition documentation, the requisition documentation should be considered the more exact representation of your equipment or system configuration.

Acronyms and Abbreviations

A	ampere(s)
ac	alternating current
ACL	application control layer
ACOM	analog common
ADF	auxiliary device feeder
ADS	auxiliary device (circuit) switch
ATBA	IS200ATBA Application Terminal Board
CCOM	control common
CPT	control power transformer
dc	direct current
DCOM	digital common
DDI	Drive diagnostic interface (keypad)
ft	foot, feet
ft-lbs	foot-pounds (torque)
ft/min	feet per minute
GE	General Electric Company
IGBT	insulated gate bipolar transistor
in.	inch(es)
in-lbs	inch-pounds (torque)
I/O	input and output
IPN	intelligent part number
kg	kilograms
LAN	local area network
LED	light-emitting diode
level H	high-level signal
level H(S)	high-level signal, special handling
level L	low-level signal
level M	medium-level signal
level P	power signal
level P(S)	power signal, special handling
m	meter(s)
max.	maximum
NEC	National Electrical Code®
n-m	Newton-meter (torque)
OSHA	occupation and safety health act.
PC	personal computer
PLC	programmable logic controller
PSI	pounds per square inch
PVC	polyvinylchloride
PWM	pulse-width modulated
SCR	silicon-controlled rectifier
RAPA	IS200RAPA Control Rack Power Supply board
RTDs	resistance thermal devices
SHCOM	shield common
V ac	volts ac (alternating current)
V dc	volts dc (direct current)

Chapter 2 Handling and Mounting Guidelines

Introduction

GE document GEI-100256 provides receiving and storage guidelines.

The handling and mounting requirements for the LV drives may vary according to the drive frame size and the lineup combination. This chapter provides general guidelines for moving the drives to the installation site, and then mounting them. The requisition drawings or standard outline and layout drawings in document GEH-6390 provide specific information for each drive system and are a required supplement to this document. This chapter is organized as follows:

Section	Page
Drive Handling Procedures	2-1
Lifting	2-2
Moving	2-3
Unpacking	2-3
Mounting	2-4
Securing Lineup Sections Together	2-4
Securing the Drive Lineup to the Floor	2-7

Drive Handling Procedures

Caution

Shock or stress caused by rough handling or improper lifting and moving can damage the equipment. Be sure to follow the guidelines provided in this chapter.

The shipped equipment may consist of either a single drive or multiple drives secured together in a lineup, typically not exceeding 15 ft in length.

GE recommends that you do not completely unpack the equipment until it has been moved as near as possible to its permanent location. This practice helps ensure that loose parts remain with the drive(s). Additionally, the shipping enclosure helps protect the equipment during storage.

Before lifting and moving the drive(s), always refer to the equipment outline drawings. Become familiar with the designated lift points and the stress points, and any specified handling instructions.

While lifting and moving the drive(s), be sure to follow the suggested methods in this chapter for handling the equipment, along with normal handling precautions. Additionally, it is important to observe any instructions that may be printed on or attached to the equipment container or wrapping.

Lifting

Lifting beams are attached across the top of the drive(s) at the factory.

- Make sure that the lifting equipment is suitable for the configuration and weight of the drive(s). Refer to the Figures 2-4 through 2-10.
- Observe the center-of-gravity.
- Make sure that the lifting beams are tightly secured to the drive(s).
- Use at least four hooks for lifting (see Figure 2-1).
- The lift cables should be at an angle greater than 45 degrees from the horizontal. Use spreader bars or similar equipment to ensure this angle.
- Lift the drive(s) in a slow and steady manner to an acceptable clearance height.
- Check for any flexing of the equipment. If noticed, lower the lineup and re-position the cables.

Caution

Do not lift and move the drive(s) using equipment that applies pressure from below, such as a forklift. Doing so could damage the drive frame. If a crane is not available for lifting, contact GE for guidelines on using other methods.

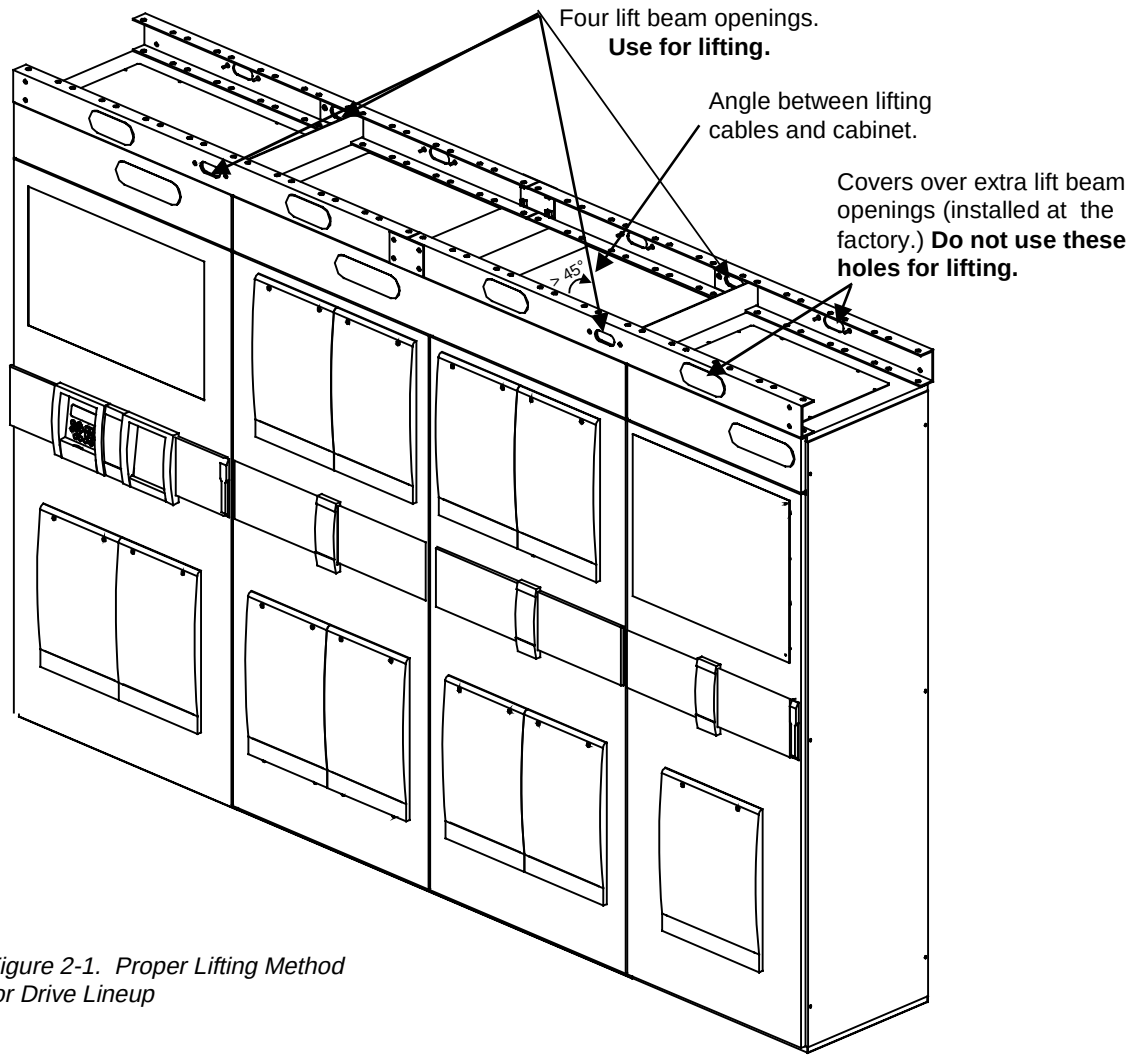


Figure 2-1. Proper Lifting Method for Drive Lineup

Moving

- When using a crane, be sure that motions are slow and smooth so that the equipment does not swing.
- If using other moving devices, such as rollers:
  - Be sure to place the rollers at the shipping splits and at the corners to reduce potential stress.
  - Roll only on the shipping pallets that are attached to the cabinets when shipped from the factory.
- Do not move with a forklift, since the weight of the drive against the forklift tines would put damaging pressure on the drive frame.
- Make sure that all doors are closed and latched.

Unpacking

Recommended: *Do not completely unpack the equipment until it is placed as near as possible to its permanent location.*

- If the equipment has been exposed to low temperatures for an extended period, do not unpack it until it has reached room temperature (location where drive will be mounted).
- Use standard unpacking tools, including a nail puller.
- When unpacking, check the contents of each case against the packing list. Report any shortage to GE.
- Carefully remove the packaging and move the equipment from its container, still observing all lifting and handling guidelines.
- While unpacking, inspect for damage that may not have been detected at the time of receipt.
- Wipe off any particles of packing materials or foreign substances that may be lodged in or between the parts.
- Small parts (such as bolts and screws) are packed in special containers to keep them together, but may become separated. For this reason, carefully inspect the packing material for loose parts before discarding it.

Document and report equipment damage to GE.

➢ **Do the following if equipment damage is discovered while unpacking**

1. Stop unpacking immediately and report this finding to the carrier (transportation company).
2. Photograph the damage (photographs may be needed later in processing the claim).
3. File a claim with the carrier.
4. Contact the local service office of GE Industrial Systems for assistance.
5. When identifying missing or damaged parts, be sure to include the following information (refer to Appendix A):
   - Serial number
   - Part (model) number
   - Drive code
   - GE requisition number
   - Case number

Mounting

*GE document GEH-6390 contains the outline drawings for each drive **frame** size.*

Figures 2-4 through 2-10 are simplified outline drawings that provide the following installation data:

- Drive dimensions
- Door clearance
- Bolt hole location
- Drive weight
- Heat loss
- Airflow requirements

These figures reference the more detailed individual outline drawings available for each frame size in GEH-6390.

*The requisition outline drawings show specific **lineup** and installation details.*

➢ **Along with the information shown on the outline drawings, use the following mounting guidelines**

- The mounting surface should be smooth and level to prevent door misalignment.
- Position the drive to permit heat radiation from all surfaces and proper ventilation (cooling air).
- Provide front clearance of at least the width of the enclosure door so that the door can be fully opened for easy access.
- If lifting beams are removed after positioning the equipment, then lifting beam hardware **must** be replaced in the holes in the enclosure top and re-tightened.

Securing Lineup Sections Together

Drives within a shipping split have been secured together at the factory.

Lineups are typically shipped in sections of 15 ft or less, called *shipping splits*. During the mounting process, the installer must attach these shipping splits together in three primary locations (refer to Figure 2-2):

- Drive cabinets, using tie brackets and plates
- Dc through-bus, using power bus tie splices (connectors)
- Protective ground, using ground tie plates

The required hardware for the connections are shipped in boxes placed inside the drive cabinets.

Connecting the Cabinets

This connection uses two tie brackets and four tie plates for each shipping split. The tie brackets mount to cabinet framework, one in front and one in the rear, approximately midway up the cabinet. The four case tie plates mount at the floor and the roof of the cabinet.

Connecting the DC Through-Bus

This connection uses two flexible dc bus tie splices for each lineup split. The bus tie splices are bolted directly to the integral dc through-bus.

➢ **When making this connection**

- Inspect the rubber sleeve for insulation damage before installing it.
- Tighten bus bolts to the appropriate torque **before** energizing the drive (see Table 2-1).

Connecting the Protective Ground

A metal ground tie plate is supplied to connect the protective ground from one cabinet to the adjoining cabinet.

This connection must be complete to ensure proper grounding of the equipment.

Table 2-2. Torque Values for Screw/Bolt Connections

Screw/Bolt Connection	Fastener Size	Torque		
		in-lbs	ft-lbs	n-m
Capacitor:				
Terminal connections	M16	30	3	3
Nylon nut	Special	70	6	8
IGBTs:				
Mounting screws to heatpipe	M6	45	4	5
Captive screws attaching interface board	M3	13	1	1
Nuts attaching interface board	M4	13	1	1
Bus bolts and standoffs (65 frame)	M4	45	4	5
Bus bolts and standoffs (92, 125, 180, 250 frames)	M5	60	5	7
Bus bolts and standoffs (375, 620, 1000, and 1800 frames)	M6, M8	95	8	11
Diode/SCR module (620, 1000, and 1800 frames), mounting screws to heatpipe	M6	96	8	11
Bus, cable, and lug bolted connections*	1/4-20 or M6	48	4	5.4
***Note** Listed values apply to bolts torqued by the nut. Add 20% to the listed values for bolts that must be torqued by the bolt head, such as into press-nuts or cage-nuts.	5/16-18 or M8	96	8	11
	3/8-16 or M10	168	14	19
	1/2-13 or M12	420	35	47
	5/8-11	840	70	95

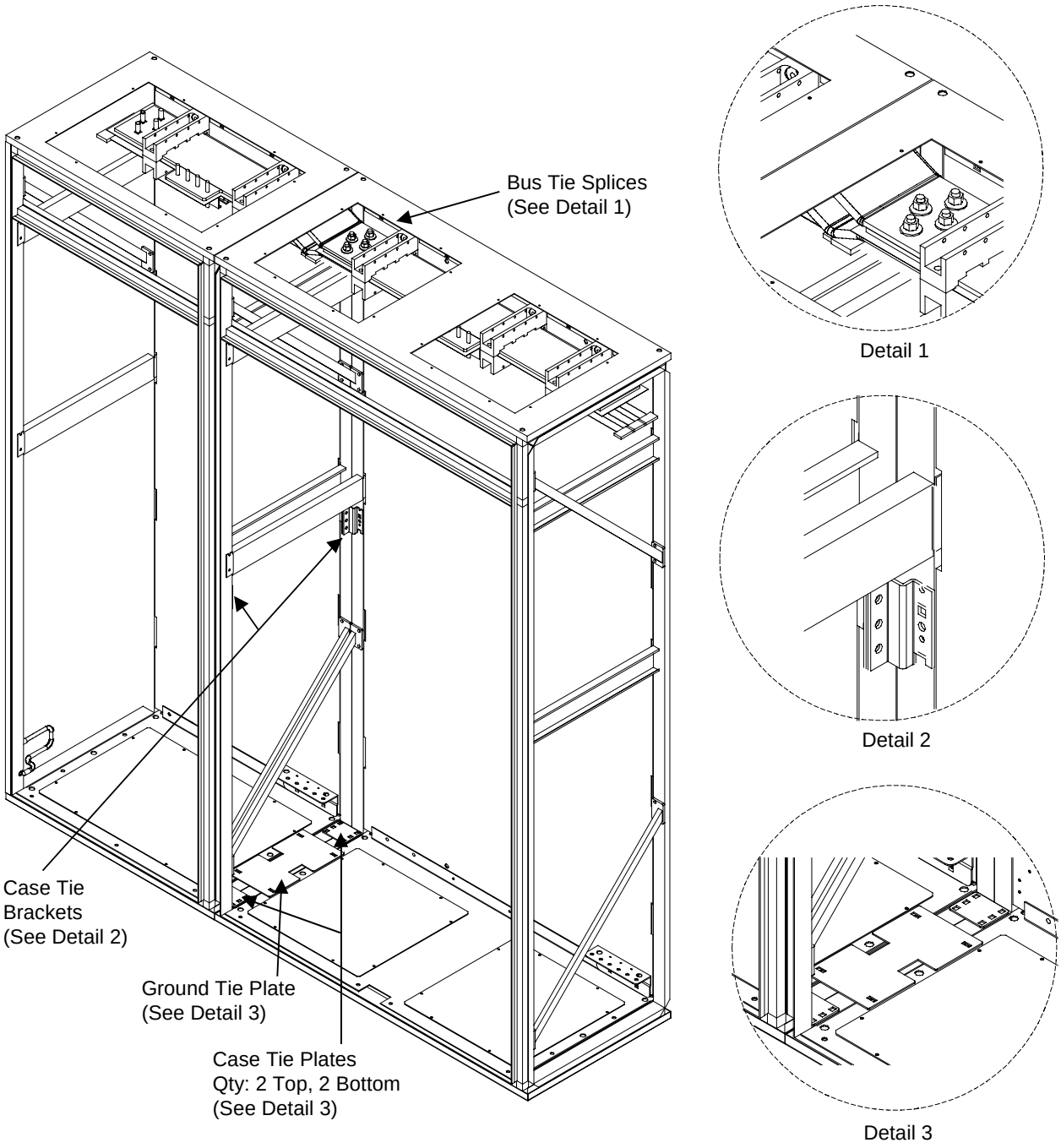


Figure 2-2. Cabinet Tie Points

Securing the Drive Lineup to the Floor

The drive lineup must be secured to the floor using mounting studs. Figure 2-3 shows the location of mounting holes within a drive cabinet. Figures 2-4 through 2-10 provide dimensions for the mounting studs and the mounting holes within each drive cabinet.

Note The drives and drive lineup do not include an option for wall-mounting.

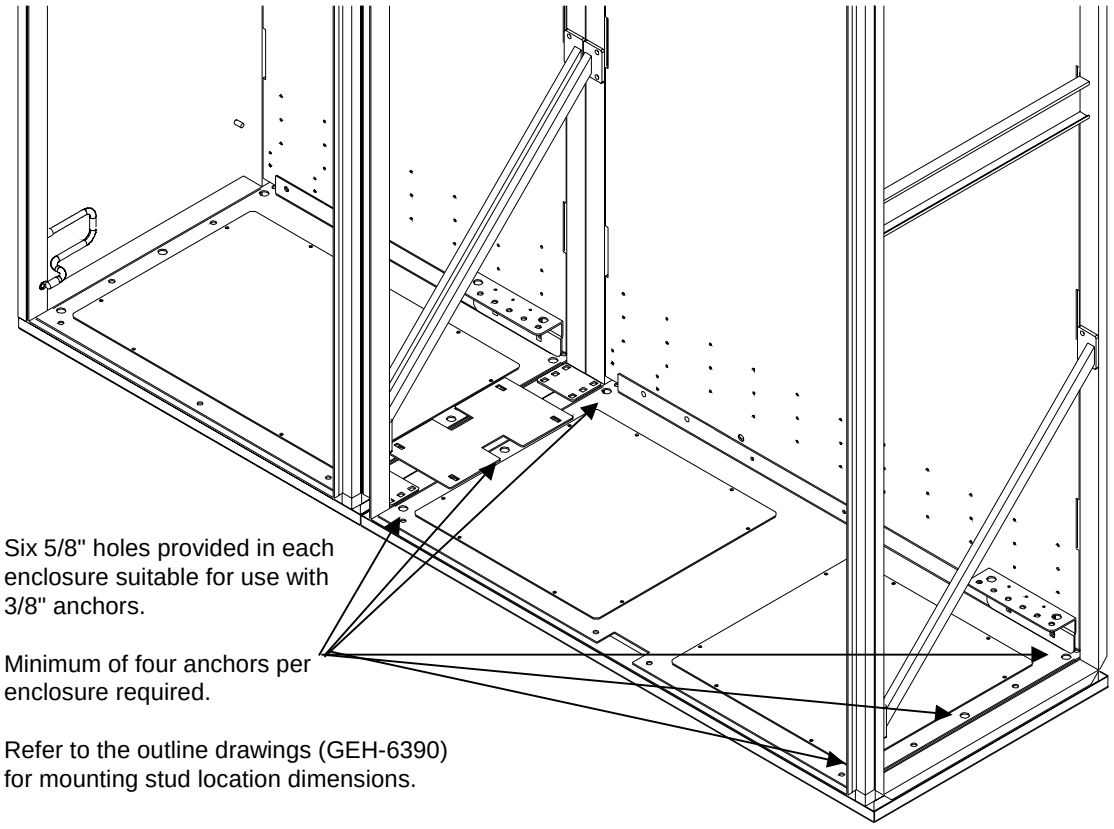
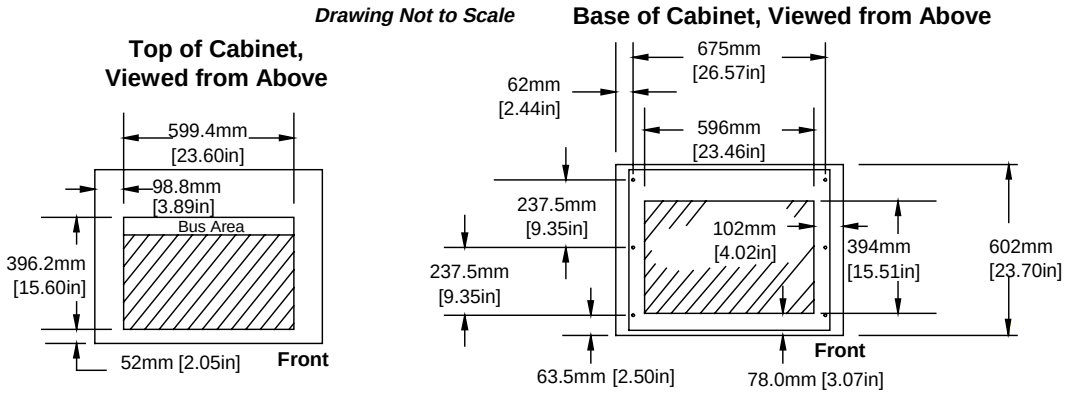
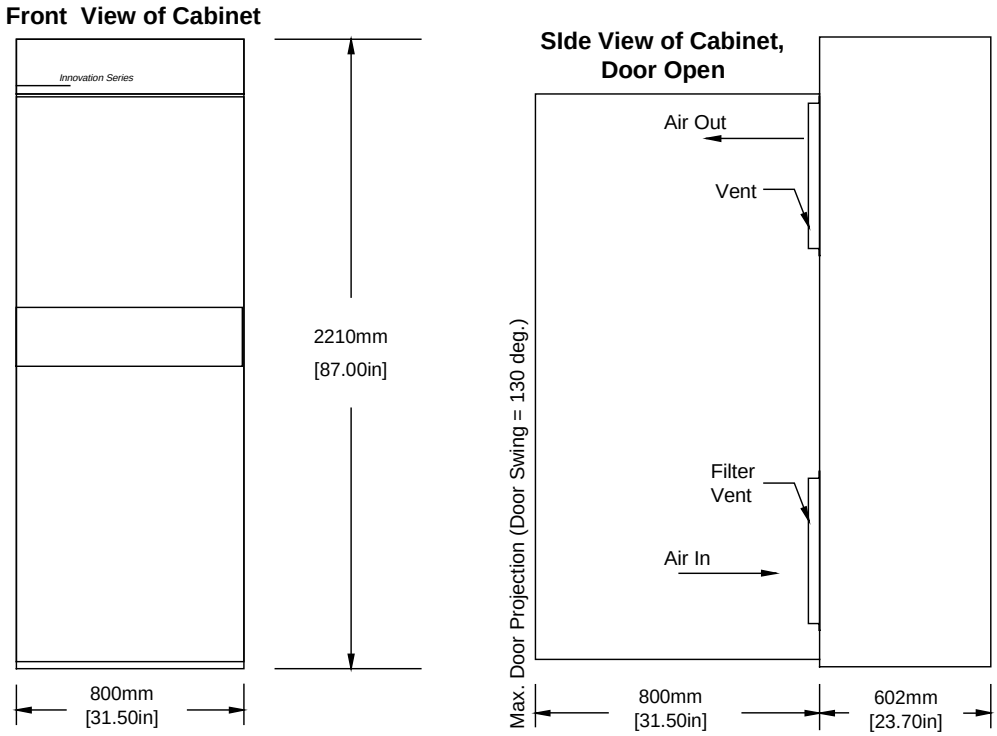


Figure 2-3. Location of Holes for Securing Drive Cabinet to Floor



Suggested Mounting Studs: 10mm[0.375in] Diameter X 76mm[3.00in] Above Floor Level

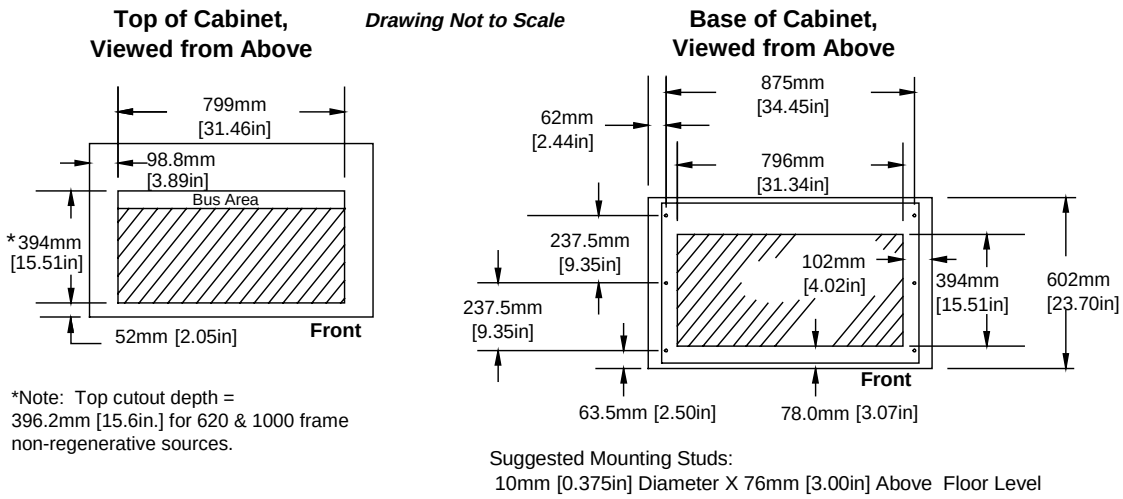


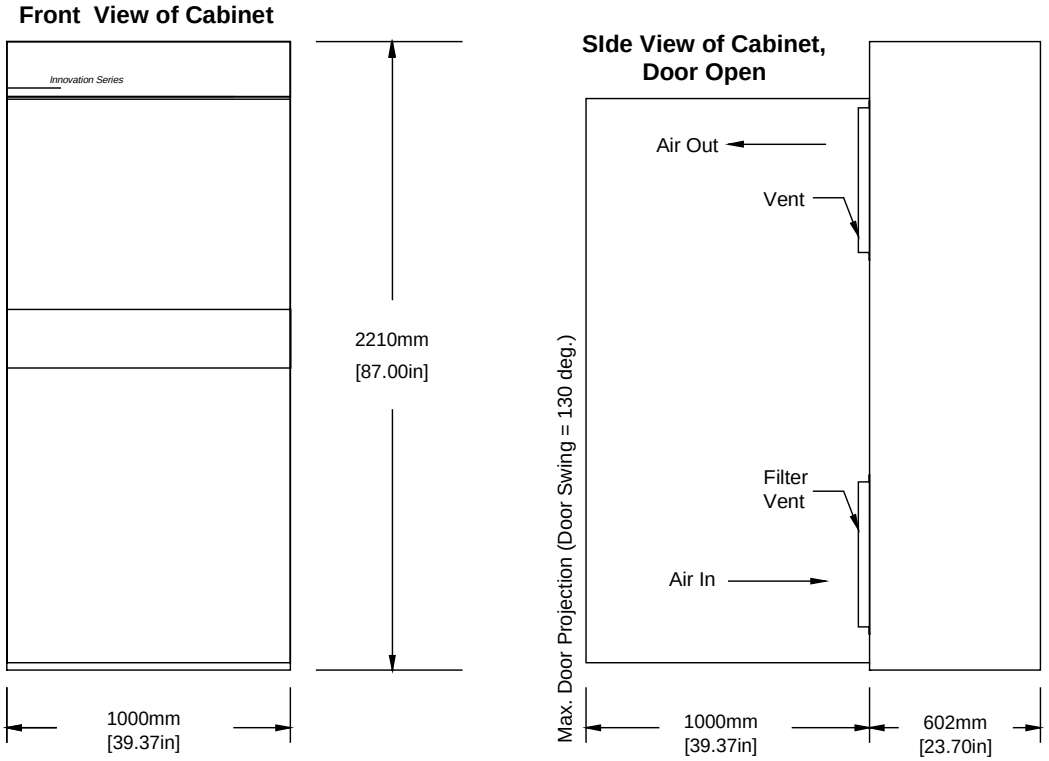
Drive Type	Frame Size	Weight (kg / lbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)**	Standard Outline Dwg. (see GEH-6390)
Inverter	65*	344 / 760	1000	80	259B4500AO
	92*		1500	200	259B4501AO
	125*		1800	200	259B4502AO
	180*		2500	200	259B4503AO
	250	408 / 900	3600	300	259B4504AO
	375		5200	600	259B4505AO
	620		8000	600	259B4506AO
Auxiliary	--------	Variable	Variable	Variable	259B4515AO

Figure 2-4. Typical Outline for 800 mm Enclosures (65, 92,125, 180, 250, 375, and 620 Frame Inverters)

*Two inverters per cabinet; heat loss per inverter.

**Airflow throughput requirements for proper cooling.

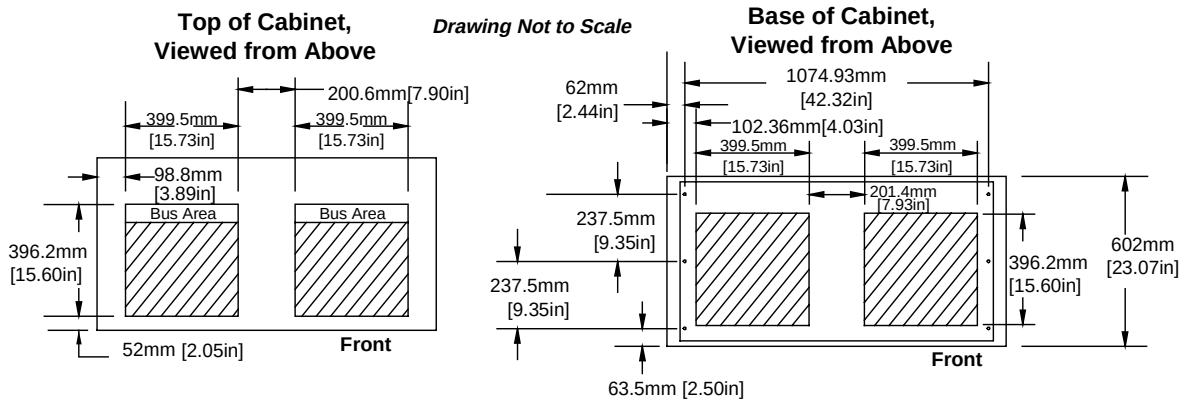




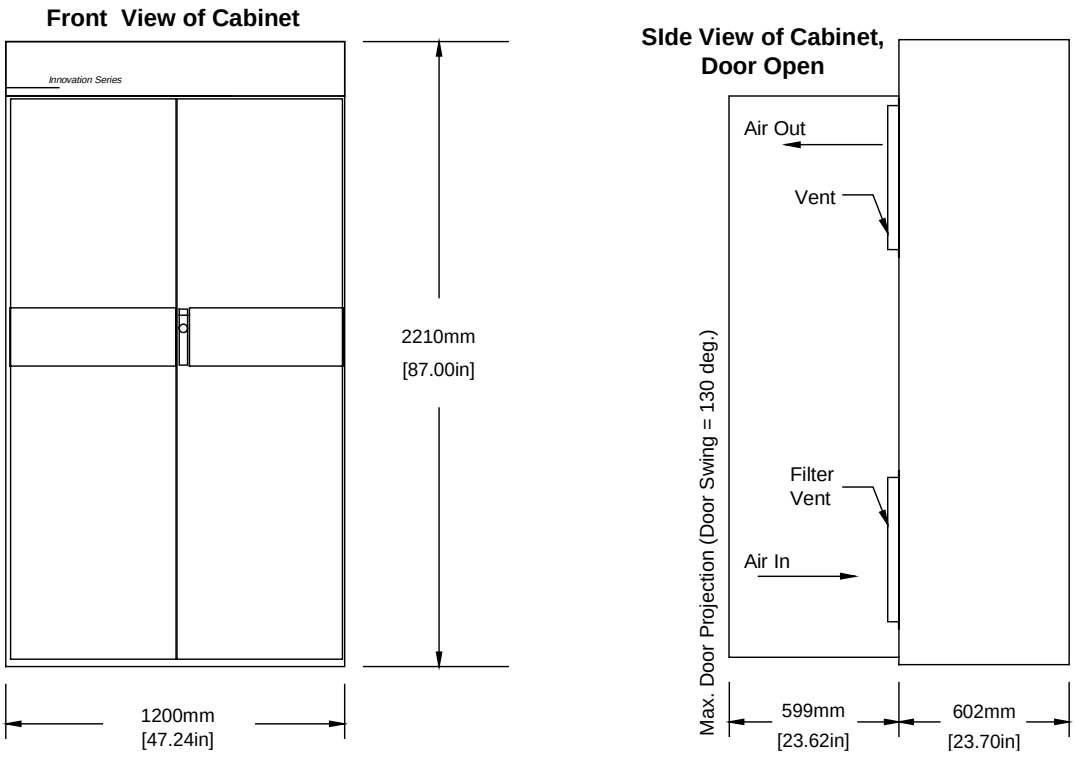
Drive Type	Frame Size	Weight (kg / lbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)*	Standard Outline Dwg. (see GEH-6390)
Regenerative source	375	590 / 1300	3000	600	259B4520AO
	620		4800		259B4521AO
Non-regenerative source	620	726 / 1600	3200	500	259B4531AO
	1000		3900	700	259B4532AO
Auxiliary	--------	Variable	Variable	Variable	259B4516AO

*Airflow throughput requirements for proper cooling.

Figure 2-5. Typical Outline for 1000 mm Enclosures
(375 and 620 Frame Regenerative Source, 620 and 1000 Frame Non-regenerative Source, and Auxiliary)



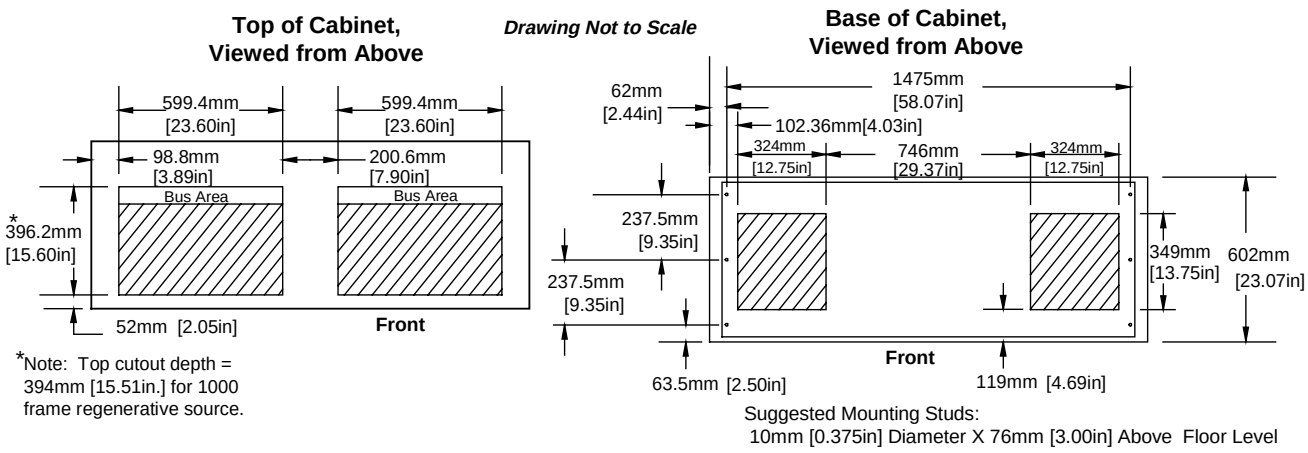
Suggested Mounting Studs:
10mm [0.375in] Diameter X 76mm [3.00in] Above Floor Level

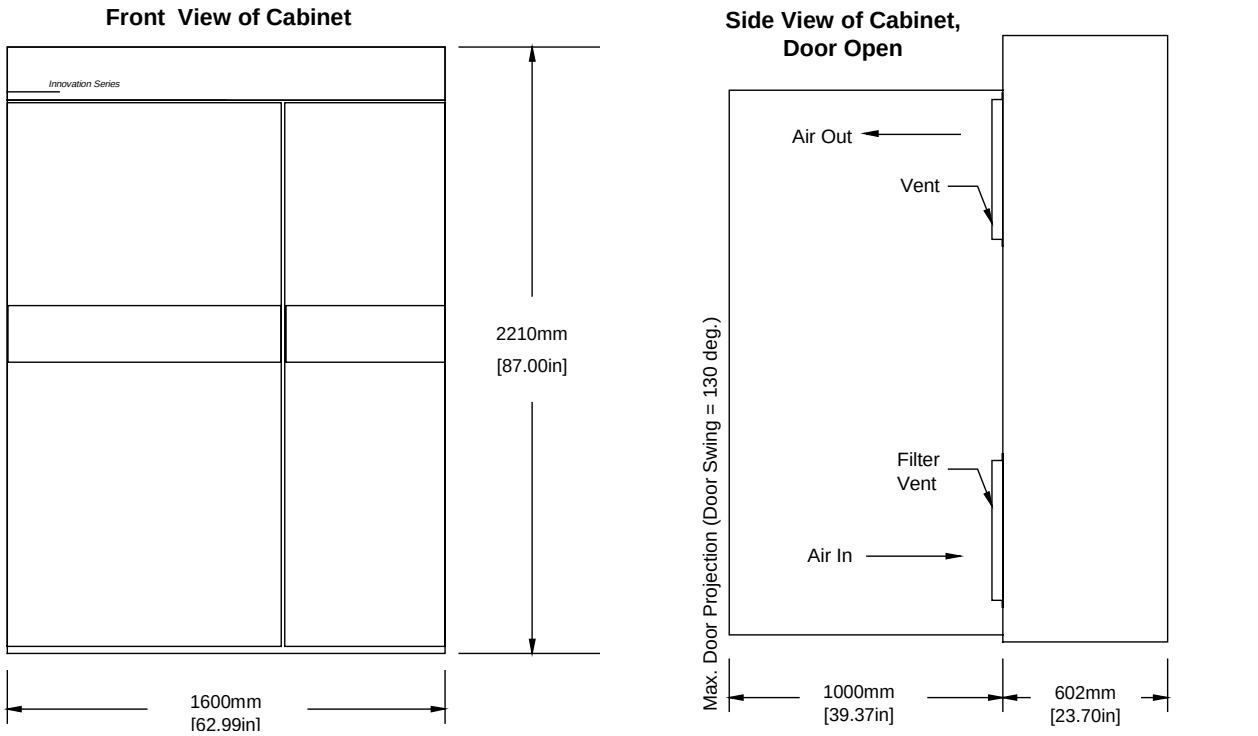


Drive Type	Frame Size	Weight (kg / lLbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)*	Standard Outline Dwg. (see GEH-6390)
Auxiliary	--------	Variable	Variable	Variable	259B4517AO

*Airflow throughput requirements for proper cooling.

Figure 2-6. Typical Outline for 1200 mm Enclosures (Auxiliary)

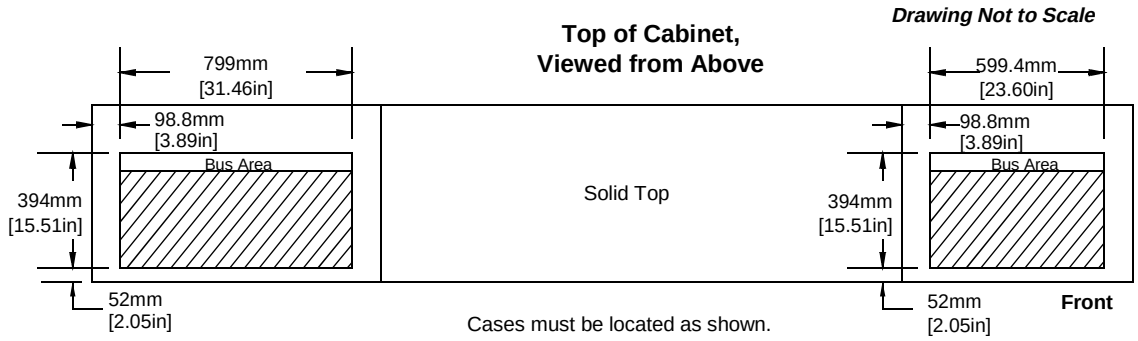




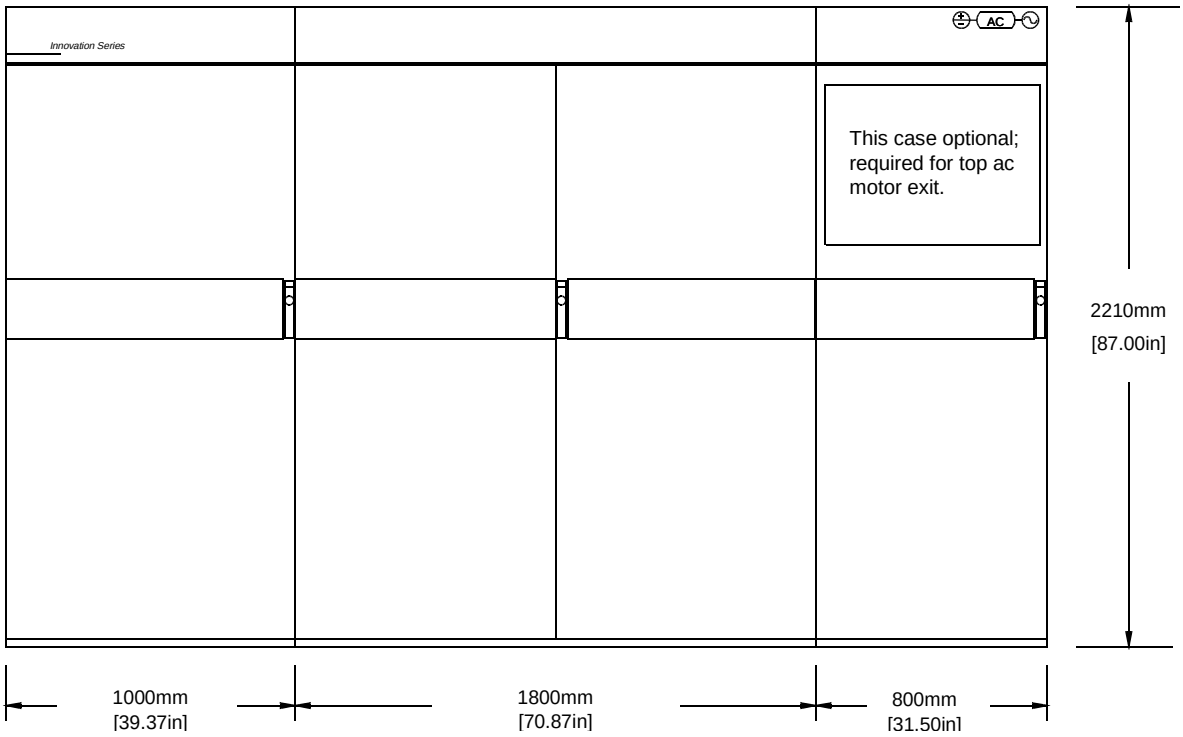
Drive Type	Frame Size	Weight (kg / lLbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)*	Standard Outline Dwg. (see GEH-6390)
Inverter	1000	714 / 1575	12500	1800	259B4508AO
Regenerative source	1000	998 / 2200	8200	1800	259B4522AO
Auxiliary	--------	Variable	Variable	Variable	259B4518AO

*Airflow throughput requirements for proper cooling.

Figure 2-7. Typical Outline for 1600 mm Enclosures
(1000 Frame Inverter, 1000 Frame Regenerative Source, and Auxiliary)



Front View of Cabinet



Drive Type	Frame Size	Weight (kg / lLbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min) ***	Standard Outline Dwg. (see GEH-6390)
Inverter	1800	1315 / 2900*	21500	3600	259B4510AO
		1633 / 3600**			

*Without optional case.
**With optional case.
***Airflow throughput requirements for proper cooling.

Figure 2-8. Typical Outline for 1800 Frame Inverter (Sheet 1 of 2)

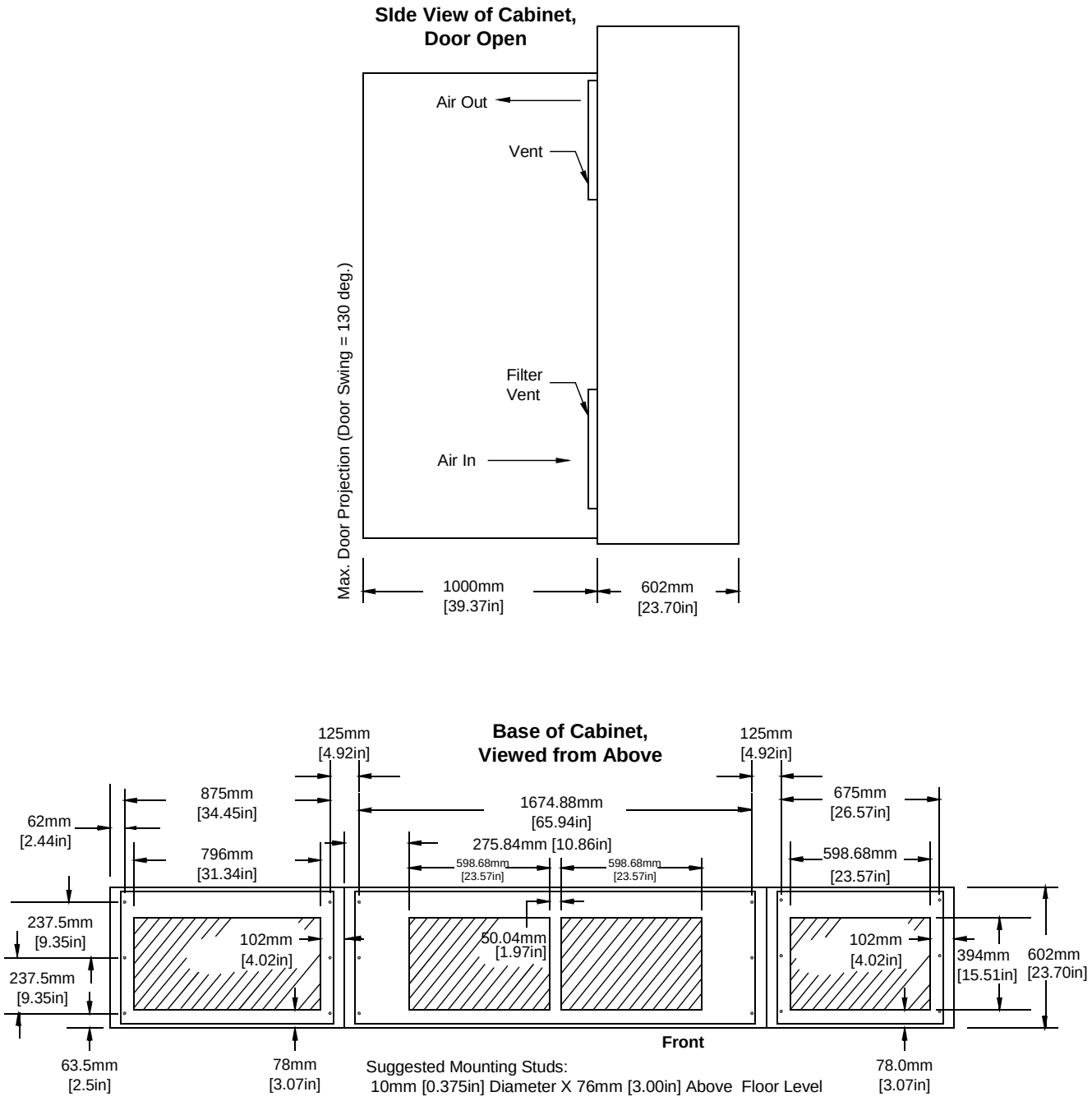
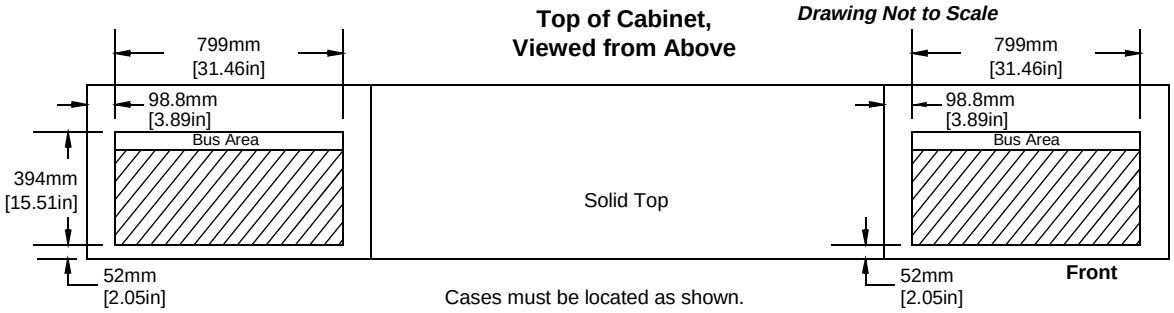
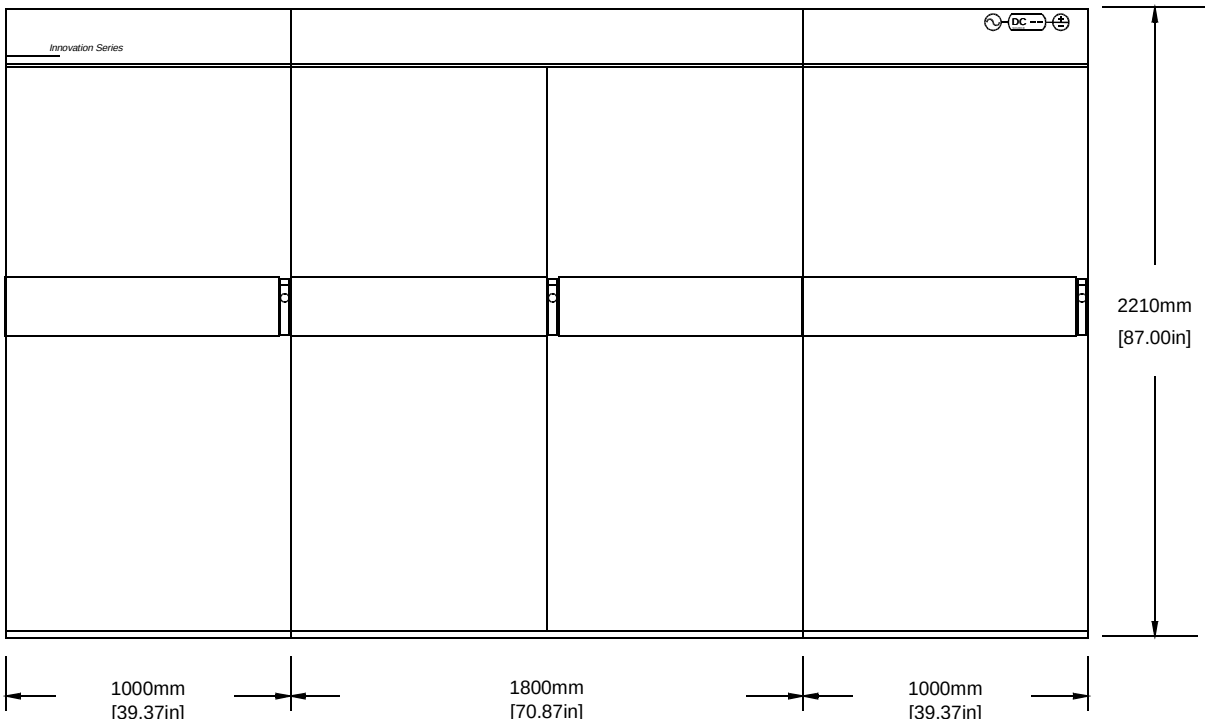


Figure 2-8. (Sheet 2 of 2)



Front View of Cabinet



Drive Type	Frame Size	Weight (kg / lLbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)*	Standard Outline Dwg. (see GEH-6390)
Regenerative source	1800	1812 / 3995	15100	3600	259B4523AO

*Airflow throughput requirements for proper cooling.

Figure 2-9. Typical Outline for 1800 Frame Regenerative Source (Sheet 1 of 2)

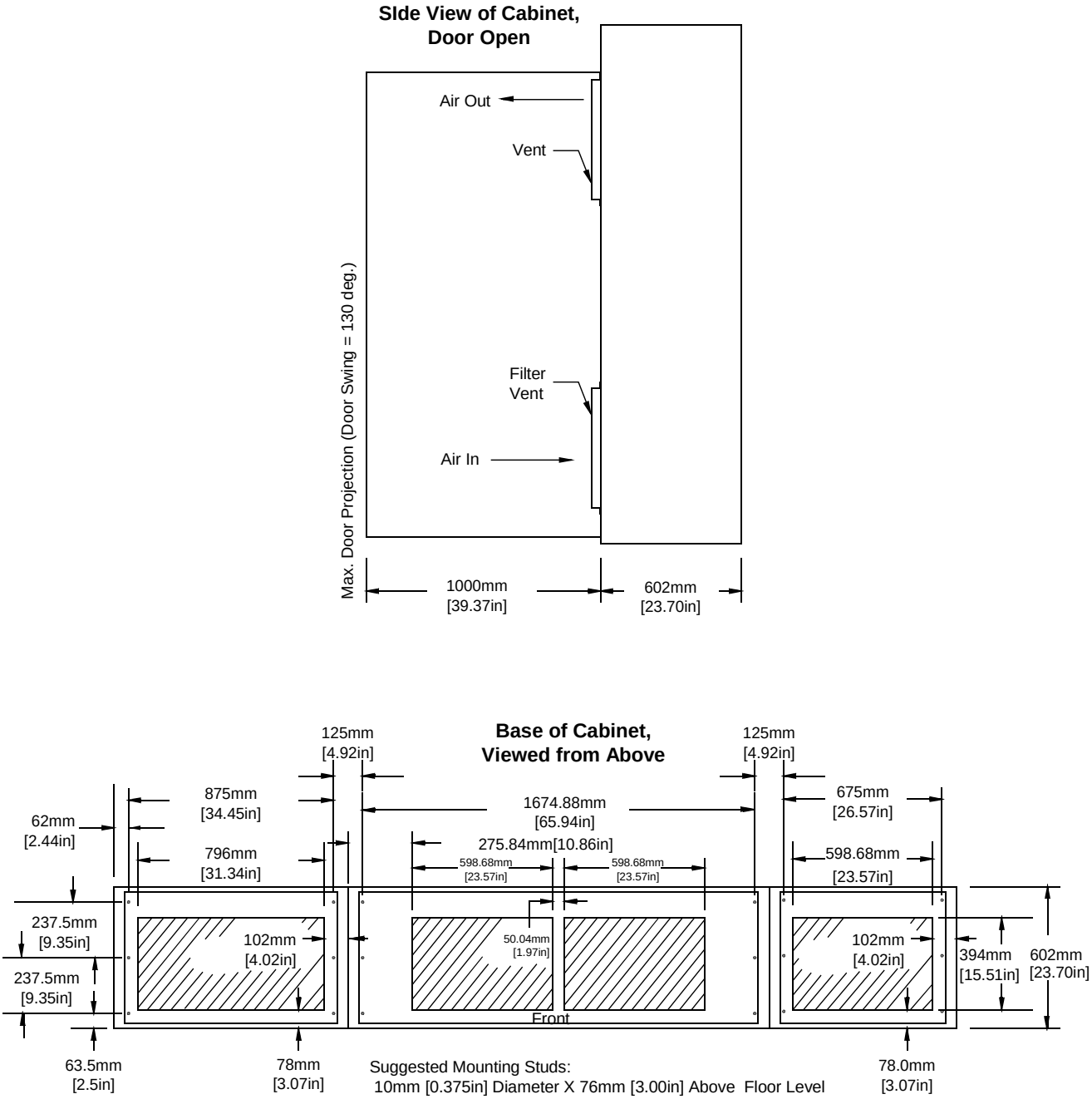
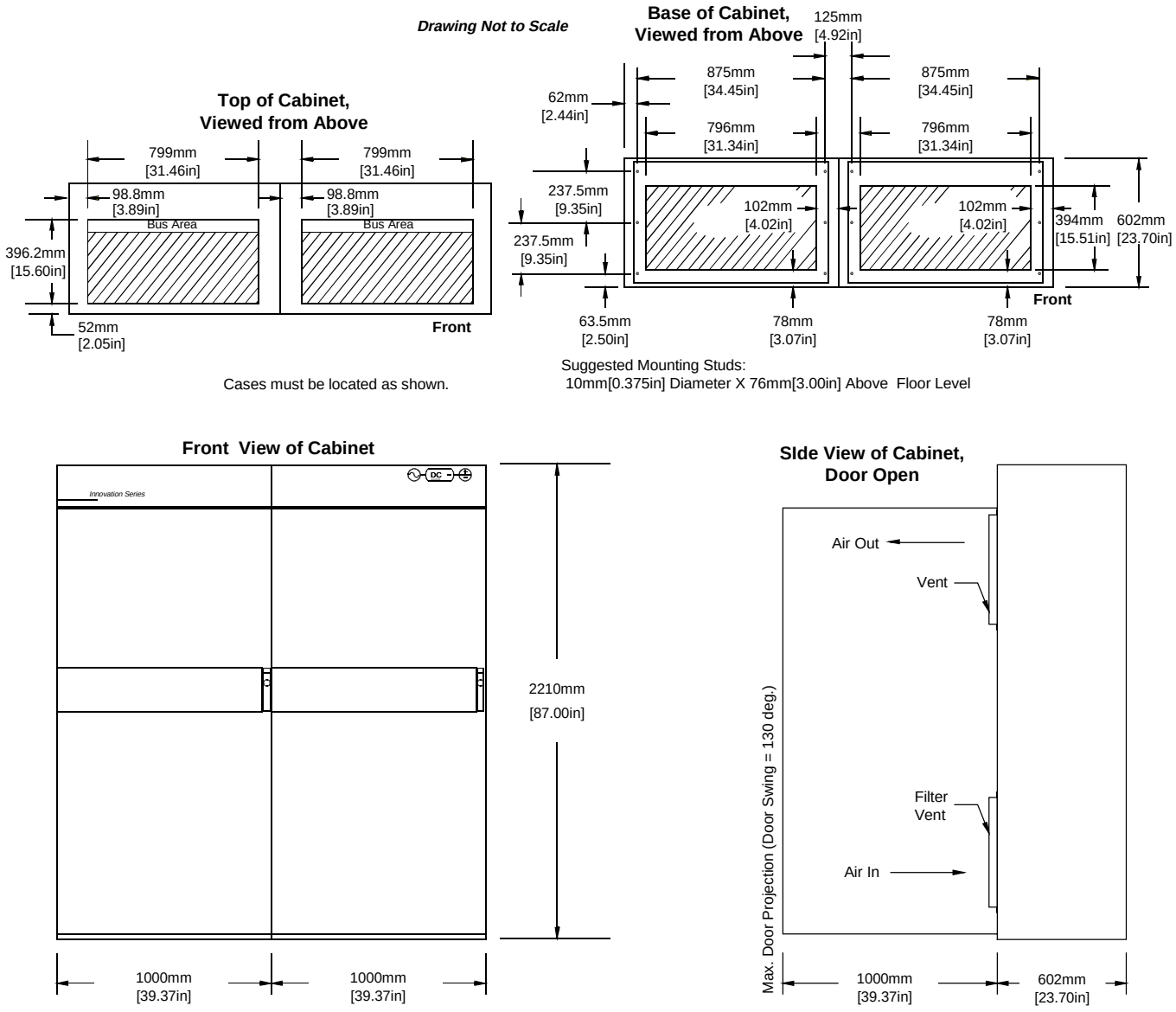


Figure 2-9. (Sheet 2 of 2)



Drive Type	Frame Size	Weight (kg / lLbs)	Heat Loss (Watts)	Airflow Req. (ft^3/min)*	Standard Outline Dwg. (see GEH-6390)
Non-regenerative source	1800	1256 / 2770	6600	1400	259B4533AO

*Airflow throughput requirements for proper cooling.

Figure 2-10. Typical Outline for 1800 Frame Non-Regenerative Source

Chapter 3 Cabling and Connections

Introduction

This chapter assumes that cabling was previously run to the installation site and ready for connection to the drive.

This chapter contains guidelines for connecting cable to the drive during installation. This information must be used along with the following equipment drawings:

- Elementary diagrams (GEH-6389), which show electrical connections and wiring, including terminal board I/O
- Layout diagrams (GEH-6390), which show physical location of the terminal board and other connection points

Do not assume any cable or any circuitry to be without power if one end of that cable could be connected to a power source. To prevent accidental electrical shock, do not touch any circuitry or bare wire without first ensuring that it does not carry electricity.

When testing for the presence of electricity and when measuring any electrical circuit, use only the equipment approved for contact with those voltage levels.

All installations should meet the requirements of both the National Electrical Code® (NEC®) and any applicable local codes. Use these codes to determine such factors as wire size, insulation type, and conduit sizing.

This chapter is organized as follows:

Section	Page
Drive Connections	3-2
Control Power	3-4
Grounding	3-6
Power Cabling Guidelines	3-7
Signal and Communications Cabling Guidelines	3-9
Preventing Cable Damage	3-9

Drive Connections

Cabling and wiring connections to the drive include:

- Cabinet ground and separate CCOM ground
- Incoming ac power cables (L1, L2, L3, top or bottom entry option with ground)
- Incoming ac control power (terminals A, B, C on line side of disconnect switch ADS with ground)
- Ac outgoing power connections to the motor (T1, T2, T3 with ground)
- Drive interface control connections to terminal board IS200ATBA

An external reactor connects to the regenerative source L1, L2, and L3 input (refer to Chapter 4).

Caution

The control power feed should not be tied between the reactor output and the bridge input of a regenerative source. Refer to the drive elementary diagram sheet CA (found in GEH-6389).

The drive User's Guide, GEH-6392, describes the terminal board I/O.

Note The drive layout drawing (see Figure 3-1) shows the location of connection points, fuses, and other drive components. These drawings are provided in document GEH-6390. Table 3-1 identifies the standard layout drawing for each frame size.

A **device nomenclature** sticker, located on the inside of the drive cabinet door identifies the drive's major components and their locations within the cabinet.

Customer cabling to the drive's terminal boards must comply with level-separation guidelines (refer to Appendix B) after it enters the drive cabinet. To meet **CE Mark requirements**, all I/O wires leaving a building must be routed inside continuous metal conduit.

Table 3-1. Standard Layout Drawings for Innovation Series Low Voltage Drives

Frame Size	Inverter Drawing	Non-Regenerative Source Drawing	Regenerative Source Drawing
65	259B4500AL		
92	259B4501AL		
125	259B4502AL		
180	259B4503AL		
250	259B4504AL		
375	259B4505AL		259B4520AL
620	259B4506AL	259B4531AL	259B4521AL
1000	259B4508AL	259B4532AL	259B4522AL
1800	259B4510AL	259B4533AL	259B4523AL

Document GEH-6390 includes the drive layout drawings.

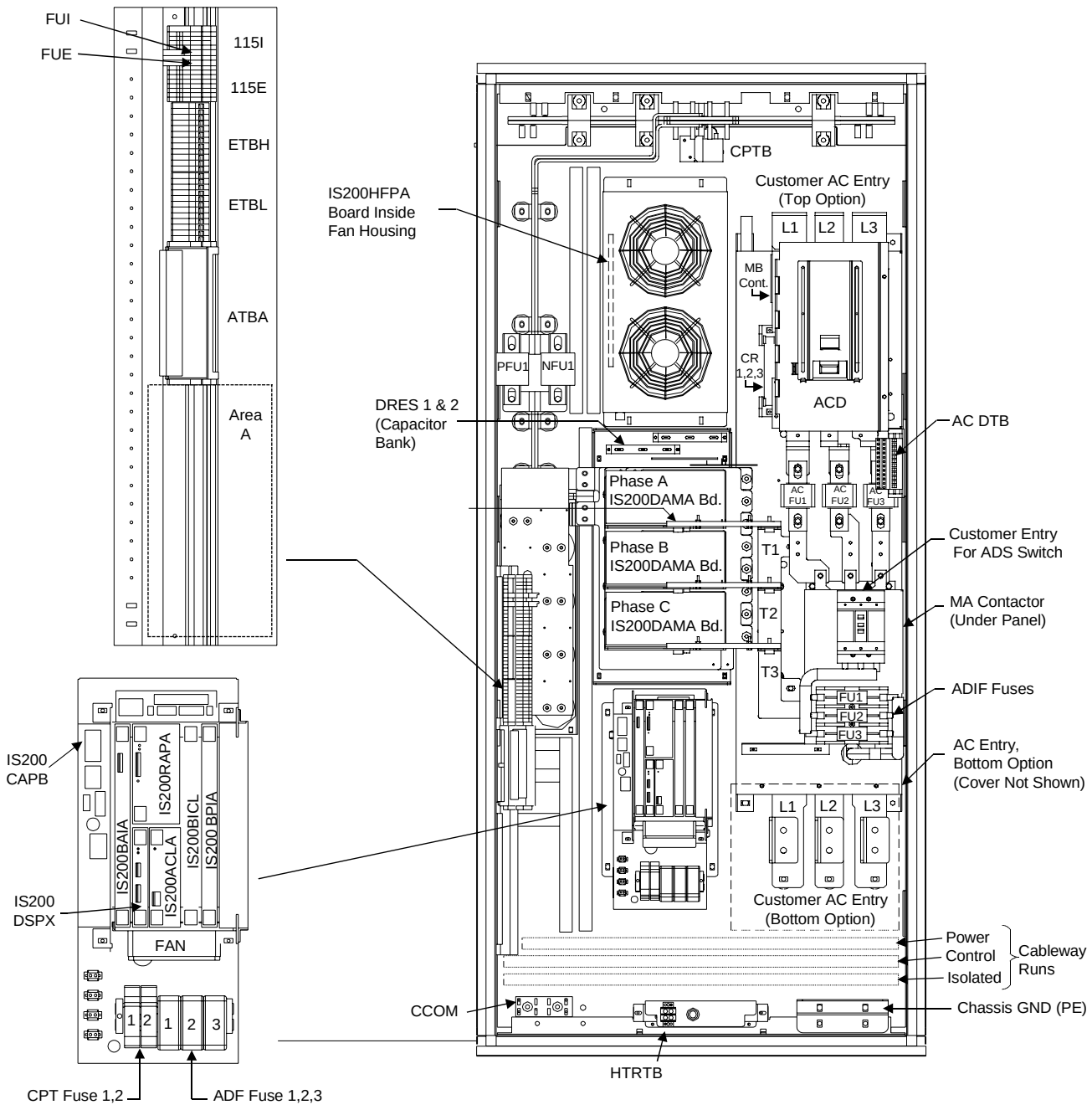


Figure 3-1. Sample Layout Drawing, 620 Frame Regenerative Source

Control Power

The drive requisition drawings specify the power requirements for the application and show connection points.

The drive control power requirements are as follows:

Voltage: 380, 415, 460, or 575 V ac, ±15% at 60 Hz; single phase

Nominal line frequency: 50 or 60 Hz, ±2%

Rating: 0.5 kVA

The CPT is mounted inside a sheet-metal subassembly within the drive cabinet. Its primary fusing is located outside this subassembly.

(Refer to Figure 3-2.) The control power transformer (CPT) primary taps are provided for voltage selection at the front of the sheet metal assembly that supports the control rack. Each CPT has a 230 V, .43 A and a 115 V, 3.47 A secondary output. 2 A of the 115 V is available at DIN-rail 115E. Secondary output fuses FUI and FUE are mounted on the DIN-rail.

Caution

***Before power is applied*, verify that the CPT primary winding's tap configuration plug is configured for the proper voltage selection.**

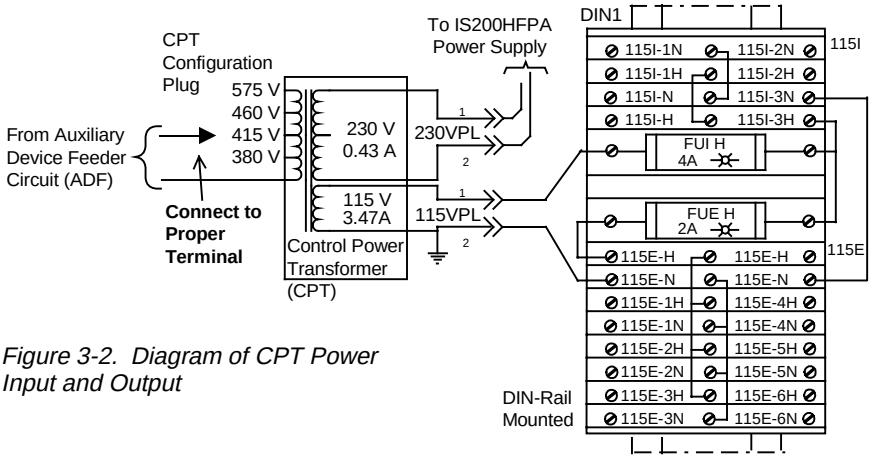


Figure 3-2. Diagram of CPT Power Input and Output

(Refer to Figure 3-3.) Control power for the drive lineup is derived from an internal 3-phase control circuit called the Auxiliary Device Feeder (ADF). The ADF is a 100 A ac, 3-phase power feeder circuit originating at the source and distributed in the overhead dc bus assembly to each dc-fed inverter.

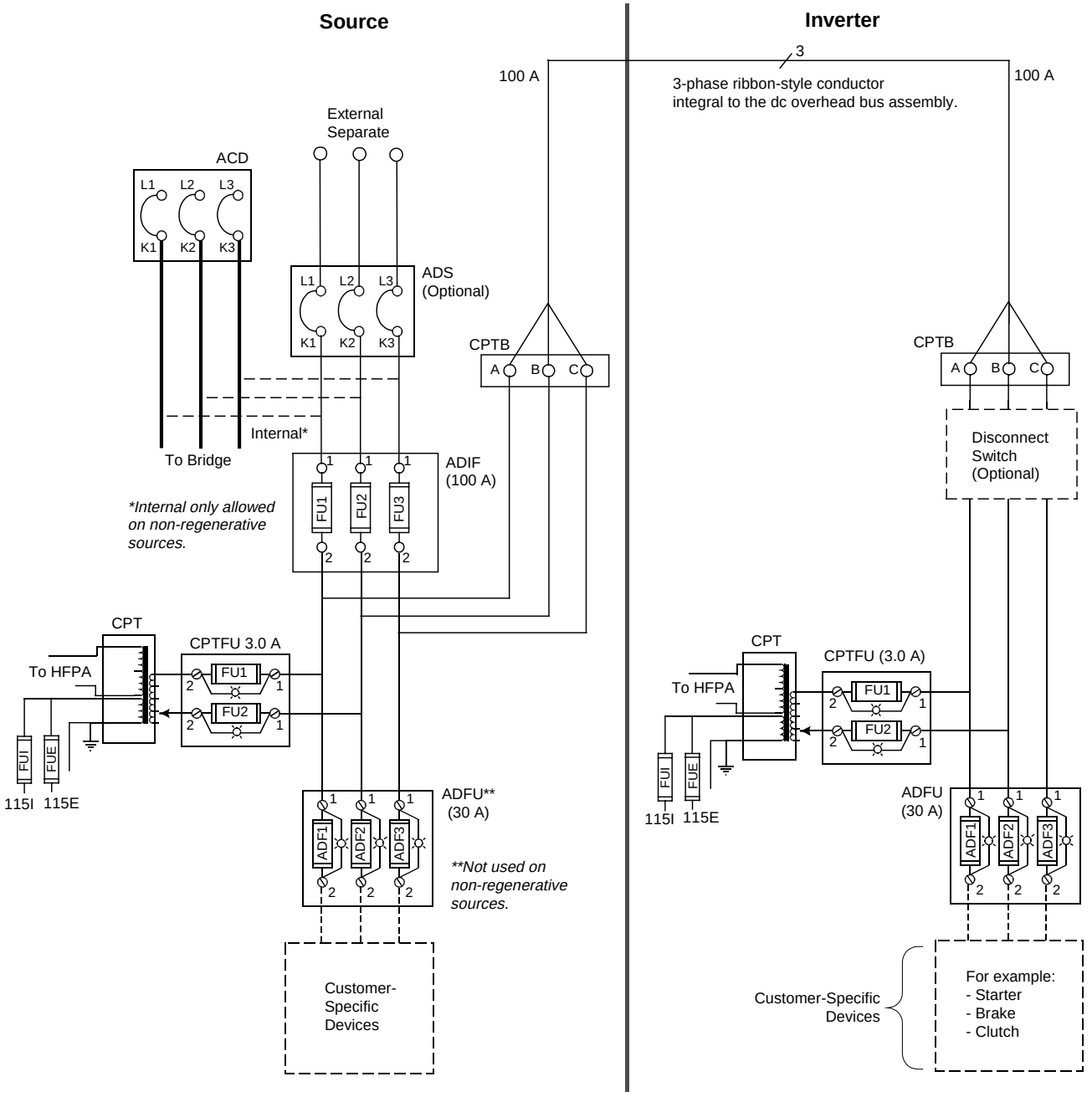
The source's ADIF fuses provide branch circuit protection for the 100 A conductor. located in the overhead dc bus assembly. 30 A branch-fuse protection (ADF1 – ADF3) is provided with each inverter to power special devices, such as motor cooling blowers and shaft brake controls. The optional dc disconnect switch serves as a cutoff for the ADF power in each inverter.

Caution

To prevent equipment damage, make sure that the total connected load currents do not exceed the ADF circuit's rating of 100 A.

In the **non-regenerative source**, the circuit can connect to either the ac incoming power lines that feed the source, or to an independent power feed. An optional ADS disconnect switch provides a cutoff for the incoming power.

In the **regenerative source**, the circuit must connect to an external source or from the line side of the source's ac reactor. This circuit **must not** connect to the load side of the reactor.



Name	Function	Name	Function
ACD	Ac power disconnect	CPTFU	Control power transformer primary fuses
ADFU	Auxiliary device feeder fuses	CPTB	Control power terminal board
ADIF	Auxiliary device input feeder fuses	HFPA	High frequency power supply board
ADS	Auxiliary device switch	115E	115 V for **external** connections at DIN-rail
CPT	Control power transformer	115I	115 V for **internal** connections at DIN-rail

Figure 3-3. Control Power Circuit in Drive Lineup

Grounding

For both safety and proper functioning of the equipment, it is important that the drive be properly grounded. The installation site must have a reliable building grounding system and the drive's grounding cable must be securely fastened to this system.

➢ **Using the elementary diagram, ground the drive lineup as follows**

- Ground the drive cabinets.
- Ground the drive common (CCOM) at only one point using a separate ground cable.

Note As an alternate to the single point grounding methods described, CCOM can be individually tied to the drive ground bus at each cabinet.

If you have an engineered system, consult your requisition elementary drawings for the grounding method recommended for your installation.

- If an isolation transformer is used and the wye neutral must be grounded, use a high-resistance ground.
- For shielded and twisted wire, ground the shields on one end only, preferably at the drive end. Provisions have been made to tie shields to chassis ground on the drive ATBA terminal board.

Figure 3-4 illustrates proper grounding of the drive.

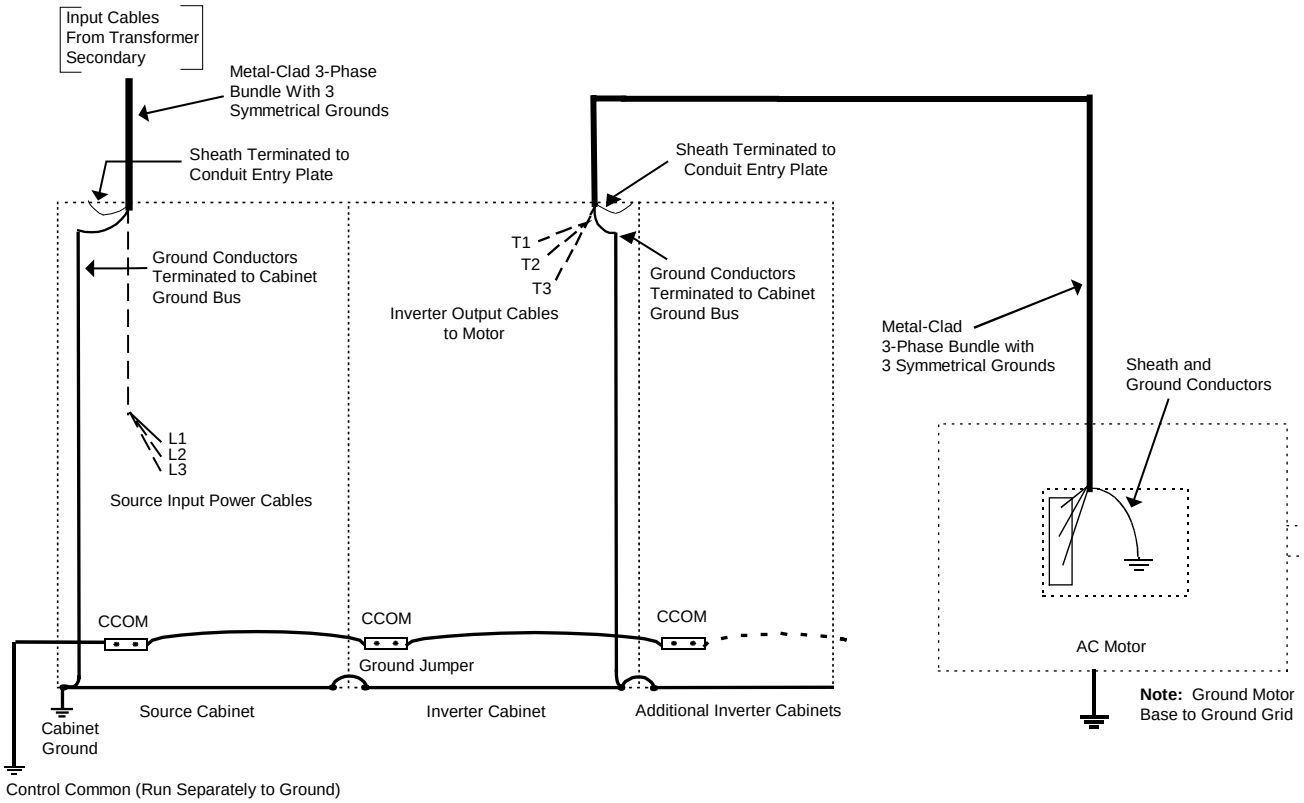


Figure 3-4. Recommended Grounding for the Drive Lineup

Power Cabling Guidelines

If help is needed, contact:

GE Industrial Systems
Product Service Engineering
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

Phone: +1 800 533 5885
Fax: +1 540 387 8606
(Replace "+" with the international access code.)

The Innovation Series drive contains sensitive electronic equipment with high voltage I/O requirements. This section provides general requirements for drive cabling.

Note Before using cable other than that recommended in this manual, consult the GE factory for assistance.

Figures 3-5, 3-6, and 3-7 illustrate the following cable requirements:

- The recommended cabling between the transformer, drive, and motor is metal-clad cable.
  - The cable must be sized to provide adequate fault protection.
  - The metal-clad cable sheath should be continuous corrugated aluminum (not spiraled interlocking aluminum).

Note Using metal-clad cable bundles, as described, provide a lower inductance path to ground and substantially reduce the bearing and foot mounting capacitive currents at the motor. This minimizes premature motor bearing wear.

A continuously corrugated aluminum sheath provides a better shield against external electric fields than the spiraled interlocking aluminum or steel (oxidation causes high resistance between the interlocking segments). Open wire (no sheath) is not recommended.

An asymmetrical arrangement of phases in a bundle can cause unbalanced fluxes.

- Each metal-clad bundle should include all three phases, symmetrically arranged.
- If multiple conductors are needed for current rating, configure them as multiple 3-conductor metal-clad bundles, each including all three phases.
- When using continuous corrugated aluminum:
  - The preferred configuration is three symmetrically arranged ground conductors within each cable bundle.
  - Otherwise, in the cable bundle, there should be at least one asymmetric ground conductor that has sufficient ampacity to meet NEC requirements.
- When using rigid conduit or spiraled interlocking aluminum, the ground conductor should be centered within the bundle.
- Terminate the sheath to the motor junction box and to the inverter cabinet (see Figure 3-4) using approved connectors.
- Terminate the ground conductors close to the cable entry according to applicable codes. If no other codes apply, connect the ground conductors according to the NEC requirements, which presently are:
  - At the motor to a ground lug (usually in a connection box)
  - And at the inverter to a ground terminal on the inverter cabinet sheet metal.
- Metal-clad bundles may be run close to other metal-clad motor power cables without considering electrical coupling. However, thermal rules do apply when determining spacing.

Preferred: Use this cable, if available.

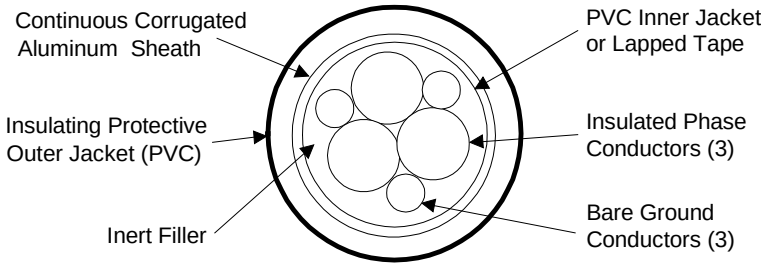


*Figure 3-5. Recommended Power Cable Configuration **(Preferred**)*

Use this cable, if cable in Figure 3-5 is not available.

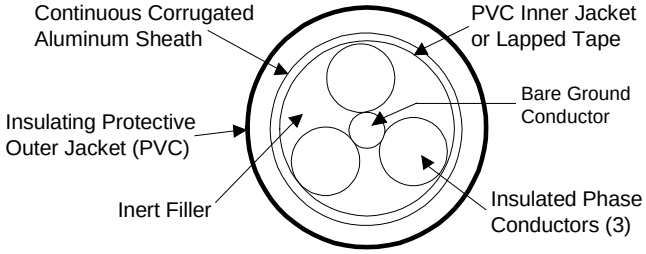


Figure 3-6. Recommended Power Cable Configuration

Use this cable, if cable in Figures 3-5 and 3-6 are not available.

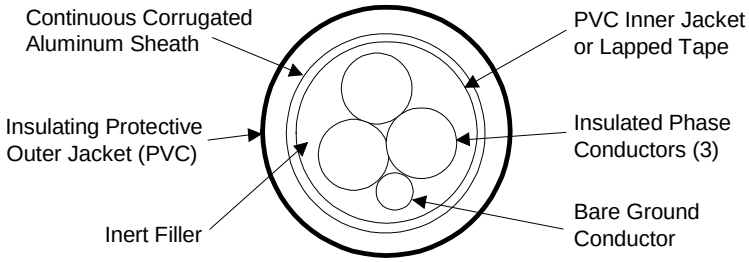


Figure 3-7. Alternate Power Cable Configuration

Signal and Communications Cabling Guidelines

- Be sure to strictly follow the **cable manufacturer's** installation instructions. These will vary based on the type of installation required.
- Signal inputs to low-level (refer to Appendix B) analog and digital blocks or to programmable logic control (PLC)-related devices should be run as shielded twisted-pair (for example, inputs from RTDs and encoders).
- To meet **CE Mark requirements**, all I/O wires leaving a building must be routed inside continuous metal conduit.
- The PC connects to a plug located on the drive cabinet door below the Drive Diagnostic Interface (DDI, also called *keypad*). The other side of this plug connects a cable to connector J9 on the control rack backplane. (See Figure 3-8 for details, including recommended cable part number.)

Note The PC-to-drive cable is not provided with the drive and must be ordered separately. Using a ferrite core on long PC-to-drive cable lengths improves communication.

Preventing Cable Damage

- Be sure to comply with OSHA and other applicable regulations.
- Observe minimum installation temperature to avoid damage to shielding and insulation.
- Do not pull cables around corners with sharp edges or corners that prohibit the minimum allowable cable-pulling radius.
- Avoid high mechanical stress (pull tension). The cable should not be excessively twisted, stretched, or flexed.
- Before pulling cable, inspect all cable trays. Cable should only be pulled into clean trays. Install bushings and dropouts, as necessary.
- Make sure that cable ends are sealed before, during, and after pulling the cable. This prevents the entrance of water or other contaminants.

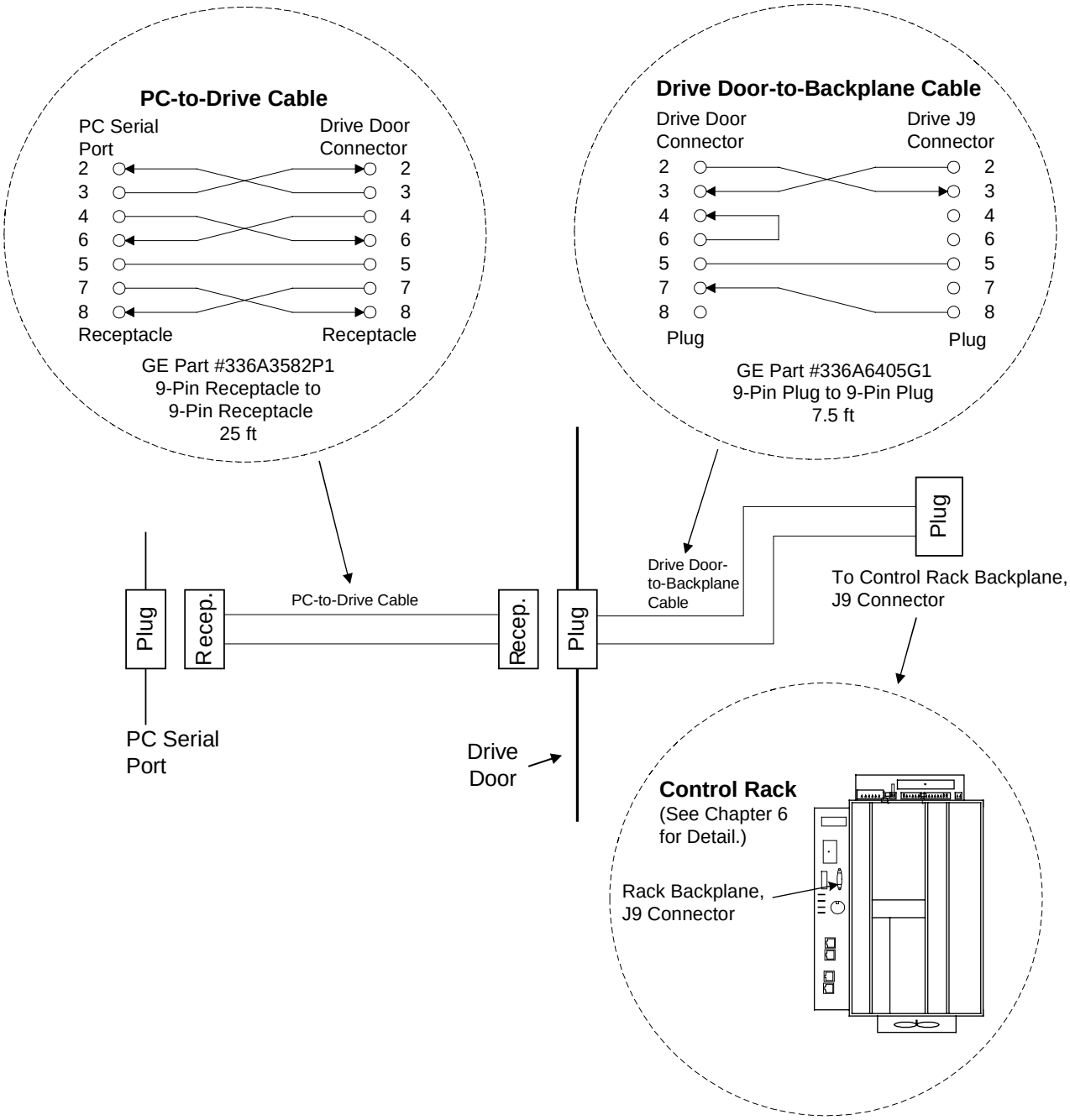


Figure 3-8. Cabling and Connections Between PC and Drive

Chapter 4 Device Installation

Introduction

This chapter defines mounting and installation instructions for external devices that are connected to the drive as part of the drive system. This information is presented as follows:

Section	Page
Tachometer Mounting	4-2
Motor Shaft Ground Brush	4-3
Installing the Ground Brush	4-3
Line Filter Assembly (Non-Regenerative Source)	4-4
Line Filter Specifications	4-5
Optional Line Reactor (Non-Regenerative Source)	4-6
Selecting the Line Reactor	4-6
Reactor Assembly (Regenerative Source)	4-8

With power applied, extremely high voltages are present on some circuitry. To prevent accidental injury, do not touch any circuitry without first ensuring that it does not carry these voltages and is grounded.

Tachometer Mounting

If the motor is equipped with a tachometer, check that it is correctly installed before energizing the motor. The tachometer should normally be mounted opposite the drive end of the motor (see Figure 4-1). The bearing on this end of the motor is normally an insulated bearing.

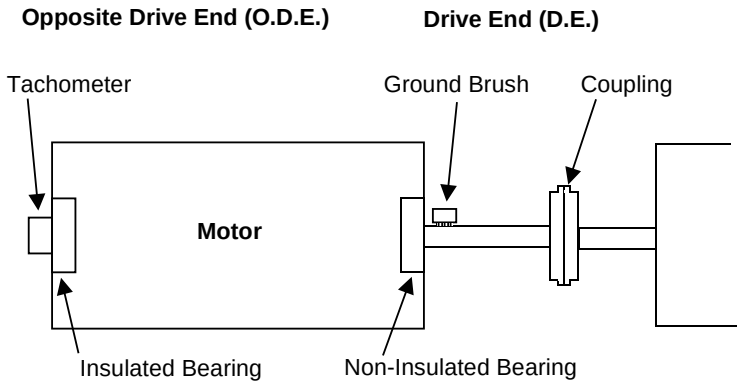


Figure 4-1. Typical Motor Configuration with Tachometer and Ground Brush

Motor Shaft Ground Brush

Before energizing the motor, check that the specified ground brush is mounted correctly on the motor shaft. Typically, it is mounted at the motor's drive end (see Figure 4-1).

Electrical motors usually contain a non-insulated bearing on the drive end and an insulated bearing on the opposite end.

Note If the tachometer end of the motor shaft comes with a shaft grounding option, remove this ground before proceeding.

The brush holder assembly is mounted outside the bearing housing. When properly installed, the carbon brush makes contact with the shaft through spring tension (see Figure 4-2). It is important that this contact be continuous to ensure that any charge buildup on the shaft is taken to ground through the brush and not through the bearing.

Installing the Ground Brush

Caution

To prevent possible motor bearing damage, the brush holder assembly (when specified) must be installed securely in place and make good contact between the shaft and ground.

➢ To install the brush holder assembly

1. Make sure that the shaft is clean. Use fine sandpaper or emery cloth, if necessary.
2. Mount the brush holder assembly to the load end of the motor shaft. Keep the gap between the brush holder and shaft to 0.1 inch.

As preventive maintenance, check the carbon brush insert every month and replace once a year. As a maintenance aid, mount a stick-on reminder nameplate (see Figure 4-3) in a visible, nearby location.

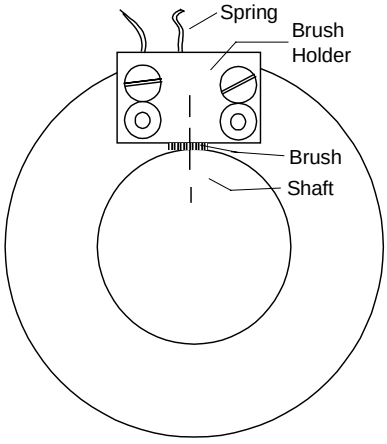


Figure 4-2. Mounted Brush Holder Assembly

CAUTION

SHAFT GROUNDING BRUSH LOCATED ON MOTOR SHAFT

REPLACEMENT BRUSH PART NUMBER _____

Figure 4-3. Sample Brush Holder Reminder Nameplate

Line Filter Assembly (Non-Regenerative Source)

GE document GEH-6389 contains standard elementary diagrams for the non-regenerative sources.

The line filter assembly, typically roof-mounted, is a line-to-line RC (resistor-capacitor) filter network (see Figure 4-5) on the 3-phase power input of a non-regenerative source. It provides softening for line voltage transients, which may inadvertently cause the source SCRs to misfire. The filter also provides attenuation for any high-voltage transient spikes that might otherwise surpass the voltage rating of the power devices.

Note The line filter is required at all times.

The following standard elementaries apply to the non-regenerative sources:

Frame Size	Drawing No.
620	259B4531AE
1000	259B4532AE
1800	259B4533AE

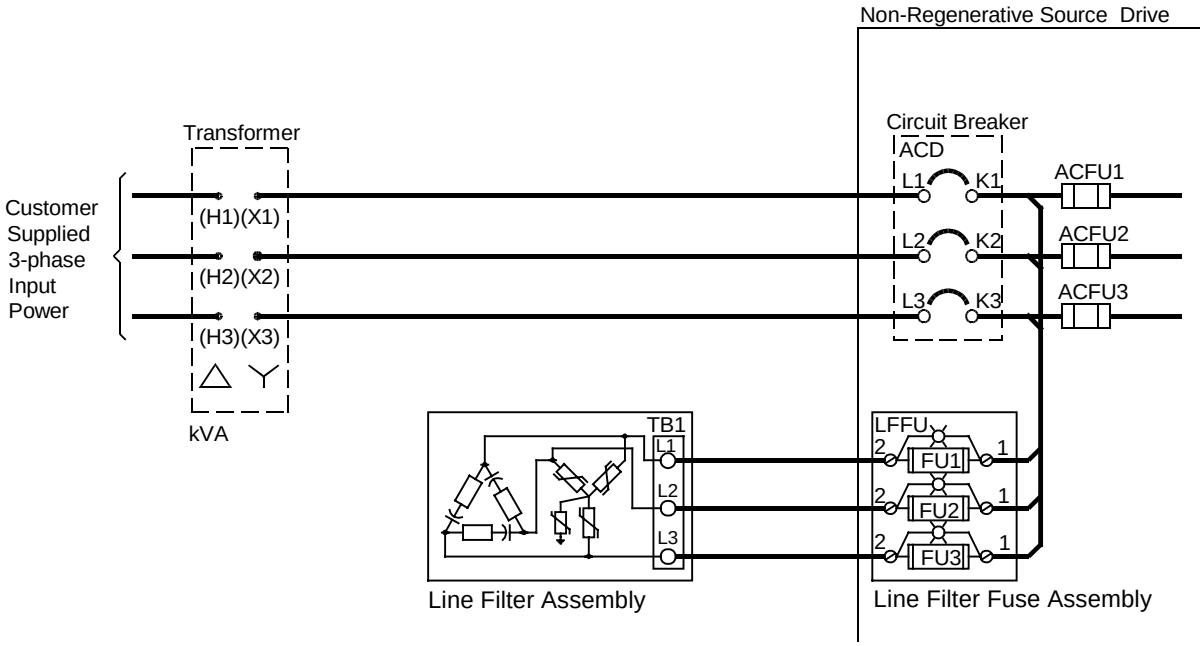


Figure 4-5. Line Filter Assembly Connections

Line Filter Specifications

When the non-regenerative source's input power comes from:

- Either an individual transformer (as shown in Figure 4-5)
- Or a common transformer with other non-regenerative sources and either of the following:
  a. dc drives (in addition to the listed filters, dc drives require line filters for their own applications, as covered in the dc drive documentation)
  b. one 1000 frame regenerative source, run at 1.5 kHz maximum
  c. one 1800 frame regenerative source, run at 1.5 kHz maximum (see Note 1)

Use these line filters:

Non-regenerative Source Frame Size	Line Filter Part No.	Quantity	Line Filter Description
620	173C9226SZ G01	1	1 μf with 30 ohms
1000 and 1800	173C9226NM G01	2	2 μf with 15 ohms
1000 and 1800*	173C9226NM G01	2 in parallel	Result: 2 μf with 15 ohms

***Note 1:** For application "c" (above) only. Each filter must be wired separately to its own set of 10 A JKS fuses.

All other applications must use a separate isolation transformer. This includes regenerative sources running at frequencies greater than 1.5 kHz and multiple regenerative sources.

Wiring

The filter must be wired with AWG no. 10 or larger wire. The wire length must be less than 12 ft from the filter, through the filter fuses (10 amp JKS, mounted in the source), to the SCRs in the bridge.

Optional Line Reactor (Non-Regenerative Source)

In some instances, additional line reactance is required to provide limiting of potential short circuit currents, or to provide sufficient reactance for the commutation of the regenerative source power devices.

When supplied, the reactor is **remote mounted**. The non-regenerative source line filter **always** be connected on the load side (source side) of the reactor.

Selecting the Line Reactor

Non-regenerative sources, whether on individual transformers or on a common transformer, require a minimum transformer inductance of 12 μH per phase. Calculate the transformer inductance using the equations and guidelines described below.

➢ Input power from an individual transformer

$L_T = [(\%\ imp) \times (V_{L\text{-}L}) \times 106] / [100 \times \sqrt{3} \times 377 \times (I_{FL})]$

Where:

L_T	= per phase transformer inductance, (μH)
$V_{L\text{-}L}$	= line-to-line voltage
% imp	= impedance of the transformer
I_{FL}	= transformer rated current, (amps)
I_{FL}	= [(kVA) x 1000 x √3] / [$V_{L\text{-}L}$ x 3]
377	= 2πf; where f is 60 Hz; for 50 Hz, change 377 to 314

If the transformer inductance is less than 12 μH, add a line reactor from Table 4-1.

Note The ac line power wiring can be used as a source of inductance. See the Table 4-2 for wire inductance values.

➢ Input power from a common transformer with only non-regenerative sources and dc drives

Calculate the transformer inductance using the equation and guidelines for sources with an individual transformer.

Additionally, you should consider that the minimum inductance between individual non-regenerative sources and between non-regenerative sources and the dc drives must be 5 μH per phase.

➢ Input power from a common transformer with non-regenerative sources and a 1000 or 1800 frame regenerative source

Non-regenerative sources, on a common transformer with a regenerative source, require a minimum **parallel** source inductance of 12 μH per phase. Calculate the transformer inductance using the equation and guidelines for sources with an individual transformer, with the following additional considerations:

- The 1000 frame regenerative source has 110 μH of inductance.
- The 1800 frame regenerative source has 63 μH of inductance
- The parallel source inductance is:

  [(LT) x (110)] / [LT + 110] or (LT) x (63)] / [LT + 63]

Additionally, you should consider that the minimum inductance between individual non-regenerative sources and between non-regenerative sources and the dc drives must be 5 μH per phase.

*Table 4-1. Line Reactor Selection**

Drive Frame Size	Part No. (TRENCO)	Inductance (μH)	Reactor Current Rating (amps)	Size (H x W x D in inches)	Weight (lbs)
620	TR-17213	5	650	38 x 24 x 21	250
620	TR-17065	12	650	38 x 24 x 21	300
1000	TR-1706	5	820	38 x 24 x 21	300
1000	TR-17062	5	1050	51 x 28 x 30	400
1000	TR-17066	12	820	38 x 24 x 21	400
1000	TR-17067	12	1050	51 x 28 x 30	500
1800	TR-17214	5	1400	51 x 28 x 30	475
1800	TR-17064	5	1550	51 x 28 x 30	500
1800	TR-17068	12	1400	51 x 28 x 30	650
1800	TR-17069	12	1550	51 x 28 x 30	700

*Select a reactor based on the maximum continuous dc current where:
maximum continuous dc x .816 = reactor current

Table 4-2. Typical Copper Wire Inductance Per Foot

AWG	Inductance Per Ft (μH)
4	.6969
3	.5573
2	.4491
1	.3638
1/0	.2972
2/0	.2466
3/0	.2065
4/0	.1759
250	.1609
300	.1459
350	.1346
400	.1290
500	.1196
600	.1155
750	.1099

Reactor Assembly (Regenerative Source)

GE document GEH-6389 contains standard elementary diagrams for the regenerative sources.

The regenerative source receives ac input power from an external reactor assembly (see Figure 4-4). The reactor must connect to the transformer output and source input lines exactly as shown on the drive elementary diagram.

Caution

To prevent possible damage to the drive bridge, check that the reactor lines are connected correctly, per the drive elementary sheet 4FA.

The following standard elementaries apply to the regenerative sources:

Frame Size	Drawing No.
375	259B4520AE
620	259B4521AE
1000	259B4522AE
1800	259B4523AE

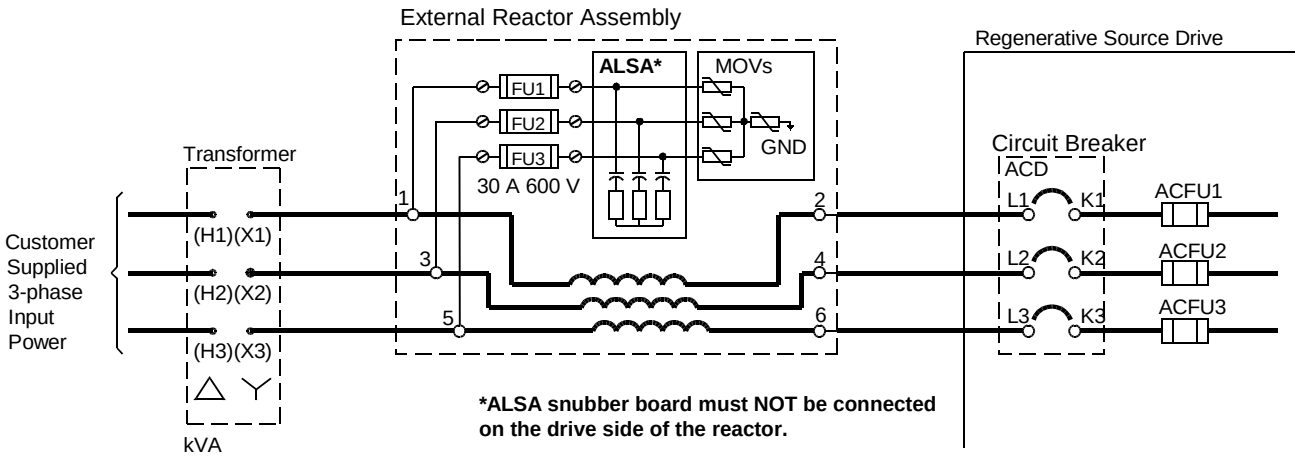


Figure 4-4. Reactor Assembly Connections

Caution

The ALSA snubber board, located in the external reactor assembly (see Figure 4-4) must not be connected on the drive side of the reactor. Otherwise, it may overheat.

Chapter 5 Pre-Powerup Installation Checks

Introduction

This chapter must be completed before beginning startup.

This chapter contains instructions to verify that the drive lineup is ready for startup. This includes checks and procedures to ensure that the drive communications, I/O, and power connections are working correctly.

In these instructions, the term *drive* applies to both the source and inverter. Any instruction that applies to only the source or the inverter(s) will specify that.

Attention

All instructions must be followed and completed *in the order presented*.

It is good practice to check off each procedure when you complete it. For this purpose, this chapter includes *checkboxes* next to each procedure heading

This chapter assumes that the drive lineup and connected devices have already been installed, and that all wiring and cabling are installed correctly. It is presented as follows:

Section ***Page***

Equipment/Material Needed 5-2
Securing the Equipment for Safety 5-2
Hardware Checks 5-3
Optional Megger Test 5-5
Pre-Test Power Checks 5-5
Non-Regenerative Sources 5-6
Regenerative Sources and Inverters 5-6

Equipment/Material Needed

Checkboxes should be marked to verify that equipment is on-hand.

Check that the following equipment and materials are available for the procedures in this chapter.

- ☐ Locks and tags, danger and caution tape
- ☐ Source of low-pressure, compressed, dry air (less than 15 psi) or clean, dry cloth
- ☐ Small standard (flat-head) screwdriver
- ☐ Torque wrench
- ☐ Socket sets, standard and metric
- ☐ Digital multimeter
- ☐ One dc megger tester (voltage not to exceed 500 V), optional
- ☐ Drive elementary diagrams, document GEH-6389
- ☐ Drive *Layout and Outline Drawings*, document GEH-6390
- ☐ Drive *User's Guide*, document GEH-6392

Securing the Equipment for Safety

☐ *All procedures in this section were completed successfully.*

1. Lock out and tag out all voltage sources to the drives. Apply safety grounds per local rules and regulations.
2. Make sure that the motor area is taped off while tests are being done.
3. If supplied, connect and energize the motor space heater to remove any moisture.
4. Provide a temporary means to stop the drive at the motor. For example, install a **Test Stop** switch at the motor.

Hardware Checks

☐ *All procedures in this section were completed successfully for:*

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

In this manual, the term "drive" is used for both the source and inverter.

All drives are factory-tested and operable when shipped to the installation site. However, connections could loosen during shipping and handling. To help ensure successful startup, check the drive hardware after installation and **before initial powerup.**

➢ **For each drive in the lineup, check drive hardware as follows**

1. Become familiar with the drive one-line on elementary sheet CA.
2. Make sure that the equipment is secured for safety, as required in the previous section.
3. Using an approved tester for the voltage levels being measured, verify that power has not yet been applied to the circuitry.

With power applied, extremely high voltages are present on some circuitry. To prevent accidental injury, do not touch any circuitry without first ensuring that it does not carry these voltages and is grounded.

When testing for the presence of high voltages and when measuring any electrical circuit, use only the equipment approved for contact with those voltage levels.

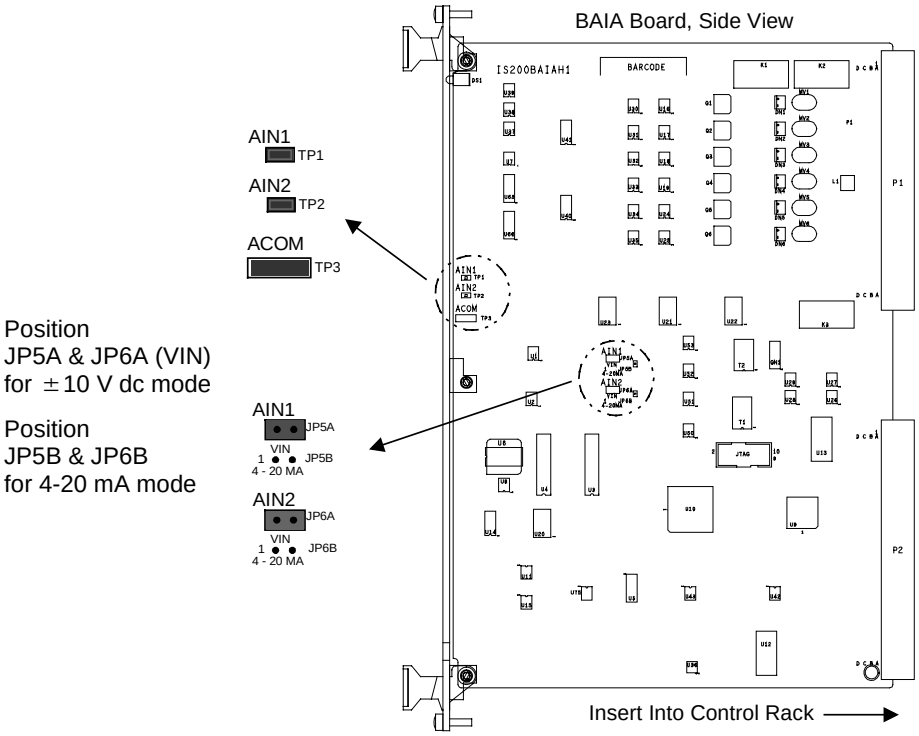
4. Using either low-pressure, compressed, dry air or a clean, dry rag, remove any dust that may have accumulated in the drive's interior.
5. Inspect wiring to ensure that it has not been damaged or frayed during installation. Replace if necessary.
6. Check that all electrical terminal connections are tight. Refer to the torque values in Tables 5-1.
7. Check that all devices, modules, and boards have not been damaged during handling or installation, are that they are secure in their mounting connections. Refer to applicable torque values in Tables 2-2.

To prevent component damage caused by static electricity, treat all boards and devices with static-sensitive handling techniques. Wear a wrist grounding strap when handling boards or components, but only after boards or components have been removed from potentially energized equipment and are at a normally grounded workstation.

Note To ensure that electrical connections remain tight, re-check them within three to six months after initial powerup, and annually thereafter. Use screwdrivers and torque wrenches for these checks.

Appendix A describes the IPN number.

8. Check that the correct shunts have been installed and that the shunt cables are installed correctly. (Refer to the drive elementary data sheet BA or intelligent part number (IPN).)
9. Check fusing in the drive cabinet (refer to the elementary or to the drive nomenclature sticker located inside the drive cabinet door).
10. Verify that the BAIA board as listed on the drive elementary data sheet BA has correct settings for analog input jumpers AIN1 and AIN2, as follows:



11. Check incoming wiring/cabling, as follows:
    a. It should be complete and agree with the elementary drawings supplied with the drive.
    b. It should conform to the cable separation guidelines defined in Appendix B.

Caution

If 115 V ac or 120 V dc is used for the system and/or local fault string, make sure that only terminal points 2 and 8 are used on the ATBA board. Terminals 4 and 10 on the ATBA are for the 24 V power supply (see elementary sheet DA).

12. Verify that the cabinet is properly grounded, including CCOM that is separate from power ground (refer to Chapter 3).
13. Operate each magnetic device by hand to make sure that all moving parts operate freely. Check all electrical interlocks for proper operation.
14. Verify that the incoming and outgoing buses are not grounded. To do this:
    - Either use an ohm meter to measure all buses in the drive to ground to ensure insulation integrity,
    - Or perform the optional megger test (refer to the following section).

Optional Megger Test

A megger (megohm meter) measures resistance by placing voltage across a device.

This optional test verifies that the system-to-ground insulation has not been damaged during shipping or installation. The procedures vary for the non-regenerative source, regenerative source, and inverter drives, as described below. However, pre-test power checks apply to all drives.

Caution

To prevent circuit damage:

- **The megger voltage should not exceed 500 V dc.**
- **Do not use ac meggers for this procedure.**

Pre-Test Power Checks

Warning

With power applied, dangerous voltages are present on some circuitry. To prevent accidental injury, do not touch any circuitry without first ensuring that it does not carry these voltages and is grounded.

➢ **Before conducting the megger test on any drive, check for the presence of power on the circuitry, as follows**

1. Check that the ac bridge power and control power have been locked out and tagged out.
2. Open both the control and line disconnect (circuit breaker or switch) in the **source** drive.

The drive layout drawing (listed in Chapter 3, Table 3-1) shows location of fuses, disconnects, and other components within the drive cabinet.

Note There could be multiple sources of power in the enclosure.

3. Disconnect all **inverter** drives on the dc bus, either through the dc disconnect or by disconnecting the dc fuses at the inverter.
4. Using a voltmeter, check that the dc bus voltage has discharged to below 1 volt on the following circuits.

Use the checkbox to mark each completed measurement.

- ☐ Line to line
- ☐ Line to ground
- ☐ Line to P-bus

(Capacitors are connected across the P-bus and N-bus. Therefore, the voltage reading will be low and show charging of the capacitors.)

- ☐ Line to N-bus
- ☐ P-bus to N-bus
- ☐ P and N-bus to ground.

Non-regenerative source drives include diodes in the power bridge.

Note Readings could be affected by the drive's line-to-line filters and dc bus capacitors and bleeder resistors.

Circuits with diodes require reading proper polarity so that results are not misleading. Refer to the elementary diagrams (GEH-6389) for assistance.

5. Continue the megger procedures that follow for the type of drive being tested.

☐ *All procedures in Option 1 or Option 2 were completed successfully.*

Non-Regenerative Sources

➢ **Option 1: Megger test across power buses**

1. Do not proceed until completing all requirements under *Pre-Test Power Checks.*
2. Short the ac and dc buses together using jumpers or wire.
3. Connect one side of the megger to one of the buses and the other side to ground.
4. Apply the megger voltage (**not exceeding 500 V dc**). The reading should be greater than 100 megohms.
5. If readings are low, identify and correct the problem before proceeding.
6. Remove all jumpers or wires from the bus before applying any power.

➢ **Option 2: Megger test using IS200RCSA board testpoints (1000 and 1800 frame drives)**

An IS200RCSA board provides snubber circuitry to protect the devices on a bridge phase.

1. Do not proceed until completing all requirements under *Pre-Test Power Checks.*
2. On one of the three IS200RCSA boards, connect the megger from the following testpoints, **one at a time**, and check for values greater than 100 megohms:
   - K1 to ground
   - A1/K2 to ground
   - A2 to ground
3. If readings are low, identify and correct the problem before proceeding.
4. Repeat this test (steps 2 and 3) for each of the two remaining RCSA boards

Regenerative Sources and Inverters

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

1. Do not proceed until completing all requirements under *Pre-Test Power Checks.*
2. Use single strand wire or jumpers to make a **continuous connection** to all the following points:
   - All gate, collector, and emitter points (the bolts) on boards mounted to the IGBTs.

Note Do not loosen bolts on the IGBT to make these connections. (Bolts are specifically torqued.) Instead, wrap the wire around the bolts. This sufficiently shorts all IGBTs.

   - On sources, across the input contactor
   - On inverters, all three shunts
   - Both dc buses (P and N)
   - ATB terminal board. This includes the primary of the CPT in the test.
3. Make sure that there is a secure ground connected to the cabinet (case).
4. Connect the megger ground lead to the cabinet ground.
5. Connect the megger hot lead to the continuous jumper in step 2.
6. Apply the megger voltage (**not exceeding 500 V dc**). The reading should be greater than 100 megohms.
7. If readings are low, identify and correct the problem before proceeding.

Chapter 6 Startup and Commissioning

Introduction

.

This chapter provides instructions to verify that the drives are in good running condition and to prepare them for operation. This includes control power checks, software setup, and tuneup and commissioning guidelines.

This chapter is presented as follows:

Section	Page
Before Beginning	6-2
Order of Startup	6-2
Information Needed	6-2
Equipment/Material Needed	6-3
Verifying Control Power	6-6
Checking Processor Start	6-6
Using the Drive Configuration Tools	6-8
Using Toolbox Online Help	6-8
Starting the Toolbox	6-9
Configuring Drive Software	6-10
Open a Drive File	6-10
Creating a New Drive Configuration File	6-11
Checking Toolbox/Drive Pattern Compatibility	6-11
Downloading to the Drive	6-13
Optional: Upgrading the .icb File	6-13
Checking for Correct Firmware and Hardware	6-15
Checking the Keypad (DDI)	6-17
Using the Keypad for Startup and Commissioning	6-17
Adjusting Keypad Display Contrast	6-18
Commissioning the Drive	6-20
Overview of Drive Parameters/Wizards	6-20
Running the Commissioning Wizard	6-24
Running the Cell Test Wizard	6-26
Optional: Using the Trend Recorder to Observe Cell Test	6-27
Running the Tuneup Wizards (Inverters Only)	6-29

Before Beginning

Before beginning the procedures in this chapter, the following conditions must be true for all drives in the lineup:

- All pre-startup and installation checks from the previous chapters are completed successfully.
- All interconnecting wires and cables are in place, connected, and ready for power on.
- Power **is not yet applied.**

User's Guide, GEH-6392, includes a functional description of the drives, including hardware structure.

Order of Startup

Although the Innovation Series low voltage drives include many different frame sizes of both sources and inverters, the design incorporates a common hardware and software structure. Therefore, the basic startup and commissioning procedures are identical for the different types of drives.

Each drive in the lineup must be started up and commissioned individually, using the following guidelines:

- Complete the procedures in this chapter for the **source first**, then for each inverter, one at a time.
- Follow the procedures in this chapter **in the order presented.**
- Figure 6-1 is a flowchart for use as a visual guide to the startup and commissioning process.

Attention

The order of startup is important. The source must be checked and set up first, since it supplies control power and the dc bus to all drives in the lineup.

All instructions must be followed and completed in the order presented in this chapter.

Tip *It is good practice to check off each procedure when you complete it. For this purpose, this chapter includes checkboxes next to each procedure heading.*

Information Needed

Before beginning, you should review the applicable elementaries and layout drawings to become familiar with the type of drives in the lineup. Make sure you know the power requirements and location of components, connections, and power switches.

Appendix A provides information about the intelligent part number and its relationship to the pattern number.

When configuring the drive with the GE Control System Toolbox, you need to know the firmware pattern for each drive in the lineup (for example, *accbn-a* for the source and *acdcf-v* for the inverter), which is included in the drive's intelligent part number (IPN).

Checkboxes should be marked to verify that equipment is onhand.

Equipment/Material Needed

Safety Equipment

- ☐ Safety gear (safety boots, safety glasses, hard-hat, high voltage gloves, face shield)
- ☐ Locks, tags, and danger and caution tape

Typical Test Equipment

Warning

When testing for the presence of high voltages and when measuring any electrical circuit, use only the equipment approved for contact with those voltage levels.

- ☐ Digital multimeter
- ☐ Small standard (flat-head) screwdriver
- ☐ Socket sets, standard and metric
- ☐ Flashlight
- ☐ Personal computer (PC) with the GE Control System Toolbox installed

Reference Documents

- ☐ System elementaries or standard drive elementaries in GEH-6389 (required)

Tip *It is good practice to study the drive elementary before working on the drive.*

"GEH-####" is the document identification number.

- ☐ Drive layout and outline drawings, GEH-6390
- ☐ Drive *User's Guide*, GEH-6392
- ☐ GE Control System Toolbox document, GEH-6401
- ☐ *Reference and Troubleshooting* guide for your product's firmware pattern identify:

  GEH-6393 for ACDCF-G

  GEH-6394 for ACDCF-S

  GEH-6395 for ACDCF-V

  GEH-6396 for ACCBN-A

  GEH-6397 for ACCBR-A

Attention

The information contained in the GE Control System Toolbox document GEH-6401 and in the *Reference and Troubleshooting* documents is also available as Help files within the toolbox program (refer to *Using Toolbox Help* in this chapter).

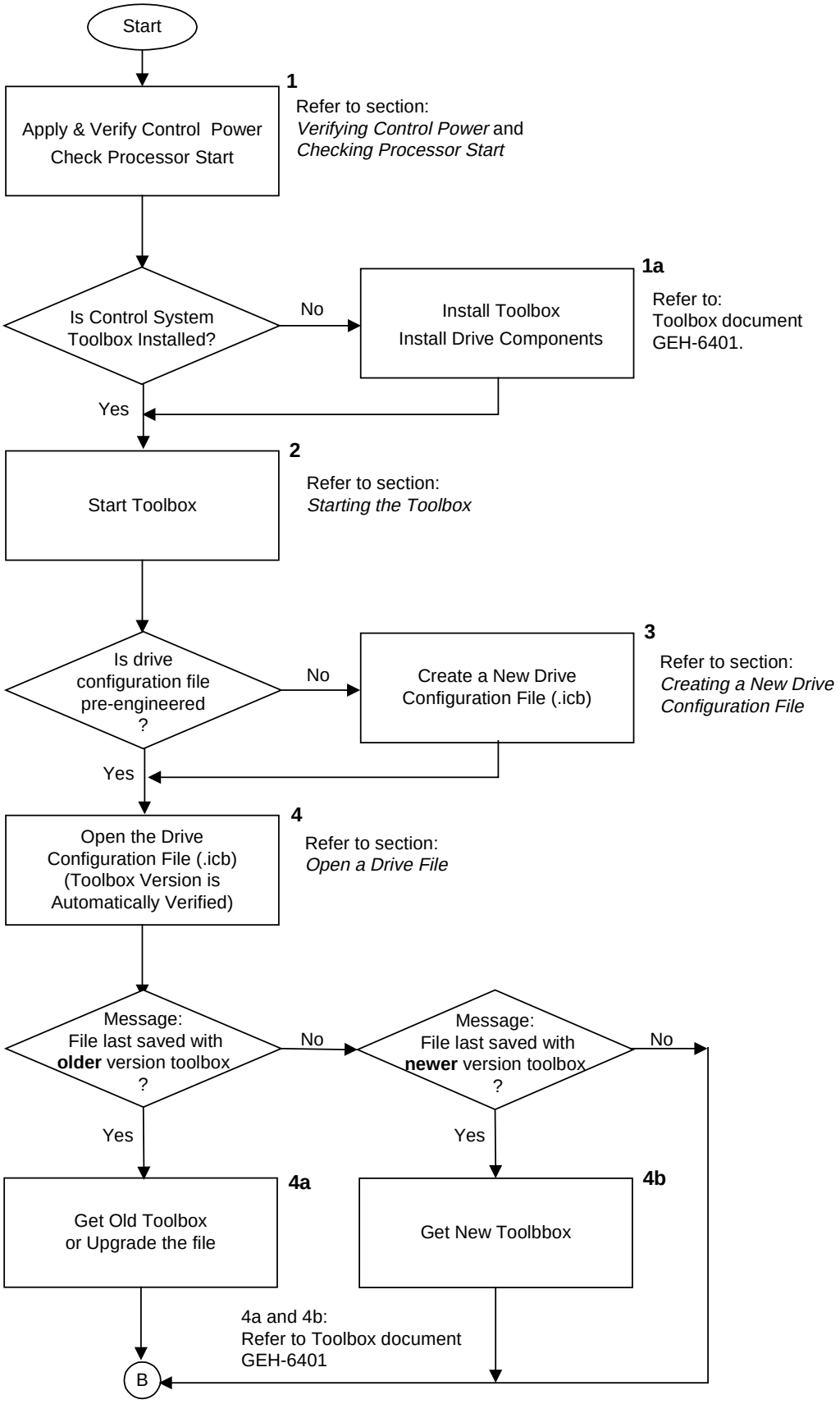


Figure 6-1. Overview of Drive Startup and Commissioning (Part 1 of 2)

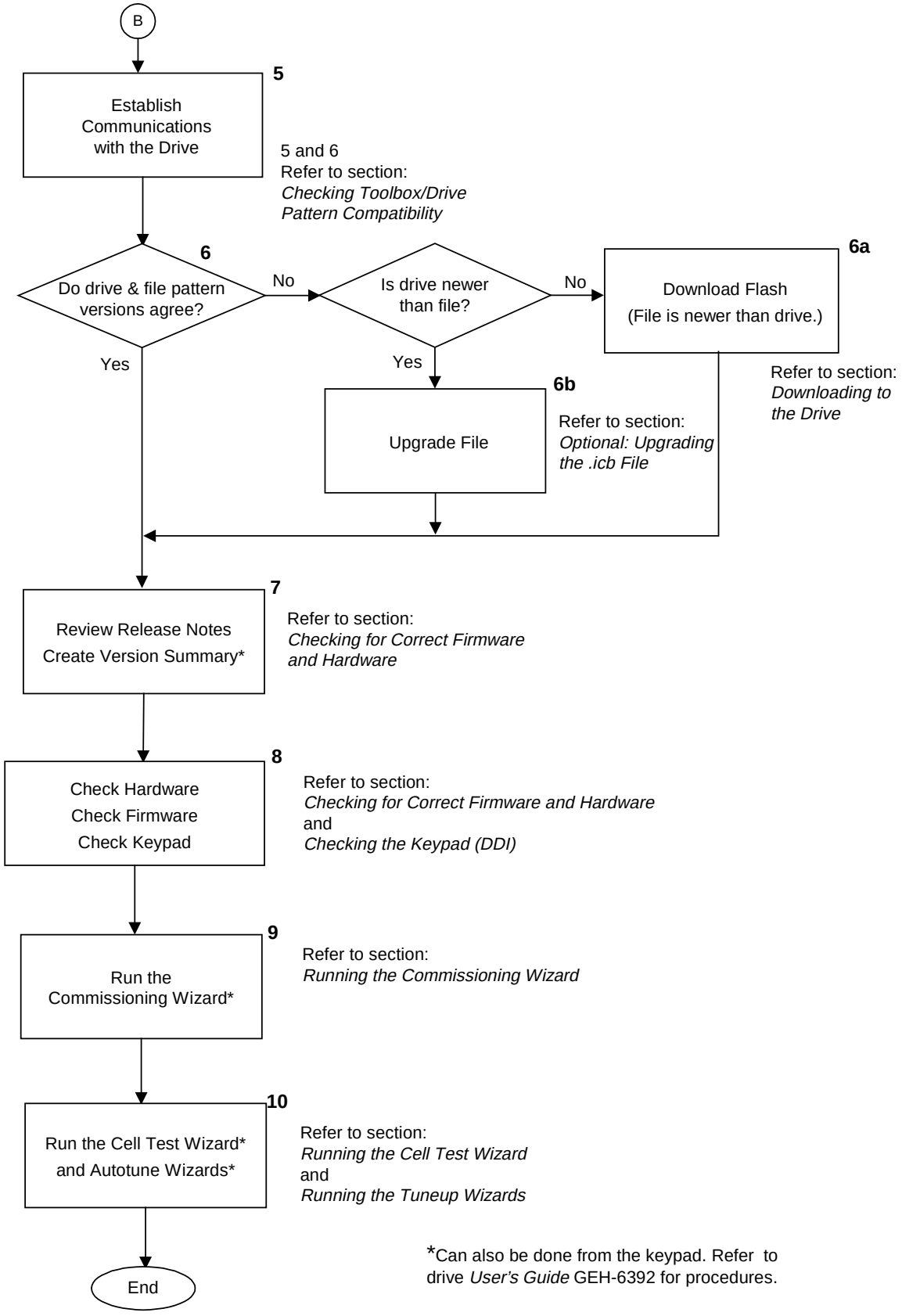


Figure 6-1. Overview of Drive Startup and Commissioning (Part 2 of 2)

Verifying Control Power

Refer to Figure 6-1, Block 1.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Refer to the *Control Power* section in Chapter 3 for an overview and diagrams of the drive lineup's control power circuitry.

Warning

With power applied, this equipment contains a potential hazard of electric shock or burn. Only personnel who are adequately trained and thoroughly familiar with the equipment and the instructions should install, operate, or maintain this drive.

To minimize hazard of electrical shock or burn, approved grounding practices and procedures must be strictly followed.

1. Before energizing the ADF circuit, verify that the CPT configuration jumper is set to the proper tap in each drive in the lineup (refer to Chapter 3).
2. Measure the line-to-line voltage of the control power supplied to the auxiliary device circuit switch (ADS) to ensure that it is consistent with the CPT jumper settings.
3. After energization, verify the 115 V ac secondary at each drive at the 115E and 115I terminal strips (provided on the left-hand sidewall of the drives; refer to Figure 3-2).
4. Check that the rack power supply is correct by monitoring the testpoints on the RAPA board with respect to DCOM: 5 V (P5) ±5%, +15 V (P15) ±5%, -15 V (N15) ±5%. (Refer to Figure 6-2.)
5. Measure the voltage at the ATBA board's terminal points 33 (I24P) and 35 (I24N). This voltage is unregulated 24 V dc (18 to 24 V dc).
6. Check the LEDs on all DSFC and DAM_ inverter gating boards, as follows:

"DSFC" is the IS200DSFC Driver/Shunt Feedback board.

"DAM_" is the IS200DAM_ Gate Drive Amplifier and Interface board.

- Green LED, on (illuminated) when the IGBT is commanded to an **off** state (-15 V dc, gate to emitter for DFSC and -7.5 V dc for)DAM_)
- Yellow LED, on when the IGBT is commanded to an **on** state (+15 V dc ±, gate to emitter)

Note During normal operation, both the green and yellow LEDs appear to be on. However, they are actually alternating at a very high frequency.

- Red LED (DSFC only), on when the dc bus voltage is above 50 V dc

The DSFC and DAM_ boards located in the power bridge at the IGBT modules, as follows:

Board	Frame	No. Boards per Drive
DSFC	1000	3 (2 per phase leg)
DSFC	1800	6 (4 daisychained per phase leg)
DAMA	620	3 (1 per phase leg)
DAMB	375	3 (1 per phase leg)
DAMC	250	3 (1 per phase leg)
DAMD	180	3 (1 per phase leg)
DAME	65	1 (for all 3 phases)

Checking Processor Start

Refer to Figure 6-1, Block 1.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Verify the that the DSPX processor board, located in the control rack, has started correctly, as follows:

1. The DSPX should boot-up with the following LED indications:
   - Green status LED steady on
   - Red fault LED blinking (indicating an alarm status because the dc bus is not charged up; solid red indicates a fault condition)
2. For the other boards in the rack, check that the green LEDs are steady on.

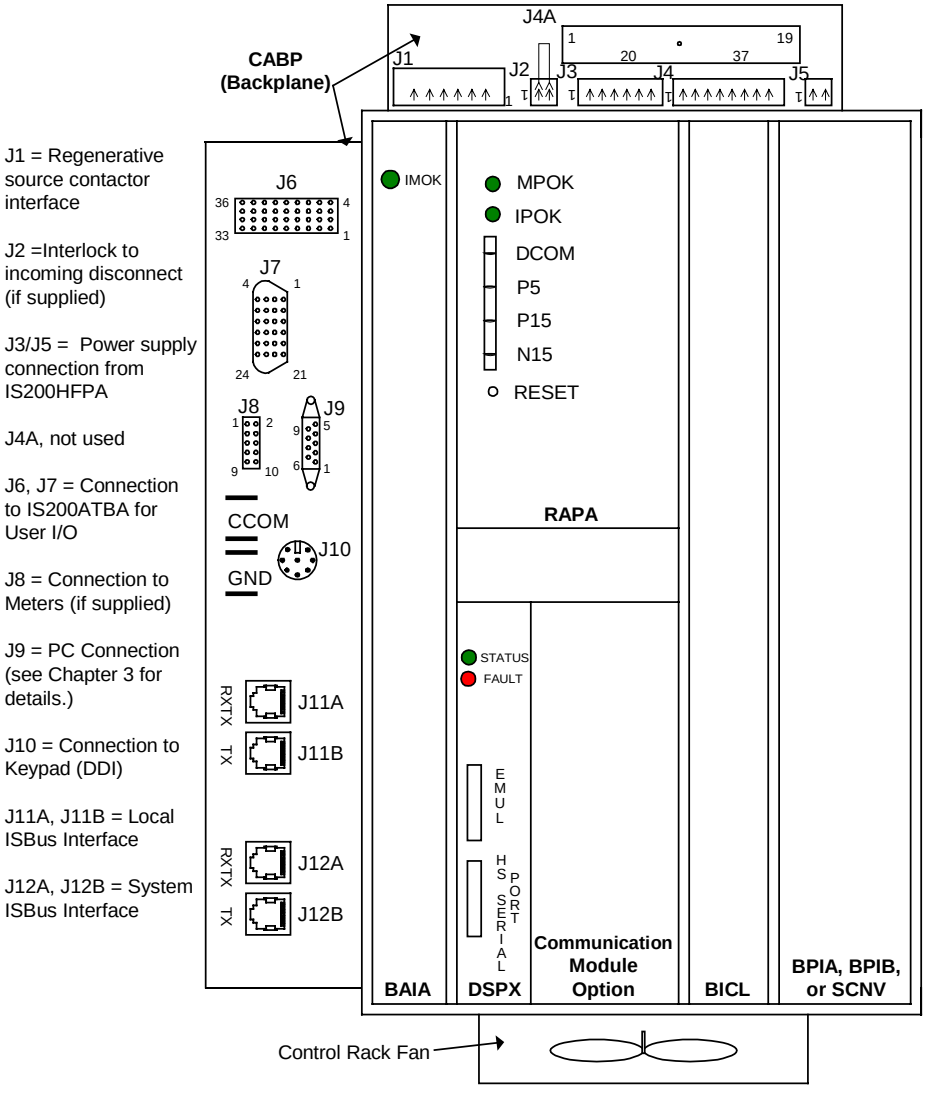


Figure 6-2. Front View of Control Rack

Control Rack Boards:

Board	***Function***
BAIA	Basic I/O
BICL	Bridge Interface
BPIA/B	Bridge Personality Interface
CABP	Control Rack Backplane
DSPX	Digital Signal Processor
SCNV	SCR/Diode Converter Interface

Communication Module Options:

Module	***Function***
ACL_	Application Control Layer
GBIA	Genius™ Bus Interface
PBIA	PROFIBUS-DP Interface

Using the Drive Configuration Tools

GE document GEH-6401 describes toolbox installation and use.

The GE Control System Toolbox is a Microsoft® Windows®-based, drive configuration program used to tune and commission the drive as needed for each application. The toolbox is designed with menus, block diagrams, dialog boxes, and wizards that simplify and guide you through the startup and commissioning process.

This chapter provides guidelines for using the toolbox to download and apply the drive pattern (application firmware specific to each drive type). For detailed information, you should refer to either the toolbox **online Help** or the product documents listed in the *Tools/Materials Needed* section.

Note To indicate that an item discussed in a procedure is also displayed in the toolbox, the item is **bolded**.

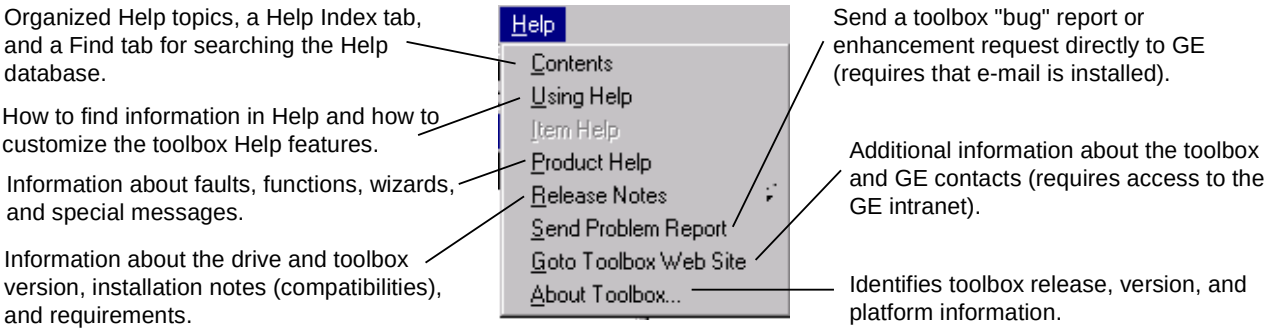
Using Toolbox Online Help

Tip *It is good practice to refer to the toolbox Help for any part of toolbox operation or menu and dialog options that you do not fully understand. You can access the Help files at any time after the toolbox is installed on your PC.*

The toolbox Help feature provides detailed information about using the toolbox. This includes installation and operation, as well as drive configuration instructions. There are several ways to access Help while running the toolbox.

For	Do this
Menu commands	Highlight the command and press function key F1.
Dialog boxes	Press F1 when the dialog box displays on the screen.
Block information	Click on the desired block with the right mouse button and choose **Item Help**.
Help contents	Choose **Help** then **Contents**.
Help	Choose **Help** then **Using Help**.
Specific word(s)	Choose **Help** then **Contents** and **Find**. From there, enter the word(s) you want to find.

When you choose **Help** on the toolbox main menu bar, a drop-down menu provides several options for finding information.



When you choose **Help** then **Contents**, the displayed screen provides several easy-to-use options for finding information.

To access this screen, select **Help** on the toolbox menu bar, then select **Contents** from the drop-down menu.

Displays an organized list of toolbox help topics, matching toolbox User document GEH-6401.

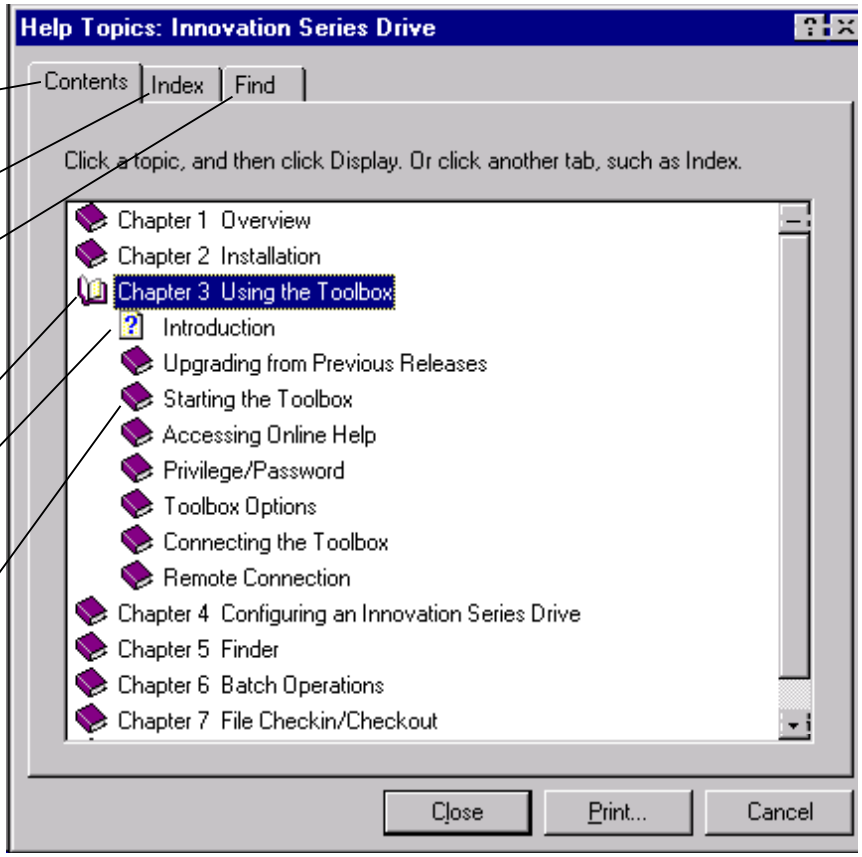
Displays an alphebetized list of toolbox help topics.

Allows you to search for a Help topic by entering a word into a text box.

Doubleclick an open-book icon to hide topics listed under that heading.

Doubleclick a question icon to display help information for the topic beside it.

Doubleclick a closed-book icon to display topics listed under that heading.



Refer to Figure 6-1, Block 2.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

GE provides the toolbox and drive configuration files on the Control System Solutions CD.

Starting the Toolbox

The remaining procedures in this chapter require that you use the toolbox.

➢ To start the toolbox

1. Make sure that the toolbox is installed on the PC and that the PC is connected to the drive control. If it is not, refer to toolbox document GEH-6401 for installation instructions.
2. Select the Windows **Start** button, then **Programs**, **GE Control System Solutions**, **Control System Toolbox,** and **Control System Toolbox**.

   This should start the toolbox, which will open into a blank screen.
3. Select **Help** then **About Toolbox** to view the toolbox version (for example, Version V06.00.19C).

You are now ready to configure drive software, as described in the next section.

Configuring Drive Software

Refer to Figure 6-1, Block 4.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

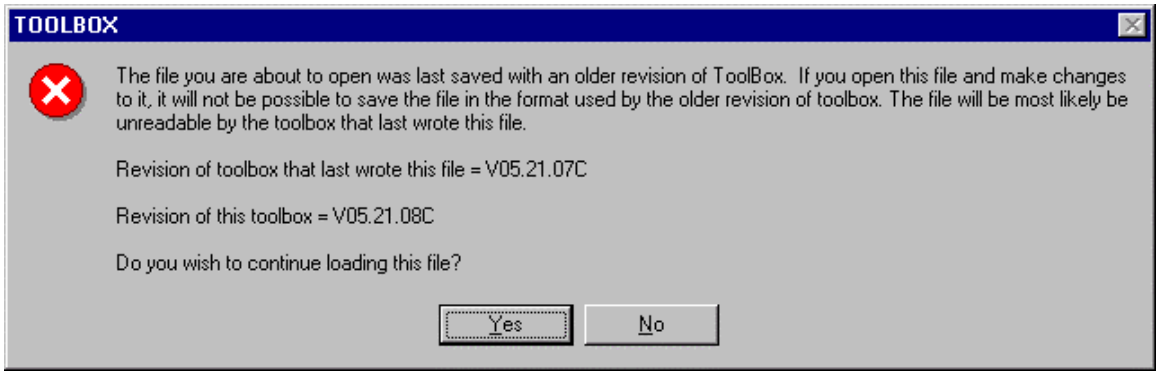
Open a Drive File

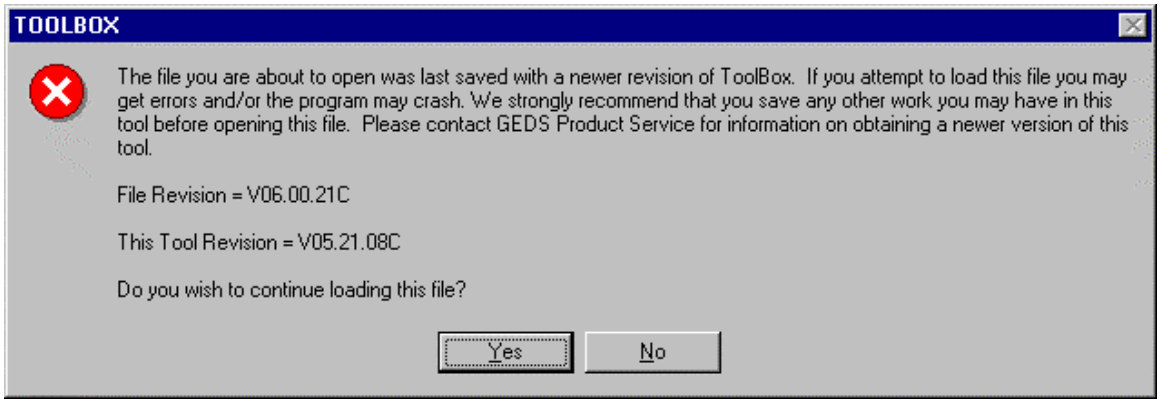
To configure drive software with the toolbox, you must open the drive configuration (.icb) file. If the drive was pre-engineered, you have an existing .icb file. Otherwise, you must create a new one.

➢ **To open an existing drive configuration file**

1. From the toolbox menu, select **File** then **Open**. This displays the default directory where the .icb files are stored.
2. Select the desired .icb file then the **Open** button.

   The toolbox then determines if the .icb file was created with the same version of toolbox . If not, it displays one of two messages.





3. If the .icb file was last edited with an **older** version toolbox, you can either obtain and install the older version of the toolbox, then repeat steps 1 and 2, or continue to open the file.
4. If the .icb file was last edited with a **newer** version toolbox, obtain and install the newer version of the toolbox, then repeat steps 1 and 2.
5. When the toolbox opens, it displays the toolbox main screen (described in Appendix E, *Toolbox Work Area*).

Creating a New Drive Configuration File

Refer to Figure 6-1, Block 3.

Refer to Appendix E, "Creating an Innovation Series Drive", for detail on these procedures.

➢ **To create a new drive configuration file**

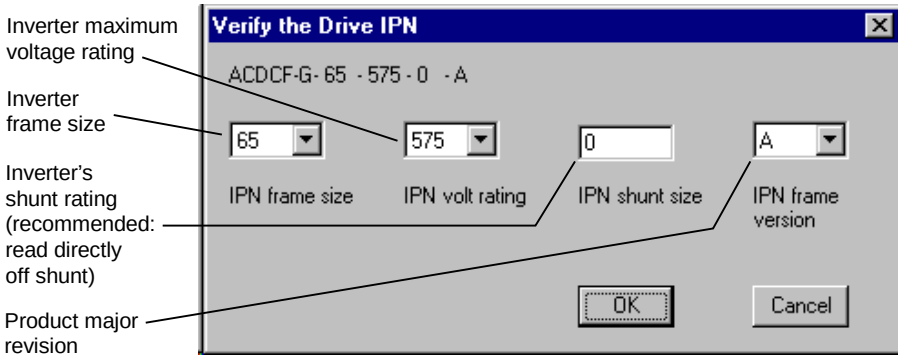
1. Create a new drive (from the toolbox menu, select **File** and **New**).
2. Choose the appropriate pattern and version for the drive being started. If you are not sure of which version, it is recommended to use the latest.
3. Verify the Intelligent Part Number (IPN) information, as shown in the following **sample screen**. Enter changes, if required.

Caution

These numbers are used to set *drive protection*. Therefore, it is extremely important that you enter these numbers correctly.

The drive IPN can be found on the data nameplate (inside the drive door) or the drive elementary.

Appendix A shows a sample data nameplate.



Refer to Figure 6-1, Blocks 5 and 6.

All procedures in this section were completed successfully for:

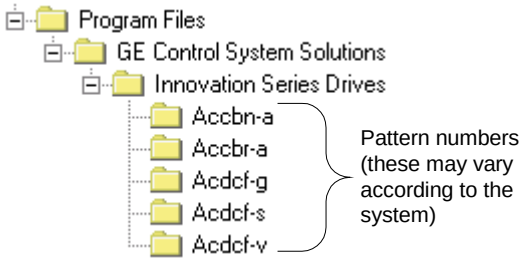
- ☐ *source*
- ☐ *inverter 1*
- ☐ *inverter 2*
- ☐ *inverter 3*

Checking Toolbox/Drive Pattern Compatibility

The firmware **pattern** used to create the .icb file must be the same version as the pattern loaded in the drive (the DSPX board). If it is not, then either the flash code (which contains the pattern version) must be downloaded from the toolbox to the DSPX, or the .icb file must be upgraded.

➢ **To check the directory for the pattern versions available for commissioning**

1. From the toolbox menu bar, select **File** then **Open**.
2. Check under the **GE Control System Solutions / Innovation Series Drive** directories for the patterns.



Note The toolbox requires the pattern directory to be located under the exact structure of **GE Control System Solutions / Innovation Series Drive**. If this exact directory structure is not present, you *must correct it.*

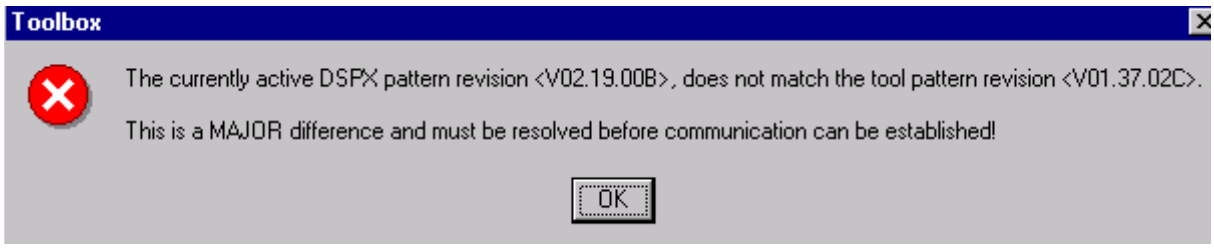
➢ **To install the latest pattern version**

1. Connect to the drive (DSPX) by selecting the **Go on/offline** button  .
2. Select **OK** after verifying the file and drive name.

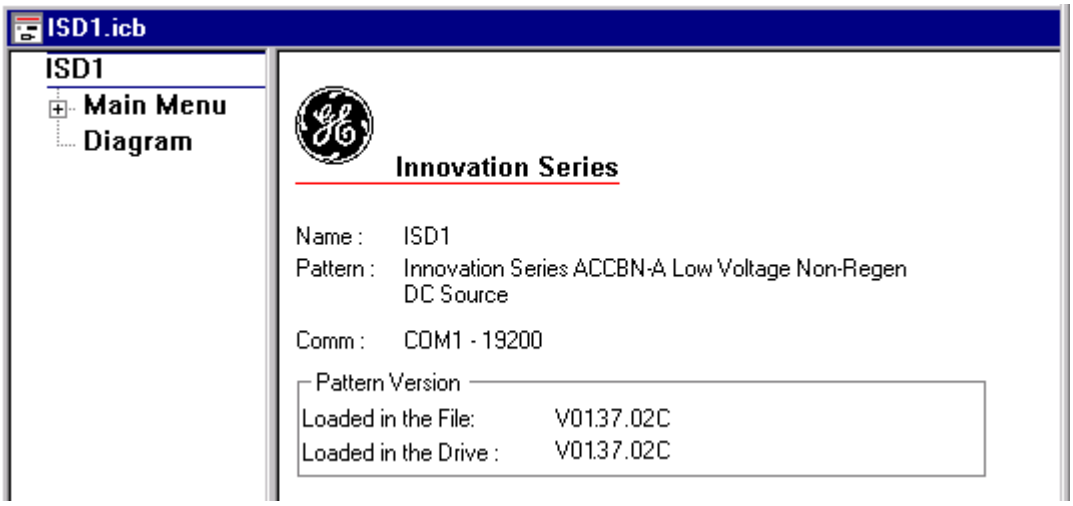
The toolbox now attempts to connect to the drive. It compares the pattern revision used to create the .icb file with the pattern version loaded into the DSPX.
A *patch* difference in version will allow connection, but a *major* or *minor* difference will not. For example:

Pattern version:	V01.	19	03	A
	Major	*Minor*	*Patch*	*Release*

If connection (communication) is not allowed because the differences are major, the toolbox will display a message.



If the pattern is compatible, the pattern displays in the Summary View of the toolbox main screen. The following sample shows equivalent patterns in the file and the drive.



3. If a pattern difference is indicated, you should do one of the following:
   - Download new drive firmware if the drive is older than the file
   - Upgrade the file if the file is older than the drive
   - Or download older drive firmware

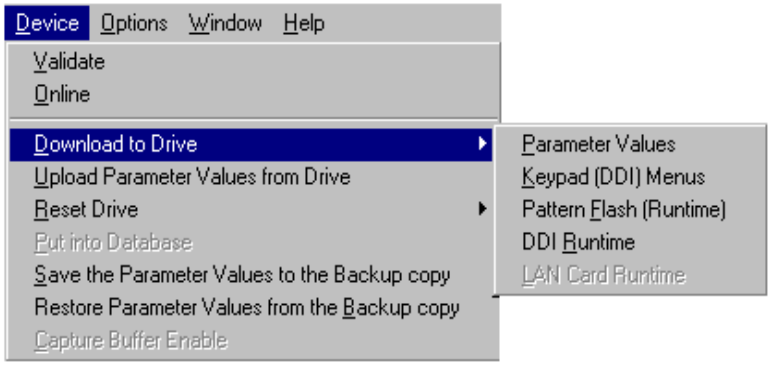
   For procedures, refer to *Downloading to the Drive* and *Optional: Upgrading the .icb File* in this chapter.

Refer to Figure 6-1, Block 6A.

Downloading to the Drive

➢ **To download the firmware pattern from the toolbox to the drive**

1. Select the **Device** menu and **Download to Drive**.
2. From the flyout menu, click on a selection and then **Yes**. A *downloading* message then appears and the drive resets after the download completes. Download the files in this order:
   a. Pattern Flash (Runtime)
   b. DDI Runtime
   c. Parameter Values
   d. Keypad (DDI) Menus



Refer to Figure 6-1, Block 6B.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Optional: Upgrading the .icb File

Associated with the pattern version in the drive are parameters that vary, depending on each application. These parameters are stored in the **.icb** file.

Tip *.icb files are typically stored in a **project** directory. To establish the default directory from the toolbox, select **Options**, **Settings**, and the tab **Directories**. Then from the Default Project text box, select the browse button to find (for example) C:\Jobs\GESalem\JobName\ISD1.icb.*

The revision of the pattern used to create the .icb file must be the same as the firmware revision loaded into the DSPX. To achieve this, it may be necessary to upgrade the .icb file to a more recent version. The toolbox can automatically upgrade older .icb files to newer revisions.

See Appendix E, "Upgrading a Configuration" and "Select Upgrade Version," for additional information.

➢ **To upgrade the .icb file from the toolbox**

1. Open the .icb file by selecting **File**, **Open**, and the correct file (for example, *ISD1.icb*).
2. Check the version (refer to the following section, *Checking for Correct Hardware and Software)*. If the file needs to be upgraded, select **File** then **Upgrade**.
3. Select **Yes** to proceed with the upgrade.

   The toolbox now displays the version or versions to be upgraded.

Note If the version required does not appear, it needs to be installed from the *Control System Solutions* CD.

4. Click the version desired, then select **OK**.
5. To check for any errors generated, select the **Validate Selected** button  .

   The toolbox status bar should display the message:

   `Validation complete with 0 errors and 0 warnings – SUCCESS`

   Otherwise, review messages for the appropriate action.
6. If the version of runtime code in the DSPX needs to be updated, then the firmware must be downloaded to the flash PROM.
7. Since the parameters have also been updated, they should be downloaded to the drive.

Tip *If these drive parameters are considered correct, you can make a backup copy that is stored in the DSPX board. To do this, select* ***Device*** *then* ***Save the Parameter Values to the Backup Copy****. If needed, this backup can be used in place of repeating steps 1 through 7.*

Checking for Correct Firmware and Hardware

Refer to Figure 6-1, Block 7.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Typically, firmware and hardware revisions are backward compatible with older revisions. However, occasionally the firmware depends upon a minimum revision of hardware. The release notes (RelNotes.txt, provided with the toolbox files; refer to Figure 6-3), provide an overview of the drive hardware and software relationship.

➢ **To determine correct hardware and software**

1. From the toolbox, select **Help**, **Release Notes**, and **Innovation Series Drive**.

   This displays the versions of drives you have (for example, *Innovation Series ACCBN-A Low Voltage Non-Regen DC Source, V02.19.00B*).

Note In older versions of the toolbox (before Version 6), this Help feature did not exist. However, the Notes.txt file was provided in each drive firmware pattern directory. You can view this file with any text viewer.

2. Select the applicable version to display the RelNotes.txt file. Within that file, check and make note of the following information:

   - *Critical Hardware Requirements* details board version requirements
   - *Dependencies* details software version requirements

Drive version and hardware information can also be viewed from the keypad

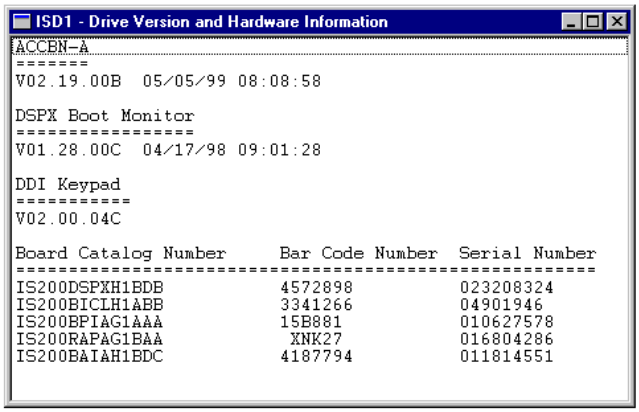
3. Within the toolbox, select **View**, **Reports**, **Drive Version** and **Hardware Information**.

Note You must be connected to the drive to do this.

   This displays a drive information screen.

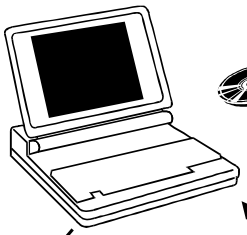
Sample toolbox screen showing drive information.

This should be compatible with the information in the RelNotes.txt file.



4. Check that the drive information displayed matches the *Critical Hardware Requirements* and *Dependencies* of the RelNotes.txt file. If hardware is different, contact GE (refer to Chapter 1). If software is different, update it using the instructions in this chapter's *Checking Toolbox/Drive Device Pattern Compatibility* section.

The drive contains multiple components that may be revision sensitive.



Control System Solutions
This CD contains the GE Control System Toolbox and all files necessary to configure the drive.

GE Control System Toolbox
The toolbox is installed on a PC connected to the drive serial port.

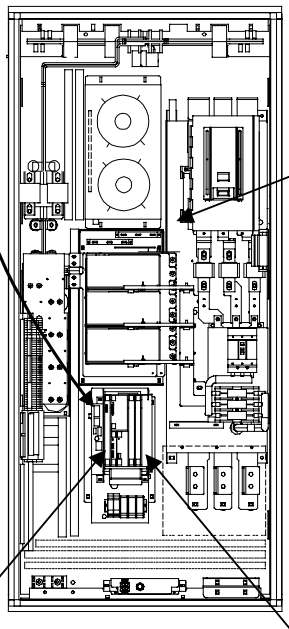
The toolbox is released periodically with new features and enhancements. These releases are identified by the Toolbox Version (for example, V06.00.14C).

The toolbox version can be obtained from the **Help** toolbar, **About Toolbox** selection.

Drive Configuration File (*.icb)
The drive **pattern** must be configured for each application. Configuration parameters can be stored in a file (*.icb) with the toolbox. The revision of this file must match the revision of the pattern loaded into the drive DSPX.

The version of the drive configuration file is displayed in the toolbox **Summary View**.

Serial Port Connection (or via ISBus)



Drive Power Bridge
The **drive configuration** is dependent upon the power bridge design. Critical design data must be entered into the drive configuration file's **IPN data** to ensure proper protection of the drive power bridge.
- Product type and version
- Drive size (frame)
- Voltage rating
- Current feedback shunt size
- Other critical drive setup data

This data can be found on the drive's IPN (included on the drive Data Nameplate).

Drive Keypad (DDI)
- DDI firmware version
- DDI alternate language file

The **DDI revision** that is present in the keypad can be determined from the keypad **General Setup** menu, or from the toolbox **View** toolbar, **Reports** pick.

Drive Control Pattern and Boot Monitor
The drive control processor board (IS200DSPX) can be loaded with one of several different control **patterns**, which are based on the **drive product type** (such as ACDCF-G, ACDCF-S, ACCBR-S, ACCBN-S). Multiple releases of each product type are typically available on the Control System Solutions CD. These releases are identified by version numbers, such as:

ACDGF-G, V01.36.04C
ACDGF-G, V01.38.00C
ACDGF-G, V02.14.00C

Each **drive product release** contains the following components:
- DSPX controller boot monitor
- Firmware (flash) pattern

The drive product type and revision that is present in the DSPX processor can be determined from the keypad **General Setup** menu, or from the toolbox menu bar, selecting **View**, **Reports**, **Drive Version**, and **Hardware Information**.

Drive Control Hardware
Control board hardware revisions exist for each board in the drive. Some control features in the software may be dependent upon minimum revisions of hardware.

Such dependencies are outlined in the toolbox **RelNotes.txt** for each drive product type.

Figure 6-3. Drive Hardware and Software Overview

Checking the Keypad (DDI)

Refer to Figure 6-1, Block 8.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3.*

The operator interface located on the control cabinet front door is the Drive Diagnostic Interface module (*DDI*, most commonly called *keypad*).

1. Observe that the display's heartbeat icon is pulsing (refer to Figure 6-4). This indicates that the keypad can communicate with the drive. (The cable from the keypad connects to the rack's J10 connector.)

Note If the keypad's display cannot be read or contrast is poor, refer to *Adjusting Keypad Display Contrast* in the following section before proceeding to step 2.

2. If faults were present, use toolbox Help (select ***Help***, ***Product Help***, ***Contents***, ***Faults***) or refer to the drive *Reference and Troubleshooting* publication (listed in *Equipment/Material Needed* in this chapter) for information.

Attention

The keypad and toolbox screens presented in this document are samples that represent one possible drive application. The screens for your drive should display information that is specific to your configuration and application.

Using the Keypad for Startup and Commissioning

The keypad can be used to check firmware and hardware versions, run the drive commissioning and autotune wizards, set drive parameters, reset the drive, and provide many other functions to control the drive. This information is provided in the drive *User's Guide* GEH-6392.

Display:

Status screens provide both analog and digital representation of drive functions and values.

Menu screens provide text-based access to parameters, wizards, and faults.

Pushbuttons:
Organized into functional groups:

Navigation buttons for using the menu

Drive Control buttons

Run and **Stop** buttons

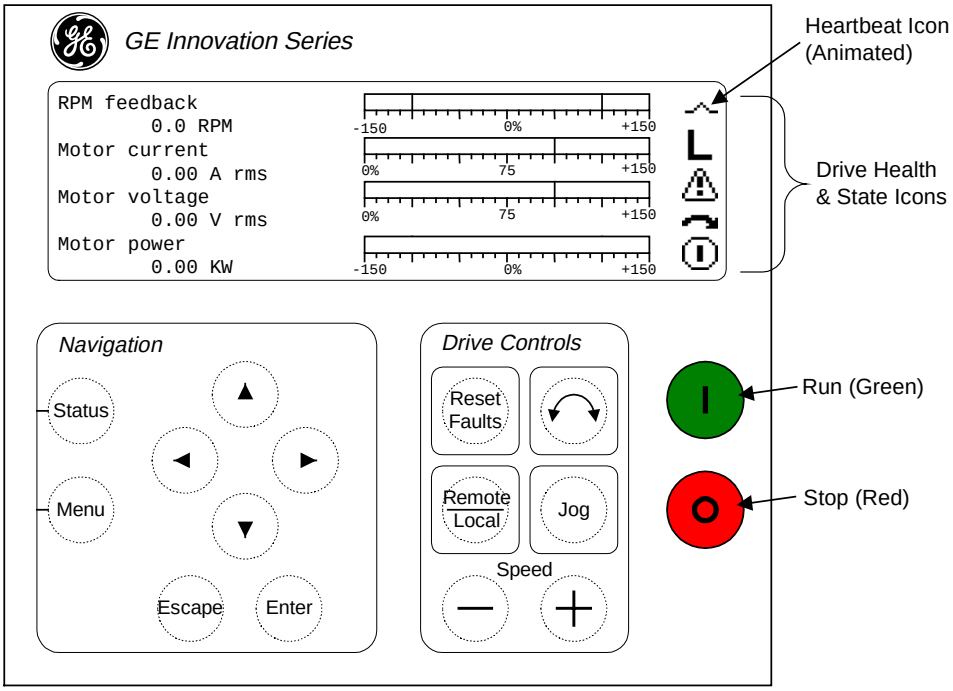


Figure 6-4. Front View of the Keypad

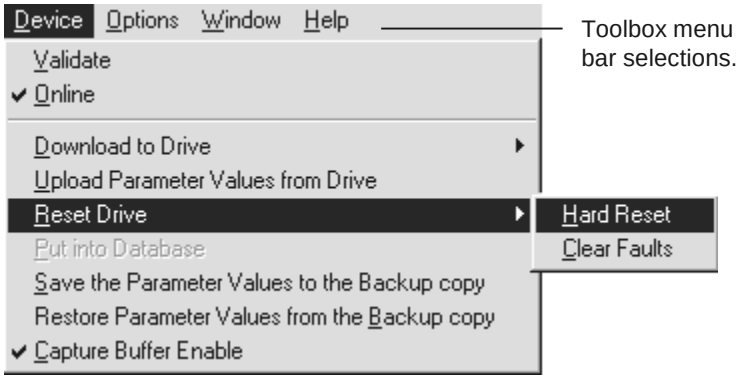
Adjusting Keypad Display Contrast

You can improve visibility of the keypad display by adjusting the contrast. This can be done using either the keypad (refer to GEH-6382) or the toolbox.

➢ **To adjust keypad display contrast using the toolbox**

You should not see "Offline" on the toolbox status bar (bottom right side of screen).

1. Check that the drive is online (the **Go on/offline** button  is selected).
2. In the toolbox work area (see Figure 6-5), expand the items displayed in the Outline View by clicking on the plus sign next to **Main Menu**, **General Setup**, **Keypad**, and **Keypad Meters**.
3. Double-click **Keypad contrast adj** to display the associated **Edit Parameter** dialog box.
4. The dialog box displays the value **Range** for this parameter. In the **Value** text box area, enter a number, then click **Send To Drive** and **OK**.
5. Reset the drive as shown below, which resets the display to the new value.



6. If the display is still not readable, contact GE Product Service (see Chapter 1, *How to Get Help*).

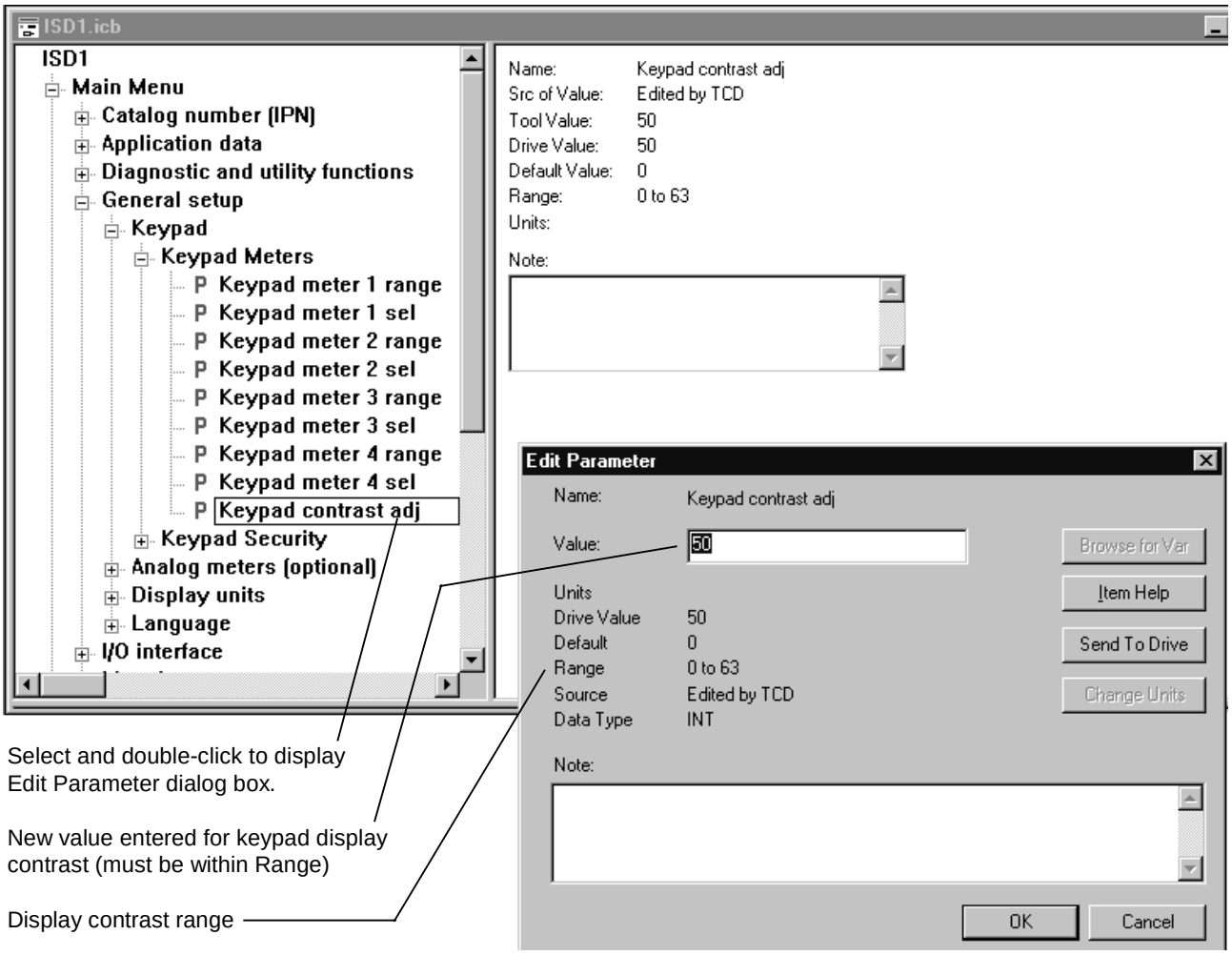


Figure 6-5. Toolbox Work Area and Dialog Box for Keypad Display Adjustment

Commissioning the Drive

Commissioning is the **final stage** of starting up a drive lineup. This process is most easily achieved by using the toolbox wizards, but can also be run from the keypad.

Typically, the source is commissioned first, then each inverter separately. The wizards must be run in the following order:

1. Commissioning (source and inverters)
2. Cell Test (source and inverters)
3. Motor Control Tuneup (inverters)
4. Speed Regulator Tuneup (inverters)

Overview of Drive Parameters/Wizards

Appendix E describes use of the wizards.

During initial commissioning, the drive (source or inverter) must be configured to meet the requirements of the specific application. This is done by adjusting parameters. The most commonly used parameters have been assembled into step-by-step wizards to facilitate quick and complete drive configuration. These wizards can be run from either the toolbox or the keypad.

Note The procedures in this chapter are based on running the wizards from the toolbox. However, the guidelines should still apply to wizards run from the keypad.

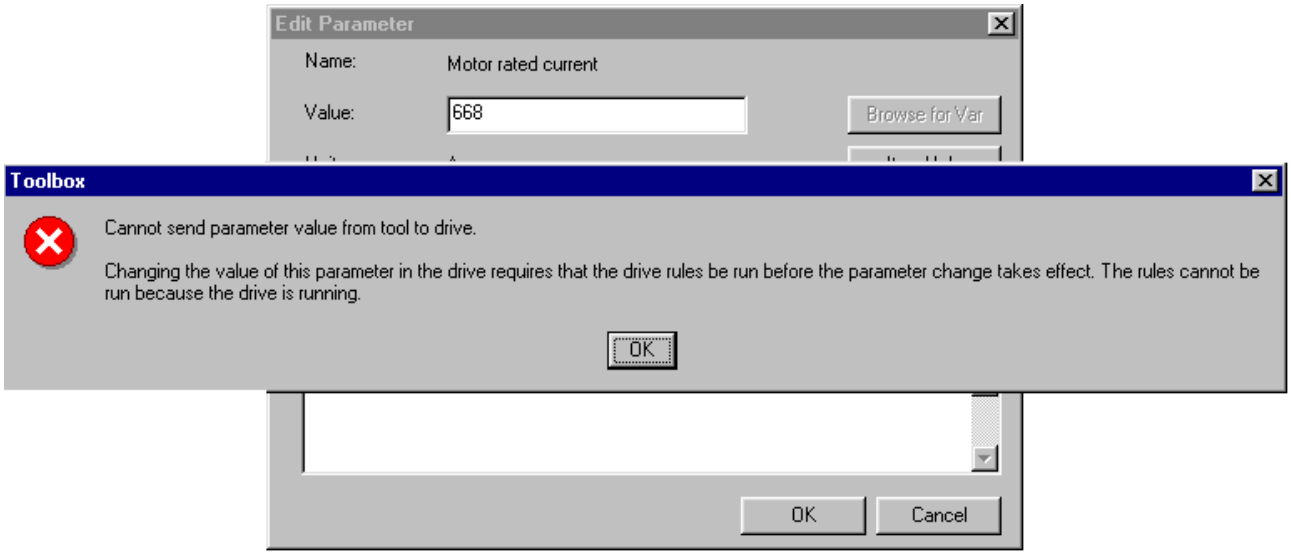
The drive Commissioning wizard must be run on every **new** configuration. After the initial configuration, use of the drive **Commissioning** wizard is optional, but still recommended. Other wizards are available to automatically tune drive regulators (such as Motor Control or Speed Regulators) and speed specific startup tasks (such as Panel Meter Setup and Ground Fault Detection).

The wizards lead the user through critical setup parameters and calculate internal settings. Because the wizards actually run in the drive processor (the toolbox must be online with the drive), the calculations will result in differences in the drive. These changes should be saved in the .icb file by uploading the parameter values from the drive to the toolbox (refer to *Optional: Uploading the .ICB File* in this chapter).

To access the block diagrams, select "Diagram" from the toolbox work area, outline view.

After the Commissioning wizard is run, parameters may be adjusted individually from the toolbox menus, the block diagram, or the keypad. Changing parameter values while the drive is running is not recommended, although some parameters, such as diagnostic setups, can be adjusted with minimal risk while running.

Some parameters should only be changed when the drive is stopped because they trigger **rules**, or calculations, in the drive processor. The toolbox does not allow these parameters to be downloaded to the drive while it is running, and will notify the user that the parameter requires rules to be run.



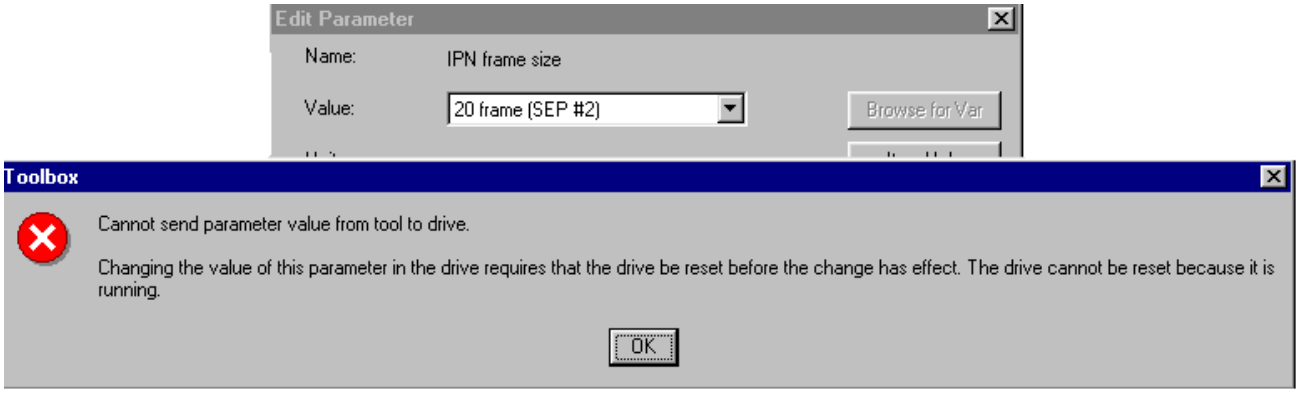
The keypad accepts the new value for these type of parameters while running, and notifies the user as follows:

```
Error starting Rules Calc for Parameter
   Press any key to Continue
```

This is an indication that the user should stop the drive for the rules to run, allowing this change to take effect.

To reset the drive from the toolbox, select the ***Device*** *menu, then* ***Reset Drive*** *and* ***Hard Reset****.*

Some parameters require a **hard reset** in order to perform the calculations. The toolbox does not allow these parameters to be downloaded to the drive while it is running and notifies the user that this parameter requires a reset to take effect. The toolbox or keypad automatically resets the drive when these parameters are sent to drive.



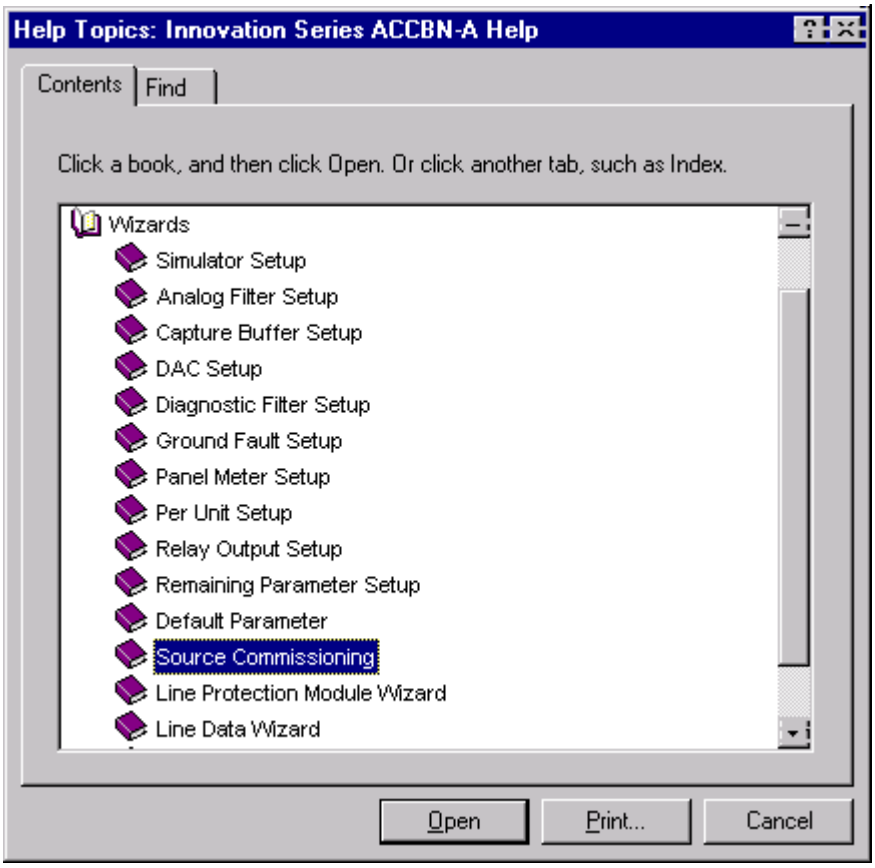
The keypad does not accept the new values for these type of parameters while running, but notifies the user as follows…

```
No Hard Reset for Parameter While Drive Running
   Press Any Key to Continue.
```

This message indicates that the user should stop the drive to make this change. If this change is made while the drive is stopped, the toolbox and the keypad automatically reset the drive.

The drive "Reference and Troubleshooting" documents (listed in the "Tools/Materials Needed" section) also contain the wizard descriptions.

For an online description of the toolbox wizards specific to your drive, select **Help**, **Product Help**, and **Wizards**.



Viewing Parameter Differences

Having the pattern versions loaded equally into the file and the drive does not mean that the parameters in the toolbox and the drive are equal.

If the parameters in the toolbox are not equal to what is in the drive, a *not equal* sign ≠ displays in the Status bar at the bottom of the toolbox window. To display the differences, double-click on the not equal sign ≠**.** This causes the toolbox to compare the parameter values with those in the drive.

The toolbox parameters must be equal to the drive parameters before the wizard can be run. The wizard will request either an upload or a download.

Calculate Parameter Final Values

Final values are calculated from parameters. These values are present in the drive, but are not normally viewable in the toolbox unless they are overwritten. The ≠ sign at the bottom of the pattern screen does not include final values. The toolbox indicates that overrides exist in the pattern by displaying a red **O** at the bottom of the screen.

The wizard uses the parameter settings that were entered to calculate the parameter final values. **If parameter final values are overridden,** running the Wizard will not update these values.

Privilege levels provide different types of access to the devices.

Level 4 allows changing parameters and editing hardware, and requires a password.

➢ **To view and clear overrides with Level 4 privilege**

1. From the toolbox, select the **Finder button**  , then **Overrides** and **Update**.
2. Double-click on the item selected.
3. Select **Clear** then **Override**.
4. Select **Device**, **Reset Drive**, **Hard Reset**.

Caution

Overrides are typically not required and should be avoided.

Refer to Figure 6-1, Block 9.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Some items are only available with Level 4 permission.

Running the Commissioning Wizard

Step through this wizard using the procedures below. Set the parameters according to the application, using the elementary data sheet as an aid.

Note Running the wizard overwrites values in the drive. Be sure to make backups if the data in the drive should be saved before proceeding.

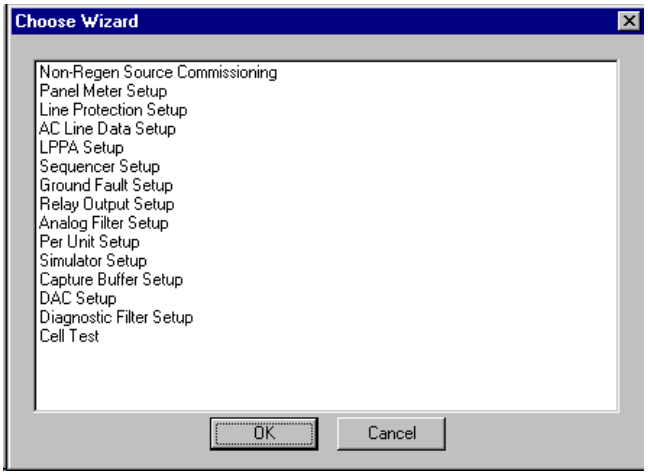
➢ To run the Commissioning wizard

1. From the toolbox, select the **Wizard** button  . This displays the Choose Wizard screen with a list of the wizards available for that drive type.

Sample toolbox screen showing wizard selection for **source.**

The Commissioning and Cell Test wizards must be run on the drive at initial startup and commissioning.

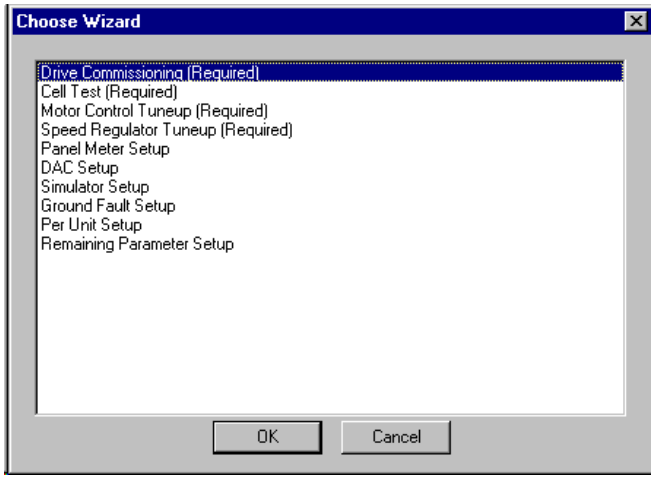
The other wizards are contained within the Commissioning wizard and do not need to be run separately. They are provided to facilitate specific configuration activities.



Sample toolbox screen showing wizard selection for **inverter.**

The "Required" wizards (Commissioning, Cell Test, and Tuneup) **must** be run on the drive at initial startup and commissioning.

The other wizards are contained within the Commissioning wizard and do not need to be run separately. They are provided to facilitate specific configuration activities.



Note In older versions of the toolbox, wizard names were preceded by either a numeral or an alphabetic character to indicate whether the wizard was included within the Commissioning wizard. Refer to Appendix E for an example.

2. Select the listed Commissioning wizard. A series of screens display for you to verify or enter information about the drive and system you are commissioning.

   The Commissioning wizard will guide you through the critical and most common configuration parameters.

3. Complete all screens as directed by the Commissioning wizard.

Note If a previous .icb file was not present and this file was created by selecting the default ***Choose Pattern and Version***, then the Commissioning wizard displays default values and/or No Values. These then need to be set according to the application.

Tip *If this is the first time running the wizards for this drive, you may want to select* ***Simulator Mode*** *when that wizard screen appears.*

Click the Help button on each wizard screen for information about the selections and requirements of that screen.

Refer to Figure 6-1, Block 10.

All procedures in this section were completed successfully for:

☐ *source* ☐ *inverter 1*
☐ *inverter 2*
☐ *inverter 3*

Running the Cell Test Wizard

The Cell Test wizard checks for proper dc bus charging. It also tests for short circuits in bridge devices and for opens in the bridge and motor circuits. During the test, the drive bus is charged.

➢ **To run the Cell Test wizard**

1. The drive doors must be closed to and the drive re-energized.

Warning

To prevent potential electrical hazard to personnel, proper re-energizing procedures must be strictly followed.

2. Clear all faults.
3. Check that the Test Stop switch is operational.
4. Check that the following conditions are true (these are required to run the Cell Test wizard):
   a. Dc bus fully charged
   b. System and local permissive satisfied
   c. Safety grounds (that were applied for test) removed and doors closed
   d. Blowers or fans on
   e. Drive not in simulator mode
   f. No faults shown on the keypad's fault display (such as ac line fuse failure)
5. From the toolbox, select the **Wizard** button  , then select and run the **Cell Test** wizard.

   If a failure occurs, the possible affected devices display on the keypad.
6. When exiting the Cell Test wizard, make sure that the toolbox and the drive are equal. If not, do an upload, as described previously.

The Trend Recorder is an optional add-in to the toolbox and is installed separately from the "Control System Solutions" CD. You can then open the Trend Recorder from within the toolbox.

Optional: Using the Trend Recorder to Observe Cell Test

The Trend Recorder enables you to graphically observe and record drive signals as the cell test runs. If a cell fails the test, you can use the Trend Recorder data for troubleshooting. (See *Using the Trend Recorder Online Help*.)

➢ To run the Trend Recorder during cell test

1. From the toolbox main menu, select the **Trend Recorder** button  . This displays the Trend Recorder menu buttons and a window showing the default signal selection.
2. Add any signals that you want to observe by selecting the Trend Recorder's + button and adjust the graphical display as desired).
3. Turn the Trend Recorder on by selecting the **Record** button  , then run the Cell Test wizard, observing the display (refer to Figure 6-6).
4. Select the **Record** button  to stop the recording.

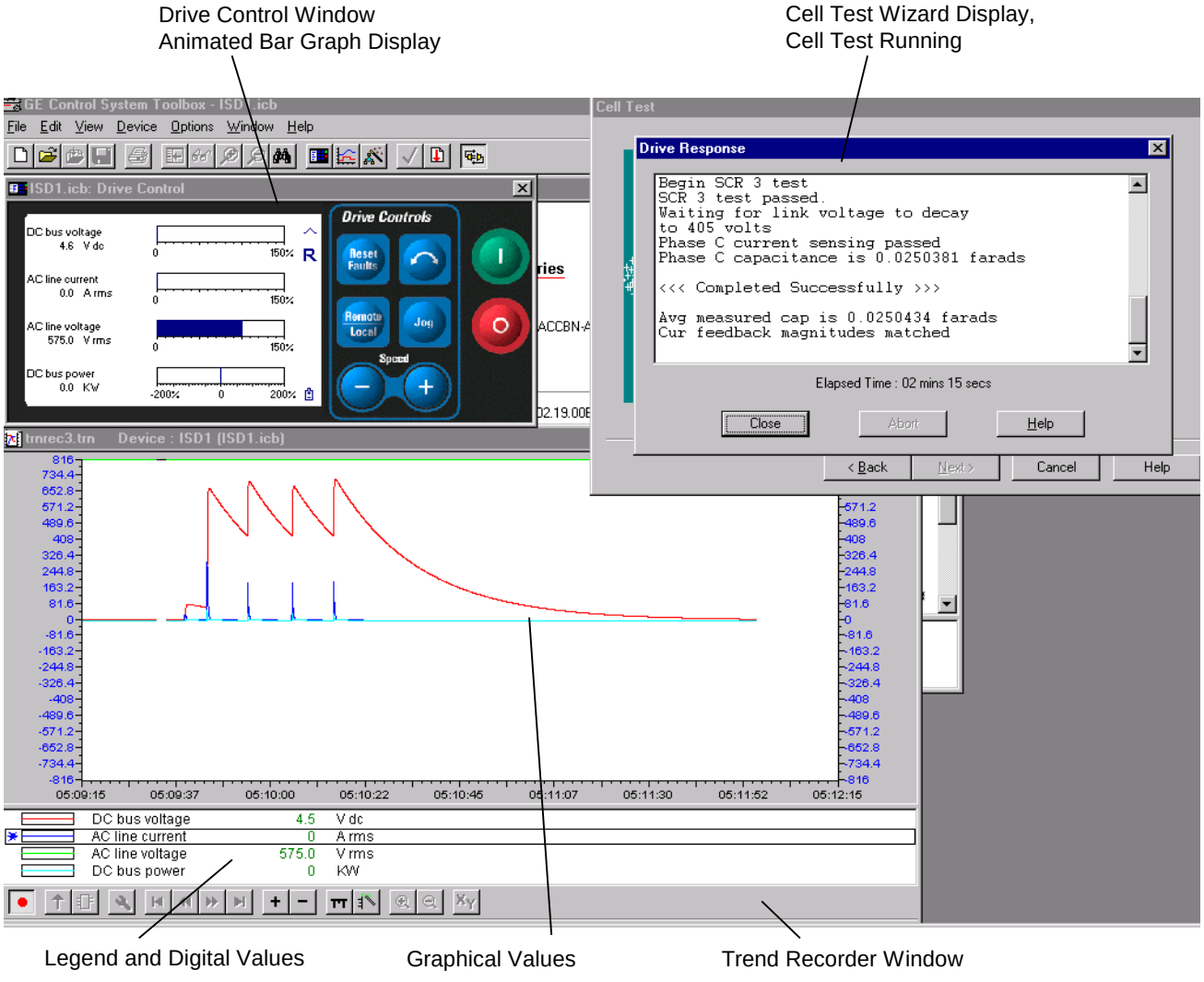


Figure 6-6. Sample Toolbox Display of Trend Recorder, and Drive Control Windows While Running Cell Test Wizard

GE document GEH-6408 contains the same information provided in the Help files.

Using the Trend Recorder Online Help

The Trend Recorder online Help feature provides detailed information about using the program.

Note Because the Trend Recorder is an add-in option to the toolbox, its Help files are not included as part of the toolbox Help. You must have the Trend Recorder installed and open to access its Help files.

To access this screen, you must have the Trend Recorder open with the Trend Recorder menu bar displayed. From there, select **Help** then **Contents**.

Displays an organized list of Trend Recorder help topics, matching its user document GEH-6408.

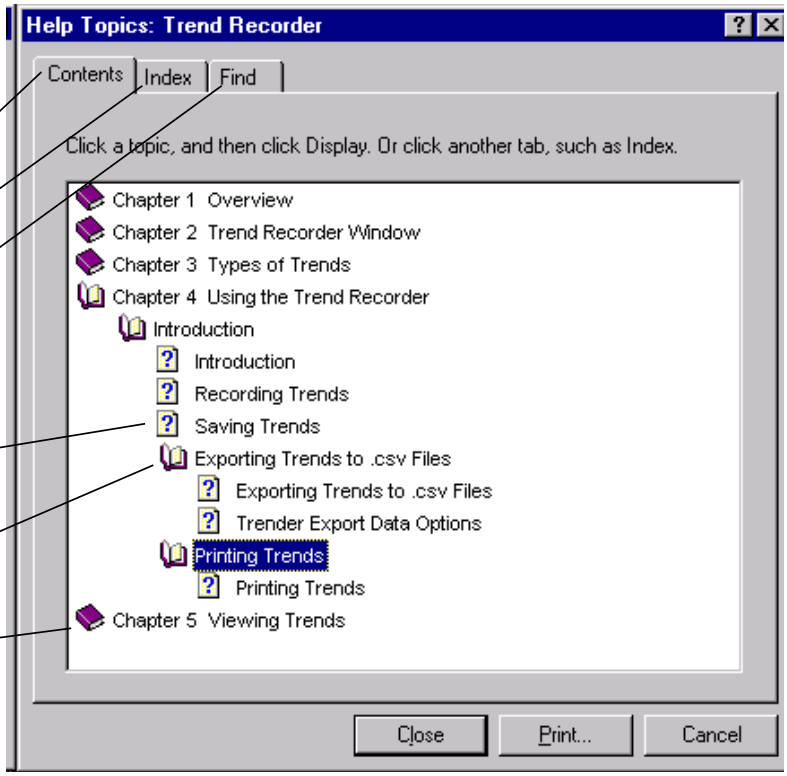
Displays an alphebetized list of toolbox help topics.

Allows you to search for a Help topic by entering a word into a text box.

Doubleclick a question icon to display help information for the topic beside it.

Doubleclick an open-book icon to hide topics listed under that heading.

Doubleclick a closed-book icon to display topics listed under that heading.



Refer to Figure 6-1, Block 10.

All procedures in this section were completed successfully for:

- ☐ *inverter 1*
- ☐ *inverter 2*
- ☐ *inverter 3*

Running the Tuneup Wizards (Inverters Only)

As a final step of commissioning the drive, you must run the *Required* wizards for the inverters. These wizards tune the motors to the drive.

From the Choose Wizard screen (refer to *Running the Commissioning Wizard)*, run the following wizards, completing the screens as directed:

1. Motor Control Tuneup
2. Speed Regulator Tuneup
3. Check the keypad display for fault indication. (The keypad's fault display provides a description of this fault.)

   For an online description of the drive faults and possible solutions, select ***Help***, ***Product Help***, and ***Faults***. These descriptions are also included in the drive Reference and Troubleshooting documents (listed in the *Tools/ Materials Needed* section of this chapter).

Notes

Appendix A Understanding Equipment Drawings

Introduction

GE document GEH-6390 contains outline and layout drawings for the Innovation Series low voltage drives.

GE drawings are an important source of information to help the customer successfully install and maintain the drive. These drawings provide an electrical and mechanical representation of the drive equipment as it applies specifically to the customer's installation. This includes layout, mounting, wiring, and interconnection information, provided as **outline drawings, panel layouts, and elementary diagrams.**

For each customer requisition, GE assigns unique **identification numbers** to the equipment and associated drawings. These numbers are included on the equipment's data nameplate, and are structured to provide information about the equipment.

This appendix defines content and numbering conventions used on drawings for GE drive systems. The purpose is to help the customer more effectively use the documentation provided. This section is presented as follows:

Section ***Page***

Data Nameplate A-1
Identifying the Equipment A-2
    Equipment Catalog Number A-2
    Intelligent Part Number A-3
Drawing Numbers A-3
Outline Drawings A-4
Panel Layout Drawings A-4
Elementary Diagrams A-4
    Equipment Reference Information A-4
    Elementary Drawing Number A-5
    Wire Number Identification A-5
Conventions Used with Other Equipment A-6

Data Nameplate

The data nameplate is located on the back of the cabinet door. Figure A-1 shows a typical data nameplate found on a lineup, a cabinet (panel)/case, and a core unit of a drive system.

Note When contacting the factory for assistance, provide the requisition number and cabinet or core module's ML and serial number printed on the nameplate.

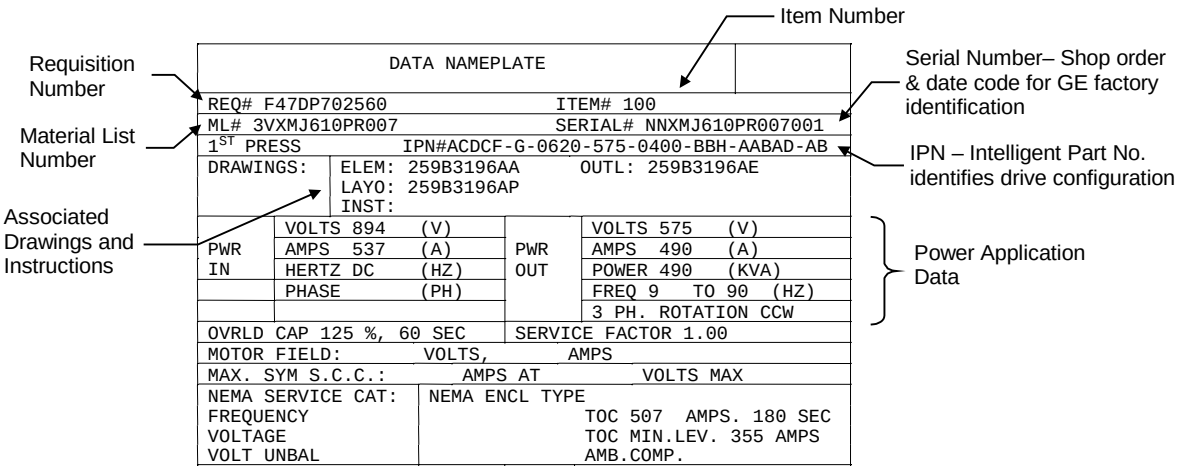


Figure A-1. Typical Data Nameplate

Identifying the Equipment

Equipment Catalog Number

The data nameplate provides the ML number.

Each GE lineup, cabinet (panel)/case, and core unit has a unique identifying catalog number, also called the **part or material list (ML) number**. This number is structured to provide information about that equipment (see Figure A-2.) The catalog number links the equipment to its requisition, drawings, components, materials, specification item, and shipping documents.

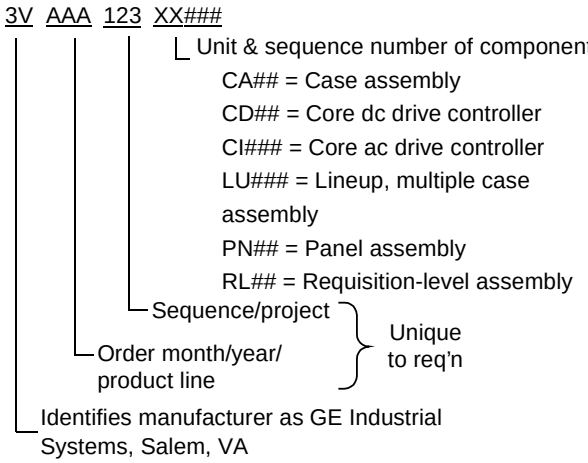


Figure A-2. Sample Drive Catalog (ML) No.

Intelligent Part Number

The elementary and data nameplate provide the IPN number.

The Intelligent Part Number (IPN) defines the drive configuration, independent of requisition requirements (this number is not unique for each customer order). It is structured so that the Base number indicates the drive type (for example, dc-fed ac drive), while additional digits identify other features (see Figure A-3). The Base and Frame digits together make up the Device ID, which is used in the system firmware.

The IPN is found on the system elementary, and may also be included on data nameplate.

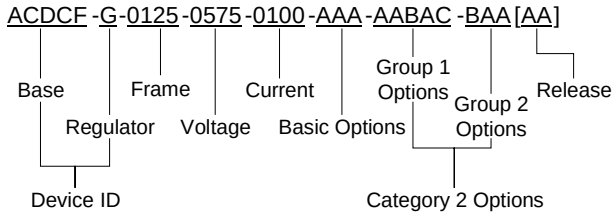


Figure A-3. Intelligent Part Number Structure

Drawing Numbers

For each customer requisition, GE assigns a unique drawing number. The number is structured to provide information about the drawing itself, as well as the equipment it defines.

Each drive frame size has a standard elementary, outline, and layout drawing. The secondary suffixes for these are E, O, and L to identify the drawing type.

(See Figure A-4.) The basic drawing number is an 8-digit structure (seven numerals and one alpha) for each drawing size. A double-alpha suffix is added to the end of the basic number to indicate the equipment category and drawing type.

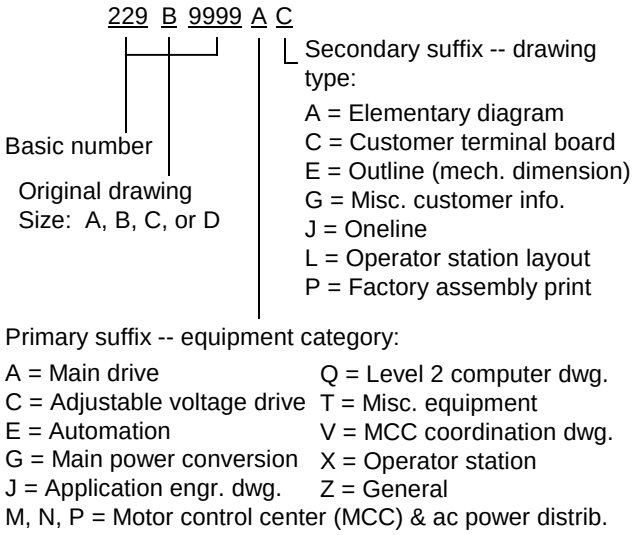


Figure A-4. Sample Requisition Drawing Number

Outline Drawings

GE document GEH-6390 provides drive outline drawings.

An outline drawing is a physical representation of the equipment to be furnished. It includes equipment dimensions, openings, weights, and heat losses. This information is essential when installing the drive.

A **typical** drive outline drawing provides the following views of the equipment:

- A front view, showing physical arrangement of the drives with panel dimensions
- An end view, showing floor sill location and general dimensions
- Bottom and/or top plan, showing conduit access areas and any other information needed to connect to or locate the equipment

Panel Layout Drawings

GE document GEH-6390 provides drive layout drawings.

A panel layout is a type of assembly drawing. It shows:

- Device locations
- Wiring paths
- External wireways/cableways
- Terminal board numbers and points
- External connection points to panel devices, and associated drive/case numbers

System Elementary Diagrams

*A **system** elementary is requisition-specific. The contract documents define distribution of these drawings.*

*A **drive** elementary is specific to the drive. GEH-6390 provides drive elementaries.*

A system elementary diagram (elementary) is a partial electrical representation of the equipment as applied to the customer's application. It references all control devices supplied by GE under a particular requisition, unless otherwise defined. The system elementary's drawing number ties it to the requisition (see Figure A-4).

A system elementary is developed from the engineering design database and mechanical motor list. The drawing includes the internal and external connections required to complete the electrical system. It indicates interconnections to the equipment using slash marks and level identifications.

Equipment Reference Information

The front sheets for each system elementary diagram (the "Drive 0" sheets, see section A-7.2) provide reference information for the equipment, such as:

- Cover sheet with customer name, requisition number, and other job information
- List of related elementaries
- Index
- GE equipment reference information
- Elementary diagram practices/symbols
- Typical equipment grounding practices

Elementary Drawing Number

*System elementaries show the **requisition-specific** drive application data.*

*Drive elementaries show the drive configuration and **general** application information.*

A system elementary diagram number consists of the **basic number** (refer to *Drawing Numbers*), plus additional digits that identify the drive.

(See Figure A-5.) Functional drive numbers (1 – 999) subdivide elementary diagrams. These are denoted in the sheet number. For example, sheets 3AA, 3AB, and 3AC apply to drive 3; sheets 100AA, 100AB, and 100AC apply to drive 100. In general, those sheets show the wires and functionality of the panel(s) assigned this drive number.

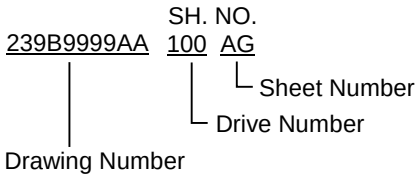


Figure A-5. Sample of Drawing Sheet Number

Each elementary diagram reserves **Drive 0** for front sheets (for example, sheets 0AA, 0AB, 0AC). These contain reference information.

Note GE does not intentionally duplicate drive numbers in any one project.

Wire Number Identification

Wires are labeled in the drive and on the elementary diagram with the same identifying number. The wire number specifies the location of its connection within the elementary.

(See Figure A-6.) Internal and external wire numbers are structured to identify the elementary diagram sheet number, plus the grid block (line number and column alpha) on the sheet where the wire originates. For example, wire number *100AA20B* originates on sheet 100AA, line 20, column B. If a second wire originates on line 20 of sheet 100AA, it must initiate in a different vertical column.

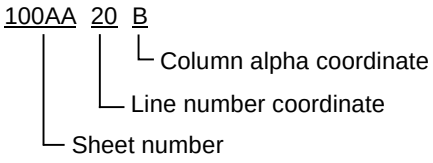


Figure A-6. Sample Wire Number

Conventions Used with Other Equipment

Note Different documentation conventions are used with other types of equipment.

An Innovation Series drive system may incorporate equipment manufactured by other GE and vendor companies. Typical examples are the ac motor control center (MCC) and the Genius™ and Field Control™ I/O systems.

These companies use different conventions for their drawings. For their application, installation, capability, and wiring information, see the instruction manual for those products.

Appendix B Cable Separation and Routing

Introduction

This appendix should be used to check for proper cabling after the equipment is installed, but before beginning startup.

Cables that carry signals and power are categorized into four defining levels: **low**, **medium**, **high**, and **power**. Each level can include classes.

Electrical noise from cabling of various voltage levels can interfere with microprocessor-based control systems, causing the drive to malfunction. This appendix provides recommended cable separation practices to reduce **electrical noise**. The information is presented as follows:

Section	Page
Low-Level Signals (Level L)	B-2
Medium-Level Signals (Level M)	B-2
High-Level Signals (Level H)	B-2
Class Codes	B-2
Cableway Spacing Guidelines	B-3
General Cableway Spacing	B-3
Tray/Tray Spacing	B-4
Tray/Conduit Spacing	B-4
Conduit/Conduit Spacing	B-5

GEH-6380 provides cabling guidance for preparing the installation site for the drive.

The recommended practices in this appendix are consistent with the installation guidance provided by document GEH-6380, *Installation Guidance for Innovation Series Drive Systems.*

Note If a situation at the installation site is not covered in this document, or if these guidelines cannot be met, please contact GE before installing the cable.

Low-Level Signals (Level L)

These signals consist of:

- Analog signals 0 through ±50 V dc
- Digital (logic-level) signals less than 28 V dc
- 4 – 20 mA current loops
- LAN signals, such as ISBus, Profibus, and Genius
- Signal commons ACOM, DCOM, CCOM, and SCOM

Medium-Level Signals (Level M)

These signals consist of:

- Analog signals greater than 50 V ac with less than 28 V ac ripple
- 28 V dc light and switching circuits
- 24 V dc switching circuits
- PCOM, SHCOM

High-Level Signals (Level H)

These signals consist of:

- Dc switching signals greater than 28 V
- Analog signals greater than 50 V dc with greater than 28 V ac ripple
- Regulating signals 50 V with currents less than 20 A
- Ac feeders less than 20 A

Power (Level P)

Power cabling carries ac and dc buses 0 – 800 V with currents 20 A – 800 A.

Class Codes

Certain conditions can require that specific wires within a level be grouped in the same cable. This is indicated by following class codes, defined as follows:

S Special handling of specified levels can require special spacing of conduit and trays. Check dimension chart for levels. These wires include:

- Signals from COMM field and line resistors
- Signals from line shunts to regulators

U High voltage potential unfused wires over 600 V dc

PS Power greater than 800 V dc and/or greater than 800 A

If there is no code, there are no grouping restrictions.

Cableway Spacing Guidelines

Spacing (or clearance) between cableways (trays and conduit) depends on the level of the wiring inside them.

General Cableway Spacing

General spacing practices apply to **all levels** of cabling. They should be used with the specific spacing values in Tables B-1 through B-3.

- All cables of like signal levels and power levels must be grouped together in cableways.
- In general, different levels must run in separate cableways, as defined in the different classes. Intermixing cannot be allowed, except as noted by exception.
- Interconnecting wire runs should carry a level designation.
- If wires are the same level and same type signal, group those wires from one panel to any one specific location together in multiconductor cables.
- When unlike signals must cross in trays or conduit, cross them in 90° angles at a maximum spacing. Where it is not possible to maintain spacing, place a grounded steel barrier between unlike levels at the crossover point.
- When entering terminal equipment where it is difficult to maintain the specific spacing guidelines given in Tables B-1 through B-3, keep parallel runs to a minimum, not to exceed 5 ft in the overall run.
- Where Tables B-1 through B-3 show tray or conduit spacing as *0*, the levels can be run together. Spacing for other levels must be based on the worst condition.
- Trays for all levels should be metal and solidly grounded with good ground continuity. Conduit should be metal to provide shielding. (Use Table B-1 for non-metal conduit/tray spacing.)
- When separate trays are impractical, levels L and M can combined in a common tray if a grounded steel barrier separates levels. This practice is not as effective as tray separation, and may require some rerouting at system startup. If levels L and M are run side-by-side, a 1-inch minimum spacing is recommended.
- Locate levels L and M trays and conduit closest to the control panels.
- Trays containing level L and level M wiring should have solid bottoms and be covered to provide complete shielding. There must be positive and continuous cover contact to side rails to avoid high-reluctance air gaps, which impair shielding.
- Trays containing levels other than L and M wiring can have ventilation slots or louvers.
- Trays and conduit containing levels L, M, and H(S) should not be routed parallel to high power equipment enclosures of 100 kVA and larger at a spacing of less than 5 ft for trays and 2 1/2 ft for conduit.
- Level H and H(S) can be combined in the same tray or conduit, but cannot be combined in the same cable.
- Level H(S) is listed only for information since many customers want to isolate unfused high voltage potential wires.
- Do not run levels H and H(S) in the same conduit as level P.

- Levels H and P can be run in a common tray if levels are separated by a barrier. This barrier does not have to be grounded. Spacing should be for level P.
- Where practical for level P and/or P(S) wiring, route the complete power circuit between equipment in the same tray or conduit. This minimizes the possibility of power and control circuits encircling each other.

Tray/Tray Spacing

Table B-1 defines the recommended minimum distance between trays: the top of one tray and the bottom of the tray above, or the sides of adjacent trays. Table B-1 also applies if the distance is less than 5 ft between trays and power equipment up to 100 kVA.

Table B-1. Spacing Between Trays*

Level	L	M	H	H(S)	P	P(S)
L	0	3	6	6	26	26
M	3	0	6	6	18	26
H	6	6	0	0	4	12
H(S)	6	6	0	0	8	18
P	26	18	4	8	0	0
P(S)	26	12	12	18	0	0

*Spacing is in inches

Tray/Conduit Spacing

Use Table B-1 for tray/conduit spacing if:

- Trays or conduit are **non-metal**
- Levels L and M trays are not covered (Table B-2 assumes levels L and M trays are covered)
- If the distance is less than 5 ft between trays or conduit and power equipment up to 100 kVA
- Table B-2 lists the minimum recommended distance between the outside surfaces of **metal** trays and conduit.

Table B-2. Spacing Between Metal Trays and Conduit*

Level	L	M	H	H(S)	P	P(S)
L	0	1	4	4	18	18
M	1	0	4	4	12	18
H	4	4	0	0	4	8
H(S)	4	4	0	0	6	12
P	18	12	4	6	0	0
P(S)	18	18	8	12	0	0

*Spacing is in inches

Conduit/Conduit Spacing

Use Table B-1 for conduit/conduit spacing if:

- Conduit is **non-metal**
- Distance is less than 2.5 ft between conduit and power equipment rated up to 100 kVA

Table B-3 lists the minimum recommended distance between the outside surfaces of **metal** conduit run in banks.

Table B-3. Spacing Between Metal Conduit Runs*

Level	L	M	H	H(S)	P	P(S)
L	0	1	3	3	12	12
M	1	0	3	3	9	12
H	3	3	0	0	3	8
H(S)	3	3	0	0	6	9
P	12	9	3	6	0	0
P(S)	12	12	6	9	0	0

*Spacing is in inches

Notes

Appendix C Printed Wiring Board Reference

Catalog (Part) Number.	Board/Module Description (Function)	Publication
IS215ACL_	Application Control Layer	GEI-100434
IS200ALSA	AC Line Snubber	GEI-100257
IS200ATBA	Application Terminal Board	GEI-100284
IS200BAIA	Basic I/O	GEI-100268
IS200BICL	Bridge Interface	GEI-100264
IS200BPIA	Bridge Interface	GEI-100265
IS200BPIB	Bridge Interface	GEI-100266
IS200CAPB	Control Rack Backplane	GEI-100270
IS200DAM_	Gate Drive/Amplifier Interface	GEI-100262
IS200DSFC	1000/1800 Frame IGBT Gate Driver/Shunt Feedback	GEI-100263
IS200DSPX	Digital Signal Processor	GEI-100267
IS215GBIA	Genius Interface Module	GEI-100269
IS200HFPA	High Frequency Ac/Fan Power Supply	GEI-100255
IS200ISBB	ISBus Bypass Relay	GEH-6410
IS200ISBD	ISBus Delay	GEH-6410
IS200ISBE	ISBus Extender	GEH-6410
IS215PBIA	ProfiBus Interface Module	GEI-100419
IS200RAPA	Control Rack Power Supply	GEI-100261
IS200RCSA	1800 and 1000 Frame Snubber	GEI-100303
IS200RCSB	620 Frame Snubber	GEI-100295
IS200SCNV	SCR/Diode Converter Interface	GEI-100280

Notes

Appendix D Pre-Startup Checklist

Transformer

- ☐ Transformer instruction manual present
- ☐ Transformer of correct rating and mounted correctly
- ☐ Proper grounding installed
- ☐ Power cables meet requirements and are installed
- ☐ Transformer overtemperature (if supplied) correctly interfaced
- ☐ If transformer is oil-filled: Sudden pressure relay installed and tested, liquid level and pressure relief operational

Drive Software

- ☐ Toolbox (drive configuration) software available
- ☐ Drive configuration pattern present (xxx.ICB file)
- ☐ Correct version of drive firmware available and installed
- ☐ Correct version of keypad firmware available and installed
- ☐ Motor data nameplate

Drive Hardware

- ☐ Drive elementary drawings supplied and up-to-date
- ☐ Drive cabinets mounted correctly to floor
- ☐ Drive lineups properly secured together at lineup splits
- ☐ Case tie plates and brackets in place and secured
- ☐ DC bus tie splices Installed and tightened to the proper torque
- ☐ Protective ground tie plates in place
- ☐ Drive equipment protective ground properly attached to ground grid with separately run CCOM ground
- ☐ Power cables meet requirements, and are installed
- ☐ Drive room has adequate cooling
- ☐ Drive source fusing correct
- ☐ Shunts sized correctly

Motor

- ☐ Motor of correct rating and mounted on base
- ☐ Motor properly grounded
- ☐ Power cables meet requirements and are installed
- ☐ Motor shaft ground brush correctly mounted
- ☐ Motor has sufficient cooling
- ☐ Optional: motor tachometer mounted

Notes

Appendix E Configuring an Innovation Series Drive

Introduction

This appendix is a duplicate of Chapter 4 of GEH-6401, "Control System Toolbox for Configuring an Innovation Series Drive".

The information in this appendix is also available in the toolbox Help files.

This appendix provides instructions for using the toolbox to configure and monitor an Innovation Series drive. It also contains information on using other features of the toolbox specific to the drive.

Section **Page**

Creating an Innovation Series Drive E-2
- New Drive E-2
- Pattern and Version E-3
- Verify the Drive IPN E-3
- Enter User Identification E-4

Configuring the Drive E-5
- Toolbox Work Area E-5
- Enter Job Specific Information E-7
- Upgrading a Configuration E-7
- Select Upgrade Version E-8

Working with Files and Menus E-9
- File Types E-9
- Pattern Files E-10
- Opening and Closing Files E-10
- Saving Files E-10
- Exporting Configuration Files E-11
- Exporting/Opening Project Files E-11
- Menu Commands E-12

Concepts E-18

Configuration E-19
- Parameters E-19
- Toolbox/Drive Communications E-21
- Communication Settings in a Second Drive E-22

Block Diagram E-24
- Links to Other Pages E-25
- Modify Parameters from Diagram E-25
- Parameter Jumpers E-26
- Live Data Display E-26
- Drag-and-Drop Variables E-27
- Printing Diagrams E-28

Drive Controls E-29

Wizards E-30
- Choose Wizard E-30

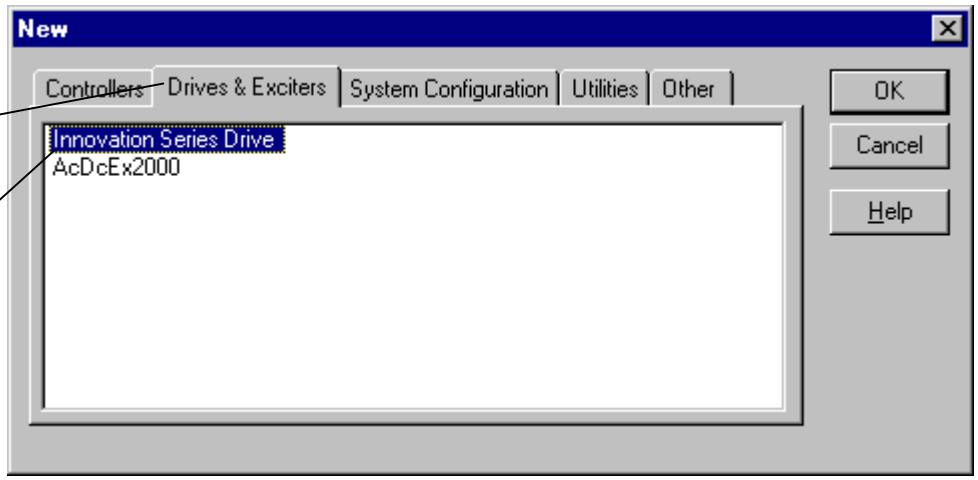
Creating an Innovation Series Drive

When the toolbox starts, the toolbox *Work Area* displays (refer to the section *Configuring the Drive*). The Work Area is used to maintain the drive configuration file in the toolbox. You must create a new drive configuration file (.icb) or open an existing one.

Or choose the  *New button.*

➢ **To create an Innovation Series drive**

- From the **File** menu, choose **New**. The **New** dialog box contains all installed toolbox products. Choose the drive as follows:

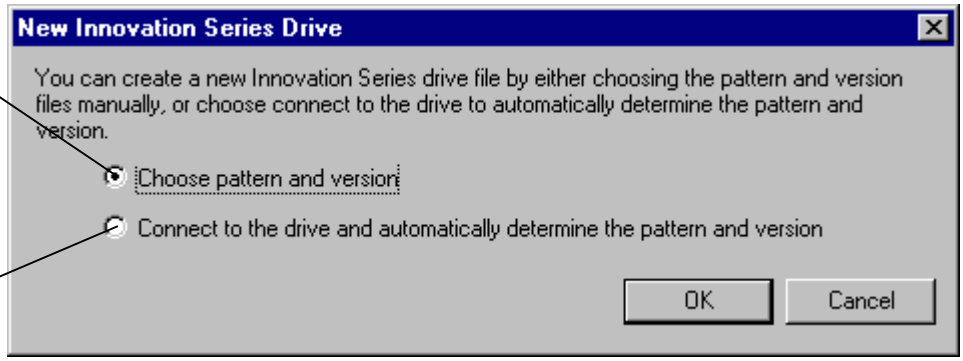


Click on the tab, Drives & Exciters.

Click on Innovation Series Drive and click OK.

The New Innovation Series Drive dialog box displays to allow you to choose the pattern and version.

New Drive

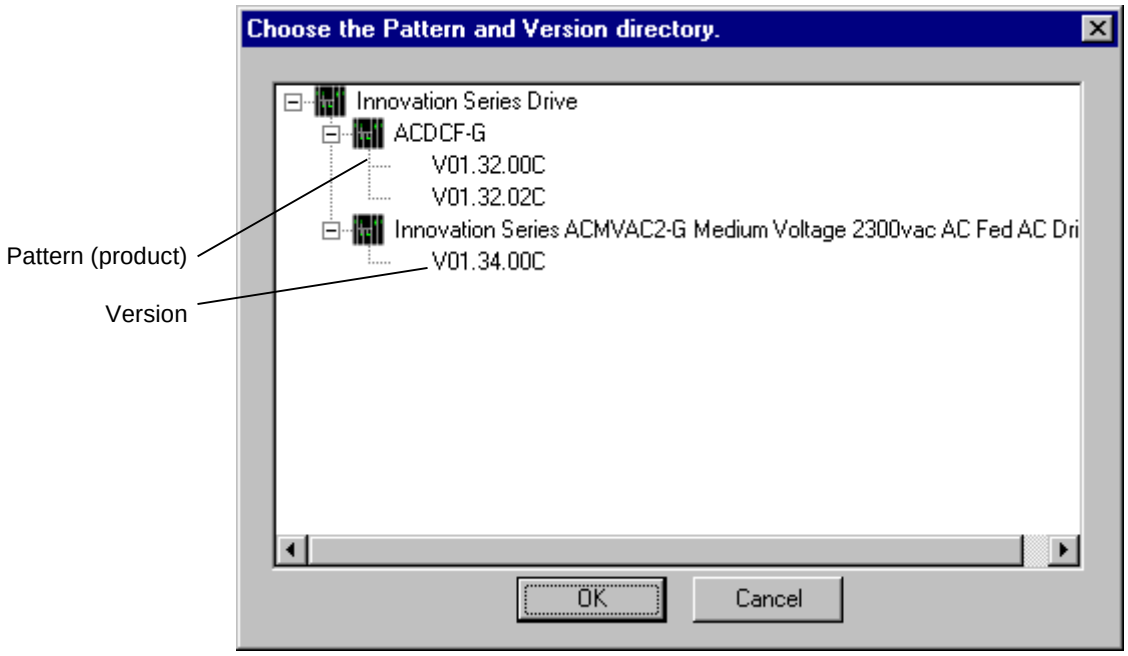


Choose this option to display the pattern and version directory dialog box and manually load the desired product (pattern).

Choose this option to go online and automatically determine the pattern and version.

Pattern and Version

Choose the Pattern and Version displays the followings dialog box and allows you to choose the Pattern name and Version directory.



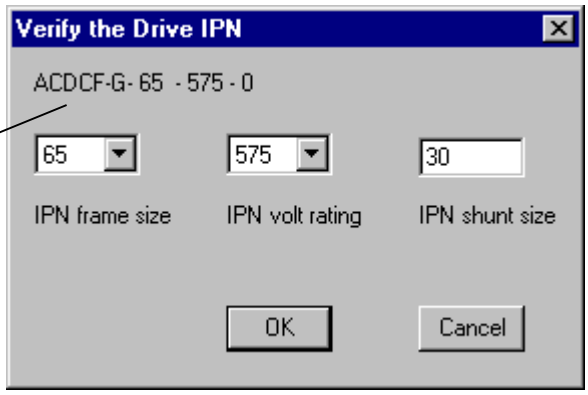
1. Click on the desired **Pattern** (product) and click ⊞ to expand the pattern list and display Version numbers.
2. Choose a **Version** from the list and click **OK**. The **Verify the Drive IPN** (Intelligent Parts Number) dialog box displays.

Verify the Drive IPN

Caution

To avoid equipment damage, the IPN must match the IPN or the cabinet Product Data nameplate.

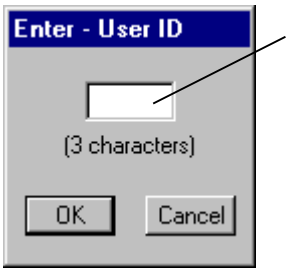
Verify these numbers from the cabinet Product Data nameplate, located inside the cabinet door. Enter the correct numbers, as necessary. Click OK.



Enter User Identification

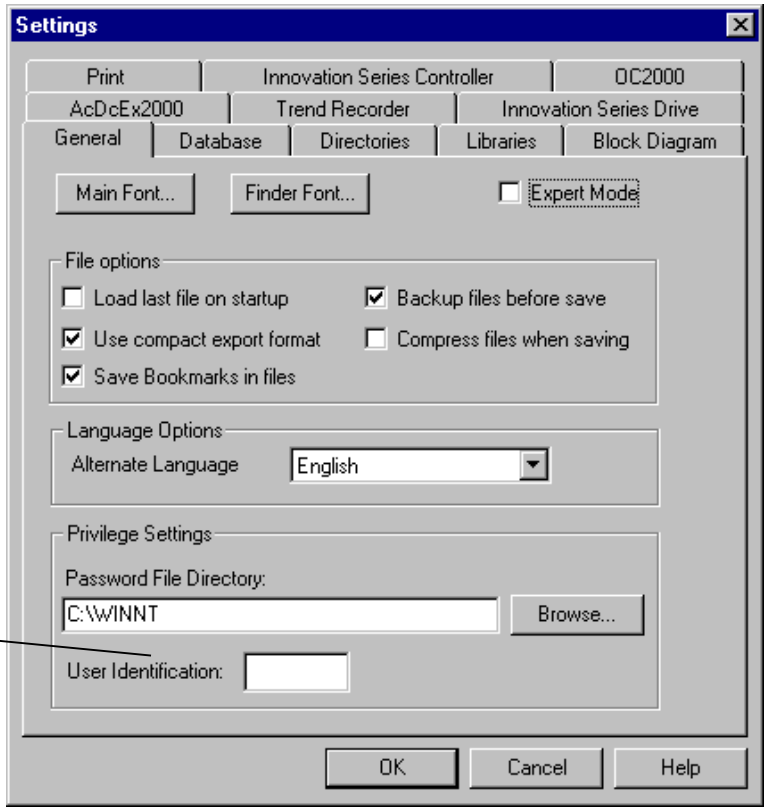
To view these configuration changes with User ID, choose the View menu and Reports.

If the Enter - ID dialog box (shown below) displays, you must enter an ID to identifies the user about to make changes to the configuration.



You must enter a three character ID (such as your initials).

If you are the only user making changes with the toolbox, you can permanently avoid this dialog box by entering your ID. Choose the **Option** menu, **Settings**, and the tab **General.**



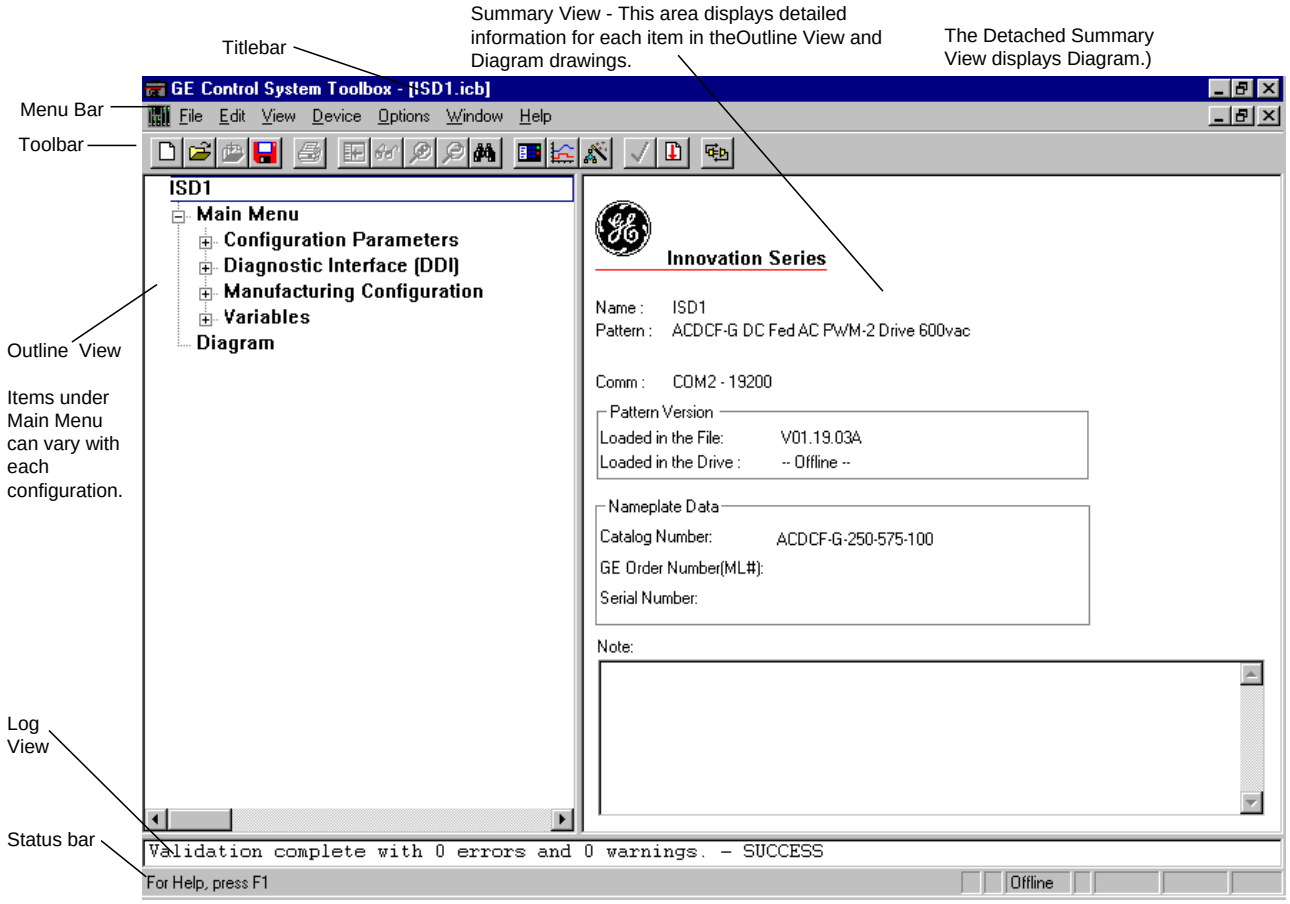
Enter your three character identification.

Configuring the Drive

The **Toolbox Work Area** is the main screen of an Innovation Series drive configuration (see screen below). This area is used to configure the drive. Across the top of this screen is the Title Bar, which contains the name of the toolbox and the name of the file (drive configuration) in use. Under the title bar is the Menu Bar containing all available menu commands. These commands are described in the section, *Working with Files and Menus.*

Toolbox Work Area

Tip *To expand or collapse an item in the Outline View, use the mouse and click on* ⊞ . ***Or****, use the left and right arrow keys to expand/collapse the list. To navigate through the items in the hierarchy list, use the up and down arrow keys.*



Once a new drive is *created* (or a file is *opened*), the Outline View displays the drive name and two items; Main Menu and Diagram.

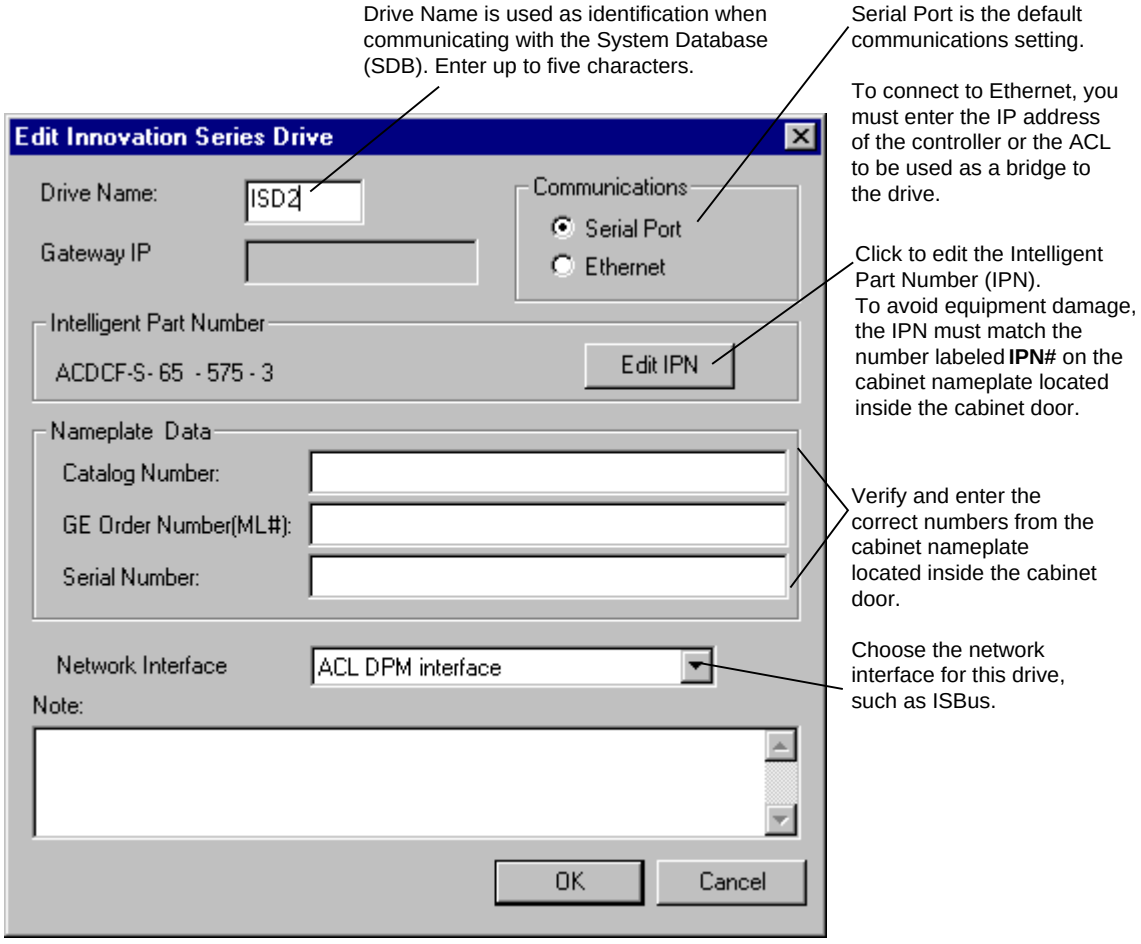
The default device name is ISD1. Additional new devices are incremented by one. This name should be modified to more accurately refer to the drive being configured. The name is limited to five characters

➢ **To modify the drive**

1. Click on the **drive** name to highlight it.
2. From the **Edit** menu, choose **Modify**.

The **Edit Innovation Series Drive** dialog box displays and allows you to edit drive properties as follows:

Modify Drive Properties



Validating the Drive

Also, any items in the hierarchy that had problems during validation will display red after the validation.

Validation checks for errors that might prevent successful operation of the drive. If the configuration needs to be validated, the Outline View displays the items in red.

➢ **To validate the drive configuration**

Or click  .

- From the **Drive** menu, choose **Validate.**

The validation results display in the **Log View** at the bottom of the toolbox Work Area.

Enter Job Specific Information

Each wizard dialog box contains a Help button.

Once a new drive has been created and the properties are modified, you must enter job specific data, such as motor hp, motor amps, and motor speed. This information can be entered in a new configuration using the menus or the Drive Commissioning Wizard (refer to the section *Wizards*). A wizard is an interactive Help utility that guides the user through each step of a particular task, such as drive commissioning.

Tip *If the drive contains a different pattern than the one presently being configured, it is necessary to first download the new pattern. Refer to the section Upgrading a Configuration. The toolbox will recognize this condition and notify the user if it is a problem.*

➢ **To configure the drive online**

Each configuration depends on application requirements. For more information, contact Product Service Engineering at + 1 800 533 5886 or Fax at + 1 540 387 8606 (replace + with the international access code).

1. From the toolbox, click  to go online.
2. From the **Edit** menu, choose **Wizards.**
3. Choose the **Drive Commissioning Wizard.**

Note Entering the Drive Commissioning wizard information and performing the applicable tuneups should be sufficient to configure the drive for basic operation.

4. From the **Device** menu, choose **Download to Drive** and **Parameter Values.**

Note If an alternative language for the keypad is desired, choose **Device** menu, **Download to Drive**, and **DDI Menu**.

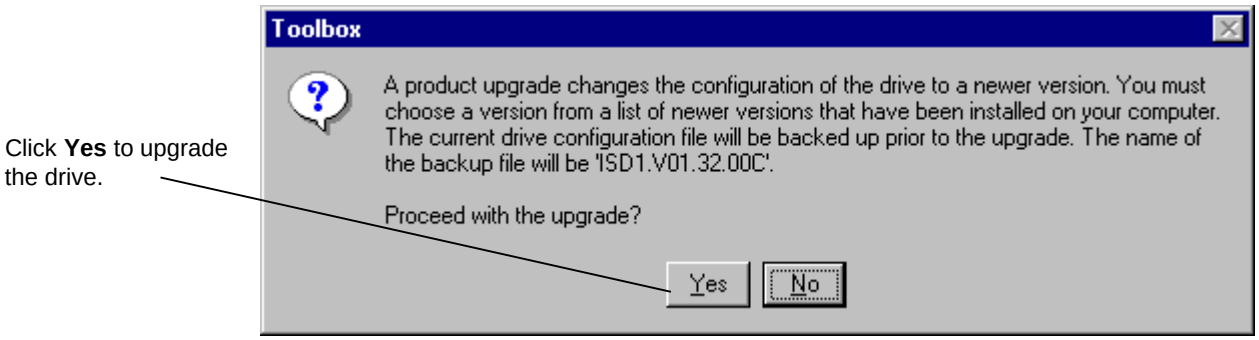
Upgrading a Configuration

Refer to GEH-6401, Chapter 3, Using the Toolbox.

The upgrade command adds the required functions of a newer version of the pattern to the current drive configuration file (.icb). For example, the current drive configuration file (.icb) is version V01.19. The application requires the functions of version V01.21.00C. Upgrade the drive configuration file as follows:

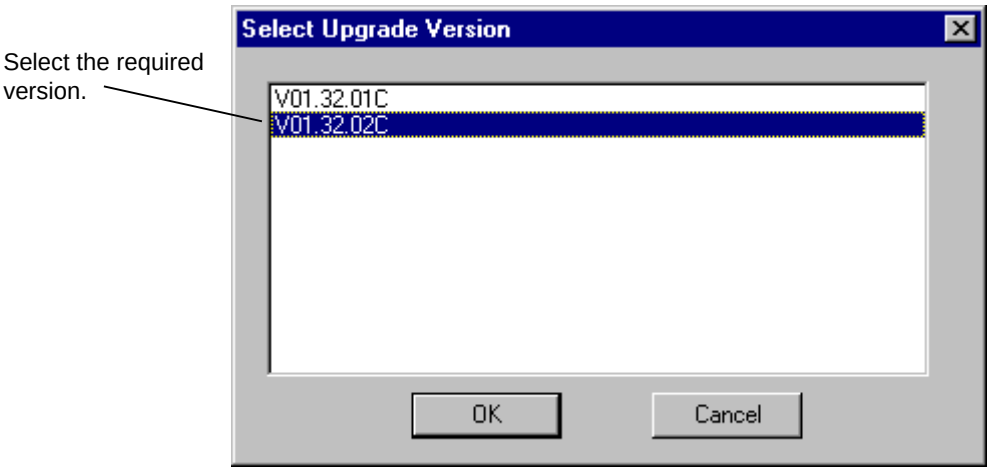
➢ **To upgrade a file**

1. Make sure the new required version is installed (refer to Chapter 3).
2. From the current drive configuration file (.icb), such as version V01.19.03C described above, choose the **File** menu and choose **Upgrade**. The following message box prompts to proceed you with the upgrade.

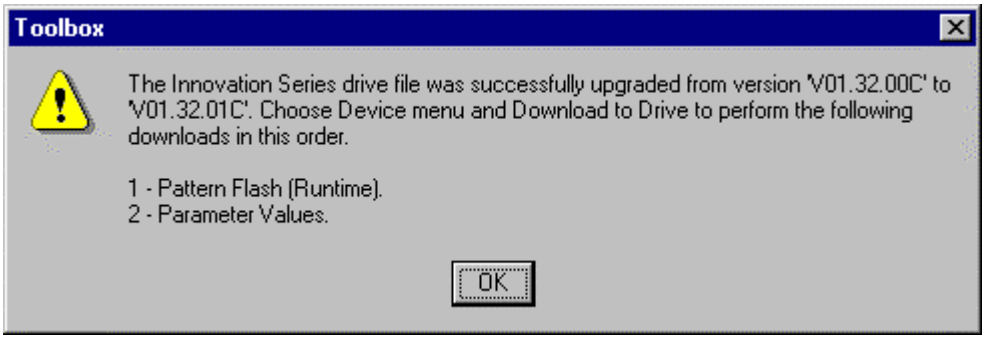


Select Upgrade Version

If you select to upgrade the drive, the **Select Upgrade Version** dialog box displays all newer installed versions.



The following message displays. These items can be downloaded from the Drive menu. Refer to the sections, *Configuring the Drive* and *Download To Drive*.



Working with Files and Menus

An Innovation Series Drive is configured using different types of files, which are described in the following sections. Menu commands are also described.

File Types

Attention

Back up all files often to avoid loss of data.

The **configuration** files generate **output** that can be downloaded to the drive.

Configuration files include:

Drive configuration file (.icb) is a binary working file that contains an exact copy of the drive configuration used by the toolbox. Users generally work from drive configuration files. When the file is saved, the *prior* .icb is renamed to an .ibb file and used as a backup file. To restore the backup copy, rename the file to a .icb file.

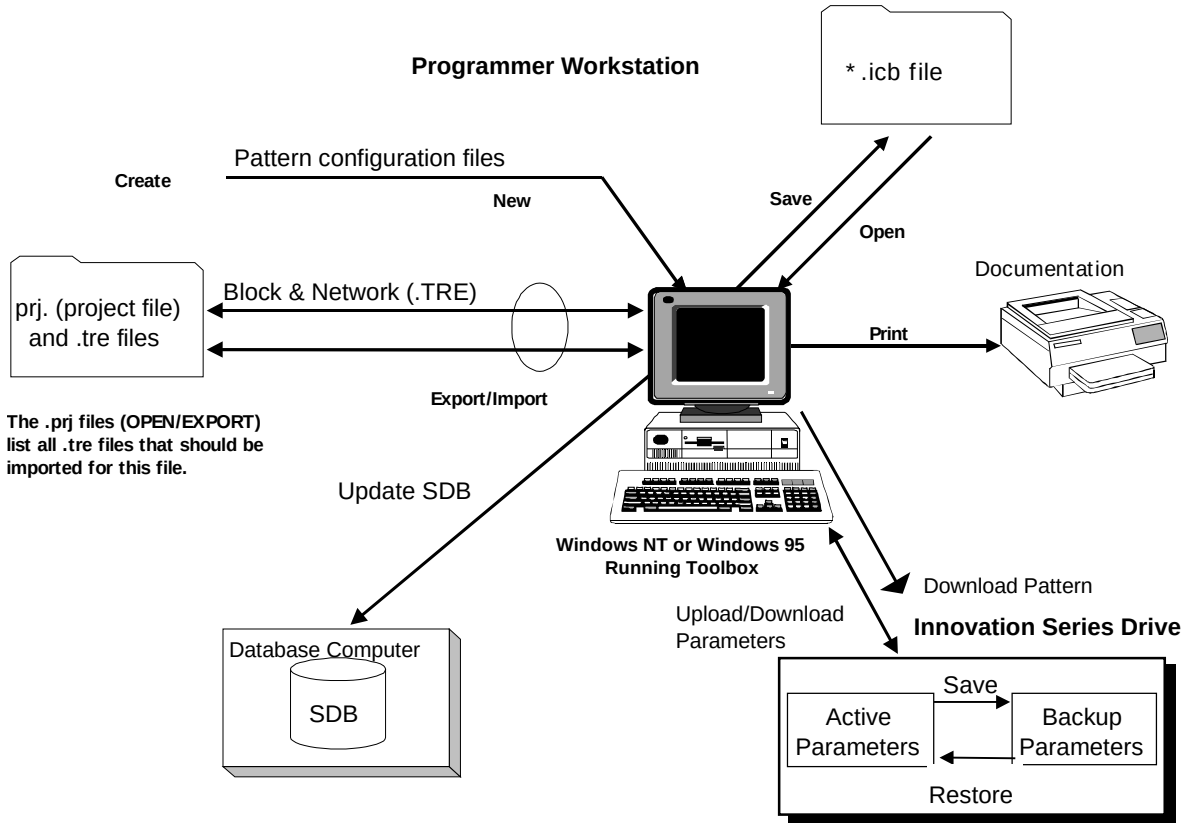
Tree files (.tre) are text files that serve several purposes. Some define the parameters, faults, menus, and other items that exist within a particular drive. Others store configurations for transport between different drives, and possibly different versions of the toolbox.

Project files (.prj) are text files that hold some drive configuration information. They are used, in conjunction with other tree files, to transport configurations across versions of drive patterns, and possibly different versions of the toolbox.

Note The .tre and .prj files are not normally used by users.

Output files include:

Drive Diagnostic Interface (DDI) database files (.icd) describe the configuration for the DDI(also known as keypad). This file is downloaded to the drive.



Pattern Files

The pattern is loaded into the drive processor, which resides on the DSPX board. The DSPX board is located in the drive control rack.

The drive can be loaded with different patterns. The term *pattern* is used to describe the functionality that can be loaded into a drive. For example, a drive can be loaded with a general industry pattern or a system pattern. A pattern is defined with the following collection of files used by the toolbox:

Tree files (.tre) are text files that contain configuration information for the pattern.

Runtime files (.arc) are binary files that contain the runtime image that is downloaded to the drive.

Diagram files (.wmf) are drawing files that contain the toolbox block diagrams.

Help files (.hlp) provide pattern specific help from within the toolbox.

Upgrade files (.dll) are binary files that provide an intelligent pattern specific upgrade from previous pattern versions.

Opening and Closing Files

Opening an drive configuration file (.icb) reads a previously saved drive configuration into the toolbox.

➢ **To open a file**

1. From the **File** menu, choose **Open.** The **Open** dialog box displays.
2. Choose the file name and click **OK**.

Or choose the  *Open button.*

Note If an older version toolbox is used to open a drive configuration file (.icb) that was saved with a newer version, a **Warning** box is displayed. Either install the version of toolbox that the drive configuration file (.icb) was saved with (listed in the Warning box) or consult the toolbox Release Notes to see if they are compatible.

Check the Release Notes located in the toolbox Help menu under About Toolbox.

➢ **To close a file**

- From the **File** menu, choose **Close.**

Closing a file removes the configuration from the toolbox. If the configuration has not been saved, a dialog box displays and asks if the configuration should be saved.

Saving Files

Saving a file writes the entire contents of the configuration to a drive configuration file (.icb). The *prior* drive configuration file (.icb) is renamed to a .ibb file and used as a backup file.

Or choose the  *Save button.*

➢ **To save a file**

1. From the **File** menu, choose **Save.** The **Save As** dialog box displays.
2. Enter the file name and click **OK**. (Once a configuration has been saved, the **Save** button saves the new file without asking for a file name.)

Tip *The* **Save** *button also indicates that a change was made to the configuration by highlighting (red) and becoming enabled. If the computer or toolbox fails when the button is red, all changes since the last save is lost, so save files often.*

Exporting Configuration Files

The .tre files can be exported selectively or for an entire drive. Refer to the next section Importing/Exporting.

The parameter values contained in a drive configuration file (.icb) can be exported in a .tre file format. Exporting drive parameters allows settings among drives to be shared.

➢ **To export parameter values**

1. From the **File** menu, choose **Export**, then choose **Parameter Values**. The **Parameter Value File Name** dialog box displays.
2. Confirm the current project directory/file name or choose a new directory. The file is saved as a .tre file.

Exporting/Opening Project Files

Attention

This option is normally not required, but is provided if a newer version of the toolbox makes a change to the format of the drive configuration file (.icb) that is not backward compatible.

Normally, newer versions of the toolbox can load drive configuration files created by older versions. However, if a major change in functionality of the toolbox occurs, the toolbox may not be able to load the drive configuration file. In this case, it is necessary to first export the drive configuration file to a project file and then import it into the new version of the toolbox.

Project files save the drive configuration in a form that can be loaded by all newer versions of the toolbox. A project file (.prj) is a text file, which contains the names of all **.tre** files in a configuration. Project files allow the user to export and import a drive configuration without having to know about all the files it contains.

➢ **To create a project file**

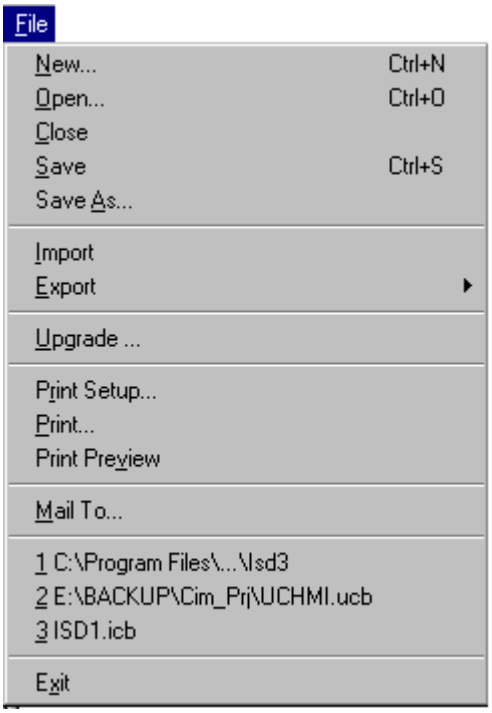
1. From the **Outline View**, choose the drive name or the desired item.
2. From the **File** menu, choose **Export** and choose either **Selected Item** (exports just the .prj file) or **All Export Code** (exports all .tre files and the .prj file).

Once a project file exists, it can be used to create a drive configuration file (.icb). From the file **Open** command, choose a .prj file. This creates an Innovation Series drive and starts a series of file imports. The toolbox imports the files listed in the .prj file, including the parameter values file.

Menu Commands

File Menu

The File menu allows you to perform file operations with the following commands:



Or click 

New creates a new drive configuration file.

Or click 

Open loads an existing drive configuration file into the toolbox.

Or click 

Close exits an existing drive configuration.

Save/Save As saves an opened drive configuration file to a specified name.

Or click 

Import retrieves values from the specified file. The values in the current configuration are replaced with the imported values.

Export sends specified items (such as parameters and files) to a designated file.

Upgrade automatically makes the required changes to upgrade an older pattern and its configuration to a new version.

Print Setup allows the user to choose a printer and printer connection.

Tip *The block diagram is designed to print best in Landscape Orientation. Refer to the section Block Diagrams/Printing Diagrams.*

Or click 

Print provides a paper (hard) copy of a specified file or page.

Print Preview displays the page as it would be printed.

Mail To opens email and provides a copy of the currently opened file to send (you must have Window messaging, such as Exchange).

File 1, 2, 3... lists and opens the most recently used files.

Exit closes the toolbox.

Edit Menu

The Edit menu allows you to edit items with the following commands:

Modify allows you to edit the highlighted item.

Or click 

Cut removes the highlighted item and places it on the clipboard.

Or click 

Copy duplicates the highlighted item and places it on the clipboard.

Or click 

Paste places the highlighted item from the clipboard into the current file.

Or click 

Wizards allow you to choose from a list of wizards used for drive configurations commissioning, tests, and tune-ups.

Or click 

Bookmarks enable you to mark major items in the Outline View and then return to them easily using the menu command Goto Next Bookmark.

Options Menu

The Options menu allows you to manage general options for toolbox operation.

Settings allow you to set general toolbox options.

Privilege sets the privilege level for a session.

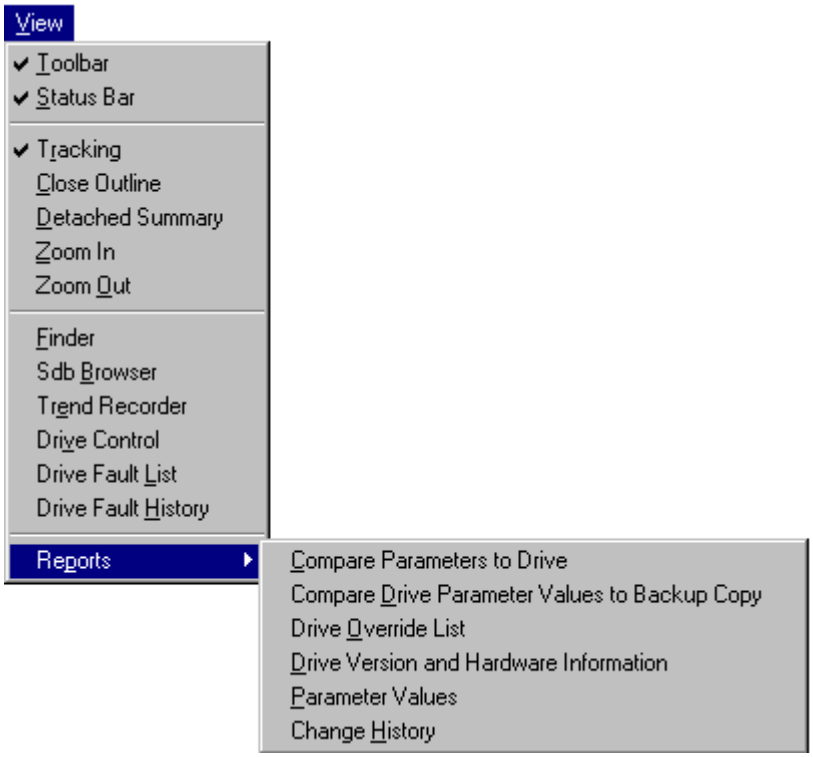
Passwords set the password for a privilege level.

Logout User closes the current user from the current session and sets the privilege level back to 0.

View Menu

Some of these commands can be toggled on and off. A check mark (✓) displays next to the command name when the feature is on and it will display in the toolbox.

The View menu allows you to manage the drive with the following commands:



Toolbar displays or hides the Toolbar.

Status Bar displays or hides the Status bar.

Or click 

Tracking toggles the tracking feature of the Summary View on and off.

Close Outline reduces the hierarchy list of items displaying in the Outline View to just the drive level.

Or click 

Detached Summary creates a detached window of the Diagram View.

Or click 

Zoom In enlarges the view of the block diagram area (Summary View).

Or click 

Zoom Out reduces the view of the block diagram area (Summary View).

Or click 

Finder starts the Finder view to search text.

SDB Browser starts the SDB Browser window to search the System Database (refer to the manual, GEI-100271).

Or click 

Trend Recorder starts the Trend Recorder application (refer to the manual, GEH-6408). Choose Tile Horizontal or Tile Vertical from the Window menu to view both the Trend Recorder and toolbox Work Area simultaneously (or use <Ctrl>< Tab> to toggle between screens).

Or click 

Drive Control starts the Drive Controls view, which can be used to start and stop the drive. It also provides specific information, such as motor speed, volts, amps and power.

Drive Fault List displays a list of all active faults and alarms. Each fault is time stamped so that the order of events can be determined.

Reports contain the following options:

Compare Parameters To Drive produces a report that shows all parameters whose values in the toolbox are not the same as in the drive.

Compare Drive Parameter Values to Backup Copy produces a report that shows the difference between the currently active parameter and the backup copy.

Override List displays a list of settings in the drive that are overridden from their manually calculated state.

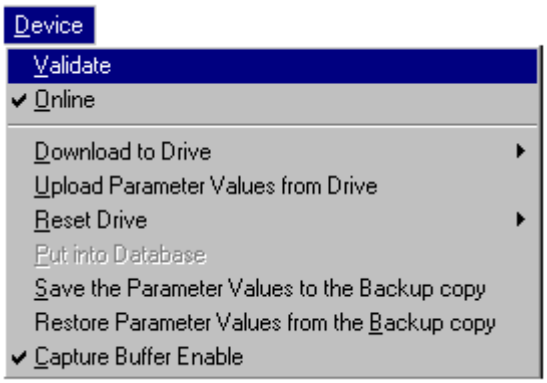
Drive Version and Hardware Info produces a report that shows the version of the drive pattern and bar code information of the boards installed in the control rack.

Parameter Values displays all parameters and their values in a menu hierarchical structure.

Change History produces a report of changes made to the drive configuration file.

Device Menu

The Device menu allows you to manage the drive with the following commands:



Or click 

Validate makes certain that drive configuration does not contain errors.

Or click 

Online/offline toggles to start or end communications between the toolbox and the current drive.

Or click 

Download to Drive sends the following data:

Parameter Values sends the values of all the parameters from the loaded drive configuration files to the current drive.

DDI Menus sends the menu structures and other data to the Drive Diagnostic Interface (DDI; also known as the keypad). This is only required when an alternative language is desired.

Pattern Flash sends the drive firmware configuration to the current drive.

Upload Parameter Values from Drive reads all the parameter values from the current drive and provides the option of replacing the values in the currently loaded drive configuration file in the toolbox.

Reset Drive has two commands:

Hard Reset initiates a hard reset of the current drive.

Clear Faults resets all faults that are currently active in the drive.

Put into Database puts information into the SDB to allow drives to share signals with other drives and controllers on the network. This command can be enabled if a network is enabled.

Save the Parameter Values to the Backup Copy saves the current set of parameter values in the drive to a permanent storage backup copy in the drive that can be retrieved later.

Restore Parameter Values from the Backup Copy allows you to restore the backup copy of parameter values previous saved.

A check (✓) displays by the command when the buffer is enabled.

Capture Buffer Enable toggles a high speed buffer, which can capture data in the drive. The contents of the capture buffer can be viewed using the Trend Recorder.

Window Menu

The Window menu arranges multiple views of open documents in the drive window with the following commands:

Cascade arranges the windows in an overlapped style.

Tile Horizontal arranges the windows horizontally in non-overlapped tiles.

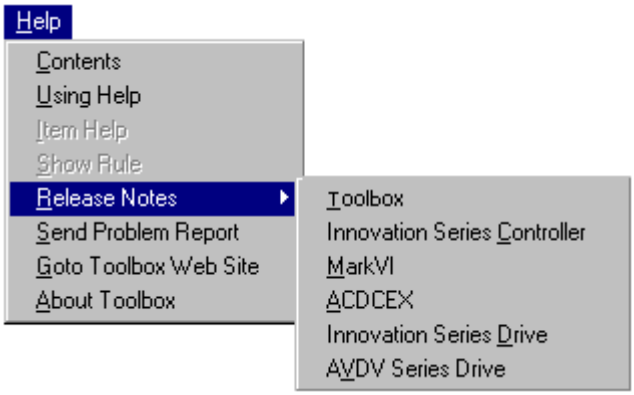
Tile Vertical arranges the windows vertically in non-overlapped tiles.

Arrange Icons arrange the icons of closed windows.

Close All closes all open windows.

Help Menu

The Help menu has the following commands:



Contents displays Help files for the toolbox. It also contains the Find tab with a work list to search for specific topics.

Using Help displays general instructions on how to use Help.

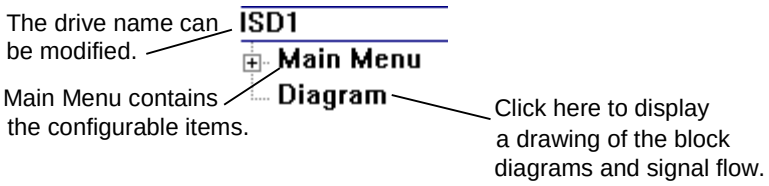
Item Help displays help for the item selected in the Outline View.

Product Help displays the Help file for the currently loaded pattern. The file contains help on parameters, faults, diagrams, and wizards.

About Toolbox displays the version number of the toolbox.

Concepts

The following section defines items and features used when configuring an Innovation Series drive. When a drive is created, the Work Area displays as follows:



Parameters allow you to configure the drive behavior. Each parameter has a name with up to 20-characters, which identifies it and helps to convey its use. A parameter also can have units, such as RPM, displayed with the toolbox and keypad. The unit field is limited to five characters. Each parameter contains a value, which can be a number or a setting. The value is adjusted in order to modify the drive behavior. Some basic parameters along with their associated units are: *Motor rated current (Amps), Motor rated freq (Hz), Motor rated voltage (Volts),* and *Regulator type.* Parameters can be set and modified from the Outline View under the items *Main Menu* or *Diagram*, or from a Wizard or keypad.

Rules process inputs from parameters and produce values for other parameters that the user does not normally edit. The rules in an Innovation Series drive are run in the actual drive. The toolbox initiates the rules in the drive and uploads the resulting values from the drive.

Variables, similar to parameters, have a 20-character name and a 5-character unit field. However, unlike parameters, the user cannot change variables. They are changed by the drive as a result of the execution of the pattern within it. For example, the variable *Speed feedback (RPM*) gets updated on a continuous basis and represents the drives actual speed.

Drive Diagnostic Interface (DDI) menu structure in the toolbox represents the same information contained on the DDI (keypad) located on the front of the drive. The unit allows the user to set, monitor, and maintain the drive.

Diagrams provide an overall picture of signal flow, sequencing and regulator control in the drive. While communicating with the drive, the diagrams display drive variables and their real time values. Contact and coil states are also indicated. Certain drive parameters can be modified from this view (refer to the section *Block Diagrams*).

Backup/Restore Parameters

A backup/restore function is provided within the drive and can be initiated from either the toolbox or the keypad. There are two areas of non-volatile RAM in the drive, which support this function. Each of these areas contains a complete set of all the drive parameter values. This allows you to save the active set of parameter values so that they can be restored later. This feature is particularly useful if undesired changes are made to a functioning drive and it becomes necessary to restore the backup copy.

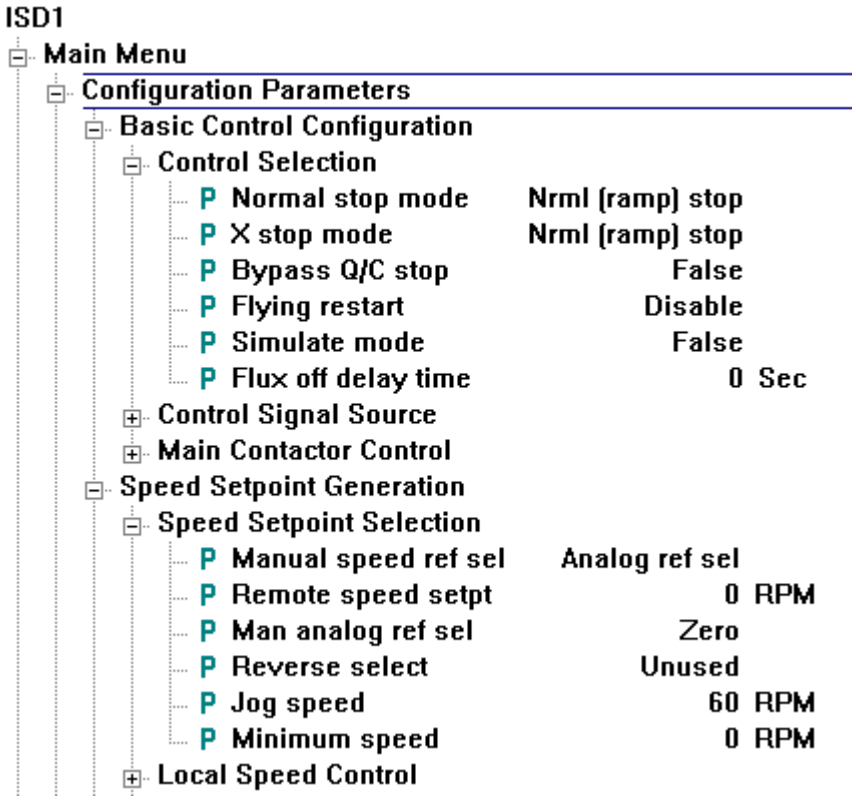
Note This feature does not restore different versions of the pattern to the working copy. Rather it rewrites the active set of parameter values with the backed up set of parameter values.

Configuration

Parameters

For detailed information about a parameter, click on the parameter (to highlight it) and press F1.

The drive contains a set of parameters whose values, together with the pattern and version, define the drive behavior. In the Outline View of the toolbox, parameters display as follows:



➢ **To modify a parameter**

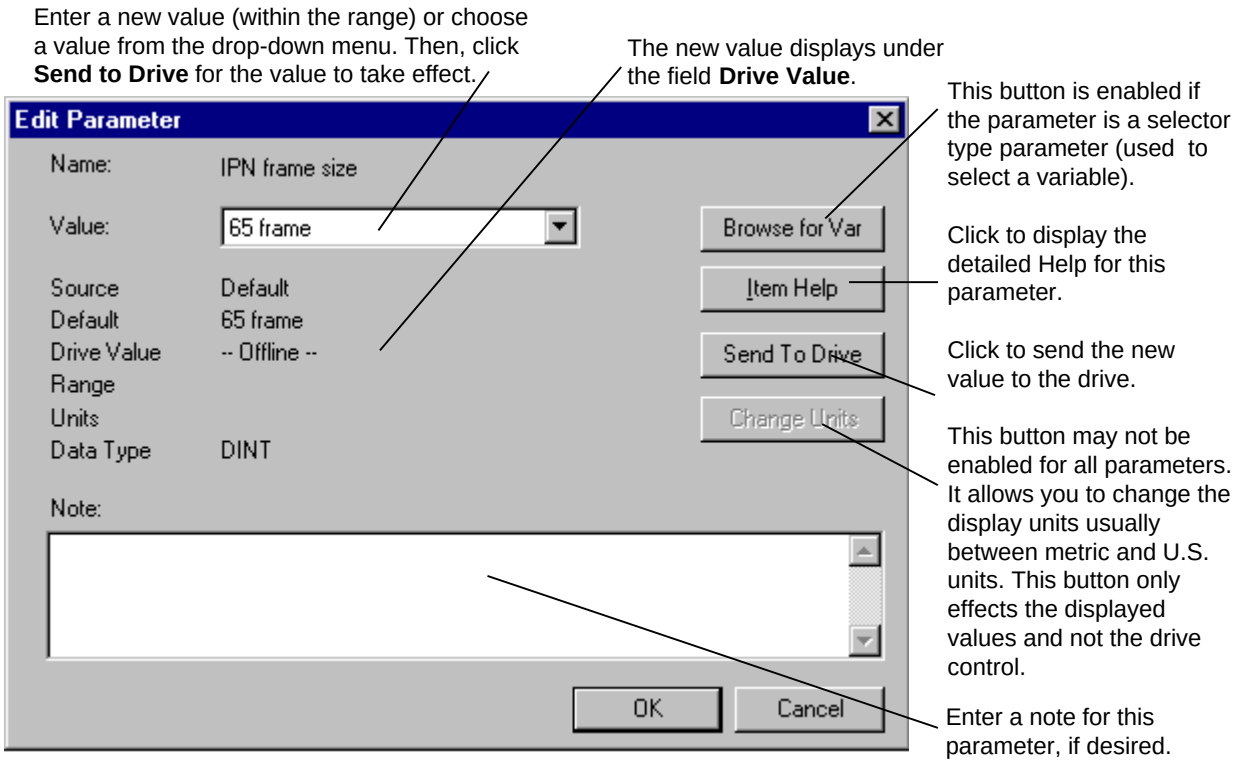
Use the Finder to easily locate a specific parameter.

1. From the **Outline View**, click on the parameter to modify.
2. Choose the **Edit** menu and choose **Modify**.

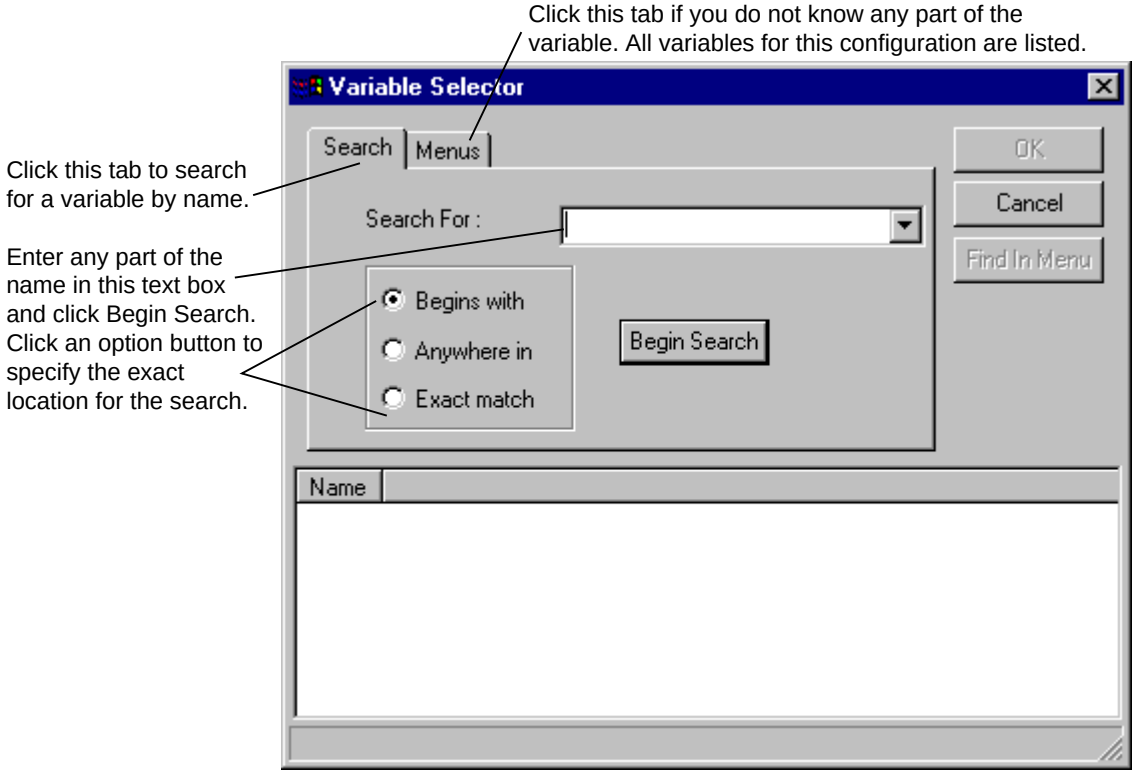
Or, double-click on the parameter. The **Edit Parameter** dialog box displays (refer to the next section).

Tip *If you know the name of the parameter (or partial name) choose the Finder and enter the name in the text box. Click Find and a list of parameters and variables display. Double-click on the parameter/variable to modify.*

Edit Parameter



Note When a parameter value is edited, you must S*end To Drive* to take effect.



Toolbox/Drive Communications

The toolbox can communicate with the drive through a serial port connection. The serial port connection settings used by the toolbox can be defined and modified. These settings are saved and used by the toolbox for every connection to a drive whose drive configuration file is set to communicate serially.

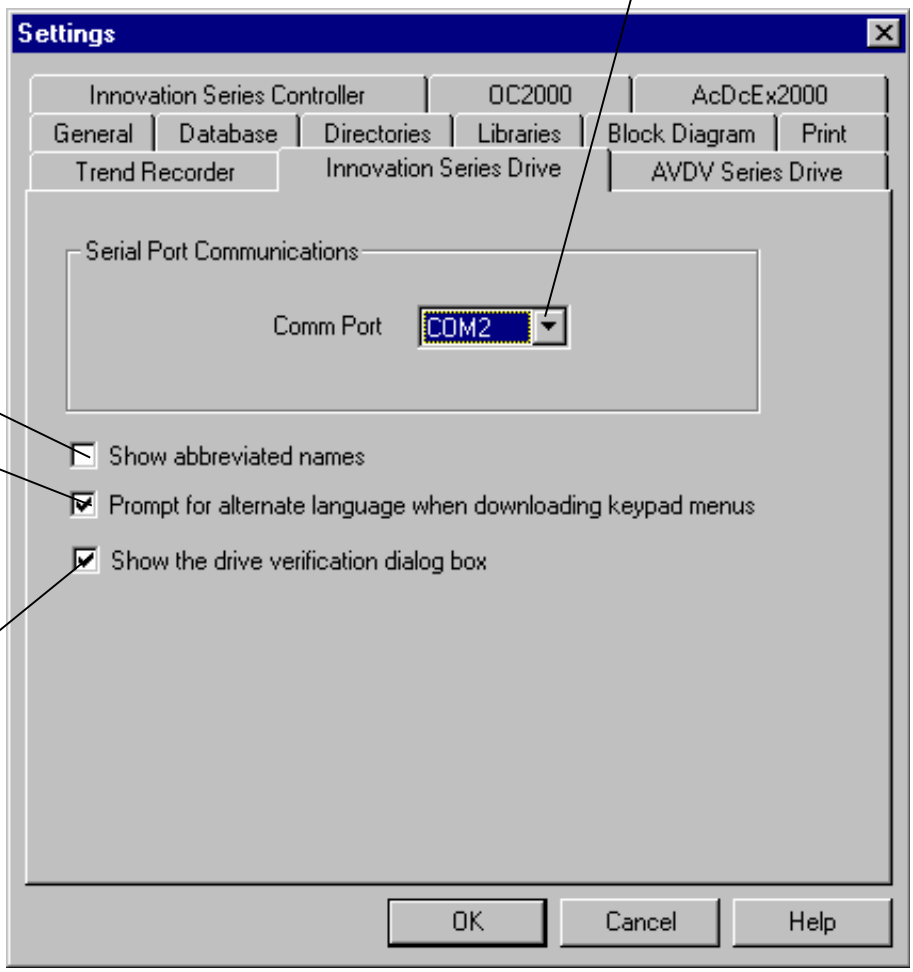
➢ **To modify the communications setting**

1. From the **Options** menu, choose **Settings**.
2. Click on the tab, **Innovation Series Drive**.
3. Modify the Serial Port Communications settings, as desired.

Settings

Note Depending on the products installed, all of the following tabs may not be available.

Click on the drop-down box to choose the communication port.



This option changes the names used on the diagrams and Outline View to internal names used mainly by firmware developers. **It should not be checked.**

Check this option to program the keypad with an additional language. You are prompted for the language when the Download to Device and Keypad menu is chosen.

If you check this option and choose to go online, the Device ID Verification dialog box displays with identification information for the toolbox and the device. It is normally checked.

Communication Settings in a Second Drive

The toolbox allows you to have more than one drive configuration open at the same time. If you have more than one serial port in your computer, you can also be online with more than one drive.

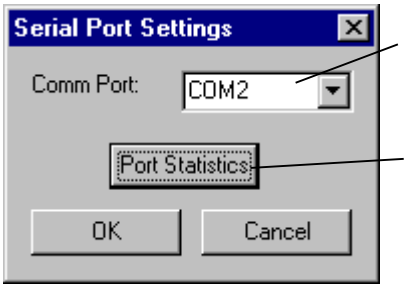
➢ **To modify communication settings in a second drive**

From Outline View, click on the drive name with the right mouse button. The following pop-up menu displays.

Choose **Communication Settings**. The Serial Port Settings dialog box displays. Modify the settings for a second drive, as desired.

Note This change is temporary and not saved between uses of the toolbox.

Serial Port Settings



Use this option to overwrite the default Comm port when using a second drive.

For diagnostic purposes only.

Download To Drive

*If the toolbox is **not** online, you will be asked to confirm that you want to go online and then download. The download performs and the **drive** resets.*

The toolbox allows you to download parameter values, keypad menu structures, and pattern flash (runtime) to the current drive.

➢ **To download to the drive**

1. From the **Device** menu, choose **Download**.
2. Choose Parameter Values, DDI Menus, or Pattern Flash (Runtime).

Upload Parameter Values

Parameter values can be uploaded from the drive to the toolbox. This can be necessary after an autotune or when values in the drive were modified using the keypad. The toolbox reads all values from the drive and compares them to the values in the toolbox. A list of differences is generated and allows you to select the parameters to upload.

➢ **To upload parameter values**

1. From the **Device** menu, choose **Upload Parameter Values from Drive**. The drive values are read and compared to the toolbox, and a list displays the differences.
2. From the list, select the parameter values to copy to the drive configuration in the toolbox by clicking on the checkbox beside each parameter name.
3. Click **OK.** The selected parameter values replace the values in the toolbox.

Reset Drive

A hard reset immediately stops all drive control and disables all bridge output power.

A hard reset restarts the drive in order to clear a fault condition.

A hard reset takes about 15 seconds to complete.

The toolbox allows you to either perform a hard reset or just clear faults in the drive. A hard reset has the same effect as cycling power to the drive. **Clear faults** resets the fault list in the drive, except for faults that require a hard reset.

➢ **To hard reset the drive**

◆ From the **Device** menu, choose **Reset Drive** and choose **Hard Reset**. A message box indicates that a reset is in progress.

➢ **To clear faults in the drive**

◆ From the **Device** menu, choose **Reset Drive** and **Clear Faults**.

Block Diagram

In landscape, the long edge of the paper is horizontal.

Diagrams provide an overall picture of signal flow, sequencing and regulator control in the drive. While communicating with the drive, the diagrams display drive variables and their real time values. Contact and coil states are also indicated. Certain drive parameters can be modified from this view

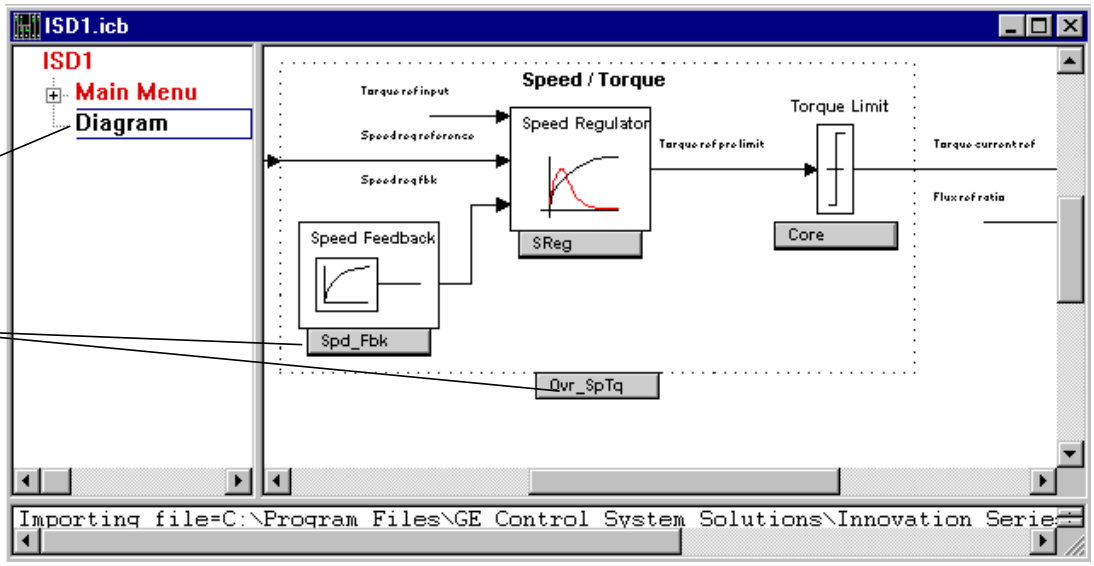
➢ **To access diagrams**

- From the **Outline View**, click on the item **Diagram.**
- The Overview diagram displays in the **Summary View**, as follows:

Click Diagram to view drive block diagrams.

Click the various link buttons in the Overview diagram to view details of the block.

Use the scroll bars to view the entire Overview diagram. Use the Print command to print the diagram.



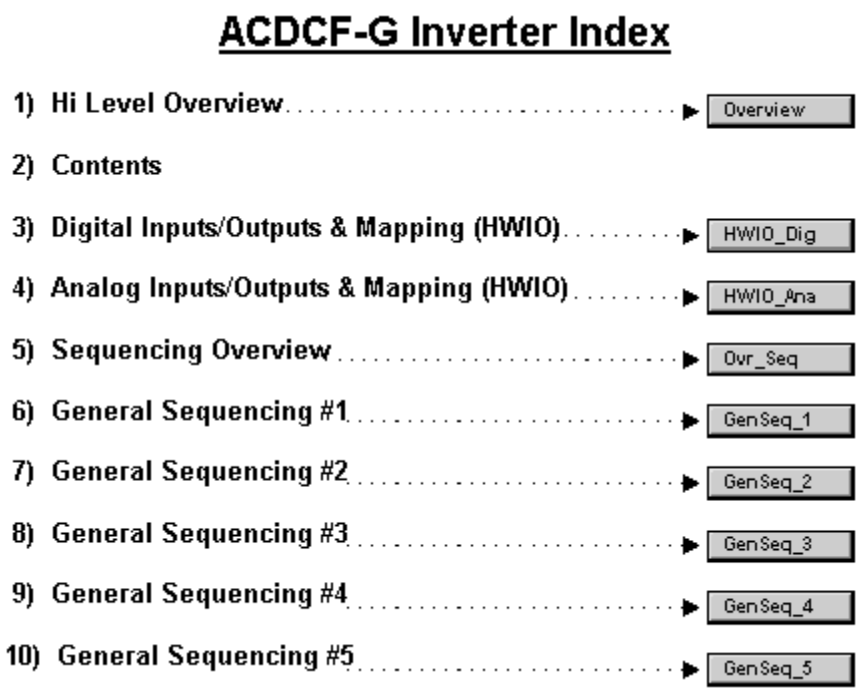
Links to Other Pages

Diagram provides links to other pages, which contain information on drive functions.

➢ **To access diagram links**

- From the **Summary View**, place the mouse pointer over a **link button,** such as Ovr_Seq on the diagram.

When the pointer turns into a hand, click on the link button. Another diagram displays with more details and links. An Index is provided, as shown below.



Modify Parameters from Diagram

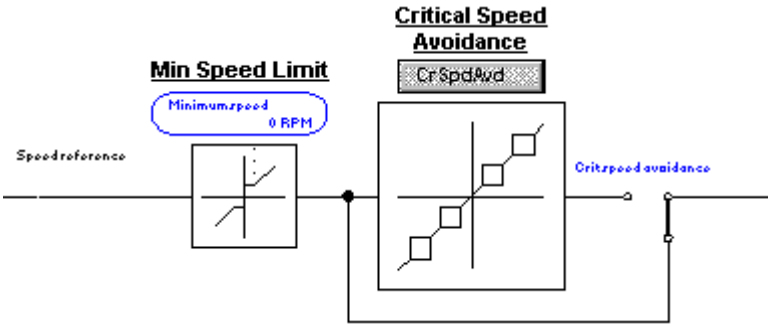
Parameters can be modified from the Diagram. In the Diagram, the toolbox displays parameter names in the color blue.

➢ **To modify a parameter**

- From the block diagram, move the cursor over the parameter until it changes into a hand. Click on the parameter. The **Edit Parameter** dialog box displays (refer to the section *Parameter Settings*).

Parameter Jumpers

In the Overview diagrams, parameter **jumpers** show how different paths of the block diagram are connected together.



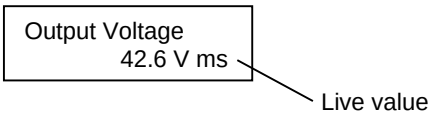
Live Data Display

If the toolbox is connected to the drive, all variables on the diagram display live values. On the Status bar, the scan rate shows the time it takes to update all the variables on the currently selected page.

Variables

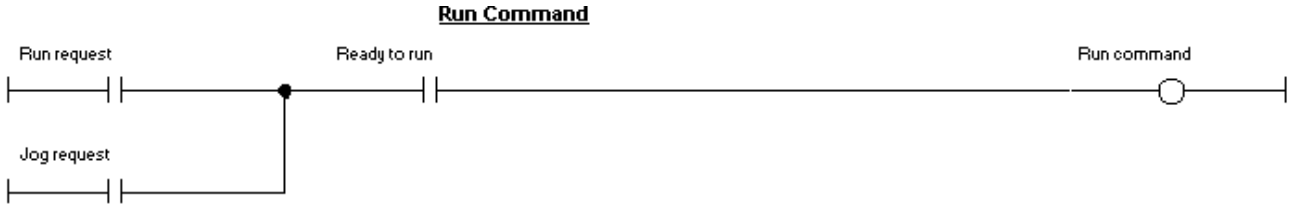
Green values are valid numbers received from the drive.

Variables can be monitored by the toolbox. Live values display in the color green.



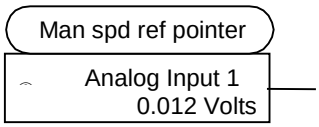
Animated Contacts and Coils

Various types of animated contacts are used in the block diagrams to show the current state of drive sequences.



Pointer Parameters on the Diagram

A pointer parameter is a special type of parameter that points to a variable. This parameter has an additional associated value, which is the value of the variable it points at. In the following example, the Man spd ref pointer is using the Analog Input 1 to supply the reference value. The live value shown is the value on the Analog input.



Pointer parameters can also be used with contacts. The following example shows the Xstop request controlled by Digital Input 1 and the Run Request controlled by Digital Input 2.

Drag-and-Drop Variables

Variables in the block diagram can be copied to the Trend Recorder using the drag-and-drop feature.

➢ **To drag-and-drop a variable in the Trend Recorder**

1. From the toolbox **Outline View**, click **Diagram** to display the Overview diagram in the Summary View.
2. Click the link buttons to locate the desired variable(s). The Diagram (Summary View) becomes full screen.

Click on 

3. From the button bar, click  to open the **Trend Recorder**.
4. Resize and move the Trend Recorder window so that it *and* the block diagram can be viewed (using regular Windows features).

Choose the Windows menu and Tile Horizontal or Tile Vertical.

Tip *To view both the toolbox and the Trend Recorder, from the Window menu, choose* ***Tile Horizontal*** *or* ***Tile Vertical*** *and adjust the size of the windows.*

5. From the **Diagram**, place the mouse pointer over the desired variable.
6. When the pointer changes to a hand, press and hold the **left** mouse button. The pointer changes to the drag-and-drop cursor.
7. Continue to hold the left mouse button down and ***drag*** to the Trend Recorder window. At the Trend Recorder, the cursor changes to the **drop** pointer.
8. Release the mouse button and the variable will ***drop*** in the Trend Recorder.

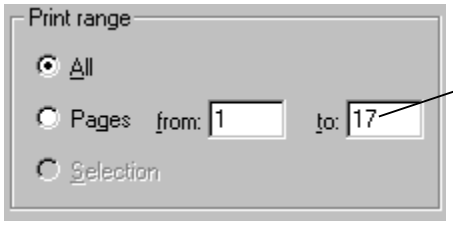
Printing Diagrams

Tip ↳ The block diagram(s) is designed to print in Landscape Orientation. From the **File** menu, choose **Print Setup** and click the option **Landscape**.

➢ **To print block diagrams**

1. From the **Outline View**, click the item **Diagram**.
2. From the **File** menu, choose **Print**. The **Print** dialog box displays.
3. Choose the number of copies to print and the page(s).

Or click 



This field shows that there are 17 diagrams in this device.
Click **OK** to print **all** the diagrams or enter the page number(s) to print.

Tip ↳ *To print a single block diagram, link to that page, so that it displays on the screen and click*  *. Choose* ***OK****. Live data can be printed out on the single page, if the drive is online.*

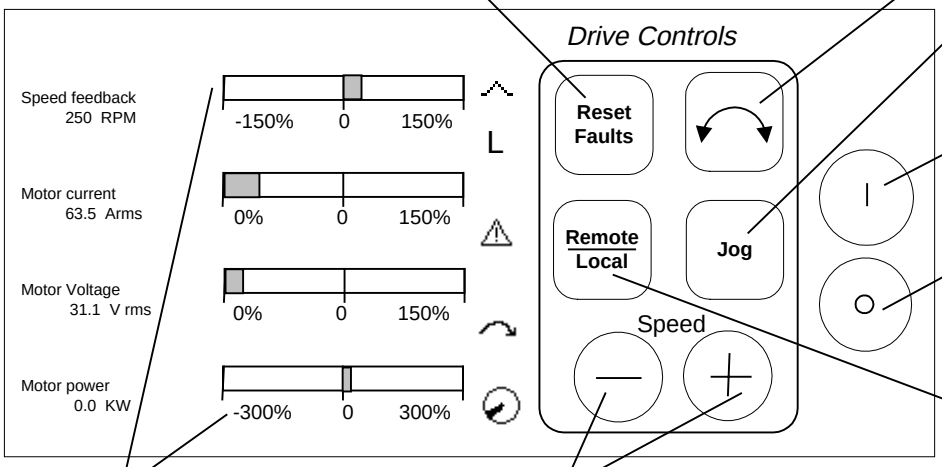
Drive Controls

The Drive Controls command enables you to operate the drive from the toolbox, as though you were operating it directly from the keypad located on the cabinet door. The variables that display are the same as those that display on the keypad.

Or click  .

➢ **To display the Drive Controls view**

- From the **View** menu, choose **Drive Controls**. The **Drive Controls** view displays.



Click here to **reset faults**.

Click here to toggle the direction of the drive (reverse resquest). The selected direction is shown with an icon (refer to the next table).*

Click here to **Jog** the drive in the selected direction.*

Click here to run the drive in the selected direction.*

Stop command can be used in Local or Remote mode.

Click here to toggle the mode of the drive between **local** and **remote**. The drive must be stopped*.

*Available in local mode only.

Bar graphs provide feedback of the current state of the device. Click on a bar graph to edit a parameter.

Click here to **decrease** or **increase** the Local Speed Reference associated with the Run and Stop commands.*

The following icons display on the Drive Controls and represent the drive's health or state. The active function of an icon depends on which button is clicked on (as described above).

Icon	Function	Indicates
	Comm. OK	The icon line is animated to show there is communication between the toolbox and the drive.
L or R	Control State	L = drive is in local mode R = drive is in remote mode
	Fault State	Icon flashing = trip Icon steady = alarm active
	Forward Reverse	Direction of drive motion that is currently selected. (This does not necessarily match the direction of motion as viewed from motor shaft.)
	Motion	Drive is running when the icon is animated in a turning motion.

Wizards

A wizard is an interactive Help utility that guides the user through each step of a particular task, such as Drive Commissioning.

The Wizard list can vary with each pattern, but there is always a Drive Commissioning Wizard.

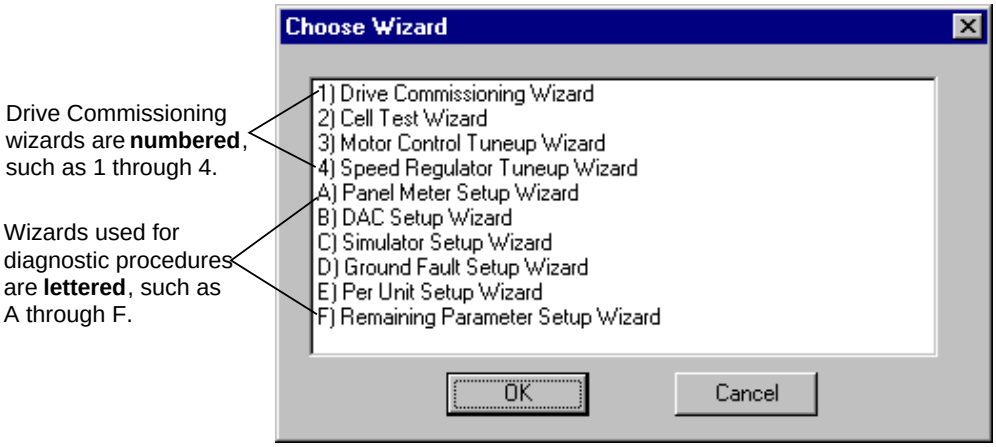
The Innovation Series drive contains wizards that guide you through the setup of a drive. Wizards display a series of dialog boxes that prompt the user for drive configuration information. This information is also used as a basis to perform additional tests and tuneups on the drive.

Note The Commissioning wizard should be the first step when setting up a new drive.

➢ To perform a wizard

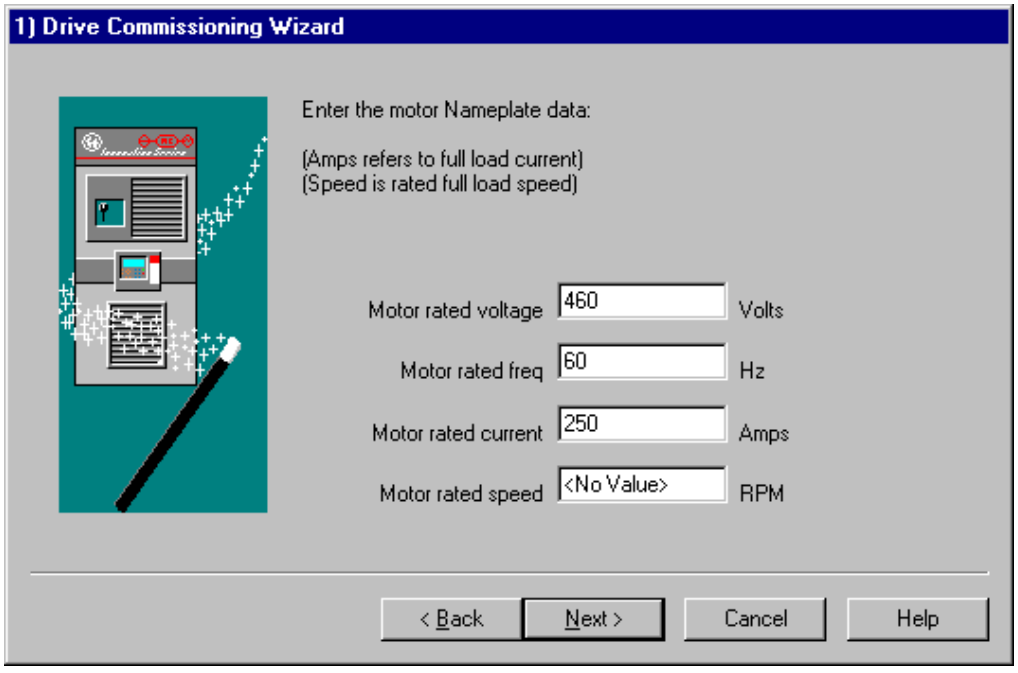
1. From the **Edit** menu, choose **Wizards**, or *click*  . The following list of wizards displays.
2. Choose the desired wizard.

Choose Wizard



*Obtain interactive Help on each field by clicking **Help**.*

The following dialog box is an example of the Drive Commissioning Wizard. Enter a value in each field that contains <no value>, unless you are instructed otherwise.



Glossary of Terms

ACL_ board

IS200ACL_Application Control Layer board. This board contains the ACL controller functions for the drive. Located in the drive control rack.

ACL controller

Application Control Layer controller. A form of the Innovation Series controller hosted in the Innovation Series drive rack that performs job specific, outer layer, drive control loops, and sequencing.

application software

Job-specific software resident in the drive, designed specifically for the customer's application.

ACOM

Analog common. Used to supply power and signals to all analog devices and components fed by +50 and -50 V power supplies.

ATBA

IS200ATBA Application Terminal Board, used for customer and power I/O. Located in the drive's control cabinet.

attenuator

An electronic transducer, either fixed or adjustable, that reduces the amplitude of a signal passing through it without causing significant distortion. (Opposite of *amplifier*.)

baud

A measure of data transmission speed, representing the number of signal-state changes per second. Named after French engineer B.M.E. Baudot.

bit

A contraction of *binary digit*. The smallest possible unit of information.

board

Printed wiring board.

CCOM

Control common.

coaxial cable (coax)

A type of wire cable with a solid metal core surrounded by an insulator, a combination shield and ground wire, and an outer protective jacket.

commissioning

Putting into service.

configure

To select specific options, either by setting the location of hardware jumpers or loading software parameters into memory.

connector

A device, either a plug or receptacle, used to terminate or connect cables.

control system

(Industrial.) A means of governing the starting, stopping, direction of motion, acceleration, speed, and retardation of the moving member of any electric apparatus, machine, or system.

control system toolbox

See *GE Control System Toolbox*.

DDI

See *Drive Diagnostic Interface*.

drive

(Industrial.) The equipment used for converting available power into mechanical power suitable for operation of a machine. (See *control system.*)

Drive Diagnostic Interface

The operator interface module located on the front door of the drive's control cabinet. Also called *DDI* or *the keypad*.

device

A configurable component of a process control system.

diagnostics

Software that checks drive hardware or software, providing error indications that identify the type or location of malfunction.

elementary diagram

Also called *elementary*. A schematic drawing that represents the electrical wiring and electrical connections of a device.

fault code

A number that represents a drive malfunction, such a warning or failure. The drive controller automatically sends this code to the operator interface, such as the DDI (keypad). Also see *warning, failure, DDI.*

ferrite

A magnetic material that consists essentially of ferric oxide combined with the oxides of one or more metals (as manganese, nickel, or zinc. It has high magnetic permeability and high electrical resistivity. The high resistance makes eddy current losses low at high frequencies.

Finder

A subsystem of the GE control system toolbox for searching and determining the usage of a particular item in a configuration.

firmware

The set of executable software that is stored in memory chips that hold their content without electrical power, such as EEPROM.

frame size

Size of drive cabinet, or cabinets. Determined by hardware components required for power application.

Genius bus

GE Fanuc's distributed network of intelligent I/O blocks.

GE Control System Toolbox

A Windows-based software package used to configure and perform diagnostics on controllers and drives.

ground

An electrical path designed to disperse high-voltage electrical spikes, usually by routing them to the earth.

grounding electrode

A conductor or group of conductors in intimate contact with the earth for the purpose of providing a connection with ground.

jacket

The outermost layer of insulating material of a cable or conductor.

hardware (hard) reset

Reset generated by a hardware device, such as a pushbutton, rather than by a software reset. Used to reset the drive boards, clear some faults, and allow certain parameter changes.

hardwired

Refers to elements of a program or device that cannot be changed. Originally, the term was used to describe functionality that was built into the circuitry (the wires) of a device. Now, the term **also is use**d to describe constants built into software.

health

A term that defines whether the drive is functioning as expected.

heartbeat

Also know as SQE (signal quality error), a test between the transceiver and data terminal equipment to check that the **transceiver is still functioning.**

heatpipe

A heat exchanger consisting of a pipe with an interior of capillary material and a small amount of fluid in a partial vacuum. Heat is transferred by absorption at one end of the pipe through vaporization of the fluid and its subsequent condensation at the other end of the pipe.

IEEE

Institute of Electrical and Electronic Engineers. A United States-based society that develops for electrical and electronic standards.

IGBT

Insulated-gate bipolar transistor.

initialize

To set values (addresses, counters, registers, and such) to a beginning value before the rest of the processing.

Intelligent Part Number

See *IPN*.

inverter

A device for converting direct current into alternating current.

I/O

Input/output. Data flow into and out of a device, or the term for input/output interfaces.

IPN

Intelligent part number. An alphanumeric part number for Innovation Series drives in which the number structure and characters define the drive configuration and application.

ISBus

A synchronous bus, serial communications system developed by GE for the Innovation Series drive system LAN. Uses RJ-45 connectors and Category 5 cabling with data transmission rate up to 5 Mbps.

keypad

See *Drive Diagnostic Interface*.

LAN

Local area network. A communications link that enables attached devices to communicate with each other over a limited geographical area. A typical LAN consists of peripheral devices and controllers contained in the same building, and often on the same floor.

layout drawing

A diagram showing the components of a panel (see definition), and their location and connections.

LED

Light-emitting diode. Used as a visual indicator for a board or drive function.

line filter, ac

A filter that connects from ac line to ac line at the input of a power converter. The filter consists of a series configuration of resistors and capacitors, which damps out high frequency oscillations on the ac power line.

line reactor, ac

A device (such as a coil, winding, or conductor of small resistance) used to introduce reactance into an alternating-current circuit. The purpose is to reduce system harmonics and protect against utility switching transients from the switching of ac power factor correction capacitors or other line transients

m

Milli. Alphabetic symbol for 1 thousandth.

M

Mega. Alphabetic symbol for 1million.

MB

Megabyte. 220 or 1,048,576 bytes.

Mb

Megabit. 220 or 1,048,576 bits.

megger test

A test of an insulation system by using a megohm meter (megger) to pass a high voltage at low current through a device, then measuring resistance, usually in megohms.

menu

A list of available software functions for selection of an operator, displayed on the computer screen after a software program has been entered or a software selection is made.

module

(Hardware) An electronic assembly of boards, components, or a combination of these, that together perform a specific function.

(Software) A collection of tasks that have a defined scheduling period.

NEC

National Electrical Code®. Electrical safety guidelines developed by the National Fire Protection Association and adopted as a standard by the American National Standards Institute (ANSI).

NEMA

National Electrical Manufacturers Association. An organization that develops standards for the electrical manufacturing industry.

network

A data communication system that links two or more computers and peripheral devices.

noise

Electrical surges, spikes, or transients on transmission lines. Noise can cause slow or immediate damage to sensitive electronic equipment.

non-regenerative

See *regenerative*.

OSHA

Occupational and Safety Health Act. A federal job safety law, passed by the United States Congress, to prevent employees from being injured or contracting diseases in the course of their employment.

outline drawing

A drawing or diagram that shows the dimensions and non-detailed layout of a device or equipment.

panel

The side or front of a piece of equipment on which terminations and termination assemblies are mounted.

panel layout drawing

See *layout drawing.*

parameters

Adjustable software settings used to program and tune the drive. Parameter values, together with the pattern and version, define the drive behavior.

pattern

Application firmware specific to each drive type, and represented by the first part of the intelligent part number (see *IPN.*) For example, the pattern *ACDCF-G* is for an **ac** drive, specifically a **dc**-**f**ed inverter, used for **g**eneral industry applications.

plug connector

An electrical fitting or termination assembly with contacts constructed to be electrically connected to a receptacle connector by being inserted into the receptacle connector. Also known as male connector.

power loss

Ratio of power absorbed to power delivered. Also called *watt loss.*

psi

Pounds per square inch. A measure of air pressure.

PVC

Polyvinylchloride. A type of plastic used for cable jackets and wire insulation.

PWM

Pulse-width modulation. Pulse-time modulation in which the value of each instantaneous sample of the modulating wave is caused to modulate the duration of the pulse. Also called *pulse-duration modulation*.

reboot

See *hardware reset* and *software reset.*

receptacle connector

An electrical fitting or termination assembly with contacts constructed to be connected electrically to a cable by the insertion of the cable's plug connector into the receptacle connector. Also known as *female connector*.

regenerative

Ability of a drive to return power from the motor armature to the ac line. Creates a braking effect on the motor.

renewal parts listing

The *Renewal Parts List* (or Quotation) is a document that lists the parts of a complete system. This list applies specifically to the equipment furnished on a customer's particular application (requisition) at the time of shipment. The document, provided per contract specifications, includes part numbers and descriptions, quantity used, recommended spares to keep onhand, and normal delivery cycle for obtaining each part.

requisition

A written request to buy something. GE assigns a unique number to each customer requisition, which is then used to identify that equipment configuration with that particular customer request or order.

safety ground

See *equipment grounding conductor*.

shield

A conductive sheath (usually metallic) applied over the insulation of a conductor or conductors. See *shielding*.

shielded cable

Cable surrounded by a separate conductor (the shield) intended to minimize the noise effects of internal or external electrical circuits.

shielding

Use of a conducting barrier between a potentially disturbing noise source and sensitive circuitry. Shields are used to protect cables (data and power) and electronic circuits. They may be in the form of metal barriers, enclosures, or wrappings around source circuits and receiving circuits.

shunt

A device having appreciable resistance or impedance connected in parallel across other devices or apparatus, and diverting some (but not all) of the current from it. Appreciable voltage exists across the shunted device or apparatus and an appreciable current may exist in it.

software (soft) reset

Reset initiated by software input, rather than by a hardware device. Activated by a serial input.

terminal board

A type of I/O connector in which individual wires from external components are inserted into a connector point and are fastened by turning a screw on the connector.

terminator

A resistor that reflects cable signals. On coaxial cable bus networks, a terminator is installed at each end of the cable, with one end requiring ground connection.

toolbox

See *control system toolbox*.

torque

Any force that acts to produce rotation. The measured ability of a rotating part, such as a gear or shaft. Units of torque include the foot-pound (or pound-foot), inch-pound, the dyne-centimeter, and the Newton-meter.

twisted-pair cable

Cable consisting of pairs of copper wire, surrounded by an insulator, and twisted together in a manner that reduces capacitance.

watt loss

See *power loss*.

wizard

An intelligent menu that leads the operator through a series of parameter edits, calculations, and command executions designed to accomplish a specific task.

Index

A

ac input, 4-3
ACCBN-A, 1-4, 1-5
ACCBR-A, 1-4, 1-5
ACDCF-G, 1-4, 1-5
ACDCF-S, 1-4, 1-5
ACDCF-V, 1-4, 1-5
ADF, 3-4, 6-6
  dc bus, 2-5, 3-4, 6-2, 6-6–6-7, 6-26
ADS, 3-2, 3-4, 6-6
airflow, 2-4, 2-8–2-12, 2-14, 2-16
ALSA, 4-3
ATBA, 3-6, 6-6
autotune, 6-17
auxiliary device feeder, 3-4

C

cable
  conduit, 3-1–3-2, 3-7, 3-9, A-4, B-2, B-3
cabling, 1-5, 3-1, 3-2, 3-7, 3-9, 3-10
  control power, 3-2, 3-4, 3-5, 6-2, 6-6
  grounding, 2-5, 3-6, 4-2
  metal-clad, 3-7
  power, 1-4, 2-4, 3-1, 3-2, 3-4, 3-5, 3-7, 3-8, 4-1, 4-3–4-5
  shields, 3-6
CCOM, 3-2, 3-6, B-2
CE Mark, 3-2, 3-9
cell test, 6-20, 6-26, 6-27
  Trend Recorder, 6-27, 6-28, E-14
clearance, 2-2, 2-4, B-3
commissioning, 6-1, 6-4, 6-8, 6-17, 6-20, 6-24, 6-29, E-7, E-30
  autotune, 6-17
  cell test, 6-20, 6-26, 6-27
  pattern, 1-4, 6-2, 6-8, 6-11–6-13, 6-22, E-3, E-7, E-10, E-19, E-22
  simulator, 6-25, 6-26
  startup, 6-1, 6-4, 6-8, 6-17, 6-20, 6-24, 6-29
  toolbox, 6-1, 6-4, 6-8, 6-17, 6-20, 6-24, 6-29, E-7, E-30
  tuneup, 6-1, 6-20, 6-29
  wizards, 6-8, 6-17, 6-20, 6-22, 6-24–6-25, 6-29, E-13, E-30
conduit, 3-1, 3-2, 3-7, 3-9, A-4, B-2, B-3
configuration, 3-4, 3-7, 3-8, 6-6, 6-8, 6-10, 6-11, A-5, E-5, E-9–E-11, E-19
connections, 2-5, 3-1, 3-2, 3-10
  ATBA, 3-6, 6-6
control power, 2-5, 3-1, 3-2, 3-4, 3-5, 3-10, 6-2, 6-6
  ADF, 3-4, 6-6
    dc disconnect:, 3-4
  ADS, 3-2, 3-4, 6-6
  auxiliary device feeder, 3-4
  CPT, 3-4, 6-6
  dc bus, 2-5, 3-4, 6-2, 6-6, 6-7, 6-26
  dc disconnect, 3-4
  disconnect, 3-2, 3-4
  fusing, 3-4
control rack
  ATBA, 3-6, 6-6
Control System Solutions, 6-9, 6-11, 6-13, 6-27
Control System Toolbox, 1-1, 6-2, 6-8, E-1
CPT, 3-4, 6-6

D

damage, 2-1–2-3, 2-5, 3-4, 3-9, 4-2, 4-3
dc bus, 2-5, 3-4, 6-2, 6-6–6-7, 6-26
dc-fed inverter, 1-4, 3-4
DDI
  keypad, 3-9, 6-13, 6-15, 6-17–6-20, 6-29, E-7, E-9, E-16, E-18, E-22, E-29
dimensions, 2-4, 2-7, A-4
disconnect, 3-2, 3-4
download
  flash, 6-11, 6-13, E-16, E-22
drawings
  elementary, 1-5, 3-1, 6-3, 6-11, 6-24, A-1, A-3–A-5
  layout, 2-1, 3-1, 3-3, 6-2, A-3, A-4
  outline, 1-5, 2-1, 2-4, A-1, A-4
  requisition, 1-5, 2-1, 2-3, 2-4, 3-4, 3-6, A-1–A-5
drive, 1-1
  dc-fed inverter, 1-4, 3-4
  frame, 1-4, 2-1
  intelligent part number (IPN), 1-4, 6-2, 6-11, A-3, E-3
  inverter, 1-4, 2-8, 6-2, 6-29
  lineup, 1-1, 1-4, 2-1, 2-4, 2-5, 2-7, 3-4, 3-6, 6-20, A-2
  pattern, 1-4, 6-2, 6-8, 6-11–6-13, 6-22, E-3, E-7, E-10, E-19, E-22, E-30
  regenerative source, 2-9, 2-11
  source, 1-4, 4-4–4-6, 6-2
    non-regenerative, 1-4, 2-9, 2-16
      line filter, 4-4–4-6
      reactor, line, 3-2, 3-4, 4-3, 4-6, 4-7
Drive Diagnostic Interface, 3-9, 6-17, E-9, E-16, E-18
DSPX, 6-7, 6-20, E-10

Index—continued

E

elementary, 1-5, 3-1, 6-3, 6-11, 6-24, A-1, A-3–A-5

F

files
  .icb, 6-10, 6-11, 6-13, 6-20, 6-25, E-2, E-7, E-9
filter, 4-1
firmware (pattern), 1-4, 1-5, 6-2, 6-8, 6-11–6-13, 6-15, 6-17, A-3, E-16, E-22
flash, 6-11, 6-13, E-16, E-22
frame, 1-4, 2-1
fusing, 3-4

G

ground brush, 4-2
  motor, 4-2
grounding, 2-5, 3-6, 4-2
  CCOM, 3-2, 3-6, B-2

H

handling, 1-1, 1-5, B-2
  lifting, 2-1, 2-3, 2-4
heat loss, 2-4, 2-8
help, 1-2, 3-7, 6-3, 6-8, 6-28, E-10, E-17
  Trend Recorder, E-14, E-27

I

I/O, 3-1, 3-7, 3-9, A-6
  ATBA, 3-6, 6-6
  connections, 2-5, 3-1, 3-2, 3-10
  terminal board, 3-1, 3-2, 3-6, A-4
installation, 1-2, 1-3, 1-5, 2-1, 2-4, 3-1, 3-6, A-1
  cabling, 1-5, 3-1, 3-2, 3-7, 3-9–3-10
  conduit, 3-1, 3-2, 3-7, 3-9, A-4, B-2, B-3
  heat loss, 2-4, 2-8
  lifting, 2-1, 2-3, 2-4
  mounting requirements, 2-1, 2-4, 2-7, 3-7, 4-1
    airflow, 2-4, 2-8–2-12, 2-14, 2-16
    clearance, 2-2, 2-4, B-3
    dimensions, 2-4, 2-7, A-4
    heat loss, 2-4, 2-8
    layout, 2-1, 3-1, 3-3, 6-2, A-3, A-4
    weight, 2-2, 2-4, A-4
  safety ground, 6-26
  unpacking, 2-3
intelligent part number, 1-4, 6-2, 6-11, A-3
inverter, 1-4, 2-8, 6-2, 6-29
IPN, 6-2, 6-11, A-3, E-3
  isolation transformer, 3-6, 4-5

K

keypad, 3-9, 6-13, 6-15, 6-17–6-20, 6-29, E-7, E-9, E-18, E-22, E-23, E-29

L

layout, 2-1, 3-1, 3-3, 6-2, A-3, A-4
LEDs, 6-6–6-8
lifting, 2-1, 2-3, 2-4
line filter, 4-4–4-6
lineup, 1-1, 1-4, 2-1, 2-2, 2-4, 2-7, 3-4–3-6, 6-20, A-2

M

metal-clad, 3-7
motor, 1-4, 3-2, 4-2, 6-20, 6-26, 6-29, A-4, A-6
  connections, 2-5, 3-1, 3-2, 3-10
  ground brush, 4-2
  tachometer, 4-2
mounting requirements, 2-1, 2-4, 2-7, 3-7, 4-1
    airflow, 2-4, 2-8–2-12, 2-14, 2-16
    clearance, 2-2, 2-4, B-3
    dimensions, 2-4, 2-7, A-4
    heat loss, 2-4, 2-8
    layout, 2-1, 3-1, 3-3, 6-2, A-3, A-4
    weight, 2-2, 2-4, A-4

N

non-regenerative source, 1-4, 2-9, 2-16
  line filter, 4-4–4-6

O

outline, 1-5, 2-1, 2-4, A-1, A-4

Index—continued

P

parameters, E-9, E-11, E-18–E-19, E-23, E-25, E-27
pattern, 1-4, 6-2, 6-8, 6-11–6-13, 6-22, E-3, E-7, E-10, E-19, E-22, E-30
  .icb, 6-10–6-11, 6-13, 6-20, 6-25, E-2, E-7, E-9
  ACCBN-A, 1-4, 1-5
  ACDCF-G, 1-4, 1-5
  ACDCF-S, 1-4, 1-5
  ACDCF-V, 1-4, 1-5
  flash, 6-11, 6-13, E-16, E-22
power, 1-4, 2-4, 3-1, 3-4, 3-5, 3-7, 3-8, 4-1, 4-3–4-5
  ac input, 4-3
  cabling, 1-5, 3-1, 3-2, 3-7, 3-9, 3-10
  connections, 2-5, 3-1, 3-2, 3-10
  LEDs, 6-6–6-8
  line filter, 4-4–4-6
  reactor line, 3-2, 3-4, 4-3, 4-6, 4-7
  transformer, 3-4, 3-6, 3-7, 4-3, 4-5, 4-6
power bridge, 6-6
preventive maintenance, 4-2
processor, 6-7, 6-20, E-10

R

reactor
  ALSA, 4-3
reactor, line, 3-2, 3-4, 4-3, 4-6–4-7
regenerative source, 2-9, 2-11
renewal parts, 1-5
requisition, 1-5, 2-1, 2-3–2-4, 3-4, 3-6, A-1–A-4, A-2, A-3–A-5
reset, 6-17–6-18, 6-21, E-16, E-23

S

safety ground, 6-26
shields, 3-6
simulator, 6-25–6-26
source, 1-4, 2-9, 4-4–4-6, 6-2
  non-regenerative
  reactor, line, 3-2, 3-4, 4-3, 4-6–4-7
storage, 1-1, 1-5, 2-1
Summary View, 6-12, E-24

T

tachometer, 4-2
terminal board, 3-1, 3-2, 3-6, A-4
toobox
toolbox, 1-1, 6-2, 6-8, 6-9, 6-15, 6-18, 6-19, 6-27, E-1, E-2, E-5, E-10, E-11, E-21, E-23, E-29
  autotune, 6-17
  configuration, 3-4, 3-7, 3-8, 6-6, 6-8, 6-10, 6-11, A-5, E-5, E-9–E-11, E-19
  Control System Solutions, 6-9, 6-11, 6-13, 6-27
  help, 1-2, 3-7, 6-3, 6-8, 6-28, E-10, E-17
  Summary View, 6-12, E-24
  Trend Recorder, 6-27, 6-28, E-14, E-27
  wizards, 6-8, 6-17, 6-20, 6-22, 6-24–6-25, 6-29, E-13, E-30
    cell test, 6-20, 6-26–6-27
torque, 2-5
transformer, 3-4, 3-6, 3-7, 4-3, 4-5, 4-6
Trend Recorder, 6-27, 6-28, E-14, E-27
  help, 1-2, 3-7, 6-3, 6-8, 6-28, E-10, E-17
tuneup, 6-1, 6-20, 6-29

U

unpacking, 2-3

W

weight, 2-2, 2-4, A-4
wizards, 6-8, 6-17, 6-20, 6-22, 6-24–6-25, 6-29, E-13, E-30
  autotune, 6-17
  cell test, 6-20, 6-26–6-27
  tuneup, 6-1, 6-20, 6-29

Notes

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