
GENIV
INSTALLATION,
COMMISSIONING,
AND MAINTENANCE
MANUAL

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Large Drives A

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Table of Contents

Safety Precautions and Warnings.....	v
About This Manual	vii
Separation of Manuals.....	vii
Reference Tools.....	vii
Conventions Used in this Manual	viii
Chapter 1: Introduction.....	1-1
Purpose	1-1
Perfect Harmony.....	1-1
GenIV	1-2
Cabinet Details	1-2
Maintenance Earthing Procedure	1-2
Chapter 2: Installation	2-1
Installation	2-1
Receiving.....	2-1
Shipping Splits	2-2
4160V Drives with Frame -1 Cell	2-2
4160V Drives with Frame - 2 Cells	2-2
6600V Drives - Less Than 2MVa	2-2
6600V Drives - 2MVa or Greater	2-2
Off-loading.....	2-3
Weight Estimates.....	2-4
Handling	2-6
Overhead Crane Lifting Method Using Slings.....	2-7
Lifting Unit Containing Louvers.....	2-8
Forklift Truck	2-9
Pipe Rollers	2-9
Roller Dollies	2-10
Placement Location and Storage	2-10
Re-Connecting the Shipping Splits	2-11
Anchoring Cabinets to Floors and Walls	2-13
External Wiring	2-13
Protection Circuits.....	2-15
I/O External Wiring.....	2-15

Chapter 3: Commissioning	3-1
Pre-Commissioning	3-1
Description.....	3-1
Process	3-1
Start Up (Commissioning)	3-3
Nomenclature ID	3-5
Chapter 4: Maintenance.....	4-1
General Maintenance	4-1
Six Month Inspection	4-1
Replacement of Parts	4-4
Spare Parts List	4-4
Basic Rules for Repairing Harmony Cells.....	4-9
How To Remove Harmony Power Cells	4-10
To Remove the Power Cell:.....	4-10
How to Return the Power Cell to Siemens	4-13
How to Install Harmony Power Cells.....	4-13
To Install the Power Cell:	4-13
General Repair Hints and Procedures	4-15
Appendix A: EMC Wiring Installation Guidelines	A-1
General.....	A-1
Key Areas for Consideration	A-1
Earthing.....	A-1
Screening	A-2
Filtering	A-2
Wiring.....	A-2
Notes.....	N-1
Reader Comments Form	R-1
Startup/Warranty Registration and Service Solutions	W-1

Safety Precautions and Warnings

The GenIV is designed with considerable thought to personal safety. However, as with any piece of high power equipment, there are numerous internal connections that present potentially lethal voltages. In addition, some internal components are thermally hot to the touch. Follow the warnings below when working in or near the GenIV System.



Danger - Electrical Hazards!

- **Always** follow the proper lock-out/tag-out procedures before beginning any maintenance or troubleshooting work on the drive.
- **Always** follow standard safety precautions and local codes during installation of external wiring. Protective separation must be kept between extra low voltage (ELV) wiring and any other wiring as specified in IEC61800-5-1.
- **Always** work with one hand, wear insulated or rubber safety shoes, and wear safety glasses. Also, always work with another person present.
- **Always** use extreme caution when handling or measuring components that are inside the enclosure. Be careful to prevent meter leads from shorting together or from touching other terminals.
- **Use** only instrumentation (e.g., meters, oscilloscopes, etc.) intended for high voltage measurements (that is, isolation is provided inside the instrument, not provided by isolating the chassis ground of the instrument).
- **Never** assume that switching off the input disconnect will remove all voltage from internal components. Voltage is still present on the terminals of the input disconnect. Also, there may be voltages present that are applied from other external sources.
- **Never** touch anything within the GenIV cabinets until verifying that it is neither thermally hot nor electrically alive.
- **Never** remove safety shields (marked with a **HIGH VOLTAGE** sign) or attempt to measure points beneath the shields.
- **Never** run the drive with cabinet doors open. The only exception is the control cabinet which contains extra low voltages (ELV).
- **Never** connect any grounded (i.e., non-isolated) meters or oscilloscopes to the GenIV system.
- **Never** connect or disconnect any meters, wiring, or printed circuit boards while the drive is energized.
- **Never** defeat the instrument's grounding.
- **Only** qualified individuals should install, operate, troubleshoot, and maintain this drive. A qualified individual is "one familiar with the construction and operation of the equipment and the hazards involved."
- **Hazardous voltages** may still exist within the GenIV cabinets even when the disconnect switch is open (off) and the supply power is shut off.
- When a system is configured with drive bypass switchgear (e.g., contactors between line and motor, and drive and motor), these switches should be interlocked so that the line voltage is **never applied** to the drive output if the medium input voltage is removed from the drive.

**Warning!**

- **Always** comply with local codes and requirements if disposal of failed components is necessary (for example, CPU battery, capacitors, etc.).
- **Always** ensure the use of an even and flat truck bed to transport the GenIV drive system. Before unloading, be sure that the concrete pad is level for storage and permanent positioning.
- **Always** confirm proper tonnage ratings of cranes, cables, and hooks when lifting the drive system. Dropping the cabinet or lowering it too quickly could damage the unit.
- **Never** disconnect control power while medium voltage is energized. This could cause severe system overheating and/or damage.
- **Never** store flammable material in, on, or near the drive enclosure. This includes equipment drawings and manuals.
- **Never** use fork trucks to lift cabinets that are not equipped with lifting tubes. Be sure that the fork truck tines fit the lifting tubes properly and are the appropriate length.

**ESD Sensitive Equipment!**

- Always be aware of electrostatic discharge (ESD) when working near or touching components inside the GenIV cabinet. The printed circuit boards contain components that are sensitive to static electricity. Handling and servicing of components that are sensitive to ESD should be done only by qualified personnel and only after reading and understanding proper ESD techniques. The following ESD guidelines should be followed. Following these rules can greatly reduce the possibility of ESD damage to PC board components.
- Always transport static sensitive equipment in antistatic bags.
- Always use a soldering iron that has a grounded tip. Also, use either a metallic vacuum-style plunger or copper braid when desoldering.
- Make certain that anyone handling the GenIV printed circuit boards is wearing a properly grounded static strap. The wrist strap should be connected to ground through a 1 megohm resistor. Grounding kits are available commercially through most electronic wholesalers.
- Static charge buildup can be removed from a conductive object by touching the object to a properly grounded piece of metal.
- When handling a PC board, always hold the card by its edges.
- Do not slide printed circuit boards across any surface (e.g., a table or work bench). If possible, perform PCB maintenance at a workstation that has a conductive covering that is grounded through a 1 megohm resistor. If a conductive tabletop cover is unavailable, a clean steel or aluminum tabletop is an excellent substitute.
- Avoid plastic, Styrofoam™, vinyl and other non-conductive materials. They are excellent static generators and do not give up their charge easily.
- When returning components to Siemens LD A, always use static-safe packing. This limits any further component damage due to ESD.

Additional safety precautions and warnings appear throughout this manual. These important messages should be followed to reduce the risk of personal injury or equipment damage.



About This Manual

Separation of Manuals

This manual is one component of a series of manuals intended for use with the Robicon Perfect Harmony series of Medium Voltage (MV) Pulse Width Modulated (PWM) Variable Frequency Drives (VFD). Each part in this series is for use by individuals having unique job functions and qualifications. The manuals in this series are listed below:

- The *GenIV Product User Manual* (A5E01454341C)
- *GenIV Installation, Commissioning, and Maintenance Manual* (A5E01454341D)
- *NXG ToolSuite Software User Manual* (A1A902291)
- *NXG Communications Manual* (A1A902399)
- *NXG Control Manual* (A1A19001588)

The *GenIV Product User Manual* (A5E01454341C) defines the configuration and capabilities of the Perfect Harmony family of Medium Voltage Variable Frequency Drives and specifically addresses the GenIV configuration.

The *GenIV Installation, Commissioning, and Maintenance Manual* (A5E01454341D) provides a detailed description of how the system is transported, installed, and maintained at the customer's site.

The *NXG ToolSuite Software User Manual* (A1A902291) provides a detailed description of ToolSuite, a PC-based application that integrates various software tools used for NXG-based Drives. The NXG ToolSuite is a high-level GUI that runs on a PC that is equipped with the Microsoft Windows operating system. The NXG control and the PC running the NXG ToolSuite communicate using Ethernet and TCP/IP protocol.

The *NXG Communications Manual* (A1A902399) describes the NXG control communication board, which enables network communication via a variety of protocols and enables modem connection.

The *NXG Control Manual* (A1A19001588) describes the NXG control system. The Harmony family of drives is a collection of MV drives with different power topologies and cooling methods. The unifying factor with the drives is the NXG control system - a second generation control for the Harmony line.

All manuals contain a readers' comments form. Please complete these forms and return them to us. Monitoring your feedback allows us to continue to exceed your expectations and provide complete, effective, easy-to-use product documentation.

Reference Tools

Many steps have been taken to promote the use of this manual as a reference tool. Reference tools include the following:

- A thorough table of contents for locating particular sections or subsections
- Chapter number thumb nails in the outer margins for easy location of chapters
- Special text styles are applied to easily differentiate between chapters, sections, subsections, regular text, parameter names, software flags and variables, and test points
- A comprehensive index

If you have any comments or suggestions to improve the organization or increase the usability of this manual, please complete the Readers' Comments Form located at the end of this manual and return it to Siemens LD A Document Control.

Conventions Used in this Manual

The following conventions are used throughout this manual:

- The terms “Perfect Harmony,” “VFD,” “variable frequency drive,” and “drive” are used interchangeably throughout this manual.



Note: Hand icons in the left margin alert readers to important operational or application information that may have special significance. The associated text is enclosed in a border for high visibility.



Attention! Attention icons in the left margin alert readers to important safety and operational precautions. These notes warn readers of potential problems that could cause equipment damage or personal injury. The associated text is enclosed in a border for high visibility.



Caution - Electrical Hazard! Electrical hazard icons in the outer margins alert readers to important safety and operational precautions. These notes warn readers of dangerous voltages, potential safety hazards, or shock risks that could be life threatening. The associated text is enclosed in a border for high visibility.



ESD Warning! These icons in the left margin alert readers to static sensitive devices. Proper electrostatic discharge precautions should be taken before proceeding or handling the equipment.

- Chapter numbers are highlighted in the outer margins to facilitate referencing (see margin)

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4.3 Replacement of Parts

Replacement of component parts may be the best method of troubleshooting when spare parts are available. When any sub-assembly is to be replaced, always check that the part number of the new unit matches that of the old unit (including the revision letter).



Note: Companion manual *NXG Control Manual* (A1A19001588) includes a Troubleshooting section in Chapter 7.

- Failures traced to individual PC boards within the Control Cabinet are best serviced by replacement of the entire board.
- Failures traced to individual power cells are best serviced by replacement of the entire cell.



DANGER!

Failure to observe the following may result in severe injury or death:

PT and CT secondary circuits are capable of generating lethal voltages and currents with their primary circuit energized. Follow standard safety precautions while performing any installation or service work (i.e. removing PT fuses, shorting secondaries, etc.)



Attention!

The disposal of any failed components (capacitors, etc.) must be done in accordance with local codes and requirements.

4.3.1 Spare Parts List

The following spare parts list is shown for reference and is subject to change without notice. Always contact Siemens about the latest information regarding spare parts.



Note: For spare parts lists for **customized drives**, refer to the custom documentation package shipped with the drive or call Siemens LD A Customer Service Department at (724) 339-9501. When calling for spare parts information, please have your sales order number and drive part number readily available.

Table 4-1: GenIV Spare Parts (for Drives less than or equal to 140A Output, 4160V Output)

Spare Part	Item Part Number				
Power Cell*	40A Cell 10000424.040	70A Cell 10000424.070	100A Cell 10000424.100	140A Cell 10000424.140	
Cell CCB Fuse	1000V, 1A Fuse A1A092604				
Cell Input Fuses	Refer to chart in Section				
Transformer Air Filters	Door Filter A1A11006180.01				
Cell Air Filters	Door Filter A1A11006180.00				
NXG	SBC & Keypad Adapter A1A10000623.000M	System I/O Board A1A10000423.00	BGA Modulator A1A10000350.00M	I/O Breakout Board	120V I/O A5E01649325
	Signal Control Board A1A10000403.01	NXGII Power Supply A1A14000461.00	Keypad A1A460A68.23		24V I/O A5E01649374
Blower Fuses	8A, 600V AJT A1A089149				
Control Transformer Fuse	Secondary 6A, 600V A1A081099				
Control Transformer Fuse	Primary 3A, 600V A1A080752 (480V)		Primary 3.5A, 600V A1A089205 (400V)		
Fiber Optic	Fiber Optic Link, 2.9M A1A10000614.00				
Blower	EC Blower A1A098200 (EBM)				
Cell Bypass	Bypass Contactor A1A10000539.00	Fuse 2A 1200V A1A089592	PCA Bypass Control A1A3636601.01M		Power Supply A1A10000484.00
Communication Network	Profibus DP A1A252241.155	Devicenet Profile12 A1A252241.156	Modbus Ethernet A1A252241.157		Control Net A1A252241.158
	Modbus + A1A252241.159	Modbus A1A252241.160			
	GenIV Cell Lifter A1A163496.08				

Table 4-2: GenIV Spare Parts (for Drives greater than 140A Output, 4160V Output)

Spare Part	Item Part Number				
Power Cell*	200A Cell A1A10000424.200		260A Cell 10000424.260		
Cell CCB Fuse	1000V, 1A Fuse A1A092604				
Cell Input Fuses	Refer to Table 4-4				
Transformer Air Filters	Door Filter (4160V) A1A11006181.01				
Cell Air Filters	Door Filter A1A11006181.00				
NXG	SBC & Keypad Adapter A1A10000623.000M	System I/O Board A1A10000423.00M	BGA Modulator A1A10000350.00M	I/O Breakout Board	120V I/O A5E01649325
	Signal Control Board A1A10000403.01M	NXGII Power Supply A1A14000461.00M	Keypad A1A460A26.23		24V I/O A5E01649374
	Communications Board A1A363818.00M				
Blower Fuses	8A, 600V AJT A1A089149				
Control Transformer Secondary Fuse	6A, 600V A1A081099				
Control Transformer Fuse	480V Primary	3A, 600V, A1A080752	400V Primary	3.5A, 600V A1A089205	
Fiber Optic	Fiber Optic Link, 3.4m A5E01437712				
Blower	EC Blower A1A0100118				
Cell Bypass	Bypass Contactor Assembly A1A10000539.00	Fuse 2A 1200V A1A089592	Bypass Control PCA A1A363662.01M		Power Supply A1A10000484.00

Spare Part	Item Part Number				
Communication Network	Profibus DP A1A252241.155	Devicenet Profile12 A1A252241.156	Modbus Ethernet A1A252241.157		Control Net A1A252241.158
	Modbus + A1A252241.159	Modbus A1A252241.160			
Hall Effect	500A HECT A1A089836				
Input CT	CT 50:5 A1A091705	CT 75:5 A1A091706	CT 100:5 A1A091707	CT 150:5 A1A091708	CT 200:5 A1A091709
	CT 250:5 A1A091710	CT 300:5 A1A091711	CT 400:5 A1A091712	CT 500:5 A1A091713	CT 600:5 A1A091714
Input Attenuator	2.4 kV A1A164877.00	3.0kV A1A164877.01	3.3kV A1A164877.02	4.16kV A1A164877.03	
	4.8 kV A1A164877.04	6.0 kV A1A164877.05	6.6 kV A1A164877.06	6.9 kV A1A164877.07	
	7.2 kV A1A164877.08	8.4 kV A1A164877.09	10.0 kV A1A164877.10	11.0 kV A1A164877.11	
	12.0 kV A1A164877.12	12.5 kV A1A164877.13	13.2 kV A1A164877.14	13.8 kV A1A164877.15	
Output Attenuator	4160V A1A164877.03				
Cell Lifter	GenIV Cell Lifter A1A163496.08				

Table 4-3: GenIV Spare Parts (for Drives greater than 140A Output, 6600V Output)

Spare Part	Item Part Number					
Power Cell*	40A Cell A1A10000424.040	70A Cell A1A10000424.070	100A Cell 10000424.100	140A Cell 10000424.140	200A Cell 10000424.200	260A Cell 10000424.260
Cell CCB Fuse	1000V, 1A Fuse A1A092604					
Cell Input Fuses	Refer to Table 4-4					
Transformer Air Filters	Door Filter A5E01679467					
Cell Air Filters	Door Filter (6600V) A5E01679468					
NXGII Control	SBC & Keypad Adapter A1A10000623.000M	System I/O Board A1A10000423.00M	BGA Modulator A1A10000350.00 M	I/O Breakout Board	120V I/O A5E01649325	
	Signal Control Board A1A10000403.01M	Power Supply A1A14000461.00	Keypad A1A460A26.23		24V I/O A5E01649374	
	Communications Board A1A363818.00M		Fiber-Optic Link Board (FOLB) A1A461D85.00M			
Blower Fuses	8A, 600V AJT A1A089149					

Spare Part	Item Part Number					
Hall Effect	200A, HECT A1A089834			500A, HECT A1A089836		
Input CT	CT 50:5 A1A091705	CT 75:5 A1A091706	CT 100:5 A1A091707	CT 150:5 A1A091708	CT 200:5 A1A091709	
	CT 250:5 A1A091710	CT 300:5 A1A091711	CT 400:5 A1A091712	CT 500:5 A1A091713	CT 600:5 A1A091714	
Input Attenuator	2.4 kV A1A164877.00	3.0kV A1A164877.01	3.3kV A1A164877.02	4.16kV A1A164877.03		
	4.8 kV A1A164877.04	6.0 kV A1A164877.05	6.6 kV A1A164877.06	6.9 kV A1A164877.07		
	7.2 kV A1A164877.08	8.4 kV A1A164877.09	10.0 kV A1A164877.10	11.0 kV A1A164877.11		
	12.0 kV A1A164877.12	12.5 kV A1A164877.13	13.2 kV A1A164877.14	13.8 kV A1A164877.15		
Output Attenuator	6600V A1A168477.06					
Cell Lifter	GenIV Cell Lifter A1A163496.08					

* Customer may request IGBTs, diode rectifiers, and Cell Control Boards rather than a complete spare cell. Contact Siemens for further information regarding individual cell P/Ns.



Note: Unless notified differently by Siemens, ALWAYS replace components with the same P/N and revision level.

4.4 Basic Rules for Repairing Harmony Cells

Cell failures or component failures should be reported to both the Quality Group and Product Development at Siemens.

Always refer to the latest BOM and Assembly Drawings for approved component Part Numbers and procedures when repairing any cell. Failure to use components other than those listed in the BOM may result in poor cell performance or further failures.



Warning! It is imperative to follow these rules for repairing Harmony Cells.

1. Never parallel or series non-identical manufactures part numbers (or Siemens LD A MDIT Numbers) for IGBTs or Electrolytic Capacitors in the same power cell.
2. Never substitute a non-specified CCB/GCB/SMPS board (or any specified component or subassembly) without formal approval from the Product Development Group.
3. Never change an input power fuse(s) without first determining the root cause for the fuse operation. Fuses are not designed to protect components in the Power cell against overload. If a fuse(s) is open, there is