



3.5 to 21 kVA N+1
Inverter

Owner's Manual



IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions for the S4 Inverter Plant that must be followed during operation of the equipment.



WARNING: Opening enclosures expose hazardous voltages. Always refer service to qualified personnel only.

ATTENTION: L'ouverture des cabinets expose des tensions dangereuses. Assurez-vous toujours que le service ne soit fait que par des personnes qualifiées.

WARNUNG! Das öffnen der Gehäuse legen gefährliche Spannungen bloss. Service sollte immer nur von qualifizierten Personal durchgeführt werden.



WARNING: As standards, specifications, and designs are subject to change, please ask for confirmation of the information given in this publication.

ATTENTION: Comme les normes, spécifications et produits peuvent changer, veuillez demander confirmation des informations contenues dans cette publication.

WARNUNG! Normen, Spezifizierungen und Pläne unterliegen Änderungen. Bitte verlangen Sie eine Bestätigung über alle Informationen, die in dieser Ausgabe gemacht wurden.

**NOTE:**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at user's own expense.

**WARNING:**

To reduce the risk of fire or electric shock, install in a temperature and humidity controlled indoor area free of conductive contaminant's.

This equipment is intended only for installations in a **RESTRICTED ACCESS LOCATION**.

ATTENTION:

Pour réduire le risque d'incendie ou d'électrocution, installer dans une enciente intérieure contrôlée en température et humidité et sans contaminant's conducteurs.

Ce matériel est destiné seulement pour des installations dans un **EMPLACEMENT RESTREINT d'cAccès**.

WARNUNG!

Um die Gefahr von Feuer und elektrischem Schock zu reduzieren, muss das Gerät in einem temperatur - und feuchtigkeitskontrollierten Raum, frei von leitungsfähigen Verunreinigungen, installiert werden. Dieses Gerät ist nur für die Installation an einem Ort mit eingeschränkter Zugangserlaubnis vorgesehen.

Diese Ausrüstung ist nur für Anlagen in einem **EINGESCHRÄNKTEN ZUGRIFF STANDORT** bestimmt.

**WARNING:**

HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply.

ATTENTION:

COURANT DE FUITE ELEVE. Raccordement a la terre indispensable avant le raccordement au reseau.

WARNUNG!

Hoher Ableitstrom Vor Inbetriebnahme Schutzleiterverbindung herstellen.

This manual covers these models:

<i>Product:</i>	<i>Rating:</i>
64074	7.0 kVA 120/240 Line to Neutral only
64144	14.0 kVA 120/240 Line to Neutral only
64214	21.0 kVA 120/240 Line to Neutral only
64074H	7.0 kVA 208/240 Line to Line only
64144H	14.0 kVA 208/240 Line to Line only
64214H	21.0 kVA 208/240 Line to Line only

3.5 kVA to 21 kVA Inverter Owner's Manual

For service call
1-800-523-0142

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3.5 to 21 kVA N+1 Inverter Owner's Manual

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Revision History

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How To Use This Manual:

This manual is designed for ease of use and easy location of information.

To quickly find the meaning of terms used within the text, look to the Glossary.

To quickly find a specific topic, look at the Table of Contents.

This manual uses Note lines and icons to convey important information.

Note lines and icons come in four varieties.



WARNING:

Indicates information provided to protect the User and service personnel against safety hazards and possible equipment damage.



CAUTION:

Indicates information provided to protect the User and service personnel against possible equipment damage.



NOTE:

Indicates information provided as an operating tip or an equipment feature.



IMPORTANT:

Indicates information provided as an operating instruction or as a tip.

CAUTION

RECORD ALL SERIAL NUMBERS FOR THE S4 INVERTER AND COMPONENTS.

THESE SERIAL NUMBERS WILL BE REQUIRED IF YOUR SYSTEM NEEDS SERVICE. KEEP THIS MANUAL IN A PLACE WHERE YOU CAN REFERENCE THE SERIAL NUMBERS IF SERVICE IS REQUIRED!

S4 INVERTER UNIT SERIAL NUMBER: _____

INVERTER MODULE SERIAL NUMBER: _____

RECEIVER CABINET SERIAL NUMBER: _____

ADDITIONAL MODULES SERIAL NUMBERS:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
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Introduction



WARNING: An AC output will be present at the output terminals immediately when AC input is energized.

ATTENTION: La tension alternative de sortie apparaît dès la mise sous tension de l'entrée.

WARNUNG! Eine Ausgangsspannung liegt an den Ausgangsklemmen, sobald der Netzeingang angeschlossen wird.

1.0 Scope

This manual provides technical information for installation, operation, and maintenance of MGE inverter systems series ranging from 3.5 kVA to 21 kVA. Please read this manual thoroughly before installing and operating the system. Please retain this manual for future reference.

The manual is divided into three sections:

Section 1 Introduction

This section introduces the 3.5 to 21 kVA static inverters, including a general description of the inverter, its components, and specifications.

Section 2 Installation & Operation

This section describes installation of the inverters, including receiving, handling, and storage procedures; prerequisites to the installation; installation procedures; and start-up procedures.

Section 3 Maintenance

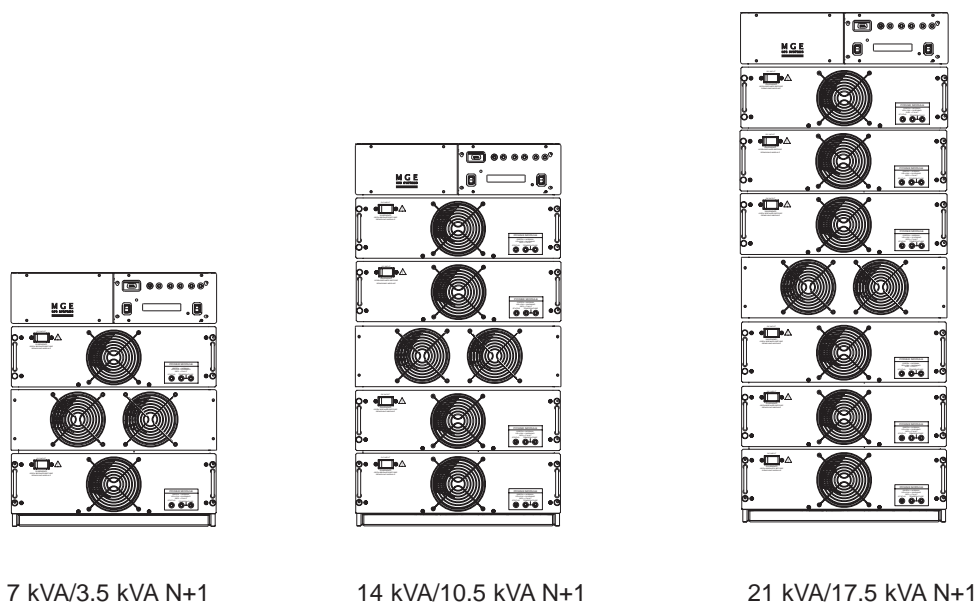
This section describes the maintenance and service of the S4 Inverter, including safety instructions, preventive maintenance, descriptions of replacement kits, and a troubleshooting table.

1.1 General Description

This static, modular inverter system series provide stable, distortion-free AC power from a DC input source at a selectable output voltage and frequency prior to shipment, for sensitive equipment. With a built-in static transfer switch, the inverter also forms a reliable and economical part of uninterruptible power supply systems in either on-line or off-line mode. This series employed modular design to provide N+1 redundancy, and twin controller cards to double reliability. There are three distinctive parts in these tower inverter systems. The top part is a built-in module that houses the twin controller, alarm cards, LCD unit, and LED indicators. The center part is a built-in module that houses a static transfer switch, and where input and output connectors are located. It is easily recognized by a twin fan front panel. Above and below this static switch module are individual inverter modules rated 3.5 kVA/3kW each (those with single fan front panel).

S4 inverters are available in three receiver cabinet configurations housing 1 to 6 inverters, a static transfer switch console, and redundant microcontroller modules.

Figure 1-1: System Configurations. (N+1 = added redundancy).



1.2 Standard Products

Consult table 1-1 below for the system(s) you are working on.

Table 1-1: Inverter System Characteristics.

Part Number	Power rating (kVA)	Nominal Input Voltage (VDC)	Input Voltage Range (VDC)	Maximum Input Current @ -40VDC (Amperes)	Maximum Output Amperes at selectable output voltage of:		Selectable Output Frequency Hz
					120	208-240	
64074/H	7	(-48)	(-40 to -60)	176	58	29	50 or 60
64144/H	14	(-48)	(-40 to -60)	353	116	58	50 or 60
64214/H	21	(-48)	(-40 to -60)	529	174	87	50 or 60

Table 1-2: Inverter Module Dimensions.

Inverter Module	HEIGHT (in/cm)	DEPTH (in/cm)	WIDTH (in/cm)	WEIGHT (lb/kg)
64004-9MSK1	5.18 / 13.16	15.12 / 38.4	15.76 / 40.03	46 / 20.86

Note: Weight: Six-mod receiver = 135 lbs. (61.2 kg) 1 UPS Module = 46 lbs. (20.09 kg)

Total System Weight, 21 kVA system = 411 lbs. (186.4 kg)

1.3 Electrical Specifications

Electrical Specifications are subject to revision without notice.

1.3.1 DC Input

Nominal: -48Vdc; Operating Range: -39.5Vdc to -57 Vdc



NOTE:

An external DC circuit breaker or fuse should be used at the DC source.

1.3.2 AC Output (per module)

Voltage: 120Vrms or 240Vrms
 Current: 25Arms or 12.5Arms
 Frequency: 60Hz or 50Hz

Table 1-3: S4 AC Output Current Ratings.

Attention: Watts rating = 85% of the VA rating at 120/240 VAC.

	MAXIMUM OUTPUT RATINGS								
	7 KVA unit			14 KVA unit			21 KVA unit		
Vout (Vac)	Iout (A)	Output Power (W)	Output VA (VA)	Iout (A)	Output Power (W)	Output VA (VA)	Iout (A)	Output Power (W)	Output VA (VA)
110	58.33	6000	6416	116.66	12000	12833	175	18000	19250
115	58.33	6000	6708	116.66	12000	13416	175	18000	20125
120	58.33	6000	7000	116.66	12000	14000	175	18000	21000
208	29.165	6000	6066	58.33	12000	12133	87.5	18000	18200
220	29.165	6000	6416	58.33	12000	12833	87.5	18000	19250
230	29.165	6000	6708	58.33	12000	13416	87.5	18000	20125
240	29.165	6000	7000	58.33	12000	14000	87.5	18000	21000

Units configured to other than 120/240VAC are derated due to current limit.

The % Load reading on the display panel is always with reference to the 120/240 Vac WATT and VA ratings.

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Efficiency	85% minimum, 88% typical (on-line mode); 97% typical (off-line mode) at full kVA/Watt load.
Power Factor	Rated kVA is available over a power factor range of 0.6 lagging to 0.6 leading at nominal voltage. Watt rating should not be exceeded.
Total Harmonic Distortion	Less than 1% for linear load conditions, 3% maximum for crest factor loads up to 3:1.
Line Regulation	System output voltage variation, less than 1% over the DC voltage range.
Load Regulation	System output voltage variation, less than 1% from zero to full load at nominal DC input.
Output Frequency	User-selectable, 50Hz or 60Hz. Free run frequency stability shall be within +/-0.02% of the selected frequency.
Short Circuit Current (SCC)	300% minimum of rated load current for four cycles. A SCC is defined as a current that exceeds 150% of rated current.
Overload Capability	Continuous overload up to 108% of rated VA/watts at 50°C maximum.
Transient Deviation and Recovery	Within 20% of average value for any change in output current or step change in input voltage within specified limits. Recovery within 1 millisecond from zero to full load.
EMI Emission	Battery Bus less than 30dBmc. FCC 47 CFR part 15 class A; EN 55022 class A; CISPR 22 class A

1.4 Mechanical Specifications

Table 1-4: S4 Receiver Cabinet Mechanical Dimensions and Weights

	MODEL		
	7 kVA	14 kVA	21 kVA
HEIGHT (in/cm)	21 / 54	31.5 / 81	42 / 107.9
DEPTH (in/cm)	18.5 / 47.5	18.5 / 47.5	18.5 / 47.5
WIDTH (in/cm)	17 / 43.7	17 / 43.7	17 / 43.7
RECEIVER WEIGHT (lb/kg)	88 / 39.9	111 / 50.3	136 / 61.7
RECEIVER + MODULES WEIGHT (lb/kg)	182 / 82.6	299 / 135.6	418 / 189.6
RECEIVER SHIPPING WEIGHT (lb/kg)	100 / 45.4	123 / 55.8	148 / 67.1

1.5 Environmental Specifications

Operating Temperature	All models operate to specifications from -5°C to +50°C (+23°F to +122°F) for altitude up to 3,300 feet (1006 Meters), and -5°C to 35°C (+23°F to + 95°F) for up to 13,300 feet (4054 Meters).
Shipping Temperature	-40°C to +75°C (-40°F to +192°F) for shipping; Not recommended for storage.
Storage Temperature	-40°C to +60°C (-40°F to +166°F).
Operating Humidity	0 to 90% relative, without condensation.
Operating Altitude	200 feet below to 13,300 feet (4054 Meters) above sea level.
Audible Noise	Less than 59 dBA per Type 2, IEC and ANSI SI.4, when measured in a 40 dBA environment at a distance of 4 feet from any surface.
Cooling	Cooling is by forced air. Air intake is through the front of the unit, exhaust out the sides.

1.5.1 Thermal Dissipation

Heat rejection: 602.28 BTU/Hr for each rated KW of the inverter system. This is based on an inverter efficiency of 85% at full load and does not include load dissipation.

kVA rating	7	14	21
Watts	1059	2118	3177
BTU/Hr	3614	7227	10841
Est. A/C, TONS	0.301	0.602	0.903

1.6 Safety Approvals

Meets UL/CSA 60950 (listed) and European Standard EN60950.

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Installation and Operation

**IMPORTANT:**

Equipment is factory set to operate at 120VAC for Line to Neutral and 240VAC for Line to Line units. Please read installation procedure to configure for Line to Neutral and 240VAC for Line to Line units other configurations.

2.0 Scope

This section describes installation of the inverters, including receiving, handling, and storage procedures, prerequisites to the installation, installation procedures, and start-up procedures.

2.1 Receiving

Before accepting the shipment from the freight carrier, inspect the exterior surfaces of all shipping containers or packaging used, and the equipment, for damage that may have occurred during transit. If the shipping containers or equipment shows evidence of damage, note the damage on the receiving document (bill of lading) prior to signing for receipt of equipment.

ALL CLAIMS FOR SHIPPING DAMAGE MUST BE FILED DIRECTLY WITH THE CARRIER. Replacements for damaged components should be ordered through MGE UPS SYSTEMS.

2.1.1 Handling

**IMPORTANT:**

A spread bar must be used, to avoid bending the bolts or side panels, if the S4 Inverter is to be lifted from the top using the eye-bolts.

The equipment can be lifted from the top, using the eye-bolts; however, a spreader bar must be used to avoid bending the bolts or the side panels. The equipment may also be handled using a forklift or pallet mover.

2.1.2 Storage

If the equipment is to be stored prior to installation, it should be stored in a cool, dry, well-ventilated location that is protected from rain, splashing water, chemical agents, etc. The equipment should be covered with a tarpaulin or plastic wrapper to protect it against dust, dirt, paint, or other foreign materials.

2.2 Prerequisites to Installation

An efficient installation depends on careful planning and site preparation. Installation of the equipment must be handled by skilled technicians and electricians familiar with the special requirements of high-voltage electrical equipment. The installation must comply with the requirements of the National Electrical Code (ANSI/NFPA 70, latest issue) and local codes as applicable.

We strongly recommend contracting MGE for system start-up. Do not allow unqualified personnel to handle, install, or operate MGE UPS SYSTEMS static inverter systems.

**NOTE:**

The inverter can be mounted close to a rear wall, because there is no rear access to the unit. All input DC, output AC, and input AC wiring to the inverter enters through the top or left side of the rack assembly. Service to the inverter rack is through the front. If a maintenance bypass unit or junction box is installed, rear access is required for this unit.

2.3 Mechanical Mounting

The equipment can be floor mounted or rack mounted in a 19" (48.3 cm), 23" (58.4 cm), or 25" (63.5 cm) rack. Optional mounting bracket kits can be ordered for rack mounting in a 25" (63.5 cm) or 26" (66.0 cm) rack.

All receivers and inverter power modules are shipped separately from the factory. Receivers will be shipped on a pallet. These receivers can be secured to a floor or to some other permanent base using one-half inch bolts through the four holes in the base supports. The inverter modules will be shipped based on customer's discretion on power configuration or the size of the receiver they are using. Modules will be shipped separately from exterior chassis. Refer to Figure 2-2 on page 2—3.

Figure 2-1: Installation Drawing, 7 kVA Inverter System.

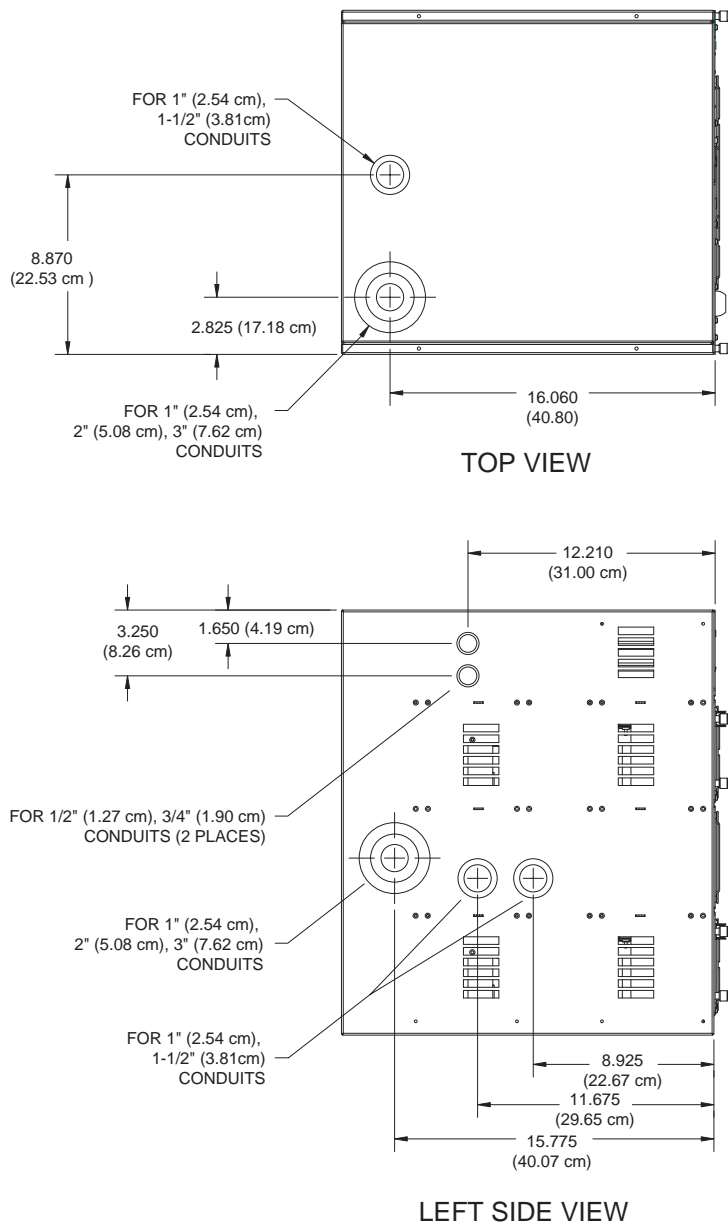
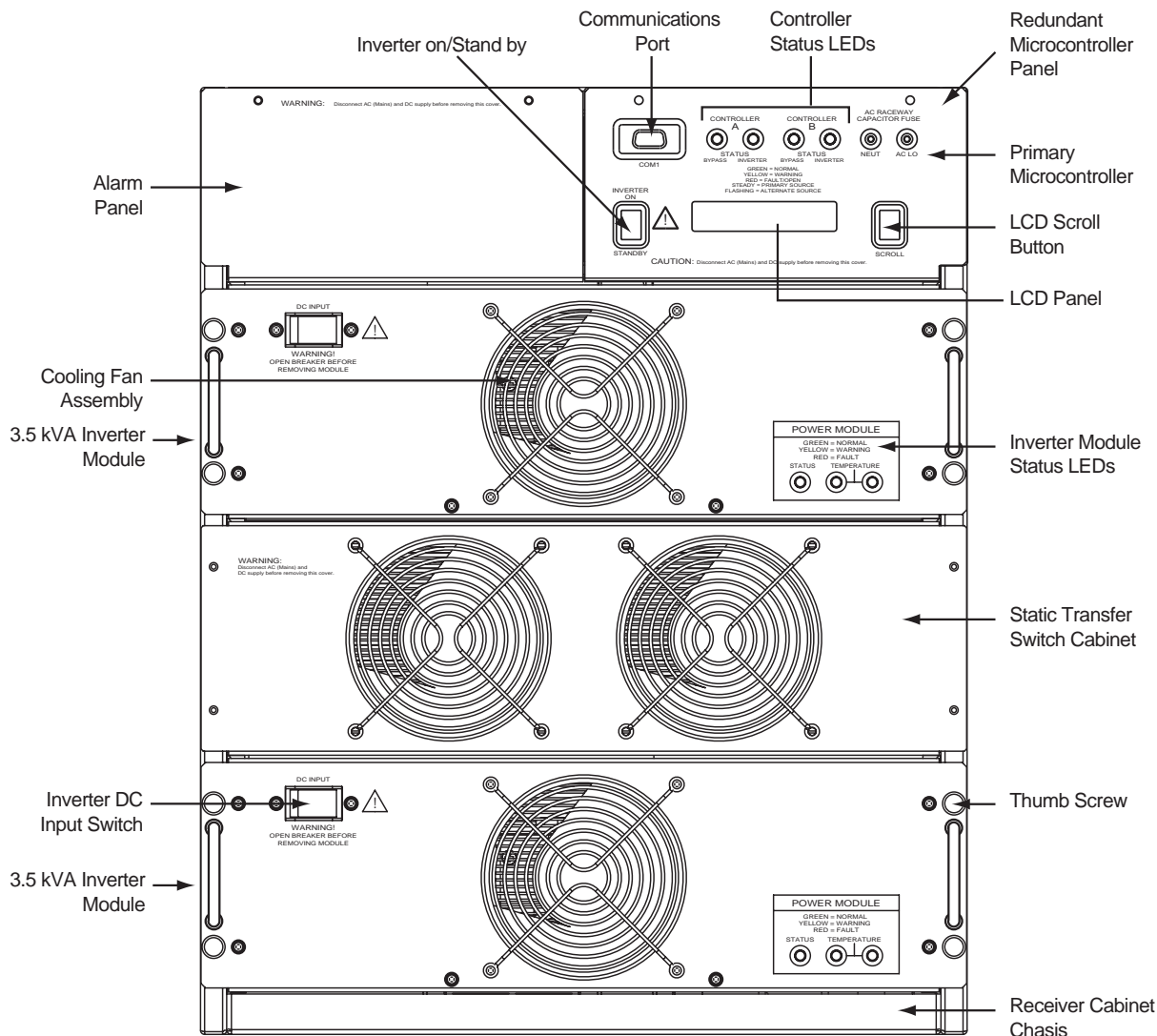


Figure 2-2: Front View, 7 kVA, System Component Description.



NOTE: Modules are shipped separately to receiver cabinet.

2.3.1 Location

The equipment is designed for installation in a protected environment. Factors to be considered in selecting a location include ventilation, temperature, humidity, and accessibility. Install the unit in a clean, dry location with an unrestricted air flow. The equipment is cooled by forced air. Allow at least 6 inches of air space to the sides of equipment for proper cooling. To comply with NEBS requirement, allow 12" (30.48 cm) to the sides when installed next to other heat generating equipment.

2.4 Wiring Connections Line to Neutral Units

Note: For Line to Line units please skip to section 2.7, page 2—10.

2.4.1 Grounding

For safety and proper operation of the unit, including maximum attenuation of electrical noise, suitable grounding is required. A separate grounding electrode conductor should be connected from the safety ground (GND) terminal to a nearby grounding electrode, and should be sized per National Electrical Code Article 250-94. The grounding electrode should be grounded structural metal, a metal water pipe, or a suitable ground rod (National Electrical Code 250-26). The grounding electrode should be as near as possible to the unit. The S4 will accommodate two 1/0 gauge wire. Customer provides grounding system.

Move the receiver cabinet to its intended location, using one of the suggested handling methods. After it is in its final position, remove the blank panels from the front of the receiver cabinet. Blank panels are supplied with the unit so as to prevent damage to the unit during shipment. Remove these blank panels, but do not discard them. Remove top cover panel on the receiver's static switch (cover of the panel with two fans) for access to the wiring area. The connections to be made are the DC input connections, load connections, AC input connections, and optional remote alarm connections. The connection terminals and busbars are located at the static switch area, which is in the center of the receiver cabinet. For safety, the DC safety ground connection should be connected first, then DC positive (+) connection made next, then the DC negative (-) last.

2.5 Input and Output Cable Connections

2.5.1 AC Input Circuit Breaker



CAUTION:

For Line to Neutral units 64074, 64144, and 64214 only.



WARNING:

If utility line voltage is connected to the system, an appropriately rated AC circuit breaker MUST be installed between the supplying AC source and the inverter plant. Installation must comply with local/national electrical installation requirements.

Table 2-1: Line To Neutral Units Suggested Circuit Breaker Ratings.

Inverter rating		7 kVA	14 kVA	21 kVA
AC breaker rating	120VAC	80A	150A	225A
	240VAC	40A	80A	125A



CAUTION:

In applications with AC Input to the inverter, before connecting the AC Input, remove the green bonding Jumper wire that is connected between the Neutral (TB4) to ground. The bonding wire is used for applications without AC Input, in Line to Neutral units only.

2.5.2 DC Input

Normal: -48VDC

Operating Range: -39.5 VDC to -57VDC

This system is designed for battery systems with the positive terminal Earth Ground. All DC breakers are in the negative DC lines. The system DC terminals are isolated from Earth Ground.

2.5.3 DC Input Circuit Breaker

Due to tremendous amounts of short circuit current available (in excess of 1000A for as long as several minutes!) from bank(s) of batteries, that supply electrical power to inverter systems, it is extremely important to connect a properly sized DC circuit breaker at the DC input cable that feeds the inverter system. The following table is provided as a guide for selecting the proper circuit breaker.

Table 2-2: Line To Neutral Units Suggested DC Circuit Breaker Ratings.

Inverter rating	7 kVA	14 kVA	21 kVA
CB rating	200A	400A	600A

Figure 2-3: Line To Neutral Inverter Receiver Junction Box.

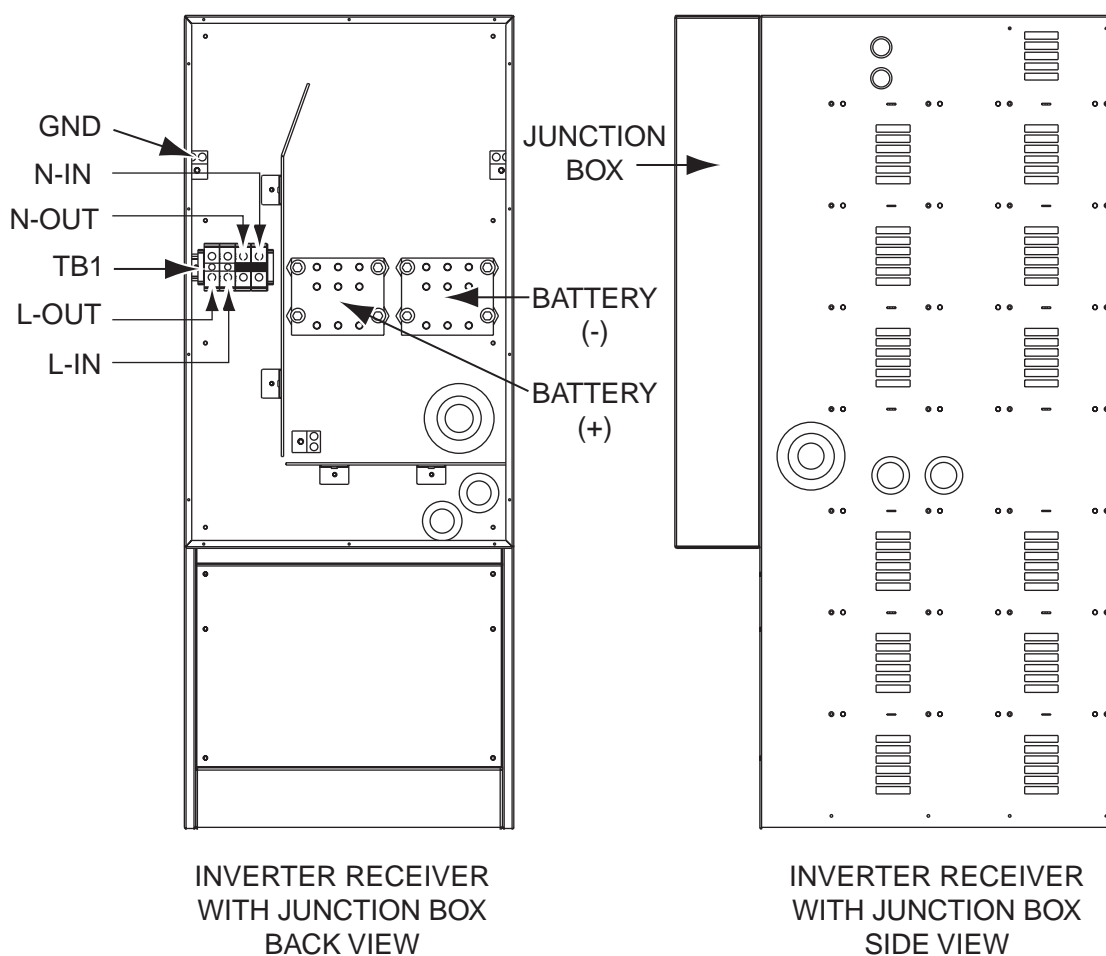
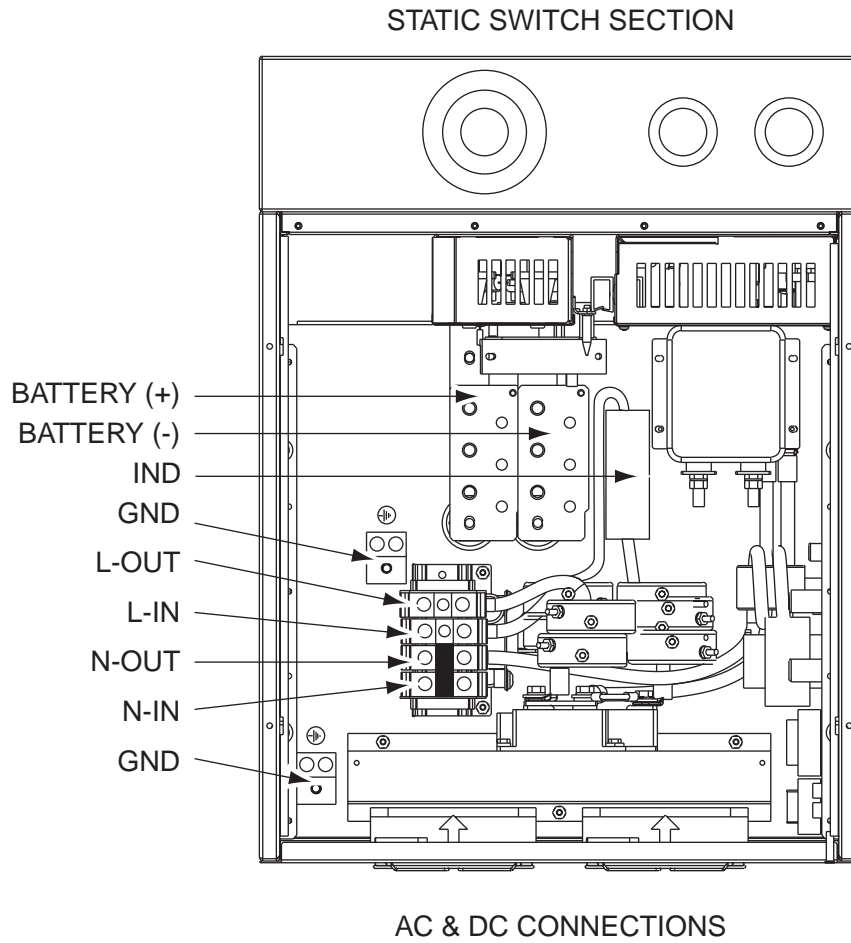


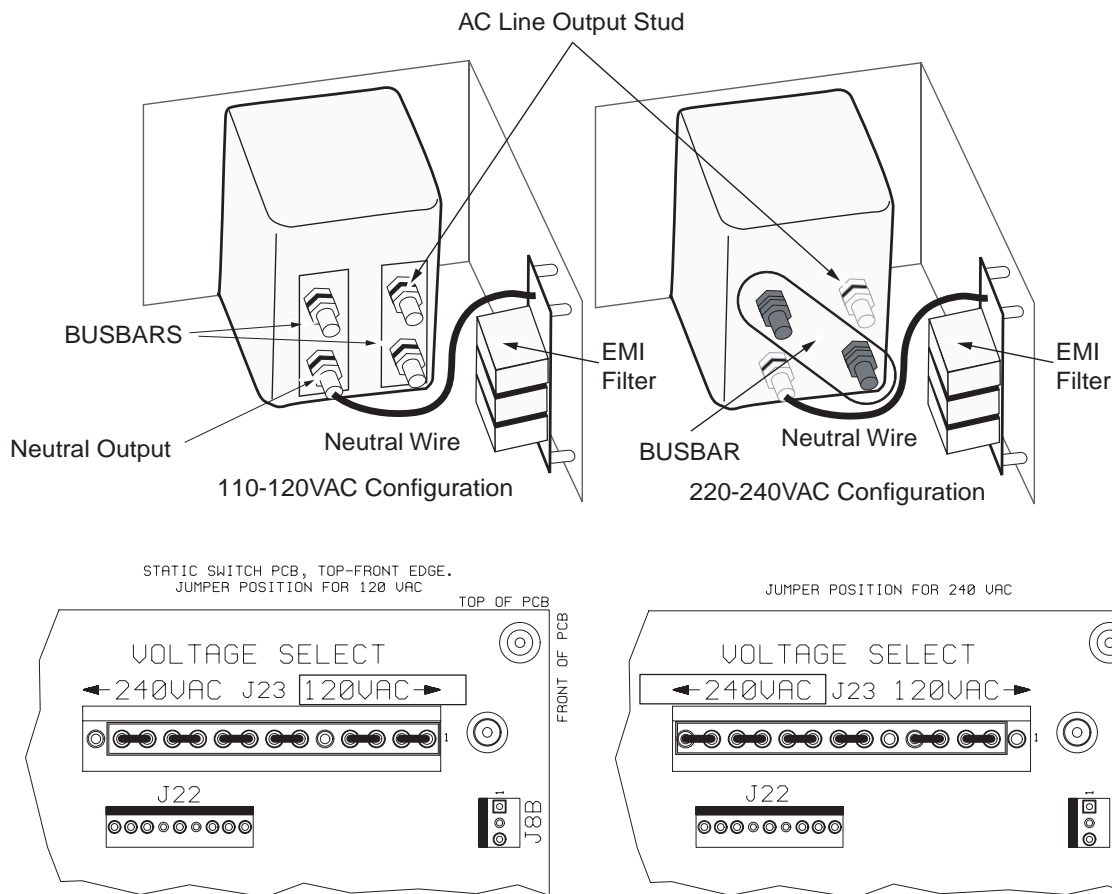
Figure 2-3a: Static Switch Section - Input and Output Wiring.



2.5.4 Connections

All DC input connections are made through the knock-outs, located in the top or left side panel. Refer to Figure 2-1. Make sure that the upstream source DC circuit breaker and AC circuit breaker (if applicable) supplying the inverter are in the off (or open) position. DC input power cables should be sized such that the maximum voltage drop between inverter busbar terminals and battery terminals is less than 1.0 volt at the breaker current rating. See Table 2-2 for CB breaker rating verses kVA rating. The inverter can accommodate three positive wires and three negative wires up to 4/0. Two 3/8" hole lugs, compression type with hole spacing of 1" should be used. All ground connections should be made first, then positive (+) DC input cable should be connected, then the negative (-) connection last. The DC input landings are marked (+) and (-). Insert the input DC power cable through the selected top or side panel knock-out. Connect the positive (+) cable to the lower terminal connection and the negative (-) cable to the upper terminal connection landing. The 14 kVA and 21 kVA inverter require the super flexible (fine strand) wire, which is installed with an optional Maintenance Bypass unit, and with an optional Junction Box that is mounted to the back side of the Inverter receiver (14kVA and 21 kVA only). See Figure 2-3.

Figure 2-4: EMI and Busbar VAC Configurations.



The utility input and output cables are connected to a screw type terminal block. Connect the ground wires first, then the neutral wires, then connect the AC input wire (if applicable) and the AC output wire. A separate, optional Maintenance Bypass unit and a Power Distribution panel (200A Square D "QO" type of circuit breakers) are available.

2.5.5 AC Input/Output Voltage Selection

The inverter is preset at the factory for 120VAC input, ON-LINE, 120VAC, 60 Hz output.

If the input voltage for your installation is different (220VAC to 240VAC), the following procedure MUST be followed. In the static switch area, there is a printed circuit board mounted to the right side panel. A multi-pin connector is located on the printed circuit board, close to the static switch front panel, identified as J23. This connector has 13 pins. Its mating plug has 12 positions, with interconnecting wires. This allows the jumper plug (P13) to be installed in one of two positions. When this jumper plug is in its most forward position (closest to the front panel), the unit is set for 110-120VAC operation. Removing the plug and installing it in its rear most position selects 220-240VAC operation. Verify that this plug is in the proper position before applying any voltage to the inverter system. See Figure 2-4.

2.5.6 EMI Filter Wiring

There are two separate inverter AC output EMI filters. Each filter provides one half of the output power to the system. These filters must be connected in parallel for 110-120VAC output or connected in series for 220-240VAC output. There are only two wires connected to these two filters. The neutral wire, with the white band, is connected to the lower EMI filter left-hand stud. The AC output wire is connected to the upper EMI filter right-hand stud. In the 110-120VAC configuration, the left-hand studs of the EMI filters are connected together by a copper busbar strap and the two right-hand studs of the EMI filters are connected together by a busbar strap. See Figure 2-4.

To change to the 220-240VAC connection, remove the wires and busbars from the output terminals of the EMI filter. Install the copper busbar between the lower EMI filter right-hand stud to the upper EMI filter left-hand stud. Reconnect the white neutral wire to the lower EMI filter left-hand stud and the AC output wire to the upper EMI filter right-hand stud. Replace the hardware (flat washer, lock washer, and nut) and tighten the 10MM nuts to the prescribed torque, 35.4 inch-lbs (4 Nm). Refer to the decal on the cover plate of the static switch for strap positions. Again, verify that P23 plug on the static switch printed circuit board (located on the right side panel, is in the 240VAC, rear most position before applying any voltage to the inverter system. The extra copper busbar may be discarded. Replace the top cover of the static switch and secure it with the three previously removed 6-32x1/4" Phillips head screws.



WARNING:

Do not perform this procedure (under Section 2.5.6) unless the configuration needs to be changed. The voltage selection jumper plug position must agree with the software selection. See Figure 2-4 EMI filter strapping.

2.6 Software Configuration Set-Up

The factory default configurations of the inverter plant is: 120V, 60Hz, Utility voltage connected and Mode of operation is Online. If the factory configuration is different, the inverter will ship with marking that will describe the inverter plant configuration. Use the configuration setup program when a different configuration is required or when a new processor is installed.

A lap-top personal computer (PC) with the field service set-up software for the S4 inverter family needs to be available and connected to the DB-9 connector of the display panel via the appropriate cable. In systems that do not have the redundant controller printed circuit board, there is no need to open the display panel or remove the redundant controller, skip the dual and redundant controller setup.

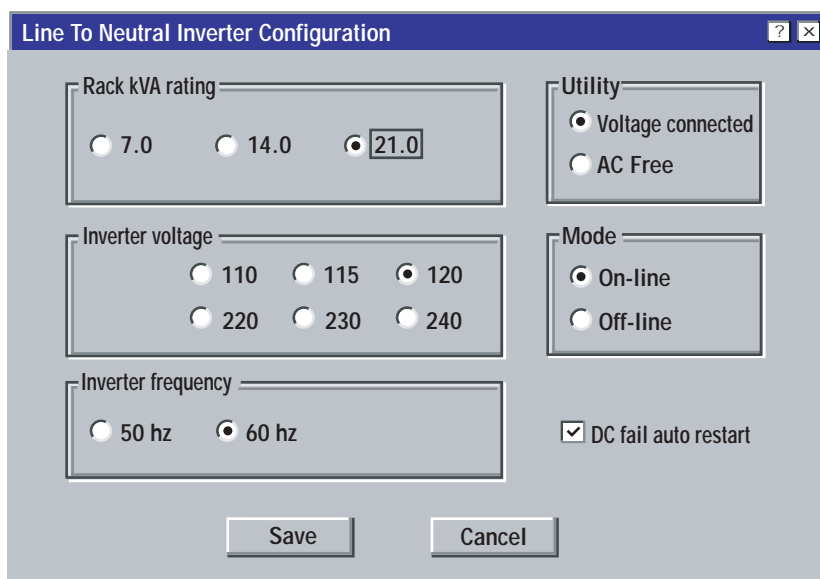
2.6.1 Dual Processor Set-Up

The following procedure should be followed for systems that contain a redundant (second) microprocessor. Using a #2 Phillips screw driver, remove the four screws securing the display panel to the receiver rack. Using the Phillips" screw driver, remove the two screws holding the microprocessor boards in place. The circuit board securing bracket is also a circuit board extractor. Using this bracket, pull the top microprocessor circuit board out slightly so that it is disengaged from its 70 pin edge plated connector. Return the display panel back to its vertical position and install the two screws to hold the panel in position. Do not tighten the screws very much, since they will be removed again.

2.6.2 System Personalization

Before installing the power modules into the receiver rack, apply the 48 DC input voltage (44 to 56VDC). The controller (microprocessor) within the unit should become activated. The status indicators on the display panel should sequence through their self test mode, changing from red to yellow to green, then momentarily off in approximately 4 seconds. After this, ignore all the LED displays. Using the laptop PC, call up the filed service set-up program. In the Windows menu, select the desired AC output voltage, frequency, and modes of operation. The Windows menu will appear similar to Figure 2-5.

Figure 2-5: Line To Neutral Setup Screen.



After the selections are complete, click on the Save button. The data will be sent to the appropriate address in the controllers "EEROM". Remove the applied 48VDC to the system by turning off the main DC feed circuit breaker.

2.6.3 Unit kVA Rating ID Label

For kVA rating see the inverter ID label. Use the label kVA rating, regardless of the number of inverter modules installed.

The processor will detect and display the number of modules installed and the number of modules that are "ON" and operating without fault. MGE is offering the 7, 14, and 21 kVA rating.

2.6.4 On-Line Mode

On-line mode is the mode in which the load is powered by the inverter system, not the utility. It will get clean, transient free electrical power from the inverter system, which is producing the AC power from a DC power source. In the event of inverter failure, the static transfer switch will transfer the load to the utility power if available.

2.6.5 Off-Line Mode

Off-line mode is the mode in which the load is powered from the Utility power line (external AC input power). In the event of a power failure, a static transfer switch will connect the system output to the inverter and activate the inverter so as to provide continuous power to the load with no interruptions of power to the load.

2.7 Wiring Connections Line to Line Units

Note: For Line to Neutral units continue to section 2.11, page 2—17.

2.7.1 Grounding

For safety and proper operation of the unit, including maximum attenuation of electrical noise, suitable grounding is required. A separate grounding electrode conductor should be connected from the safety ground (GND) terminal to a nearby grounding electrode, and should be sized per National Electrical Code Article 250-94. The grounding electrode should be grounded structural metal, a metal water pipe, or a suitable ground rod (National Electrical Code 250-26). The grounding electrode should be as near as possible to the unit. The S4 will accommodate two 1/0 gauge wire. Customer provides grounding system.

Move the receiver cabinet to its intended location, using one of the suggested handling methods. After it is in its final position, remove the blank panels from the front of the receiver cabinet. Blank panels are supplied with the unit so as to prevent damage to the unit during shipment. Remove these blank panels, but do not discard them. Remove top cover panel on the receiver's static switch (cover of the panel with two fans) for access to the wiring area. The connections to be made are the DC input connections, load connections, AC input connections, and optional remote alarm connections. The connection terminals and busbars are located at the static switch area, which is in the center of the receiver cabinet. For safety, the DC safety ground connection should be connected first, then DC positive (+) connection made next, then the DC negative (-) last.

2.8 Input and Output Cable Connections

2.8.1 AC Input Circuit Breaker



CAUTION:

For Line to Line units 64074H, 64144H, and 64214H only.



WARNING:

If utility line voltage is connected to the system, an appropriately rated AC circuit breaker MUST be installed between the supplying AC source and the inverter plant. Installation must comply with local/national electrical installation requirements.

Table 2-3: Line To Line Units Suggested Circuit Breaker Ratings.

Inverter rating		7 kVA	14 kVA	21 kVA
AC breaker rating	240VAC	40A	80A	125A

2.8.2 DC Input

Normal: -48VDC

Operating Range: -39.5 VDC to -57VDC

This system is designed for battery systems with the positive terminal Earth Ground. All DC breakers are in the negative DC lines. The system DC terminals are isolated from Earth Ground.

2.8.3 DC Input Circuit Breaker

Due to tremendous amounts of short circuit current available (in excess of 1000A for as long as several minutes!) from bank(s) of batteries, that supply electrical power to inverter systems, it is extremely important to connect a properly sized DC circuit breaker at the DC input cable that feeds the inverter system. The following table is provided as a guide for selecting the proper circuit breaker.

Table 2-4: Line To Line Units Suggested DC Circuit Breaker Ratings.

Inverter rating	7 kVA	14 kVA	21 kVA
CB rating	200A	400A	600A

Figure 2-6: Inverter Receiver Junction Box, Input and Output Wiring.

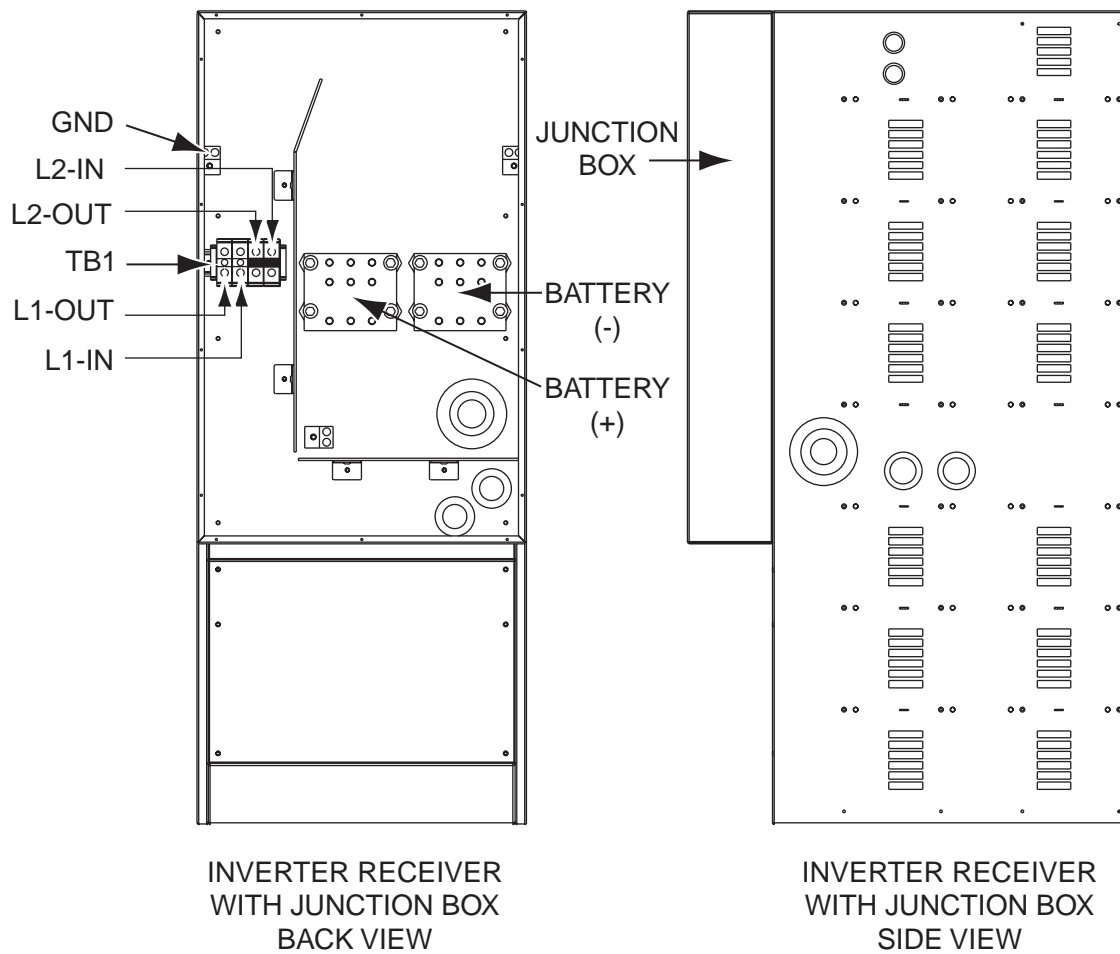
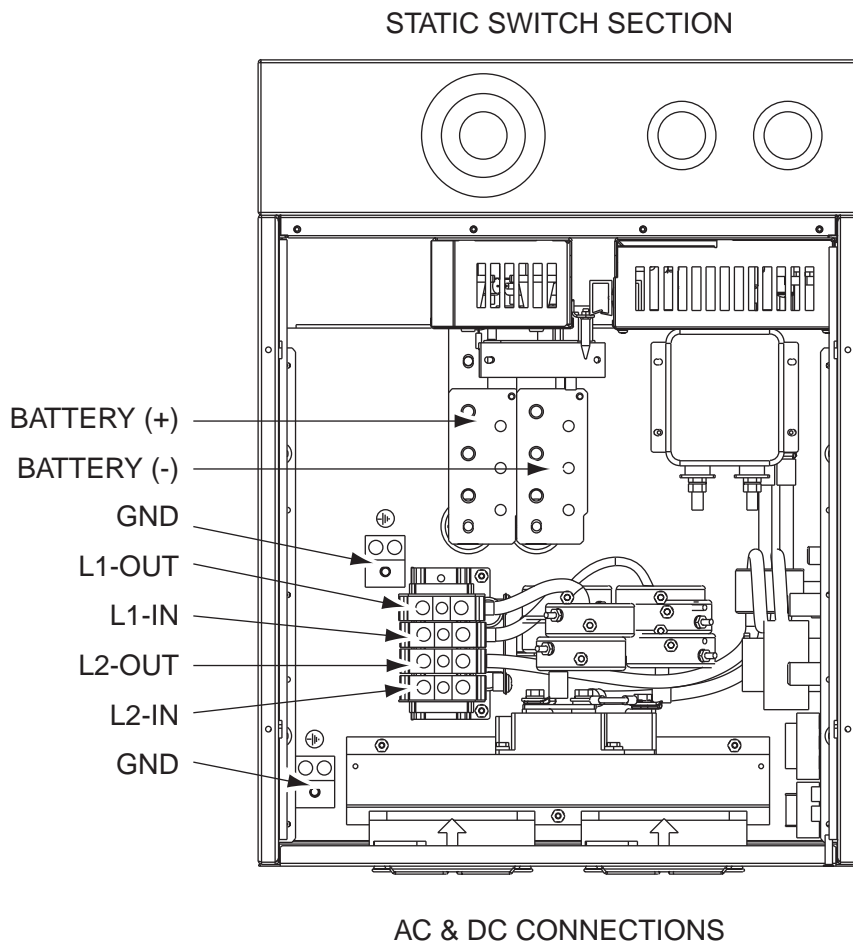


Figure 2-6a: Static Switch Section - Input and Output Wiring.



2.8.4 Connections

All DC input connections are made through the knock-outs, located in the top or left side panel. Refer to Figure 2-1. Make sure that the upstream source DC circuit breaker and AC circuit breaker (if applicable) supplying the inverter are in the off (or open) position. DC input power cables should be sized such that the maximum voltage drop between inverter busbar terminals and battery terminals is less than 1.0 volt at the breaker current rating. See Table 2-4 for CB breaker rating versus kVA rating. The inverter can accommodate three positive wires and three negative wires up to 4/0. Two 3/8" hole lugs, compression type with hole spacing of 1" should be used. All ground connections should be made first, then positive (+) DC input cable should be connected, then the negative (-) connection last. The DC input landings are marked (+) and (-). Insert the input DC power cable through the selected top or side panel knock-out. Connect the positive (+) cable to the lower terminal connection and the negative (-) cable to the upper terminal connection landing. The 14 kVA and 21 kVA inverter require the super flexible (fine strand) wire, which is installed with an optional Maintenance Bypass unit, and with an optional Junction Box that is mounted to the back side of the Inverter receiver (14kVA and 21 kVA only). See Figure 2-6.

The utility input and output cables are connected to a screw type terminal block. Connect the ground wires first, then connect the AC input wires (if applicable) and the AC output wires. A separate, optional Maintenance Bypass unit and a Power Distribution panel (125/200A Square D "QO" type of circuit breakers) is available.

2.8.5 AC Input/Output Voltage Selection

The inverter is preset at the factory for 240VAC input, ON-LINE, 240VAC, 60 Hz output. If the input voltage for your installation is different (208VAC to 240VAC), the following procedure MUST be followed.

2.9 Software Configuration Set-Up

The factory default configurations of the inverter plant is: 240V, 60Hz, Utility voltage connected and Mode of operation is Online. If the factory configuration is different the inverter plant will ship with marking that will describe the inverter plant configuration. Use the configuration setup program when a different configuration is required or when a new processor is installed.

A lap-top personal computer (PC) with the field service set-up software for the S4 inverter family needs to be available and connected to the DB-9 connector of the display panel via the appropriate cable. In systems that do not have the redundant controller printed circuit board, there is no need to open the display panel or remove the redundant controller, skip the dual and redundant controller setup.

2.9.1 Dual Processor Set-Up

The following procedure should be followed for systems that contain a redundant (second) microprocessor. Using a #2 Phillips screw driver, remove the four screws securing the display panel to the receiver rack. Using the Phillips" screw driver, remove the two screws holding the microprocessor boards in place. The circuit board securing bracket is also a circuit board extractor. Using this bracket, pull the top microprocessor circuit board out slightly so that it is disengaged from its 70 pin edge plated connector. Return the display panel back to its vertical position and install the two screws to hold the panel in position. Do not tighten the screws very much, since they will be removed again.

2.9.2 System Personalization

Before installing the power modules into the receiver rack, apply the 48 VDC input voltage (44 to 56VDC). The controller (microprocessor) within the unit should become activated. The status indicators on the display" panel should sequence through their self test mode, changing from red to yellow to green, then momentarily off in approximately 4 seconds. After this, ignore all the LED displays. Using the laptop PC, call up the field service set-up program. In the Windows menu, select the desired inverter voltage, frequency, and modes of operation. The Windows menu will appear similar to Figure 2-7.

Figure 2-7: Line To Line Setup Screen.

The screenshot shows a software dialog box titled "Line To Line Inverter Configuration". It features several groups of radio buttons for configuration:

- Rack kVA rating:** 7.0, 14.0, and 21.0 (selected).
- Utility:** Voltage connected (selected) and AC tree.
- Inverter voltage:** 208, 220, 230, and 240 (selected).
- Inverter frequency:** 50 hz and 60 hz (selected).
- Mode:** On-line (selected) and Off-line.
- DC fail auto restart:** A checked checkbox.

 At the bottom of the dialog are "Save" and "Cancel" buttons.

After the selections are complete, click on the Save button. The data will be sent to the appropriate address in the controllers "EEROM". Remove the applied 48VDC to the system by turning off the main DC feed circuit breaker.

2.9.3 Unit kVA Rating ID Label

For kVA rating see the inverter ID label. Use the label kVA rating, regardless of the number of inverter modules installed.

The processor will detect and display the number of modules installed and the number of modules that are "ON" and operating without fault. MGE is offering the 7, 14, and 21 kVA rating.

2.9.4 On-Line Mode

On-line mode is the mode in which the load is powered by the inverter system, not the utility. It will get clean, transient free electrical power from the inverter system, which is producing the AC power from a DC power source. In the event of inverter failure, the static transfer switch will transfer the load to the utility power if available.

2.9.5 Off-Line Mode

Off-line mode is the mode in which the load is powered from the Utility power line (external AC input power). In the event of a power failure, a static transfer switch will connect the system output to the inverter and activate the inverter so as to provide continuous power to the load with no interruptions of power to the load.

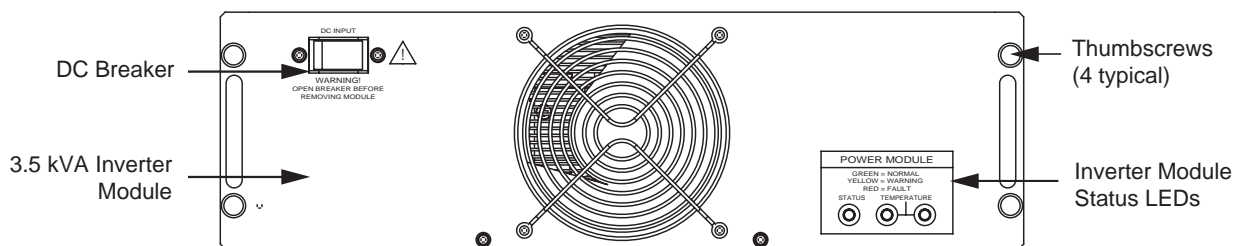
2.10 Redundant Controller Set-Up

After making sure the 48VDC power has been removed from the unit, remove the two Phillips head screws from the display panel as above. Re-install the top controller printed board that was previously partially removed. Using the circuit board retaining bracket, disengage the bottom controller board from its connector. Replace the display panel and secure it with the two Phillips head screws previously removed. Repeat steps for the second controller. When the set-up is complete, remove the 48VDC applied to the system. Again open the front display panel and reseal the bottom controller circuit board. Replace the circuit board retaining bracket and secure it in its final position using the two 6/32 Phillips head screws. Replace the display panel and secure it to the rack using the two 8/32 x 3/8" Phillips head screws. Set up is complete.

2.10.1 Inverter Module Installation

The power modules are designed to be hot swapped. However, for initial start up, all of the inverter modules should be installed. In a system where all of the module positions are not used, reinstall the previously removed blank panels in these locations. Install the inverter modules, and tighten the four thumbscrews on each module. Before turning on the main source DC circuit breaker and utility AC circuit breaker (if used), make sure that all of the inverter module circuit breakers (upper left-hand corner) of each module is OFF. Also verify the ON/Stand-by switch on the display panel is in the Standby (down) position. The inverter plant usually supplies power to some type of distribution circuit breaker panel. Confirm that all of these circuit breakers (loads) are OFF before starting up the inverter. After the DC input cable, utility line cable, and output cable are properly connected and secured, the inverter system is ready to be turned ON.

Figure 2-8: Inverter Module.



ATTENTION! Turn off the Input DC Breaker before removing the inverter Module. After turning the inverter module off, to allow discharge of the Input capacitors, wait 3 minutes before turning the Inverter Module back "ON."

2.11 Indicators and Controls

There are six LED indicators divided into three groups – DS1 and DS2, DS3 and DS4, DS5 and DS6 - on the display front panel. DS1 and DS2 are indicators of controller A; DS3 and DS4 are indicators for controller B; DS5 and DS6 are for output capacitors fuse indicators. Failure of output capacitors will trip output fuses, and will activate DS5 and/or DS6 indicators. See Figure 2-9.

At power-up, one of the two controller units will be up quicker than the other and will take control the system. The stand by controller LED's will be green, toggling on/off. Consequently DS1 or DS3 will be on blinking green, signaling that AC Input is available and the system output is ready to be turned on, through the Power Distribution breakers.

The inverter output voltage is turned ON or to Stand-by via switch SW1 located on the left side of the LCD display panel. Pushing it up is to turn the inverter ON, and pushing it down is to turn the inverter OFF. **WARNING:** In the stand-by position, if AC power is applied to the AC input terminal block, AC power will be on the output of the unit. When the Inverter voltage is on, DS2 (or DS4) indicator will be on green steadily, signaling that every thing is normal.

The system measurement information is displayed on the LCD display panel. Switch SW3 (scroll button, on the right side of the display panel), is pushed down (or up) to scroll the LCD's screens for more information. Individual inverter module has only one control, an ON/OFF circuit breaker, located at the upper left corner of the front panel. This breaker is used to energize (or de-energize) the inverter module.

Note: For initial start-up the module circuit breakers must be turned on prior to turning the system Inverter "ON".

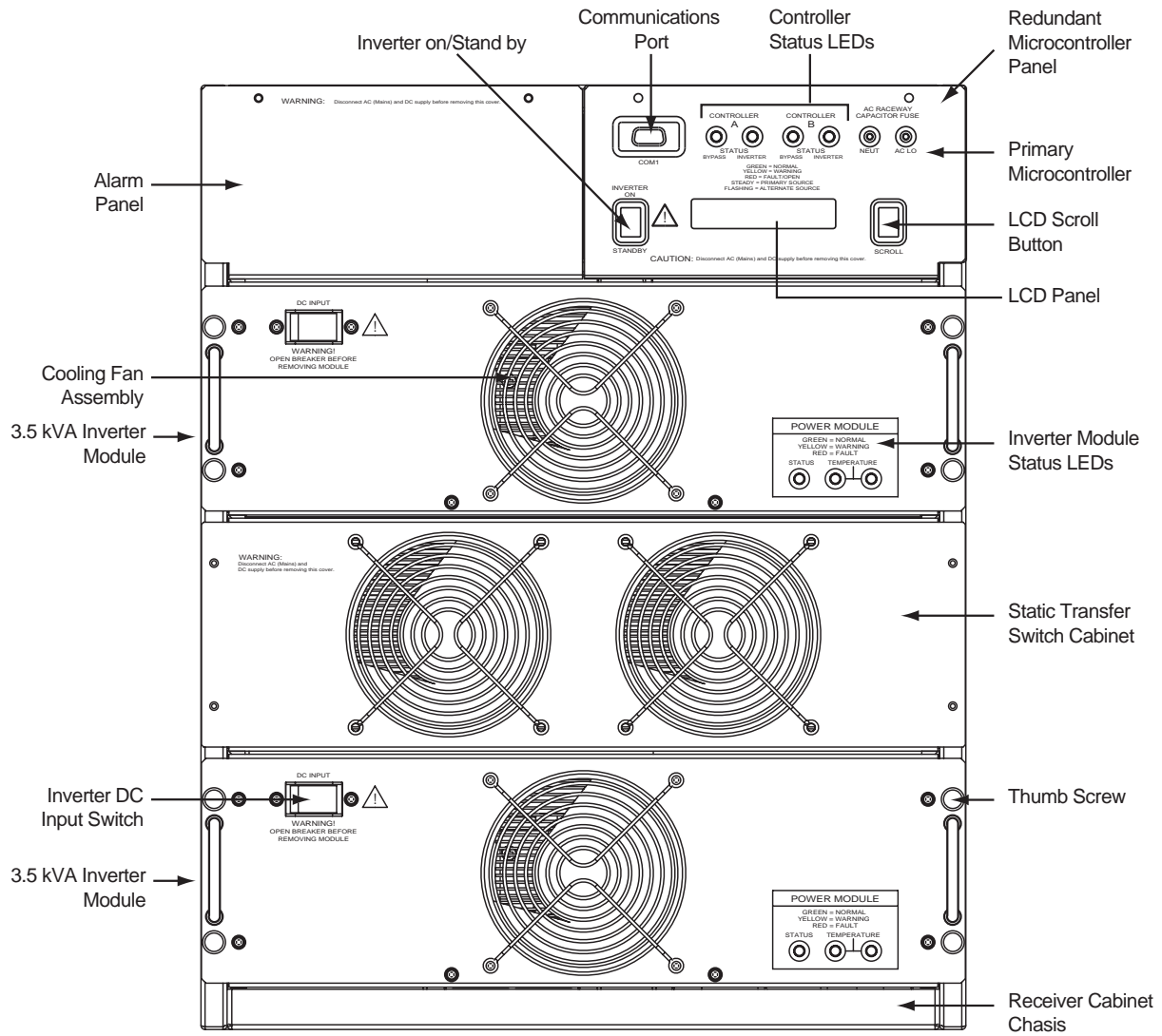
2.11.1 LCD Readout

The LCD unit displays two lines (out of a total of seven lines) of information at a time. Each line can be scrolled up (or down) independently by toggling the scroll switch SW3. Typical seven lines of information are shown below:

Line 1	INV:	off	normal	Inverter off/on
Line 2	BYP:	static	normal	Static bypass on/normal operation
Line 3	LOAD:	120V	100%	AC Output/Load % of nominal
Line 4	AC IN:	120V	60 Hz	AC input voltage/frequency
Line 5	DC IN:	48.0V	073.5A	DC voltage/DC current
Line 6	LOAD:	03000 W	025.0A	Load Power (W)/Current (A)
Line 7	INV:	6 of 6	60 Hz	Number of good modules out of # installed modules Operation/Frequency.

3.5 to 21 kVA N+1 Inverter

Figure 2-9: S4 Inverter Components.



NOTE: Modules are shipped separately to receiver cabinet.

2.12 Remote Alarm

The system provides three alarm signals, namely, Utility alarm, Minor alarm, and Major alarm.

- ▶ Utility alarm – Utility alarm is ON when utility input voltage is lost/out of tolerance.
- ▶ Minor alarm – The system sends out this signal to indicate something is not functioning properly, but inverter can still maintain the load.
- ▶ Major alarm – Whenever load is lost power and the system is energized.

For alarm connection, see Table 2-5.

2.12.1 Alarm Relays

There are three alarm relays. All relays are “form C” type, that is, the relay has a normally open and a normally closed contact set.

The Major Alarm relay will be energized when the system is operating properly, that is, power is being supplied to the load either from the Inverter or from the Utility. There are two sets of “form C” contact sets on the Major Alarm relay.

The Minor Alarm relay will be de-energized, and will be energized for the alarm condition. A minor alarm will be issued if the system is not operating properly. Such an alarm will be issued during overload, battery voltage not within specified limits, power modules over temperature and module fault.

The Utility Alarm relay will be de-energized during normal operation and will be energized for the alarm condition. This alarm will be issued if the utility voltage is not within specified limits or the input frequency is not within proper limits.

The table below shows the alarm and the non-alarm terminal block connections. This terminal block is located in the top, left side of the receiver cabinet. The small front panel must be removed to gain access to the terminal block.

Table 2-5: Alarm Connections.

J21 terminal block screw position ---	1	2	3	4	5	6	7	8	9	10	11	12
MAJOR ALARM ---		X	X									
MAJOR ALARM ---					X	X						
No Major Alarm ---	X	X										
No Major Alarm ---				X	X							
Minor Alarm ---							X	X				
No Minor Alarm ---								X	X			
Utility Alarm ---										X	X	
No Utility Alarm ---											X	X

“X” indicates a short circuit between J21 terminal block points.

2.13 Start-Up Sequence

Confirm that all power modules' ON/OFF circuit breakers are set to the OFF position. On the LCD "Display" panel, be sure inverter switch SW1 is set at STANDBY position.

2.13.1 Power-Up Procedure

Turn the main source DC input circuit breaker ON to apply 48VC to the system. The "controller" boards and LCD "Display" panels are now energized. The following message will be displayed. See Figure 2-9.

Line 1:	INV:	off	module
Line 2:	BYP:	static	AC LOW

If the system is equipped with two controllers, one controller will take control of the system, the other will be a back-up. Assuming "Controller A" takes control of the system, the BYPASS Status LED (DS1) will be red, Inverter Status LED (DS2) will be out, "Controller B" Bypass and Inverter LED's (DS3, DS4) will alternately blink On and Off, green for Bypass, green for Inverter. If "Controller B" takes control, its Status LED's will be as for "Controller A" above.

If an external AC power source is used, turn on the source AC circuit breaker. After about 20 seconds the LCD should display the following information:

Line 1:	INV:	off	module
Line 2:	BYP:	static	normal

The "Status" LED's will be as above, except the "Bypass" will be green if the AC input voltage is within proper limits (voltage and frequency).

2.13.2 Powering Up the Inverters

DO NOT turn on the inverter switch SW1 yet! Turn the circuit breaker on each power module to the ON position. The LCD "Display" panel is still displaying the above two lines, but "module" will change to "normal". Now, everything is ready and the inverter switch, SW1, can be turned ON (push-up). The "Status" LED's will be as above, except that the "Inverter" indicator that was out will now be green if the system is functioning properly. The inverter is now supplying the power to the system. Using a voltmeter, verify that the proper voltage (110, 115, 120, 208, 220, 230, 240VAC) exist at the output terminals. Load circuit breaker may be turned ON.

2.13.3 De-Energizing the System

If the system is equipped with an AC input, turn off the main feed circuit breaker. Then turn switch SW1 to the stand-by position (push down). Next, turn all the power modules front panel circuit breakers OFF. Lastly, turn the DC input supply circuit breaker OFF.

Maintenance Adjustment and Troubleshooting

**CAUTION:**

Troubleshooting the static inverter should be done only by qualified electronic technicians. Connecting and disconnecting the input and output power conductors in the course of troubleshooting should be done in accordance with the installation instructions in Section 2 of this document. External circuit breakers are essential for the protection of the source and for safely connecting and disconnecting the input power connectors. The internal DC circuit breakers in the system are for protection of the systems internal circuits only. External circuit breakers between the AC or DC source and the system are essential for the protection of the source and for safely connecting and disconnecting the input power connectors.

ATTENTION

Le dépannage de l'inverseur statique devrait être fait seulement par les techniciens électroniques qualifiés. Relier et débrancher les conducteurs de puissance d'entrée et de sortie au cours du dépannage devraient être faits selon les instructions d'installation dans la section 2 de ce document. Les disjoncteurs externes sont essentiels pour la protection de la source et pour sans risque se relier et débrancher et les connecteurs de puissance d'entrée. Les disjoncteurs internes de C.C dans le système sont pour la protection des circuits internes de systèmes seulement. Les disjoncteurs externes entre la source à C.A. ou de C.C et le système sont essentiels pour la protection de la source et pour sans risque brancher et débrancher les connecteurs de puissance d'entrée.

VORSICHT

Fehlersuche am statischen Umformer sollte nur von qualifiziertem Elektronik-Technikern ausgeführt werden. Das Anschließen und das Trennen der Eingangs- und Ausgangsanschlußleitungen sollten in Übereinstimmung mit den Montagevorschriften in Kapitel 2 dieses Dokumentes erfolgen. Externe Sicherungsautomaten sind für den Schutz der Quelle und für sicheres Anschließen und Trennen der Eingangsnetzes wesentlich. Die internen Gleichspannungssicerungsautomaten sind zum Schutz der internen Stromkreise der Systeme. Externe Sicherungsautomaten zwischen der Wechselspannungs- oder Gleichspannungsquelle und dem System sind für den Schutz der Quelle und für sicheres Anschließen und Trennen der Eingangsnetzstecker wesentlich.

NOTE 1: DC input power is normally from a battery system with a very high short circuit capacity. Accidental welding and severe burns can be caused by errors while connecting or disconnecting these conductors.

NOTE 2: Many operation problems are due to incorrect installation or setup. Before turning the unit on, review the installation and setup instructions which are associated with your system configuration.

3.0 Scope

This section describes the maintenance and service of the S4 Inverter, including safety instructions, preventive maintenance, descriptions of replacement kits, and a troubleshooting table.

3.1 Safety Instructions for Servicing

IMPORTANT SAFETY INSTRUCTIONS FOR INVERTER SERVICING SHOULD BE PERFORMED OR SUPERVISED BY QUALIFIED PERSONNEL ONLY.



WARNING:

IMPORTANT SAFETY INSTRUCTIONS FOR INVERTER SERVICING SHOULD BE PERFORMED OR SUPERVISED BY QUALIFIED PERSONNEL ONLY.



WARNING:

DC input power to the inverter is normally from a bank of batteries with potentially high short circuit current capability. Accidental welding and severe burns are highly possible if mistake occurs during connecting or disconnecting these conductors.



WARNING:

The green grounding wire at the TB1-4 to E1 ground lug needs to be removed, if the inverter is to be attached to AC input power, instead of an AC free environment.

3.2 Preventative Maintenance

The following preventive maintenance routines should be considered as a minimum requirement. Your installation and site may require additional preventive maintenance to assure optimal performance from your installed inverter and associated equipment. These routines should be performed twice a year (more often if required). We strongly recommend a contract with MGE Customer Support Services for preventive and remedial maintenance.

The technician or electrician performing preventive maintenance on the equipment must read and understand thoroughly this manual and be familiar with the indicators, controls, and operation of the equipment.

- a. Isolate and de-energize the equipment for all maintenance operations.
- b. Ensure that the equipment is clean and free of loose dust, dirt, and debris. The exterior of the enclosures can be cleaned with a mild solution of soap and water, lightly applied with a lint-free cloth.
- c. Inspect the air intake and exhaust areas in the inverter module. Verify that air flows freely through the equipment. Clean the air intake and exhaust areas, and the enclosure interior, with a vacuum cleaner as required.
- d. Initiate the start-up procedure.
- e. Test the main operating sequences as applicable to your equipment configuration and installation.

3.3 Equipment Adjustment and Calibration

The equipment is factory adjusted and, normally, no further adjustments and calibration are required. However, in the course of repair, components may have to be changed that will require configuration of the equipment. These configurations should only be made by a qualified technician.

3.4 Air Intake Cleaning

Inspect the air intake and exhaust openings for blockage. Verify that air flows freely through the equipment. Clean the air intake and exhaust openings with a vacuum and a soft brush.

3.5 AC Fan Replacement

Every five years, replace the Static Switch front panel, including fans (MGE part number 64004-0SSK1). This is accomplished by removing all the DC and AC power to the unit by turning the Maintenance Bypass Switch to the MBP position.

Perform the following steps:

1. Remove the front panel from the "static switch panel (with two fans), using a #2 Phillips screw driver take out the four screws securing the panel to the receiver rack.
2. Unplug the two fan wires at the static switch printed circuit board.
3. Install the fan assembly onto the static switch, making sure to plug fan's back into the static switch printed circuit board connectors.
4. Secure the front panel in place by using the four Phillips"head screws previously removed.
5. Power up the system by switching the Maintenance Bypass Switch to SBP and to Normal.
6. Close DC Breaker and verify that the inverter is in normal mode - display panel inverter indicator should be green.
7. Verify that the Inverter output indicator on the Maintenance Bypass Switch display is "ON".

3.6 DC Fan Replacement

Every five years, replace the DC fan in each power module (MGE fan part number 64004-0FSK1). This is accomplished by removing the power module from the receiver.

Perform the following steps:

1. Remove the front panel from the power module by removing the six Phillips head screws securing the front panel to the chassis, the two screws securing the top cover to the front panel (6-32" Phillips head screws), and the two screws hold the DC circuit breaker to the front panel. It should not be necessary to remove the top cover.
2. Remove the front panel, being careful to unplug the fan from the printed circuit board.
3. Observe the orientation of the fan wires and the fan guard so that it will appear like all other power module front panels. Remove the fan from the front panel by removing the four screws holding the fan, panel, and fan guard together.
4. Install the new fan in the reverse order of disassembly. When installing the front panel onto the chassis, care must be taken to ensure the three LED's project through the front panel. Install all ten flat head screws.
5. Make sure the circuit breaker on the front panel is in its OFF position.
6. Install the inverter module back into the receiver rack.

3.7 Replacement Parts

MGE offers a complete spare parts kit for each model number. Spare parts kits include the inverter modules. Parts (those included in the spare parts kit) can be ordered individually or as a complete parts kit. To order on individual part, give the full description along with the complete model number and serial number of the inverter.

Table 3-1: Spare Parts and Kits.

MGE Parts #	Description
64004-L1SK1	Level 1 Spares Kit
	64004-OFSK1
	6 x 038-003002-0000-15A Fuse for PCB-72-153594-OX
64004-L2SK1	Level 2 Spares Kit
	Level 1 + 64004-9MSK1
64004-L3SK1	Level 3 Spares Kit
	Level 2+ Static Switch PCB-72-153595-00 + 64004-03SK1
64004-L3SK2	Level 3 Spares Kit for L-L receiver
	Level 2+ Static Switch PCB-72-153842-00 + 64004-03SK1
64004-03SK1	LCD Display
64004-0SSK1	Static Switch Fan Assembly
64004-0FSK1	Inverter Module Fan
64004-01SK1	System Controller
64004-9MSK1	Inverter Module

3.8 Redundant Microprocessor (72-153588-00) Installation/Configuration

Follow this procedure to replace or add a microprocessor board to the S4 Inverter. Only one microprocessor can be configured at a time. To configure a microprocessor, install only that microprocessor board in the inverter receiver.

The redundant microprocessor board is factory calibrated and pre-configured. Please see the configuration on the label. If this is the desired configuration, skip steps 6 to 10.

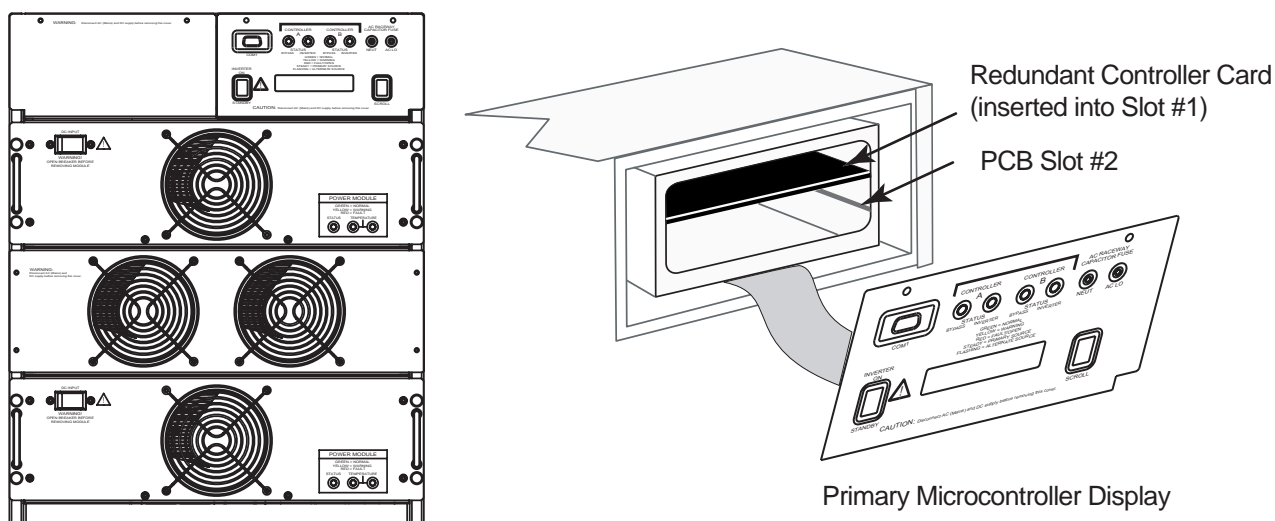
Before installing the microprocessor, disconnect all power sources that feed the inverter.

If a Maintenance Bypass Switch is installed – transfer the unit to MBP position.

If no Maintenance Bypass switch is installed – Turn the inverter off (Attention: No power to the load in this case), open the DC and AC breakers that feed the inverter.

1. Using a Phillips screwdriver, remove the four screws securing the display panel to the inverter receiver.
2. Remove the two screws securing the bracket in front of the Microprocessor board.
3. Use this bracket to pull out the old microprocessor.
4. Install the new microprocessor. Mount the Display Panel.
5. Verify that the unit is in Standby mode and the inverter modules are OFF.
6. Apply AC only to the inverter. Attention: The inverter output is powered.
(Unit with Maintenance Bypass – move switch to SBP) The display should be ON.
7. Connect a PC through a RS232 cable to the communication port on the Display Panel.
8. Run the configuration setup program on the PC.
9. On the configuration screen, select the correct configuration for your unit: KVA rating, inverter voltage, inverter frequency, Utility, Mode and Auto restart. Click on SAVE to send the configuration to the Microprocessor memory. Disconnect the AC power. (Unit with Maintenance Bypass – move switch to MBP)
10. To configure a second Microprocessor, repeat steps 1, and 3 to 9. Repeat step 1. Reinstall the first Microprocessor board.
11. Mount the bracket and the Display panel.
12. Restart the unit; follow start up instruction in the unit installation and user manual.

Figure 3-1: Redundant Microprocessor Component Location.



3.9 Troubleshooting and Servicing

Should you encounter a problem in the operation of the inverter and need MGE Systems to service your equipment, it is recommended to leave the unit in its current state. Record message (if any) and color signals on the LCD display and LED indicators on the display panel, then call MGE Customer Support Services at 1-800-523-0142 for assistance. Leaving the unit in its current state will facilitate the field engineers to troubleshoot and bring your equipment back on line more easily. If you cannot wait, you may want to consider the following troubleshooting tips.

3.9.1 Installation Check

Often, operation problems are caused by incorrect installation or setup. Before turning the system on, review Chapter 2 for instructions pertaining to your particular system. Use the checklist below. If the system fails to operate properly after being turned on, all items in this list need to be rechecked and verified to make sure things are connected correctly.

Installation Checklist: (Installed item to be verified)

- ▶ Inverter System included static transfer switch
- ▶ DC input terminals have correct voltage polarity
- ▶ Utility input terminals have correct voltage connections
- ▶ AC output terminals voltage connections
- ▶ Input conductor size correct ampacity
- ▶ Output conductor size correct ampacity
- ▶ Correct output voltage selected in personalization
- ▶ Correct frequency selected
- ▶ On/Off Line Inverter is on-line
- ▶ Automatic or manual start is selected

3.10 AC Output Circuit Breaker

A Power Distribution Panel is available from MGE UPS SYSTEMS at a nominal cost. Order part number 6421P-9 for 14 or 21 kVA units, or 6210-0AD for the 7 kVA, which will accommodate up to 20/24 single-pole circuit breakers, "Square-D" QO type.

3.10.1 Cable Connection and Static Switch Module

All input and output connection terminals are mounted inside the built-in Static Switch. It is very easy to identify this module by looking at a front panel that has twin cooling fans. The top panel can be opened with a #2 Phillips screw driver. When making connection, always double check to make sure that DC cable goes to DC busbars, identified as (+) and (-). The utility cables go to a terminal block, for Line to Neutral units 120/240VAC line connects to TB1-2, NEUTRAL to TB1-4. AC output is from TB1-1 (120/240VAC), NEUTRAL to TB1-3. For Line to Line units (208-240): Line 1 connects to TB1-2 and L2 to TB1-4, AC outputs: L1 connects to TB1-1 and L2 to TB1-3. One of the best ways to verify continuity is to use a DMM.

3.11 Troubleshooting Guide

After having thoroughly reexamined the installation and setup of the system, and still found it un-operational, user can follow Table 3-2 to identify a problem, its cause, and recommendations for fixing it.

Table 3-2: Troubleshooting table.

Problem	Possible Cause	Possible Solution
Display panel not illuminated	No power to system	Check AC & DC power sources.
No output voltage	SW1 not ON	Turn SW1 ON
System starts, then shuts down almost immediately	Overload, or shorted output.	Remove some of the load and restart the inverter.
Power module LED turn red	Module faulted	Reset by recycling circuit breaker
Module temp. indicator on	Module fan failure	Replace module or cooling fan

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Glossary

Symbols	Definition/Meaning
@	At.
/	And/or.
+/-	Plus or Minus.
≤	Equal to or less than.
#	Number.
°C	Degree Celsius.
°F	Degree Fahrenheit.
∅	Phase angle.
Ω	Ohm; unit of resistance.
®	Trade Mark.
2nd	Second.
ABC	Normal sequence of phase (clockwise) in three-phase power.
AC or ac	Alternating current, also implies root-mean-square (rms).
Ambient Temp.	Temperature of surrounding air.
Ambient noise	Acoustical noise of surrounding environment.
ANSI	American National Standard Institute.
AWG	American Wire Gauge.
Automatic bypass the AC-power source.	Automatic switch controlled by the UPS, used to connect the equipment directly to
Automatic start following return of AC input power	When AC input power returns following shutdown at the end of the battery backup time, UPS automatic start can be enabled or disabled.
Backup time	Time that the connected equipment can operate on battery power.
Bar graph percent load.	Device on the front panel indicating the percent remaining backup time or the
Battery circuit breaker	DC-power circuit breaker that protects the battery circuit.
Battery test	Internal UPS test on battery status.
Breaker	Electrical circuit interrupter.
BTU or Btu	British thermal unit. Defined as the amount of heat required to raise the temperature of one pound of water by 1°F.

BYPASS	See "Static Transfer switch".
Bypass	Maintenance bypass; wrap-around manual maintenance bypass using the optional bypass circuit breaker Q3BP in conjunction with circuit breaker Q4S and isolation circuit breaker Q5N.
Bypass AC Input	Mains 2.
BYPASS mode	See "off-line mode".
Carrier	The company or individual responsible for delivering goods from one location to another.
C	Common.
CB	Circuit breaker.
cm	Centimeter.
Comm.	Communication.
Conduit	A flexible or rigid tube enclosing electrical conductors.
Cold start	See "Start on battery power".
Connection module	Unit grouping the receptacles for connection to the AC-power source and the equipment.
C.S.S.	Customer Support Service.
Current rating	The maximum current that a conductor or equipment can carry reliably without damage.
dB	Decibels.
DC	Direct current.
dBA	Decibel Adjusted.
dBrnC	Decibel above reference noise.
DC or dc	Direct current, or voltage.
Digital Meter	The LCD display on the front panel of inverter system.
Double conversion	The power supplied to the connected equipment is completely regenerated by continuous double conversion, i.e. the AC power from the AC-power source is rectified (AC - DC), then converted back (DC - AC) to AC power.
Earth ground	A ground circuit that has contact with the earth.
Electrician	Refers to an installation electrician qualified to install heavy-duty electrical components in accordance with local codes and regulations. Not necessarily qualified to maintain or repair electrical or electronic equipment.
FET	Field effect transistor.
Freq.	Frequency.
Frequency slew rate	The change in frequency per unit of time. Given in term of Hz per second (Hz/sec.).

GND	Ground (safety).
Hz	Hertz, frequency measurement unit, 1Hz is one cycle per second.
Inverter mode	See "on-line" mode.
I	Current.
IEC	International Electrotechnical Commission.
IEEE	Institute of Electrical and Electronic Engineers.
Input branch circuit	The input circuit from the building power panel to the equipment.
Inverter	An electrical circuit that generates an AC voltage source from a DC voltage source.
IGBT	Insulated gate bipolar transistors
kVA	KiloVolt-Ampere; is equal to 1000 Volt-Ampere.
kVAR	KiloVolt-Amperes reactive.
kW	KiloWatt; a measure of real power, equal to 1000 watts.
L	Line.
LCD	Liquid-Crystal Display unit.
LED	Light Emitting Diode.
Load	Connected to the UPS output, such as computer systems or critical devices.
Low battery shutdown	The battery has reached the lowest permitted operating voltage, and the inverter has shutdown (disconnecting the load) to protect the battery from damage due to further discharge.
Mains or Mains 1	Main AC input source.
Mains 2	Bypass AC input source.
mA	Milliamperere.
MAX.	Maximum.
MCM	Thousand circular mil; standard wire sizes for multiple stranded conductors over 4/0 AWG in diameter. M is from Roman numerical system indicating 1000.
M-M	Multi-Module.
Module	Refers to individual power inverter module.
N	Neutral.
NC	Normally close.
NEC	National Electrical Code.
NFPA	National Fire Protection Association.

NO. or No.	Part number.
NO	Normally open.
Online mode	Inverter output power is the primary energy source to load.
Offline mode	Inverter output is off, and the load connected at the inverter output receives power from utility line via a static transfer switch or maintenance bypass relay.
OSHA	Occupational Safety and Health Agency.
PCA	Printed circuit assembly.
PCB	Printed circuit board.
P.F.	Power Factor.
PWM	Pulse Width Modulation.
Rectifier/Charger	Converts the AC input voltage from the utility source into DC voltage, supplying the inverter and regulating the charge of the battery system.
SCR	Silicon controlled rectifier.
Shipping damage	Any damage done to an article while it is in transit.
S-M	Single-Module.
SPDT	Single Pole Double Throw.
SSC	Static Switch Cabinet (in shared systems).
Static Transfer Switch	A solid state switching mechanism electronically controlled to pass AC power directly from the utility to an output load.
Sync or synch	Synchronization.
Technician	Refers to an electronic technician qualified to maintain and repair electronic equipment. Not necessarily qualified to install electrical wiring.
Test connector	DB-9 type connector on the LCD panel allowing MGE UPS SYSTEMS Customer Support Service technician to access programmable and diagnostic features of the system.
Test/Maintenance Mode	Maintenance bypass circuit breaker is closed and system output circuit breaker is open.
UPS	Uninterruptible power system.
V	Volts.
VA	Volt amperes.
VA	Volt-amps, unit for apparent power measurement, equal $V \times I$.
VAC or Vac	Voltage of AC type.
VDC or Vdc	Voltage of DC type.

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