

**Standard Features**

- ▶ Epsilon 200A System
- ▶ Epsilon 400A/600A System



## **Epsilon STS™**

*200A and 400A/600A  
Static Transfer Switch*

### ***Installation and User Manual***

86-504004-00 B03



# Epsilon STS™

## 200A and 400A/600A Static Transfer Switch

### Installation and User manual

#### Revision History

Epsilon STS 200A and 400A/600A STS, *Installation and User Manual* 86-12345-00 B02

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	B02	ECN:#004471	07/2005
	B03	ECN:#004991	10/2006

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#### **Customer Care Center:**

1-800-438-7373 (Hours: 24/7)

**M G E**  
**UPS SYSTEMS**



## IMPORTANT SAFETY INSTRUCTIONS

**SAVE THESE INSTRUCTIONS** – This manual contains important instructions for the Epsilon STS™ 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.

## Certification Standards

- ▶ IEEE 587-1980/ANSI C62.41 for Cat. B3, 1980 Standards for Surge Withstand Ability
- ▶ FCC rules and regulations of Part 15, Subpart J, Class A , EN50081-2 (use shielded cables)
- ▶ UL listed under 1008, Standards for Transfer Switch Equipment.
- ▶ NEMA PE 1 (National Electrical Manufacturers Association) - Uninterruptible Power Systems
- ▶ NEMA 250 (National Electrical Manufacturers Association)
  - Enclosures for Electrical Equipment (1000 Volts Maximum)
- ▶ NFPA 70 – National Electrical Code
- ▶ ISO 9001 Quality Assurance, NEC, ANSI, NEMA, NFPA, IEEE.
- ▶ Occupational Safety & Health Administration (OSHA)



**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'accès**.

**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 **INGESCHRÄNKTEN 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.**

## How to use this manual and Symbol Usage

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

This manual uses four icon symbols with text to convey important information and tips.



**WARNING**

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



**CAUTION**

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



**IMPORTANT**

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



**NOTE**

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

## **CAUTION: Record All Serial Numbers!**

**RECORD ALL SERIAL NUMBERS FOR THE Epilson STS™ 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!**

**UPS SERIAL NUMBER:** \_\_\_\_\_

**MODULE SERIAL NUMBER:** \_\_\_\_\_

**BATTERY SERIAL NUMBER:** \_\_\_\_\_

**ADDITIONAL MODULES SERIAL NUMBERS:**

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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**CAUTION**

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**Scheduling of the MGE Field Service Engineers typically should be done 7 to 10 days before they are required on-site. If the startup of the UPS is critical to maintaining your schedule, please call the MGE toll free telephone number at 1-800-438-7373 for assistance.**

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**Final installation and start-up should be completed by a qualified MGE Field Service Engineer.**

This On-site Quick Start will guide qualified engineers through unpacking and positioning the unit, the equipment, tools, and steps required to perform power input/output connections to prepare the unit for MGE Field Service Engineers to perform on-site final installation and startup.

**To insure a successful installation, each of these (4) steps should be followed in their correct sequence. Note that any unauthorized installation may cause damage to the UPS(s) and void the MGE warranty.**

## **First steps by an on-site qualified Technical Engineer**

- Step 1.      Unpack and position the unit
- Step 2.      Connect the main (utility) power
- Step 3.      Connect the output to the power distribution panel
- Step 4.      The MGE Field Service Engineer finalizes installation and the startup process.

Optional :    Procedure for temporary power prior to the final startup.

## **Required Equipment and Tools**

The following equipment and tools are recommended for on-site installation:

- ▶ Digital volt meter (DVM)
- ▶ 1/8 inch slotted screwdriver
- ▶ Pallet jack/forklift
- ▶ Conduit installation tools
- ▶ Nut driver set

## Step 1 Unpacking

Once the Epsilon STS™ UPS System has been inspected and received from the shipping courier, the unit should be moved with the use of a fork lift or pallet jack to a position as close to the final installation location as possible.

Prior to any installation, the following items should be observed upon receipt of the Epsilon STSTM 10-30 kVA UPS.

1. Inspect shipment for any damage prior to receipt. Damage claims should be filed directly with the courier. Replacements for damaged components should be ordered through MGE Customer Support Services at 1-800-438-7373.
2. Remove wrapping and foam corners to verify that the equipment nameplate (located on the inside door of the cabinet) details a system that corresponds with the equipment ordered. See Figure QS-1.
3. The casters on the unit will allow it to be positioned into the final installation location. At this point, the leveling legs can be adjusted to provide a level and stable footing for the Epsilon STS™ system.

**Figure QS-1** Positioning of 200A Epsilon STS™.

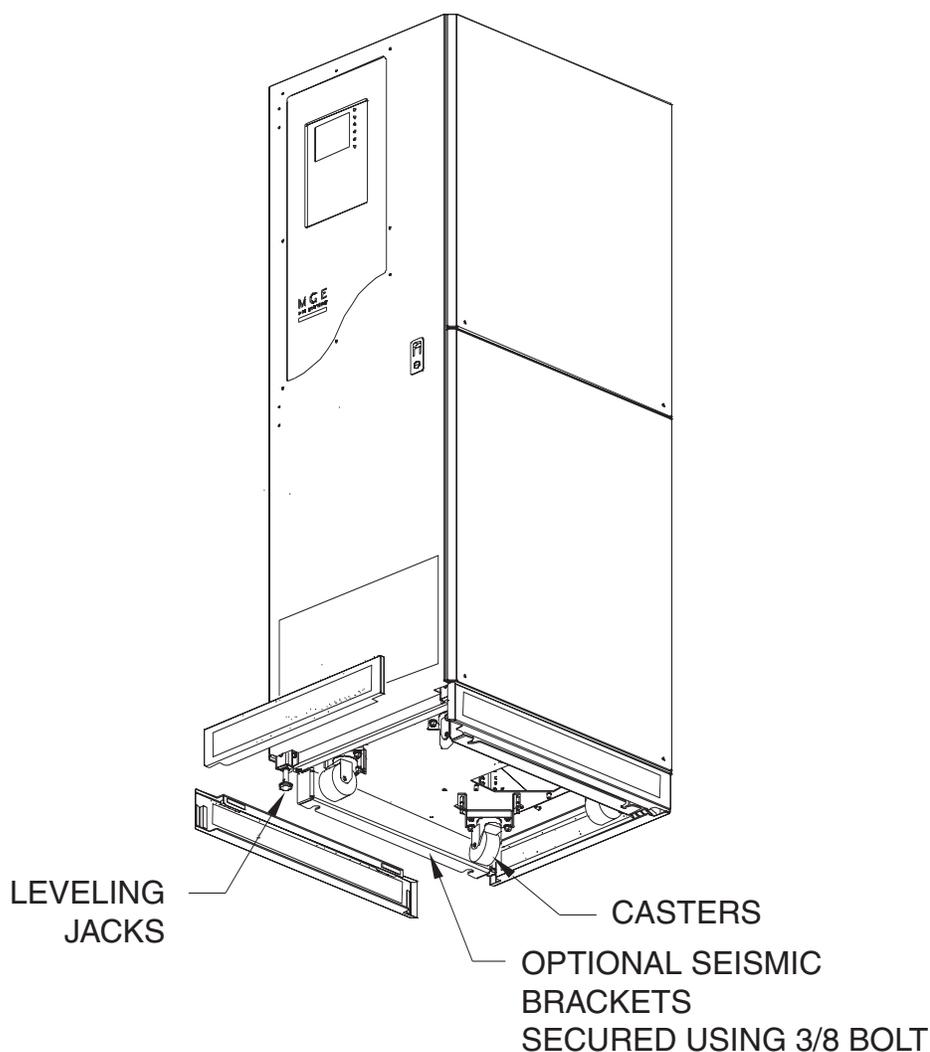
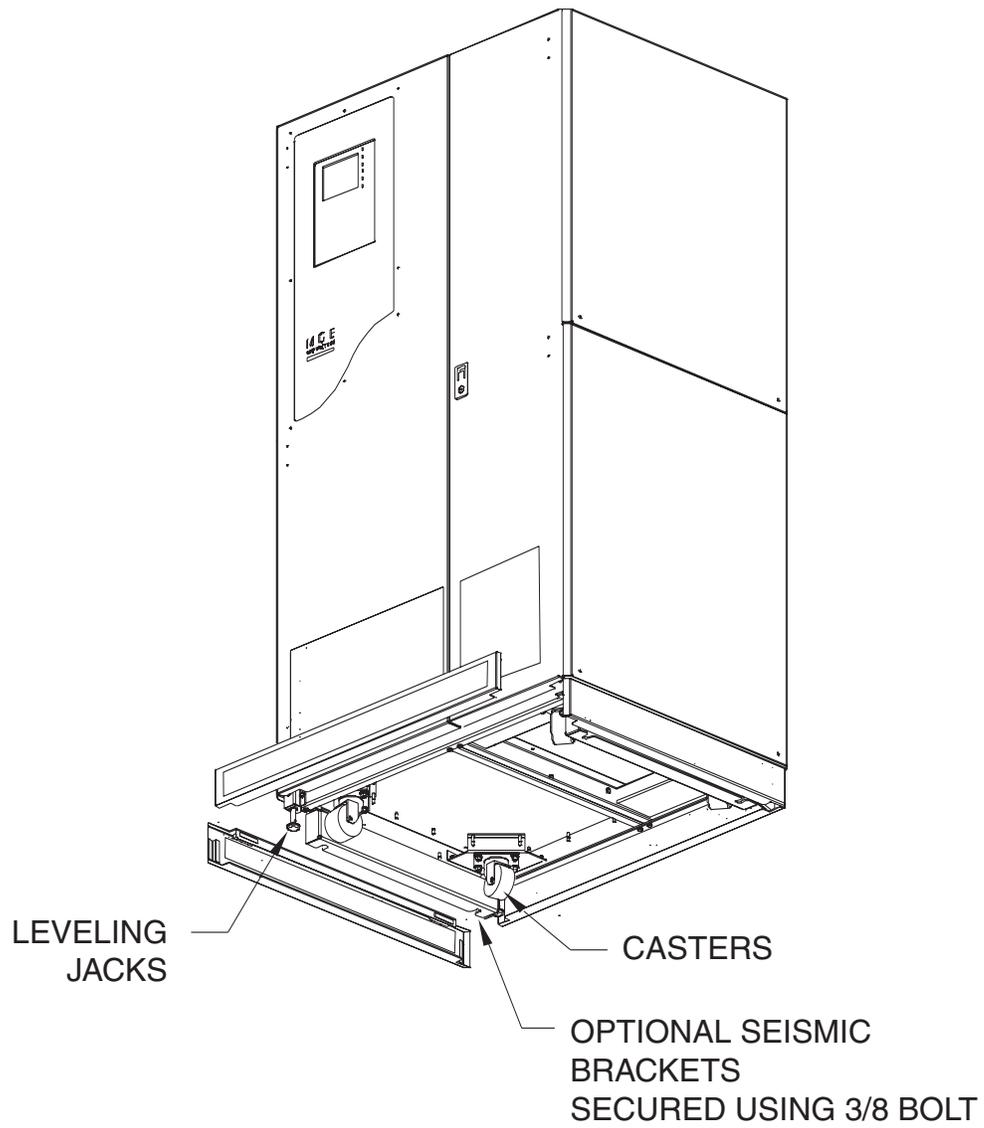


Figure QS-2 Positioning of 400/600A Epsilon STS™



## Step 2 Connection of Utility Power Inputs

### Connect Input Power from Two Sources

The Epsilon STS™ systems provides for either top or bottom cable entry. Connections are to be made with 75°C copper wire cables and using the lugs supplied with the STS unit. Refer to section 2.0 Installation and/or the system installation drawing(s) for more details (such as cable size and number of conductors).



**NOTE:**

**Three phase input power supplied as a Wye must have a separate, solidly grounded neutral that will be connected to the STS neutral busbar. If neutral is not supplied or not required for the load, connect only three phases and ground.**

**It is recommended to use isolation transformers so that the neutral of both AC sources can be grounded to the same potential.**

## Step 3 Connection of the Load Outputs

The Epsilon STS™ system provides for either top or bottom cable entry. Connections are to be made with 75°C copper wire cables and using the lugs supplied with the STS unit. Refer to section 2.0 Installation and/or the system installation drawing(s) for more details (such as cable size and number of conductors).



**NOTE:**

**Input and output cables inside the STS cabinet must be braced at 12" intervals as shown in Figures QS-3 and QS-4.**

**For Control Wiring connections refer to section 2.0 Installation.**

**Figure QS-3** 200A STS Input/Output Power Connections.

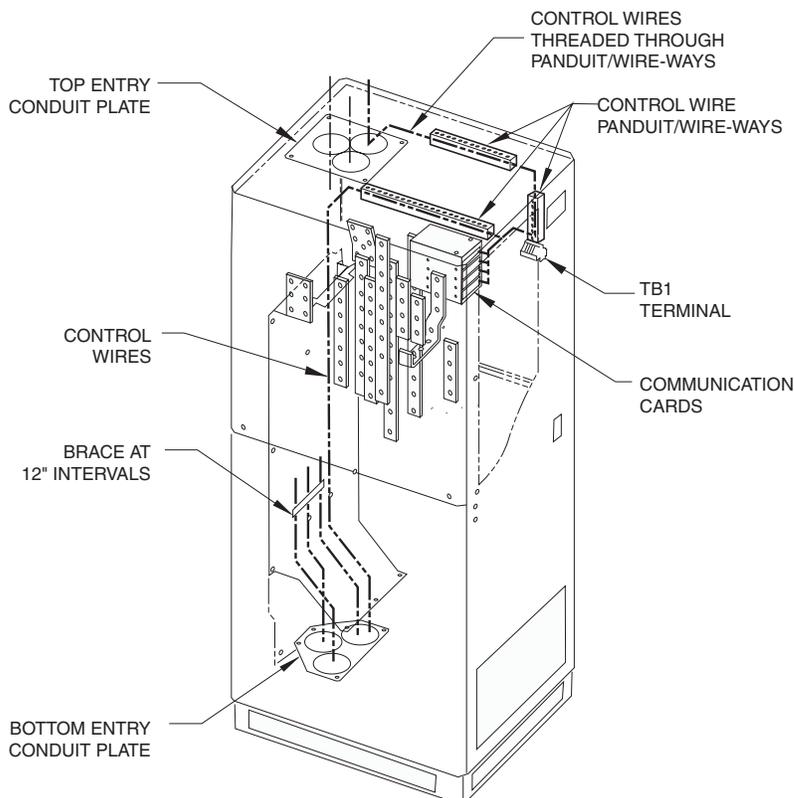
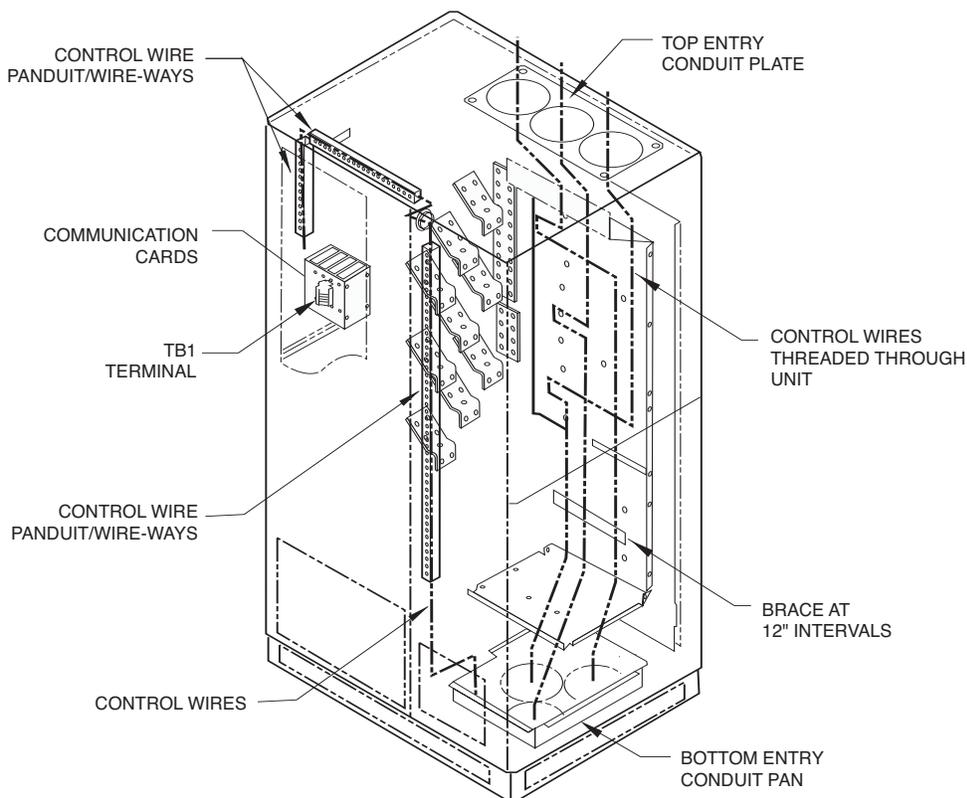


Figure QS-4 400/600A STS Input/Output Power Connections.



### Step 4 Arrival of MGE Field Engineer

The MGE Field Engineer will finalize the initial Epsilon STS™ start-up. To insure a successful installation and reliable STS service, the MGE Field Engineer will verify all of the installation connections, fusing, and then will examine the extensive set of Epsilon STS™ personalization parameters to insure that the operation of the STS exactly matches your installation requirements.

**Optional Steps**

Should you require AC power on site prior to the arrival of the MGE Field Engineer, the following procedure will provide the AC power in the bypass mode. Should you have any questions about this procedure, do not hesitate to contact MGE Customer Support.

- A. Ensure that all switches, CB1-5 in the STS are open (off).
- B. Apply input power to the source S1 input of the STS by closing the upstream circuit breaker for source S1. The STS controls will power up and issues alarm(s). Silence the alarm buzzer by pressing the “Alarm Silence” pushbutton on the front display panel.
- C. Lock CB5 (S2 bypass switch) and remove the lock key (for 4-interlock system, also lock CB2 and remove key). Using key(s), unlock and close CB4 (S1 bypass switch).
- D. At this point, power will be available for site usage until the STS is properly commissioned.
- E. Upon arrival of the MGE Field Service Engineer, the main power must be disconnected so that a safe and proper commissioning of the unit may be accomplished.



**WARNING** Do not, under any circumstance, close CB1, CB2, CB3A and CB3B (if installed) until the unit has been commissioned by an MGE Field Engineer.

Figure QS-5a 200A STS

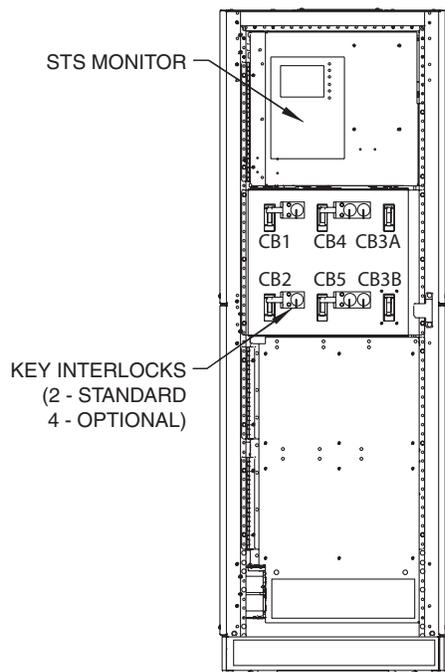
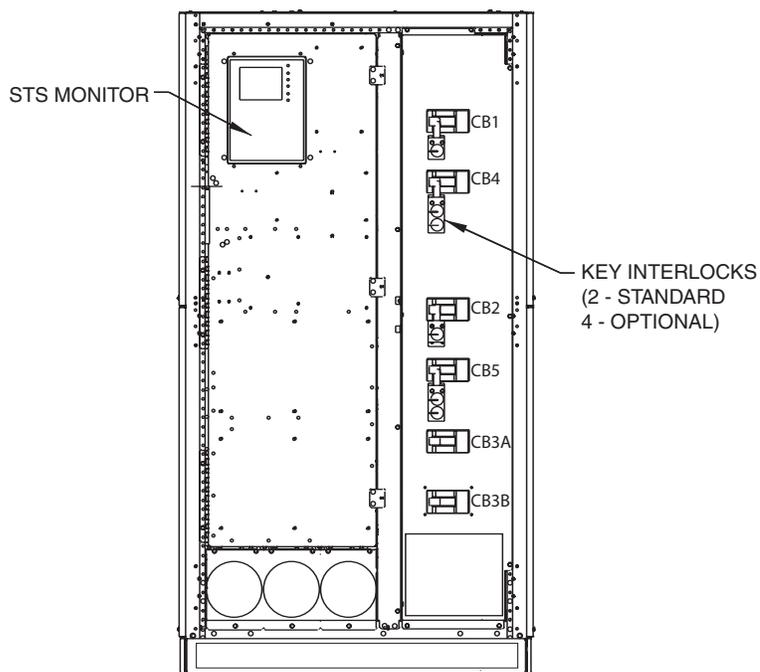


Figure QS-5b 400/600A STS



## 1.0 Scope

Introduction is a general description of system characteristics of Epsilon STS™, its intended use and applicable electrical, mechanical and environmental specifications.

## 1.1 Reference Manuals

160304-00 C00 JBUS/RS232, Installation and User manual.

## 1.2 Section Descriptions

### Quick Start

This Quick Start will guide qualified engineers through unpacking and positioning the unit, the equipment, tools, and steps required to perform power input/output connections to prepare the unit for MGE Field Service Engineers to perform on-site final installation and startup.

#### 1 Introduction

Introduction is a general description of system characteristics of Epsilon STS™, its intended use and applicable electrical, mechanical and environmental specifications.

#### 2 Setup and Installation

Setup and Installation guides the User through tools and equipment required for making hardwire connections. Included are power cable connections with wire diagrams for configuring the product to specifications, and obtaining MGE field service assistance for final installation and startup.

#### 3 Operation

Operation describes Epsilon STS™ system characteristics of indicators and controls, startup and shutdown procedures, safety checklists, modes and specifications and theory of operating the Epsilon STS™ system.

## 1.3 General Description

The Epsilon STS™ system is available in two different cabinet sizes. Dimensions for the cabinets are:

- ▶ 200A cabinet: 72"H x 24"W x 30"D
- ▶ 400A/600A cabinet: 72"H x 38"W x 30"D

Both cabinets are designed to provide for top and/or bottom entry of input and output power feeds.

The Epsilon STS™ system can be purchased to accept 208 VAC, 220 VAC, 240 VAC, 440 VAC, 480 VAC, 575 VAC or 600 VAC utility feed.

Figure 1-1a: Epsilon STS™ - 200A Cabinet.



Figure 1-1b: Epsilon STS™ - 400/600A Cabinet.



### Physical Characteristics

<b>Enclosure Type</b>	NEMA 1, Free-standing, modular configured with hinged dead front construction protecting high voltage areas.
<b>Enclosure Dimensions</b>	Depth: 30" (System will pass through standard 36" wide door). Height: 72". Width: 24" for 200A STS; 38" for 400A and 600A STS.
<b>Accessibility</b>	Front access for operation and maintenance. Front or side access for customer power connection points.
<b>Power Connections/ Busbars</b>	All power connections and terminations to be solid copper braced rated for 100KAIC.(400/600A models may be a combination of copper busbars and cables).
<b>Cable Entry</b>	Top and Bottom.
<b>Mounting</b>	360° Casters and Leveling Jacks with 1" minimum adjustment.

## 1.4 Epsilon STS™ System Characteristics

The Epsilon digital Static Transfer Switch (STS) is a solid state, three-phase, break-before-make, dual position switch designed to connect a critical three-phase load to one of two separate, independent, synchronized sources of three-phase power. The STS consists of six pairs of SCR's connected in an AC switch configuration. Each 3-phase input is fed through a molded case automatic switch which provides short circuit protection by means of a magnetic trip only. The switch then feeds three pairs of “hockey-puck” SCR's, each pair consisting of two SCR's in an anti-parallel arrangement. The SCR outputs for each corresponding phase from both inputs are then connected and fed through an output isolation molded case switch to the output terminals. These SCR's are rated to carry the full 100% load (continuous rated) while operated as stipulated herein and at the maximum ambient temperature specified. The source to which the load is normally connected to is designated as the “Preferred” source, and the other redundant, standby source is the “Alternate” source. Selection of which input source is preferred is user selectable from the operator control panel, by control contact inputs, or through the communications port(s).

In normal operation, the load is connected to the preferred source as long as all phases of the preferred source are within the acceptable limits. Upon failure of the preferred source (more degraded than the alternate source), the load will be transferred to the alternate source until such time as the preferred source returns to within acceptable limits. The switching action itself is practically instantaneous and the time involved in the operation is mainly the sensing time required to determine that a transfer is necessary, normally a small fraction of a cycle.

The STS is controlled by a number of system operating variables which define the operation and performance of the system. Many of these variables may be adjusted for site-specific criteria.

The determination to transfer from one source to the other involves the evaluation of Source Qualities and System Operating parameters:

<b>Source Quality</b>	Concerns the evaluation of a sources ability to support the critical load by evaluating the voltage, phase, current and frequency of a source on a real time basis.
<b>System Operating</b>	Parameters control transfers between the two sources, given the state of both sources and the load together with the specified site-specific operating criteria.

During a transfer (or re-transfer), the SCR's of the loaded source are turned off and the SCR's of the previously unloaded source are turned on in such a way as to prevent any cross-current between sources, even if the sources have large phase displacement. Normally, transfer between sources with large phase difference is not allowed.

The molded case switches with magnetic trips will provide short circuit protection only – overcurrent protection must be provided by upstream and/or downstream devices.

Triple-redundant control power supplies, independent gate drive circuits for each sources SCR switch and other design features provide the optimal level of reliability and immunity to single point failures. The Epsilon STS™ is also built to withstand up to 100KA of available short circuit current.

A Bypassing scheme is provided. This can be used to manually bypass the AC load directly to either of the two power sources and isolate the static switching for servicing.

The Epsilon STS™ is available in three current ratings – 200A, 400A and 600A (208-600V range). The 200A model is natural convection cooled. The 400A and 600A models use forced air cooling by fans (with one redundant fan). The STS is designed for installation in a room where humidity and temperature can be controlled. The recommended and maximum environmental parameters are listed in Appendix B, of this document.

The Epsilon STS™ is listed for safety by Underwriters Laboratories, Inc. (UL) under UL Standard 1008.

## 1.4.1 PMM<sup>2</sup> Plus and PMM<sup>2</sup> Ultra

In the PMM<sup>2</sup> Plus configuration, the input of the PMM<sup>2</sup> cabinet is supplied by the output of the STS. The dual input distribution system accepts two independent AC input sources feeding to the STS. If the preferred input source power is not available, the STS will transfer to the alternate input source, avoiding interruption to the critical load. The output power is conditioned and stepped down to distribution voltage via an isolation transformer, feeding panelboards or main frame circuit breakers.

In the PMM<sup>2</sup> Ultra configuration, an isolation transformer feeds each STS input source upstream of the STS. The transformer secondary output of the PMM<sup>2</sup>-1 (left cabinet) supplies the Source-1 input and PMM<sup>2</sup>-2 (right cabinet) supplies Source-2 input of the STS cabinet. If the preferred source input power is not available, the STS will transfer to the alternate input source, avoiding interruption to the critical load. The output of the STS connects to the output busbars of the PMM<sup>2</sup>-1 and PMM<sup>2</sup>-2 cabinets, feeding panelboards or main frame

Figure 1-2: PMM<sup>2</sup> and PMM<sup>2</sup> Ultra Cabinets.

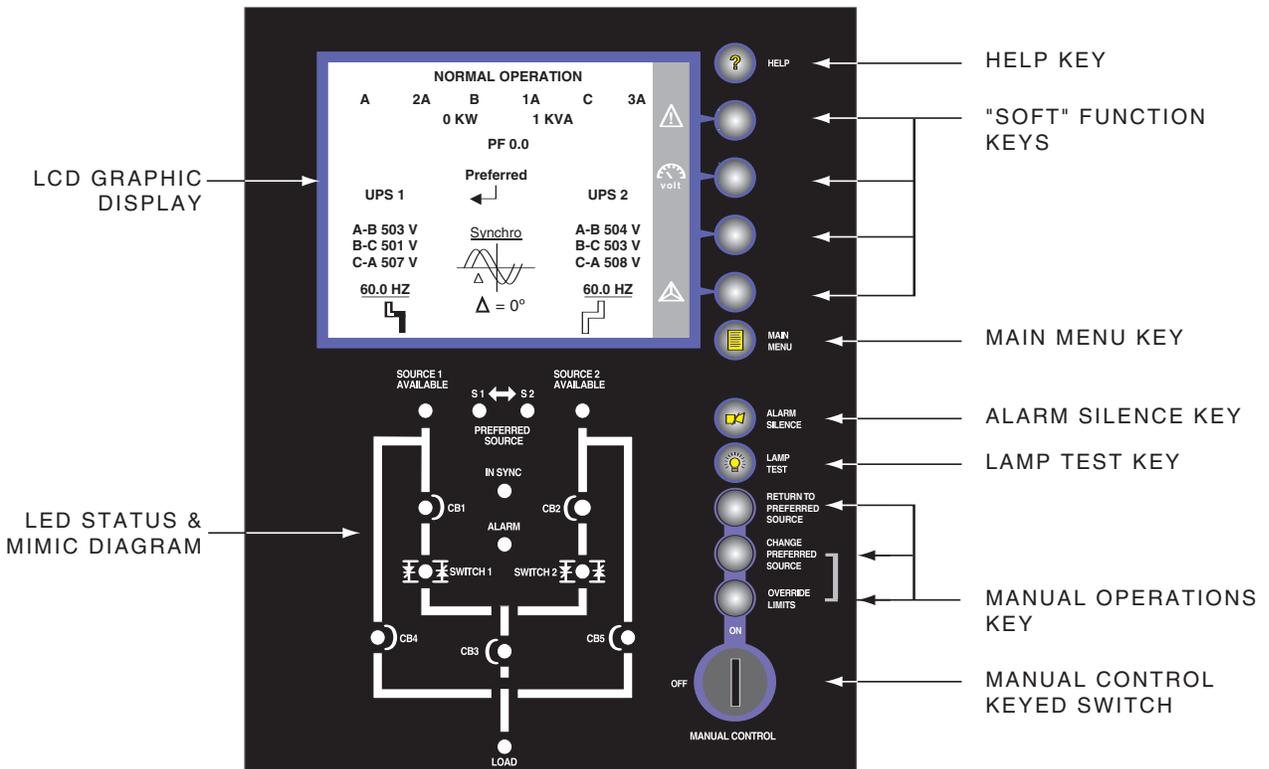


## 1.5 System Major Components

<b>Source #1 CB1</b>	Input isolation molded case switch with magnetic trip for isolating SCR static switch #1 and associated components from source S1.
<b>Source #2 CB2</b>	Input isolation molded case switch with magnetic trip for isolating SCR static switch #2 and associated components from source S2.
<b>Output CB3A</b>	Output isolation molded case switch with magnetic trip for isolating both static switch sections from the load.
<b>Output CB3B</b>	Optional, redundant output isolation molded case switch with magnetic trip (paralleled with CB3A) for isolating both static switch sections from the load.
<b>Source #1 Bypass CB4</b>	Maintenance bypass molded case switch with magnetic trip for bypassing the static switch section and connecting the load directly to source S1.
<b>Source #2 Bypass CB5</b>	Maintenance bypass molded case switch with magnetic trip for bypassing the static switch section and connecting the load directly to source S2.
<b>Keyed Interlocks</b>	Provided on the two bypass switches to prevent closure of both at the same time. An optional interlocking scheme is available for additional keyed interlocks on the source isolation switches to ensure that, prior to bypassing to a particular source, the STS transfers the load to that source if the load is not already being powered by that source. On closure of a bypass switch, the control logic will also shunt trip opposite bypass and input isolation switches if necessary to prevent cross-connection of the two sources.
<b>SCR Static Switch Assy.</b>	Three heatsink assemblies containing six pairs of “hockey-puck” SCR's. Switch #1 and #2 (each having 3 pairs of SCR's) automatically switch the load to either source S1 or S2.
<b>Control Electronics</b>	The microprocessor-based core control uses FPGA's for input and output signal processing and control sequencing to optimize sensing time.
<b>Front Display Panel</b>	The LCD screen, pushbuttons and LED mimic diagram make up the display.
<b>Gate Drive &amp; Acq. PCA</b>	Independent gate drive and acquisition circuits for each sources SCR switch.
<b>Backfeed Protection Assy</b>	A separate redundant circuit for each source provides backfeed protection to ensure that there is no cross-connection between the two sources in the event of a shorted SCR on the inactive source with the upstream circuit breaker open.
<b>TVSS Assemblies</b>	Optional Transient Voltage Surge Suppressor on each source input.
<b>Triple-Redundant Control Power Supplies</b>	Three, independent DC control power supply assemblies (fed from each of the two sources and the STS output) provide redundant DC control power.
<b>CB Control Assembly</b>	A separate circuit supplies DC control power (fed directly from the output terminals) for shunt-tripping the power switches CB1-5 and for supplying EPO power even in maintenance bypass mode.
<b>Output Snubber Assembly</b>	Provides preload under no-load conditions.
<b>Communications Card Cage</b>	Relay card providing programmable contacts (6 outputs/2 inputs) and JBUS card for RS232 or RS485 connections. Two slots available for options.
<b>Customer Terminal Block</b>	Terminals for connection of remote Emergency Power Off (EPO) and Source Loss Test switch.
<b>Fans (400/600A Models only)</b>	Ventilation fans provide forced-air cooling in the 400/600A models. 200A models are convection cooled.

- Front Display Panel**      Comprised of a 4.7" x 3.6" LCD with associated "soft" keys for monitoring status, alarms, changing certain settings and performing certain operations; an LED "mimic" diagram display for indicating switch status and power flow; and manual control pushbuttons for manual transfer functions.
- Hard Keys**              Manual, dedicated keys (pushbuttons) that have a single function.
- Input Power**             The Epsilon STS™ is normally connected to two separate, independent sources, Source S1 and Source S2. Power from each source can be provided by the electrical utility company, a generator or a UPS.
- SCR Switch**             A set of three pairs of SCR's that function as a three-phase, AC switch for each source.
- Soft Keys**                Programmable keys (pushbuttons) associated with the LCD, that can be used for several different functions depending on the displayed screen
- Static Transfer Switch (STS)** All components within the Epsilon STS™ cabinet that function as a system to transfer the critical load between two independent sources of power using solid-state SCR switches or bypass to either source using manual bypass switches
- PMM² Plus**                A configuration with the Epsilon STS™ and PMM² cabinet. The input of the PMM² cabinet is supplied by the output of the STS. Refer to the PMM² manual 86-505004-00 for more details.
- PMM² Ultra**              A configuration with the Epsilon STS™ and PMM² cabinet. PMM² isolation transformers feed each STS input source upstream of the STS. The transformer secondary output of the PMM²-1 (left cabinet) supplies the Source-1 input and PMM²-2 (right cabinet) supplies Source-2 input of the STS cabinet. The output of the STS connects to the output busbars of the PMM²-1 and PMM²-2 cabinets, feeding panelboards or main frame circuit breakers. Refer to the PMM² manual 86-505004-00 for more details.

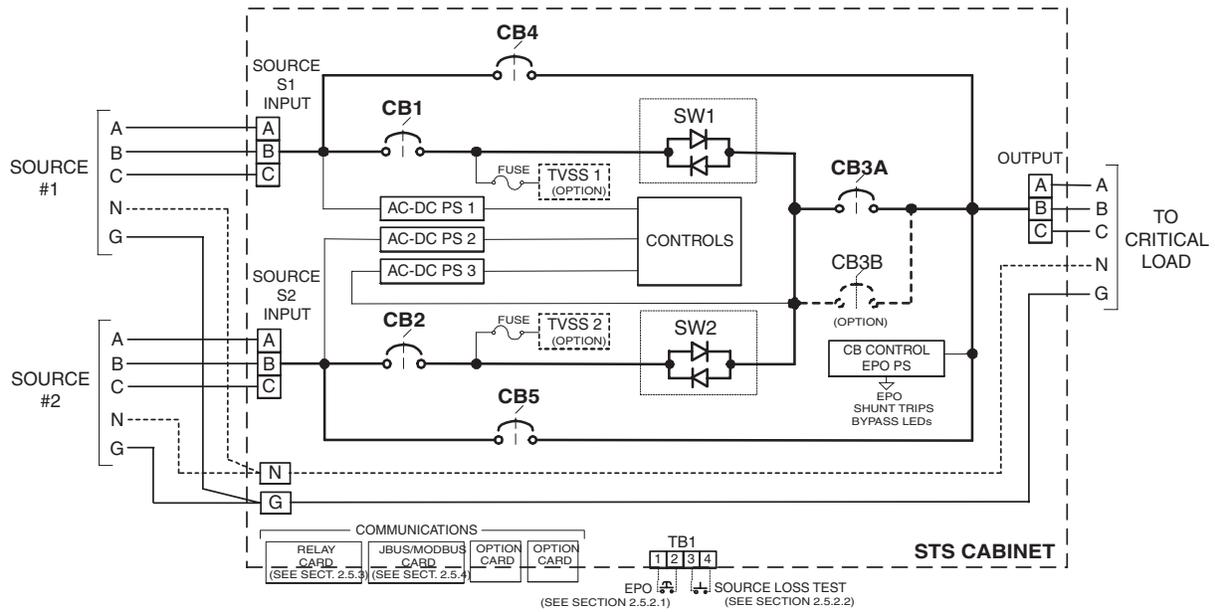
Figure 1-3: Operator Input Display.



### 1.6 Single Line Diagram

During normal operation, CB1, 2, 3A and 3B (if installed) are closed and the load receives power from the designated preferred source through either SW1 or SW2 SCR switch. In the event of a preferred source failure, the STS will transfer the load to the alternate source in a fraction of a cycle. If bypassed by closing either CB4 or CB5 bypass switch, CB1, 2, 3A and 3B (if installed) are opened, isolating the static switch section for maintenance.

Figure 1-4: Single Line Diagram, Epsilon STS™ with Options.



## 1.7 System Specifications

<b>Recommended environment</b>	20° to 25°C (68° to 77°F); 50% relative humidity; computer room or other temperature and humidity-controlled environment.
<b>Operating temperature</b>	10° to 40°C (50° to 104°F).
<b>Storage</b>	-10° to 60°C (-14° to 140°F).
<b>Humidity</b>	up to 95% non-condensing (operating).
<b>Altitude</b>	sea level to 8,500 feet without derating.
<b>Acoustic noise</b>	65 dBA typical at rated load as measured 5 feet from the front of the STS module.

### 1.7.1 Electrical Electrical Characteristics

<b>Nominal Input Voltage</b>	208, 220, 240, 440, 480, 575, 600 VAC ± 15%, three(3) phase, 3 or 4-wire plus ground.
<b>Nominal Output Voltage</b>	208, 220, 240, 440, 480, 575,600 VAC ± 15%, three(3) phase, 3 or 4-wire plus ground to correspond with input voltage. .
<b>Maximum Continuous Current</b>	200, 400, 600 Amps.
<b>Molded Case Switch Rating</b>	250, 400, 600 Amps.
<b>Input/Output Frequency</b>	50/60 Hz ± 5 Hz.
<b>Load Power Factor</b>	Unity to 0.60 lagging or leading.
<b>Non-Linear Loads Capability</b>	100% of its rating up to maximum crest factor of 3.5.
<b>Overload Rating</b>	150% for 15 minutes; 1000% for three(3) cycles.
<b>Source Voltage Distortion</b>	Up to 10% THD with notching and ringing transients.
<b>Output Voltage Distortion</b>	Less than 1% added.
<b>Voltage Transient Withstand</b>	Up to 6 KV (6000 volt spike) per IEEE C62.41 for Cat. B3. Meets EN 50082-1 (with optional TVSS installed). Such transient levels shall not effect the operation of the STS. The STS may transfer on over-voltage conditions.
<b>Short Circuit Withstand</b>	Up to 100KA.
<b>Harmonic Current</b> (Feedback from the Load)	Unlimited.
<b>Emission Limits</b>	Meets FCC Part 15 Class A, EN 50081-2.

## 1.72 Electrical Cable Access and Connections

Electrical connections and other cabinet interconnection will vary depending upon the configuration and options selected with your Epsilon STS™ system. Refer to the installation drawings supplied with your equipment.



### CAUTION:

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**Before making any electrical connections, verify that all circuit breakers are in the "off" position. Customer-supplied upstream protective devices and distribution circuits should be OFF.**

**Risk of Electric Shock. For Plus and Ultra configurations, the PMM<sup>2</sup> equipment receives power from more than one source. Disconnect all sources to this equipment before servicing.**

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## 1.7.3 Connecting Power Cables

To access the connection terminal busbars, open the front door of the Epsilon STS™. Remove the screws securing the swing-out control panel (upper panel in the 200A STS) and open it. Remove the safety panel located in the upper left hand section of the unit.

- a) Connect the 3-phase, ground and neutral (if used) conductors of input AC Source #1 to the Source #1 busbars.
- b) Connect the 3-phase, ground and neutral (if used) conductors of input AC Source #2 to the Source #2 busbars.
- c) Connect the 3-phase, ground and neutral (if used) conductors supplying the load to the Output busbars.
- d) Securely brace all cables at 12" intervals with cable ties.
- e) Replace and secure all panels and covers back in place. rated voltage and tolerances

1.7.4 Accessing Electrical Connections



**CAUTION:**

**Only an authorized electrical professional should access electrical connections. A severe shock hazard exists.**

The ONLY user serviceable items in the Epsilon STS™ unit are:

- A. The input power connections
- B. The load connection
- C. Any wire connections to the customer control terminal block.
- D. The communication card options

The access method for connections made to the communication cards is clearly seen when the front door to the Epsilon STS™ unit is opened. Figure 1-5 and 1-6 show the panduit wire-ways used to thread wire through the conduit plates (top or bottom entry). However, access to the input and load power connections is made through the removal of the safety panel located in the upper left of the Epsilon STS™ front (with the door open). This safety panel is removed by first removing the screws securing the panel. It can then be removed by lifting the safety panel away from the unit.

Figure 1-5: 200A STS Power and Control Wire Connections.

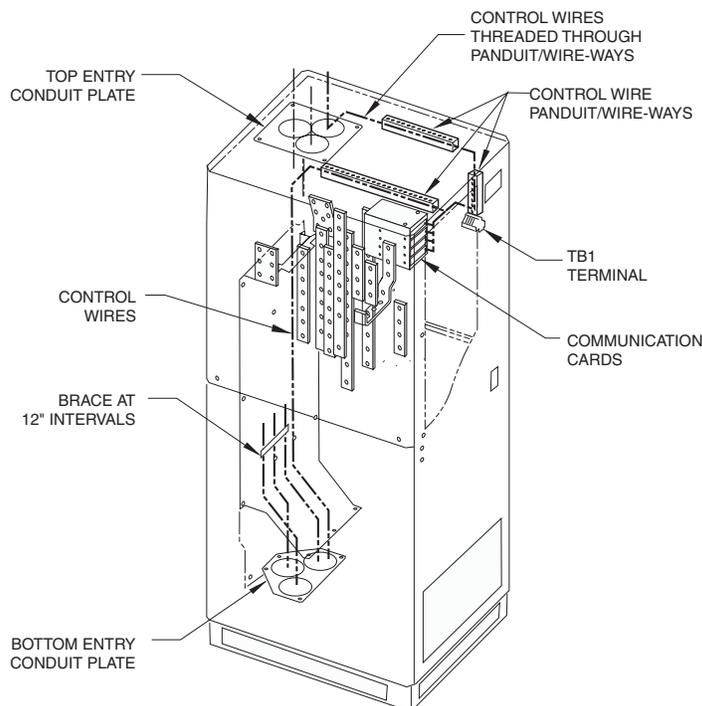


Table 1-1: Input/Output Power Connections.

PHASE	# OF CABLES PER		MINIMUM CABLE SIZE (75°C, CU)	CABLE LUG (SUPPLIED)	CONDUIT HOLE DIA. (QTY.)
	N	GND			
1	2	1	# 4/0 AWG	# 4/0, 3/8" STUD (T&B L973 OR EQUIV.)	2-1/2" (3)

Figure 1-6: 400/600 STS Power and Control Wire Connections.

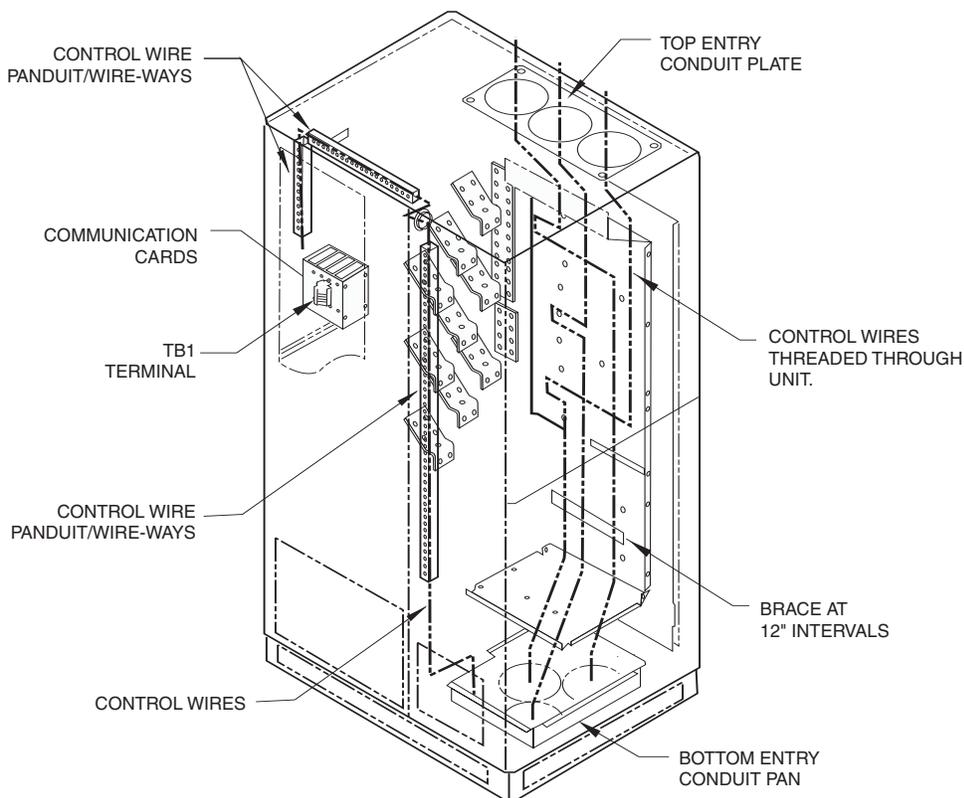


Table 1-2: Input/Output Power Connections.

STS RATING (AMPS)	# OF CABLES PER			MINIMUM CABLE SIZE (75°C, CU)	CABLE LUG (SUPPLIED)	CONDUIT HOLE DIA. (QTY.)
	PHASE	N	GND			
400	2	4	1	# 250 MCM	# 250 MCM, 3/8" STUD (T&B M973 OR EQUIV.)	4" (3)
600	3	5	1	# 250 MCM	# 250 MCM, 3/8" STUD (T&B M973 OR EQUIV.)	4-1/2" (3)

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# Setup and Installation

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## 2.0 Scope

Setup and Installation guides the User through tools and equipment required for making hardwire connections. Included are power cable connections with wire diagrams for configuring the product to specifications, and obtaining MGE field service assistance for final installation and startup.

**Final installation and start-up should be completed and performed by a qualified MGE Field Service Engineer.**



### CAUTION

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**Scheduling of the MGE Field Service Engineers typically should be done 7 to 10 days before they are required on-site. If the startup of the UPS is critical to maintaining your schedule, please call the MGE toll free telephone number at 1-800-438-7373 for assistance.**

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**To insure a successful installation, each of these (5) steps should be followed in their correct sequence. Note that any unauthorized installation may cause damage to the UPS(s) and void the MGE warranty.**

### First steps by an on-site qualified Technical Engineer

- Step 1.      Unpack and position the unit
- Step 2.      Connect the main (utility) power
- Step 3.      Connect the output to the power distribution panel
- Step 4.      The MGE Field Service Engineer finalizes installation and the startup process.
- Optional:    Procedure for temporary power prior to the final startup.

### Required Equipment and Tools

The following equipment and tools are recommended for on-site installation:

- ▶ Digital volt meter (DVM)
- ▶ 1/8 inch slotted screwdriver
- ▶ Pallet jack/forklift
- ▶ Conduit installation tools
- ▶ Nut driver set

## 2.1 Cabinet Placement and Environment

The complete STS system may consist of more than one cabinet depending on whether the STS is a stand-alone unit or it is used in conjunction with input isolation or output distribution cabinets such as the Power Management Module<sup>2</sup> (PMM<sup>2</sup>) cabinets. Cabinets must be arranged in the required positions to ensure proper connections. When facing the Epsilon STS™ from the front, the standard arrangement provides for any PMM<sup>2</sup> Plus auxiliary cabinets to be located on the right hand side. The PMM<sup>2</sup> Ultra has cabinets located on both sides of the STS. The interconnect cables and side barrier(s) are supplied with the PMM<sup>2</sup> cabinet. The interconnect brackets are supplied with the Epsilon STS™.

The Epsilon STS™ is intended for use in an environment where control of temperature and humidity is provided. The maximum operating and recommended environmental parameters are listed in Appendix B.

The Epsilon STS™ cabinets generate heat and exhaust air through the top portion of its enclosures. Air intake is through the lower front or bottom of the cabinet. All other auxiliary cabinets are convection cooled. To assist you in planning for your HVAC needs, heat rejection data is provided in Table 2.1 for a worst case scenario (i.e., maximum rated power output).

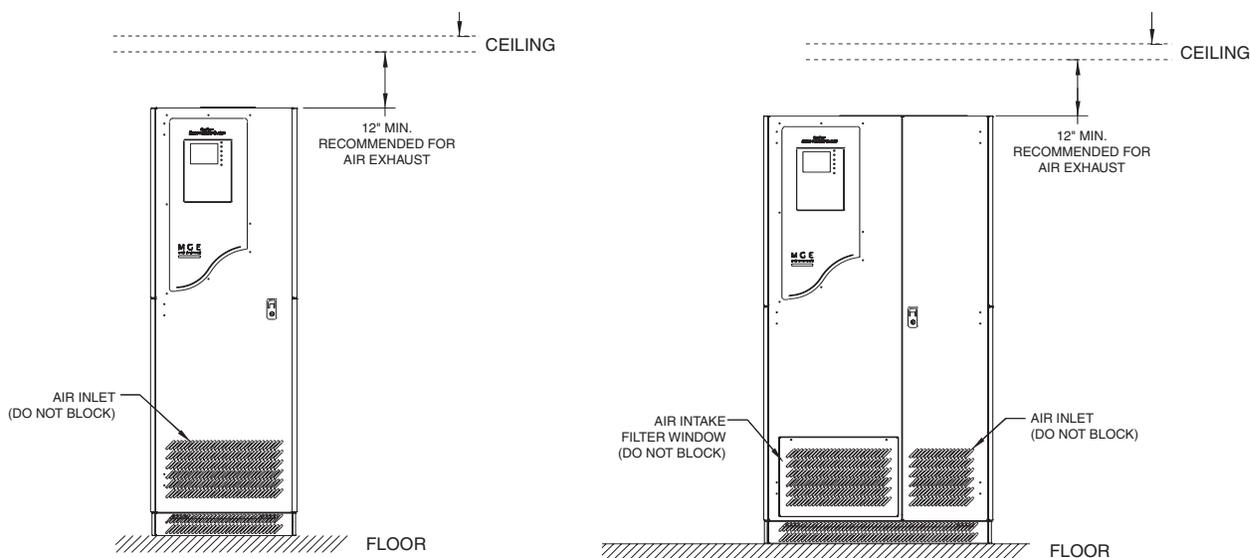
Table 2-1: Heat Rejection Data and Rated Current.

<u>Data</u> <u>STS Module</u>	<u>Rate</u> <u>BTU/Hr</u>
200A	5,600
400A	11,400
600A	16,700

## 2.2 Clearances and FootPrint

As can be seen in the following illustration, the footprint for each cabinet is nominally 30" deep. Additionally, adequate space must be included in the front of each cabinet (approx. 36") to allow the door of the cabinet to be opened for service and maintenance procedures.

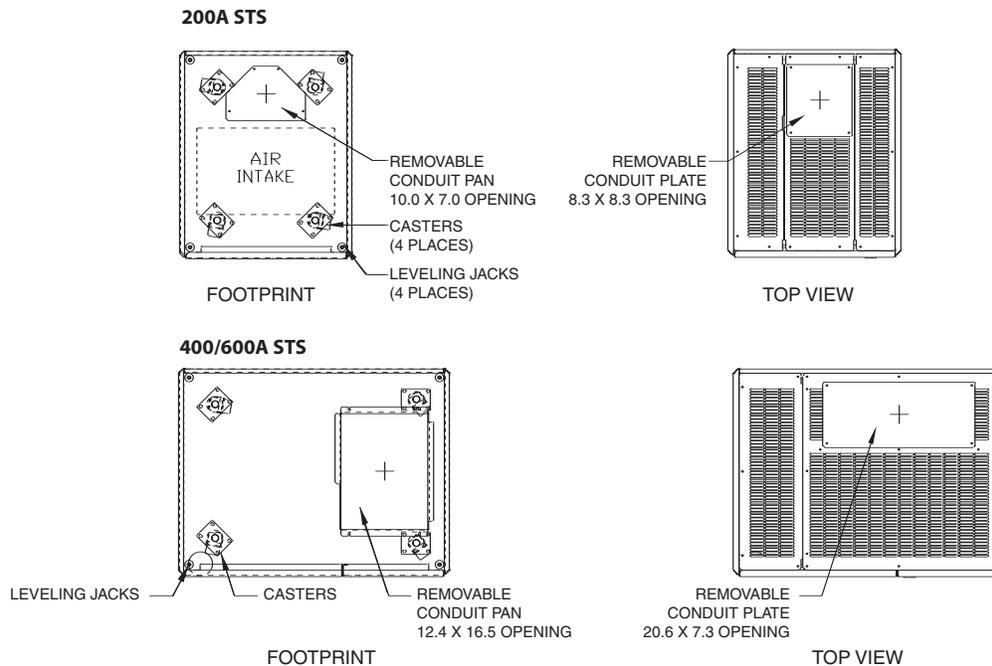
Figure 2-1: 200STS and 400/600A STS Cabinet Clearances.



### 2.2.1 Conduit Plate Location (bottom entry)

Cable entry through the bottom is the standard preferred design for the Epsilon STS™ cabinet. Please see the following figure for the location of the bottom entry conduit plate.

Figure 2-2: 200A /400/600A STS Cabinet Footprint and Top View.



## 2.3 Source #1 AC Input Connections

The connections to be made are the three phases, neutral (if used) and ground cables of input AC Source #1 to the STS. The main 3-phase cables of input Source #1 are terminated at the Source #1 input busbars. Neutral (if supplied) and Ground cables are terminated at the Neutral (N) and Ground (GND) busbars respectively. All cables from Source #1 should be run in a single conduit separately from all other cables (power supply or computer-system interconnection cables). They should not pass near interference-emitting equipment or sensitive loads. Complete wiring instructions for your installation are provided on the installation drawings supplied with the equipment. See Figure 1-5 and 1-6, refer to table 1-1 and 1-2 for details.

### 2.3.1. Source #2 AC Input Connections

The connections to be made are the three phases, neutral (if used) and ground cables of input AC Source #2 to the STS. The main 3-phase cables of input Source #2 are terminated at the Source #2 input busbars. Neutral (if supplied) and Ground cables are terminated at the Neutral (N) and Ground (GND) busbars respectively. All cables from Source #2 should be run in a single conduit separately from all other cables (power supply or computer-system interconnection cables). They should not pass near interference-emitting equipment or sensitive loads. Complete wiring instructions for your installation are provided on the installation drawings supplied with the equipment. See Figure 1-5 and 1-6, refer to table 1-1 and 1-2 for details.

### 2.3.2 AC Output Connections

The connections to be made are the three phases, neutral(if used) and ground cables from the load to the STS. The main 3-phase cables from the load are terminated at the Output busbars. Neutral(if supplied) and Ground cables are terminated at the Neutral(N) and Ground(GND) busbars respectively. All cables from the load should be run in a single conduit separately from all other cables(power supply or computer-system interconnection cables).

They should not pass near interference-emitting equipment or sensitive loads. Complete wiring instructions for your installation are provided on the installation drawings supplied with the equipment.

### 2.3.3 Remote Emergency Power Off (REPO) Cable Connections

Control connections are available for “Remote Emergency Power Off” (REPO) through a customer-supplied normally open dry contact or pushbutton.

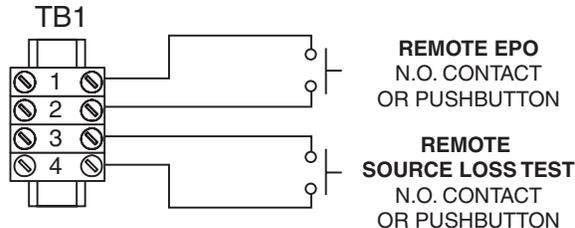
- a) Connect the emergency power off N.O. contact or pushbutton to terminals 1 and 2 of the customer terminal block TB1. Run control wires in the wireway provided in the front portion of the STS cabinet. See Figures 1-5 and 1-6, they show the panduit wire-ways used to thread wire through the conduit plates ( top or bottom entry).
- b) If two or more STS's are connected in parallel to a single REPO contact or pushbutton, ensure that each side of the contact or pushbutton is connected to the same terminal on all the STS's.

### 2.3.4 Remote Source Loss Test Cable Connections

Control connections are available for “Remote Source Loss Test” through a customer-supplied normally open dry contact or pushbutton.

- a) Connect the source loss test N.O. contact or pushbutton to terminals 3 and 4 of the customer terminal block TB1. Run control wires in the wireway provided in the front portion of the STS cabinet. See Figures 1-5 and 1-6, they show the panduit wire-ways used to thread wire through the conduit plates ( top or bottom entry).
- b) If two or more STS's are connected in parallel to a single Source Loss Test contact or pushbutton, ensure that each side of the contact or pushbutton is connected to the same terminal on all the STS's.

Figure 2-3: Control Connections



### 2.3.5 Connection of the Relay Communication Card

The relay communications card contains six programmable dry contact outputs and two programmable dry contact inputs, and is standard on the Epsilon STS™. The inputs and outputs are factory programmed according to functions listed in Table 2-2.

Table 2-2: Relay Contacts (communications card)

	Inputs	Factory Setting	Options (available on both contacts)
1.A		- Select Source S1 as Preferred.	- Reset Memorized Faults. - Select Source S1 as Preferred. - Select Source S2 as Preferred. - Enable Automatic Retransfer. - Disable Automatic Retransfer.
1.B		- Select Source S2 as Preferred.	- Enable Transfers. - Disable Transfers.

Note: 1. Power sources connected to card must be equipped with protection devices with a maximum breaking capacity of 2A.  
2. Connections must be form "C" Dry Contacts.

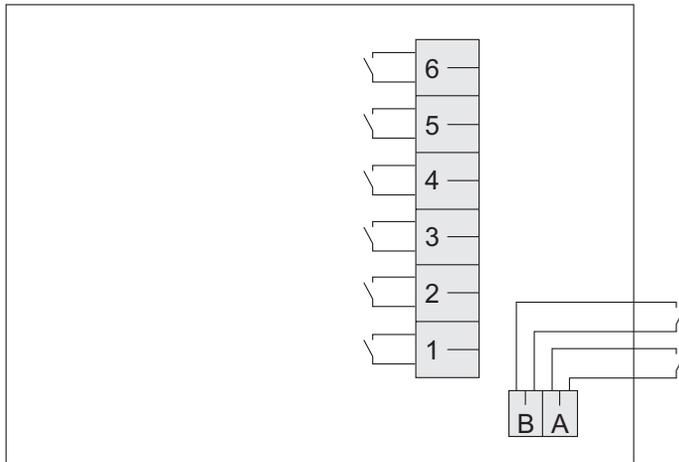
	Outputs	Factory Setting	Options (available on all contacts)
1.1		- Power supplied to Load.	- Power supplied to Load. - Summary Alarm (source or STS fault).
1.2		- Summary Alarm (source or STS fault).	- STS Fault. - Source S1 Out-of-Tolerance. - Source S2 Out-of-Tolerance.
1.3		- STS Fault.	- Sources Out-of-Phase.
1.4		- Overload Condition.	- Source S1 Active. - Source S2 Active.
1.5		- Source S1 Out-of-Tolerance.	- Source S1 is Preferred Source. - Automatic Transfer Disabled.
1.6		- Source S2 Out-of-Tolerance.	- Overload Condition.

The indications 1.X become 2.X for a second optional card of the same type.

### 2.3.6 Characteristics of the Output Contacts

<b>Relay type</b>	Normally Open.
<b>Max. voltage</b>	250VAC, 30VDC.
<b>Max. current</b>	2A.
<b>Cable</b>	4 x 18 AWG, cover plate hole diameter 0.26 inch ± 0.01 inch

Figure 2-4: Output Contacts.



### 2.3.7 Characteristics of the Input Contacts

<b>Switched voltage</b>	5 VDC.
<b>Consumption</b>	10 mA.
<b>Cable</b>	4 x 22 AWG, hole diameter 0.2 inch ± 0.02 inch

Output alarms are always activated on the conditions stated unless requested by the customer to operate on other conditions.

Input contacts are designed for remote STS operation. Use extreme caution when using these contacts so as not to endanger persons or compromise the STS load.



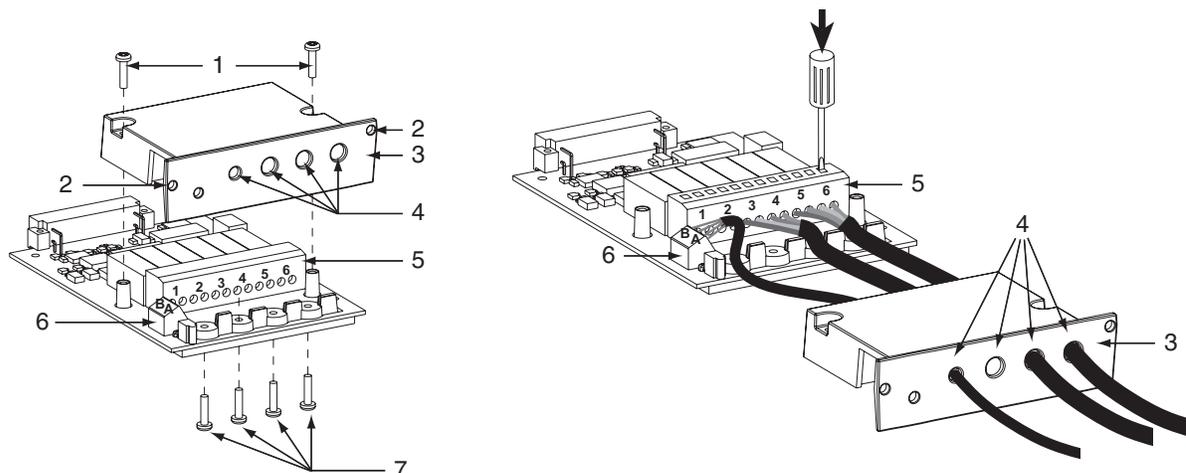
**CAUTION:**

**Isolate and lock-out all power sources for this card before making connections. Never connect ELSV (governed by UL1778) and non-ELSV circuits to the different outputs of the same card.**

### 2.3.8 Removing the Communications Card Cover

- a) Remove the cover “3” secured by the screws “1”.
- b) Run the communications cables through the cable entry holes “4”.
- c) Connect the conductors to the input “6” and output “5” terminal blocks (see connection example in diagram below).

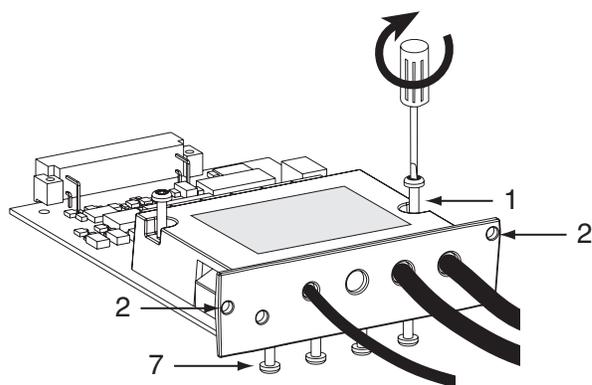
Figure 2-5: Removing the Communications Card Cover.



### 2.3.9 Replacing the Cover

- d) Put the cover back in place and secure it with the screws “1”.
- e) Tighten the screws “7” to clamp the cables.
- f) Indicate the locations of the power sources on the labels.
- g) Insert the card in its slot.
- h) Secure the card with two screws “2”.

Figure 2-6: Replacing the Communications Card Cover.



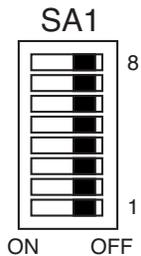
## 2.4 Setting Operation Mode

Set DIP switch SA1 for one of the following configuration modes:

First Card

Standard Mode (default)

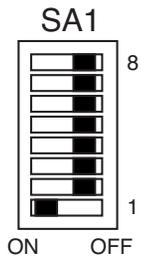
All switches OFF



Second Card (optional)

Standard Mode (default)

SA1 switch 1 ON



First Card

Programmable Mode

SA1 switch 3 ON



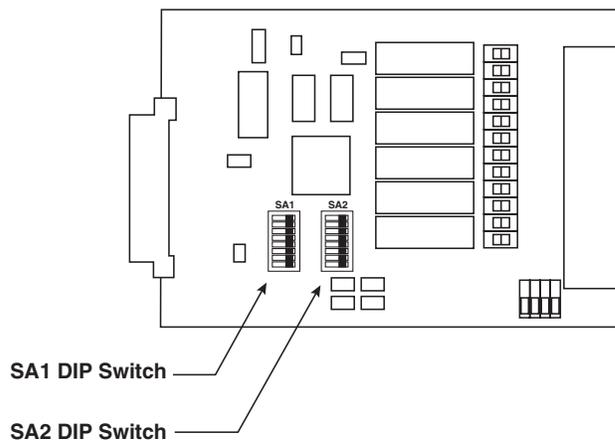
Second Card (optional)

Programmable Mode

SA1 switches 1 & 3 ON



Figure 2-7: SA2 and Dip switch location on communication card.



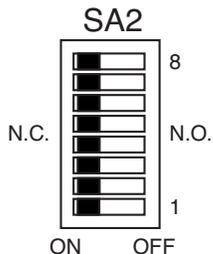
## 2.5 Setting the Output Relay Contacts and Input Switching States

Set DIP switch SA2 for one of the following configuration modes:

N.O. Setting (default)  
All switches OFF



N.C. Setting  
All switches ON



**NOTE:**  
By default, all the relay contacts are Normally Open (NO) (see section 1.4):

- ▶ Contact open = relay not controlled.
- ▶ Contact closed = relay controlled.

By default, the inputs are activated when the external contact is closed (NO):

- ▶ External contact open = input not activated.
- ▶ External contact closed = input activated.

It is possible to individually set each relay and input to N.O. or N.C. mode by setting each switch on SA2 individually. The parameters for relays 1 to 6 are set using SA2 DIP switches 1 to 6 respectively. The parameters for inputs A and B are set using SA2 DIP switches 7 and 8 respectively.

When the SA2 DIP switch is set to OFF, the relay/input is set to N.O.

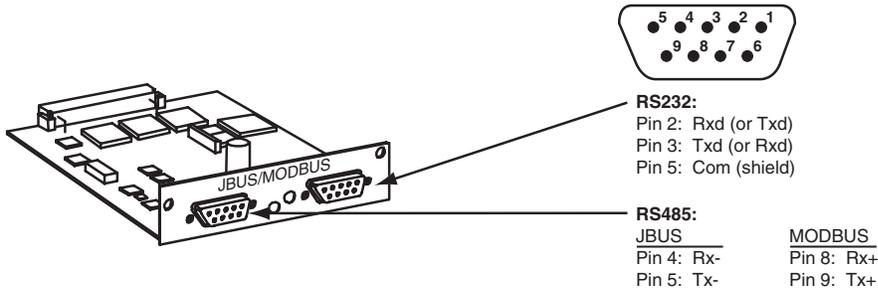
When the SA2 DIP switch is set to ON, the relay/input is set to N.C.

### 2.5.1 Connection of the JBUS Communication Card

The JBUS communications card provides two DB-9 ports (RS232 and RS485 communications). Only one communication port may be used at a time.

For information on using the communication card, see the JBUS communication card manual.

Figure 2-8: JBUS Communication Card.



## 2.6 Check Points Before and After Start Up

Before starting the Epsilon STS™, be certain that you fully understand the operation of the indicators, controls, and operational sequences. MGE UPS SYSTEMS, INC. offers professional start up services in most countries. It is suggested that before applying power to your Epsilon STS™, your contract with MGE for a professional start up with an MGE Field Engineer.

### 2.6.1 Pre-Start Up Safety Check List

- ▶ All power and control wires have been properly connected and securely tightened.
- ▶ The upstream and downstream protective devices are not tripped, and have been sized properly for the STS and load requirements.
- ▶ The input voltage is the same as indicated on the STS nameplate, located inside the door of the Epsilon STS™ module.
- ▶ The air filters located inside the STS module door (400/600A units only) are properly installed and free of dust, dirt, and debris. Make certain that no objects block the air intake underneath and around the front bottom of the STS module and the air exhaust on the top of the STS module is free of obstructions.
- ▶ All switches in the STS, CB1-5, are in the OFF (open) position.
- ▶ All panels and covers are replaced and secured back in place.

### 2.6.2 Post-Start Up Safety Check List

After initial start-up of the system, normal operation should be tested. At the minimum, the following tests should be performed as applicable to your installation.

- ▶ Emergency power off (EPO) test.
- ▶ Remote emergency power off (REPO) test (if applicable).
- ▶ STS start up on preferred source.
- ▶ Transfer test on preferred source loss.
- ▶ Maintenance bypass procedure.

## 3.0 Scope

Operation describes Epsilon STS™ system characteristics of indicators and controls, startup and shutdown procedures, safety checklists, modes and specifications and theory of operating the Epsilon STS™ system.

## 3.1 Preparation for Operation

Several items must be considered when preparing the Epsilon STS™ system for operation.

<b>Configuration</b>	The STS cabinet and any auxiliary cabinets (such as PMM cabinets containing power distribution panels, transformers, etc.) must be arranged in the required configuration to insure that the interconnection cables are located in the correct adjacent cabinets.
<b>Location</b>	The cabinets must be situated in a location that provides for proper air flow and heat rejection.
<b>Environment</b>	The room in which the Epsilon STS™ system is located must maintain environmental conditions within recommended tolerances.
<b>Electrical Connections</b>	All electrical connections must utilize the top or bottom conduit entries provided. See section 2 for details for connections.

The following sections discuss in more detail these items.

## 3.2 Pre-Start Up Safety Check List

- ▶ Ensure all power and control wires have been properly connected and securely tightened. Recheck phase rotation for both sources and proper grounding of the equipment.
- ▶ Check to see that the upstream and downstream protective devices are not tripped, and have been sized properly for the STS and load requirements.
- ▶ Check that the input voltage is the same as indicated on the STS nameplate, located inside the door of the Epsilon STS™ module.
- ▶ Verify that the air filters located inside the STS module door (400/600A units only) are properly installed and free of dust, dirt, and debris. Make certain that nothing is blocking the air intake underneath and around the front bottom of the STS module and that the air exhaust on the top of the STS module is free of all obstructions.
- ▶ Verify that all switches, CB1-5 in the STS are in the “off” (open) position.
- ▶ All panels and covers are replaced and secured back in place.
- ▶ Check to see that the cabinet is resting on its the lifting leveler and not on the 4 casters.
- ▶ Check that the load-circuit breakers (where applicable) are in the "OFF" position.

### 3.2.1 Normal Start Up Procedure

With all of the initial safety check points verified, the Epsilon STS™ system can now be powered. The following procedure should be used after the Epsilon STS™ system has been commissioned (typically by an MGE Field Service Engineer).

1. Ensure that all switches, CB1, 2, 3A, 3B(if installed), 4 and 5 in the STS are OFF (open).
2. Energize both input sources and check for correct voltage, phase rotation and source synchronization. The STS controls will be powered up and the display LCD should turn on. The LED indicators and mimic diagram should also be functioning. The display and buzzer may indicate an alarm since the source isolation switches, CB1 and CB2 are open.
3. If external load circuit breaker(s) are not installed between the STS output and the load, check that the load is ready for power application.
4. Check that Source #1 is the preferred source (factory default setting) – as indicated on the LCD display and the “Preferred Source S1” LED located in the mimic diagram.
5. Close the Source #1 bypass switch, CB4, which connects the output to Source #1, bypassing the static switch section. Output is now energized by Source #1. The bypass switches are interlocked – see note.



#### NOTE

**CB4 and CB5 bypass switches are key-interlocked. The standard 2-interlock system, lock the opposite bypass switch and remove the key (for the optional 4-interlock system, it is also necessary to open the opposite source isolation switch (CB1 or CB2), lock it, remove the key). Using the removed key(s), unlock and close the selected bypass switch.**

6. Apply power to the load by closing the load-circuit breakers (if installed), including PMM power distribution circuit breakers (where applicable).
7. Close the Source #1 (preferred) isolation switch, CB1. The STS will turn on the preferred source SCR Switch 1. Verify on the LED mimic diagram on the front display panel. Also check the operating status on the LCD screen.
8. Close the Source #2 (alternate) isolation switch, CB2. Verify on the LED mimic diagram on the front display panel. Also check the operating status on the LCD screen – no alarms should be displayed.
9. Static switch operation may now be checked by opening the preferred source isolation switch, CB1. The STS will transfer to the alternate source. Verify on the LED mimic diagram on the front display panel. Also check the operating status on the LCD screen.
10. Re-close the preferred source isolation switch, CB1. After the preset retransfer time delay, the STS will retransfer back to the preferred Source #1.
11. Close the STS output isolation switch(es), CB3A (and CB3B if installed). Source #1 power is now supplied through the static switch to the output of the STS.
12. Open (and lock) the Source #1 bypass switch, CB4. The load is now supplied through the static switch. Verify on the LED mimic diagram on the front display panel. Also check the operating status on the LCD screen.
13. The STS is now in the normal operating mode:  
 CB1, CB2, CB3A and CB3B(if installed) - CLOSED.  
 CB4 AND CB5 - OPEN  
 LCD screen - Normal Operation  
 LED Mimic diagram - “Source S1 Available”, “Source S2 Available”, “CB1”, “CB2”, “Switch 1”, “CB3”, “Load” and “In Sync” LED's on.

### 3.2.2 Post Start Up Safety Check List

After initial start up of the system, normal operation of the STS should be verified. At the minimum, the following should be checked as applicable to your installation:

- ▶ Remote emergency power off (REPO) operation (all switches in the STS should trip off). After this test, reset all switches in the OFF position and repeat the start up procedure.
- ▶ Maintenance bypass procedure.
- ▶ Proper readings on the LCD display for Voltages, Current, Frequency and Power.
- ▶ Operation of the Manual Control pushbuttons (“hard keys”) on the front panel.



#### CAUTION

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#### EXPOSURE TO HAZARDOUS VOLTAGES.

**Dangerous voltage levels are still present inside the STS cabinet. When bypassed/isolated, control power supply circuits are still live and power is provided for indicator lights and emergency power off circuits. Disconnect all sources of power before servicing. Refer servicing to qualified service personnel.**

---

### 3.2.3 Shutdown Procedure

To isolate and shutdown the static switch section of the STS:

1. Check that the desired bypass source is available and that the LCD and mimic diagram display indicate that the static switch is on the desired bypass source.
2. Follow the Bypass Procedure to bypass the static switch and connect the load through the bypass switch to the desired bypass source. Isolation switches CB1, CB2, CB3A and CB3B (if installed) will be in the OFF (or Tripped) position.

### 3.3 Transfer Operations

#### 3.3.1 Automatic Transfers

Automatic transfer of the load from one source to the other is accomplished by turning off the **active** source SCR's and turning on the **inactive** source SCR's in a sequence and timing that allows a combined sense and on transfer time of less than one quarter cycle (4.17ms). Automatic transfer is initiated under any of the following conditions, provided transfer is authorized and the “inactive” source is not more degraded than the “active” source:

- a) Under-voltage on any phase of the **active** source.
- b) Over-voltage on any phase of the **active** source.
- c) Under-frequency of the **active** source.
- d) Over-frequency of the **active** source.
- e) Open SCR on the **active** source (transfer to **inactive** source, then shunt trip the **active** C.B. and inhibit retransfer until repair is made and the system is reset).
- f) Shorted SCR on the **inactive** source (transfer to shorted **inactive** source, then shunt trip the previously **active** C.B. to prevent retransfer. Inhibit transfers and retransfers until repair is made and the system is reset).
- g) SCR Over-temperature on the **active** source (if there are no current overload faults, transfer to **inactive** source and inhibit re-transfer until repair is made and the system is reset. If **inactive** source subsequently fails, transfer back to the **active** side if it is within acceptable limits, including over-temperature limits).
- h) SCR Gate Drive power supply failure on the **active** source (transfer to **inactive** source and inhibit re-transfer until repair is made and the system is reset).
- i) TVSS failure on the **active** source (if optional TVSS is installed).

#### 3.3.2 Manual Transfers

The STS can be operated as a manual switch when the **Manual Control** keyed switch on the front panel is in the ON position, enabling the manual control pushbuttons and some setpoint changes, for the following manual operations:

- a) Manual **Change Preferred Source** Pushbutton – Selects other source as Preferred, causing a transfer (without break) to the selected source if it is available and within acceptable limits and is not the active source. If the two sources are outside the preset **in sync** phase window, a transfer (with break) can be made by pressing the manual **Override Limits** pushbutton simultaneously.
- b) Manual **Return to Preferred Source** Pushbutton - If auto-retransfer is disabled, pressing this pushbutton will initiate a retransfer back to the preferred source, overriding owner selected auto retransfer time delay.

To prevent normal automatic transfers, the operator can use the **Change Preferred Source** pushbutton to transfer to the desired source, and then shut down the feeder to the other inactive source.

#### 3.3.3 Automatic Retransfers

Automatic retransfer of the load from the alternate source back to the preferred is accomplished by turning off the **active** alternate source SCR's and turning on the **inactive** preferred source SCR's in a sequence and timing that allows a combined sense and transfer time of less than one quarter cycle (4.17ms). Providing the **inactive** preferred source is not more degraded than the **active** alternate source, retransfer will occur under the following conditions:

- a) If retransfer is not prohibited, retransfer will occur after an owner selected time delay after the preferred source becomes available and within acceptable limits.
- b) If retransfer is prohibited, retransfer can be manually initiated by pressing the manual **Return to Preferred Source** Pushbutton (Pre-conditions: **Manual Control** switch in ON position; **inactive** preferred source is available and within acceptable limits). Transfer is temporarily authorized for a preset time.

### 3.3.4 Transfer Authorization/Prohibition

Transfer is prohibited under the following conditions:

- a) Transfer Prohibit Input from the operator control panel, control contact input, or communications port.
- b) Peak Current Overload.
- c) External Power Fault (peak current overload caused by undervoltage) - Memorized.
- d) Overtemperature (active or inactive switch) - Memorized. Reset fault from alarm menu. If the fault persists, call MGE Customer Service.
- e) Shorted SCR (active or inactive switch) – Memorized. Reset fault from alarm menu. If the fault persists, call MGE Customer Service.
- f) Open SCR (active switch) – Memorized. Reset fault from alarm menu. If the fault persists, call MGE Customer Service.
- g) Reverse Power.
- h) Inactive source Out-of-Tolerance.
- i) Inactive source Power Supply Fault.
- j) Phase Rotation Fault.
- k) Inactive source input isolation switch open.

## 3.4 Maintenance Bypass/Molded Case Switches/Live System Test

### 3.4.1 Switch Arrangement

A manually operated maintenance bypass switching arrangement is included to permit complete isolation of the static switch SCR assemblies for servicing without disrupting power to the critical loads. The maintenance bypass consists of :

- a) STS input isolation switch. One for each static switch SCR assembly (two total - CB1, CB2).
- b) STS output isolation switch. One for both static switch SCR assemblies (one total - CB3A). A second redundant output isolation switch (CB3B) is available as an option.
- c) Maintenance bypass switch. One for each static switch SCR assembly (two total – CB4, CB5).

All STS switches are automatic with magnetic trip only with plug-in bases for ease of removal for replacement, calibration or testing, without interruption of power to the critical load. All switches are equipped with shunt trips and auxiliary contacts. Continuously activated shunt trips will not allow closing of the switch (not even as much as a contact to contact touch).

### 3.4.2 Electrical Bypass Switch Interlock

If either maintenance bypass switch is closed, the opposite maintenance bypass switch will be electrically shunt tripped.

### 3.4.3 Electric Input-Bypass Switch Interlock

If the output switch and either maintenance bypass switch is closed, the opposite input isolation switch will be electrically shunt tripped.

### 3.4.4 Mechanical Key Interlocks

Mechanical Kirk key interlocks are provided on the two maintenance bypass switches (CB4 and CB5) to prevent an operator from closing both bypass switches at the same time. A single key allows closure of one switch at a time. Additional key interlocks on the two STS input isolation switches (CB1, CB2) to ensure that the STS is on the source that the operator intends to bypass to, are available as an option.

### 3.4.5 Live System Test (Except with 4-Interlock System)

While in maintenance bypass, and with the STS output isolation switch off, the STS can be tested with both sources connected to the STS through the input isolation switches (using the SCR's to make actual transfers).

### 3.4.6 EPO

In the event of an Emergency Power Off (EPO) condition, all switches are shunt tripped.

### 3.5 Preferred Source Selection (Symmetrical Operation)

At the operators option and without any degradation of performances or loss of protective features, the unit may be operated with either source designated as the **preferred** source and the current **alternate** source can be switched to be the **preferred** source (using LCD screen, the manual hard key, comm. port or remote input contact).

### 3.6 Sensing and Transfer Times

Voltage and/or current sensing using fast digital conversion techniques are employed for both sources to meet a maximum 2 milliseconds sensing time requirement (to sense a deviation of power quality outside of user parameters).

Total sense and transfer time is 1/4 cycle (4.17 milliseconds) maximum.

### 3.7 Overload Operation

On sensing a Peak Current Overload (Crest factor setting: 3.5 maximum.), automatic transfers will be inhibited and the load will stay on the “active” source until the overload condition is cleared.

On sensing Peak Current Overload condition, a check is made for an under-voltage condition indicating that the under-voltage condition caused the overload. Automatic transfer is inhibited and the load will stay on the **active** source until the overload condition is cleared and the system is reset (this fault condition is memorized).

An **Overload** alarm will be given if the load current exceeds the RMS current overload setting for more than 30 seconds. This overload condition will not cause an automatic transfer.

### 3.8 Shorted SCR Protection (including Backfeed Protection)

The STS design includes sensing circuits to detect a shorted SCR and in addition to the following actions, will initiate audible and visual alarms:

- a) In the event of a shorted SCR in the active source powering the load, the unit will alarm, and stay on the active source. Then the SCR isolation switch on the inactive source will be shunt tripped to prevent transferring to the **inactive** source. Automatic transfer and retransfer will be inhibited until repair is made and the system is reset.
- b) In the event of a shorted SCR in the non-conducting SCR in the inactive source that is not powering the load at the time, the unit will alarm. The STS will immediately transfer the load to the inactive source to eliminate cross-connect current between the shorted sources. The SCR isolation switch in the previously active source will be shunt tripped to prevent retransfer. Automatic transfer and retransfer will be inhibited until repair is made and the system is reset. A separate redundant backfeed protection circuit is provided.

### 3.9 Open SCR Protection

The STS design includes sensing circuits to detect an open SCR and in addition to the following actions, will initiate audible and visual alarms:

In the event of an open SCR in the active source powering the load, the unit will alarm and immediately transfer to the inactive source. Then the SCR isolation switch on the previously active source will be shunt tripped. Automatic retransfer will be inhibited under such conditions until repair is made and the system is reset.

### 3.10 Source Cross-Connection Protection

The STS transfer logic will check that the two input sources, of any combinations, are never connected in a fashion to allow current flow from one source to the other without first passing through the load. The logic circuitry has protective sensing circuits that prohibit this conduction. Transfers and retransfers between sources will be break-before-make to prevent any cross-conduction, even in out-of-phase conditions.

### 3.11 Bypass Procedure

#### Bypass Load to Source #1

1. The Source #1 SCR Switch #1 must be indicated closed on the display panel. If not, transfer the load to Source #1 by turning the **Manual Control** key switch on the front display panel to the "ON" position and pressing the **Change Preferred Source** Pushbutton. The STS should transfer to Source #1.
2. Open Source #2 isolation switch, CB2. (For 4-interlock system, lock and remove the key).
3. Lock Source #2 bypass switch, CB5, and remove the key.
4. Using the key(s), unlock and close Source #1 bypass switch, CB4. CB1, CB3A and CB3B (if installed) will shunt trip, isolating the static switch section.

#### Return to Normal Operation (load on Source #1)

1. Close Source #1 isolation switch, CB1.
2. Wait for indication on the display panel that Source #1 SCR Switch #1 is closed.
3. Close Output isolation switch(es), CB3A and CB3B (if installed).
4. Open Source #1 bypass switch, CB4, and lock.
5. Close Source #2 isolation switch, CB2. (For 4-interlock system, remove key from CB4 lock to unlock CB2, and close CB2).

### **Bypass Load to Source #2**

1. The Source #2 SCR Switch #2 must be indicated closed on the display panel. If not, transfer the load to Source #2 by turning the **Manual Control** key switch on the front display panel to the “ON” position and pressing the **Change Preferred Source** Pushbutton. The STS should transfer to Source #2.
2. Open Source #1 isolation switch, CB1. (For 4-interlock system, lock and remove the key).
3. Lock Source #1 bypass switch, CB4, and remove the key.
4. Using the key(s), unlock and close Source #2 bypass switch, CB5. CB2, CB3A and CB3B (if installed) will shunt trip, isolating the static switch section.

### **Return to Normal Operation (load on Source #2)**

1. Close Source #2 isolation switch, CB2.
2. Wait for indication on the display panel that Source #2 SCR Switch #2 is closed.
3. Close Output isolation switch(es), CB3A and CB3B (if installed).
4. Open Source #2 bypass switch, CB5, and lock.
5. Close Source #1 isolation switch, CB1. (For 4-interlock system, remove key from CB5 lock to unlock CB1, and close CB1).

### **Test Mode (Except with 4-Interlock System)**

1. Bypass the load to Source #1 or #2 (see above procedures).
2. Close both source isolation switches, CB1 and CB2.
3. The static switch may now be tested without disturbing the load.



**CAUTION:**

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**EXPOSURE TO HAZARDOUS VOLTAGES.**

**Dangerous voltage levels are still present inside the STS cabinet. When bypassed/isolated, control power supply circuits are still live and power is provided for indicator lights and emergency power off circuits. Disconnect all sources of power before servicing. Refer servicing to qualified service personnel.**

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## 3.12 Front Panel

The Epsilon STS™ system is simple to operate and yet provides a wealth of continuous monitoring and diagnostic features to insure the proper operation of the unit.

Operators gain access to information in the Epsilon STS™ system through the operator interface. This display panel and keyboard is conveniently located on the front of the STS cabinet. (See Figure 3-1, page 3-10).

Operator Interface - The Epsilon STS™ Operator Interface provides an easy to use method to access and control the Epsilon STS™ features. Through the use of four (4) "soft" keys and four (4) dedicated purpose keys, the operators can quickly move through the available displays, and control the performance of the unit.

The operation of the Epsilon STS™ is designed to require minimal operator interaction, and yet it provides, as can be seen in the previous sections, a multitude of displays and menus to provide information about and capabilities to control the system.

The final appendix sections of this manual are included to provide general and technical information concerning the Epsilon STS™ product line as well as terminology that will prove useful in discussions about STS and other power systems in general.

MGE UPS Systems is pleased that you have selected our product to protect the AC power in your facility or installation. Should you have any questions about this manual or the Epsilon STS™ product, please do not hesitate to contact MGE Customer Support at 1 800 523-0142.

### 3.13 Front Display Interface Panel

Figure 3-1: Front Display Interface Panel.

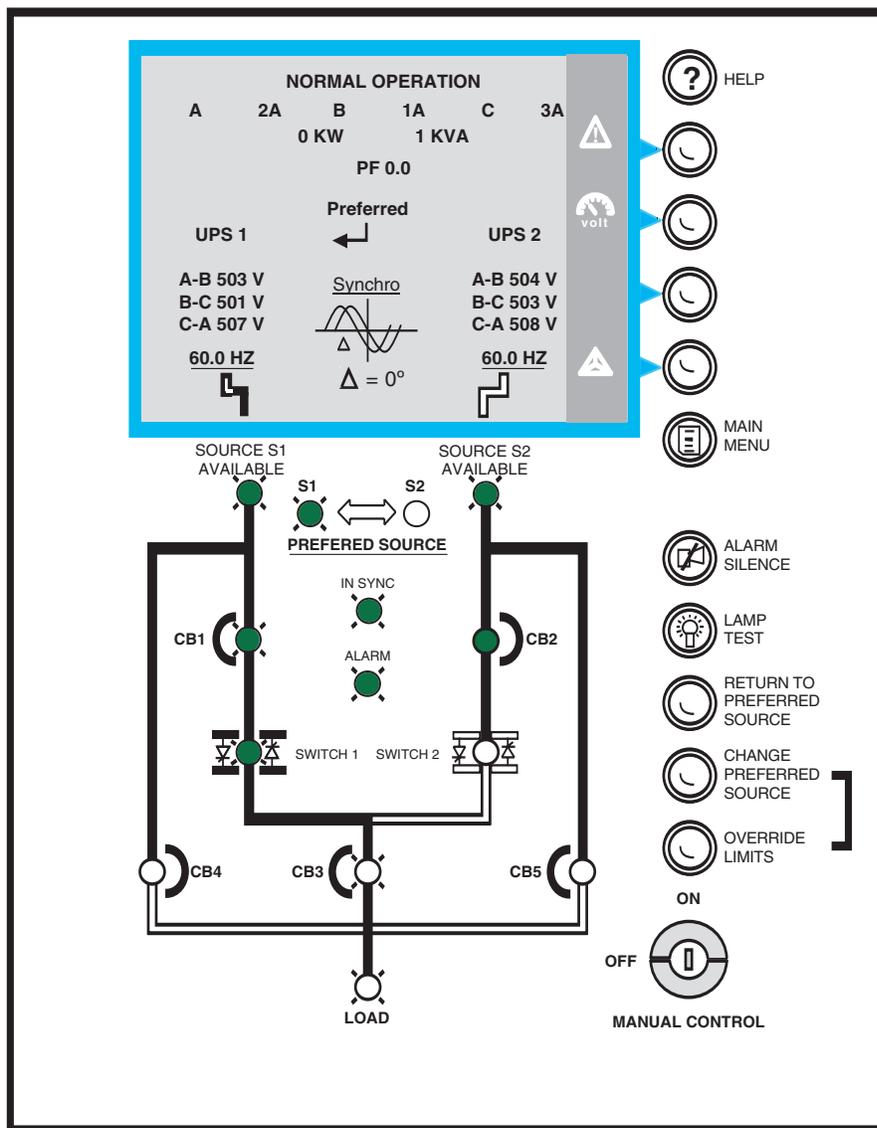


Figure 3-2: LCD Normal Operation Screen

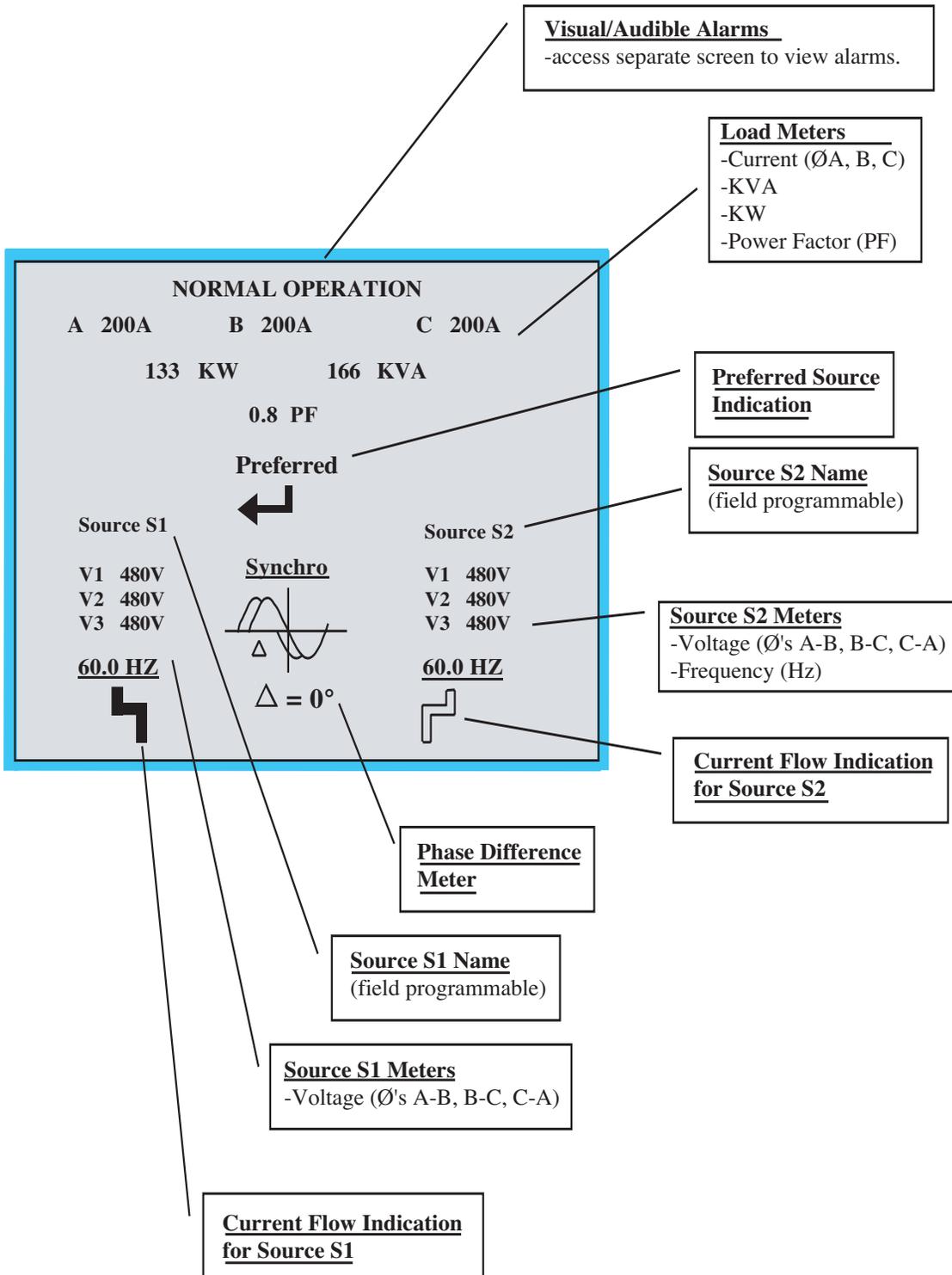


Figure 3-3: Manual Operation Pushbuttons.

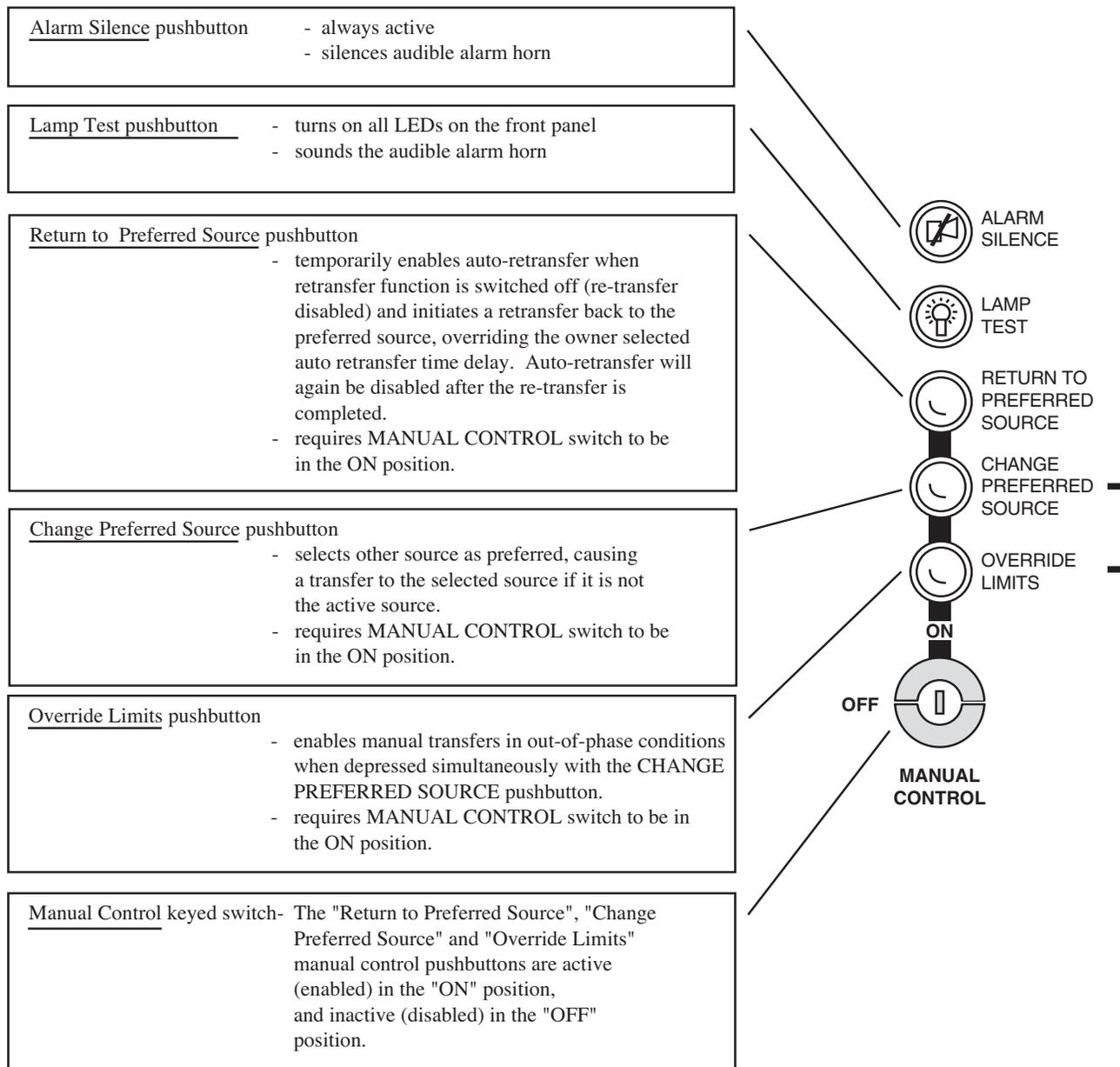
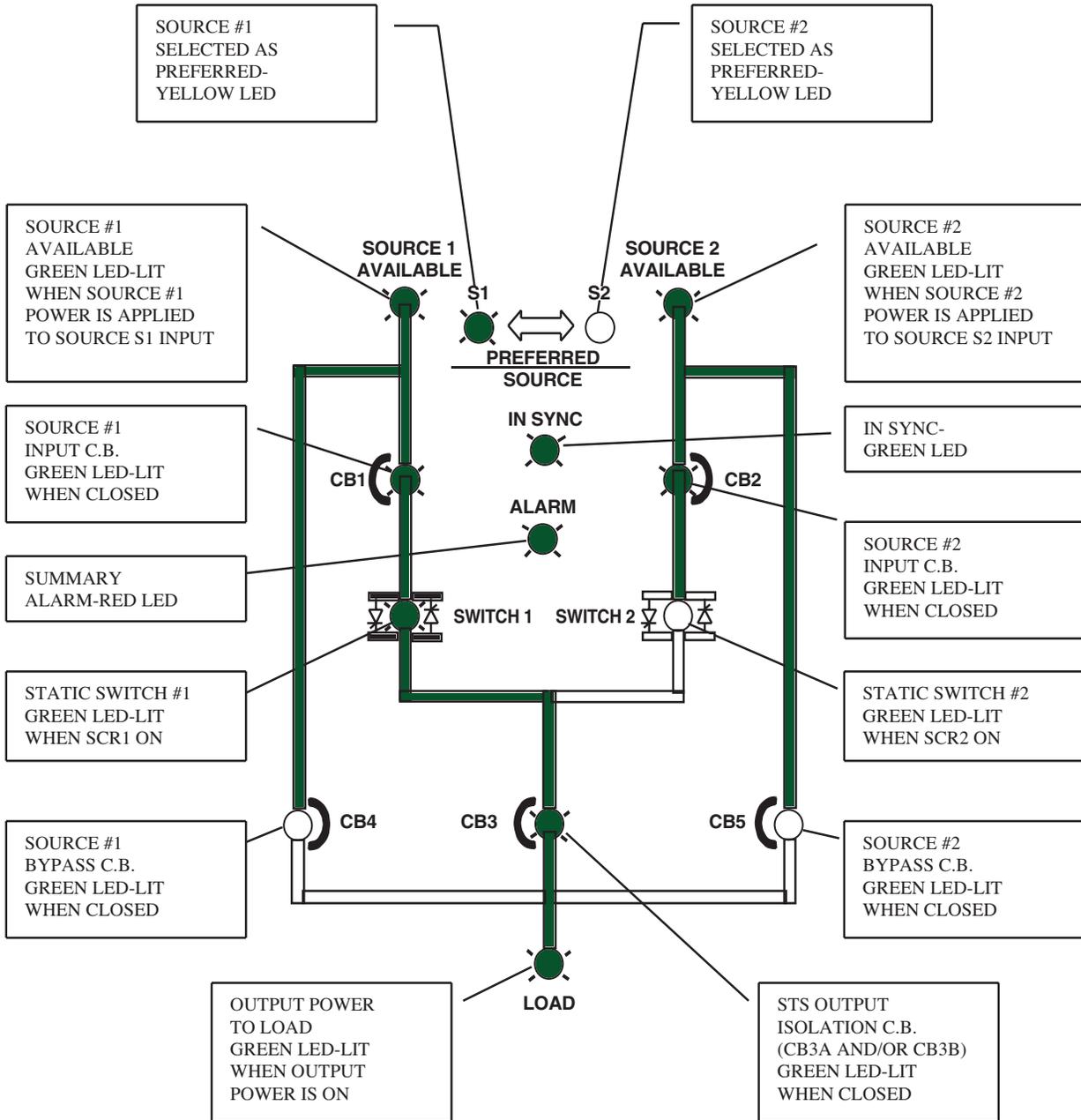


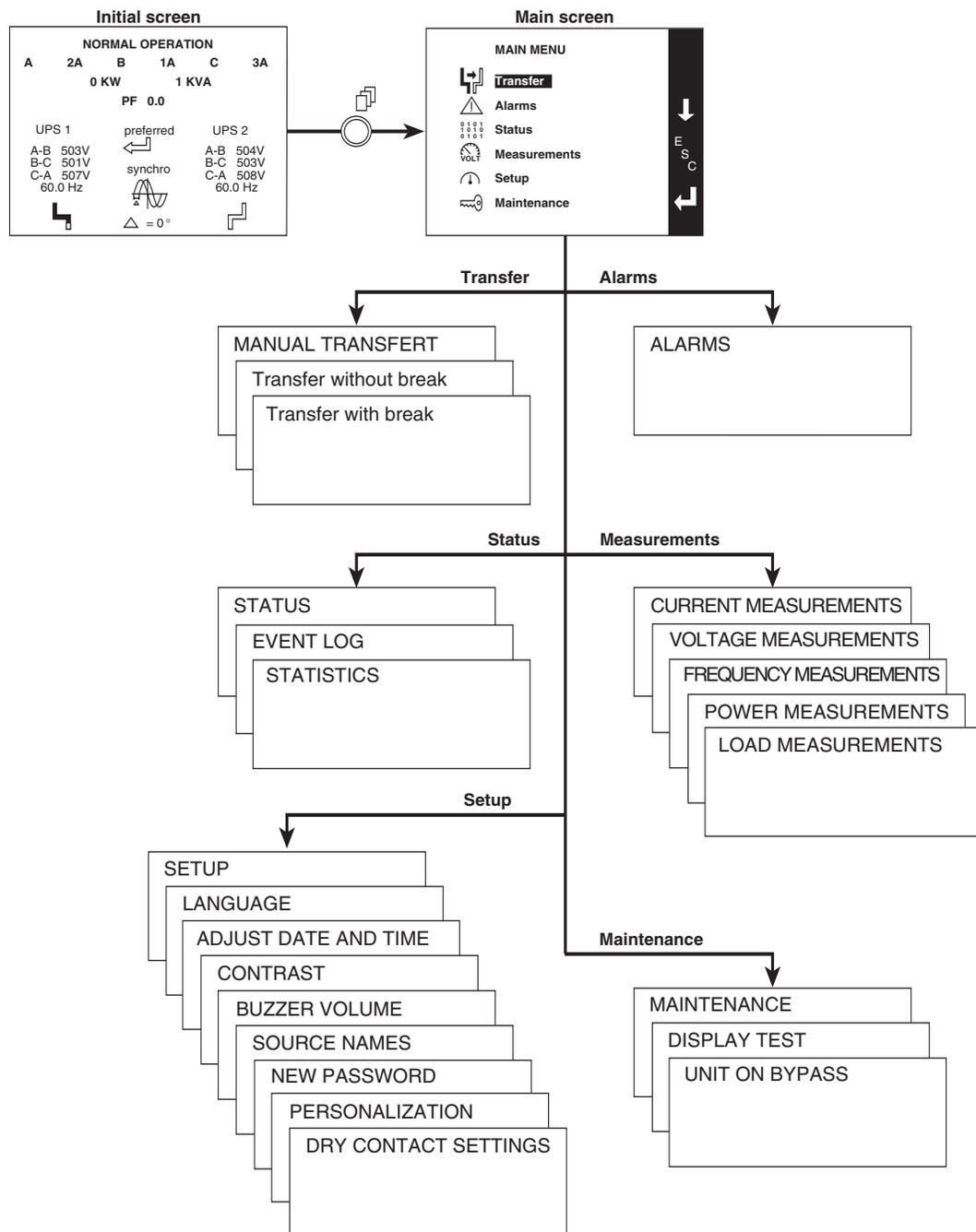
Figure 3-4: LED Mimic Diagram.



### 3.14 Operator Interface Screens

The screen displays contained on the Epsilon STS™ Operator Interface provide an easy to use method to access and control the STS features. A screen saver feature will blank out the LCD screen after the Epsilon STS™ has been in continuous operation for a while.

Figure 3-5: LCD Display Screens.



### 3.15 Epsilon STS™ Customization

Certain parameters can be customized as follows:

1. Press the <Menu> button.
2. Select <Setup>, then <Customization> using the function buttons marked  or .
3. Confirm by pressing the function button marked .
4. Enter the password (default factory password is “0 0 0”). Select **Setup**, then **Password** to change the password).

Figure 3-6: Customization Screen.

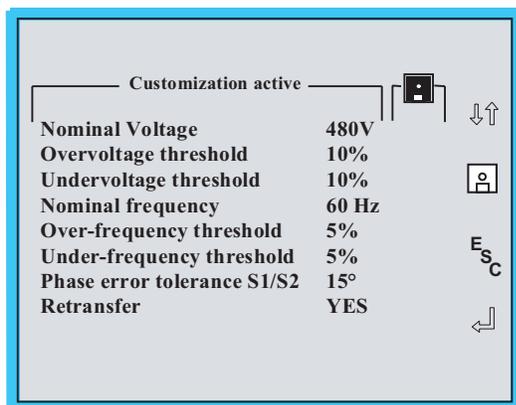


Table 3-1: Customization Settings.

Parameter	Factory setting	Customization
Nominal Voltage (both sources)	As specified by customer	208,220,240,440,480,575,600V
Overvoltage threshold	+10%	+5% to +20% (1% steps)
Undervoltage threshold	-10%	-5% to -20% (1% steps)
Nominal Frequency (both sources)	60 Hz	50 or 60 Hz
Over-frequency threshold	+5%	+1 to +10% (0.5% steps)
Under-frequency threshold	-5%	-1 to -10% (0.5% steps)
Phase error tolerance (between sources)	±15°	±1° to ±45° (1° steps)
Retransfer (return to preferred source after transfer)	Automatic (YES)	Manual (NO)

For additional customization of your Epsilon STS™ (e.g. to change the retransfer time delay from the factory setting of 10 seconds), we recommend that you contact our MGE Customer Support (reference page QS-8).

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## **MGE Warranty & Proprietary Rights Statement for Three Phase Products**

(Applicable within the United States, Canada and Mexico)

### **MGE Standard Three Phase Warranty**

MGE UPS SYSTEMS, INC. ("MGE") warrants three phase products it manufactures to be free from defects in materials and workmanship for a period of three hundred sixty five (365) days counting from the date of purchase by or for the first end user ("Purchaser"), or, if applicable, the date of MGE's completion of initial startup of the subject product, provided however said warranty shall not exceed eighteen (18) months from the date of delivery of the subject product to Purchaser (the "Warranty Period"). MGE's liability hereunder is limited to replacing or repairing at MGE's factory or on the job site, at MGE's option, any part or parts that are defective and reported to MGE during the Warranty Period. MGE shall have the sole right to determine if the parts are to be repaired at the job site or whether they are to be returned to the factory for repair or replacement. All items returned to MGE for repair or replacement must be sent freight prepaid to its factory. Purchaser must obtain MGE's Return Goods Authorization ("RGA") prior to returning items. The conditions stated herein must be met for MGE's warranty to be valid. MGE will not be liable for any damage done by unauthorized repair work, unauthorized replacement parts, from any misapplication of the subject product, for damage due to accident, abuse, or act of God (such as earthquake, flood, inclement weather, rain or fire), or relating to Purchaser's failure to follow proper environmental conditions for the product.

In no event shall MGE be liable for loss, damage, or expense directly or indirectly arising from the use of or any defects in the subject product, or from any other cause, except as expressly stated in this warranty. EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY, MGE UPS SYSTEMS, INC. MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR NON-INFRINGEMENT. MGE is not liable for and Purchaser waives any right of action it has or may have against MGE for any consequential or special damages arising out of any breach of warranty, and for any damages Purchaser may claim for damage to any property or injury or death to any person arising out of its purchase or the use, operation or maintenance of the subject product. The warranty stated herein includes parts and labor; however, MGE will not be liable for any labor subcontracted or performed by Purchaser for preparation of the warranted item for return to MGE's factory or for preparation work for field repair or replacement, and MGE will not be responsible to pay any invoice therefore.

This warranty shall be exclusive of any and all other warranties express or implied and may be modified only by a writing signed by an authorized officer of MGE UPS SYSTEMS, INC. This warranty shall extend to the Purchaser but to no one else. Accessories supplied by MGE, but manufactured by others, carry any warranty the manufacturers have made to MGE, and which can be passed on to Purchaser.

MGE UPS SYSTEMS, INC. makes no warranty with respect to whether the products sold hereunder infringe any patent, U.S. or foreign, and Purchaser represents that any specially ordered products do not infringe any patent. Purchaser agrees to indemnify and hold MGE UPS SYSTEMS, INC. harmless from any liability by virtue of any patent claims where Purchaser has ordered a product conforming to Purchaser's specifications, or conforming to Purchaser's specific design.

Purchaser has not relied and shall not rely on any oral representation regarding any products sold hereunder and any oral representation shall not bind MGE UPS SYSTEMS, INC. and shall not be part of any warranty.

There are no warranties which extend beyond the description on the face hereof. In no event shall MGE UPS SYSTEMS, INC. be responsible for consequential damages or for any other damages except as expressly stated herein.

### **Proprietary Rights Statement**

The information in this manual is the property of MGE UPS SYSTEMS, INC., and represents a proprietary article in which MGE UPS SYSTEMS, INC. retains any and all intellectual property rights, including exclusive rights of use and/or manufacture and/or sale. Possession of this information does not convey any permission to reproduce, print, manufacture or have made the article or articles shown herein. Such permission may be granted only by specific written authorization signed by an authorized officer of MGE UPS SYSTEMS, INC.

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For Three Phase Warranty outside of the United States, Canada and Mexico, refer to Three Phase International Warranty.

## Warranty and Product Registration

Thank you for choosing MGE UPS SYSTEMS, INC. for your power protection, distribution, and quality requirements. We are pleased to have you join our increasing family of users.

In order to maximize the value you receive from this product, and to ensure that you are kept informed of product or software updates, we recommend that you take a few minutes to register your new purchase. You may register online at the URL noted below. Should you not have Internet access, you may mail or fax this form back (attn: Warranty Registration) as indicated at the bottom of the page.

Register your UPS at: <http://www.mgeups.com/email/warranty/menu.htm>

Please be prepared with the following information to register and validate your UPS warranty, keep informed on software and product updates, and register your extension "Warranty+" if purchased with the UPS.

### User Information

Last name \_\_\_\_\_  
First name \_\_\_\_\_  
Company name \_\_\_\_\_  
Address \_\_\_\_\_  
Zip code \_\_\_\_\_  
City \_\_\_\_\_  
State/Province \_\_\_\_\_  
Country \_\_\_\_\_  
Tel \_\_\_\_\_  
Fax \* \_\_\_\_\_  
Email\* \_\_\_\_\_

### Product information

Model \_\_\_\_\_  
Serial Number \_\_\_\_\_  
Date of purchase \_\_\_\_\_

### **Warranty Extension (Warranty+)**

I have purchased a warranty extension (Warranty+)

Reference: \_\_\_\_\_ Contract Number: \_\_\_\_\_

Thank you from all of us at MGE.

## MGE Customer Care Center - Three Phase Products

### Technical Support and Product Services



Technical questions? If you encounter a problem while following the instructions in this manual, or have questions about the operation, repair, or servicing of your equipment, please direct calls to MGE UPS SYSTEMS, INC. Customer Care Center or visit our web site [www.mgeups.com](http://www.mgeups.com) for complete service information.

To insure that your questions are correctly answered, please obtain the part number, assembly number, and serial number of the unit and include them in any discussions or correspondence.

Part Number: \_\_\_\_\_

Assembly Number: \_\_\_\_\_

Serial number: \_\_\_\_\_

### Who To Contact

**Technical Support:**                   **1-800-523-0142** (during business hours)

**Customer Care Center:**           **1-800-438-7373** (Hours: 24/7)

**Customer FAQ  
or International calls:**           **1-714-557-1636**

**Commitment:** MGE UPS SYSTEMS, INC. is committed to providing easy to access factory trained experts that will provide responses to any questions that you might have.

### Scheduling Field Service Engineer Support

Scheduling of the MGE Field Service Engineers typically should be done 7 to 10 days before they are required on-site. If the startup of the UPS is critical to maintaining your schedule, please call the MGE toll free telephone number at **1-800-438-7373**, to insure a safe installation and startup that will maintain the MGE warranty and insure smooth performance

### Return Policy for Repair of Three Phase Products (RGA)

Should you require factory service for your equipment, contact MGE Customer Care Center and obtain a Return Goods Authorization (RGA) prior to shipping your unit. Never ship equipment to MGE without first obtaining an RGA number.

Date: \_\_\_\_\_

RGA Number: \_\_\_\_\_

Contact Name: \_\_\_\_\_

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# Glossary

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<b>Term used</b>	<b>Definition / Meaning</b>
@	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.
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.
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 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.
dB	Decibels.
DC	Direct current.
Conduit	A flexible or rigid tube enclosing electrical conductors.
C.S.S.	Customer Support Service.

Current rating	The maximum current that a conductor or equipment can carry reliably without damage.
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.
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.
L	Line.
LCD	Liquid-Crystal Display unit.
LED	Light Emitting Diode.
Mains or Mains 1	Main AC input source.
Mains 2	Bypass AC input source.
mA	Milliampere.
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.
Module	Refers to individual power inverter module.
N	Neutral.
NC	Normally close.
NO	Normally open.
NEC	National Electrical Code.

NFPA	National Fire Protection Association.
NO. or No.	Part number.
On-line mode	Inverter output power is the primary energy source to load.
Off-line 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.
PWM	Pulse Width Modulation.
SCR	Silicon controlled rectifier.
Shipping damage	Any damage done to an article while it is in transit.
SPDT	Single Pole Double Throw.
Static Transfer	An solid state switching mechanism electronically controlled to pass AC power directly from the utility to an output load.
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.
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.
ve	Battery voltage.
Via	By way of.

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