



EPS 7000

Single Module

Users Manual

M G E
UPS SYSTEMS

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions for all EPS 7000 Single Module 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 generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with installation 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 his own expense.

EPS 7000

Single Module

Users Manual

For service call
1-800-523-0142

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EPS 7000

Single Module Users Manual

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Revision History

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Revision: X0 R&D-001651

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08/2004

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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 variations.

**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 SINGLE
MODULE UPS SYSTEM.**

**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 UNIT SERIAL NUMBER: _____

MBP CABINET SERIAL NUMBER: _____

ADDITIONAL SERIAL NUMBERS:

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

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Introduction

1.0 Scope

This manual provides User instructions for operating the EPS 7000 Single Module system (S-M). Descriptions include section descriptions, a general overview of system internal components, circuit breaker diagrams, descriptions for front panel displays and control indicators.

Please read this manual before installing the EPS 7000 equipment. Please retain this manual for future reference.

1.1 Reference Manuals

The EPS 7000 Installation Manual (MGE part number 86-134003-00) provides technical information required for installation and maintenance of EPS 7000 Single Module and Shared Systems. The EPS 7000 Shared Systems Users Manual, (MGE part number 86-134005-00) provides detailed operating instructions for shared systems.

86-134005-00 EPS 7000 Users Manual, Shared System

86-134003-00 EPS 7000 Installation Manual, Single Module and Shared Systems

86-132204-00 Graphical Command Center, User Manual

1.2 Section Descriptions

This manual is divided into four sections:

Section 1 Introduction

This section provides User instructions for operating the EPS 7000 Single Module system. Descriptions include section descriptions, a general overview of system internal components, circuit breaker diagrams, descriptions for front panel displays and control indicators.

Section 2 Operation

This section describes procedures for normal operation of EPS 7000 Single Module systems. Including interactive front panel display, settings for language configuration, alarms message displays, voltage, current, battery measurements, with before and after start-up checks, emergency shutdown using EPO disconnects, and normal conditions for using forced transfers.

Section 3 Maintenance

This section describes maintenance of the EPS 7000, including troubleshooting LCD alarm message, safety instructions, preventive maintenance, isolation for maintenance, and information about replacement parts.

A Glossary in the rear of this manual provides definitions of terms used within the text.

1.3 General Description

EPS 7000 is a family of compact, high-efficiency uninterruptible power systems. Standard power ratings for single-module systems range from 300 to 500 kVA. EPS 7000 are optimized for compatibility with non-linear computer-type loads. Computer-aided UPS diagnostics and modular construction assures that any required service on the UPS can be identified and completed rapidly. Remote system monitoring, remote annunciation of UPS performance signals, and telecommunication capabilities allow total control of the UPS by the user.

The EPS 7000, SSC, battery, and all auxiliary equipment is listed for safety by Underwriter's Laboratories, Inc. (UL) under UL Standard 1778 and under Canadian Standards Association (CSA) standard C22.107.

Major components of the EPS 7000 Single Module include:

- ▶ UPS Single Module
- ▶ UPS maintenance bypass cabinet
- ▶ UPS bypass cabinet
- ▶ Battery disconnect

Each of these cabinets is described below. Figure 1-1 shows a single-module UPS.

Figure 1-1: EPS 7000 System, Single-Module Configuration, 1 GCC per Module.



1.4 Specifications, Circuit Breakers and Powerflow Diagrams

1.4.1 Circuit Breakers

EPS 7000 circuit breakers (except the battery disconnect circuit breaker QF1) are located behind the doors of the Input/Output cabinet. Following is a brief description of the available circuit breakers and contacts, and their function (Figures 1-2, 1-3, and 1-4).

- Q1** Input isolation circuit breaker, used to isolate the UPS from the main AC input (mains 1) and provide input current protection.
- QF1** Battery disconnect circuit breaker, external to the UPS, used to disconnect the battery from the UPS. QF1 provides isolation and protection between the UPS and its battery system.
- Q3BP** (optional) Maintenance bypass circuit breaker, used to supply the attached load via the bypass source while the UPS is being serviced.
- Q5N** Optional UPS isolation circuit breaker, used to isolate the UPS module from the attached load.
- Q4S** Bypass input circuit breaker; it is used to isolate the UPS from the bypass input (mains 2) source and provide back-feed protection.

Figure 1-2: Circuit Breaker Locations on the EPS 7000.

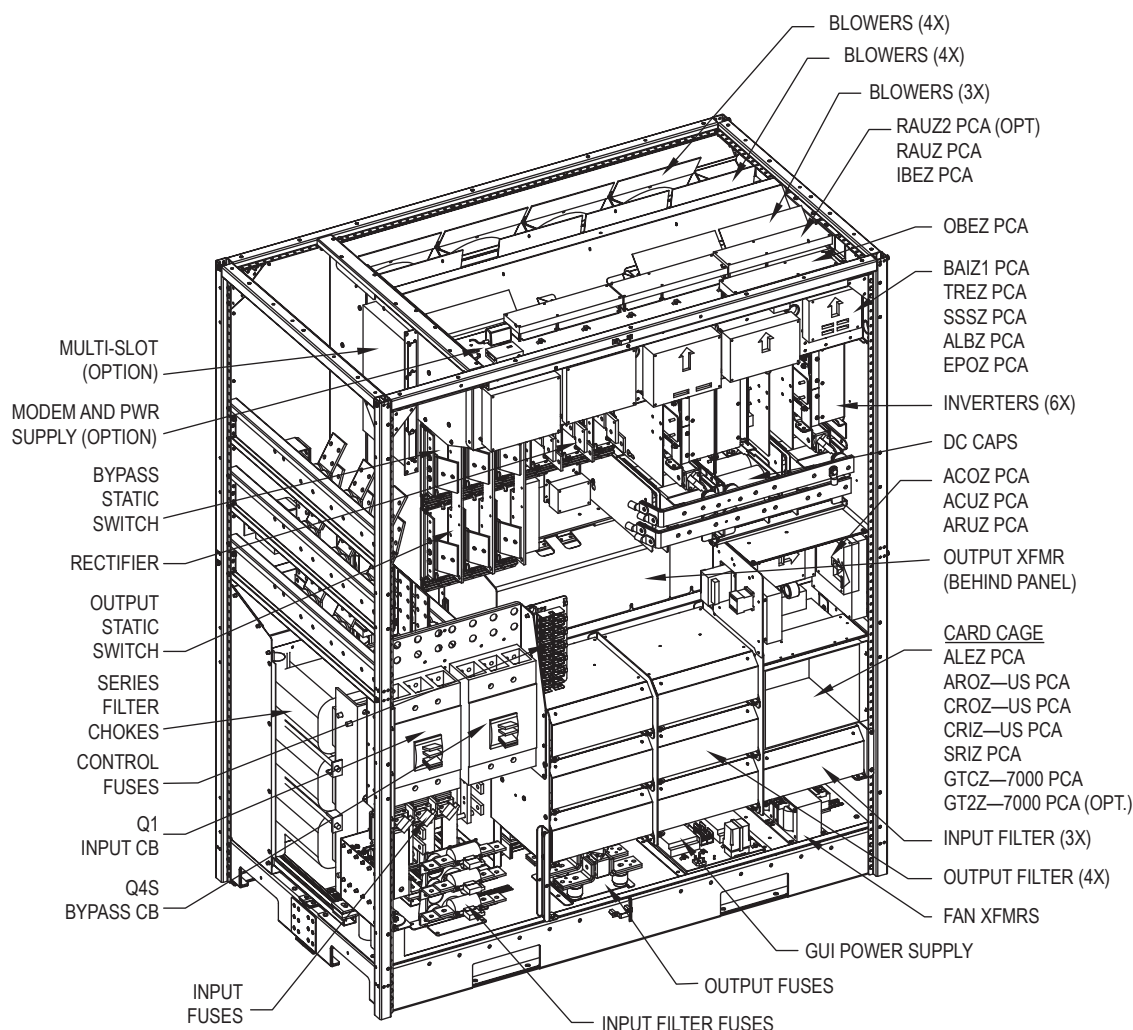
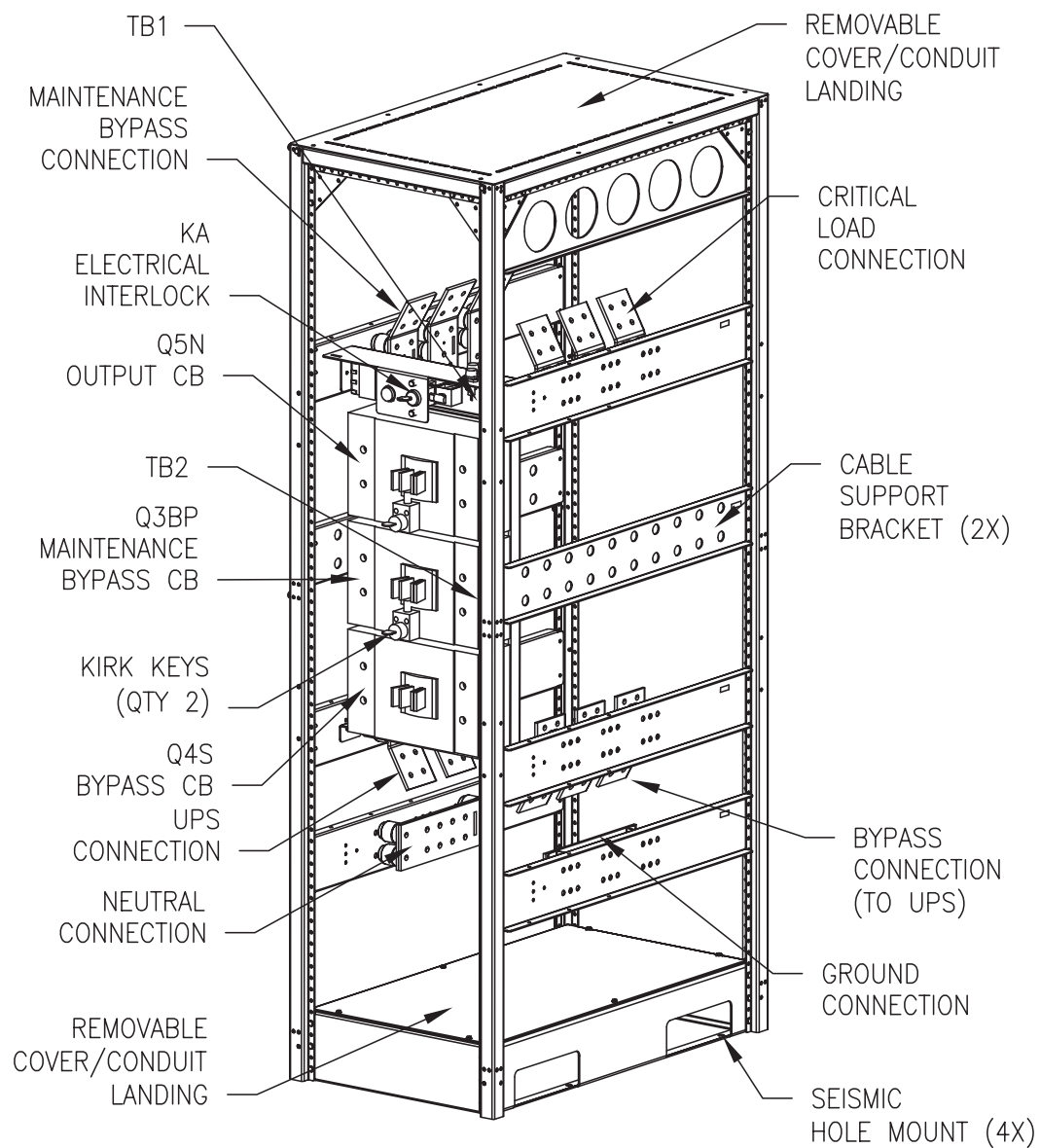


Figure 1-3: Circuit Breaker Locations on the Maintenance Bypass Cabinet.

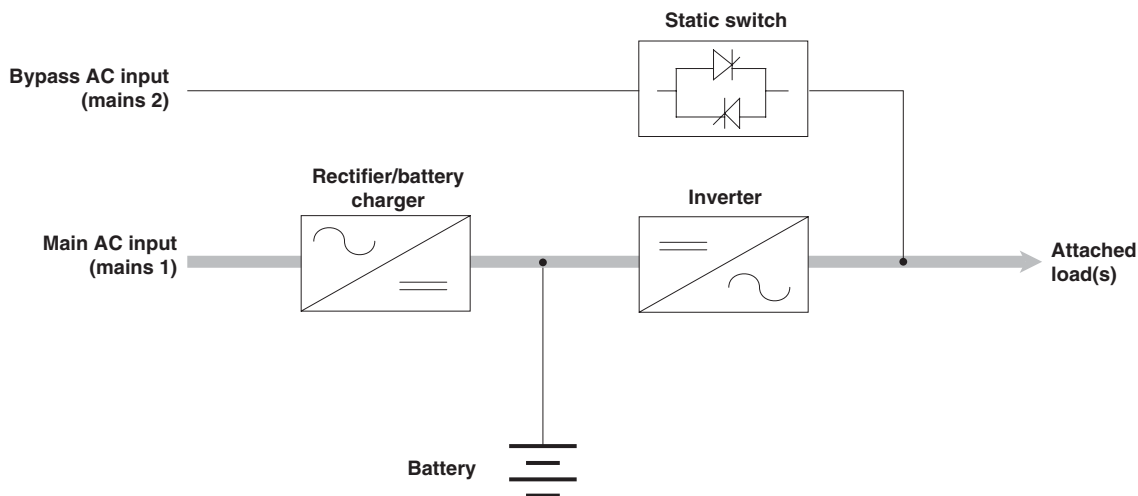


1.4.2 Power Flow Diagrams

1.4.2.1 Normal Operation

During normal operation, power flows from the main AC input source (mains 1) into the UPS rectifier/battery charger section. The rectifier/battery charger converts the AC voltage to DC, maintains the charge of the battery, and feeds the DC power to the inverter. The inverter regenerates AC voltage, and supplies the attached load. See Figure 1-5.

Figure 1-4: Normal Operation, Power Flow Diagram.

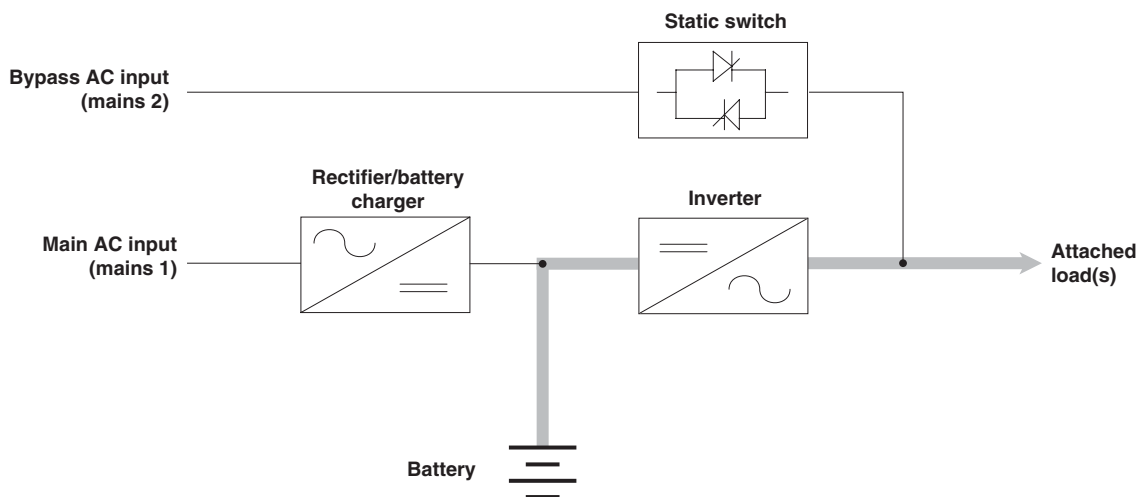


1.4.2.2 On-Battery Operation

If the main AC input source (mains 1) fails or goes out of tolerance, the charger stops. Power flows from the battery to the UPS inverter, which in turn supplies the attached load. When the main AC input source (mains 1) returns, the charger restarts automatically and the UPS resumes its normal operation. See Figure 1-6.

If the battery becomes depleted before the main AC input source (mains 1) returns, the inverter stops and the attached load is transferred to the bypass AC input source (mains 2) if it is available.

Figure 1-5: On-Battery Operation, Power Flow Diagram.



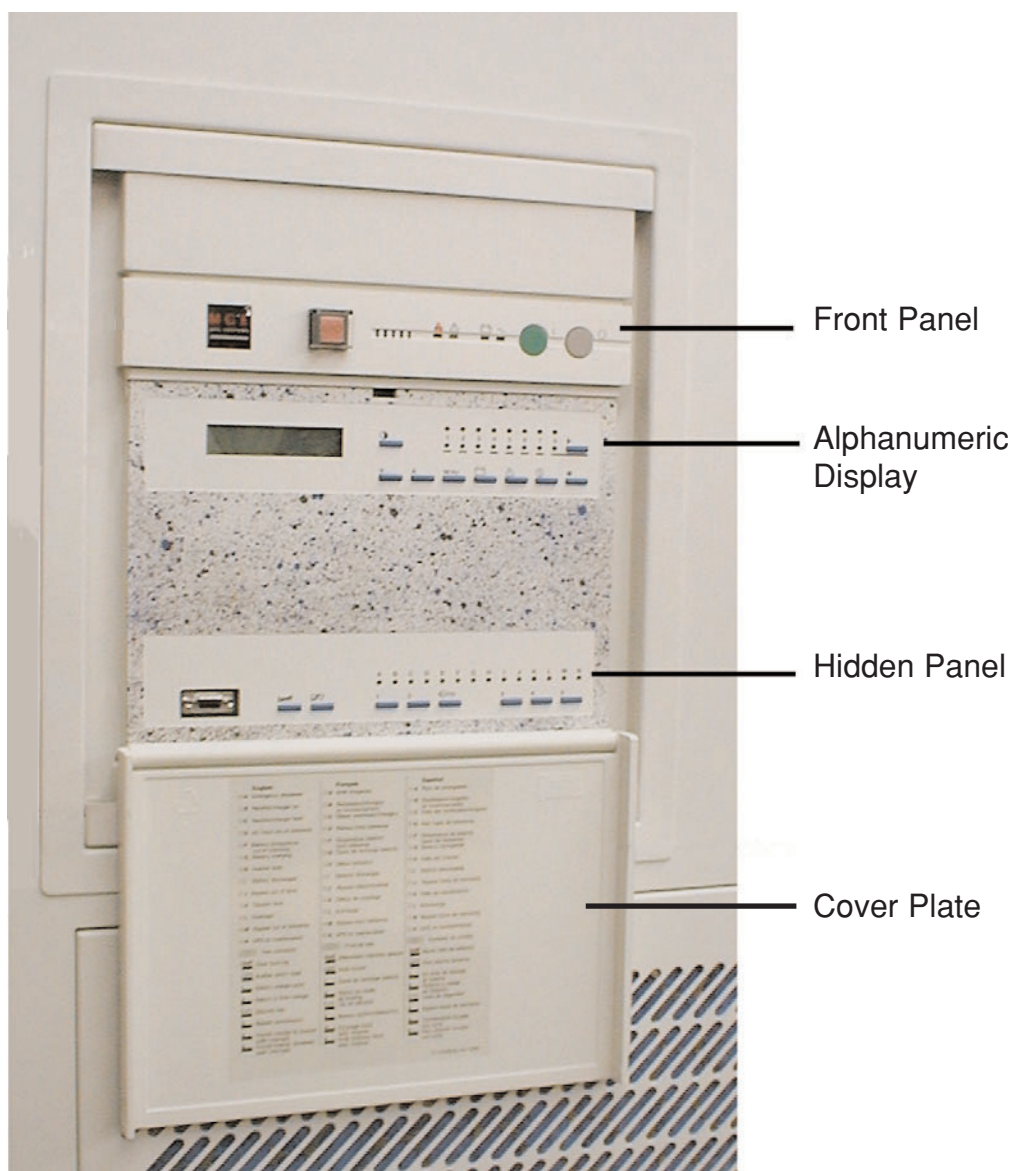
1.5 Single Module Indicators and Controls

Single Module indicators and controls are located in three places on the UPS cabinet: on the front panel, behind a drop-down cover just below the front panel, and inside the cabinet doors, see Figure 1-7. In battery cabinets and auxiliary cabinets, the controls are located behind the cabinet doors.

The following display descriptions:

- ▶ Front Panel
- ▶ Alphanumeric Display
- ▶ Hidden Panel

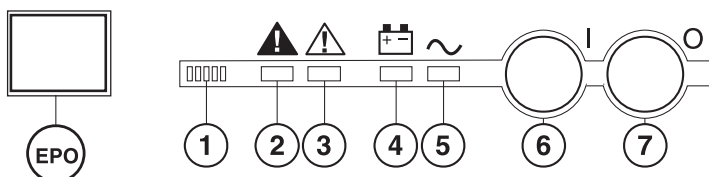
Figure 1-6: EPS 7000 Front Panel Indicators and Controls.



1.5.1 Front Panel

The UPS front panel, includes the emergency power off (EPO) pushbutton, the audible alarm, four LEDs that serve as system status indicators, the “inverter on” pushbutton, and the “inverter off” pushbutton. See Figure 1-8.

Figure 1-7: Front Panel Indicators and Control Display.



EPO

On the left side of the front panel, an emergency power off (EPO) pushbutton is provided, with a protective cover to guard against inadvertent operation. This pushbutton, when activated, disconnects the main AC input (mains 1), bypass AC input (mains 2), and battery power to the UPS, and disconnects output power to the attached load.

Audible alarm

(item 1) The audible alarm provides an audible warning to the operator by sounding a pulsed “beep” when any of the following conditions occur:

- ▶ Load transferred to bypass (mains 2)
- ▶ Load supplied via battery
- ▶ Operating problem

During minor alarm conditions, the alarm sounds at a slow rate and a low sound level. When the battery approaches the low-voltage shutdown level, the alarm sounds louder and at an increased rate. If the inverter shuts down, the alarm sounds loudly and continuously.

An audible alarm reset is located on the hidden panel. See Figure 1-7. Pressing it will silence the alarm. Should a higher-level alarm condition occur after the reset has been activated, the audible alarm will sound the new alarm condition.



Load not protected

(item 2) This red LED turns on when any of these conditions occur:

- ▶ The load is no longer protected following an inverter shutdown, or the opening of the isolation circuit breaker (Q5N).
- ▶ The battery circuit breaker QF1 is open, making battery power unavailable.



Operating problem

(item 3) This orange LED turns on when an operating problem exists, such as fan failure; static switch power supply fault; battery temperature fault; overload fault; or bypass AC input (mains 2) out of tolerance. The UPS continues to protect the attached load.



Battery

(item 4) This orange LED turns on to indicate that the attached load is being partially or completely supplied by the battery. When the main AC input (mains 1) fails or is outside tolerance, stored battery energy is supplied to the inverter, which in turn supplies the load.



Load protected

(item 5) This green LED indicates that the attached load is supplied by the inverter and protected by the battery. During normal operation, this LED is the only one that is on.

Inverter on

(item 6) This green pushbutton is used to start the inverter. When it is pushed, the green “load protected” LED flashes for three seconds, indicating that the start command has been received. When the inverter has synchronized with the bypass AC input (mains 2) source, the static switch transfers the load to the inverter output.

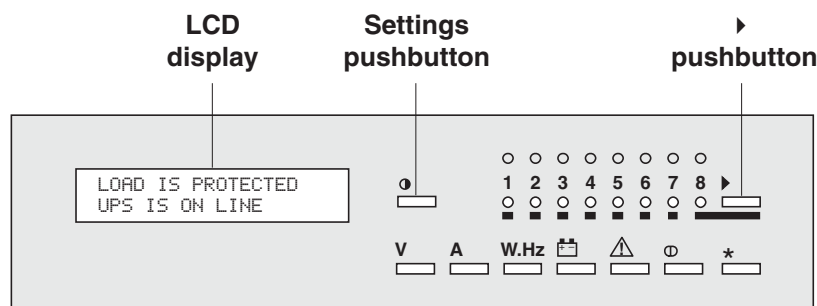
If the inverter cannot synchronize to the bypass AC input (mains 2) source, the load must be forced to transfer using the hidden panel (see section 2.11, Forced Transfers).

Inverter off

(item 7) This gray pushbutton is used to stop the inverter. When it is pressed for 3 seconds, the inverter stops and the load is transferred to the bypass AC input (mains 2) source. If the uninterrupted transfer conditions are not met, this pushbutton has no effect and the inverter can be stopped only from the hidden panel (see Section 2.12, Forced Transfers).

1.5.2 Alphanumeric Display and Controls

The alphanumeric display is located directly below the front panel display. See Figure 1-7. For complete instructions, refer to section 2.0 Operation, Using the Alphanumeric Displays.



A brief description of the display and controls follow.

Figure 1-8: Alphanumeric LCD Display , Settings , and Pushbutton Indicators and Controls.

Front Panel Alphanumeric Legend: (details on following page)

ⓘ	Settings	V	Voltage	A	Current	W.Hz	Power/Frequency
🔋	Battery	⚠	Alarms	⦿	On/Off	★	Confirm/Verify

1.5.2.1 Two-line Alphanumeric Display

This 40-character, two line LCD displays general status of the UPS continuously, and displays measurements of UPS operating parameters as selected with the control pushbuttons.

1.5.2.2 Alphanumeric Display Pushbuttons

Descriptions of the function of the alphanumeric display settings pushbuttons.



Settings

This pushbutton is used to select the display language and adjust the LCD screen contrast for optimal viewing.



Selection

Depending on the displayed message, the “▶” key may serve to indicate selection, negative response, and other functions.



Voltage

This pushbutton provides access to voltage measurements, including:

- ▶ Main AC input (mains 1) phase-to-phase voltage
- ▶ Bypass AC input (mains 2) phase-to-neutral and phase-to-phase voltage
- ▶ Inverter output phase-to-neutral and phase-to-phase voltage
- ▶ Load phase-to-neutral and phase-to-phase voltage



Current

This pushbutton provides access to current measurements, including:

- ▶ Main AC input (mains 1) current
- ▶ Bypass AC input (mains 2) current
- ▶ Inverter output current
- ▶ Load current
- ▶ Percent current drawn by the load relative to UPS rating
- ▶ Crest factor per phase



Power/Freq.

This pushbutton provides access to power and frequency measurements, including:

- ▶ Main AC input (mains 1) frequency
- ▶ Bypass AC input (mains 2) frequency
- ▶ Inverter frequency
- ▶ Power drawn by the load (in kW and kVA)
- ▶ Load power factor



Battery

This pushbutton provides access to battery measurements, including:

- ▶ Battery voltage
- ▶ Battery current
- ▶ Battery ambient temperature
- ▶ Battery time available
- ▶ Battery time remaining



Alarms

This pushbutton is used to display current alarms, or to display stored alarms.

If the alarm key is pressed repeatedly, the display will scroll through the stored alarm record, returning to the latest after the oldest is shown.

If a blinking character (!) appears in the display, the user may press the Alarm pushbutton again to scroll through additional useful information.



On/off

This pushbutton is reserved for future use.



Confirmation/Verify

Depending on the displayed message, this pushbutton may serve to indicate confirmation, positive response, and other functions.

1.5.2.3 Numbered Lights

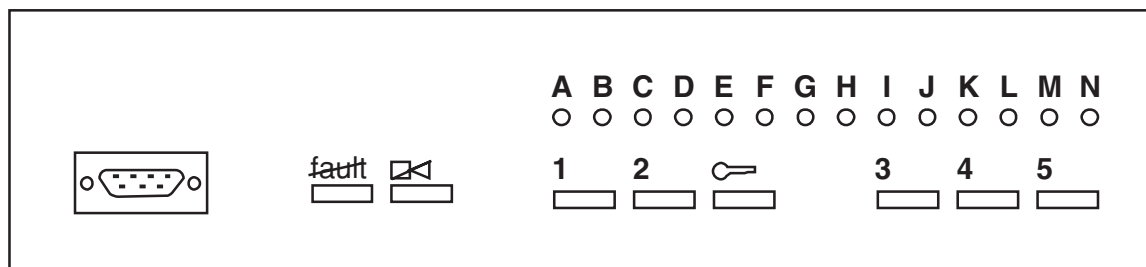
During normal operation, the green LED #1 will be on, indicating that the UPS core controller communicates with the display. If there is an alarm condition, the red LED #1 will turn on.

1.5.3 Hidden Panel Indicators

The hidden panel is located behind the hinged cover, at the lowest pane of the front panel, refer to Figure 1-6.

The hidden panel includes the alphanumeric display and controls, and following controls and indicators, see Figure 1-8 and 1-9.

Figure 1-9: Hidden Panel Alphanumeric LEDs and Pushbutton Indicators and Controls.



Hidden panel alphanumeric legend: (upper display, details on following page)

A	Emergency Shutdown	G	Battery charging	L	Overload
B	Rectifier/Charger on	H	Inverter fault	M	Bypass outside tolerance
C	Rectifier/Charger fault	I	Battery discharged	N	Maintenance position
D	Input Outside Tolerance	J	Inverter Desynchronized		
F	Battery temp. outside Tolerance	K	Transfer Fault		

(lower display)

(port) Test connector

1 Battery charge cycle

3 Inverter sync/desync

~~fault~~ Clear faults

2 Return to float voltage

4 Forced Transfer

(audio) Alarm reset

(key) Security

5 Forced Shutdown

1.5.3.1 LED Alphanumeric Indicators

Fourteen alphabetically labeled LEDs provide detailed information on UPS status as follows:

A: Emergency shutdown

This red LED indicates that the emergency power off (EPO) or remote emergency power off (REPO) has been activated. See section 2.11.1, Emergency Shutdown.

B: Rectifier/charger on

This green LED indicates that the rectifier/battery charger is on.

C: Rectifier/charger fault

This red LED indicates an alarm condition within the rectifier/battery charger. It indicates the presence of one of the following fault conditions:

- ▶ Input circuit breaker Q1 open
- ▶ Input power protection fuse blown
- ▶ Rectifier/battery charger over-temperature
- ▶ Battery charge overcurrent
- ▶ Battery overvoltage
- ▶ Rectifier/battery charger control board fault
- ▶ Power supply board fault

D: Main AC input (mains 1) outside tolerance

This orange LED indicates that the main AC input (mains 1) source is outside tolerance (voltage and/or frequency too high or too low).

E: **Reserved for future use.**

F: Battery temperature outside tolerance

This orange LED indicates that the ambient temperature of the battery is too high or too low.

G: Battery charging

This orange LED indicates that the battery is being recharged. This LED functions only when the connected battery is of the vented lead-acid type (sealed lead-acid batteries will not activate this signal).

H: Inverter fault

This red LED indicates an alarm condition in the inverter, which may be one or more of the following conditions:

- ▶ Inverter shutdown due to output voltage out of tolerance
- ▶ Inverter output protection fuse blown
- ▶ Inverter leg fault
- ▶ Inverter output transformer over-temperature
- ▶ Inverter leg over-temperature
- ▶ Internal clock fault
- ▶ Inverter control board fault
- ▶ Power supply board fault

I: Battery discharged

This orange LED indicates that the battery has reached the end of its autonomy, shutting down the inverter.

J: Inverter desynchronized

This orange LED indicates that the inverter is not synchronized with the bypass AC input (mains 2).

K: Transfer fault

This red LED indicates a transfer fault, which may be one or more of the following conditions:

- ▶ Inverter output static switch fault
- ▶ Static switch over-temperature
- ▶ Static switch power supply fault
- ▶ Transfer control board fault
- ▶ Power supply board fault

L: Overload

This orange LED indicates an alarm condition resulting from one or more of the following conditions:

- ▶ Inverter current above rating
- ▶ Output current above rating
- ▶ Inverter and/or static switch shutdown due to excessive load current

M: Bypass AC input (mains 2) outside tolerance

This orange LED indicates that the bypass AC input (mains 2) voltage and/or frequency are too high or too low.

N: Maintenance position

This orange LED indicates that circuit breakers QF1, Q4S, Q5N, or Q3BP are set to the maintenance position. The UPS is not available for load protection.

1.5.3.2 Hidden Panel Lower Pushbuttons

Following are brief descriptions of the function of the hidden panel pushbuttons. See Figure 1-9.

Test connector	(port) This 9-pin connector is reserved for service. It is used to connect the cabinet to a computer, allowing system calibration, personalization, and computer-aided diagnostics.
Clear fault log	Pressing this pushbutton clears the alarms stored in memory, allowing the unit to restart. Memorized alarms cannot be cleared until the condition causing the alarm has been corrected.
Audible alarm reset	Pressing this pushbutton stops the audible alarm. Should a new fault condition at a higher alarm level occur, the alarm will sound again.
Battery charge cycle	(pushbutton #1) Pressing this pushbutton begins a battery charging cycle. After the cycle is complete, the rectifier/battery charger returns to float charge levels on the battery. The battery charge cycle is not applicable to sealed lead-acid battery installations.

Return to float voltage	(pushbutton #2) This pushbutton can be used during a battery charge cycle to force the rectifier/battery charger back to the float voltage level.
Security pushbutton	(key) This pushbutton must be pressed simultaneously with any of the following three pushbuttons. This helps guard against inadvertent transfer of the load with interruption.
Inverter desync/sync	(pushbutton #3) Pressing and holding the “security key” while pressing this pushbutton forces the inverter output to desynchronize or synchronize to the bypass AC input (mains 2) source.
Forced bypass to inverter	(pushbutton #4) Pressing and holding the “security key” while pressing this pushbutton forces the transfer of the load to the inverter output when the bypass is out of tolerance. The inverter must be on; press the “inverter on” pushbutton on the UPS front panel if necessary. The load will experience a 0.8 second interruption. Refer to section 2.12, Forced Transfers.
Forced inverter to bypass	(pushbutton #5) Pressing and holding the “security key” while pressing this pushbutton stops the inverter and transfers the load to the bypass AC input (mains 2) even if the bypass is out of tolerance. The load will experience a 0.8 second interruption. Refer to section 2.12, Forced Transfers.

**CAUTION:**

Using the forced transfer functions will cause the load to experience an interruption for a minimum of 0.8 seconds. Be certain the load can tolerate this interruption; see section 2.12 Forced Transfers.

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Operation

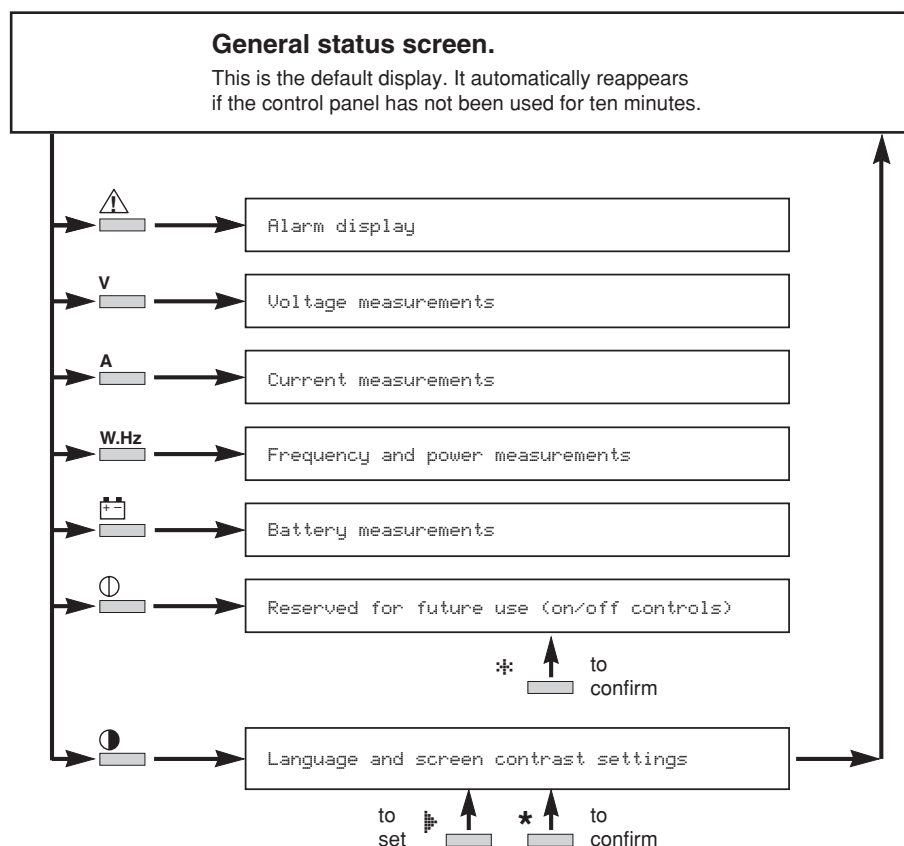
2.0 Scope

This section describes procedures for normal operation of EPS 7000 Single Module systems. Including interactive front panel display, settings for language configuration, alarms message displays, voltage, current, battery measurements, with before and after start-up checks, emergency shutdown using EPO disconnects, and normal conditions for using forced transfers.

2.1 Status Screen Display

The alphanumeric interactive status screen display, (located in the top pane of the hidden panel, see Figure 1-8), is the automatic default display for status setting configurations.

Figure 2-1: Default Status Screen Alphanumerical Display Configuration.



During normal operation, when there are no alarm conditions present and the load is supplied by the UPS inverter output, the display will present the general status message:

```
LOAD IS PROTECTED
UPS IS ON LINE
```

When there are alarm conditions, the display will present a general alarm message, and the user can use the “alarm” pushbutton (!) to determine the exact cause of the alarm condition, see section 2.9, Alarms.

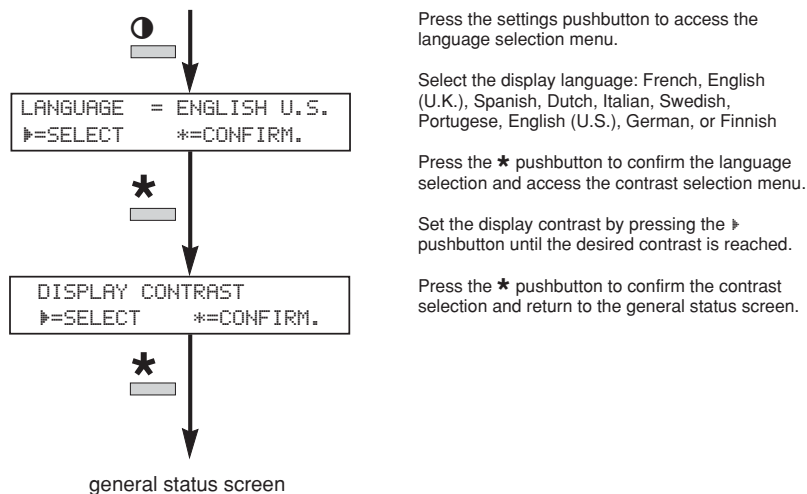
The following sections present detailed operating instructions for the alphanumeric display.

2.2 Settings Selection Screen

The settings selection screens allow the user to configure the display language and set the contrast of the LCD display.

To access the settings selection screen, press the settings pushbutton, and follow the steps. See Figure 2-2.

Figure 2-2: Settings Selection Display Screen.



IMPORTANT:

Select ENGLISH U.S. as the display language to match the displays as presented in this manual.

2.3 Alarms

In the event of an alarm condition, the general status screen shows an alarm message. To determine the specific condition causing the alarm, press the alarm key on the front panel and follow the sequential steps.

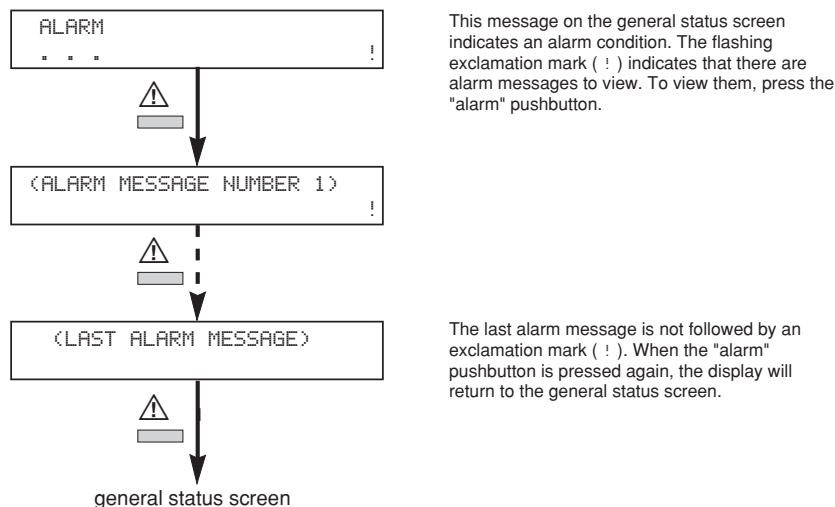
If there is a flashing exclamation mark (!) in the displayed message, there is additional information to be viewed, follow the steps as indicated in Figure 2-3.

Most alarm messages are self-explanatory. See section 2.8 LCD Messages for a listing of the most common alarm messages.

The most serious alarms are stored in the fault log, and may be viewed by following the steps shown in Figure 2-3.

To reset the alarms, press the "clear fault log" pushbutton. See section 1.5.2.2 Alphanumeric Display Pushbuttons.

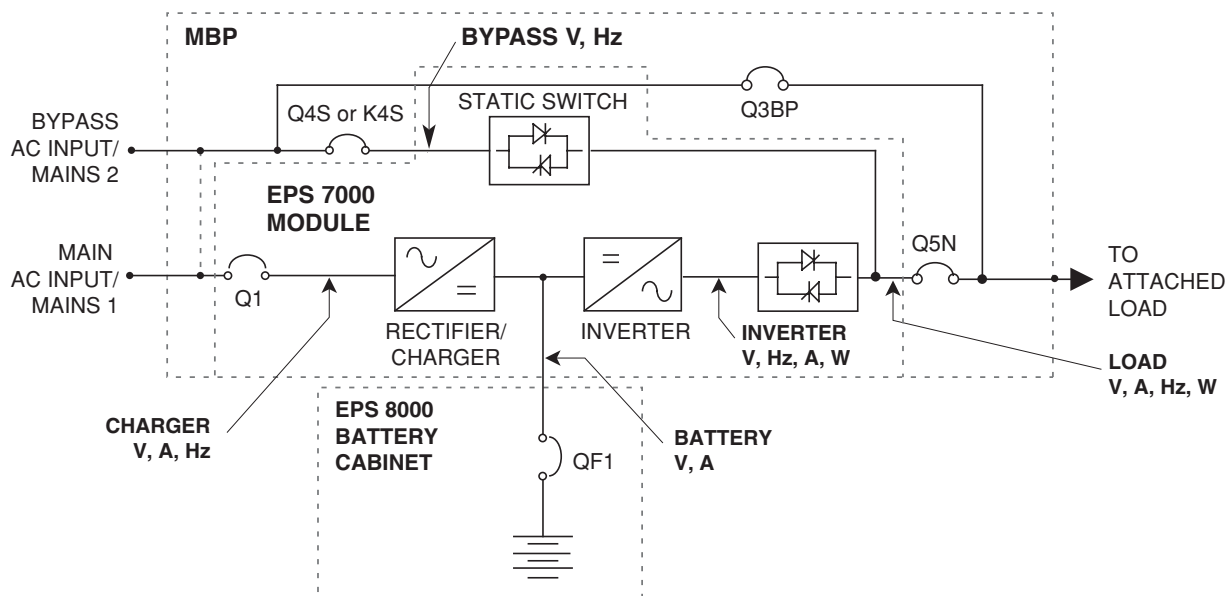
Figure 2-3: Sequential Alarm Messages for Viewing the Fault Log.



2.4 Sensor Measurements

The LCD displays comprehensive information about UPS performance monitoring functions through sensor measurements devices located within the EPS 7000 single module. See Figure 2-4.

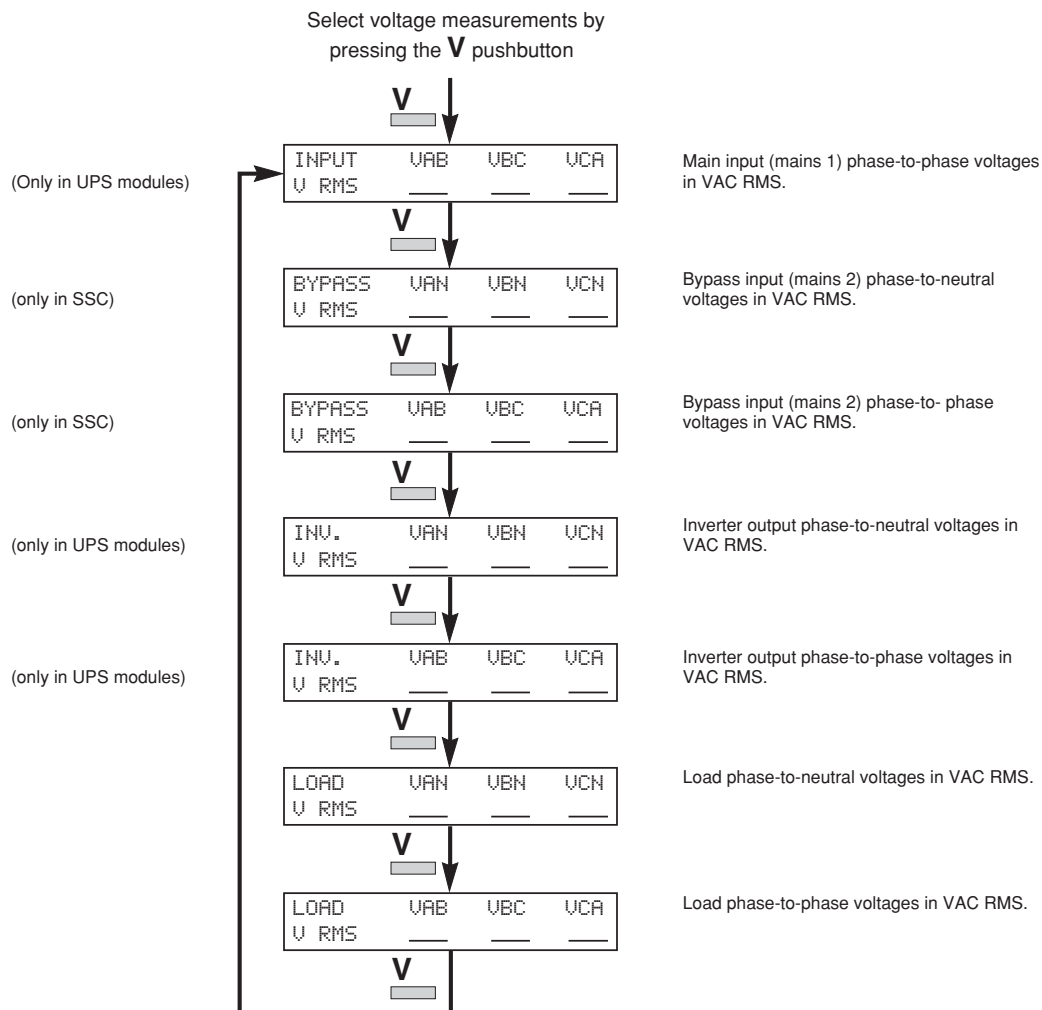
Figure 2-4: Measurement Sensors Located throughout the EPS 7000 Single-Module UPS.



2.5 Voltage Measurements

To display voltage measurements, press the “V” key on the keyboard. See Figure 2-5.

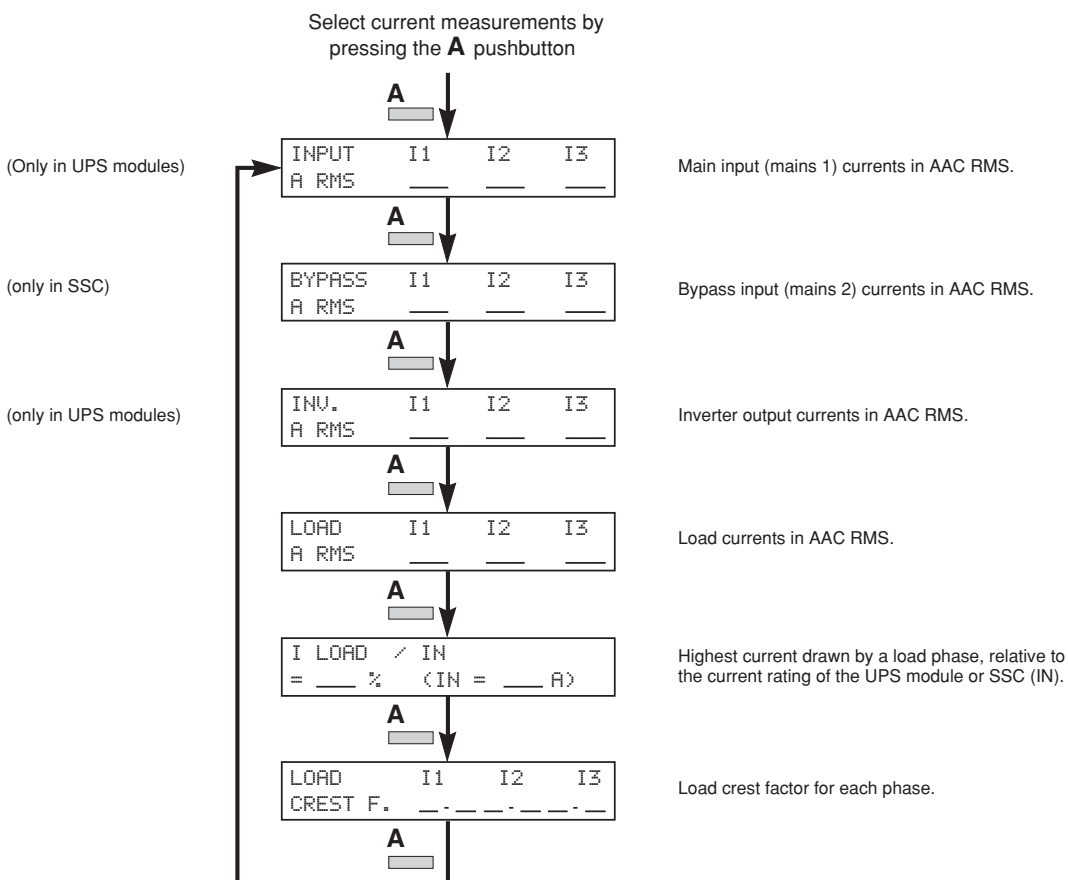
Figure 2-5: Voltage Measurement Displays.



2.6 Current Measurements

To display current measurements, press the “A” key on the keyboard. See Figure 2-6.

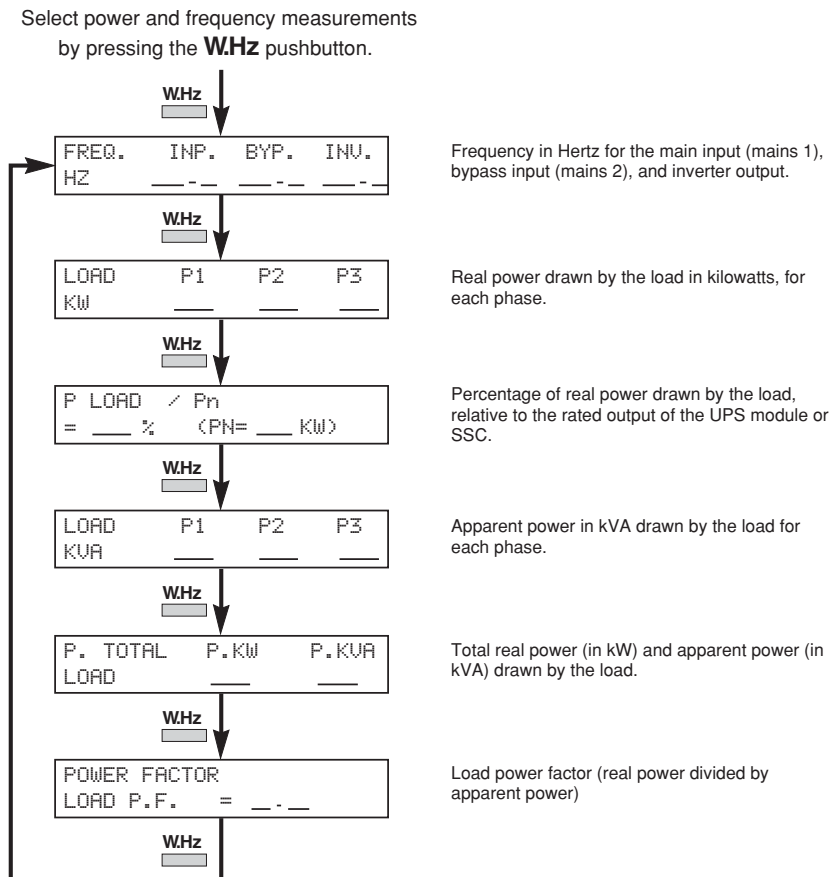
Figure 2-6: Current Measurements Displays.



2.7 Power Frequency Measurements

To display power or frequency measurements, press the “W.Hz” key on the keyboard. See Figure 2-7.

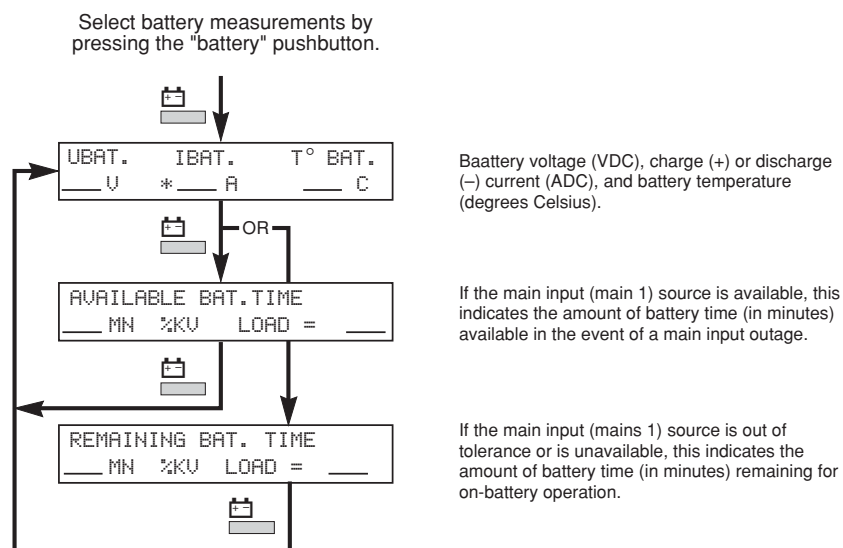
Figure 2-7: Power and Frequency Measurements Displays.



2.8 Battery Measurements

To display battery voltage, current, ambient temperature, and time available or remaining, press the battery key on the keyboard. see Figure 2-8.

Figure 2-8: Battery Measurements Displays.



2.9 LCD Messages

This section presents the most common alarm messages that appear on the LCD (the alphanumeric section of the “hidden” panel), and explains their meaning.

```
LOAD IS PROTECTED
UPS IS ON LINE
```

This is the normal display message. There are no alarms or problems, and the load is being supplied by the UPS inverter.

2.9.1 General Alarms

```
LOW LEVEL ALARM
UPS OK    !
```

This message indicates that a problem requiring action has occurred. The load is still supplied by the inverter. The problem is listed in the secondary alarm message (see below), as indicated by the flashing exclamation mark (!). The alarm message may be viewed by pressing the “alarm” pushbutton (!).

```
UPS INPUT FAILURE
LOAD ON BATTERY !
```

This message indicates that the main AC input (mains 1) has failed or is outside of tolerance, and power to the inverter is being supplied from the UPS battery system. The load is still supplied via the inverter.

```
REMAINING BAT. TIME
__ MN  %KW LOAD = __
```

This message is automatically displayed every five seconds when the UPS is on battery. It alternates with the previous message. The message provides an estimate of the available remaining time on battery, based on the percentage of full rated load being supplied, the type of battery, the battery temperature, and the battery age.

```
UPS LOW BATTERY
SHUTDOWN IMMINENT !
```

This message indicates that the batteries have reached the “low battery shutdown” warning level. The user must take steps to prepare the load for shutdown (load shedding, file saving and computer shutdown, etc.). This message replaces the previous two messages when the batteries are nearly depleted. When this message appears, there are only a few minutes of battery back-up time remaining.

```
UPS ALARM
CALL SERVICE    !
```

This indicates that the battery disconnect circuit breaker QF1 has been open or the inverter has stopped and that service is required. The problem is listed in the secondary alarm message (see below), as indicated by the flashing exclamation mark (!). The secondary alarm message may be viewed by pressing the “alarm” pushbutton (!).

2.9.2 Secondary Alarms

The presence of these alarms is indicated by a flashing exclamation mark (!) on the general alarm message. Press the “alarm” pushbutton to view these messages.

```
EMERGENCY SHUTDOWN
REPO ON !
```

This message indicates that the UPS has been shut down because a remote emergency power off (REPO) pushbutton has been pressed and is still closed.

LOAD ON
BYPASS !

This message indicates that the load has been transferred to the bypass AC input (mains 2) source. The load is no longer protected.

BYPASS PROBLEM
CHECK FREQUENCY !

This message indicates that the bypass AC input (mains 2) source is out of frequency tolerance. The inverter has switched to free-running mode. Transfer of the load from the inverter output to the bypass AC input source requires an interruption of power to the load.

BYPASS PROBLEM
CHECK VOLTAGE !

This message indicates that the bypass AC input (mains 2) source is out of voltage tolerance. The inverter has switched to free-running mode. Transfer of the load from the inverter output to the bypass AC input source requires an interruption of power to the load.

INDEPENDENT INVERTER
FREQ. COMMAND ON !

This message indicates that the inverter has been set to free-running mode. The inverter is not synchronized to the bypass AC input (mains 2) power source. Transfer of the load from the inverter output to the bypass AC input source requires an interruption of power to the load.

BYPASS TRANSFER
LOCKOUT COMMAND ON !

This message indicates that the UPS has been set not to transfer from the inverter to the bypass AC input (mains 2) source. In the event of an inverter shutdown, the load will be disconnected.

BATTERY CABINET
OVERTEMP. !

This message indicates that the ambient temperature of the battery is out of tolerance.

UPS INPUT PROBLEM
CHECK FREQUENCY !

This message indicates that the main AC input (mains 1) frequency is out of tolerance. The rectifier/battery charger has shut down and the inverter is operating from its battery source.

UPS INPUT PROBLEM
CHECK VOLTAGE !

This message indicates that the main AC input (mains 1) voltage is out of tolerance. the rectifier/battery charger has shut down and the inverter is operating from its battery source.

CHARGER SHUTDOWN
COMMAND ON !

This message indicates that the rectifier/battery charger has been instructed to shut down, for example during progressive (stepped) transfer to a motor-generator set.

INPUT KVA LIMITED
COMMAND ON !

This message indicates that the rectifier/battery charger has been instructed to limit the power drawn from the main AC input (mains 1) source. This condition occurs, for example, when the load is being supplied by an undersized motor-generator set; the UPS battery source is called upon to make up the difference.

BATTERY CURRENT
LIMIT COMMAND ON !

This message indicates that the rectifier/battery charger has been instructed to limit the charge current to the battery. Normal charge current to the battery will be supplied when the command is released. This condition occurs, for example, when the load is being supplied by an undersized motor-generator set.

QF1 BATTERY BREAKER
OPEN !

This message indicates that the battery circuit breaker QF1 has been opened or has tripped. the load is no longer protected, since battery power is unavailable.

LOW BATTERY
. . . !

This message indicates that the inverter has shut down, due to depletion of the batteries' stored energy.

CHARGER OFF
. . . !

This message indicates that the rectifier/battery charger has shut down.

CHARGER FAULT
CALL SERVICE !

This message indicates that a fault has occurred in the rectifier/battery charger, and that service is required.

Q1 UPS INPUT CB
OPEN !

This message indicates that the input isolation circuit breaker is open or has tripped. It must be closed for rectifier/battery charger start-up.

INVERTER OVERLOAD
CHECK P.F. AND KW

This message indicates that the inverter is in an overload condition, usually due to excessive real power (kW) being drawn by the load. The flashing "KW" indicates that the operator should check the load real power. The inverter will keep supplying the load for a certain amount of time depending on the overload level.

INVERTER FAULT
CALL SERVICE !

This message indicates that a fault has occurred in the inverter, and that service is required.

INVERTER SHUTDOWN
OVERLOAD > I MAX!

This message indicates that an overload greater than 1.5 times the full power rating of the inverter has occurred, and that the inverter has shut down.

INVERTER SHUTDOWN
THERMAL OVERLOAD A

This message indicates that an overload below 1.5 times the full power rating of the inverter has occurred and that the inverter has shut down. The flashing "A" indicates that the operator should check the load current.

I LOAD > IN
CHECK LOAD A

This message indicates that the load power being drawn is greater than the UPS full load rating. The flashing "A" indicates that the operator should check the load current. The inverter or static switch will keep supplying the load for a certain amount of time depending on the overload level.

TRANSFER FAULT
CALL SERVICE !

This message indicates that a fault has occurred that affects the transfer of the load between the inverter and the bypass source. Service is required.

PH OUT OF TOLERANCE !

This message indicates that there is an out of tolerance condition between the inverter and bypass AC input (mains 2) sources. Transfer of the load between the inverter and bypass AC input will result in an interruption of load power.

Q4S BYPASS SWITCH
OPEN !

This message indicates that the circuit breaker Q4S is open. Transfer of the load from the inverter to the bypass source is not possible.

Q5N UPS OUTPUT ISOL.
SWITCH OPEN !

This message indicates that the optional UPS isolation circuit breaker Q5N is open. The load is not supplied unless the maintenance bypass circuit breaker Q3BP is closed.

Q3BP MAINT. BYPASS
SWITCH CLOSED !

This message indicates that the optional maintenance bypass circuit breaker Q3BP is closed. The system is set to maintenance bypass, and the load is supplied by the bypass AC input source (mains 2).

STATIC SWITCH O.L.
EMERGENCY OFF !

This message indicates that the static switch has shut down following an overload condition, disconnecting the load.

DISPLAY NUMBER 1
UNAVAILABLE

This message indicates that the alphanumeric display is not operating properly. The status of the UPS is still correctly indicated by the LEDs of the visible panel and the hidden panel, see section 1.5 Single Module Indicators and Controls.

HARMONIC FILTER
FUSE FAILED

This message indicates that the fuse(s) protecting the input harmonic filter has opened and that service is required. The status of the UPS is still correctly indicated by the LEDs of the visible panel. Refer to section 1.5 Single Module Indicators and Controls for front and hidden panel indicators and controls.

2.10 Preparations Before Start-up

Preparing before start-up uses a check list to powering up the EPS 7000. Reference the EPS 7000 Shared Systems Users Manual 86-134005-00, and Installation Manual for Single module and Shared Systems 86-134003-00, in conjunction with this start-up procedure, to utilize information of the controls and indicators during start-up.

2.10.1 Checks Before Start-up

Before starting the EPS 7000, thoroughly read this manual to be certain that you fully understand the operation of the EPS 7000 Single Modules indicators, controls, and operational sequences.

Before starting the EPS 7000, make certain that these conditions exist (as applicable to your installation):

- ▶ 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 UPS and load requirements.
- ▶ The input voltage is the same as indicated on the UPS nameplate, located inside the left door of the EPS 7000 module.
- ▶ The air filters located inside each EPS 7000 module front door are properly installed and free of dust, dirt, and debris. Make certain that no objects block the air intake around the front bottom of the enclosures, and that the air exhaust at the top rear of the enclosures is free of obstructions.
- ▶ The UPS module input isolation circuit breaker Q1 is in the OFF (open) position.
- ▶ The bypass circuit breaker Q4S is in the OFF (open) position.
- ▶ The optional maintenance bypass circuit breaker Q3BP (if present) is in the OFF (open) position.
- ▶ The optional UPS isolation circuit breaker Q5N (if present) is in the OFF (open) position.
- ▶ The battery disconnect circuit breaker QF1 is in the OFF (open) position.

2.10.2 Start-up

The following start-up procedure should be performed during the initial start-up following installation of the system, and this sequence should be followed any time that the EPS 7000 UPS is being restarted from an off condition (i.e., after the UPS has been powered down by removing the upstream AC input power and opening all the circuit breakers of the UPS).

- a. Apply power to Q4S by closing the upstream circuit breaker supplying Q4S.
- b. Apply power to the UPS input by closing the upstream circuit breaker supplying the main AC input (mains 1).
- c. Close the optional maintenance bypass circuit breaker Q3BP (if present). Power is now available at the UPS output (the load is energized) via the bypass source.
- d. Close the control or bypass circuit breaker Q4S. The static switch will come on-line; the fans will start.
- e. Close the output isolation circuit breaker Q5N (if present).
- f. Open the maintenance bypass circuit breaker Q3BP (if present). The load is now supplied via the bypass source.

Note that if your UPS configuration does not include the maintenance bypass option, start-up requires only closing Q4S to supply the bypass source to the attached load.

g. Close the input isolation circuit breaker Q1. Verify that the following conditions exist:

- ▶ The red “load not protected” LED is on
- ▶ The rectifier/battery charger automatically starts

If either condition is not present, there is a fault. Open Q1 and contact MGE Customer Support Services.

h. Close the battery disconnect circuit breaker QF1. The batteries are now connected to the rectifier/battery charger, and have begun charging.

**IMPORTANT:**

Because it is standard for the UPS module to be programmed for automatic restart, the inverter will automatically start after the battery disconnect circuit breaker QF1 has been closed.

- i. If the UPS is not programmed for automatic restart, press the “inverter on” pushbutton. The green “load protected” LED will flash for about 3 seconds, indicating that the inverter is starting.
- j. The UPS will automatically transfer the load to the UPS inverter output. The green “load protected” LED will turn on and remain on.

**NOTE:**

If the transfer conditions are not satisfied (bypass AC input sources is out of tolerance) a forced transfer is required. Refer to section 2.12 Forced Transfers.

2.10.3 Checks After Start-up

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).
- ▶ Inverter start and stop.
- ▶ Battery transfer test.
- ▶ Maintenance bypass procedure.

2.11 Shutdown

Shutdown procedures in this section apply to the EPS 7000 cabinet under normal, emergency, overload, and maintenance conditions.

2.11.1 Emergency Shutdown Using EPO



CAUTION:

Pressing the EPO disconnects the attached load. The emergency power off (EPO) is to be used during emergency situations only, where a hazard to personnel or equipment exists, such as during a fire. DO NOT USE THE EPO TO TURN THE UPS OFF; follow the procedures listed in this section for turning the inverter on and off.

During an emergency situation, such as a fire in the computer or electrical room, the UPS and all downstream devices can be instantly shut down by pressing the “emergency power off” (EPO) pushbutton on the front panel of the UPS cabinet, or by pressing the “remote emergency power off” (REPO) optional pushbutton located within the room.

The EPO or REPO pushbuttons should not be used for normal shutdown of the equipment; when activated, ground paths may be broken (depending on installation) and sensitive loads attached to the UPS may lose safety ground connection.

2.11.2 Normal Shutdown

To shut down the UPS, press the “inverter off” pushbutton on the module front panel for 3 seconds. To restart, press the “inverter on” pushbutton. Note that the transfer will occur only if the inverter is synchronized to the bypass; otherwise, a forced transfer is needed, see section 2.12 Forced Transfers.

To isolate the UPS for maintenance, or to transfer the load to the bypass AC input source (if present), follow the procedure that applies to your configuration.

2.11.3 With Maintenance Bypass

This procedure assumes that the UPS is operating normally, with the attached load supplied via the UPS inverter:

1. Stop the inverter by pressing the “inverter off” pushbutton on the UPS front panel for 3 seconds. The audible alarm will sound; silence the alarm by pressing the audible alarm reset pushbutton on the hidden panel. See section 1.5 Single Module Indicators and Controls.

If the transfer conditions are not satisfied (bypass out of tolerance or another reason), a forced transfer will be required., in this case refer to section 2.12 Forced Transfers for procedures.

2. Depress transfer initiate switch. Unlock and remove the key from key interlock. Unlock and close the maintenance bypass circuit breaker Q3BP, see Figure 1-3.
3. Open the UPS isolation circuit breaker Q5N and lock open. The UPS is now isolated from the load which is supplied by the bypass AC input source.
4. Open the circuit breaker Q4S.
5. Open the battery disconnect circuit breaker(s) QF1.
6. Open the input isolation circuit breaker Q1.
7. Remove the key from Q5N.
8. Insert the key into key interlock and turn to lock. The UPS system is ready for maintenance.

For complete protection, the upstream circuit breaker(s) supplying the UPS should be opened, locked, and tagged while the UPS is being serviced. The UPS is now isolated for maintenance.

NOTE: This will dump any load being serviced even through the Bypass.

To restart the UPS after maintenance:

1. Close all the upstream circuit breakers supplying the UPS. Close the input isolation circuit breaker Q1.
2. Close the circuit breaker Q4S. The UPS fans will start. Verify that the UPS is on bypass.
3. Depress transfer initiate switch. Unlock and remove the key from key interlock.
4. Insert the key into Q5N and unlock. Close the UPS isolation circuit breaker Q5N.
5. Open the maintenance bypass circuit breaker Q3BP and lock open. Remove the key.
6. Insert the key into the key interlock and turn to lock.
7. Wait for the green LED "B" on the hidden panel to turn on (indicating that the rectifier/battery charger has started), then close the battery disconnect circuit breaker QF1. If there is more than one battery cabinet in your configuration, close all the battery disconnect circuit breakers.
8. Automatic restart of the UPS is the normal configuration; the UPS inverter will start automatically and resume normal operation. If your EPS 7000 has been programmed NOT to automatically restart, start the inverter by pressing the "inverter on" pushbutton on the UPS front panel. The inverter will start and the UPS will resume normal operation. If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer will be required. Refer to section 2.12, Forced Transfers.

2.11.4 Without Maintenance Bypass

This procedure assumes that the UPS is operating normally, with the attached load supplied via the UPS inverter.

1. Stop the inverter by pressing the "inverter off" pushbutton on the UPS front panel for 3 seconds. The audible alarm will sound; silence the alarm by pressing the audible alarm reset pushbutton on the hidden panel (see Figure 1-8). If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer is required; refer to Section 2.12, Forced Transfers.
2. Open the circuit breaker Q4S.



CAUTION:

Opening Q4S with the inverter stopped in a UPS without maintenance bypass will disconnect the attached load.

3. Open the battery disconnect circuit breaker(s) QF1.
4. Open the input isolation circuit breaker Q1.

For complete protection, the upstream circuit breaker(s) supplying the UPS should be opened, locked, and tagged while the UPS is being serviced. The UPS is now isolated for maintenance.

To restart the UPS after maintenance:

1. Close all the upstream circuit breakers supplying the UPS. Close the input isolation circuit breaker Q1.
2. Close the circuit breaker Q4S. The UPS fans will start and the attached load will be supplied via the bypass source.

3. Wait for the green LED “B” on the hidden panel to turn on (indicating that the rectifier/battery charger has started), then close the battery disconnect circuit breaker QF1. If there is more than one battery cabinet in your configuration, close all the battery disconnect circuit breakers.
4. Automatic restart of the UPS is the normal configuration; the UPS inverter will start automatically and resume normal operation. If your EPS 7000 has been programmed NOT to automatically restart, start the inverter by pressing the “inverter on” pushbutton on the UPS front panel. In a few moments, the inverter will start and the UPS will resume normal operation. If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer will be required. Refer to section 2.12, Forced Transfers.

2.12 Forced Transfers

This section describes the normal transfer conditions and the procedures to be followed when issuing forced transfers.



CAUTION:

Opening Q4S with the inverter stopped in a UPS without maintenance bypass will disconnect the attached load.

2.12.1 Uninterrupted Transfer Conditions

To transfer the load between the UPS module output and the bypass AC input (mains 2) source without interruption, the following conditions must be satisfied:

- ▶ inverter output and bypass AC input phases must be in sync
- ▶ Bypass AC input voltage must be within 10% of nominal
- ▶ Bypass AC input frequency must be within a certain programmable tolerance of nominal

Provided that both the UPS module output and bypass AC input sources meet these conditions, uninterrupted transfers can take place. If these conditions are not met, transfers cannot take place without interruption. A forced transfer is required.

Forced transfers require a power interruption to the load of 0.8 seconds. Before issuing a forced transfer command, be certain that the attached load can tolerate the brief outage. The following paragraphs describe the forced transfer procedures.

2.12.2 Forced Transfer from Bypass AC Input Source to Inverter

Start the inverter by pressing the “inverter on” button on the front panel.

On the hidden panel, press the “security” key and hold it while pressing the “forced bypass to inverter” key (pushbutton #4). The load will be disconnected for 0.8 seconds, then connected to the inverter.

2.12.3 Forced Transfer from Inverter to Bypass AC Input

On the hidden panel, press the “security” key and hold it while pressing the “forced inverter to bypass” key (pushbutton #5). The inverter will stop and the load will be disconnected for 0.8 seconds; then the load will be connected to the bypass AC input source.

Maintenance

3.0 Scope

This section describes maintenance of the EPS 7000, including safety instructions, preventive maintenance, isolation for maintenance, information about replacement parts, and troubleshooting LCD alarm messages.

3.1 Safety Instructions



WARNING:	DC input power to the inverter is normally from a battery bank with a very high short-circuit capacity. Accidental welding and severe burns can be caused by mistakes while connecting or disconnecting these conductors.
ATTENTION	L'entrée DC de l'onduleur est normalement alimentée par une batterie avec un courant de court-circuit élevé. Une erreur lors de la connexion ou deconnexion de ces conducteurs peut causer des soudures accidentelles et des brûlures sérieuses.
WARNUNG!	Gleichstrom zum Wechselrichter kommt gewöhnlich von der Batteriebank mit einer sehr hohen Kurzschluss Leistungsfähigkeit. Unbeabsichtigtes Schweißen und schwere Verbrennungen können die Folge von fehlerhafter Verbindung und Trennung sein.

3.2 IMPORTANT SAFETY INSTRUCTIONS FOR SERVICING BATTERIES

- A. Servicing of batteries should be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.
- B. When replacing batteries, use the same model and manufacturer of batteries.
- C. **CAUTION** — Do not dispose of battery or batteries in a fire. The battery may explode.
- D. **CAUTION** — Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
- E. **CAUTION** — A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working with batteries:
 1. Remove watches, rings, or other metal objects.
 2. Use tools with insulated handles.
 3. Wear rubber gloves and boots.
 4. Do not lay tools or metal parts on top of batteries.
 5. Disconnect charging source prior to connecting or disconnecting battery terminals.
 6. Determine if the battery is inadvertently grounded. If inadvertently grounded, remove the source of ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.

3.3 Preventive Maintenance

The following preventive maintenance routines should be considered the minimum requirements; your installation and site may require additional preventive maintenance to assure optimal performance from your installed EPS 7000 and associated equipment. These routines should be performed twice a year (more often if required). We strongly recommend contracting MGE Customer Support Services for preventive and remedial maintenance.

The technician or electrician performing preventive maintenance on the UPS must thoroughly read this manual, and reference the EPS 7000 Installation Manual for Single Module and Shared systems (MGE part number 86-134003-00) or the EPS 7000 Shared Systems Users Manual, (MGE part number 86-134005-00), to become familiar with the indicators, controls, and operation of the EPS 7000 systems.

- a. Isolate and de-energize all EPS 7000 equipment for all maintenance operations.
- b. Ensure that all equipment is clean and free of loose dust, dirt, and debris. The exterior of the enclosures may be cleaned with a mild solution of soap and water, lightly applied with a lint-free cloth.
- c. Inspect the air intake and exhaust plates and clean as required. Verify that air flows freely through the equipment. Clean the air intake and exhaust plates, and the enclosure interior, with a vacuum cleaner.
- d. The EPS 7000 module is equipped with air filters that should be changed at regular intervals. Inspect the filters regularly to determine how long the filters will last in your installation.
- e. Initiate the start-up procedure, as described in the User's guide.
- f. Test the main operating sequences as applicable to your equipment configuration and installation.

3.4 Replacement Parts

There are no user replaceable parts inside the EPS 7000.

Three levels of replacement parts are available for the EPS 7000. The three levels are designated A, B, and C. The level that you should keep on hand for your installation will vary depending on the type of maintenance planned on site, and the configuration of your UPS system. Having the replacement parts on hand will prevent any unacceptable delays (due to time involved obtaining spare parts) during critical periods, such as system start-up.

Any items used during start-up will be replaced by MGE at no charge. Contact MGE Customer Support Services for specific recommendations. A description of each level is provided below:

Level	Description
A	This level of replacement parts consists of consumable items, specifically fuses and air filters. It is recommended to have these items on hand during installation of the UPS systems, including initial start-up.
B	This level of replacement parts is recommended when the user can tolerate short-duration UPS down-time to obtain replacement parts in the event of a major UPS failure. This level of replacement parts consists of consumable items, specifically fuses, air filters, an inverter leg, and the most critical circuit board assemblies.
C	This level of replacement parts is recommended when the user can tolerate only a minimum of down-time in the event of a major UPS failure. This level of replacement parts consists of consumable items, specifically fuses, air filters, an inverter leg, and a complete set of circuit board assemblies.

Glossary

Symbols	Definition / Meaning
@	At.
/	And/or.
+/-	Plus or Minus.
≤	Equal to or less than.
#	Number.
°C	Degree Celsius.
°F	Degree Fahrenheit.
Ø	Phase angle.
Ω	Ohm; unit of resistance.
®	Trade Mark.
2nd	Second.
A, B, C	Normal sequence of phases (clockwise) in three-phase power.
AC or ac	Alternating current, also implies root-mean-square (rms).
Alphanumeric display	The LCD display above the hidden panel (behind the drop-down cover) on the UPS module and the SSC.
Ambient Temp.	Temperature of surrounding air.
Ambient noise	Acoustical noise of surrounding environment.
Ambient noise	The noise level of the environment.
Attached load	The load attached to the UPS output, such as a computer system or manufacturing system.
Audible alarm	A buzzer, located behind the front panel on the UPS module and the SSC, that sounds when alarm conditions occur.
ANSI	American National Standard Institute.
AWG	American Wire Gauge.
B or BAT. or BATT.	Battery.
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.
Input branch circuit	The input circuit from the building power panel to the equipment.
Inverter	An electrical circuit that generates an AC sinewave output from a DC input.
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.
Load protected	The attached load is being supplied by the UPS module inverter output, and the battery is available in the event that incoming (utility) power is lost.
Load not protected	The attached load is being supplied, but the battery system is unavailable.
Low battery	
Shutdown	The battery has reached the lowest permitted operating voltage, and the inverter has shut down (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	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-battery operation	The attached load is being supplied by the stored energy in the battery system.
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.
PCB	Printed circuit assembly.
PCB	Printed circuit board.
PWM	Pulse Width Modulation.
Q1	UPS input isolation circuit breaker.

Q3BP	Optional maintenance bypass circuit breaker (in single-module UPS system); optional maintenance bypass circuit breaker in MBC cabinet (in shared systems).
Q4S	Control or bypass circuit breaker (in single-module UPS systems); user-supplied bypass AC input circuit breaker supplying the SSC (in shared systems).
Q5N	Optional UPS isolation circuit breaker (in single-module UPS systems); UPS module isolation circuit breaker (in shared systems); optional SSC isolation circuit breaker (in MBC).
QF1	Battery disconnect circuit breaker.
Remote emergency power off	A switch used for shutting down electrical equipment from a location away from the equipment.
SCR	Silicon controlled rectifier.
Security bypass (key)	Pushbutton on the hidden panel (UPS modules and SSC) allowing forced transfers and other commands to be issued. The security key pushbutton must be held down while the desired function is executed.
Shipping damage	Any damage done to an article while it is in transit.
SPDT	Single Pole Double Throw.
SSC	Static switch cabinet (in shared systems).
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.
U	Voltage.
UF	Under frequency.
UL	Underwriters Laboratories, Inc.
UPS	Uninterruptible power system.
UV	Under voltage.
VAC	Volts of alternating current.
Vb	Battery voltage (in volts DC).
VDC	Volts of direct current.
Via	By way of.
VPC	Volts per cell, the measure of the electrical potential of a storage cell, such as a battery.
XFMR	Transformer.

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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