EPS 6000
150 to 750 kVA
Uninterruptible Power System
User's Guide

MGE
UPS SYSTEMS

IMPORTANT SAFETY INSTRUCTION

SAVE THESE INSTRUCTIONS — This manual contains important instructions for EPS 6000 inverters that must be followed during installation, operation and maintenance of the equipment.

WARNING

OPENING ENCLOSURES EXPOSES HAZARDOUS VOLTAGES. ALWAYS REFER SERVICE TO QUALIFIED PERSONEL ONLY

WARNING

As standards, specifications, and designs are subject to change, please ask for confirmation of the information given in tihs publicaion.

This manual is a controlled document, pages should not individually be removed from this binder.

NOTE

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with 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 his own expense.

prepared for:

EPS 6000 150 to 750 kVA

Uninterruptible Power System

User's Guide

For service call
1-800-438-7373

86-130033-00 B00 11/96

MGE UPS Systems
1660 Scenic Avenue
Costa Mesa, CA 92626
(714) 557-1636

MGE
UPS SYSTEMS

EPS 6000 150 to 750 kVA Uninterruptible Power System User's Guide

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Seller warrants to the Ultimate Purchaser (the purchaser who buys for use, and not for resale) that all products furnished under this order and which are manufactured by Seller will conform to final specifications, drawings, samples and other written descriptions approved in writing by Seller, and will be free from defects in materials and workmanship. These warranties shall remain in effect for period of twelve (12) months after delivery to the Ultimate Purchaser. But if the Seller installs the equipment or supplies technical direction of installation by contract, said one year shall run from the completion of installation, provided installation is not unreasonably delayed by Ultimate Purchaser. Parts replaced or repaired in the warrant period shall carry the unexpired portion of the original warranty. A unit placed with the Purchaser on consignment and then later purchased will be warranted for twelve (12) months from the time the Seller receives notification of the Purchaser's intent to purchase said consigned item. The foregoing in its entirety is subject to the provision that in no case will the total warranty period extend beyond 18 months from date Seller ships equipment from point of manufacture.

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Proprietary Rights Statement

Revision History

EPS 6000 Uninterruptible Power System Installation Manual
86-130033-00

Revision: B00 11/96

Contents

Illustrations

Tables

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 in the Glossary.

This manual uses Noteboxes to convey important information. Noteboxes come in four varieties:

WARNING

A WARNING notebox indicates information provided to protect the user and service personnel against safety hazards and/or possible equipment damage

CAUTION

A CAUTION notebox indicates information provided to protect the user and service personnel against possible equipment damage.

IMPORTANT

An IMPORTANT notebox indicates information provided as an operating instruction, or as an operating tip.

NOTE

A NOTE notebox indicates information provided as an operating tip or an equipment feature.

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Introduction

1.0 Scope

This manual provides technical information required for operation and maintenance of the single EPS 6000 uninterruptible power system (UPS). Please read this manual before operating the EPS 6000 equipment. Please retain this manual for future reference.

The manual is divided into three sections:

Section I — General Description

This section introduces the EPS 6000 family of uninterruptible power systems, including a general description of the system and its internal components, a description of available options, and system specifications.

Section II — Operation

This section describes operating information for EPS 6000 UPS single-module systems, including an overview of the system, its components, and their functions; a description of the indicators and controls and their functions; and operational sequences to be followed for all conditions of normal, emergency, and maintenance operation.

Section III — Maintenance and Service

This section describes maintenance of the EPS 6000 UPS, including safety instructions, preventive maintenance, information about replacement parts, and customer service.

A Glossary in the rear of this manual provides definitions of terms used within the text. A separate manual, the EPS 6000 UPS Installation Manual, (MGE part number 86-130035-00) provides detailed installation instructions.

1.1 General Description

EPS 6000 is a family of compact, high-efficiency uninterruptible power systems, available in power ratings for single-module systems from 150 to 500 kVA. EPS 6000 UPS 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 6000 UPS, 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 6000 UPS family include:

- EPS 6000 UPS module
- EPS 6000 auxiliary cabinet
- EPS 6000 battery cabinet

Each of these cabinets is described below. Figure 1-1, 1-3 and 1-5 show an EPS 6000 single-module UPS. Figure 1-2, 1-4 and 1-6 show single-line diagrams of typical single-module installations (one UPS module, and one battery). Table 1-1 identifies single-module EPS 6000 UPS model numbers.

Table 1-1 **EPS 6000 Model Numbers, Single-Module UPS Modules**

MODEL NUMBER	INPUT VOLTAGE (VAC)	OUTPUT VOLTAGE (VAC)	OUTPUT RATING (kVA/kW)	INPUT CB (Amps)	TOTAL WIDTH (mm/in)	TOTAL WEIGHT (kg/lb)	HEAT LOSS (Btu/hr)	AIR FLOW (CFM/m^3/mm)
EPS 6150								
EPS-6150/22,66	208	208	150/120	400	3,325/131	3,013/6,644	40,494	2500/70
EPS-6150/42,66	480	208	150/120	400	2,460/97	2,664/4,876	30,818	2500/70
EPS-6150/44,66	480	480	150/120	400	1,610/63.5	2,044/4,508	25,603	2500/70
EPS 6225								
EPS-6225/22,66	208	208	225/180	400	3,325/131	3,013/6,644	49,797	2500/70
EPS-6225/42,66	480	208	225/180	400	2,460/97	2,665/5,876	46,227	2500/70
EPS-6225/44,66	480	480	225/180	400	1,610/63.5	2,044/4,508	39,202	2500/70
EPS 6300								
EPS-6300/22,66	208	208	300/240	600	4,115/162	4,451/9,815	66,396	2500/70
EPS-6300/42,66	480	208	300/240	600	2,870/113	3,800/8,379	61,636	2500/70
EPS-6300/44,66	480	480	300/240	600	1,610/63.5	2,514/5,543	52,269	2500/70
EPS 6375								
EPS-6375/22,66	208	208	375/300	700	4,115/162	4,736/10,440	82,995	2500/70
EPS-6375/42,66	480	208	375/300	700	2,870/113	4,007/8,836	77,045	2500/70
EPS-6375/44,66	480	480	375/300	700	1,610/63.5	2,545/5,612	65,336	2500/70
EPS 6500								
EPS-6500/44,66	480	480	500/400	1000	2,565/113	4,244/7,211	79,453	3400/95
EPS 6750								
EPS-6750/44,66	480	480	750/600	1600	4,950/195	6,200/13,600	13,1000	5900/165

NOTES:

1. Total width, weight, and heat loss are for system line-up including auxiliary cabinets but excluding pallets.
2. Data does not include battery data; refer to the installation drawings supplied with your equipment.
3. Information provided is for standard configurations; data may change with optional equipment. Consult the installation drawings provided with your equipment.

Figure 1-1 **EPS 6000 UPS 150 - 375 kVA Pictorial**

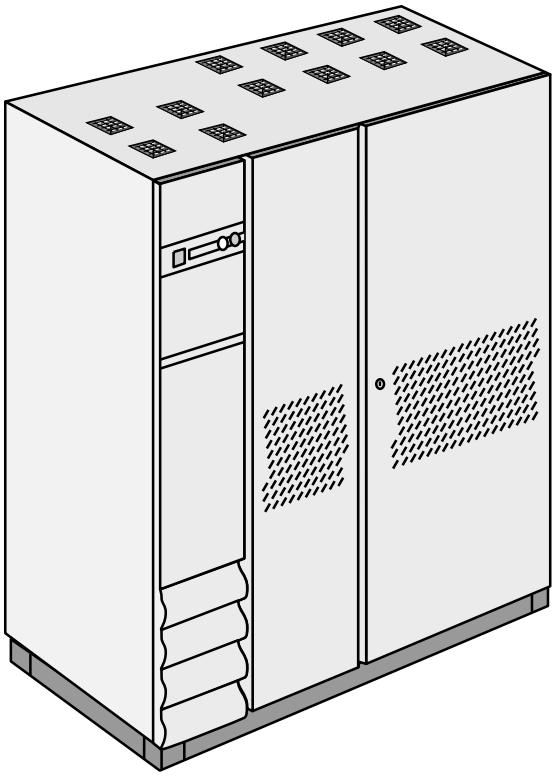


Figure 1-2 **Typical Single-line Diagram: EPS 6000 480 VAC Input/Output Single-Module 225 kVA UPS With Battery Cabinet**

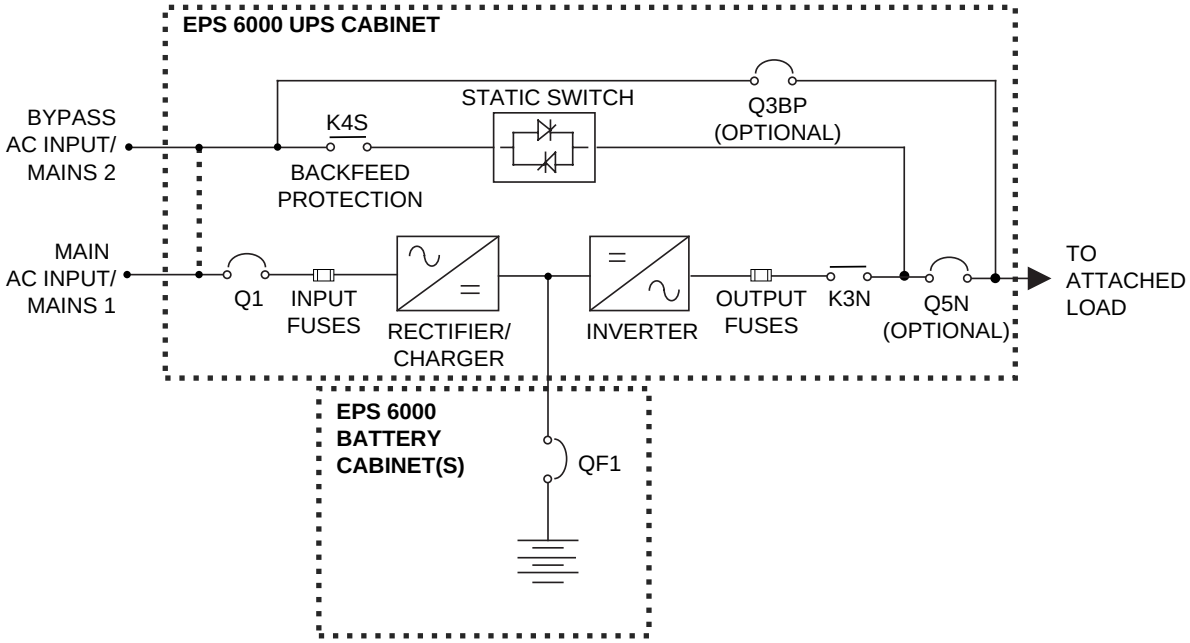


Figure 1-3 **EPS 6000 UPS 500 kVA Pictorial**

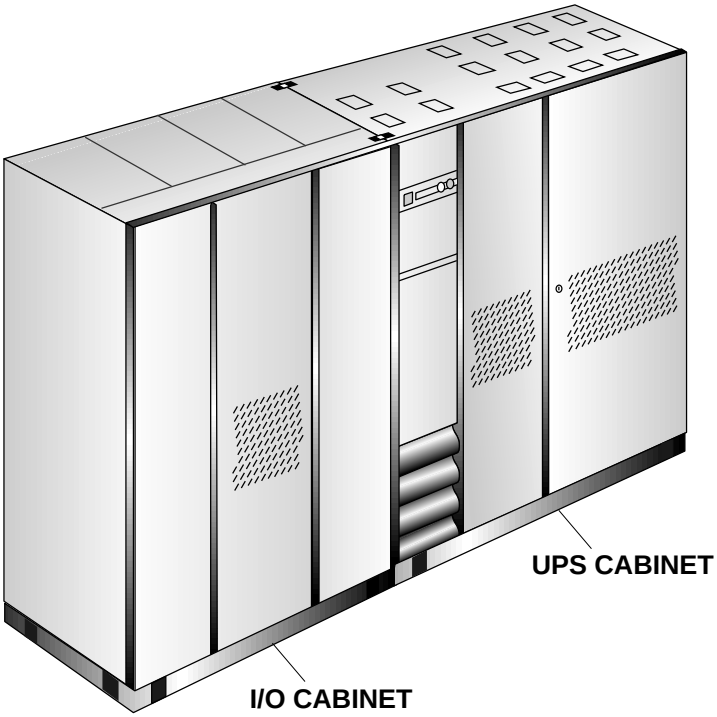


Figure 1-4 **Typical Single-Line Diagram: EPS 6000 480 VAC Input/Output Single Module 500 kVA UPS With Battery Cabinet**

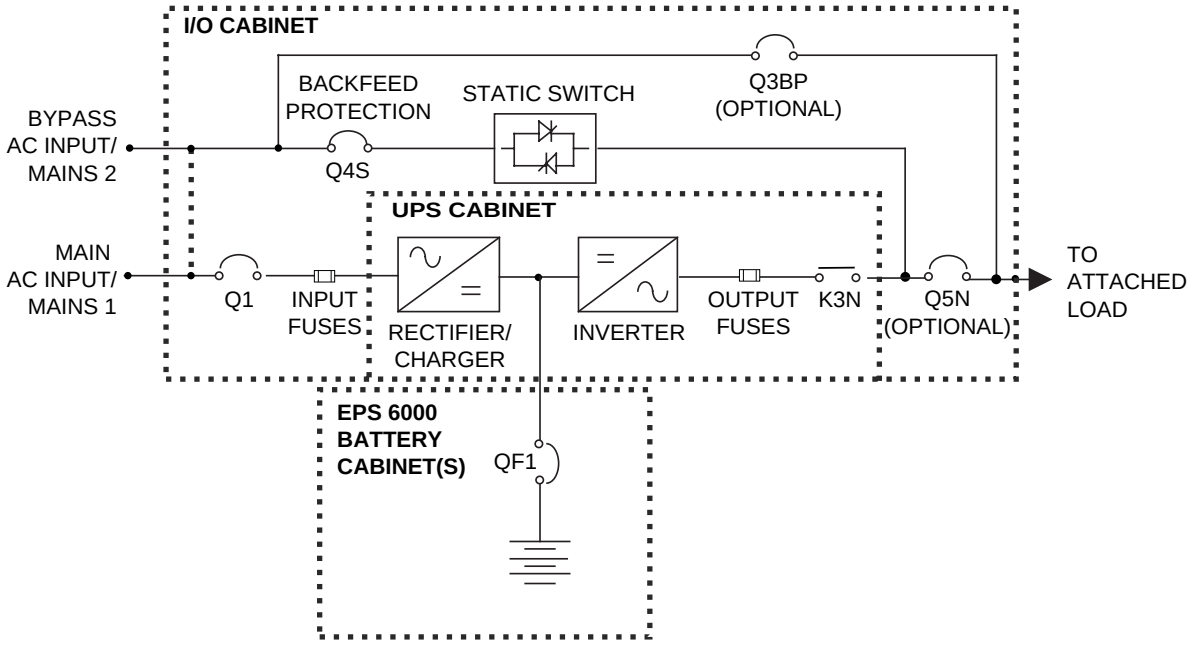


Figure 1-5 **EPS 6000 UPS 750 kVA Pictorial**

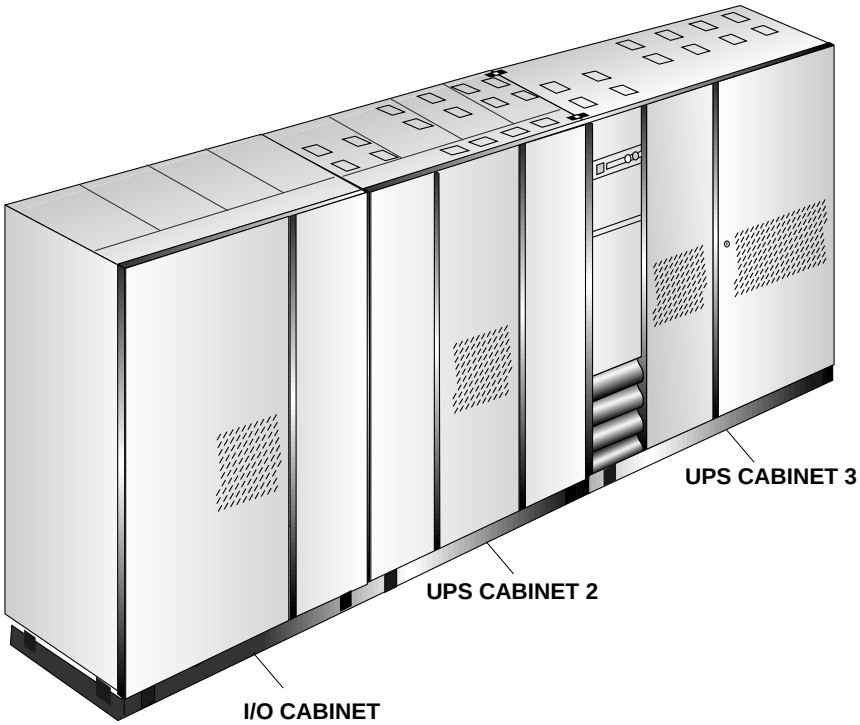
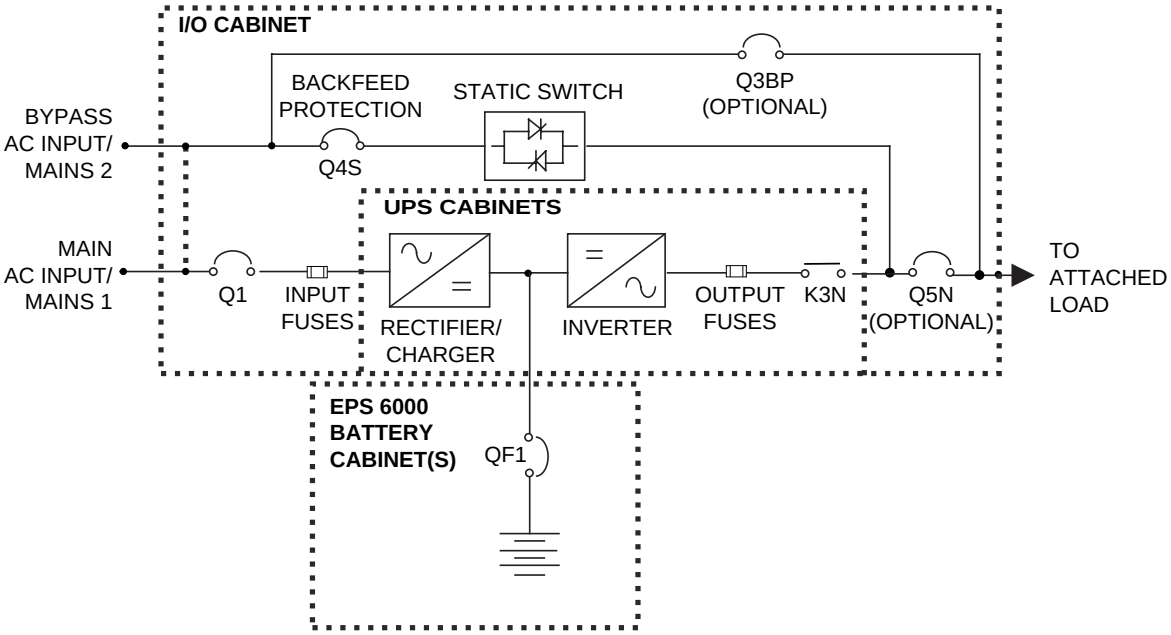


Figure 1-6 **Typical Single-Line Diagram: EPS 6000 480 VAC Input/Output Single Module 750 kVA UPS With Battery Cabinet**



1.2 Description of UPS Module Major Internal Components

Following is a description of the EPS 6000 UPS major internal components. Refer to the single-line diagram provided in Figures 1-2, 1-4 and 1-6, and the component locators provided in Figure 1-7 through Figure 1-13.

1.2.1 Rectifier/Battery Charger

The rectifier/battery charger converts the AC input voltage from the utility source into a DC voltage, supplying the inverter and regulating the charge of the battery system. A capacitor bank filters the DC voltage.

1.2.2 Inverter

The inverter chops the DC voltage supplied from either the rectifier/battery charger or the battery system into a three-phase AC voltage. An AC output filter is used to achieve a computer-grade sinewave output voltage waveform, with a total harmonic distortion of less than 2% under linear-load conditions.

1.2.3 Inverter Transformer

During normal operation, the inverter transformer provides complete electrical isolation between the UPS output to the attached load and the utility power source input as well as the UPS battery source.

1.2.4 Static Switch

The static switch transfers the load between the inverter output and the bypass AC source without interrupting the supply of power to the load, allowing the load to continue operation while the UPS is being maintained, or in the event of a UPS fault. The static switch circuit assures that voltage from the UPS output cannot feed back to the utility input lines.

1.2.5 Battery System

The battery system stores energy for use by the inverter. The stored energy is utilized in the event that the AC input power from the utility source fails, or falls outside of acceptable tolerance.

The battery system may be an MGE battery cabinet designed for operation with the EPS 6000 UPS, or a customer-supplied battery installation. MGE-supplied EPS 6000 battery cabinets may be a provided as stand-alone enclosures, or as enclosures designed to be mounted adjacent to the EPS 6000 UPS module.

The EPS 6000 comes with a special battery ambient temperature sensor which allows the optimization of the DC voltage level as a function of the temperature, ensuring that the battery is properly charged and preserving its longevity.

Figure 1-7 **EPS 6000 Major Internal Components, Single-Module UPS 150 - 225 kVA**

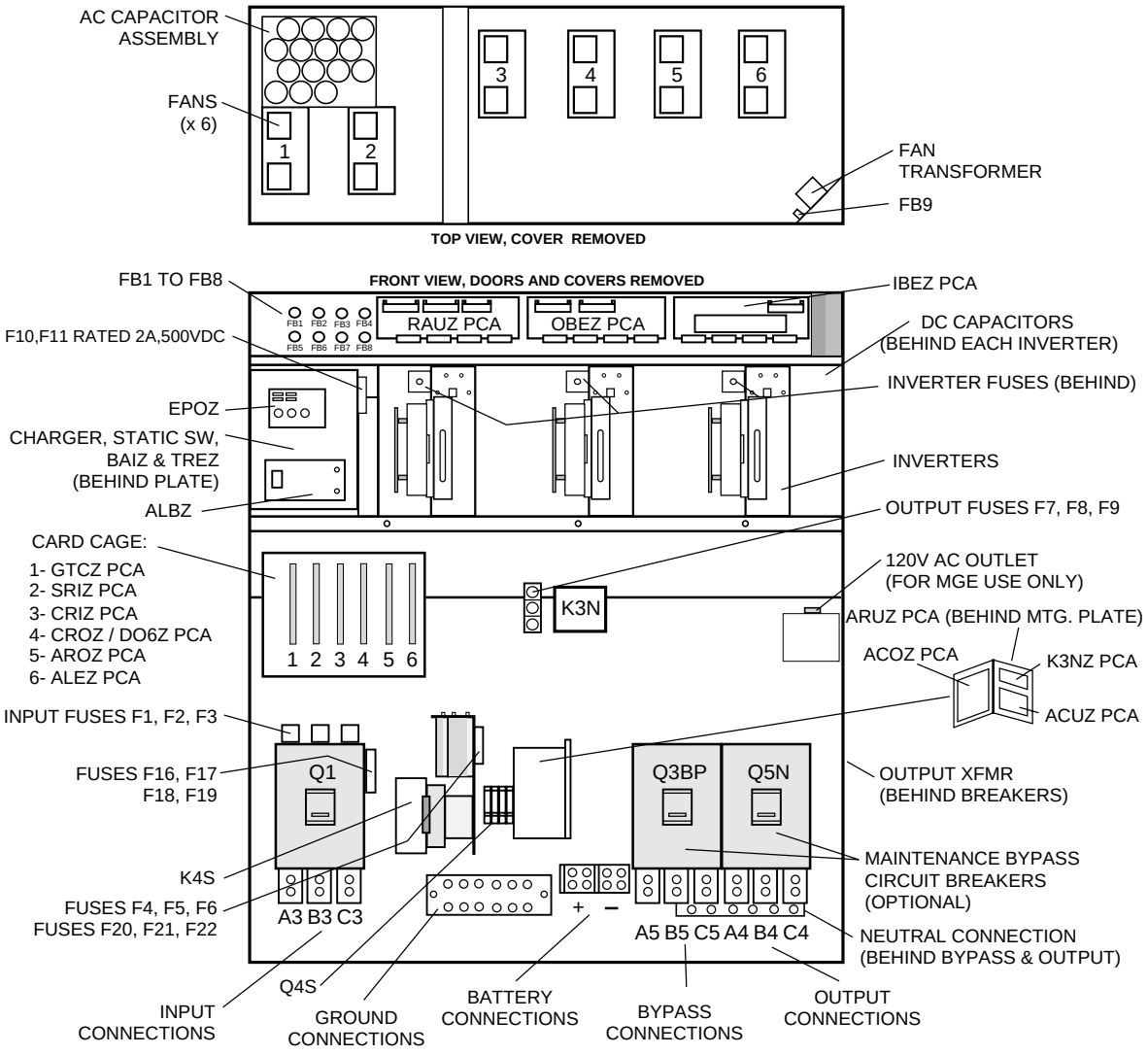


Figure **EPS 6000 Major Internal Components,**

1-8 **Single-Module UPS 300/375 kVA**

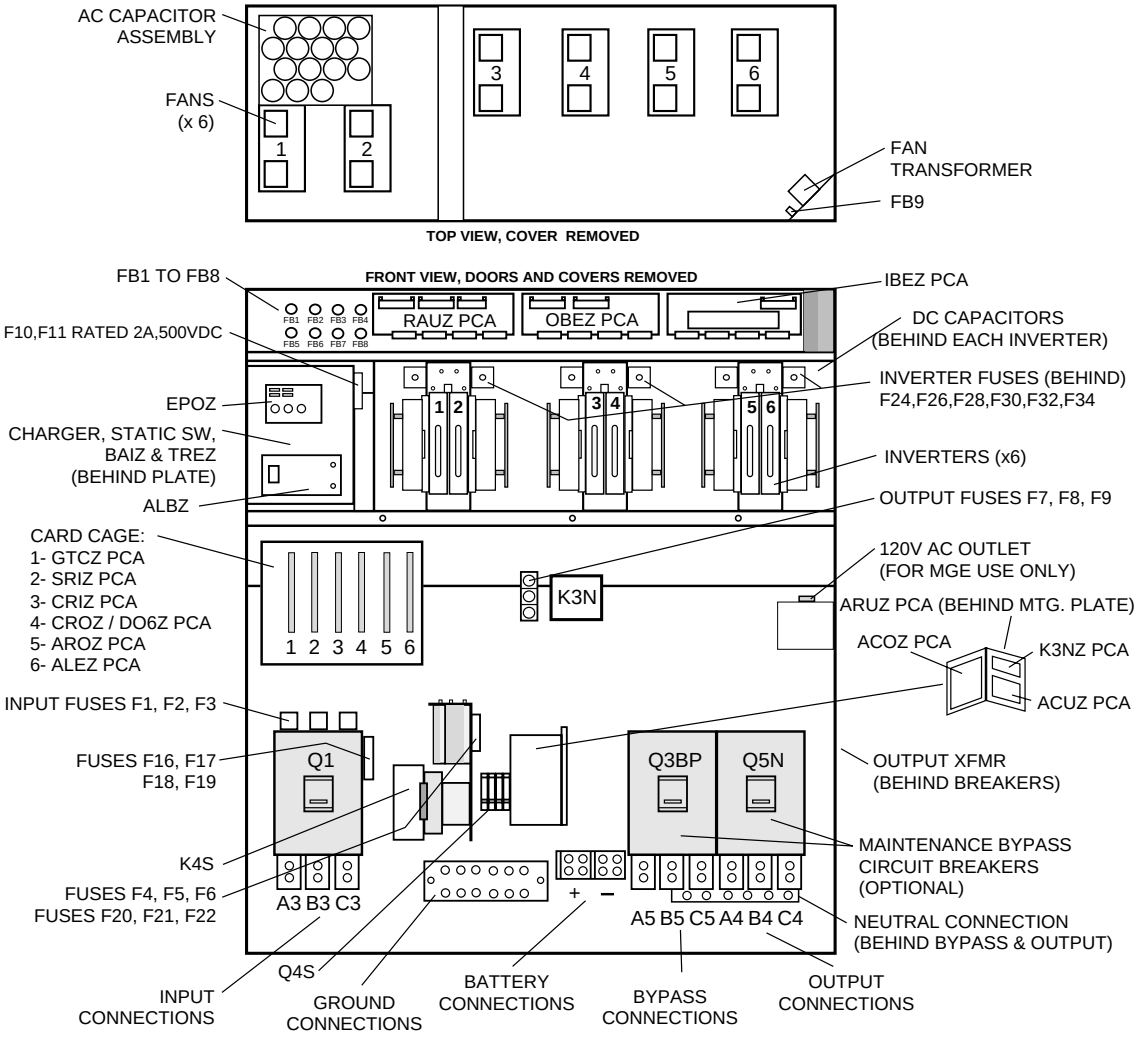


Figure 1-9 **EPS 6000 Major Internal Components**

500kVA UPS Cabinet

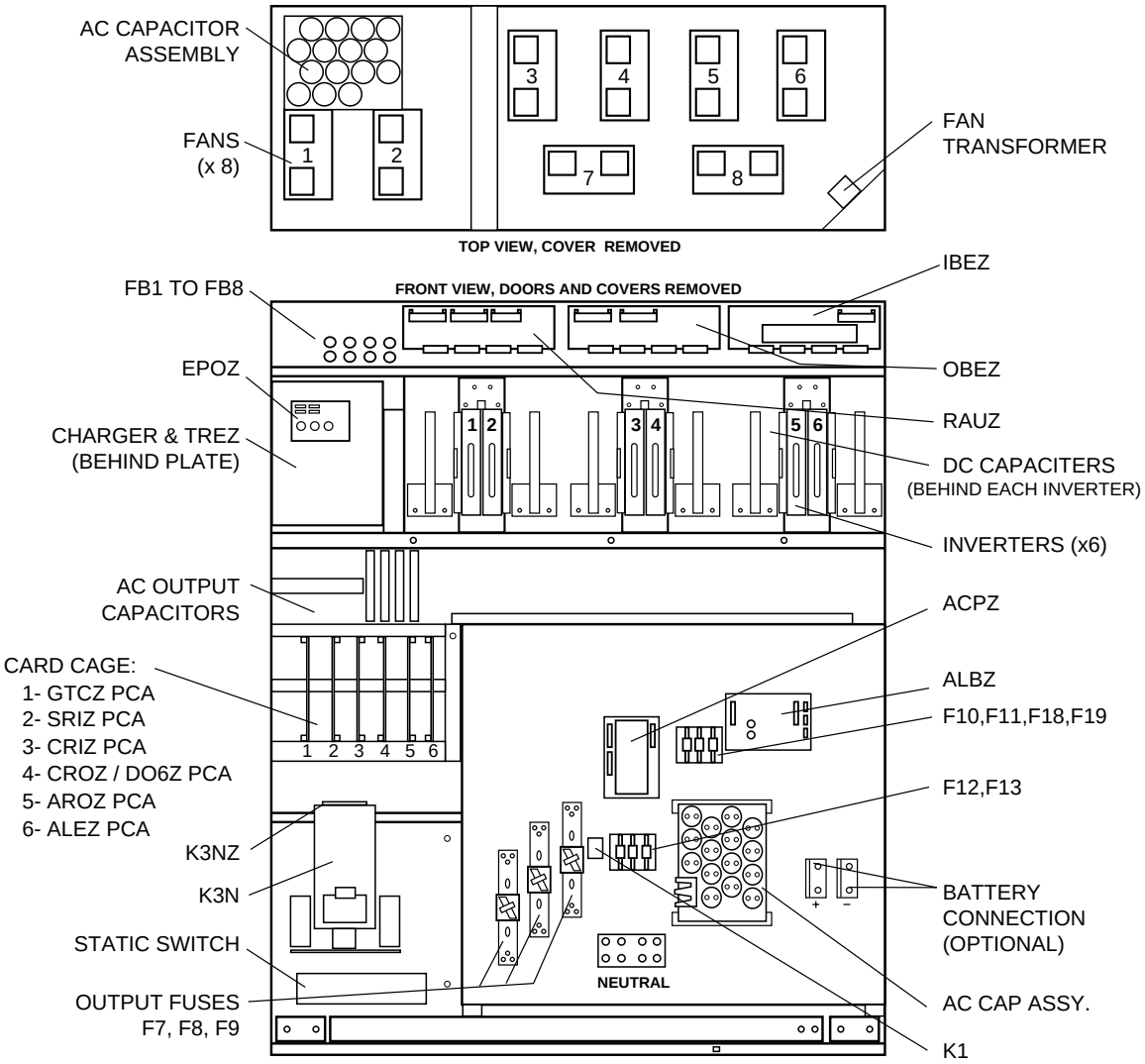


Figure **EPS 6000 Major Internal Components**

1-10 **500 kVA Input/Output Cabinet**

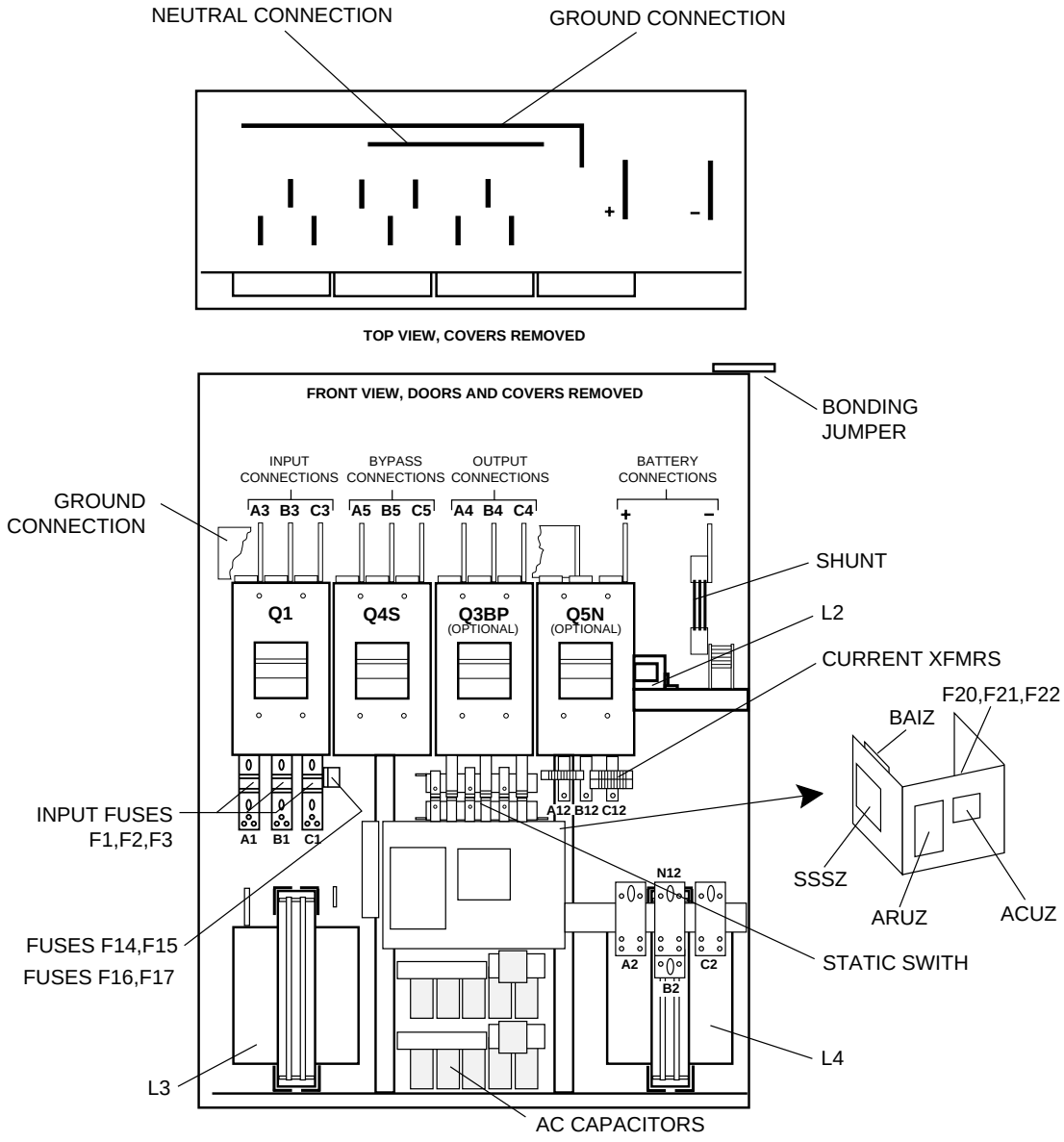


Figure **EPS 6000 Major Internal Components**

1-11 **750 kVA UPS Cabinet 1**

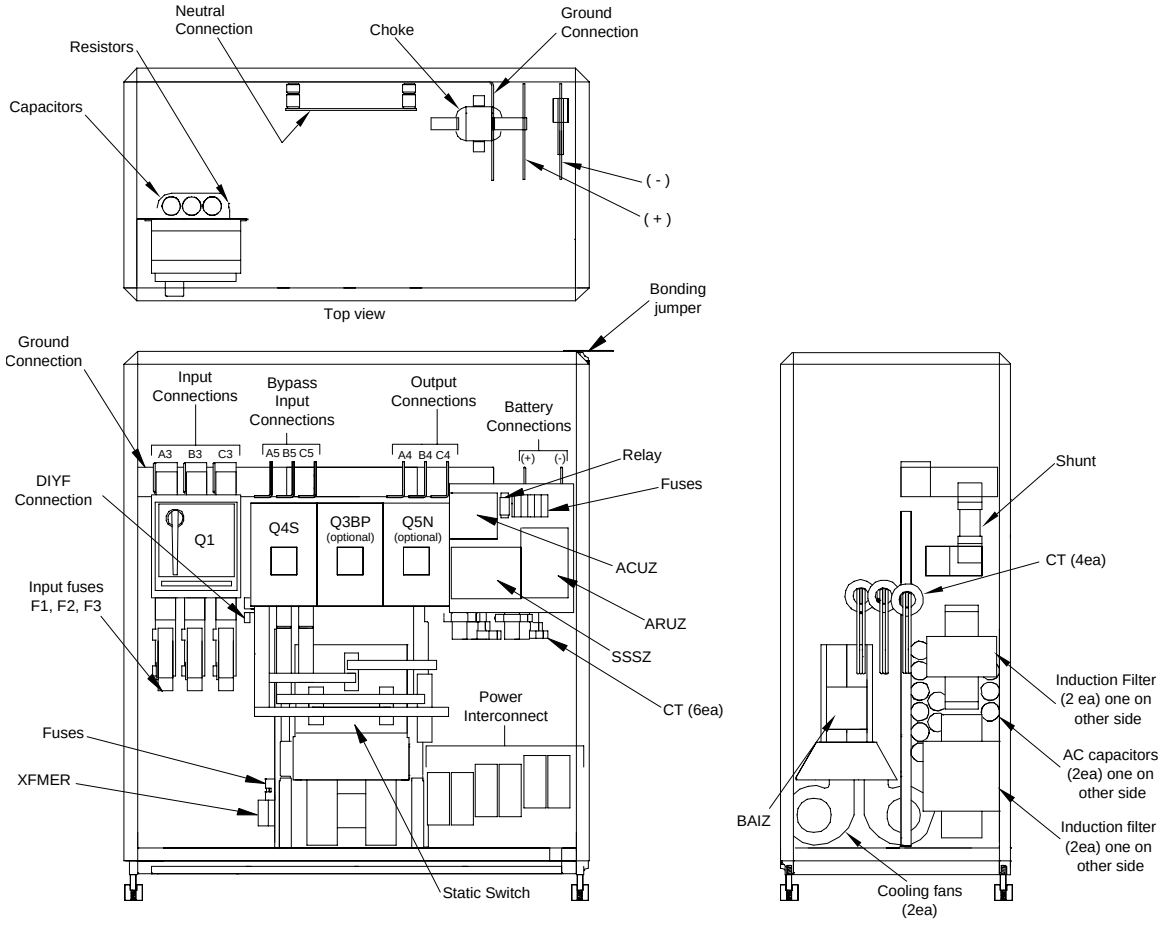


Figure **EPS 6000 Major Internal Components**

1-12 **750 kVA UPS Cabinet 2**

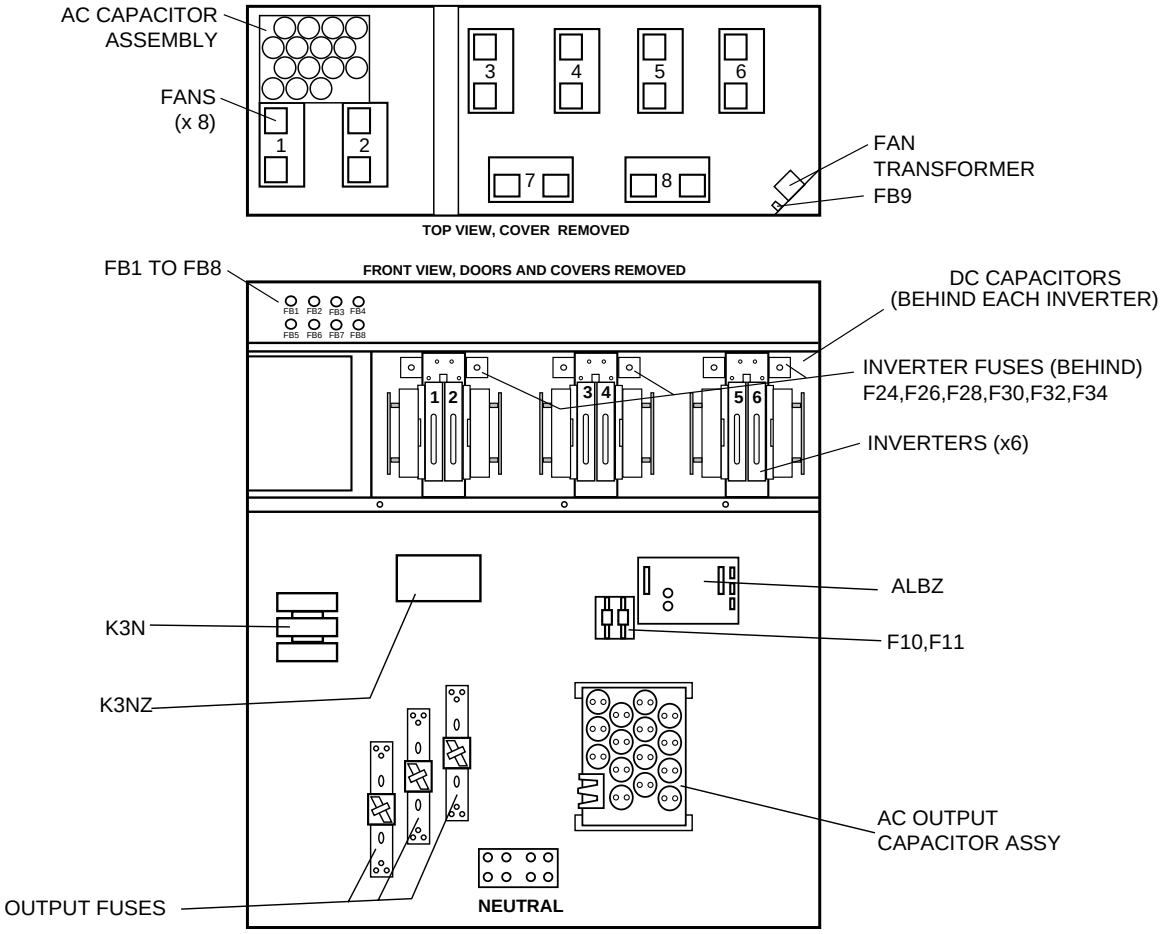
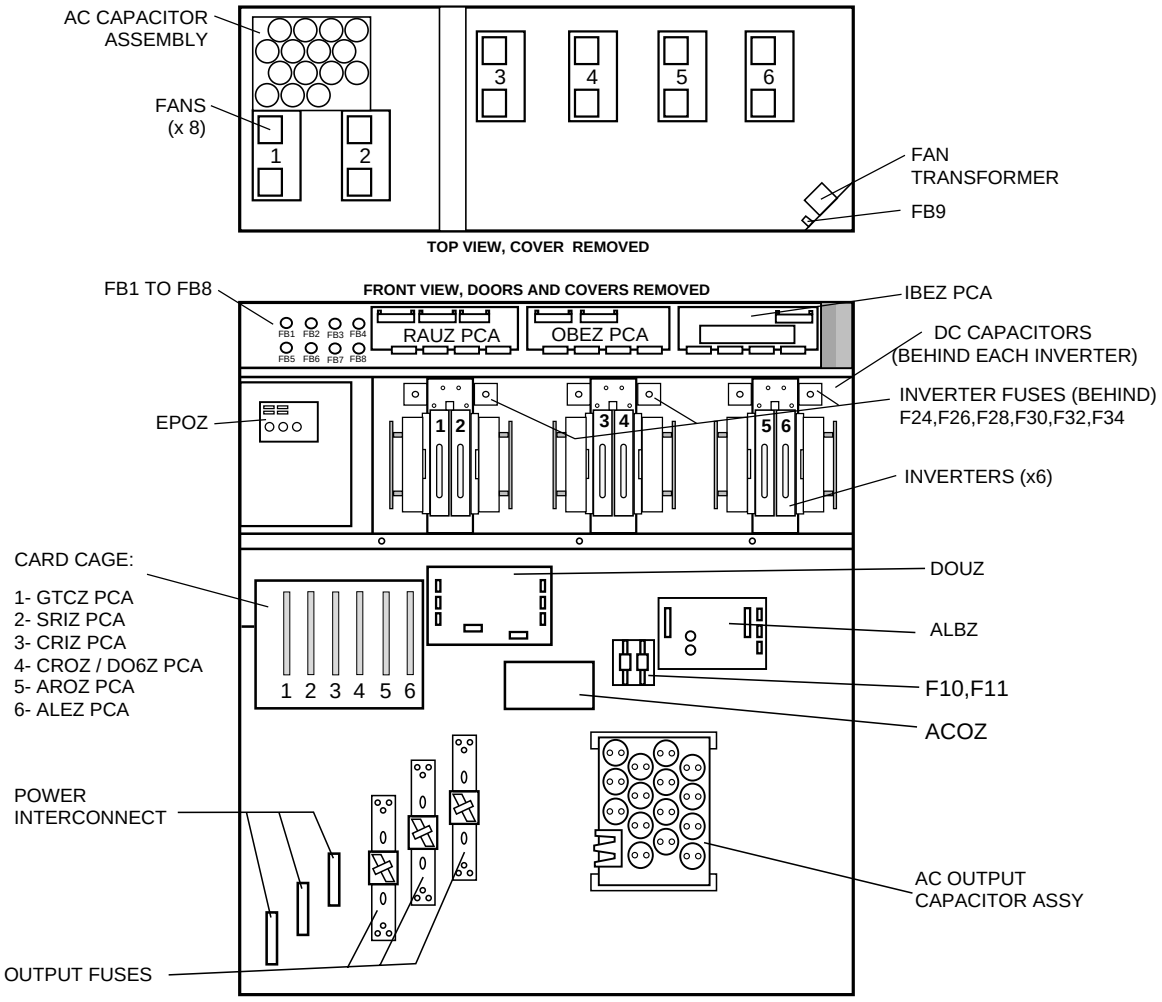


Figure 1-13 **EPS 6000 Major Internal Components**

750 kVA UPS Cabinet 3



1.3 Options

This section describes options available for the EPS 6000 UPS. Some configurations do not support some options. Most options must be specified at the time of equipment order; some options can be installed in the field. Contact your MGE dealer for complete information.

Electrical room package

The electrical room package option allows configuration of all input and output cables, or selected cables, through the top of the enclosures. It features separate main AC input (mains 1) and bypass AC input (mains 2) feeder support. The electrical room package is standard on all EPS 6000 modules configured for shared systems.

Computer room package

The computer room package option allows configuration of the EPS 6000 UPS using a single utility AC source for both main AC input (mains 1) and bypass AC input voltage (mains 2). The computer room option includes additional filtering, making the EPS 6000 UPS fully compliant with the requirements of FCC part 15, subpart J, class A, and the National Electrical Code (NEC) article 645, Electronic Computer/Data Processing Equipment

Additional battery cabinets

Up to a maximum of four battery cabinets can be supplied for a single EPS 6000 UPS module, making additional back-up time available during power outages.

Input filter

An input harmonic current filter is available for the EPS 6000 UPS. For some power levels, the input filter is installed within the UPS enclosure. For others, the input filter is installed in an auxiliary cabinet.

Input or output transformers

The single-module EPS 6000 UPS can be equipped with an isolation or autotransformer on both the input and output. The transformer provides battery isolation or voltage step-up or step-down as required for the particular installation.

High interrupting capacity circuit breakers

The EPS 6000 UPS module is normally equipped with circuit breakers rated at 30 kAIC. As an option, these breakers can be provided with a rating of 65 kAIC.

Maintenance bypass

The maintenance bypass option provides a direct bypass AC input source (mains 2) that can be used to supply the load while the UPS module is being serviced.

Output distribution cabinet

Some single-module EPS 6000 systems can be provided with a output distribution cabinet, with up to four output circuit breakers.

Remote alarm status panel (RASP)

A remote alarm status panel (RASP) is available. The RASP allows the following status indications to be viewed from a remote location:

- UPS on line

- UPS on battery
- UPS on bypass
- UPS on maintenance bypass
- Low battery shutdown
- Charger on
- Overload
- Charger fault
- Inverter fault
- Transfer lockout
- Summary alarm

Additionally, the RASP contains an audible alarm and two pushbuttons:

- UPS test/reset pushbutton
- Audio reset pushbutton

Remote summary alarm panel (RSAP)

A remote summary alarm panel (RSAP) is available. The RSAP allows the following status indications to be viewed from a remote location:

- UPS summary alarm
- UPS on battery

Additionally, the RSAP contains an audible alarm and two pushbuttons:

- Alarm test/reset pushbutton
- Audio reset pushbutton

ES/9000 interface

An interface to an IBM ES/9000 mainframe computer is available. This option provides four (4) sets of normally-open, isolated dry contacts, connected to a 9-pin DB-9 female connector, located on the inside cable entry point of the EPS 6000 UPS enclosure. The four sets of contacts indicate:

- UPS on line
- UPS on bypass
- UPS on battery
- Low battery, shutdown imminent

The interface is provided with a 15-foot long 9-pin cable that connects the EPS 6000 to the IBM ES/9000 computer.

Active RS-232/RS-485

A communications port is available that allows the UPS to be monitored from a remote terminal or computer. For detailed information on the communication features, contact your MGE dealer.

1.4 Specifications, UPS Modules

Specifications provided refer to an EPS 6000 UPS module and any required auxiliary cabinets.

1.4.1 Electrical

AC input ratings

Voltage: 208 or 480 VAC, +10%, -15%
Frequency: 60 Hz, ± 10%
Phases: 3 Ø (phase sequence must be A, B, C)
Wires: 3 or 4 wires plus ground
Current:

rating in kVA	150	225	300	375	500	750
Amperes @ 208 VAC	460	680	900	1,100	N/A	N/A
Amperes @ 480 VAC	200	300	400	490	702	980

Power factor: Up to 0.9 lagging; 0.95 with optional input harmonic filter

AC output ratings

Voltage: 480 VAC ± 0.5% (steady-state conditions)
480 VAC ± 5% (transient conditions from 0% to 100% or 100% to 0%)
Frequency: 60 Hz ± 0.1% (free-running)
Phases: 3 Ø (phase sequence must be A, B, C)
Wires: 4 wires plus ground
Current:

rating in kVA	150	225	300	375	500	750
Amperes @ 208 VAC	416	625	833	1,041	N/A	N/A
Amperes @ 480 VAC	180	271	361	451	601	902

Power factor: 0.8 lagging
Total harmonic distortion (THD): < 2% (linear load)
< 4% (for 100% non-linear load with a crest factor of up to 3.5)
Dynamic regulation: ± 0.5% for balanced load
± 2.5% for 100% unbalanced load
Dynamic response: ± 5% for 100% step load change
Overload: 125% of rated load for 10 minutes
150% of rated load for 1 minute

DC ratings

Battery voltage: 545 VDC float
480 VDC nominal
390 VDC minimum

rating in kVA	150	225	300	375	500	750
Maximum battery current at cut-off voltage (ADC)	323	485	647	809	1,074	1,620

1.4.2 Mechanical

Height: 1,905 mm (75")
Depth: 815 mm (32")
Width: See Table 1-1
Weight: See Table 1-1
Finish: MGE light gray

1.4.3 Environmental

Recommended environment: 20° to 25° C (68° to 77° F.); 50% relative humidity; computer room or other temperature- and humidity-controlled environment
Operating temperature: 0° to 40° C (32° to 104° F.) except battery
Storage: -20° to 50° C (-4° to 122° F.)
Humidity: up to 90% non-condensing (operating)
Altitude: sea level to 1,000 meters (sea level to 3,280 feet) without derating; 1,000 to 2,000 meters (3,280 to 6,560 feet): derate operating temperature to a maximum of 28° C (82° F)

Acoustic noise:

rating in kVA	150	225	300	375	500	750
Accoustic noise at rated load in dBA at 5 feet from the front of the UPS module	72	72	72	72	75	78

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Operation

2.0 Scope

This section presents operating information for the single EPS 6000 UPS module, including an overview of the system, its components, and their function; a description of the indicators and controls and their function; and operational sequences to be followed for all conditions of normal, emergency, and maintenance operation.

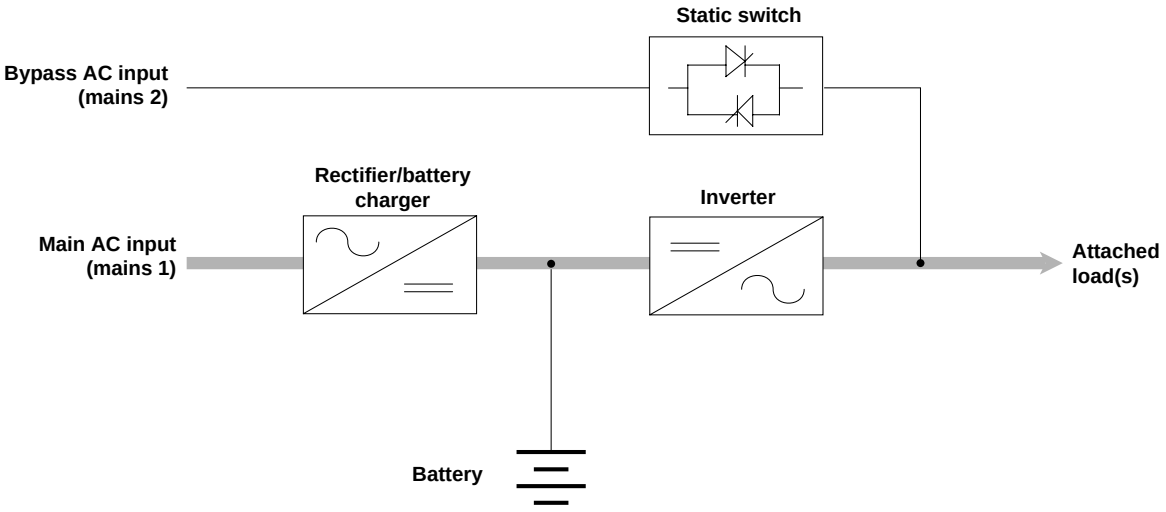
2.1 System Operation Overview

This section presents an overview of the system operation.

2.1.1 Normal Operation

During normal operation (as shown in Figure 2-1), 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.

Figure 2-1 **Power Flow, Normal Operation**



2.1.2 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 (as shown in Figure 2-2). When the main AC input source (mains 1) returns, the charger restarts automatically and the UPS resumes its normal operation (as shown in Figure 2-1).

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 (as shown in Figure 2-3).

Figure 2-2 **Power Flow, On-battery Operation**

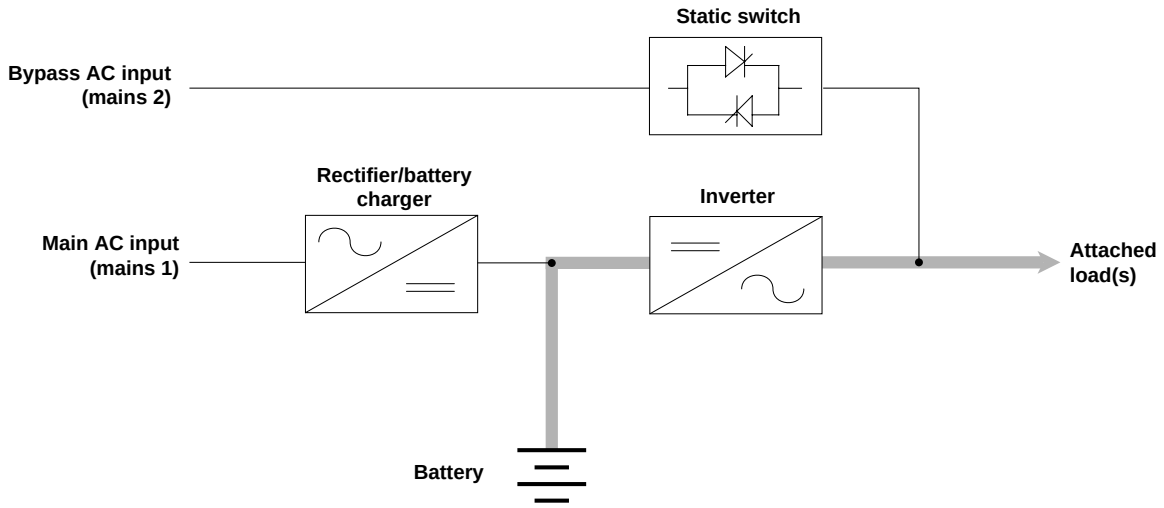
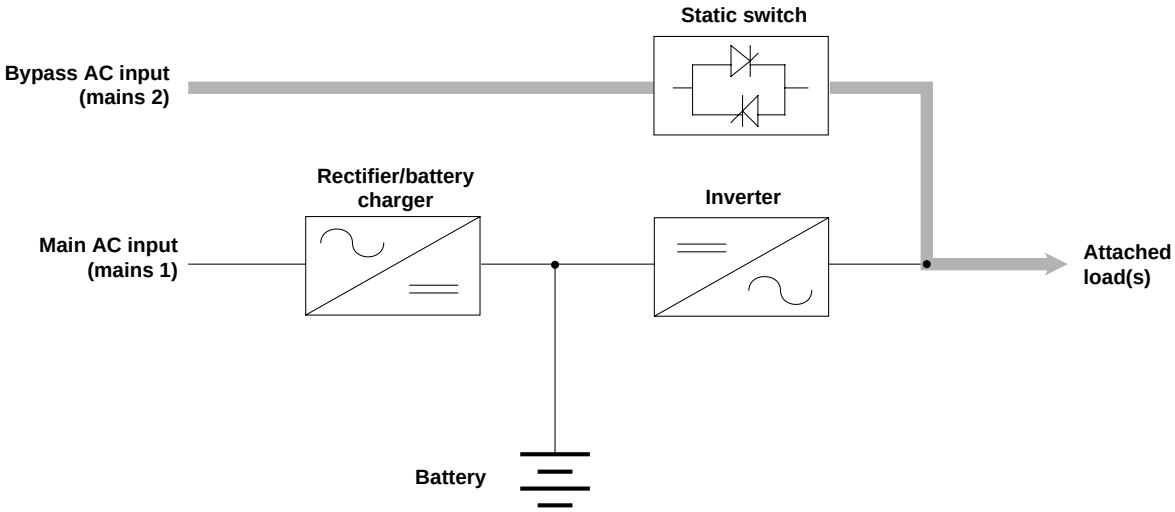


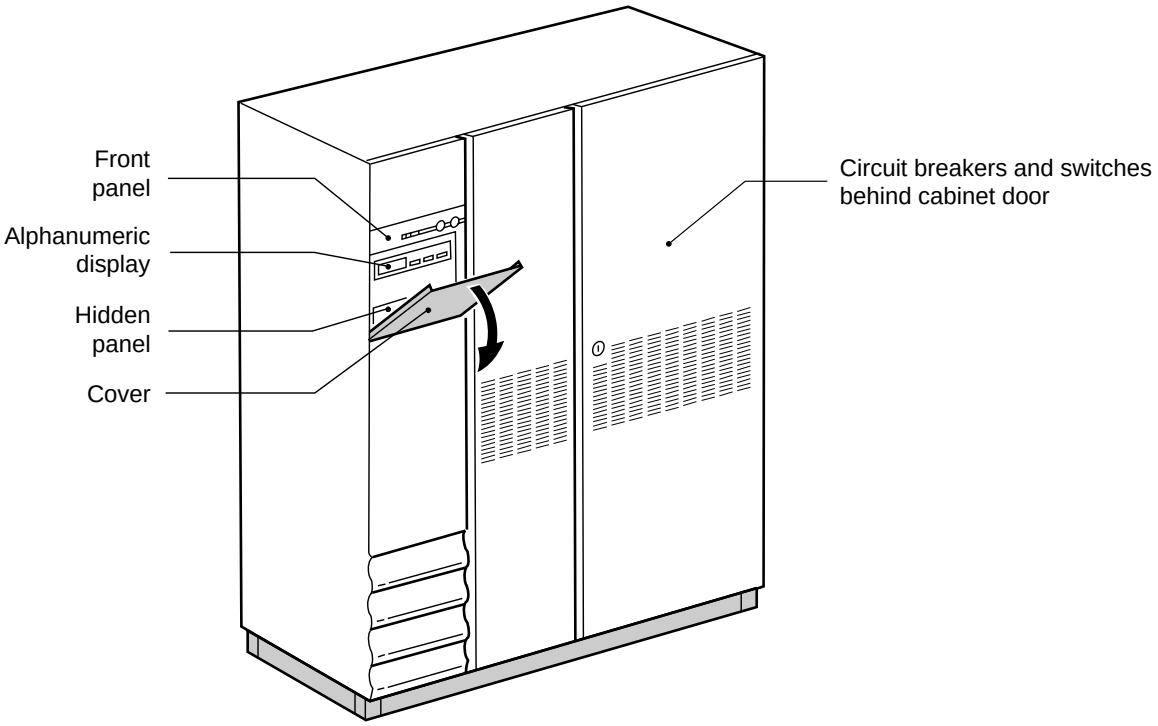
Figure 2-3 **Power Flow, Bypass Operation**



2.2 Indicators and Controls

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, as shown in Figure 2-4. In battery cabinets and auxiliary cabinets, the controls are located behind the cabinet doors.

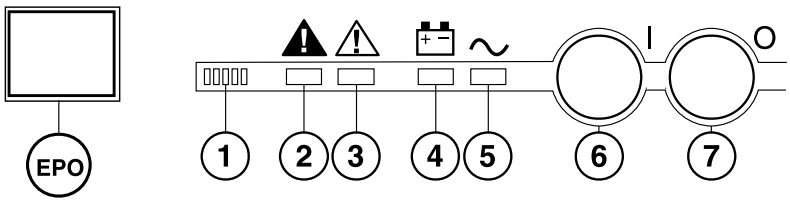
Figure 2-4 **EPS 6000 Controls and Indicators**



2.2.1 Front Panel

The UPS front panel, shown in Figure 2-5, 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.

Figure 2-5 **EPS 6000 Front Panel**



Emergency power off (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 ON OR OFF; follow the procedures listed in this section for turning on and off the inverter.

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 (Figure 2-5, 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 2-7). 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 LED (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 LED (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 operation LED (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 LED (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 (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 2.4.6, Forced Transfers).

Inverter off (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 2.4.6, Forced Transfers).

2.2.2 Alphanumeric Display and Controls

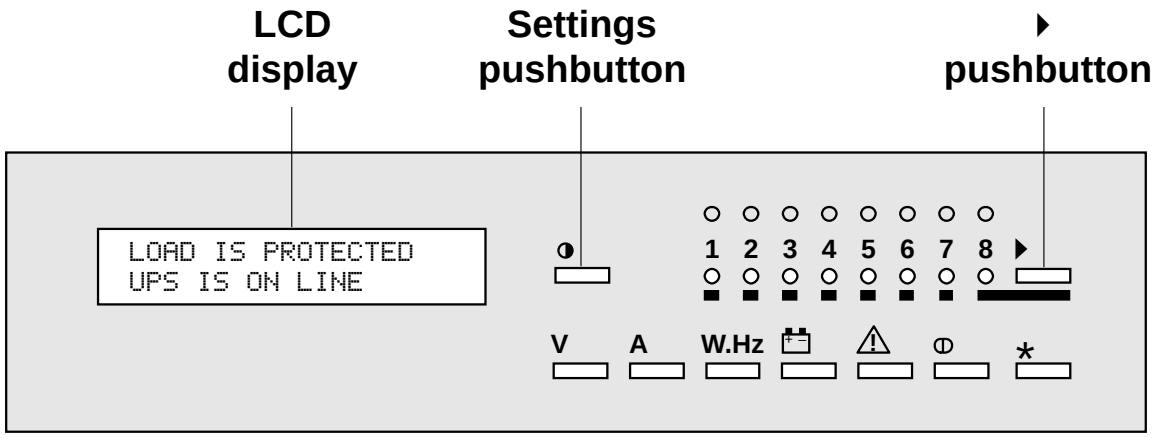
The alphanumeric display is located on the hidden panel, directly below the front panel, behind the hinged cover, as shown in Figure 2-4. For complete instructions, refer to Section 2.3, Using the Alphanumeric Display. A brief description of the display and controls follows:

Two-line alphanumeric display (Figure 2-6)
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.

Pushbuttons

Following are brief descriptions of the function of the alphanumeric display pushbuttons.

Figure 2-6 **Alphanumeric Display and Controls**



Settings pushbutton

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

Pushbutton

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

V **Pushbutton**

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

A **Pushbutton**

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

W.Hz Pushbutton

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 pushbutton

This pushbutton provides access to battery measurements, including:

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

Alarms pushbutton

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 pushbutton

This pushbutton is reserved for future use.

Pushbutton

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

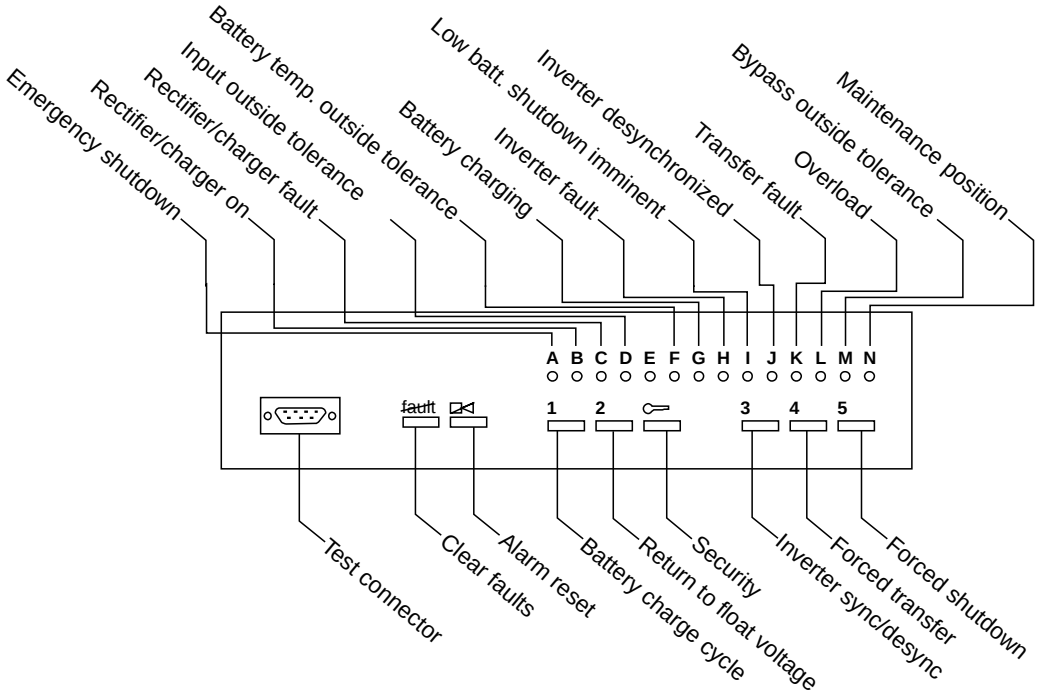
Numbered lights

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.

2.2.3 Hidden Panel

The hidden panel is located directly below the front panel, behind the hinged cover, as shown in Figure 2-4. The hidden panel includes the following controls and indicators as shown in figure 2-7:

Figure 2-7 **Hidden Panel**



Alphabetical lights

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 2.4.4.1, Emergency power off).

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 contactor K3N 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.

Test connector (Figure 2-8)

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.

Pushbuttons

Following are brief descriptions of the function of the hidden panel pushbuttons, shown in Figure 2-8.

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 2.4.6, 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 2.4.6, 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 the load can tolerate this interruption; see Section 2.4.6, Forced Transfers.

2.2.4 Circuit Breakers and Contactors

EPS 6000 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 contactors, and their function. Figure 2-8 through 2-14 show the location of each circuit breaker and contactor within the UPS cabinet, and Figure 2-15 shows the location of each circuit breaker and contactor in relation to the electrical power flow within the UPS cabinet.

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.
K3N	Inverter output contactor (automatic), used to isolate the inverter when it is off.
K4S	Backfeed contactor, in the 150 to 375 kVA UPS only, automatically opens if the bypass

upstream power is removed.

Q4S — In the 150 to 375 kVA UPS, it is a control circuit breaker; it controls the function of the backfeed contactor K4S. When Q4S is open, K4S is always open. When Q4S is closed, K4S functions automatically to provide backfeed protection.

Q4S — In the 500 and 750 kVA UPSs, it is a power circuit breaker; it is used to isolate the UPS from the bypass input (mains 2) source and provide backfeed protection.

Figure 2-8 **EPS 6000 Major Internal Components, Single-Module UPS 150 - 225 kVA**

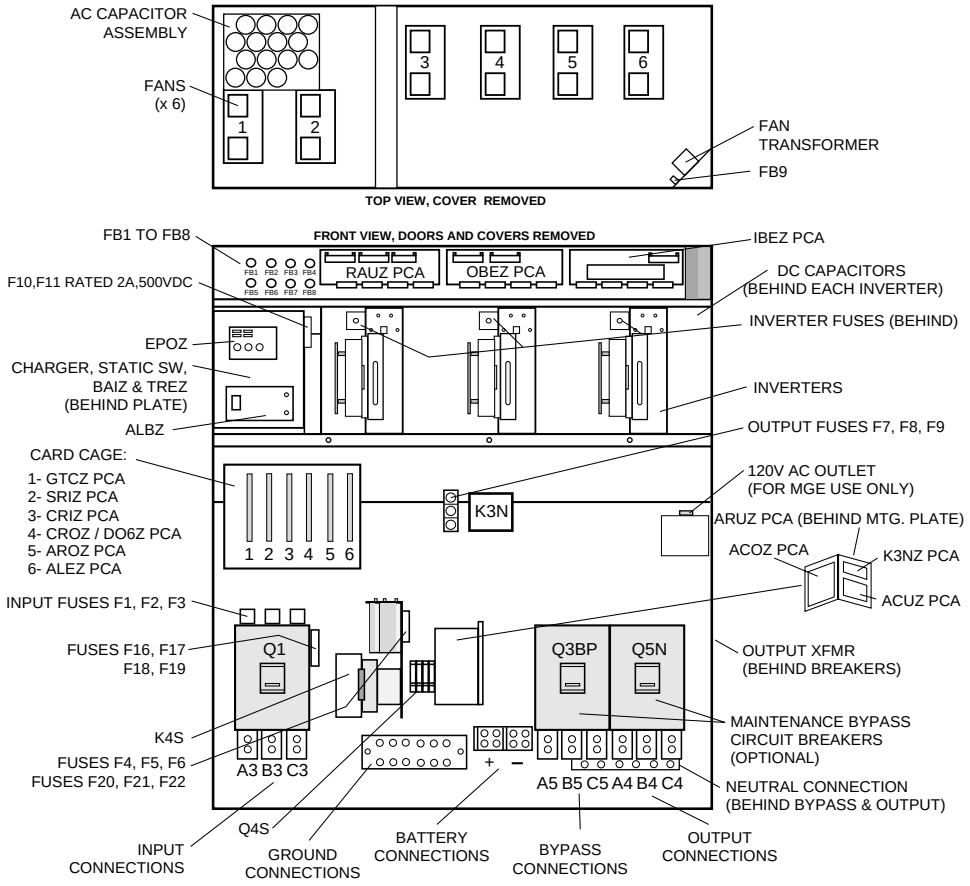


Figure 2-9 **EPS 6000 Major Internal Components, Single-Module UPS 300/375 kVA**

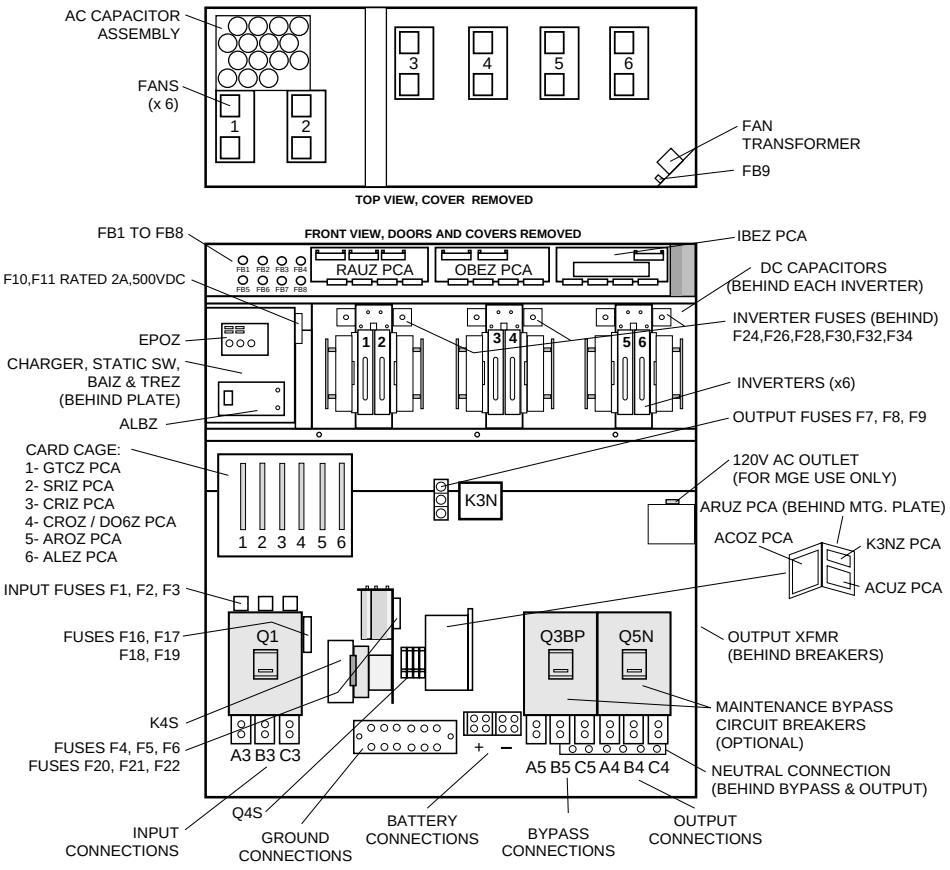


Figure 2-10 **Single EPS 6000 500 kVA Major Internal Components**

UPS Cabinet

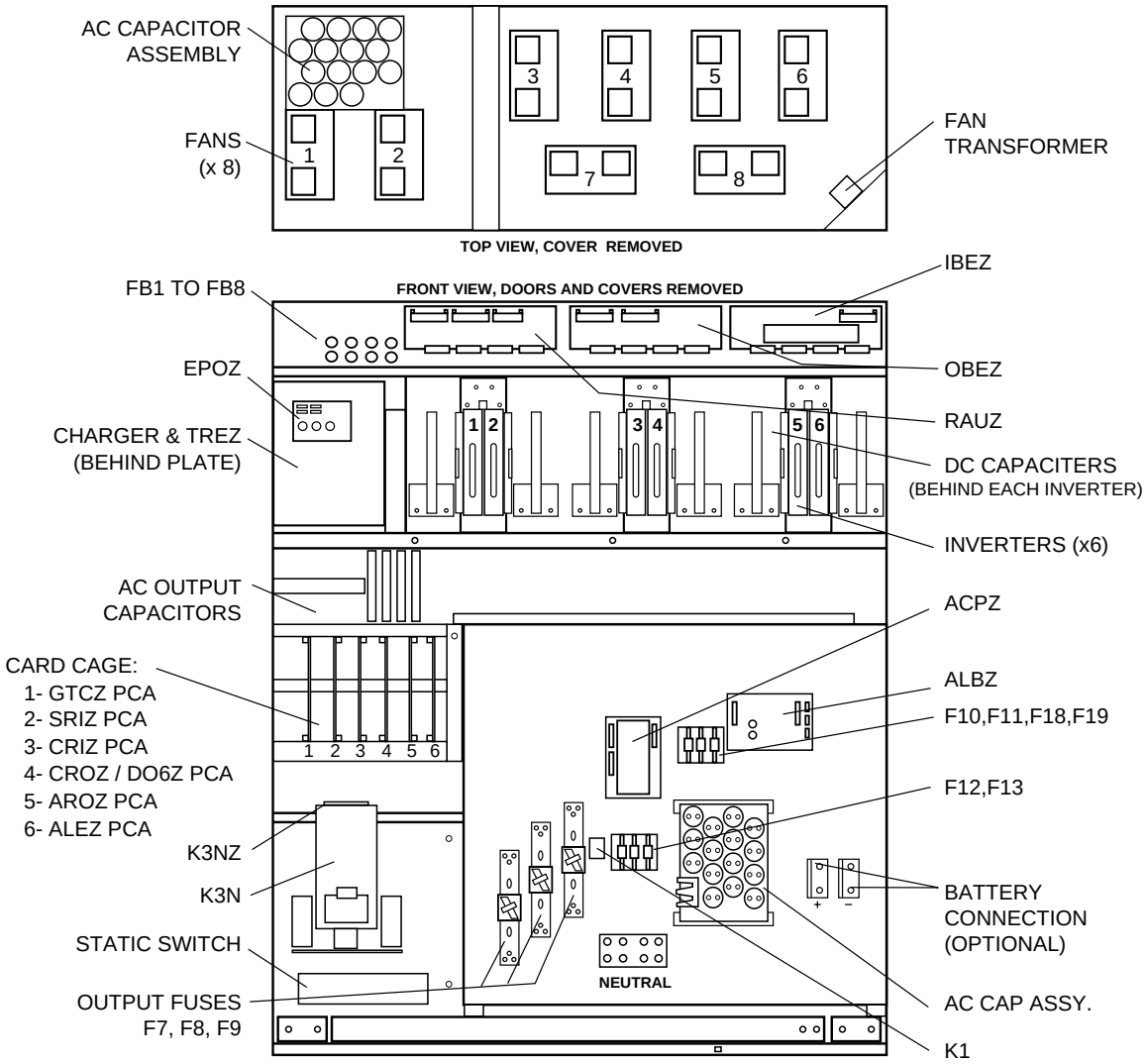


Figure 2-11 **Single EPS 6000 500 kVA Major Internal Components**
Input/Output Cabinet

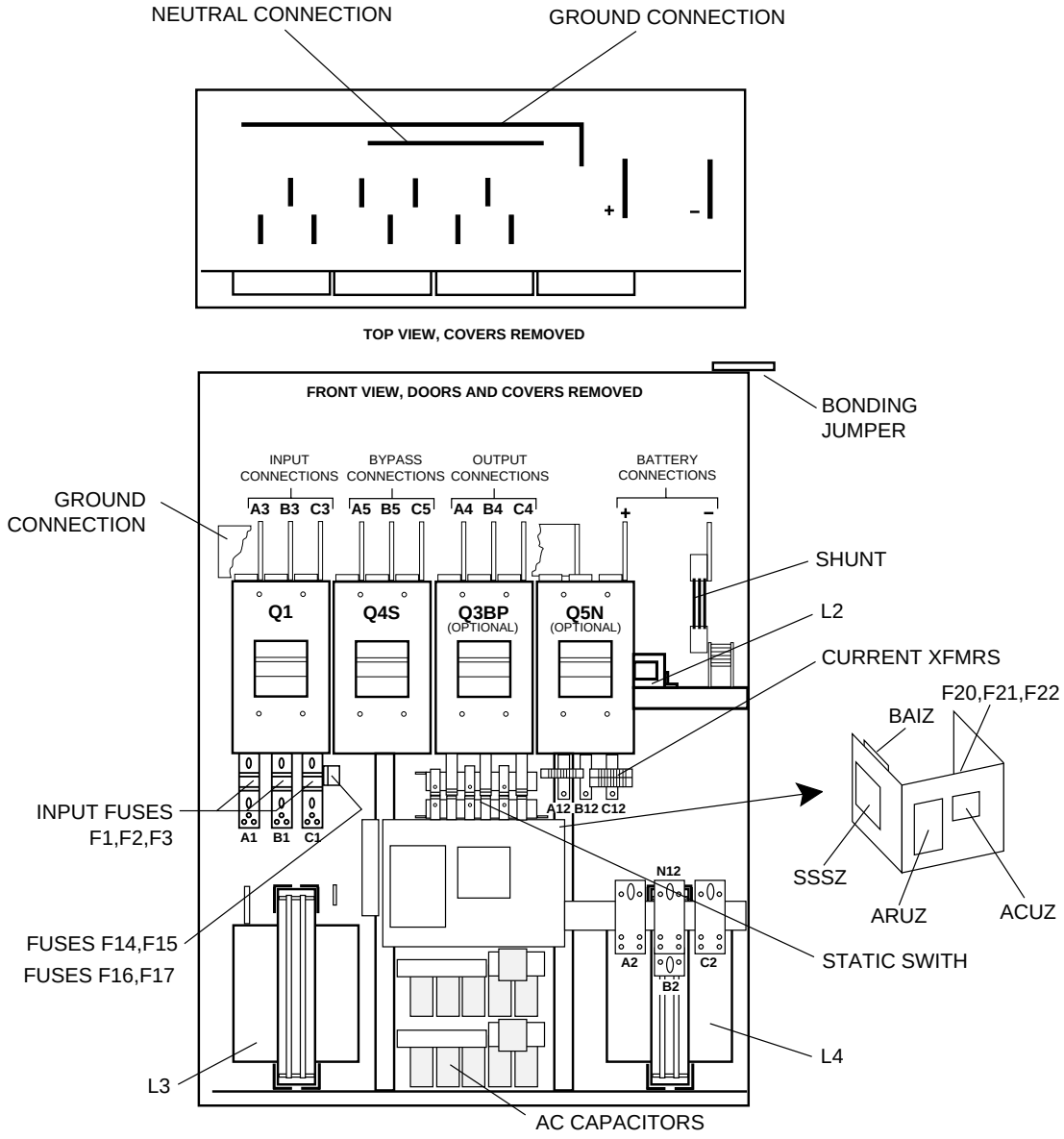


Figure 2-12 **Single EPS 6000 500 kVA Major Internal Components**

UPS Cabinet 1

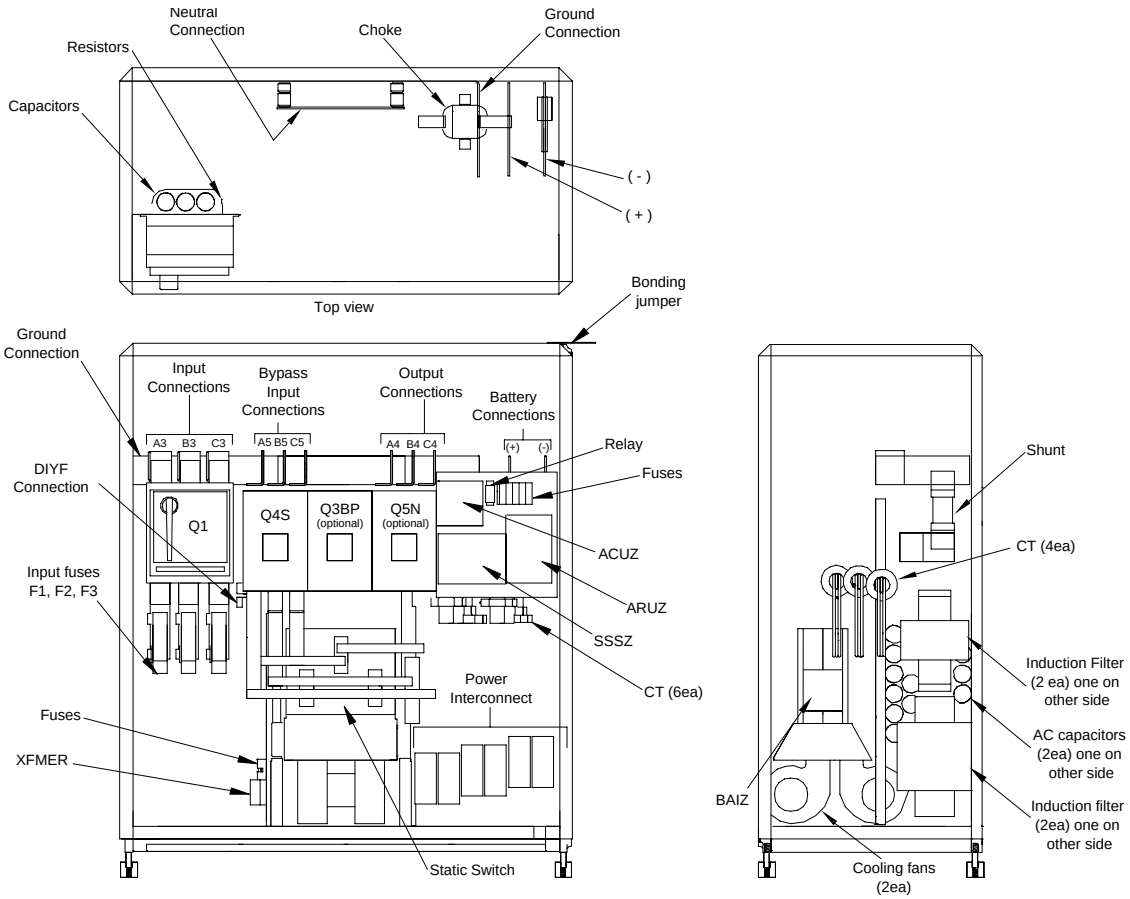


Figure 2-13 **Single EPS 6000 500 kVA Major Internal Components**

UPS Cabinet 2

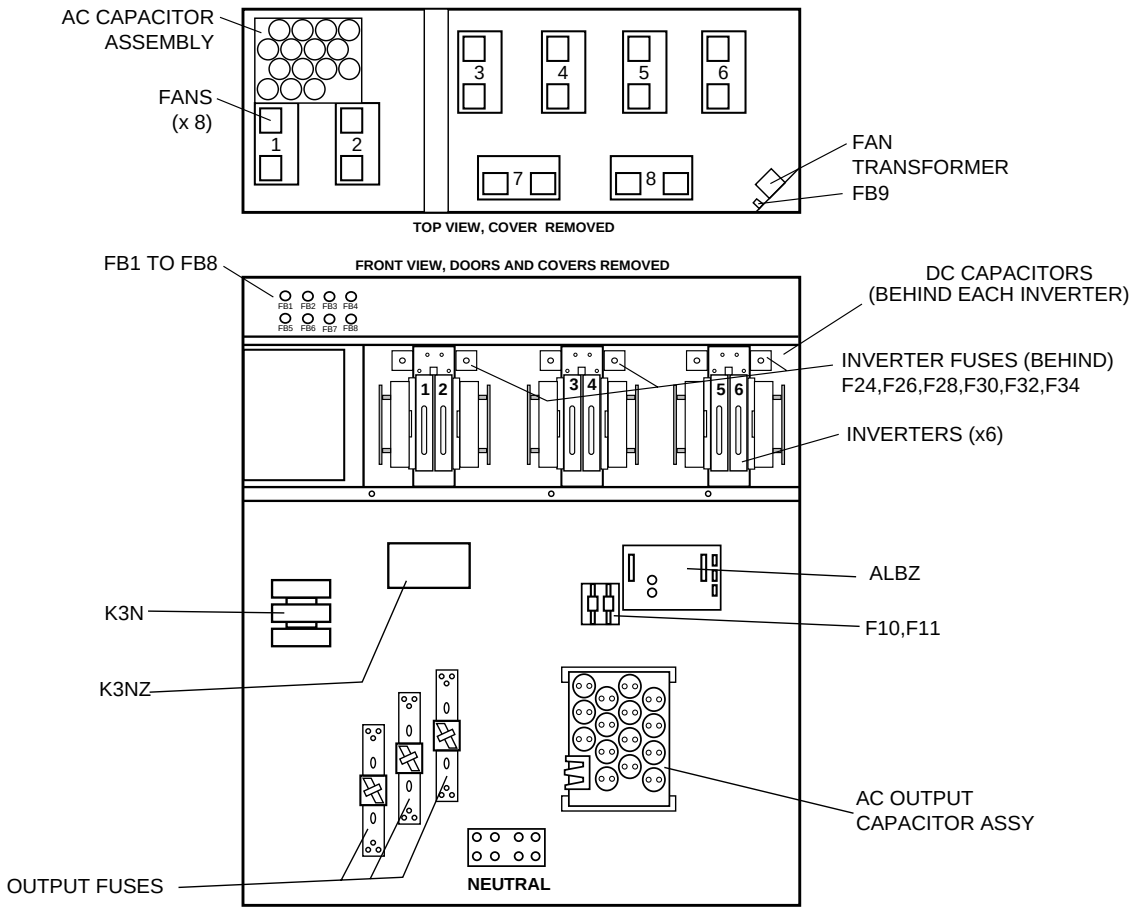


Figure 2-14 **Single EPS 6000 500 kVA Major Internal Components**

UPS Cabinet 3

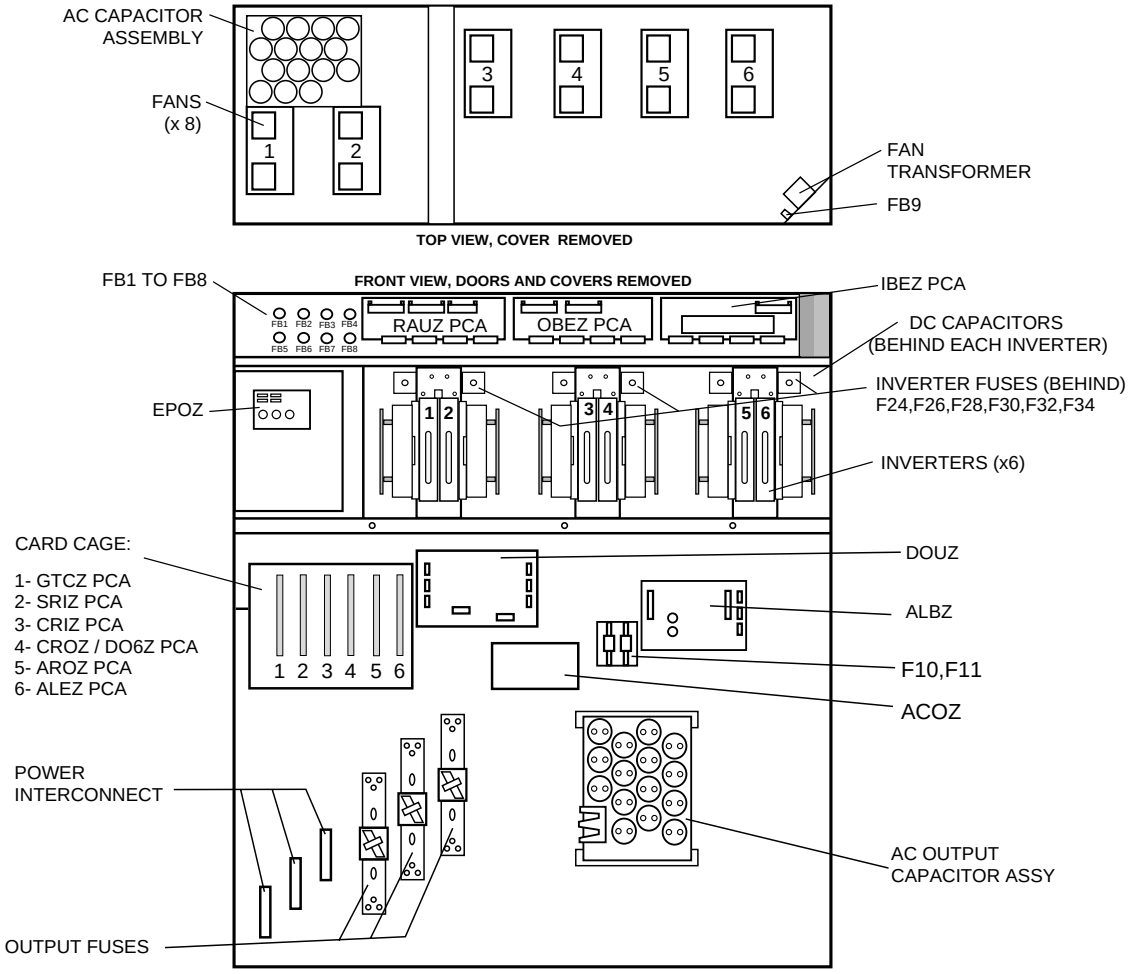


Figure 2-15 **Location of Circuit Breakers and Switches Within the Electrical Path of the UPS Cabinet**

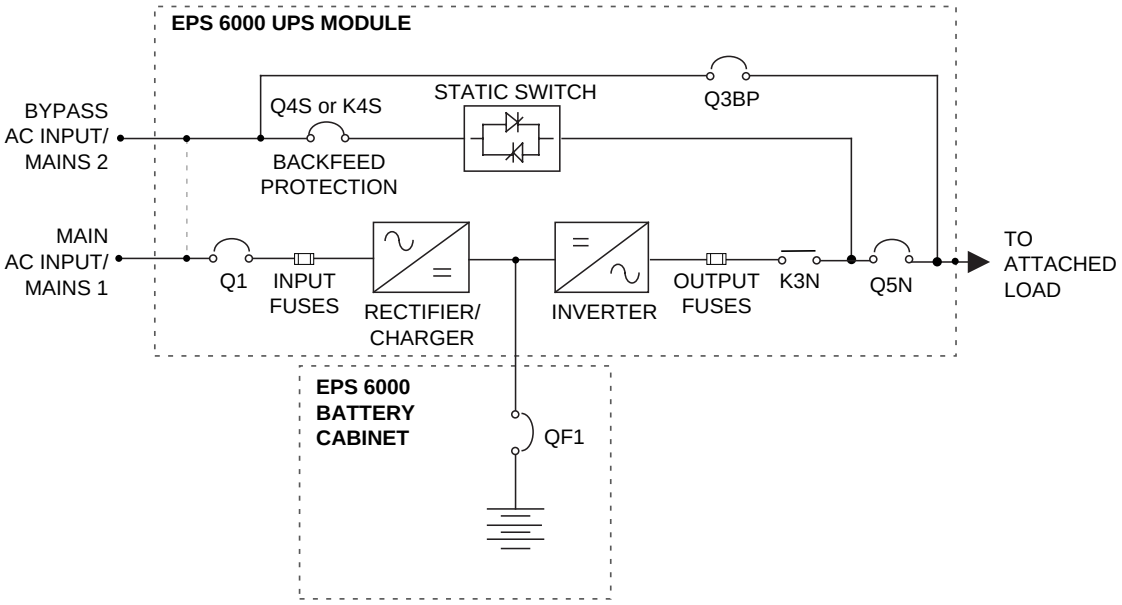
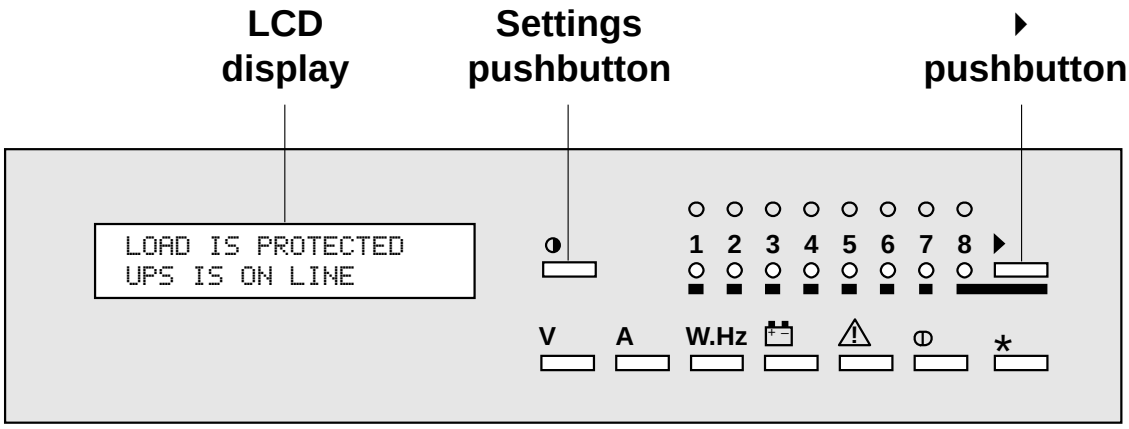


Figure 2-16 **Alphanumeric Display**



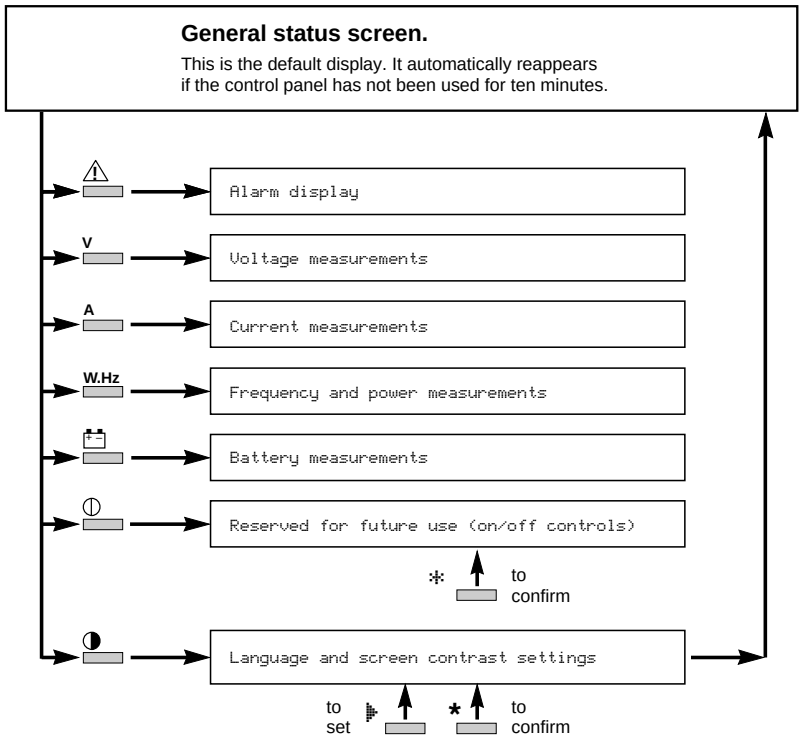
2.3 Using the Alphanumeric Display

This section describes operation and use of the alphanumeric display in detail.

The alphanumeric display interacts with the user via the top half of the hidden panel (Figure 2-4). Figure 2-7 shows the general organization of the alphanumeric display.

Figure **General Display Configuration**

2-17



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 2.3.2, Alarms).

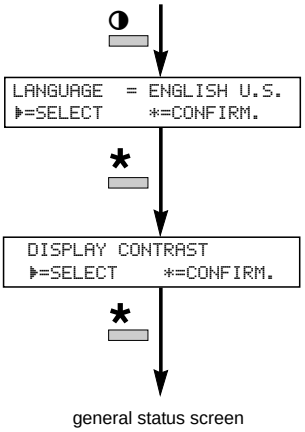
The following sections present detailed operating instructions for the alphanumeric display.

2.3.1 Settings

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 as indicated in Figure 2-18.

Figure 2-18 **Display Settings Display**



Press the settings pushbutton to access the language selection menu.

Select the display language: French, English (U.K.), Spanish, Dutch, Italian, Swedish, Portugese, English (U.S.), German, or Finnish

Press the * pushbutton to confirm the language selection and access the contrast selection menu.

Set the display contrast by pressing the ▶ pushbutton until the desired contrast is reached.

Press the * pushbutton to confirm the contrast selection and return to the general status screen.

IMPORTANT

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

2.3.2 Alarms

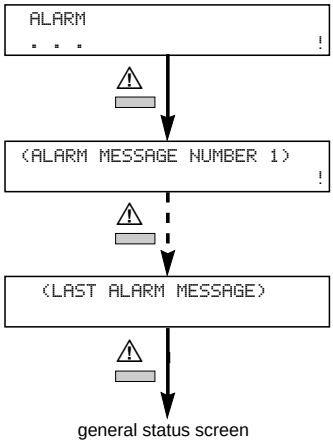
In the event of an alarm condition, the general status screen shows an alarm message. To determine the specific condition causing the alarm, press the alarm key on the front panel, as shown in Figure 2-7.

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 2-19.

Most alarm messages are self-explanatory; see Section 2.5 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 2-19. To reset the alarms, press the "clear fault log" pushbutton (see Section 2.2.3).

Figure 2-19 **Displaying Alarm Messages**



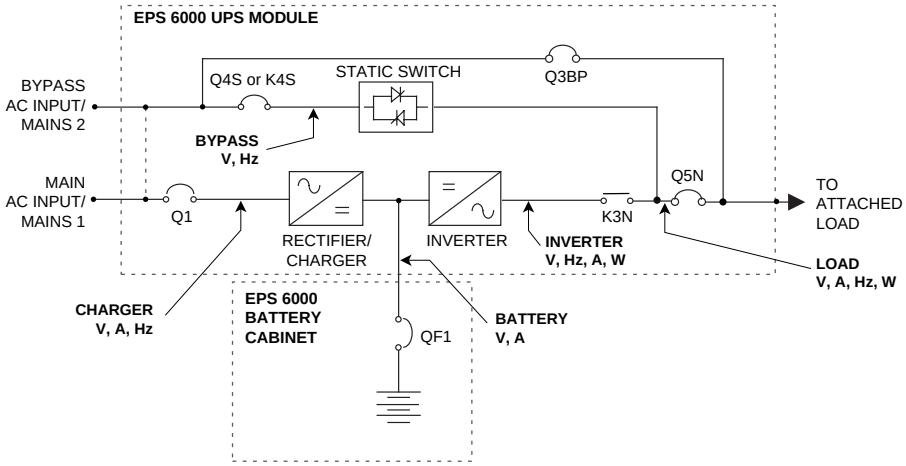
This message on the general status screen indicates an alarm condition. The flashing exclamation mark (!) indicates that there are alarm messages to view. To view them, press the "alarm" pushbutton.

The last alarm message is not followed by an exclamation mark (!). When the "alarm" pushbutton is pressed again, the display will return to the general status screen.

2.3.3 Measurements

The LCD can display comprehensive information about UPS performance through its monitoring functions. Figure 2-20 shows the location of measuring sensors within the UPS.

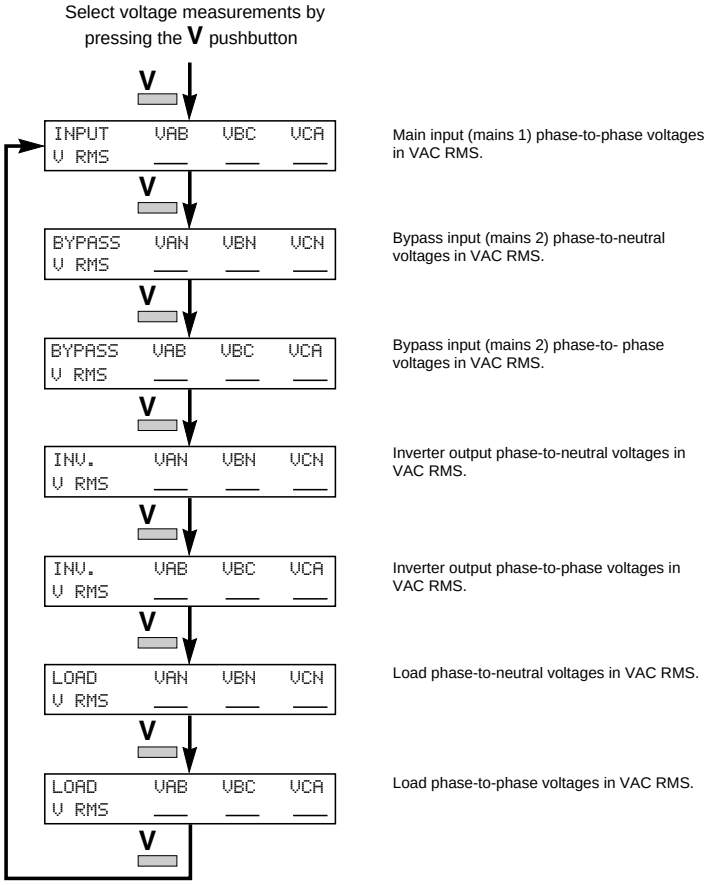
Figure 2-20 **Location of Sensors Within the EPS 6000 UPS**



2.3.3.1 Voltage Measurements

To display voltage measurements, press the "V" key on the keyboard, as shown in Figure 2-21.

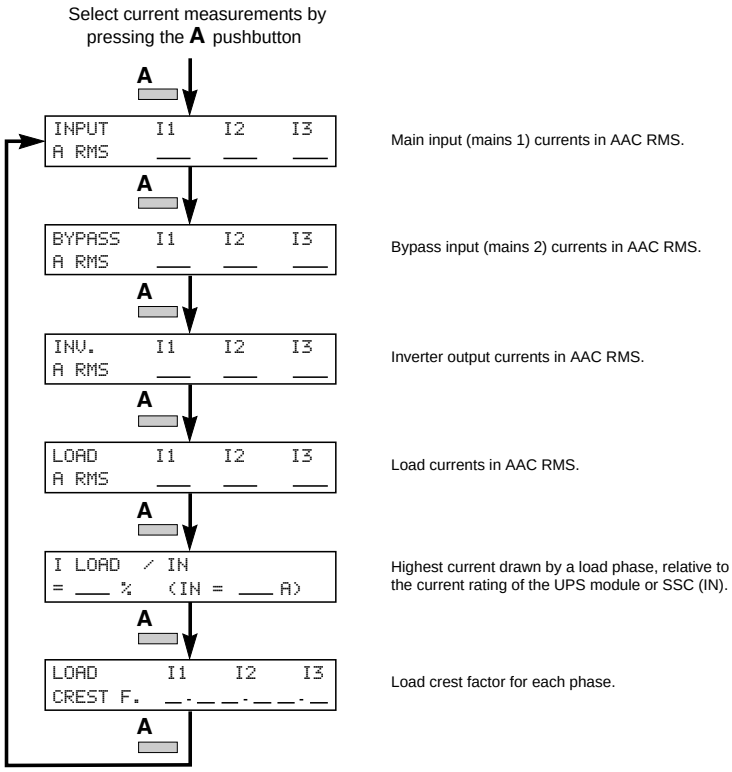
Figure 2-21 **Voltage Measurements**



2.3.3.2 Current Measurements

To display current measurements, press the “A” key on the keyboard, as shown in Figure 2-22.

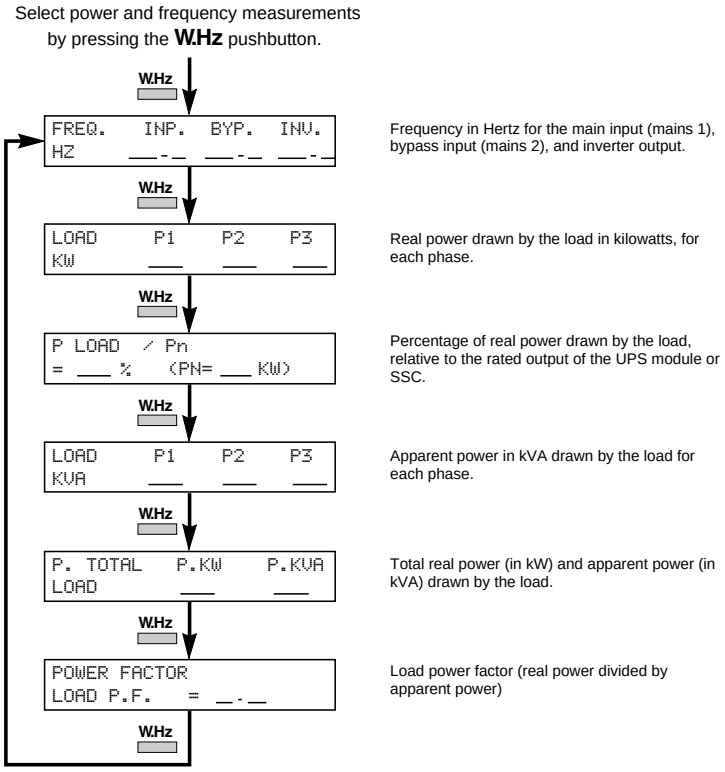
Figure 2-22 **Current Measurements**



2.3.3.3 Power and Frequency Measurements

To display power or frequency measurements, press the "W.Hz" key on the keyboard, as shown in Figure 2-23.

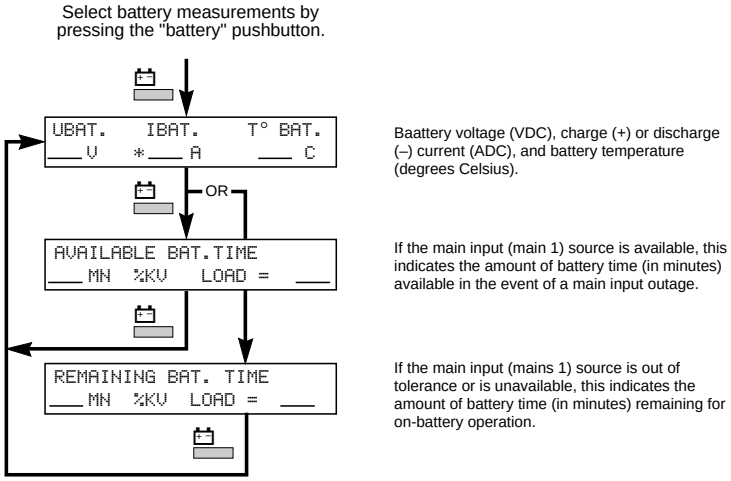
Figure 2-23 **Power and Frequency Measurements**



2.3.3.4 Battery Measurements

To display battery voltage, current, ambient temperature, and time available or remaining, press the battery key on the keyboard, as shown in Figure 2-24.

Figure 2-24 **Battery Measurements**



2.4 Normal Operating Procedures

This section presents normal operating procedures for the EPS 6000 UPS. It is best to contract MGE Customer Support Services for start-up and maintenance of the EPS 6000 UPS. Do not allow unqualified personnel to operate the EPS 6000.

2.4.1 Checks Before Start-up

Before starting the EPS 6000 UPS, 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 right door of the EPS 6000 UPS module.
- The air filters located inside each EPS 6000 UPS module front door are properly installed and free of dust, dirt, and debris. Make certain that no objects block the air intake at 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.

2.4.2 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 6000 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, or some other reason), a forced transfer is required. Refer to Section 2.4.6, Forced Transfers.

k. Close the optional output distribution circuit breakers (if present).

2.4.3 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.

2.4.4 Shut-down

This section presents procedures for shutting down the UPS cabinet under normal, emergency, overload, and maintenance conditions.

2.4.4.1 Emergency Shut-down 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 ON OR 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.

2.4.4.2 Normal Shut-down

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 2.4.6).

2.4.5 Isolation for Maintenance

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.

2.4.5.1 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 Section 2.2.3). If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer is required; refer to Section 2.4.6, 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.

The UPS is now isolated 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.

To restart the UPS after maintenance:

1. 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 6000 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 2.4.6, Forced Transfers.

2.4.5.2 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 2.2.3). If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer will be required. Refer to Section 2.4.6, Forced Transfers.
2. Close the maintenance bypass circuit breaker Q3BP.
3. Open the UPS isolation circuit breaker Q5N. 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.

The UPS is now isolated 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. **NOTE: This will dump any load being serviced even through the Bypass.**

To restart the UPS after maintenance:

1. Close the input isolation circuit breaker Q1.
2. Close the circuit breaker Q4S. The UPS fans will start.
3. Close the UPS isolation circuit breaker Q5N.
4. Open the maintenance bypass circuit breaker Q3BP.
5. 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.
6. Automatic restart of the UPS is the normal configuration; the UPS inverter will start automatically and resume normal operation. If your EPS 6000 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 2.4.6, Forced Transfers.

2.4.6 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.

2.4.6.1 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.

2.4.6.2 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 (Figure 2-7,) 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.

2.4.6.3 Forced Transfer From Inverter to Bypass AC Input

On the hidden panel, press the "security" key (Figure 2-7) 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.

2.5 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.

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 (!).

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 battery's 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.

```
BATTERY CHARGING !
```

This message indicates that the battery is being recharged.

```
INDEPENDENT INVERTER
FREQUENCY  !
```

This message indicates that the inverter is operating in free-running mode, and is no longer synchronous with the bypass AC input source (mains 2). Inverter frequency is stable within 0.1 Hz, but transfer of the load to the bypass AC input source is not possible without an interruption of power to the load.

```
UPS
TRANSFER LOCKOUT   !
```

This message indicates that the load cannot be transferred from the inverter to the bypass AC input (mains 2) source without interruption because the conditions for transfer without interruption are not met (see Section 2.4.6.1), or because the inverter is operating in free-running mode or in current limit, or because the UPS has been commanded not to transfer without interruption, or because of an internal fault.

```
FAN FAILURE
CALL SERVICE   !
```

This message indicates that a fan has failed, and that service is required. Because the fans of the rectifier/battery charger and the inverter are redundant, the load is still supplied by the inverter.

```
AUXILIARY CABINET FAULT
CALL SERVICE   !
```

This message indicates that there is a fault in an auxiliary cabinet, and that service is required.

```
CALL SERVICE FOR
BATTERY PM   !
```

This message indicates that the battery may have reached its end of life (based on the rated lifetime and the conditions of use).

```
MODULE NUMBER 1
UNAVAILABLE
```

This message indicates that the core controller of the UPS is not sending data to the alphanumeric display. The status of the UPS is still correctly indicated by the LEDs of the visible panel (see Section 2.2.1) and the hidden panel (see Section 2.2.3).

```
MODULE NUMBER 1
FAULT
```

This message indicates that the core controller of the UPS is sending invalid data to the alphanumeric display. The status of the UPS is still correctly indicated by the LEDs of the visible panel (see Section 2.2.1) and the hidden panel (see Section 2.2.3).

```
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 (see Section 2.2.1) and the hidden panel (see Section 2.2.3).

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Maintenance and Service

3.0 Scope

This section describes maintenance of the EPS 6000 UPS, including safety instructions, preventive maintenance, descriptions of replacement parts kits, and service.

3.1 Safety Instructions

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.

3.2 Preventive Maintenance

The following preventive maintenance routines should be considered as the minimum requirements; your installation and site may require additional preventive maintenance to assure optimal performance from your installed EPS 6000 UPS 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 be familiar with the indicators, controls, and operation of the UPS, as described in this manual.

a. Isolate and de-energize all EPS 6000 UPS equipment for all maintenance operations.
b. Ensure that all equipment is clean and free of loose dust, dirt, and debris. The exterior of all 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 6000 UPS 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 Section 2.4.1.
f. Test the main operating sequences as applicable to your equipment configuration and installation.

3.3 Replacement Parts

There are no user replaceable parts inside the EPS 6000 UPS.

Three levels of replacement parts are available for the EPS 6000 UPS. 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 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 system, 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.

3.4 Troubleshooting and MGE Servicing

Should you encounter a problem in the operation of a UPS and need MGE UPS Systems, Inc. to service your product, please take into account the following recommendations.

To the extent that you feel comfortable with the unit, leave it in its current state, make a record of the display lights and alarm messages and call either your local MGE Field Engineer or MGE's Customer Support Services at 1-800-438-7373 for assistance. Leaving the unit in its current state will enable MGE's field engineers to troubleshoot your product and bring it back on line more easily.

If you are not comfortable with the current status of the unit, you may want to take the following actions (listed by order of increasing impact on ease of troubleshooting):

1. If the audible alarm is active, reset it by pressing the audible alarm reset button (the second button from the left on the lower hidden panel as shown in Figure 2-7).
2. Stop the inverter (see Section 2.4.4.2 for normal shutdown and Section 2.4.6.3 for forced shut down).
3. Put the load on maintenance bypass by closing the maintenance bypass circuit breaker Q3BP, opening the isolation circuit breaker Q5N, and opening the circuit breaker Q4S.
4. Open the battery circuit breaker(s) QF1.
5. Reset the alarms by pressing the fault log clear button (the left most button on the lower hidden panel as shown in Figure 2-7).
6. Open the input isolation circuit breaker Q1 or the upstream circuit breaker feeding Q1. **NOTE: This will dump all loads serviced by a single-feed UPS with maintenance bypass.**

After taking these steps, make a record of the display lights and alarm messages and call your local MGE Field Engineer or call 1-800-438-7373 for assistance.

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Glossary

Symbols

¶	Used to reference paragraph headings that are listed in the table of contents.
/	Used to represent “and/or.”
%	Percent; of each hundred.
° F.	Degrees Fahrenheit.
° C	Degrees Celsius.
@	At.
±	Plus or minus.
#	Number.
Ø	Phase.
Ω	Ohms.
2nd	Second.
A, B, C	Normal sequence of phases (clockwise) in three-phase power.
AC or ac	Alternating current.
Alphanumeric display	The LCD display above the hidden panel (behind the drop-down cover) on the UPS module and the SSC.
Ambient air temperature	The temperature of the surrounding air.
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.
AWG	American Wire Gauge, formerly Brown & Sharp gauge.

B or BAT. or BATT.	Battery.
Breaker	Circuit breaker.
British Thermal Unit	A unit of heat equal to 252 calories (see BTU).
BTU or Btu	British thermal unit. Defined as the amount of energy required to raise the temperature of 1 pound of water by 1° F.
BYP	Bypass.
BYPASS	Maintenance bypass; wrap-around manual maintenance bypass using the optional bypass circuit breaker Q3BP in conjunction with circuit breaker Q4S and isolation circuit breaker Q5N.
Bypass AC input	Mains 2.
Calorie	A unit of heat. One calorie is the amount of energy required to raise the temperature of one gram of water by one degree Celsius.
Carrier	The company or individual responsible for delivering goods from one area to another.
CB	Circuit breaker.
Conduit	A flexible or rigid tube surrounding electrical conductors.
C.S.S.	Customer Support Services.
CT	Current transformer.
Curr.	Current.
Current rating	The maximum current that a piece of electrical equipment is designed to carry.
DC or dc	Direct current.
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. Compare to technician.
EPO	Emergency power off.

Free running	Indicates that the inverter frequency is stable and independent of the bypass AC input (mains 2) frequency.
FREQ	Frequency.
Fusible	Capable of being melted with heat.
GND	Ground
Hz	Hertz, a measure of frequency; one cycle per second equals one Hertz.
I	Current.
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.
kVA	Kilovolt-Ampere; a measure of apparent power.
kW	Kilowatt; a measure of real power.
LCD	Liquid-crystal display.
LED	Light-emitting diode.
LEG or Leg	Inverter leg.
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.
MAX	Maximum.
MBC	Optional maintenance bypass cabinet that attaches to the SSC (in shared systems).

MCM	Thousand circular mil; standard wire sizes for multiple stranded conductors over 4/0 AWG in diameter. M is from the Roman numeral system; it is the symbol for 1,000.
MG	Motor-generator set.
MGE	MGE UPS Systems, Inc.
module	Refers to an EPS 6000 UPS module (rectifier/battery charger, inverter, and attached battery cabinet).
MOV	Metal-oxide varistor.
NEC	National electrical code.
NFPA	National fire protection association.
NO. or No.	Part number.
OSHA	Occupational safety and health act.
OF	Over-frequency.
On-battery operation	The attached load is being supplied by the stored energy in the battery system.
OV	Over-voltage.
Packing list	The list of articles included in a given shipment.
P.F.	Power factor.
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.
REPO	Remote emergency power off.
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.
SEQ	Sequence.
Shipping damage	Any damage done to an article while it is in transit.
Shipping pallet	A platform on which articles are fixed for shipping.
Specific gravity	The ratio of the weight of a given volume of substance (such as electrolyte) to that of an equal volume of another substance (such as water) used as a reference.
SSC	Static switch cabinet (in shared systems).
Sync or synch	Synchronization.
Technician	Refers to an electronic technician qualified to maintain and repair electronic equipment. Not necessarily qualified to install electrical wiring. Compare with electrician.
Test connector	DB-9 type connector on the hidden panel (UPS modules and SSC) allowing an MGE Customer Support Services 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.

Reorder form

MGE UPS SYSTEMS

1660 Scenic Avenue
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