

Features

- ▶ Single and Parallel UPSs
- ▶ Battery Cabinet
- ▶ Maintenance Bypass
- ▶ Optional Up-link to an IBM AS4000



Galaxy PW™

*100 to 225kVA
Uninterruptible Power Systems*

Installation and User Manual

86-133060-00 A00



IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions for the Galaxy PW™ that must be followed during operation of the equipment.



WARNING

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

ATTENTION

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

WARNUNG!

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



WARNING

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

ATTENTION

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

WARNUNG!

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



NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at user's own expense.

Certification Standards

- ▶ IEEE 587-1980/ANSI C62.41 1980 Standards for Surge Withstand Ability
- ▶ FCC rules and regulations of Part 15, Subpart J, Class A
- ▶ UL listed under 1778-ULC, Standards for Uninterruptible Power Supply Equipment
- ▶ NEMA PE 1 (National Electrical Manufacturers Association) - Uninterruptible Power Systems
- ▶ NEMA 250 (National Electrical Manufacturers Association)
 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- ▶ NFPA 70 – National Electrical Code
- ▶ ISO 9001
- ▶ Occupational Safety & Health Administration (OSHA)



WARNING

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

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

ATTENTION

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

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

WARNUNG!

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

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



WARNING

HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply.

ATTENTION

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

WARNUNG!

Hoher Ableitstrom Vor Inbetriebnahme Schutzleiterverbindung herstellen.

How to Use This Manual and Symbol Usage

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

Locate specific topics in the Table of Contents.

For terms used in the text refer to the Glossary.

Typographical conventions use single quote marks in procedures to denote a prompt for User action:

For example: 1. After the selections are complete, click on the "Save" button.

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



WARNING

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



CAUTION

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



IMPORTANT

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



NOTE

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

CAUTION: Record All Serial Numbers!

**RECORD ALL SERIAL NUMBERS FOR THE GALAXY PW™ AND COMPONENTS.
THESE SERIAL NUMBERS WILL BE REQUIRED IF YOUR SYSTEM NEEDS SERVICE.
KEEP THIS MANUAL IN A PLACE WHERE YOU CAN REFERENCE THE SERIAL
NUMBERS IF SERVICE IS REQUIRED!**

UPS SINGLE SERIAL NUMBER: _____

UPS PARALLEL SERIAL NUMBER: _____

BATTERY CABINET SERIAL NUMBER: _____

MBP SERIAL NUMBER: _____

ADDITIONAL MODULE SERIAL NUMBERS:

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

Galaxy PW™
100 to 225kVA
Installation and User Manual

Revision History

Galaxy PW™ 100 to 225kVA Installation and User Manual 86-133060-00 A00			
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1.0 Scope

Introduction is a general description and overview of Galaxy PW™ 100 to 225kVA components, its intended use, environment, and applicable specifications, power input/output requirements, and system characteristics for different system configurations.

1.1 Section Descriptions

1 Introduction

Introduction is a general description and overview of the Galaxy PW™ 100 to 225kVA components, its intended use, environment, and applicable specifications, power input/output requirements, and system characteristics for different system configurations.

2 System Setup

System Setup describes receiving and handling of the Galaxy PW™ 100 to 225kVA, a description of major components, the battery cabinet, and definition of the control panel indicators. Includes electrical, mechanical and environmental specifications.

3 Installation

Installation guides the User through single and parallel UPS unit power cable connections, hot swap options, connections between cabinets, communication card connections, battery temperature monitoring. Wire diagrams are included for configuring the unit to specifications.

4 Operation

Operation describes the theory of operation, start-up for single and parallel units, modes of operation, normal specifications for operating the Galaxy PW™ 100 to 225kVA. The User procedures include display messages, measurement systems, alarms, battery cabinet, and log time-stamping procedures.

5 Maintenance

Maintenance procedures for isolation for maintenance, startup for single and parallel units, functional and visual checks, software configurations, and testing scenarios.

Appendices

- A List of primary and secondary display messages.
- B Electrical supervision options. (Teleservice and GTC Cards)
- C Instructions of the optional IBM AS400 up link process.

1.2 General Description

The cabinets are cooled by forced ventilation. The air enters via the doors and grids at the bottom and is discharged through the roof, which means the cabinets can be positioned against the back wall.

Connections are made through the bottom. (Connections through the top are an available option.)

The connection cables may be run in three ways:

- ▶ In a trench running under the cabinets.
- ▶ Under a false floor.
- ▶ On the floor under the cabinets, in the free space equal to the height of the feet; in this case the cables should be run side by side to avoid blocking the flow of air for ventilation.

The cables for connections are between:

- ▶ The battery and UPS cabinets (power and control cables).
- ▶ The bypass AC-source transformer in an auxiliary cabinet and the UPS cabinet.

Only the wires for the inter cabinet control connections between parallel-connected UPS units are supplied.

The other power cables for connections between cabinets are not supplied.

Figure 1-1: Galaxy PW™ System.



1.3 System Major Power Components

Rectifier/charger module (A)	Converts 3-phase AC power from the normal AC source supply (1) into DC power for the normal inverter input and float charges or recharges the battery.
Battery unit (D)	Provides backup power for the inverter in the event of a voltage drop or a normal AC source failure.
Inverter module (B)	Converts the DC power supplied by the rectifier/charger module or the battery unit into 3-phase AC power for the load.
Static bypass module (C)	Ensures the instantaneous transfer of the load to the bypass AC source input in the event of an inverter shutdown (initiated by the user or by a protective device) or a sudden overload.
Maintenance Bypass	Isolates the UPS for maintenance and transfers the load to bypass AC source input without interrupting the supply of power. The maintenance bypass is made up of three manual switches (Q3BP, Q4S and Q5N).
External Bypass	Option for parallel UPSs and Hot-Swapping.
Q5N:	Isolation of the inverters of all the parallel UPS systems from the load.
Q3BP:	Bypass for maintenance.

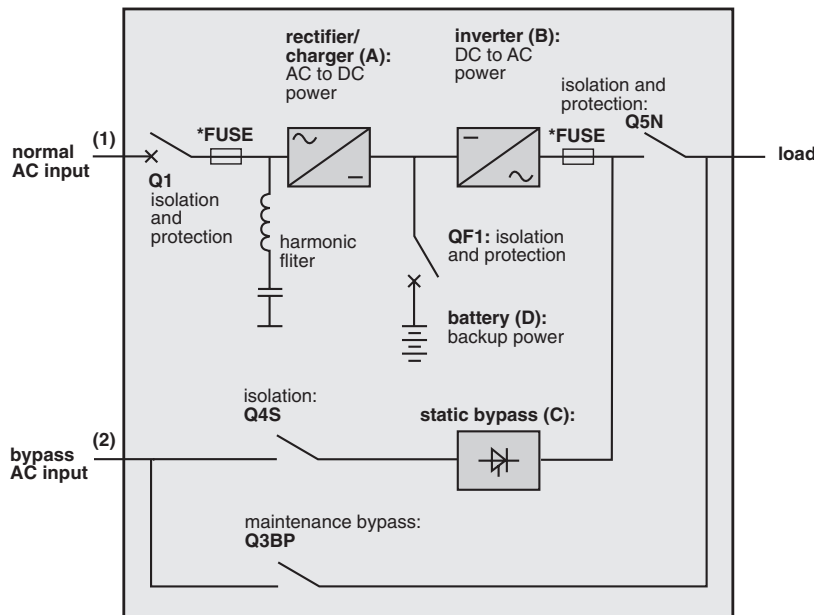
The normal AC input and the bypass AC input have different functions and, depending on the installation, may be protected differently upstream and/or come from different sources.

When increased power is required, several Galaxy PW™ units may be connected in parallel (up to four, refer to section 4.0). In this configuration, an "isolation" function is added for the UPS system as a whole for maintenance purposes, without interrupting the supply of power to the load.

1.4 Different Types of Galaxy PW™ Systems

1.4.1 Single UPS System

Figure 1-2: Galaxy PW™ Single UPS System.



Legend:

- Q1** (Molded CB NA): Isolation of the rectifier/charger (A) from the normal AC source (1); rectifier/charger (A) start-up.
- QF1** (circuit breaker): Battery (D) protection and isolation.
- Q5N** (switch): Isolation of the UPS (B) from the load.
- Q4S** (switch): Isolation of the static bypass (C) from the bypass AC source (2).
- Q3BP** (switch): Bypass switch for maintenance.
- FUE** (fuses): Protection of the rectifier/charger (A) from the normal AC source.
- FUS** (fuses): Protection of the inverter (B) from the load. Switch Q3BP is lock on open position on parallel UPS systems constituted to increase available power.

Note: *The Fuse is to protect against catastrophic rectifier/inverter semiconductor failure.

1.4.2 Parallel UPS System

Parallel UPSs can be utilized when increased power is required (two to four parallel units), or an external bypass must be added.



CAUTION

PARALLEL UPS WITH EXTERNAL MAINTENANCE BYPASS During maintenance operation, when CB1 (MBP) is closed and CB2 (UPS ISOLATION) is open, each UPS control panel display will show a message “LOAD PROTECTED” when the UPS is placed in ON-LINE MODE. In this mode the critical load is not protected because it is supplied by the maintenance bypass power.

1.5 System Specifications

1.5.1 Electrical Characteristics

UPS power rating in kVA		100	130	150	180	200	225
Normal AC input							
number of conductors	3 phases						
rated voltage and tolerances	480 V ± 10% (adjustable to ± 15%)						
rated frequency and tolerances	60 Hz / ± 10%						
THDI		< 14%	< 11%	< 10%	< 8%	< 7.6%	< 7.5%
power factor	up to 0.9						
Bypass AC input							
number of conductors	3 phases 3 phases + neutral						
rated voltage and tolerances	480 V / ± 10%						
rated frequency and tolerances	60 Hz / ± 10%						
Load							
number of conductors	3 phases 3 phases + neutral						
Ph/Ph voltages	480 V						
Ph/N voltages	277 V						
voltage fluctuations (Ph/Ph,Ph/N)	± 1%						
adjustable frequency and tolerances (on battery power)	60 Hz ± 0.05 Hz						
synchronization with bypass	± 0.5 Hz (adjustable from ± 0.25 Hz to ± 2 Hz)						
transient voltage variation for 0 to 100% load step change	± 2% (with battery), +2%/-6% (without battery)						
permissible overloads	150% for 1 minute, 125% for 10 minutes						
Isc Ph/Ph (% of I rated)		4.7	3.6	3.2	2.6	2.4	2.1
Isc Ph/N (% of I rated)		7.4	5.7	5	4.1	3.7	3.3
THDU Ph/Ph and Ph/N for linear load	< 1.5% Ph/Ph, < 2% Ph/N						
THDU Ph/Ph and Ph/N for non-linear load (at 80% of Pn)	< 2% Ph/Ph, < 3% Ph/N						
Battery							
voltage floating	512V to 561V						
standard battery type	gas-recombination sealed lead-acid battery						
UPS characteristics							
active power (kW)		100	130	150	180	200	202.5*
efficiency at 50% load (%) (values ± 1%)		90.5	91	92	92.5	92.5	93
efficiency at 100% load (%) (values ± 1%)		92.5	93	93	93	93.5	93.5
heat losses (1)	in kW	8.1	9.8	11.3	13.5	13.9	14.1
	in cal./s	1940	2350	2700	3240	3340	3380
storage temperature range °F (°C)	-13 to 158 (-25 to 70) dry heat — unit without battery -4 to 113 (-20 to 45) — unit with battery						
operating temperature range °F (°C)	32 to 95, 104 for 8 hours (0 to 35, 40 for 8 hours)						
relative humidity	95% maximum non condensing at ambient temperature						
maximum operating altitude without derating, FT(m)	< 3280 (< 1000)						
noise level (dBA)		62	63	64	65	67	68
dimensions, in. (mm)	width	47.8 (1215)					
	depth	33 (840)					
	height	74.8 ± .39 (1900 ± 10)					
weight lbs (kg)	3050 (1388)						
standards	design	NFPA / NEC / NEMA / OSMA					
	product and safety	UL 1778 - ULC					
	electromagnetic compatibility	FCC Part 15, Subpart J, Class A - IEEE587 / ANSI 62.41					

(1): The losses indicated are those produced at full rated load with the battery float charging. They must be taken into account when sizing the ventilation system.
* pf of 225kVA unit has 0.9 and remaining units have 1.0.

1.6 Electrical Parameters for Selecting Protective Devices

1.6.1 Normal AC Source

The parameters given in Table 1-1 can be used to determine the required rating of the upstream protective circuit breaker on the normal AC input for one single-UPS or parallel-UPS unit.

Normal and Bypass AC Input:

number of conductors	3 phases
rated voltage and tolerances	480 V \pm 10% (adjustable to \pm 15%)
rated frequency and tolerances	60 Hz / \pm 10%



IMPORTANT

It is essential to choose the type of circuit breaker according to its breaking capacity and the prospective short-circuit current at its place of installation. This choice must also be made so as to protect the static-switch semiconductors with respect to the maximum permissible currents and ensure discrimination between the UPS output fuses and the downstream protection devices.

Table 1-1: Electrical Parameters for Normal AC Source.

Electrical parameters for the normal AC source

rated UPS output in kVA	current normal AC source			
	rated current I_n for unit:		for 25% overload (3)	for 50% overload (3)
	with battery at start of charge cycle (1)	without battery (2)		
100	166	159	199	239
130	214	205	256	308
150	245	236	295	354
180	295	283	354	425
200	328	316	395	474
225	332	320	400	480

- (1) The rated normal AC source currents (I_n) have been determined for a rated phase-to-phase voltage of 480 V, a battery with a 10 minute backup time at the beginning of its charge (412 x 1, 2 = 494 Volts) and full rated load with a power factor of 0.9.
- (2) The rated normal AC source currents (I_n) have been determined for float charging voltage and full rated load with a power factor of 0.9
- (3) The normal AC source currents given for an overload of 25% or 50% are maximum values. They have been determined for a battery with float charging voltage and a load power factor of 0.9. When choosing the circuit breaker rating, use the "rated current" column and check that the circuit breaker tripping curves are compatible with the values in the overload columns.

1.6.2 Bypass AC Source

The parameters given in Table 1-2 and 1-2A can be used to determine the required rating of the upstream protective circuit breaker on bypass AC input.



NOTE

If the installation includes a transformer on the bypass AC input, allow for the inrush current caused by magnetization of the transformer windings.

Table 1-2: Electrical Parameters for Bypass AC Source.

Electrical parameters for bypass AC source (480 V)

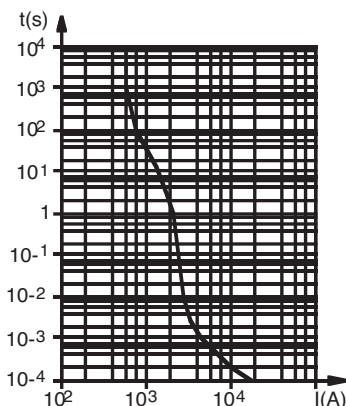
rated UPS output in kVA	current bypass AC source (1)		
	rated current I_n for unit:	for 25% overload	for 50% overload (3)
100	120	150	180
130	156	205	234
150	180	236	270
180	217	283	325
200	241	316	362
225	271	320	407

(1) The bypass AC source currents have been determined for a rated phase-to-phase voltage of 480 V, a load power factor of 0.9 and for full rated load as well as overloads of 25% or 50%. When choosing the circuit breaker rating, use the "rated current" column and check that the circuit breaker tripping curves are compatible with the data in the overload columns. See table and chart below.

Table 1-2A:

UPS output in kVA	maximum permissible current
100	50 I_n for 20 ms
130	38 I_n for 20 ms
150	33 I_n for 20 ms
180	27 I_n for 20 ms
200	25 I_n for 20 ms
225	22 I_n for 20 ms

Figure 1-3: Fuse Curve Chart.



1.7 Recommended Protection

1.7.1 Protection Upstream of Galaxy PW™

The information provided here is purely indicative, for a single UPS unit. Check that all the criteria mentioned in the previous section are taken into account (short-circuit current and protection of the static switch semiconductors on the bypass AC input).

Table 1-3: Rating Recommended for Devices Upstream of Single UPS.

Ratings				
rated UPS output in kVA	CB on normal AC input		CB on bypass AC input	
	circuit breaker	control unit	circuit breaker	control unit
100	125A	125A	125A	125A
130	160A	160A	160A	160A
150	250A	200A	250A	200A
180	250A	250A	250A	250A
200	400A	400A	400A	400A
225	400A	400A	400A	400A

1.7.2 Protection Downstream of Galaxy PW™

These protection devices ensure discrimination for each of the Galaxy PW™ output circuits. If the recommended downstream protection is not installed and a short-circuit occurs, the result may be a break longer than 20-min on all the other output circuits.

Table 1-4: Rating Recommended for Devices Downstream of Single UPS.

Ratings		
rated UPS output in kVA	downstream circuit breaker(s)	
	circuit breaker	control unit
100 to 225kVA	100A	63A curve C 100A curve B

1.8 Parallel Connected UPS Units

For installations with redundant units, take into account only the units required to supply the load power (e.g. for an installation made up of 3 parallel-connected UPS units, one being redundant, only 2 UPS units are used to determine bypass AC source and load currents and cable cross-sections).

Table 1-5 serves as an example for a parallel connected installation comprising up to four UPS units.

Table 1-5: Parameters for Bypass AC Source and Load Cables for a Parallel UPS.

Parameters

rated unit output in kVA	number of parallel-connected units	total UPS rated output in kVA	bypass AC source or load line current in Amps
100	2	200	240
	3	300	360
	4	400	480
130	2	260	312
	3	390	468
	4	520	624
150	2	300	360
	3	450	540
	4	600	720
180	2	360	434
	3	540	651
	4	720	868
200	2	400	482
	3	600	723
	4	800	964
225	2	450	542
	3	675	813
	4	900	1084

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2.0 Scope

System Setup describes receiving and handling of the Galaxy PW™ 100 to 225kVA, a description of major components, the battery cabinet, and definition of the control panel indicators, which includes electrical, mechanical and environmental specifications.

MGE also recommends obtaining an MGE field service engineer for final installation and basic startup for single and parallel units.



CAUTION

Scheduling of the MGE Field Service Engineers typically should be done 7 to 10 days before they are required on-site. If the startup of the UPS is critical to maintaining your schedule, please call the MGE toll free telephone number at 1-800-438-7373 for assistance. The MGE Field Service Engineers will insure a quick installation for the initial safe startup and configuration of your Galaxy PW™.

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

2.0.1 First steps by an on-site qualified Technical Engineer

- Step 1. Unpack and position the unit.
- Step 2. Connect the main (utility) power.
- Step 3. Connect the power circuits.

2.0.2 Final steps by MGE Field Service Engineer

- Step 4. Call MGE and wait for the MGE Field Service Engineer to complete the installation.
- Step 5. The MGE Field Service Engineer finalizes installation and the startup process.
- Optional: Procedure for temporary power prior to the final startup.

2.0.3 Required Equipment and Tools

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

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

2.1 Receiving

On delivery, check that the equipment has not been damaged in transport (declare any damage to the carrier in accordance with customary claim procedures).

Also check that the characteristics noted in the test report for the equipment correspond to those specified on the order form. In the event of a non-conforming item, quote the delivery note reference number when making your claim.

2.1.1 Handling

The cabinets are delivered on pallets, equipped with a shock absorbing system. Ideally, the equipment should be unpacked just before installation (see "unpacking" section below). Cabinet weights and dimensions are specified on the packaging. Cabinets may be handled in one of the following ways (see Figure 2-1):

Rolling on Bars (B)

Do not mount the foot pads, but place the cabinet on the rollers (at least three). The cabinet may be pulled on rollers using a sling positioned horizontally. This technique should only be used when absolutely necessary (narrow doorway or corridor, preventing the use of a fork-lift or pallet-mover).

From the Bottom (A)

The cabinets can be moved from the front or the rear (715 mm wide cabinets) using a pallet truck or fork-lift truck, or on the 4 surfaces (1015 mm and 1215 mm wide cabinets) using a fork-lift truck.

Fork tunnel height: 140 ±10 mm.

Fork opening: 560, 650 or 700 mm according to cabinets width.

The 715 mm wide cabinets are designed to pass through 715 mm wide openings, and the other cabinets are designed to pass through 825 mm wide openings. For narrow openings, (follow the instructions below) cabinets are normally 825 mm deep.

This depth can be reduced to:

- ▶ 817 mm by removing rear panels.
- ▶ 805 mm by removing doors.
- ▶ 800 mm by removing doors and door hinges.

unpack the cabinet, refer to section 2.2 'Unpacking', page 4. The cabinet can then be handled by lifting machines on all surfaces after the pallets have been dismantled by removing the rear panels, and remove the fixing screws using a "torx" screwdriver.

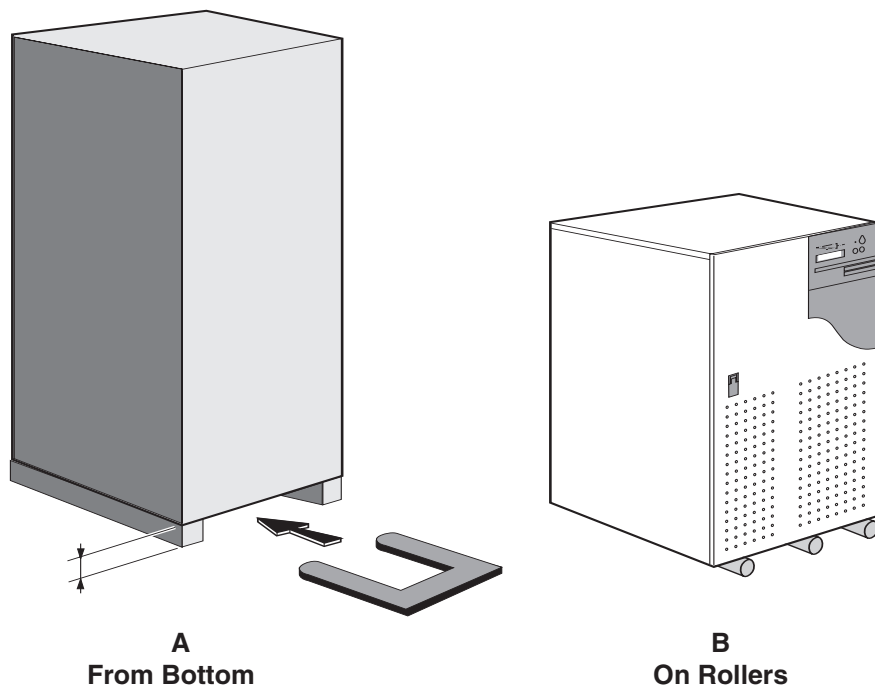
Removing the doors:

1. Open the door(s).
2. Disconnect the door earth connection from the frame.
3. For cabinets fitted with a control panel, carefully disconnect the ribbon cables from the panel circuit boards located on the inside of the door.
4. Knock out the hinge pins from below.
5. Remove the door(s).

Removing the door hinges:

1. Remove the screws holding the side panels to the hinges.
2. Remove the central screw holding the hinge.

Figure 2-1: Handling Cabinet From the Bottom or Rolling on Bars.



2.1.2 Storage

The equipment must be stored in a dry and well-aired location, sheltered from rain, water sprays or splashes and all chemical agents. Storage in original packing is recommended, since this packaging is designed to provide maximum protection during storage and handling. If the unit must be unpacked prior to final installation, cover the equipment with a shroud providing protection against dust, debris, or paint.

Please dispose of the packaging in accordance with the applicable legislation.



IMPORTANT

Transport: the temperatures must remain within the -30° to +50°C range and the duration should not exceed 30 days.

Storage: the battery is of the sealed lead-acid or vented lead-acid type and should not be stored for more than six months at 20°C without recharging for batteries that are initially fully charged (for partially charged batteries, the storage time should be reduced). After the recommended maximum storage time, the battery must be charged, requiring partial start-up of the equipment (rectifier-charger).

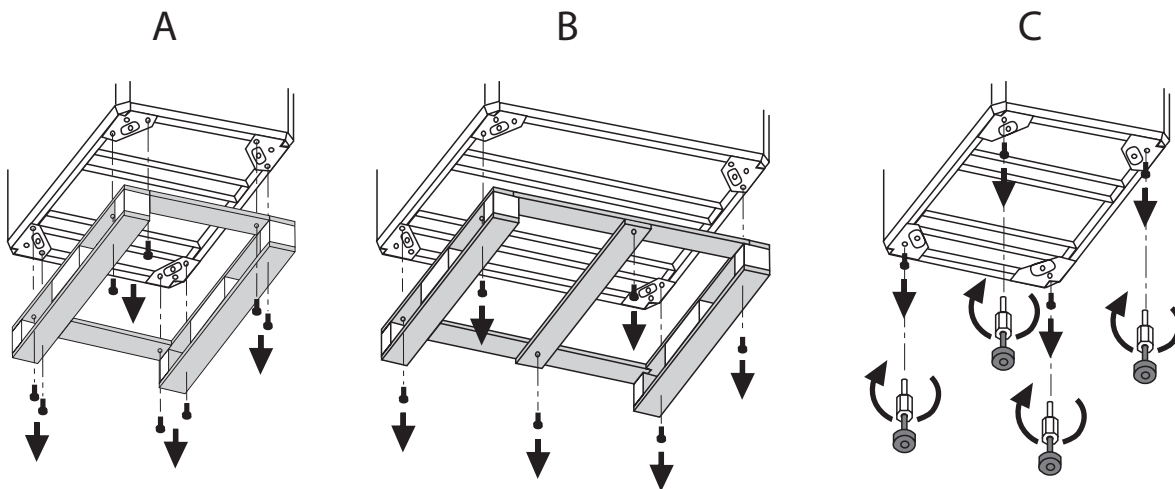
The battery cells can be stored at a temperature between -20°C and +45°C if delivered in their initial packing.

The ideal battery storage temperature is between 15° and 25°C (higher temperatures result in reduced storage life or downgraded technical characteristics). If higher temperatures cannot be avoided during transport or storage, please consult us.

2.2 Unpacking

1. Remove the packing box and the document holder on the top of the cabinet; raise the cabinet.
2. Dismantle the blocks fixed beneath the cabinet by M12 screws, see Figure 2-2 (A or B), according to the width of the cabinet);
3. Dismantle the 4 M12 screws screwed on the 4 leg supports (C).
4. Withdraw the "hexagonal spacer + leg" assemblies delivered inside the document holder.
5. Screw the spacers onto the cabinet frame (C).
6. Lock these spacers in position using a 24 mm flat wrench, and fit the cabinet on its legs.
7. Adjust cabinet height and verticality by screwing or unscrewing the legs using a 13 mm flat wrench.

Figure 2-2: Dismantling Leg Supports and Attaching Spacers to Cabinet.



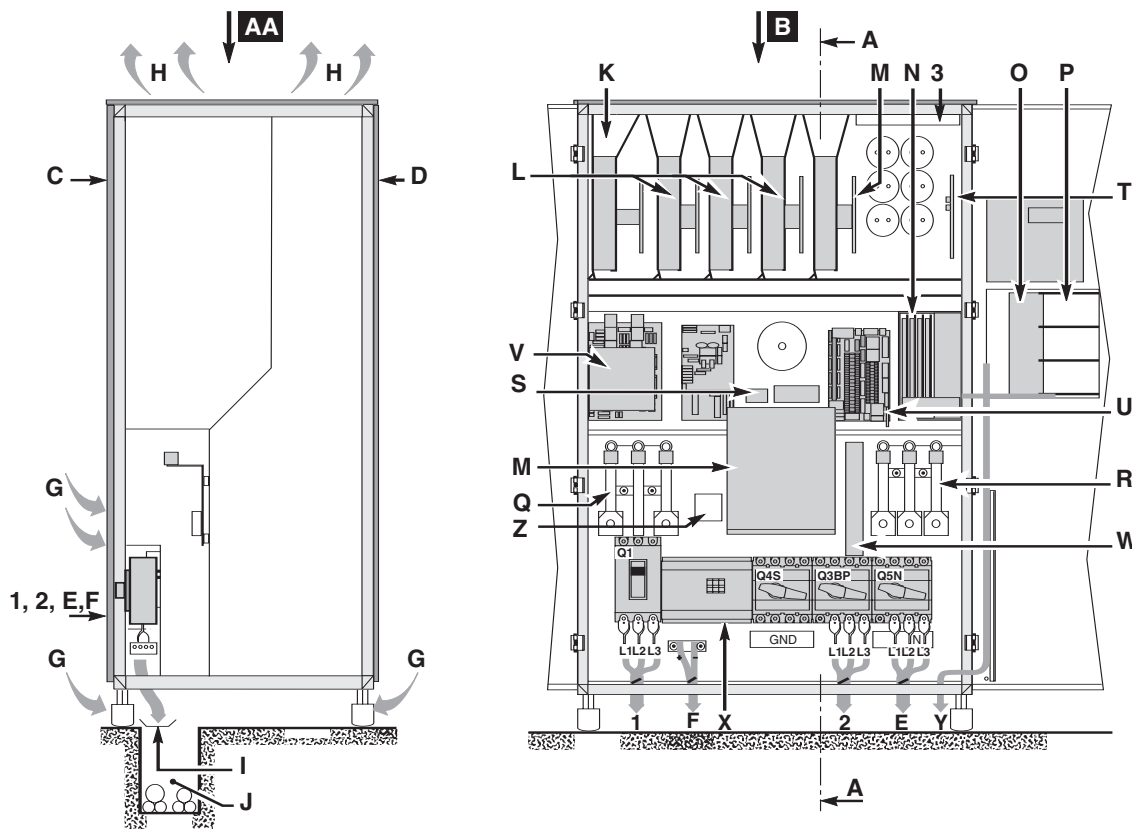
2.3 Galaxy PW™ Cabinet Major Components

Legend:

- AA:** cross-sectional view of the cabinet,
- B:** front view of the cabinet,
- C:** front panel,
- D:** rear panel,
- 1:** normal AC input connection,
- 2:** bypass AC input connection,
- E:** load connection,
- F:** battery connection,
- G:** air inlets,
- H:** air outlets,
- I:** cable exit through the bottom,
- J:** trough, if applicable,
- K:** rectifier/charger module,
- L:** inverter module,
- M:** static-bypass module,

- N:** rack containing electronic boards,
- O:** Media Contacts 11 board,
- P:** slot for communications boards,
- Q:** FUE input fuses,
- R:** FUS output fuses,
- S:** RALI board,
- T:** UPOZ /UCOZ board,
- U:** MUSI board,
- V:** backfeed protection (contactor),
- W:** control wire routing,
- X:** fuses for overvoltage protection RC circuit on bypass,
- Y:** control-wire connection (auxiliary "Media Contacts 11" circuits and communications options).
- z:** EP0I Board
- 3:** VETI Board

Figure 2-3: Layout of the Major Cabinet Components.

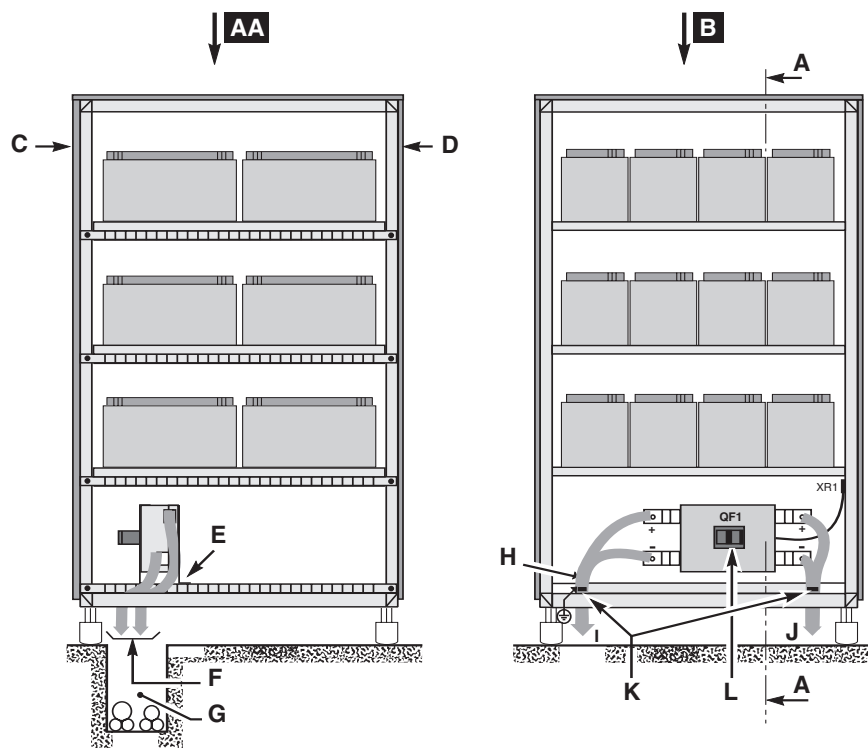


2.4 Battery Cabinet

Legend:

- AA: cross-sectional view of the cabinet,
- B: front view of the cabinet,
- C: front panel,
- D: rear panel,
- E: cable ties to duckboard shelf,
- F: cable exit through the bottom,
- G: trough, if applicable,
- H: connection of exposed conductive parts to duckboard shelf,
- I: cable exit to battery connection point in UPS cabinet,
- J: cable exit to an additional battery cabinet, if applicable,
- K: cable ties to duckboard shelf,
- L: fixture locking circuit breaker "QF1" in the open position.

Figure 2-4: Component Layout in a Battery Cabinet or a Battery Circuit-breaker Enclosure.



2.5 Remote External Maintenance Bypass Cabinet

350A and 1200A (See Figure 2-5)

Refer to "Installation Instructions" 90-133056-01 for detailed information about 350A cabinet.

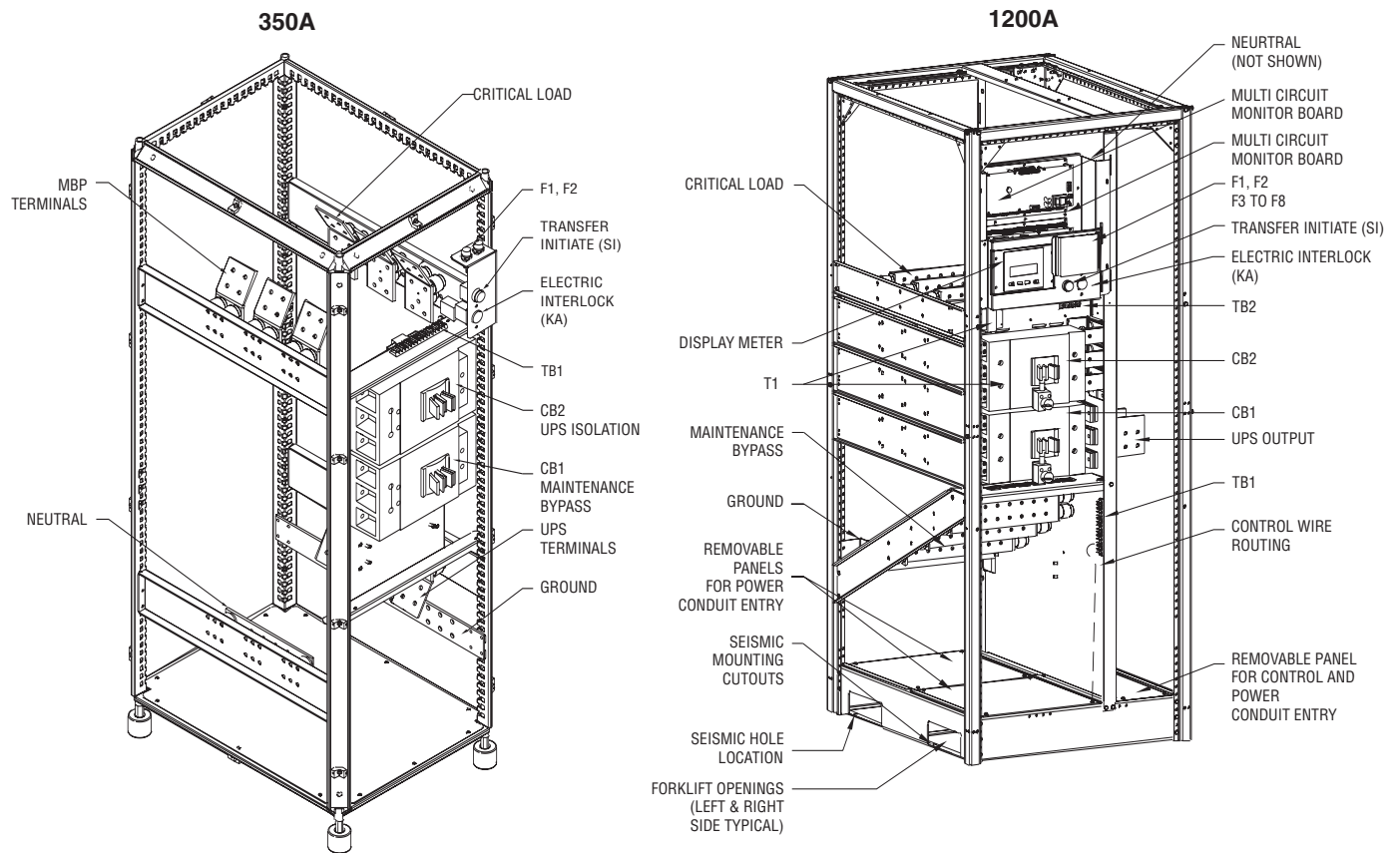
Refer to Installation drawing 90-133077-00 for detailed information about 1200A cabinet.

If your installation is custom designed, a separate installation drawing may apply to your system.

All external wiring are provided and installed by the user.

Transfer instructions can be found in front of the cabinet including the proper operation of the kick key interlock.

Figure 2-5: 350A and 1200A Maintenance Bypass Cabinet.



2.6 General Instructions for Screens

To display the desired information and enter commands using the ▲, ▼ and ø keys:

1. Press the ▲ key to exit the time-stamping consultation mode and return to the main menu. If no commands are entered for five minutes, the system automatically returns to the normal display mode.

To scroll through the screens displaying information:

1. Press the ▲ and ▼ keys to scroll up and down through the screens.

For time-stamped events, the display begins with the last event logged. To access older events, press the ▼ key. If during consultation, you wish to review more recent events, press the ▲ key.

2.6.1 Control Panel Indicators and Definitions

The control panel on the Galaxy PW™ UPS comprises the basic controls and indications required to check the general status of the system. See Figure 2-6.

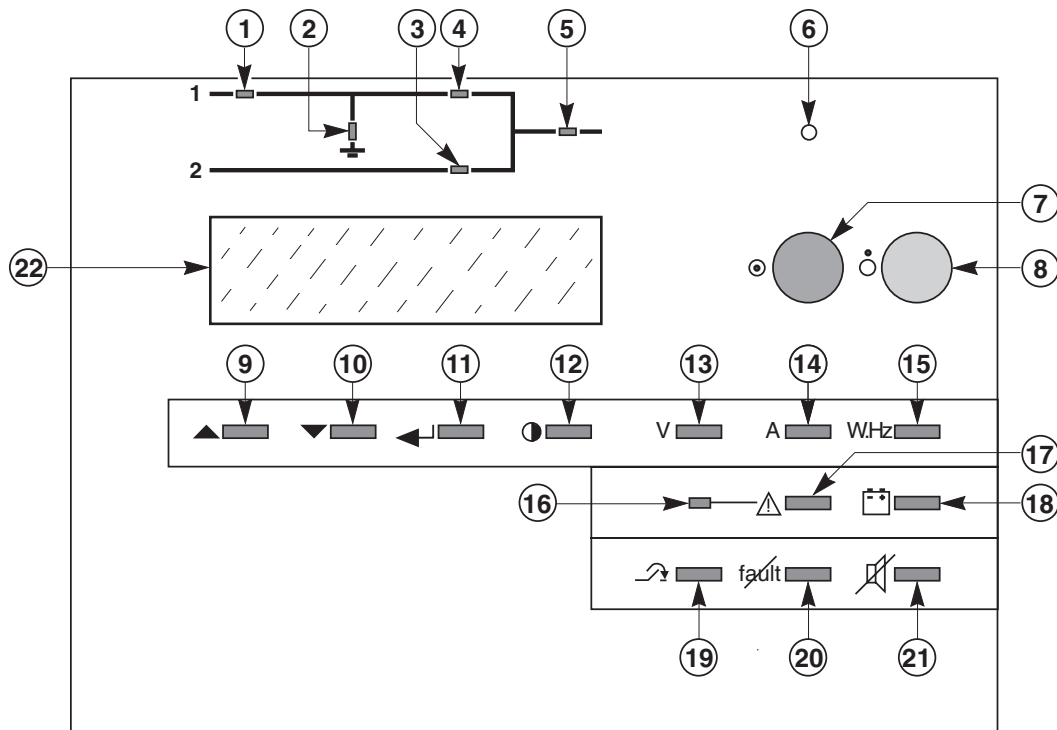
Located in the upper right part of the cabinet front, the control panel is designed to provide an easy and rapid overview of system status. See Figure 2-6.

Interpretation of symbols is very simple and requires no particular training. The information concerns only the cabinet on which the panel is located. Refer to Appendix A for a complete List of Primary and Secondary display messages.




The panel indicates:

- ▶ Normal operation (load protected).
- ▶ Operation with load on battery power.
- ▶ Abnormal situations (operating problem).
- ▶ Dangerous situations (load not protected).

Figure 2-6: Control Panel Indicators.



Control Panel Alphanumeric Legend:

1	"Rectifier/charger" light	Indicates on/off and charging activity.
2	"Battery light"	Indicates battery status.
3	"Static-bypass" light	Indicates static bypass tolerance status.
4	"Inverter" light	Indicates inverter on/off status.
5	"Load" light	Indicates Load supplied and not supplied.
6	Buzzer	The buzzer sounds in load operating situations.
7	"Inverter ON" button	This button is used to start the inverter locally.
8	"Inverter OFF" button	This button turns the inverter off locally.
9 -10	Keys	These keys are used to select commands in the main menu and access the secondary messages.
11	Key	This key is used to validate the user's choice.
12	 Key	This key is used to access the main menu: display language, display-contrast setting, sound level of the buzzer, lamp test, date and time settings, inverse-video and event log.
13	"V" Key	This key is used to access voltage measurements.
14	"A" Key	This key is used to access current measurements.
15	"W.Hz" Key	This key is used to access other measurements:
16	"Anomaly" light	This indicator light indicates the presence of anomalies.
17	 Key	This key is used to access the primary messages.
18	 "Battery" Key	This key is used to access battery measurements:
19	"Forced-transfer"	This key is used to voluntarily transfer the load to the inverter or from the inverter to the static bypass (return transfer).
20	"Alarm reset"	This key is used to reset stored alarms. The system accepts resetting only when alarms have been cleared.
21	"Buzzer reset"	This key is used to stop the buzzer. However, new alarms set the buzzer off again.
22	Display	The display continuously indicates the system operating status.

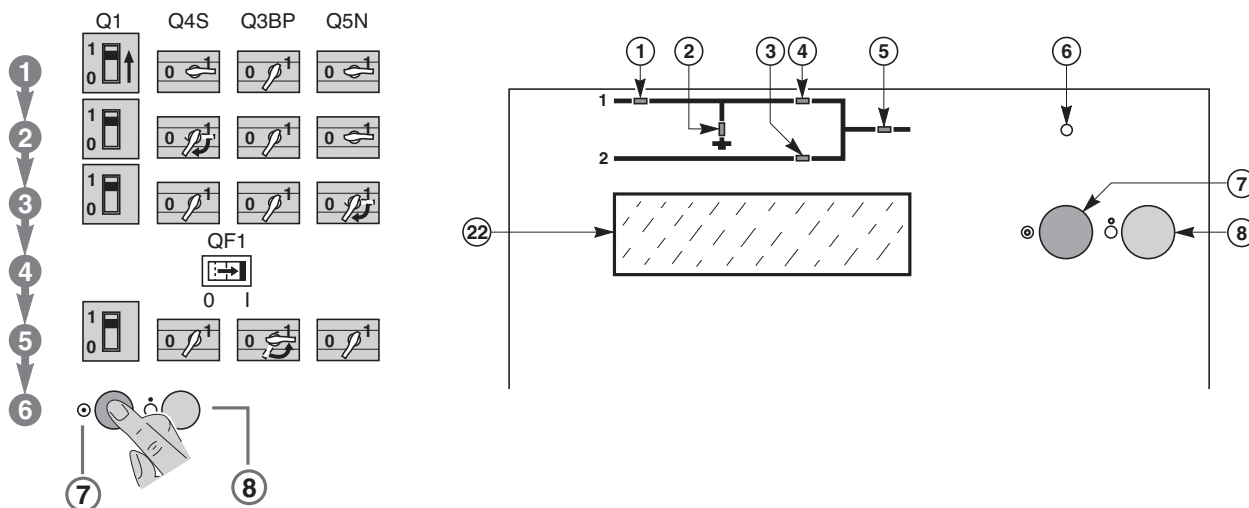
2.7 System Start-up

2.7.1 Single UPS unit or Redundant Parallel UPS

Proceed in the following order: See Figure 2-7.

1. Close the upstream switches supplying normal and bypass AC source power (on the LV switchboard).
2. Close normal AC input switch Q1. The system powers up:
 - the rectifier/charger automatically starts.
 - green light **1** on the control panel goes on.
 - light **2** turns red.
3. Close bypass AC input switch Q4S:
 - green lights **3** and **5** on the control panel go on.
4. Close inverter output switch Q5N.
5. Close battery circuit breaker QF1:
 - light **2** goes off.
6. Open maintenance bypass switch Q3BP.
7. Press the "inverter on" button **7** on the control panel:
 - the green "inverter" light **4** flashes.
 - the inverter starts, then, if the bypass AC source transfer conditions are satisfied, the load is transferred to the inverter if the on-line mode is selected.
 - the green "static-bypass" light **3** goes off.
 - the green "inverter" light **4** shines for on-line mode.

Figure 2-7: Single UPS Unit Start-up Diagram.

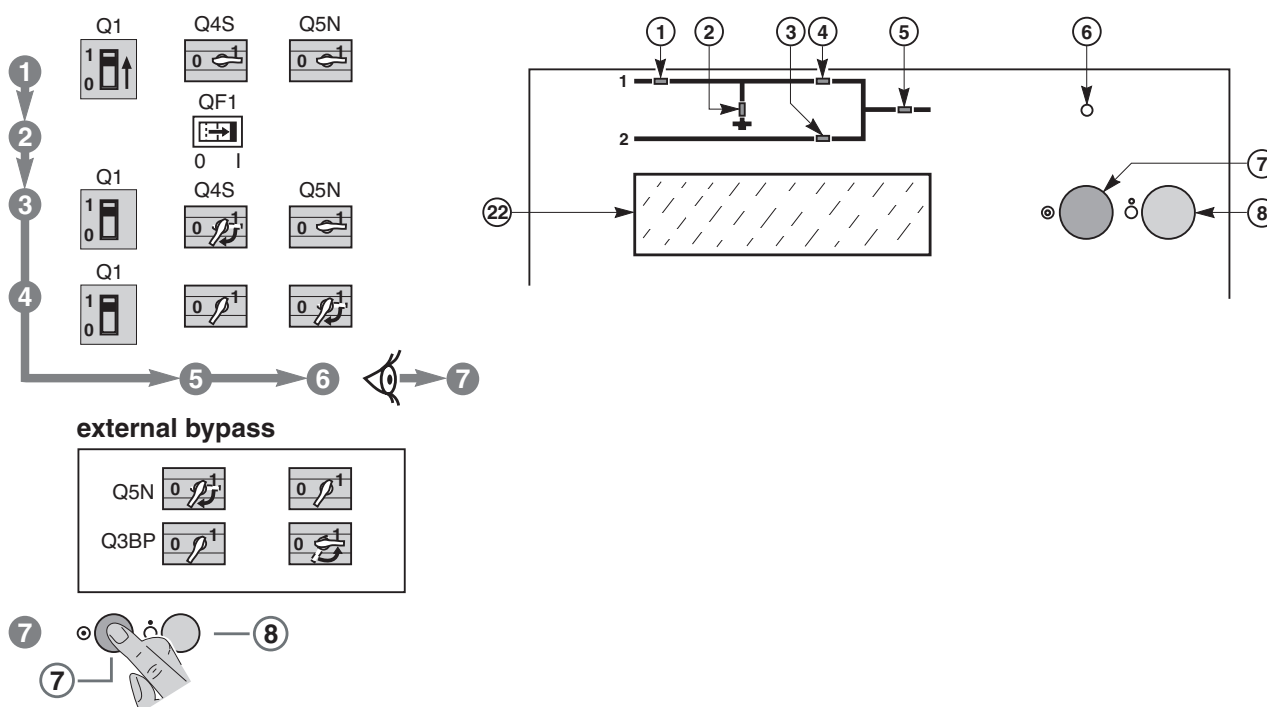


2.8 Parallel UPS Unit for Increased Output

Proceed in the following order: See Figure 2-8.

1. Check that all load devices are off or that the load is disconnected.
2. Close the upstream switch supplying normal AC source power (on the LV switchboard).
3. Close the normal AC input circuit breakers Q1 on the UPS units. The system powers up:
 - the rectifier/chargers automatically start,
 - the green "rectifier/charger" lights **1** in the control panels go on,
 - lights **2** turn red.
4. Close the battery circuit breakers QF1.
 - lights **2** go off.
 - green lights **3** and **5** on the control panels go on.
5. Close Main **2** input switch Q4S for the units.
6. Close output switches Q5N for the inverters and in the external bypass unit.
7. Open maintenance bypass switch Q3BP in the external bypass unit.
8. Press the "inverter on" button **7** on each control panel:
 - the green "inverter" lights **4** flash.
9. When a sufficient number of inverters are ready, the inverter-output contactors close:
 - the green "inverter" lights **4** shine permanently green.
 - the "static-bypass" lights **3** go off.

Figure 2-8: Parallel UPS Unit for Increased Output.



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3.0 Scope

Installation guides the User through single and parallel UPS unit power cable connections, hot swap options, connections between cabinets, communication card connections, battery 'temperature monitoring' installation. Wire diagrams are included for configuring the unit to specifications.

MGE recommends obtaining an MGE field service engineer for final installation and basic startup for single and parallel units. **Final installation and start-up should be completed and performed by a qualified MGE Field Service Engineer.**

3.1 Optional Communications Card Installation

Three slots are available on the "Media Contacts 11" board for optional communications. See the position of these slots marked "P" in Figure 2-3, page 2—5.

Installation of Boards setup notes:

- ▶ Boards may be installed with the UPS on, without removing the protective covers.
- ▶ Boards must be pushed to the end of the slots to ensure correct installation.
- ▶ Board front plates must be screwed to the protective "Media Contacts 11" board cover.
- ▶ Wire routing holes are provided in the support for the "Media Contacts 11" board for tying down the wires;
- ▶ The control wires must then be routed through the cableway marked "W" in figure 2-3, page 2—5.

3.2 Notes on Connection of Power Circuits

- ▶ Open the doors and remove the lower terminal shields (secured by screws to the cabinet chassis) of the UPS cabinets, connect the power cables, each cabinet must be grounded.
- ▶ All the cabinets must be interconnected for equipotential bonding, forming a mesh which is itself connected to the building structure and earthing electrode.

The connection drawings hereafter show the cabinets with doors open and terminal shields removed.



CAUTION

Before making connections, check that switches Q1, Q4S, Q3BP, Q5N and QF1 are in the "open" position.



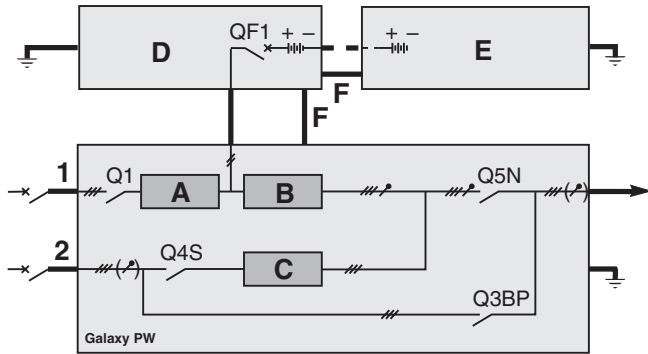
IMPORTANT

For parallel UPS with an external bypass unit, the power connections between each UPS cabinet and the external bypass unit must imperatively be of the same length. Outside the cabinets, separate the auxiliary wiring from the power cables.

3.3 Power-Circuit Wiring Diagrams

The single UPS wire diagram is for typical UPS installations shown in Figure 3-1. The heavy lines represent the cables that must be connected (F), refer to section 3.5 'Connections Between Cabinets' for more detail on cables.

Figure 3-1: Galaxy PW™ Single UPS Unit Wire Diagram.



Legend:

- 1: Normal AC source,
- 2: Bypass AC source,
- A: Rectifier/charger module,
- B: Inverter module,
- C: Static-bypass module,
- D: Battery cabinet next to the Galaxy PW™ UPS cabinet,
- E: Additional battery cabinets,
- F: The equipotential-bonding connection between cabinets.

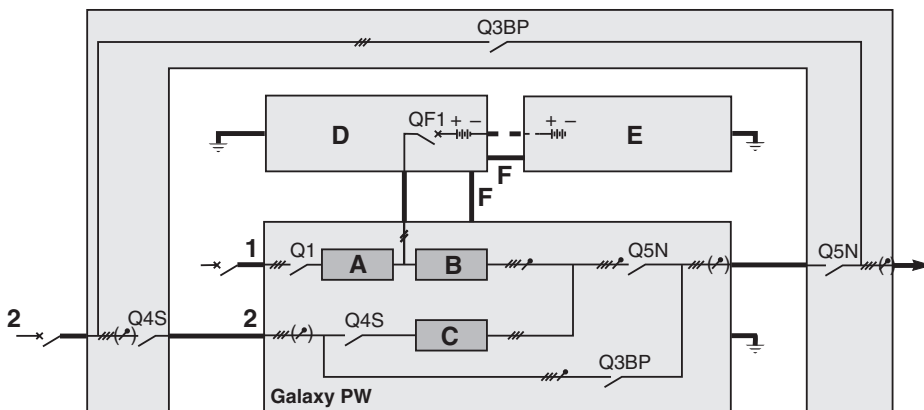
3.4 Hot Swap Options

The external bypass may be used to construct a bypass outside the UPS, thus making it possible to shutdown the UPS for maintenance purposes.

The option may be used for single UPS units and redundant parallel UPS. For the power-circuit connections of a single UPS unit see Figure 3-2, for the power-circuit connections of parallel UPS see Figure 3-3.

Power cables for UPS-to-bypass connections are not supplied.

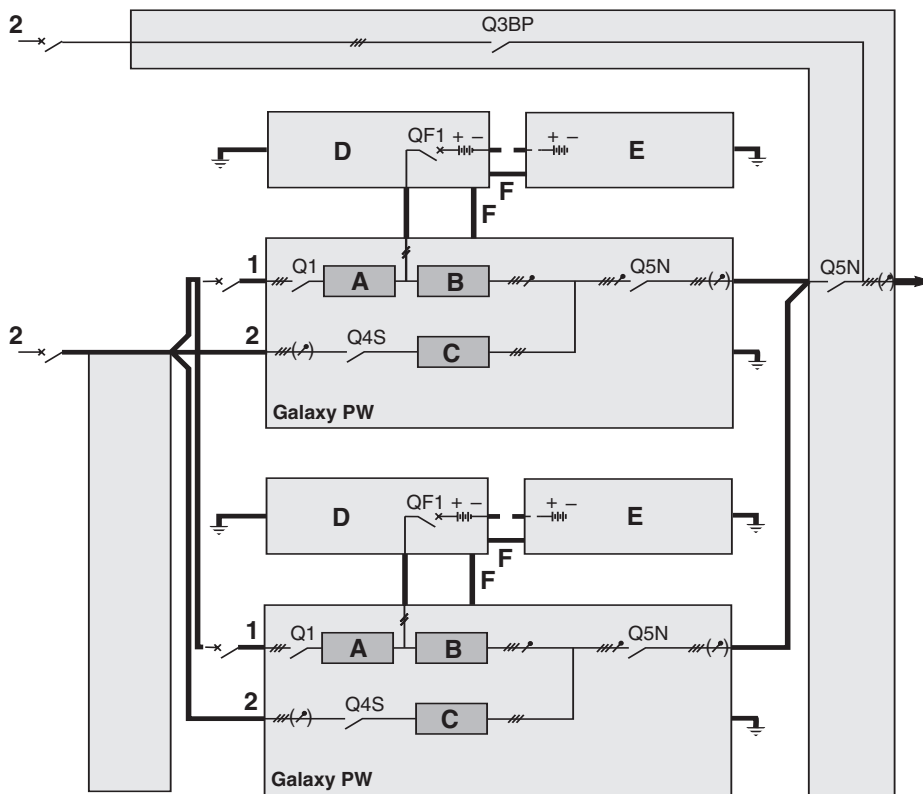
Figure 3-2: Single UPS Unit Power Circuit Connections.



Legend:

- 1: Normal AC source.
- 2: Bypass AC source.
- A: Rectifier/charger module.
- B: Inverter module.
- C: Static-bypass module.
- D: Battery cabinet next to the Galaxy PW™ UPS cabinet.
- E: Additional battery cabinets.
- F: The equipotential-bonding connection between cabinets.

Figure 3-3: Parallel UPS Unit Power Circuit Diagram.



Legend:

- 1: Normal AC source,
- 2: Bypass AC source,
- A: Rectifier/charger module,
- B: Inverter module,
- C: Static-bypass module,
- D: Battery cabinet next to the Galaxy PW™ UPS cabinet,
- E: Additional battery cabinets,
- F: The equipotential-bonding connection between cabinets.

3.5 Connections Between Cabinets

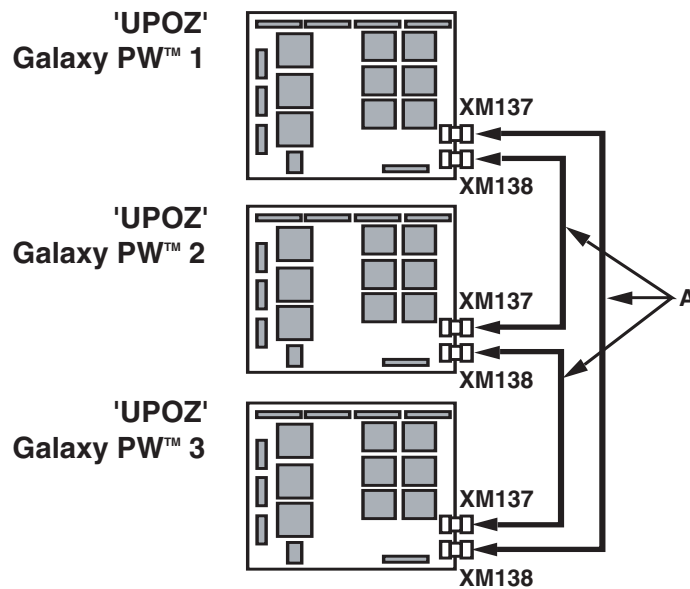
These connections are made on the UPOZ board (marked T) and MUSI board (marked U). See Figure 2-3, page 2—5.

3.5.1 Connections Between UPOZ Boards

These connections are made using the cables (A) supplied, see Figure 3-4.

The purpose of the connection is to make a loop. Connector XM137 on the UPOZ board of one UPS unit must be connected to connector XM136 on the UPOZ board of the next UPS unit and so on until the first board is returned to origin.

Figure 3-4: Connections Between UPOZ Boards.



3.5.2 Connections Between UPS Cabinets and the Remote External Bypass

Refer to the installation drawing included with the Maintenance Bypass Cabinet for control and power connections. These connections are provided and installed by the user.

3.5.3 Connections Between MUSI Boards

These connections are made using the special cables (A) supplied, see Figures 3-5.

1. Connectors XM5, XM6 and XM7 on the MUSI board are used to transmit signals.
2. Connectors XM10, XM11 and XM12 on the MUSI board are used to receive signals.
3. Connector XM5 is associated with connector XM10 for communication with one UPS unit; similarly, XM6 is associated with connector XM11 for communication with a second UPS unit and XM7 is associated with connector XM12 for communication with a third UPS unit.
 - ▶ For connection with two parallel UPS units, see Figure 3-5.
 - ▶ For connection with three parallel UPS units, see Figure 3-6, page 3—6.
 - ▶ For connection with four parallel UPS units, see Figure 3-7, page 3—6.



IMPORTANT

Outside the cabinets, group the "UPOZ" inter-board and "MUSI" inter-board connections with the inter-cabinet auxiliary connections, and separate this assembly using power cables.

Figure 3-5: Two Parallel UPS Units Connections.

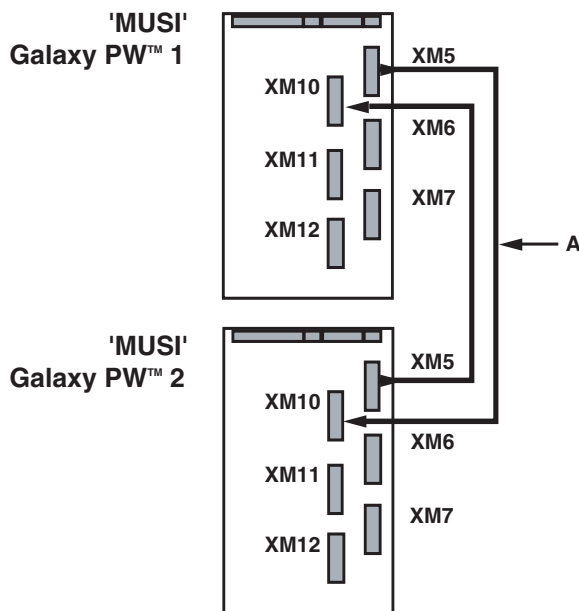


Figure 3-6: Three Parallel UPS Units Connections.

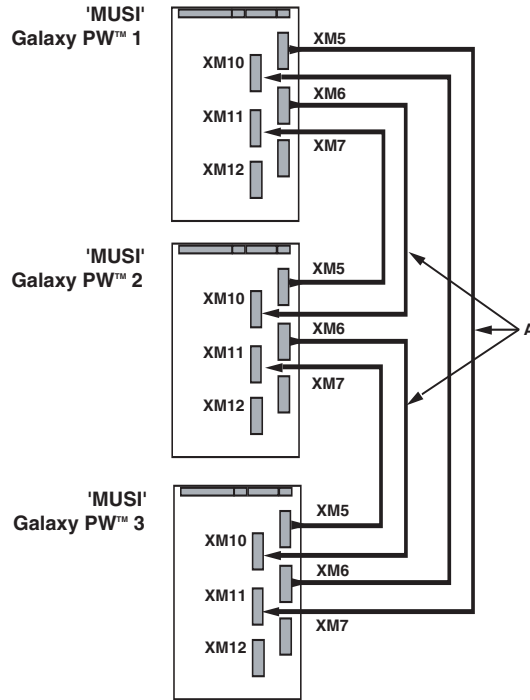
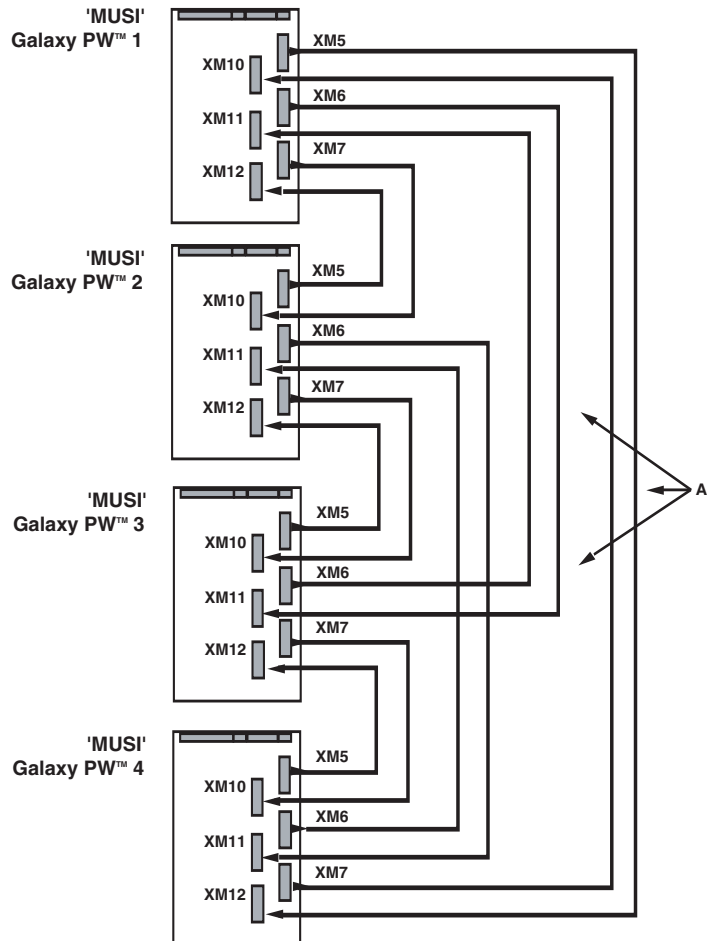


Figure 3-7: Four Parallel UPS Units Connections.



3.6 Environmental Signal of the Media Contacts 11 Board

Terminals XR2, XR3, XR4 and XR5 on the "Media Contacts 11" board of each type of unit can be used to receive signals from the operating environment and to transmit signals concerning the operating status of the UPS, see Figure 2-3, page 2—5 for the position of the board, item 1 and 2).

3.6.1 Signal Reception

The signals should be provided by volt-free contacts.

Emergency off: An NC contact causes shutdown of the inverter and the rectifier/charger, opening of the battery circuit breaker, blocking of the static bypass and activation of a relay contact on the "Media Contacts 11" board.

Battery room ventilation fault: A 'NO' contact causes shutdown of the rectifier/charger.

Battery circuit breaker QF1 closed: A 'NO' contact prevents inverter start-up if the circuit breaker is open.

Battery temperature: A PC-board, placed near the battery, supplies information on the battery temperature, thus enabling the rectifier/charger to regulate the battery voltage.

"Auxiliary" signals: Depending on the selected settings, these signals may be used to provoke:

- forced shutdown of the inverter (whatever the status of the bypass AC source),
- protected shutdown of the inverter (load transfer to the bypass AC source).
- limiting of the current drawn by the rectifier/charger (programmable value) when supplied by an engine generator set with an insufficient power rating. The additional power required by the inverter is supplied by the battery which discharges,
- limiting of the battery charge current (programmable value) if the normal AC source is replaced by an engine generator set with an insufficient power rating.

3.6.2 Signal Transmission

An auxiliary 24 V power supply: Isolated and backed up, is used to supply:

- the undervoltage release of the battery circuit breaker(s) QF1.
- the board that measures the temperature in the battery room.

"low battery" warning signal: (Volt-free changeover contact) indicating that battery time is about to run out. The warning threshold may be personalized.

"load on UPS" signal: (Volt-free changeover contact) indicating that the load is supplied by the inverter. For a single-UPS unit, one volt-free changeover contact may be used to indicate that the load is supplied by the bypass AC source.

"load on battery power" signal: (Volt-free changeover contact) indicating that the inverter is supplied by the battery in the following cases:

- normal AC source outage or voltage drop.
- rectifier/charger shutdown.
- rectifier/charger current limiting.

This signal, which may be used to initiate process saving and shutdown procedures, is time-delayed 30 seconds to avoid unnecessary operations following micro-breaks.

"Maintenance position" signal: (Volt-free changeover contact) indicating that:

- maintenance bypass switch Q3BP is closed,
- bypass AC source input switch Q4S is open,
- inverter output switch Q5N is open,
- battery circuit breaker QF1 is open.

Signal to open battery

circuit breaker(s) QF1:

In the event the "emergency off" button is pressed or to avoid an excessive battery discharge (lasting more than three times the rated backup time plus two hours).

Repo Contact:

(Volt-free changeover contact) used to trip switching devices in the event of an emergency shutdown.

"General Alarm" information:

(Volt-free changeover contact) which includes:

- internal faults.
- information on temperatures outside tolerances in the battery room (optional).
- overload information (> In).
- static-switch ventilation and power-supply faults.



NOTE

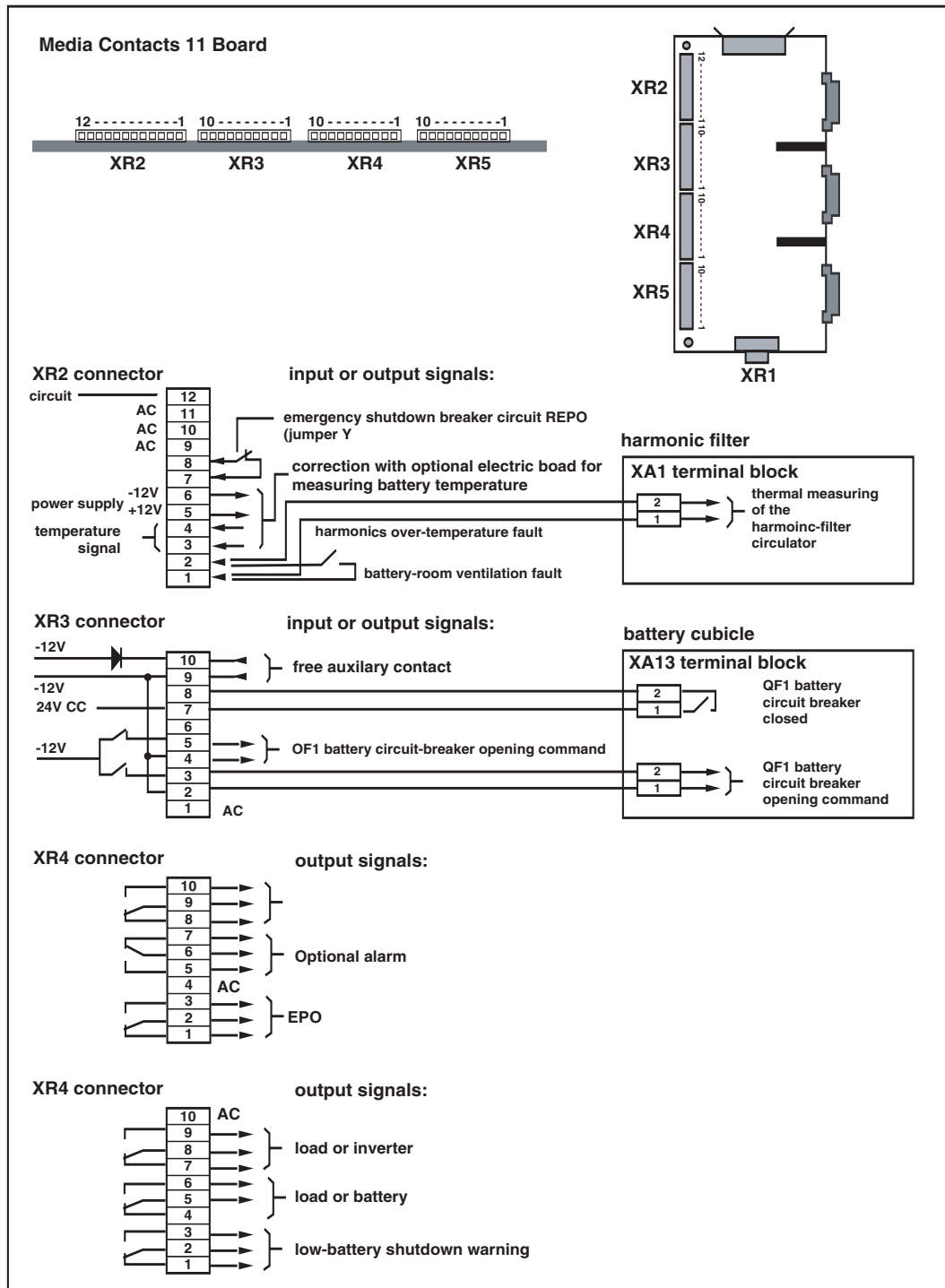
The maximum breaking capacity of the changeover contacts is 5A at 250V.

3.7 "Media Contacts 11" Standard Auxiliary Circuits Connection

Connecting the auxiliary circuits to the three connectors on the "Media Contacts 11" board in the Galaxy PW™ UPS cabinet, see the position of this board, marked "O", see Figure 2-3, page 2–5.

Recommended cable cross-section: 1 mm². The male connectors that fit the female connectors on the board (XR2 to XR5) are supplied. The contacts are volt-free and are shown in the diagram under the following conditions: UPS on, contact at rest. Contact breaking capacity: 250 V, 5 A.

Figure 3-8: Standard Auxiliary Circuits Connections.



3.7.1 Battery Circuit Breaker "QF1" Connection

Connect the cable from connector XR3 (pins 2 to 8) on the "Media Contacts 11" board in the UPS cabinet to connector XR1 in the battery cabinet containing battery circuit breaker QF1.



IMPORTANT

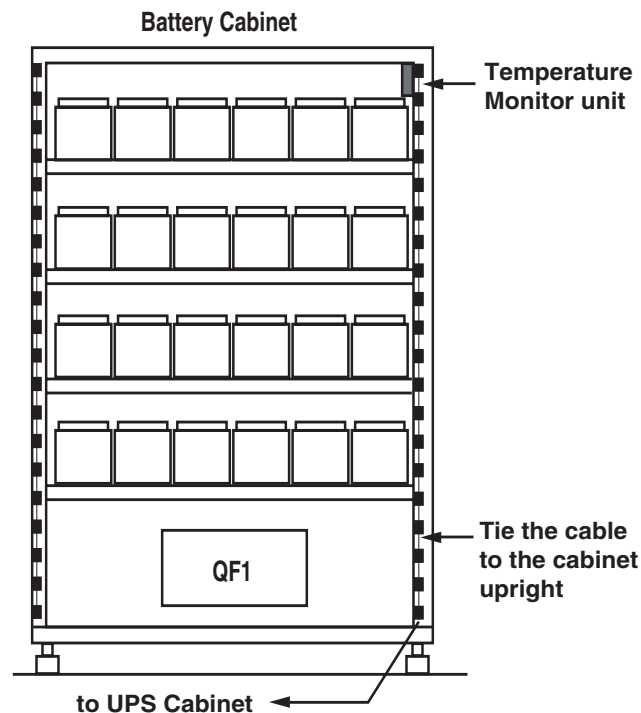
In the case of a complex installation with parallel units, there should be only one emergency shutdown pushbutton and this pushbutton must interrupt all the units. This pushbutton must therefore have as many contacts as there are units in the installation. The emergency shutdown pushbutton turns off the rectifier/chargers and inverters, opens the battery circuit breakers (QF1), the input circuit breaker (Q1) on the normal source, the backfeed protection contactor (K4S) on the bypass AC source, blocks the static switches and activates a contact on the "Media Contacts 11" board (terminals 1 to 3 on connector XR4).

3.8 Installation of the "Temperature Monitor" in the Battery Cabinet

The "Temperature Monitor" unit is placed inside the battery cabinet housing circuit-breaker QF1. See Figure 3-9.

1. Open the unit cover, and before fixing, break the self-cleaving seal on the base of the unit for insertion of the connecting cable.
2. Fix the unit on the plate using the self-adhesive sticker and a screw (nut and washer combination, diameter 4 mm, length 16 mm, not supplied).
3. Connect and put back the cover. The temperature sensor MUST be placed at the top of the cabinet to work properly.
4. Tie the connecting cable to the cabinet upright so that it does not pull on the unit.

Figure 3-9: Installing the "Temperature Monitor" in a Battery Cabinet.

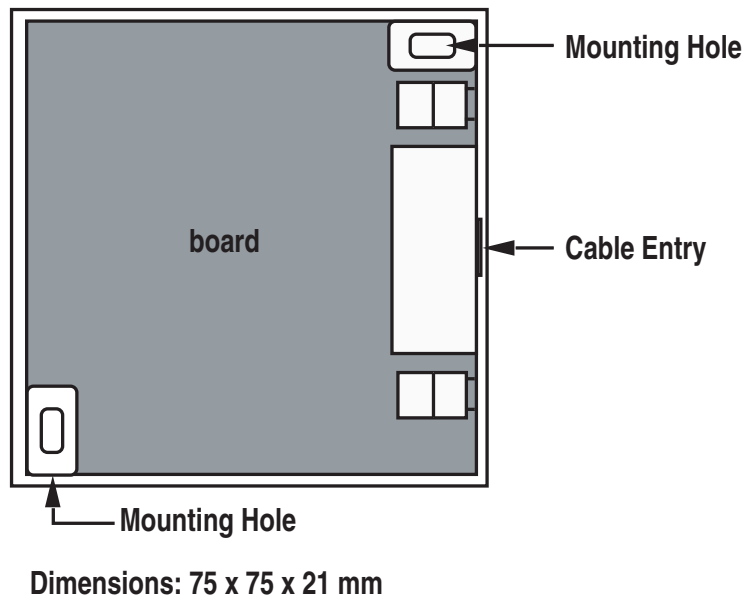


3.8.1 "Temperature Monitor" installation in a Battery Room

The "Temperature Monitor" should be secured against a wall or any vertical support. See Figure 3-10.

1. Choose a location near the batteries and away from draughts which adversely affect the accuracy of temperature measurements. Dimensions: 75 x 75 x 21 mm.
2. Use the holes provided in the base plate to screw the unit to the vertical support, unless the connecting cable runs on the surface, break the knock-out in the unit base plate provided for cable entry. Secure the cable by suitable means so that it does not pull on the unit.

Figure 3-10: "Temperature Monitor" Base.



3.8.2 Connection of the Battery "Temperature Monitor"

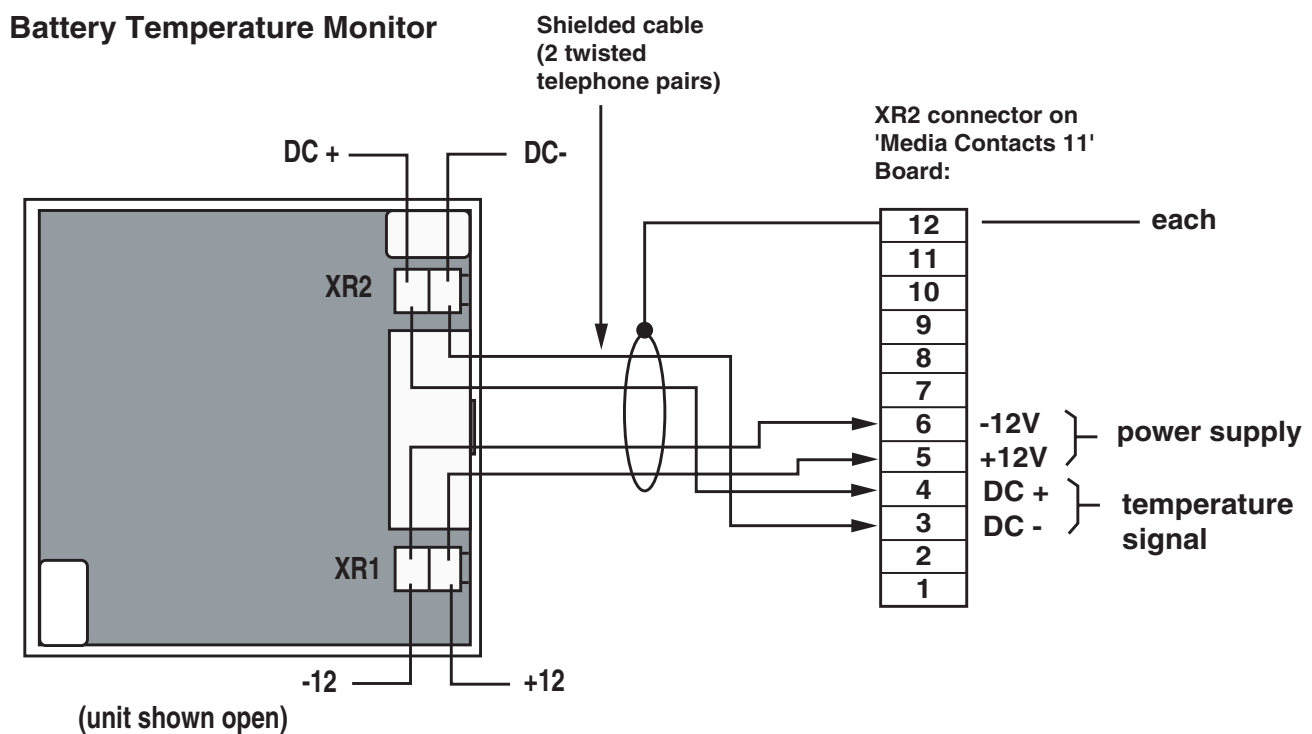
This unit must be connected to the XR2 connector on the remote indications "Media Contacts 11" board of the UPS cabinets. For the location of the "Media Contacts 11" board, marked "O" see Figure 2-3, page 2—5.

Use a shielded cable made up of 2 twisted telephone pairs with a conductor cross-section of at least 0.1 mm², not longer than 100 m in length. Do not forget to connect the cable shield to ground pin 12 on connector XR2;

In the case of a parallel UPS configuration, the connections between cabinets may be made by means of a shielded cable made up of 1 or 2 twisted telephone pairs. In this case, the total length of all the connecting cables must not exceed 100 m;

A "Temperature Monitor" unit can be connected to several UPS cabinets only when the batteries of these cabinets are located in the same room at the same ambient temperature.

Figure 3-11: Single UPS Unit Connection of the Battery "Temperature Monitor".



Refer to Appendix C for link-up options using an IBM AS400 computer for additional monitoring capability.

Figure 3-12: Connection of the Battery "Temperature Monitor." (In Parallel UPS Units with Batteries in Same Room.)

Battery Temperature Monitor

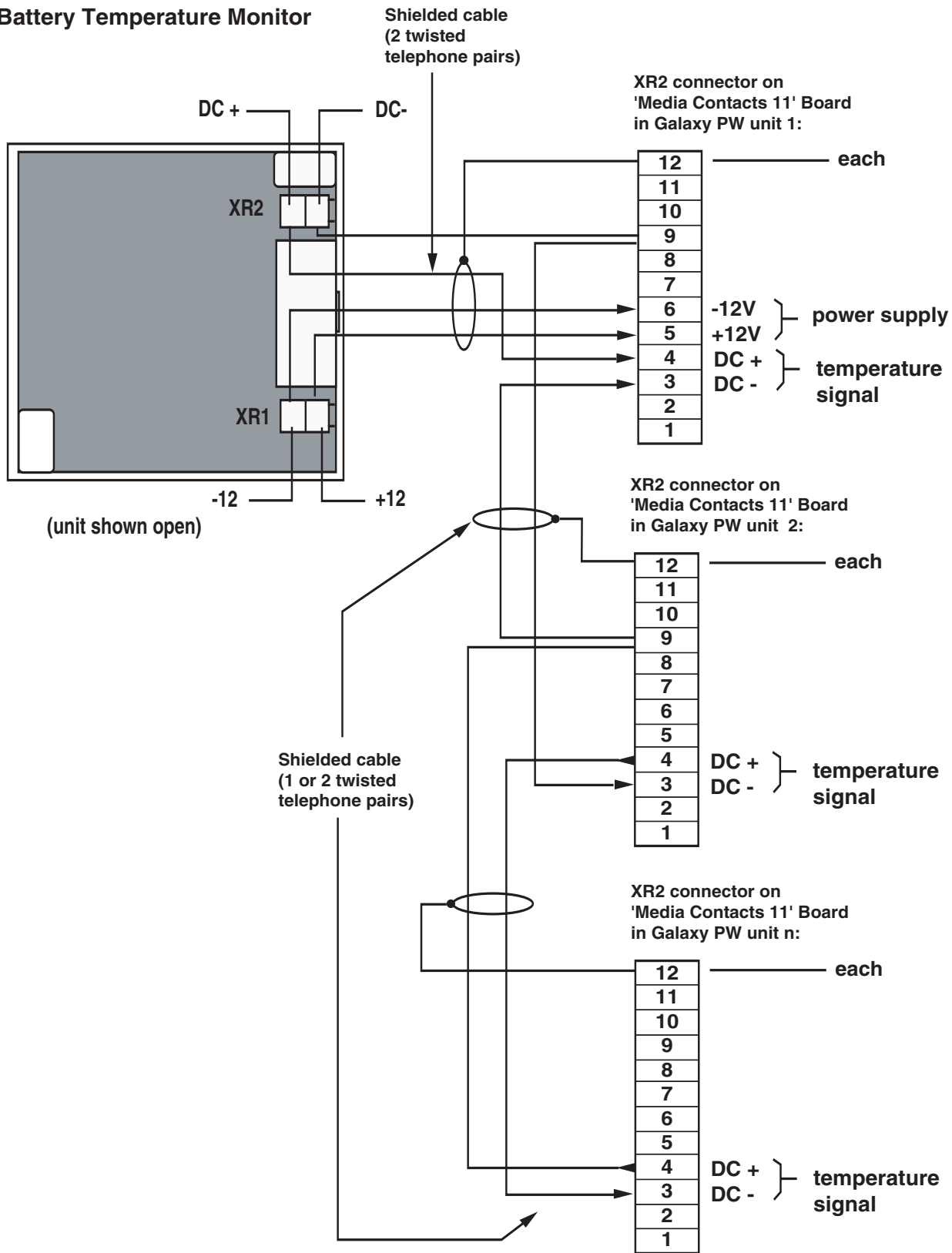
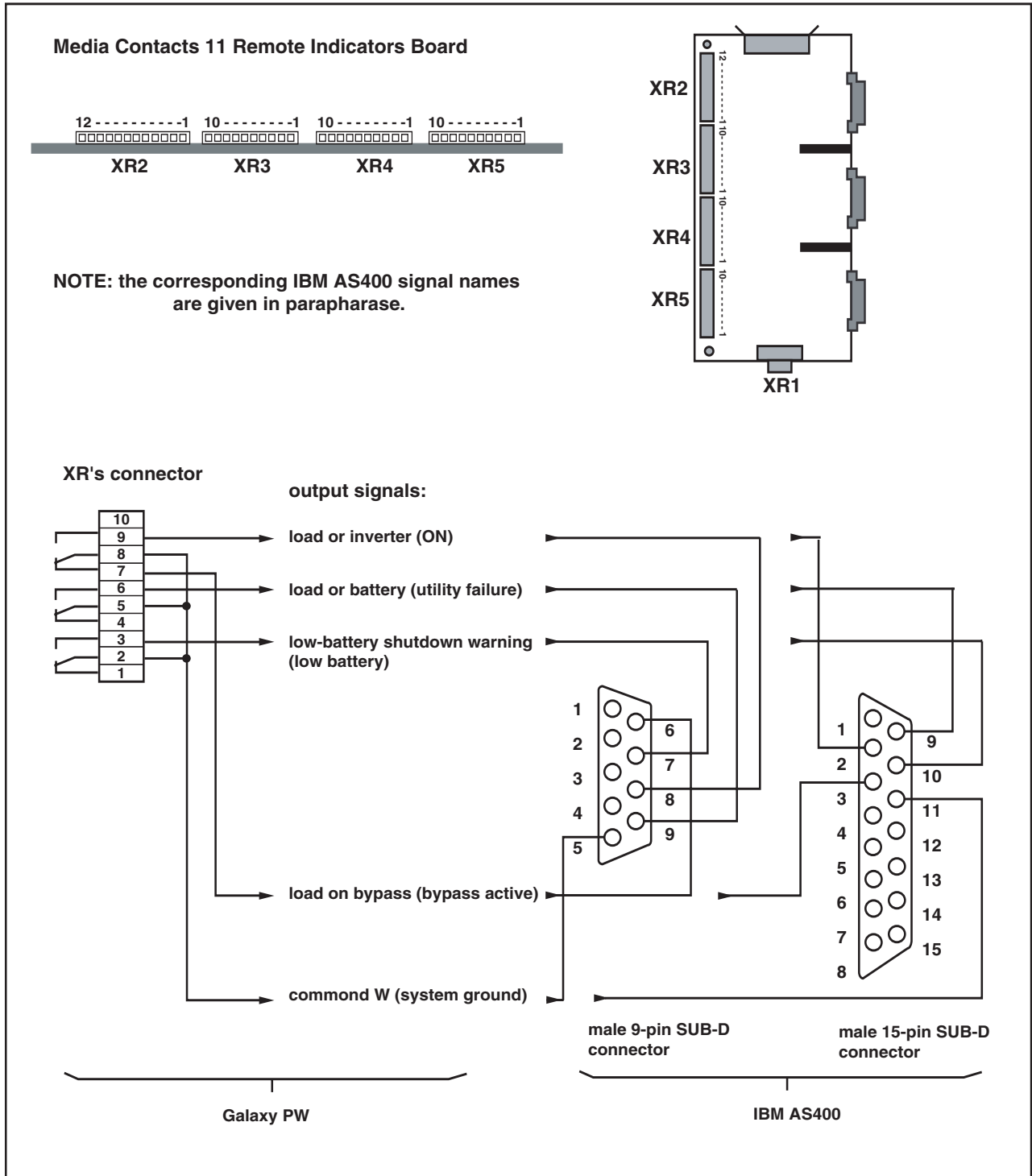


Figure 3-13: Connection to the "Media Contacts 11" Board.



3.9 About Final Installation Steps

After making the connections, install the front and rear base plates of the cabinets, clipping them to the feet of the cabinets (unless the connecting cables are fed through these openings), and refit the terminal shields of the terminal blocks, switches and circuit breakers.

4.0 Scope

Operation describes the start-up for single and parallel units, modes of operation, normal specifications for operating the Galaxy PW™ 100 to 225kVA, including display messages, measurement systems, alarms, batteries, and log time stamping operations.



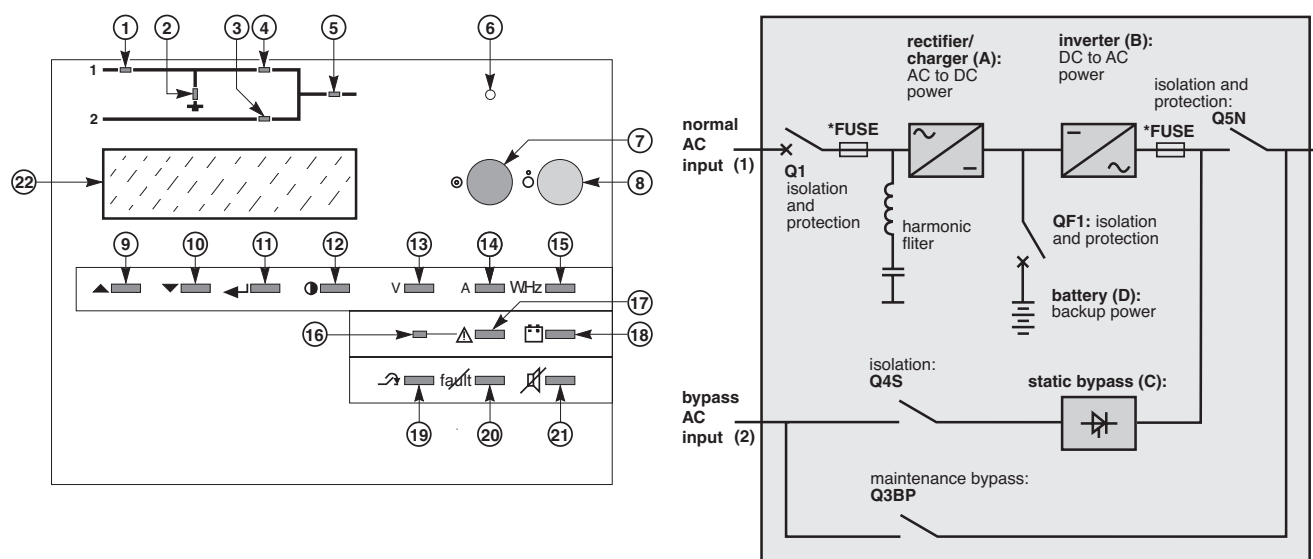
WARNING

Rectifier/charger start-up is automatic when normal AC input circuit breaker Q1 is closed. DC voltage is present in the DC bus.

4.1 Start-up of a Module

Rectifier/charger start-up is automatic when the normal AC input circuit breaker Q1 is closed. The green "rectifier/charger" light 1 on the control panel goes on. Close battery circuit breaker QF1.

Figure 4-1: Control Panel and Circuit Breaker Diagram.



4.1.1 Start-up of an Inverter

When the rectifier/charger is on, press the "inverter ON" button 7 on the control panel. The green "inverter" light 4 flashes.

4.1.2 Emergency Power Off (EPO)

The UPS emergency shutdown function is generally wired to a "mushroom-head" type emergency-off pushbutton. In case of its use, the pushbutton contact has to reset.



IMPORTANT

After EPO/REPO, unit has to be reset by opening M2 feed (switch Q4S). Open switch Q5N also, and then follow the procedure of single UPS for single unit or parallel UPS for parallel units to start-up the system.

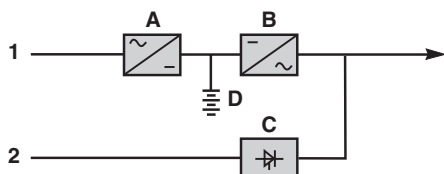
4.1.3 Single UPS Unit

The inverter starts, then, if the bypass AC source transfer conditions are satisfied, the load is transferred to the inverter, if the on-line mode is selected.

For on-line mode:

- ▶ The green "inverter" light **4** remains on.
- ▶ The "static-bypass" light **3** goes off.

Figure 4-2: Single UPS Diagram .



4.1.4 Parallel UPS Unit

The inverter starts and awaits the start of the other inverters. When they are all on or enough have been started to supply the rated load power, the output switch for each running inverter closes and the load is supplied with power:

- ▶ The green "static-bypass" light **3** goes off.
- ▶ The green "inverter" light **4** on the control panels of the running inverters goes on.

Figure 4-3: Two Parallel Connected UPS Units.

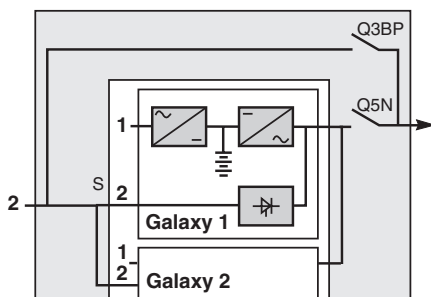
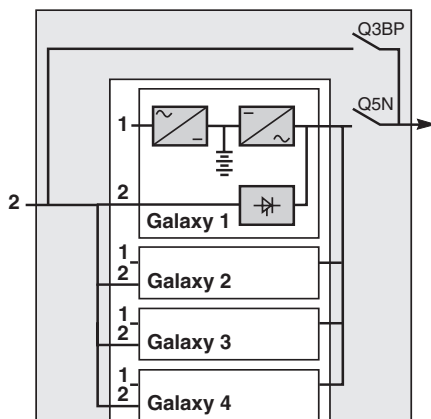


Figure 4-4: Four Parallel Connected UPS Units.



4.2 Operation in On-line Mode

4.2.1 Normal Operation

Normal AC source power is available, see Figure 4-5.

- ▶ Lights **1** , **4** and **5** shine green on the control panel.

-The power necessary for the load is provided by the normal AC source (**1**) through the rectifier/charger (**A**) and the inverter (**B**). The rectifier/charger (**A**) also supplies the power to float charge and recharge the battery if any.

The output voltage (DC) is regulated to supply:

- ▶ The float-charging or the recharging voltage for vented lead-acid or Ni/Cd batteries.
- a single charge voltage for sealed lead-acid batteries.

The voltages depend on the number of battery cells and the battery manufacturer. Factory set, they may also be adjusted by support technicians.

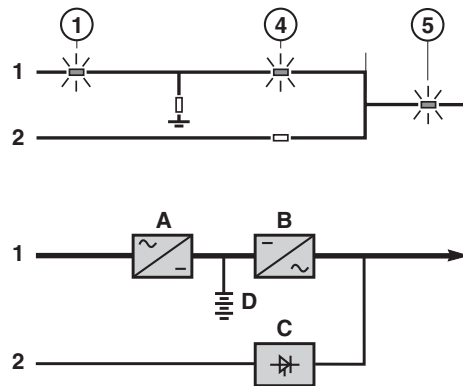
An electronic board continuously measures the battery temperature and automatically adjusts the voltages.



NOTE

In parallel Galaxy PW™ systems, the power drawn by the load is equally shared between the different units.

Figure 4-5: Normal Operation Indicator Diagram.



4.2.2 Operation with the Normal AC Source Down

In the event of a normal AC source failure or voltage outside specified tolerances of $\pm 10\%$ in amplitude ($\pm 15\%$ optionally), the rectifier/charger (A) stops and the battery (D) supplies the necessary backup power to the load via the inverter (B).

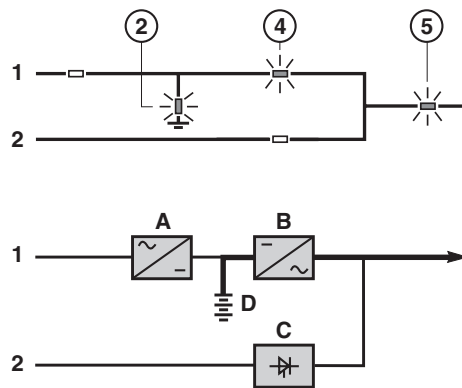
The battery, float-connected between the rectifier/charger and the inverter, discharges during this operating mode:

- ▶ lights 2, 4 and 5 shine green.

The user is warned of battery operation by the slow beeping of the buzzer 6, see Figure 4-6, and the message "LOAD PROTECTED, BATTERY DISCHARGING", followed by the remaining backup time and the percent load.

This information is also available via volt-free changeover contacts for remote control devices.

Figure 4-6: Normal AC Source Indicator Diagram.



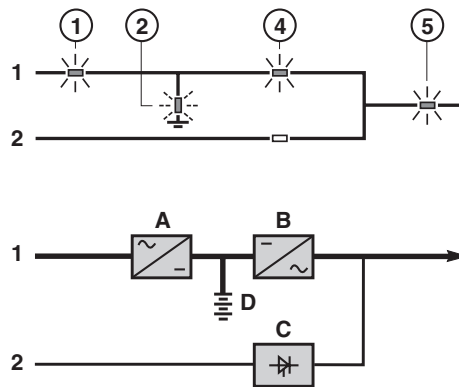
4.3 Operation with the Normal AC Source Restored

When normal AC source power (1) is restored or its voltage returns to within specified tolerances, the system automatically returns to its normal operating mode described above (on the condition it did not reach the end of battery power). If the end of battery power was reached (with the resulting inverter shutdown), the rectifier/charger (A) restarts automatically, but the inverter (B) must be restarted manually.

The rectifier/charger recharges the battery (D) which was discharged during the mains outage. During battery charging, light 2 flashes green.

The message "BATTERY CHARGING" is displayed, together with the value of the recharging current and battery voltage.

Figure 4-7: Normal Operation Mode Indicator Diagram.



The battery charge cycle takes place in two steps: See Figure 4-8.

step 1: the battery is recharged at a constant current limited to $0.1C_{10}$ (i.e. 1/10th of the battery capacity specified for a 10 hour discharge). The DC voltage increases with the battery charge until the charge level is reached.

step 2: the battery is recharged at constant voltage equal to the charge level. The charging current gradually decreases until reaching a specified low value (floating current).

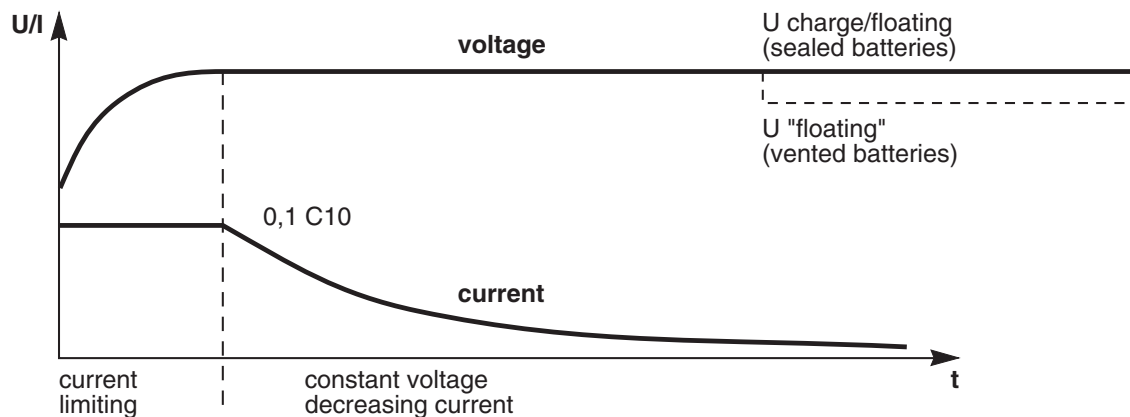
For vented lead-acid batteries, the rectifier/charger supplies the charging voltage for 0 to 255 hours (parameter defined by the after-sales support department) and then the floating voltage. For sealed lead-acid batteries, the charging and floating voltages are the same.



NOTE

If the normal AC source failure is shorter than 0 to 255 seconds (default value = 30 seconds) (parameter defined by after-sales support department), the charger automatically supplies the floating voltage given the low battery discharge.

Figure 4-8: Battery Charge Cycle Chart.



4.4 Operation with Engine Generator Set

If a stand-by generator is included in the installation, it is generally started automatically in the event of a normal AC source failure and connected to the main low voltage switchboard. It is disconnected when normal AC source power is restored.

With such a system, the required battery time may be reduced to the time necessary for starting and bringing on line the stand-by generator. The battery (D) supplies power to the inverter (B) during the transfers:

- ▶ Normal AC source to the generator.
- ▶ Generator to the normal AC source.

The transfer sequences described above (normal AC source → battery, battery → generator, generator → battery, and battery → normal AC source) are fully automatic. They in no way affect the load and require no manual operation by the user.

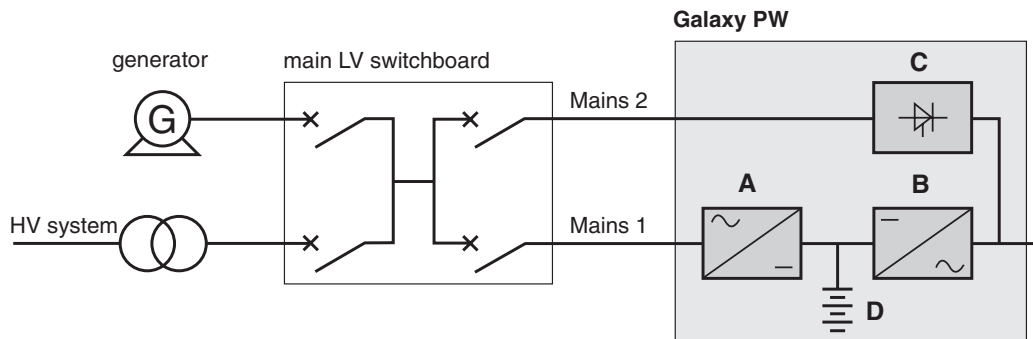


NOTE

To avoid load surges on the generator, the rectifier/charger is started with a 10 second maximum current consumption walk-in (lasting 3 to 10 seconds, depending on the percent load).

To avoid overloading an undersized engine generator set, it is possible to set a maximum power level drawn by the normal AC input. Any additional power required is supplied by the battery. This modification can be made on site by an MGE UPS SYSTEMS field engineer

Figure 4-9: Installation with an Engine Generator Set.



4.5 Battery Time

The available battery time during a normal AC source outage depends on the:

- ▶ Rated capacity of the battery.
- ▶ Power consumed by the load.
- ▶ Temperature of the battery.
- ▶ Age of the battery.

The specified battery time corresponds to a minimum duration at full rated load.

The actual backup time can therefore be greater if the system operates below its full rated load during the normal AC source outage. Operation on battery power can be extended beyond the specified time by reducing the load power consumption (by disconnecting non-critical loads).

A "low battery" warning signal is sent via volt-free changeover contacts for remote control devices when the battery voltage reaches a level slightly above the minimum level. This signal warns the user of the imminent end of battery power. On the device itself, the buzzer beeps rapidly.

The message "LOW-BATTERY SHUTDOWN WARNING" is displayed, followed by the remaining backup time and the percent load. Light 2 turns red and flashes.

Battery power stops when the voltage supplied by the battery reaches the minimum threshold. This results in inverter shutdown and transfer of the load without interruption to the bypass AC source. Light 2 shines red (not flashing). The message "LOAD NOT PROTECTED, ON-LINE MODE" is displayed and the buzzer sounds continuously.

If the bypass AC source also fails, the load is no longer supplied. The inverter automatically shuts down when the time on battery power exceeds three times the specified backup time.



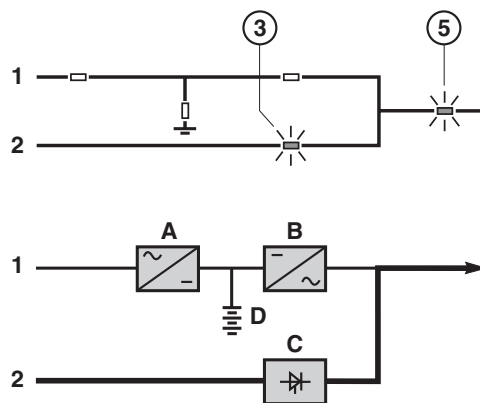
NOTE

The "low battery shutdown" warning signal can be sent with an adjustable time delay prior to the effective end of battery power.

4.6 Inverter Shutdown or Overload

Devices or installations operating in on-line mode with a Bypass AC source.

Figure 4-10: Operating in On-line Mode Diagram.



4.6.1 Single UPS Unit (On-line mode)

In the event of a UPS shutdown (initiated by the user or by an internal protective device), the load is automatically transferred to the bypass AC source. If transfer conditions are satisfied, transfer takes place instantly, without interruption to the load.



NOTE

Transfer conditions are not satisfied when bypass AC source characteristics are outside tolerances (voltage: $\pm 10\%$. frequency as per personalization. phase sync with inverter $\pm 3^\circ$).

In the event of a major transient overload (greater than $1.65 I_n$), immediate transfer takes place as above, without interruption to the load.

The return to the inverter is automatic when the overload disappears if the number of possible returns has not been reached (0 to 255, programmable by personalization). If this number has been reached, the load continues to be supplied by the bypass AC source. This operating mode allows start-up of load devices causing high inrush currents.

This system requires satisfied transfer conditions. If the conditions are not satisfied, the inverter will current limit to 165% of its rated current for 1 second before stopping.

In the event of a small but extended overload (i.e. a continuous level of power exceeding the full rated load), the inverter will continue to supply power for a period depending on the magnitude of the overload (10 minutes for a 125% overload, 1 minute for a 150% overload). See the overload curve in Figure 4-11.

- ▶ In all the above cases, inverter shutdown and supply of the load via the bypass AC source results in the following on the control panel:
 - light **4** goes off,
 - activation of the buzzer (continuous beep),
 - light **3** shines green,
 - the message "LOAD NOT PROTECTED, ON-LINE MODE" is displayed.

4.6.2 Parallel UPS Without Redundancy



WARNING

During maintenance operation, when CB1 (MBP) is closed and CB2 (UPS ISOLATION) is open, each UPS control panel display will show a message "LOAD PROTECTED" when the UPS is placed in ON-LINE MODE. In this mode the critical load is not protected because it is supplied by the maintenance bypass power.

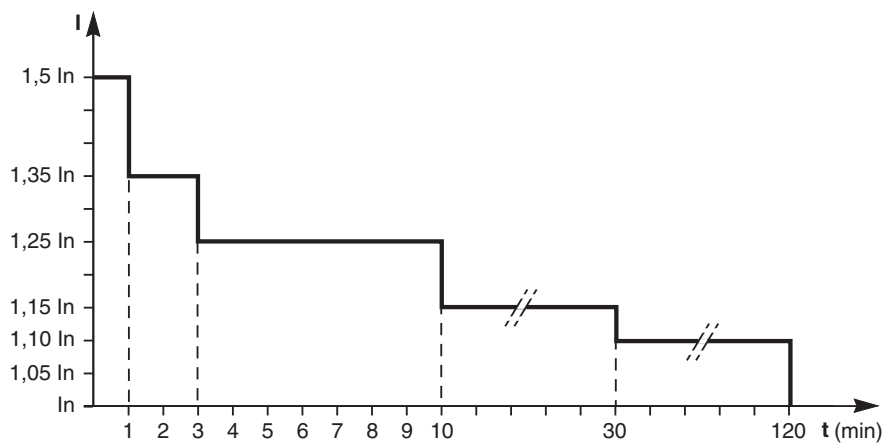
The shutdown of one inverter results in overload on the other inverters in operation. Two cases may then arise:

- A) if the overload on each remaining inverter is > than 1.65 in, the load is immediately transferred to the bypass AC source.
- B) if the overload is less than 1.65 in, the remaining inverters support the overload (see curve in Figure 4-11), and the load is transferred to the bypass AC source.

After this transfer:

- the light **4** goes off,
- the buzzer is activated and sounds continuously,
- the light **3** goes on and turns green,
- the message "LOAD NOT PROTECTED, PARALLEL ON-LINE MODE" is displayed.

Figure 4-11: Overload Curve Diagram.



4.6.3 Parallel UPS With Redundancy

The shutdown of one UPS unit is of no consequence for the load. The others each take up an equal amount of load power and the load continues to be supplied normally.

- ▶ Unit shutdown results in the following on the control panel:
 - Lights **4** and **5** go off,
 - Activation of the buzzer (continuous beep),
 - The message "LOAD NOT PROTECTED, PARALLEL ON-LINE MODE" is displayed.
 - In the event of an overload, the system only loses its redundancy as long as the overload is less than the total rated power of the functioning units. If the overload is greater, the operating mode is that previously described for systems without redundancy.

4.7 Output Voltage Quality and Continuity

The output voltage is stable in amplitude and frequency and is free of interruptions or transients outside specified tolerances, irrespective of normal AC source or load disturbances (outages, load step changes, etc.).

4.7.1 Steady State Voltage Regulation

For stable or slowly varying load conditions, the inverter output voltage is regulated to within $\pm 0.5\%$ in amplitude.

The frequency of the output voltage can theoretically be regulated to within 0.1% of the rated value, however the output frequency range may be intentionally extended to a maximum of ± 2 Hz so that the inverter can remain synchronized with the bypass AC source and its inherent frequency fluctuations, thus enabling transfer of the load to the bypass line at any time.

When the bypass AC source frequency returns to within the specified tolerances, the inverter is gradually re-synchronized to the bypass line at a rate of 0.5 Hz to 2 Hz/s (as per the value personalized by the after-sales support department), thus avoiding exposing the load to sudden frequency variations.

4.7.2 Transient Voltage Regulation

The inverter output voltage is not notably affected by instantaneous major variations in load characteristics.

This is made possible by the PWM (Pulse Width Modulation) chopping technique and the microprocessor-based regulation system that instantly compensates for any variation. In particular, the inverter output voltage remains within $\pm 2\%$ of the rated voltage for load step changes of 0 to 100% or of 100 to 0%.

The battery charge cycle takes place in two steps:

step 1: The battery is recharged at a constant current limited to 0.1C10 (i.e. 1/10th of the battery capacity specified for a 10 hour discharge). The DC voltage increases with the battery charge until the charge level is reached.

step 2: The battery is recharged at constant voltage equal to the charge level. The charging current gradually decreases until reaching a specified low value (floating current).

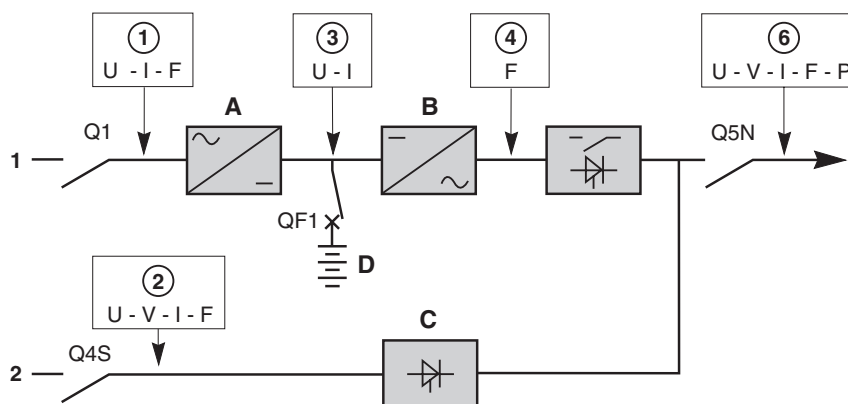
For vented lead-acid batteries, the rectifier/charger supplies the charging voltage for 0 to 255 hours (parameter defined by the after-sales support department) and then the floating voltage. For sealed lead-acid batteries, the charging and floating voltages are the same.

4.8 Measurement System

The display may be used to read a number of input and output measurements made at different points in the system. See Figure 4-12.

- ▶ Normal AC source 1**
 - phase-to-phase voltages,
 - currents of the three phases,
 - frequency.
- ▶ Bypass AC source 2**
 - phase-to-neutral voltage,
 - phase-to-phase voltages,
 - frequency,
 - currents of the three phases.
- ▶ Battery 3**
 - voltage.
 - charge or discharge current.
 - remaining battery time (for the UPS unit concerned).
 - battery temperature.
- ▶ Inverter output 4**
 - frequency
- ▶ Total load 6**
 - phase-to-neutral voltage.
 - phase-to-phase voltages.
 - currents of the three phases.
 - frequency.
 - active and apparent power.

Figure 4-12: Measurement System Diagram.



4.8.1 Voltage Measurements

These measurements may be accessed by pressing the "V" key **13**. The following data is displayed.

Note:

M1: normal AC source

M2: bypass AC source

RMS	M1	M2	LOAD	RMS	M2	LOAD
U12	----	----	----	V1	----	----
U23	----	----	----	V2	----	----
U31	----	----	----	V3	----	----

4.8.2 Current Measurements

These measurements may be accessed by pressing the "A" key **14**. The following data is displayed.

Note:

CF: crest factor

RMS	M1	M2	LOAD	RMS	M2	LOAD
U12	----	----	----	V1	----	----
U23	----	----	----	V2	----	----
U31	----	----	----	V3	----	----

4.8.3 Power and Frequency Measurements

These measurements may be accessed by pressing the "W.HZ" key **15**.

The following data is displayed.

Note:

PF: power factor

RMS	M1	M2	LOAD	RMS	M2	LOAD
U12	----	----	----	V1	----	----
U23	----	----	----	V2	----	----
U31	----	----	----	V3	----	----

4.8.4 Battery Measurements

These measurements may be accessed by pressing the "battery" key **18**. The following data is displayed.

RMS	M1	M2	LOAD	RMS	M2	LOAD
U12	----	----	----	V1	----	----
U23	----	----	----	V2	----	----
U31	----	----	----	V3	----	----

4.9 Selections and Settings

These selections and settings may be accessed by pressing the "contrast" key **12** .

The following menu is displayed:

CHOOSE LANGUAGE	DATE AND TIME
CONTRAST SETUP	INVERSE VIDEO
BUZZER SETUP	PAST EVENTS
LAMP TEST	BATTERY TEST

▶ Selecting the language:

FRENCH	SPANISH
ENGLISH	DUTCH
GERMAN	SWEDISH
ITALIAN	PORTUGUESE

▶ Adjusting the display contrast:

DISPLAY CONTRAST SETUP
CHOOSE WITH KEYS ▲ OR ▼
VALIDATE WITH KEY ø

▶ Adjusting the buzzer volume:

BUZZER VOLUME SETUP
CHOOSE WITH KEYS ▲ OR ▼
VALIDATE WITH KEY ø

▶ **Lamp test:**

When this function is selected, all the lights shine orange for three seconds.

▶ **Set Date and Time:**

Use the "▲▼" keys to enter the data and confirm using the "ø" key.

```
DATE AND TIME SETUP
YEAR      ----      MONTH  --
DAY       --       HOURS  --
MINUTES   --       SECONDS --
```

▶ **Inverse Video:**

When this function is selected, the text and background colors are reversed (white text on black or black text on white).

▶ **Past Events:**

See section 3.15 "logging and Time-Stamping" for event details.

```
CHARGE LEVEL           =    -- %
REMAINING SERVICE LIFE = -- MONTH
■ MANUAL TEST  press key ø
■ AUTO TEST    press key ø
```

▶ **Battery test:**

the screen opposite is displayed when a battery test is requested. It indicates the battery charge status and the remaining service life. A manual or automatic test may be requested.

- this screen is displayed during a battery test, whether manual or automatic,

```
TESTING BATTERY
U BATTERY =          --- V
```

- this screen is displayed following a positive, manual battery test:

BATTERY TEST RESULT OK

- this screen is displayed following a negative, manual battery test:

BATTERY TEST RESULT NOT OK


- this screen is displayed following a positive, automatic battery test. It indicates the time since the last test and provides access to test settings:

TIME SINCE LAST TEST
 WEEK -- DAY -- HOUR --
 LAST BATTERY TEST RESULT OK
 NEW PARAMETERS YES = ▲ NO = ▼

- this screen is displayed following a negative, automatic battery test. It indicates the time since the last test and provides access to test settings,

TIME SINCE LAST TEST
 WEEK -- DAY -- HOUR --
 LAST BATTERY TEST RESULT NOT OK
 NEW PARAMETERS YES = ▲ NO = ▼

- this screen is displayed when the user requests access to the automatic test settings. It is possible to modify the interval between two automatic tests,

SELECT TIME OF NEXT TEST WITH KEYS ▲ ▼
 CHANGE UNITS WITH ∅
 WEEK -- DAY -- HOUR --
 confirm with key 

- this screen is displayed when the battery test cannot be completed.

TEST INTERRUPTED
 CHECK PRESENCE OF THE BATTERY
 CHECK ALARMS

4.10 Alarms

The auto diagnostic system considers any system status other than normal as a problem.

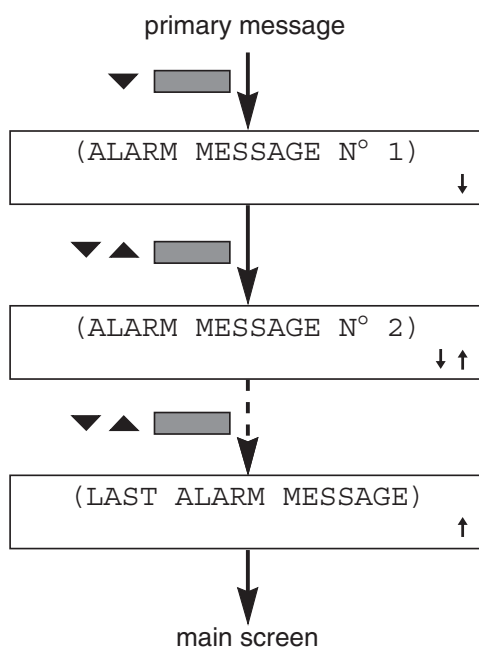
Before taking any action, note down the messages displayed on the control panel.

Certain problems may prevent the control panel from functioning.

In this case, it is strongly recommended to call the MGE UPS SYSTEMS Customer Support Service at: 1-800-438-7373.

- A) If the load is still correctly supplied with power, it has probably been transferred to the bypass AC source (static bypass) and is therefore no longer protected (if the system is in on-line mode).
- B) If the load is no longer supplied with power, transfer it manually to the maintenance bypass.

Figure 4-13: Display of Alarm Messages..



4.11 Maintenance Bypass Option

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

This operation is possible only if the system includes a bypass AC source. It results in the load being directly supplied by the Bypass AC source via Maintenance Bypass switch Q3BP, thus ensuring a higher level of security in the event of a malfunction.

Switching procedures are explained on drawings next to each switch in the UPS cabinet and the External Bypass unit.

4.12 Logging and Time-Stamping

4.12.1 Event Time-Stamping

Time-stamping of events by Galaxy PW™ makes it possible to:

- ▶ Log the events.
- ▶ Consult the last 500 events that occurred on the Galaxy PW™ UPS.
- ▶ Consult general statistical data on UPS operation.
- ▶ Consult measurement records for a number of physical values concerning system operation.

The time-stamping information may be accessed via the Galaxy PW™ keypad and display (standard equipment). This information may also be forwarded for the Teleservice function using the JBUS RS232/485 communications board. When the optional JBUS RS232/485 communications board is installed, the time-stamped information can be sent to the Teleservice center. Refer to Utilization of Teleservice Card options Appendix B.

4.12.2 Consulting Logged (time-stamped) Events

When the PAST EVENTS command is selected, the system displays a screen indicating the last event logged. Log screens are very similar to those displayed for current events. However, log screens include a line indicating the corresponding date and time with the mention "Appearance of" or "Disappearance of", followed by the standard text for the event (see example opposite). Consult the user manual for indications on the meaning of events.

The complete log may comprise up to 500 events. If over 500 events have occurred, only the last 500 may be consulted:

1. Press the ▼ key to display the event that occurred just before the displayed event. If the displayed event is the oldest in the list, the display is not modified.
2. Press the ▲ key to display the event that occurred just after the displayed event. If the displayed event is the most recent in the list, the display is not modified.

Example:

```
02/09/1997  07:25:03  Appearance:
MAINS 2 INPUT SWITCH Q4S IS OPEN
```

Note: numerical values are never indicated in screens for time-stamped events.

Example:

```
03/09/1997  15:30:23  Disappearance:
OVERLOAD
RATED CURRENT PER PHASE
=  _ _ _  A
CHECK LOAD LEVEL
```

4.13 Setting the Date and Time for the UPS - Utilization Via the Galaxy PW™ Display

The time and date can be set for the UPS via the main menu on the display (see below), using the DATE AND TIME command. The time-stamping information, statistics and measurement records are also available via the same menu, using the PAST EVENTS command.

Simply select the desired command with the ">" sign that can be moved using the ▲ and ▼ keys. The selected command can be confirmed by pressing the ↵ key.

When the DATE AND TIME command is selected, the date and time is displayed in the order of year, month, day, hours, minutes, and seconds. When you leave this command, the date and time is displayed in the reverse order.

DATE AND TIME SETUP				
> YEAR	1997	MONTH	9	
DAY	8	HOURS	8	
MINUTES	11	SECONDS	42	▲ ▼

The current values are automatically displayed.

Modify any of the displayed values by:

1. Position the ">" sign opposite the value to be modified. Then press the ∅ key.
2. Use the ▲ and ▼ keys to modify the value.
3. Use the ▲ key to increment the value by one.
4. Use the ▼ key to decrement the value by one.

The selected value can be confirmed by pressing the ∅ key. A second value may then be selected for modification, again using the ▲ and ▼ keys. Modifications are made and confirmed value by value.

5. Press the △ key at any time to exit the DATE AND TIME function.

That is the only means to leave the function. If no modifications to values are confirmed, exiting the function corresponds to cancelling the request.

4.14 Consulting Statistics

```

FIGURES SINCE COMMISSIONING
total backup time (h):                0
total time on static switch (h):      0
total time on UPS (d):                3627
total time with Tbatt >25°C (h):      1
FIGURES SINCE RESET
last reset:                          05/09/1997
elapsed backup time (min):            0

```

Legend:

- total backup time (h):** This is the total time of operation on battery power since initial startup of the UPS. It is expressed in hours.
- total time on static switch (h):** This is the total time of operation on the static switch since initial startup of the UPS. It is expressed in hours.
- total time on UPS (d):** This is the total time that the load has been supplied by the UPS since initial startup. It is expressed in days.
- total time with T_{batt} > 25°C (h):** This is the total time of operation with the battery temperature greater than 25°C since initial startup of the UPS. It is expressed in hours.
- last reset:** This is the date that the information was last set to zero by the Teleservice function.
- elapsed backup time (min):** This is the total time of operation on battery power since the last reset. It is expressed in minutes.

FIGURES SINCE RESET

nb of backups:	0
nb of backups < 1 min:	0
1 min < nb of backups < 3 min:	0
nb of backups > 3 min:	0
nb of overloads < 5 s:	0
nb of overloads > 5 s:	0
nb of times TBatt. > 25°C:	0

Legend:

- nb of backups:** This is the number of times the load was supplied by the UPS from battery power since the last reset.
- nb of backups < 1 min:** This is the number of times the load was supplied by the UPS from battery power for less than one minute, since the last reset.
- 1 min < nb of backups < 3 min:** This is the number of times the load was supplied by the UPS from battery power for more than one minute and less than three minutes, since the last reset.
- nb of backups > 3 min:** This is the number of times the load was supplied by the UPS from battery power for more than three minutes, since the last reset.
- nb of overloads < 5's:** This is the number of times the UPS was overloaded (output current greater than I_n) for less than five seconds, since the last reset.
- nb of overloads > 5's:** This is the number of times the UPS was overloaded (output current greater than I_n) for more than five seconds, since the last reset.
- nb of times TBatt. > 25°C:** This is the number of times the battery temperature was measured at over 25°C, since the last reset.

4.14.1 Consulting Recorded Measurements

Recorded measurements are presented in the same manner (see below):

- ▶ the lists indicate the last 30 measurements recorded for the given parameter. The chronological order of the measurements is indicated in the Figure opposite.
- ▶ the most recent measurement is presented first, in the upper left-hand corner of the list. The following measurement is listed just below, and so on until the 30th value listed in the bottom right-hand corner of the list.
- ▶ the period T between two successive measurements is 30 days. The displayed measurements are instantaneous values.

PARAMETER NAME (units)	T=30 days
▼ last read: 05/09/1997	
M(t+29T) M(t+23T) M(t+17T) M(t+11T) M(t+05T)	
M(t+28T) M(t+22T) M(t+16T) M(t+10T) M(t+04T)	
M(t+27T) M(t+21T) M(t+15T) M(t+09T) M(t+03T)	
M(t+26T) M(t+20T) M(t+14T) M(t+08T) M(t+02T)	
M(t+25T) M(t+19T) M(t+13T) M(t+07T) M(t+T)	
M(t+24T) M(t+18T) M(t+12T) M(t+06T) M(t)	



NOTE

when this screen is selected, approximately ten seconds are required to call up and display the information. If the number of measurements is greater than 30, only the last 30 (the most recent) are displayed.

The **battery capacity** is the value measured by the UPS microprocessor. It is expressed in Ampere-hours. This value changes over time depending on the parameters of the battery itself and its environment. This measurement is used to check that the battery is capable of supplying the rated power in the event of a mains outage.

BATTERY CAPACITY (Ah)				T=30 days	
▼ last read: 05/09/1997					
97	0	0	0	0	0
96	0	0	0	0	0
95	0	0	0	0	0
94	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

The **backup time** is the value calculated by the UPS microprocessor on the basis of measurements carried out on the battery. It is expressed in minutes. The calculation uses the percent load and the battery charge status at the time of the measurement.

BACKUP (min)				T=30 days	
▼ last read: 05/09/1997					
120	0	0	0	0	0
115	0	0	0	0	0
110	0	0	0	0	0
105	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

The **load level** is the ratio between the power supplied by the UPS to the load at the time of the measurement and the rated output of the UPS. It is expressed as a percentage.

OUTPUT LOAD LEVEL(%)				T=30 days	
▼ last read: 05/09/1997					
63	0	0	0	0	0
52	0	0	0	0	0
63	0	0	0	0	0
63	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

5.0 Scope

Maintenance procedures include preventive maintenance, isolation procedures for maintenance, startup for single and parallel units after isolation, functional and visual checks, software options and configurations, and testing scenarios.

5.1 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 Galaxy PW™ 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 read thoroughly this manual Galaxy PW™ Installation and Users Manual (MGE PN 86-133060-00) and be familiar with the indicators, controls, and operation of the UPS prior to maintenance.

Technician or Engineer checks for preventive maintenance:

- a. Isolate and de-energize all Galaxy PW™ 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 Galaxy PW™ 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 Installation and Users Manual section 2.7 System Start-up, page 2—10.
- f. Test the main operating sequences as applicable to your equipment configuration and installation.

5.2 Replacement Parts

There are no user replaceable parts inside the Galaxy PW™.

Three levels of replacement parts are available for the Galaxy PW™ 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 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 downtime 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 downtime 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.

5.2 Maintenance Isolation Procedures



CAUTION

PARALLEL UPS WITH EXTERNAL MAINTENANCE BYPASS During maintenance operation, when CB1 (MBP) is closed and CB2 (UPS ISOLATION) is open, each UPS control panel display will show a message "LOAD PROTECTED" when the UPS is placed in ON-LINE MODE. In this mode the critical load is not protected because it is supplied by the maintenance bypass power.

5.2.1 Single UPS Unit

During maintenance, the UPS must be isolated from the normal and bypass AC source, the battery and the load.

UPS Isolation

Proceed in the following order: (see Figure 5-2):

1. Shut down the inverter (press the "inverter OFF" button **8** for three seconds),
2. Close bypass switch Q3BP,
3. Open isolating switches Q5N, Q4S, QF1 and Q1.

The UPS is powered down once the capacitors have discharged (a few minutes).

Start-up

Following servicing, proceed in the following order: (See Figure 5-3)

1. Close switch Q1, then after approximately ten seconds, switches QF1, Q5N and Q4S,
2. Open bypass switch Q3BP,
3. Start the inverter (press the "inverter ON" button 7).

Figure 5-1: UPS Isolation Diagram for Normal AC Bypass Source.

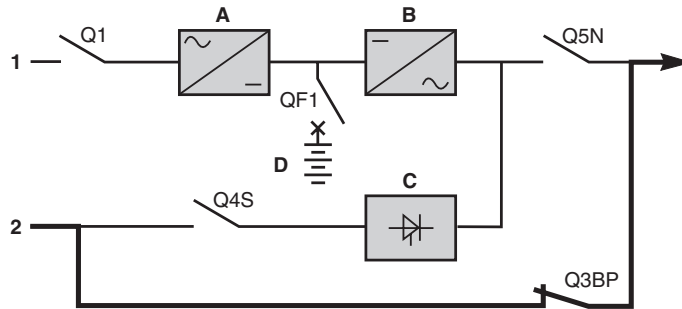


Figure 5-2: Panel Procedures for UPS Isolation.

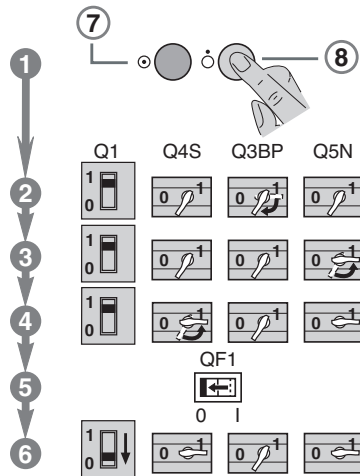
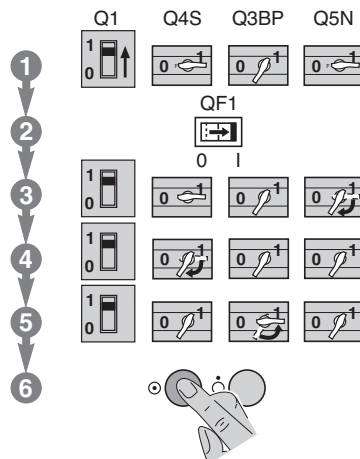


Figure 5-3: Start-up After Isolation Procedure is Completed.





CAUTION

Work should be carried out in accordance with applicable safety regulations. to avoid interrupting the load, the various switching operations must be carried out in the correct order. Operations are explained in diagrams placed next to the switches. the system cabinet is only partially powered down. The load is still supplied via the bypass AC source and switch Q3BP.

5.3 Steps for Parallel UPS Redundancy to Increase Output



CAUTION

PARALLEL UPS WITH EXTERNAL MAINTENANCE BYPASS During maintenance operation, when CB1 (MBP) is closed and CB2 (UPS ISOLATION) is open, each UPS control panel display will show a message “LOAD PROTECTED” when the UPS is placed in ON-LINE MODE. In this mode the critical load is not protected because it is supplied by the maintenance bypass power.

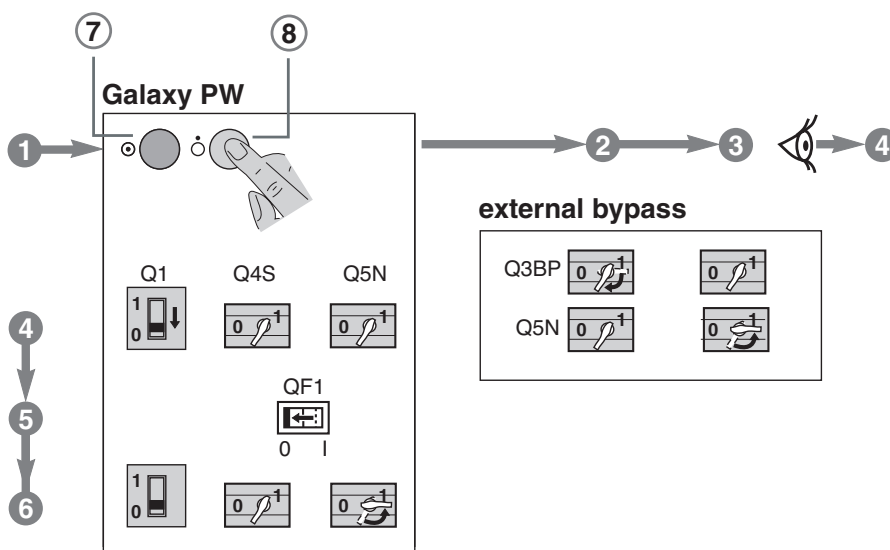
First Isolate all UPSs: (Refer to section 5.2, page 5—2)

See Figure 5-6.

Proceed in the following order: (See Figure 5-4)

1. Shut down the inverters (press the "inverter OFF" buttons **8** for three seconds).
2. Close switch Q3BP and open switch Q5N in the external bypass unit.
3. Open switches Q1, QF1, and Q5N on the UPS units.

Figure 5-4: Isolate All UPS's Procedures Diagram.



Start-up

Following servicing, proceed in the following order: (see Figure 5-5)

1. Close switches Q5N on the UPS units.
2. Close switch Q5N in the external bypass unit.
3. Open switch Q3BP in the parallel-connection unit.
4. Close switches Q1 and QF1 on the UPS units.
5. Start the inverters (press the "inverter ON" buttons 7).

Figure 5-5: Start-up Procedure After Isolation Diagram.

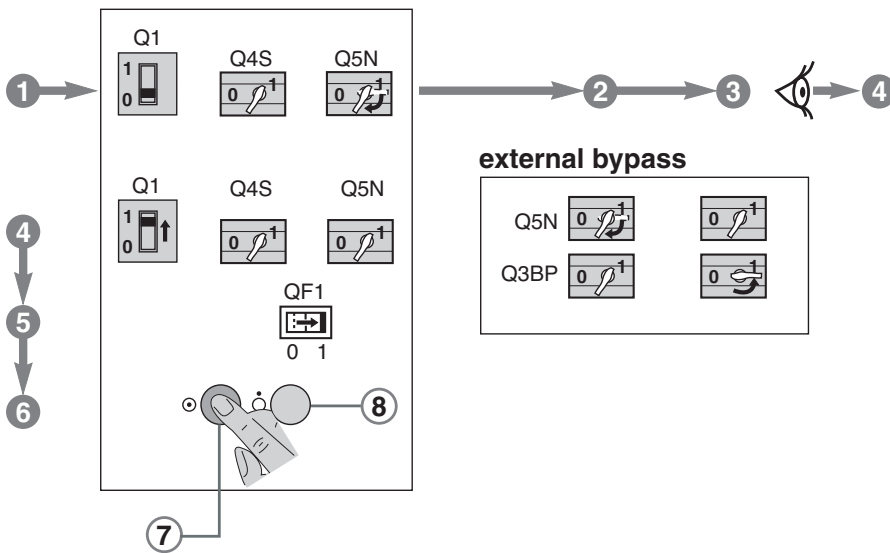
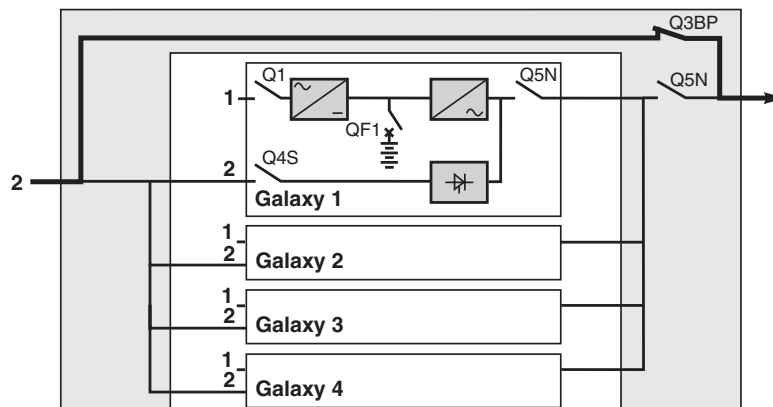


Figure 5-6: Redundancy for Increased Output Diagram.



5.4 Battery Maintenance

Consult the instructions supplied by the battery manufacturer. Below are a few general indications:

▶ **Sealed lead-acid Batteries:**

- these batteries require no maintenance, but check the terminals of each cell from time to time and clean if necessary.

▶ **Vented lead-acid Batteries:**

- check the electrolyte level regularly and add water if necessary,
- check the voltage of each cell to determine if it is necessary to equalize the battery,
- check the terminals of each cell and clean if necessary.

5.5 Visual Check

Power down the system prior to any maintenance operations.



NOTE

In redundant parallel UPS systems the check may be carried out successively on each UPS unit without interrupting the load. In other configurations, the load must be supplied via the maintenance bypass (see "maintenance bypass" in the "Alarm" section).

1. Clean the system regularly, particularly the air filter inlet and outlet grills. Check that the air circulates freely in the cabinets. Use a vacuum cleaner if necessary.
2. Check that nothing hinders the ventilation at the top and at the back of the system.

5.6 Functional System Checks

1. Check that lights **1** , **2** and **3** on the control panel are not red, to avoid an interruption in the supply of power to the load due to incorrect transfer conditions or a battery problem.
2. Press the "inverter OFF" button and check that the buzzer and control panel lights function correctly (see the section on operating modes in the introduction).
3. Press the "inverter ON" button and check again that the control panel lights function correctly.
4. Run a transfer to battery test. With the inverter on, open input circuit breaker Q1. The orange "battery" light on the control panel should light. After two minutes on battery power, close input circuit breaker Q1. The rectifier/charger should automatically restart and the orange "battery" light on the control panel should go off.

5.7 Testing Parallel Systems

5.7.1 Galvanic Isolation and Voltage Matching Transformers

The UPS can be equipped with an isolation or auto transformer on both the input and output to provide galvanic isolation or voltage step-up or step-down as required.

5.8 Management of Computer Networks

5.8.1 Integrated SNMP Agent

This electronic board, installed in the UPS system, enables direct connection to all Ethernet networks using TCP/IP.

The UPSs may then be supervised via the computer network. Furthermore, they can be used to close system files without having to add an external SNMP agent.

This board is fully compatible with "Solution Pac™" software.

The RJ45 connector of the communications option delivers information using the SNMP protocol. The sticker located on the board indicates the UPS MAC address.

Figure 5-7: MAC Address Sticker.



- ▶ The MAC address is written in the following way: 0080C8 ZZ XX YY.
- ▶ The default IP address is 168.8.xx.yy (xx and yy are decimal values of XX and YY).

For example, MAC address 00 80 C8 AB AA 01 is related to IP address 168.8.170.1.

Please refer to the "userman.doc" user manual contained in the directory "emb/galaxy/snmp/release3.xx" of the Solution-Pac CD-ROM in order to discover the management capabilities of your SNMP Galaxy PW™ UPS.

Please contact your sales representative for more detailed information.

5.8.2 Two-channel Network Board

This electronic board comprises two ports, each of which may be user set, either for the U-Talk protocol or as a relay contact.

- A) U-Talk is the protocol required to establish contact with the communications software.
- B) Relay contacts may be used for specific network applications (IBM AS400, Novell, etc.).

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Front Control Panel Display Definitions

1 "Rectifier/charger" light

- ▶ light off: rectifier/charger OFF.
- ▶ light shines green: rectifier/charger ON.
- ▶ light shines red: rectifier/charger fault, the stored alarm indicates one or several of the following faults:
 - input circuit breaker Q1 open,
 - protection fuse at the rectifier/charger input (FUE) blown,
 - abnormally high internal rectifier/charger temperature,
 - abnormally high battery charge current,
 - abnormally high battery voltage,
 - fault, non-calibration or non-personalization of the electronic control board for the rectifier/charger,
 - fault on the electronic power-supply board,
 - abnormally high temperature in the harmonic filter inductor.

2 "Battery light"

- ▶ light off: battery float charging.
- ▶ light flashing green: battery recharging.
- ▶ light shines green: load on battery power.
- ▶ light flashing red: low-battery shutdown warning.
- ▶ light shines red: battery at end of backup time and circuit breaker QF1 open, or battery fault.

3 "Static-bypass" light

- ▶ light off: bypass AC source within specified tolerances and static bypass open.
- ▶ light shines green: static bypass closed.
- ▶ light shines red: the stored alarm indicates one or several of the following faults:
 - bypass AC source voltage or frequency outside specified tolerances,
 - static-bypass fault,
 - abnormally high internal static-bypass temperature,
 - static-bypass ventilation fault,
 - power-supply fault for the static-bypass control function,
 - fault on the electronic board controlling the transfer function,
 - non-calibration or non-personalization of the electronic control board for the inverter,
 - fault on the electronic power-supply board,
 - fault on monitoring the "inverter ready" response channels (parallel UPS system).

4 "Inverter" light

- ▶ light off: inverter OFF.
- ▶ light flashing green: inverter starting, inverter ON but not connected to the load.
- ▶ light shines green: normal inverter operation.
- ▶ light shines red: inverter fault, the stored alarm indicates one or several of the following faults:
 - inverter shutdown due to inverter output voltage outside specified tolerances,
 - protection fuse at the inverter output (FUS) blown,
 - abnormally high inverter-output transformer temperature,
 - abnormally high inverter temperature,
 - output-voltage fault (amplitude or phase) (parallel UPSs),
 - fault, non-calibration or non-personalization of the electronic control board for the inverter,
 - fault on the electronic power-supply board.

5 "Load" light

- ▶ light off: load not supplied.
- ▶ light shines green: load supplied via the inverter or the bypass AC source (via the static bypass).

6 Buzzer

The buzzer sounds in the following situations:

- ▶ load supplied by the bypass AC source.
- ▶ load on battery.
- ▶ operating problems.

It sounds slowly and discontinuously for a minor problem or when the inverter is on battery power.


When the alarm "LOW BATTERY SHUTDOWN" is activated, the buzzer sounds more rapidly. Finally, if the inverter shuts down, the beep is loud and continuous. The buzzer may be reset by pressing a button. If the buzzer is reset, a higher level alarm will set it off again.

7 "Inverter ON" button This button is used to start the inverter locally.

8 "Inverter OFF" button This button turns the inverter off locally.

9-10 Keys These keys are used to select commands in the main menu and access the secondary messages.

11 Key This key is used to validate the user's choice.

12 Key  This key is used to access the main menu: display language, display-contrast setting, sound level of the buzzer, lamp test, date and time settings, inverse-video and event log.

13 "V" Key

This key is used to access voltage measurements:

- ▶ normal AC source phase-to-phase voltages.
- ▶ bypass AC source phase-to-phase and phase-to-neutral voltages.
- ▶ load phase-to-phase and phase-to-neutral voltages.

14 "A" Key

This key is used to access current measurements:

- ▶ normal AC source, bypass AC source and load currents.
- ▶ percent load.
- ▶ load crest factor.

15 "W.Hz" Key

This key is used to access other measurements:

- ▶ normal AC source, bypass AC source and inverter frequencies.
- ▶ level of active and apparent power drawn by the load.
- ▶ load power factor.
- ▶ inverter load level (percent).

16 "Anomaly" indicator light This indicator light indicates the presence of anomalies.

17 Key  This key is used to access the primary messages.

18 "Battery" Key 

This key is used to access battery measurements:

- ▶ battery voltage (or the DC voltage on frequency converters without a battery).
- ▶ battery current (charge or discharge).
- ▶ battery temperature.
- ▶ available battery backup time.
- ▶ inverter load level (percent).

19 "Forced-transfer"

This key is used to voluntarily transfer the load to the inverter or from the inverter to the static bypass (return transfer). Transfer and return transfer are carried out only following confirmation requested by the display and a warning as to the risk of an interruption in the supply of power to the load.

20 "Alarm reset" This key is used to reset stored alarms. The system accepts resetting only when alarms have been cleared.

21 "Buzzer reset" This key is used to stop the buzzer. However, new alarms set the buzzer off again.

22 Display The display continuously indicates the system operating status.

Display of Primary and Secondary Messages

The display is structured around primary and secondary messages, measuring tables and setting screens. As a rule, the message displayed on the screen is always a primary one. The secondary messages, if any, are accessed by pressing keys **9 ▲** and **10 ▼**. See Figure 2-6, page 2—8.

The presence of secondary messages is indicated by the arrow \emptyset at the end of the primary message. Return to the primary messages is automatic if the keypad is not used for 2 minutes, or direct by pressing key **17**. The display screen lights up when a key is pressed, and goes off if no key is pressed for 5 minutes.



NOTE

Most functions may be directly accessed. For example, when voltage measurements are currently displayed, it is possible to directly access current measurements by pressing the "A" button.

In addition to keypad operations, the graphical display brings up a window giving the overall device status. The message displayed is then said to be primary (see list in the paragraph below). A primary message can be used to access the measuring tables using keys **13**, **14**, **15** and **18** on the keypad. The configuration screens can be accessed by pressing key **12**.

A flashing arrow appears at the end of a primary message if there is a problem or an alarm. Secondary messages can be accessed by pressing key **9** on the keypad (see the list of secondary messages). The presence of another message is indicated by the arrows \emptyset and \neq at the end of the secondary message. They can be accessed by pressing keys **9** and **10** on the keypad.

The return to the primary message is automatic after a 2 minute time delay or by pressing key **17** on the keypad.



IMPORTANT

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

Primary Messages

```
LOAD PROTECTED
ON-LINE MODE
```

This is the normal display when there are no alarms or problems and the load is correctly supplied by the inverter, in on-line mode.

```
LOAD PROTECTED
PARALLEL ON-LINE MODE
```

This is the normal display when there are no alarms or problems and the load is correctly supplied by the inverter in a parallel UPS system, in on-line mode.

```
LOAD NOT PROTECTED
ON-LINE MODE ⓪
```

This display indicates that the load is not supplied by the inverter, or that there is no battery backup. The arrow ⓪ indicates the presence of one or more problems specified in secondary messages.

The buzzer sounds continuously.

```
LOAD NOT PROTECTED
PARALLEL ON-LINE MODE ⓪
```

Situation identical to that in the previous screen, but for parallel UPS systems.

```
LOAD PROTECTED
BATTERY DISCHARGING
Remaining battery time (min) = XX
% kW used = XXX
```

The load is supplied by the inverter, but the normal AC source is down or outside tolerances and power is supplied by the battery.

This message indicates the remaining battery time in minutes prior to inverter shutdown and the percent load. The battery time calculation takes into account:

- ▶ The percentage of full rated load power currently being drawn.
- ▶ The type of battery.
- ▶ Battery temperature.
- ▶ Battery age.

The buzzer sounds slowly and discontinuously.

```
LOAD PROTECTED
LOW-BATTERY SHUTDOWN WARNING
Remaining battery time (min) = XX
% kW used = XXX
```

This message replaces the preceding if the power outage persists and the warning level has been reached.

The user is warned that the battery is about to shut down.

The buzzer sounds rapidly and discontinuously.

LOAD PROTECTED
ECO MODE

This is the normal display when there are no problems: the load is supplied by the inverter or the bypass AC source, and battery backup is available.

LOAD NOT PROTECTED
ECO MODE ∅

This display indicates that the load is supplied but has no battery backup. The arrow ∅ indicates the presence of one or more problems specified in secondary messages.

The buzzer sounds continuously.

LOAD FORCED TO INVERTER
ECO MODE

The load has been transferred to the inverter following a specific request by the user.

Secondary Messages

LOAD ON MAINS 2

The load has been transferred to the bypass AC source (M2) and is no longer protected (only in on-line mode). The buzzer sounds continuously.

MAINS 2 OUTSIDE TOLERANCES
TRANSFER DISABLED
CHECK MAINS 2

The bypass AC source (M2) frequency or voltage is outside tolerances and the inverter is unable to synchronize.

Transfer of the load from the inverter to the bypass AC source (M2) or vice-versa will result in an interruption of the supply of power to the load. The buzzer sounds slowly and discontinuously.

BATTERY OVER TEMPERATURE,
CHECK VENTILATION

The battery temperature is outside tolerances. The buzzer sounds slowly and discontinuously

BATTERY ROOM VENTILATION
FAULT, CHECK VENTILATION

A fault requiring servicing has occurred in the battery room ventilation system. The rectifier/charger shuts down after a 30-second time delay.

The user must take steps to re-establish correct operation of the ventilation system.

This message also signals an abnormally high temperature in the filter inductor.

The buzzer sounds slowly and discontinuously.

MAINS 1 OUTSIDE TOLERANCES
CHECK MAINS 1

The normal AC source (M1) frequency or voltage is outside specified tolerances and the rectifier/charger has shut down. The inverter is on battery power.

MAINS 1 INPUT SWITCH Q1
IS OPEN

The normal AC input (M1) switch Q1 is open. It must be closed for rectifier/charger start-up. The buzzer sounds slowly and discontinuously.

INTERNAL UPS FAULT
LOAD TRANSFER FAULT,
CALL MAINTENANCE

A fault has occurred in the static switch that transfers the load between the inverter and the bypass AC source (M2). Servicing by the after-sales support department is required. The buzzer sounds continuously.

OVERLOAD
RATED CURRENT PER PHASE = XXXA
CHECK LOAD LEVEL

This display informs the user that load current is greater than rated current, and gives the value. The buzzer sounds continuously.

UPS SHUTDOWN DUE TO AN OVERLOAD
CHECK LOAD LEVEL

This message follows the preceding when the overload persists. The UPS has shut down and the buzzer sounds continuously.

INVERTER NOT IN PHASE WITH MAINS 2
TRANSFER DISABLED,
CHECK MAINS 2

The phase difference between the inverter and the bypass AC source (M2) is outside tolerances. Transfer of the load between the inverter and the bypass AC source (M2) will result in an interruption in the supply of power to the load.

For parallel UPSs, this message should be interpreted as meaning the phase difference between the inverter for which the message is displayed and the other inverters is outside tolerances.

UPS SHUTDOWN
BY AN EXTERNAL COMMAND

The inverter has received a command to shut down. The command is in the form of a signal from received the remote-indications relay board which has been set for this function.

- ▶ The inverter is started again.

MAINS 2 INPUT SWITCH Q4S IS OPEN

The bypass AC source (M2) input switch Q4S is open, i.e. backup power for the load via the bypass AC source (M2) is not available.

INVERTER OUTPUT SWITCH Q5N IS OPEN

Inverter output switch Q5N is open, i.e. the load cannot be supplied via the inverter.

BYPASS SWITCH Q3BP IS CLOSED

Maintenance bypass switch Q3BP is closed. The system is in maintenance configuration and the load is supplied by the bypass AC source.

STATIC SWITCH (M2) OFF
DUE TO AN OVERLOAD

The load is no longer supplied by the bypass AC source (M2), due to an extended overload. The buzzer sounds continuously.

BATTERY CHARGING

I BAT.=XXX A U BAT. = XXX U

The battery is currently be recharged.

BATTERY AT END OF SERVICE LIFE CALL MAINTENANCE

The battery is nearing the end of its estimated service life. This information is based on average service-life calculations since its initial installation. The buzzer sounds slowly and discontinuously.

EMERGENCY OFF

This message is displayed when the external emergency-off pushbutton is pressed. The result is:

- ▶ Shutdown of the inverter.
- ▶ Shutdown of the rectifier/charger.
- ▶ Opening of the battery circuit breaker.
- ▶ Blocking of the static bypass.
- ▶ Opening of the backfeed protection contactor (M2),
- ▶ Opening of the Q1 circuit breaker (M1),
- ▶ Activation of a relay contact on the remote-indications relay board.

Servicing by the after-sales support department is required.

The buzzer sounds discontinuously.

THE BATTERY C.B. QF1 IS OPEN,
CHECK THE INSTALLATION

Battery circuit breaker QF1 is open. The load is no longer protected because battery power is no longer available in the event of a normal AC source outage. The buzzer sounds continuously.

LOW BATTERY SHUTDOWN

The inverter has shut down at the end of battery power. The buzzer sounds continuously.

INTERNAL UPS FAULT,
INVERTER FAULT,
CALL MAINTENANCE

A fault has occurred in the inverter. Servicing by the after-sales support department is required. The buzzer sounds continuously.

INTERNAL UPS FAULT,
CHARGER FAULT,
CALL MAINTENANCE

A fault has occurred in the rectifier/charger. Servicing by the after-sales support department is required.

The buzzer sounds slowly and discontinuously.

FORCED TRANSFER TO INVERTER REQUESTED,
POWER TO LOAD MAY BE INTERRUPTED,
CONFIRM YOUR REQUEST WITH KEY Ø

The requested transfer to the inverter may provoke an interruption in the supply of power to the load if Mains 2 characteristics are not within the specified tolerances.

THE NUMBER OF UPS READY IS INSUFFICIENT,
LOAD TRANSFER IN STANDBY

This message may be displayed in non-redundant, parallel UPS systems, when the number of ready inverters is not sufficient to supply the load.

INVERTER NOT CONNECTED

This message may be displayed in parallel UPS systems, when the inverter is not connected to the load.

PARALLEL UPS,
FORCED TRANSFER INHIBITED

This message is displayed when forced connection is requested on a parallel UPS system for a power extension.

INTERNAL UPS FAULT,
SELF-TEST FAULT

Communication between the system and the display is faulty. The buzzer sounds slowly and discontinuously.

FORCED TRANSFER TO M2 REQUESTED,
POWER TO LOAD MAY BE INTERRUPTED
CONFIRM YOUR REQUEST WITH KEY 0

This message is displayed following pressing of the "forced-transfer" key 20, when the load is supplied via the inverter.

UPS SUPPLIED BY A GENERATOR SET

This message informs the user that the UPS has received the order to limit the current drawn by the rectifier/charger. It is displayed when the corresponding signal is transmitted by the remote indications board which must be configured for this function.

VENTILATION FAULT

This message is displayed when a fault occurs on a fan.

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Appendix B

Monitoring - Electrical Supervision Options

"Teleservice"

"Teleservice" is a contract offering continuous remote supervision and maintenance of UPS systems via a modem. Real-time communication is established with our "Teleservice" centre for communication of all alarms and events occurring in the installation.

Utilization Via Teleservice

When the optional JBUS RS232/485 communications board is installed, the time-stamped information can be sent to the Teleservice center.

The center can remotely consult the same information and carry out the same modifications as the user locally on the display. Note that only the Teleservice centre can reset the counters for the statistical data.

GTC Board

This electronic board provides user access to the J-Bus communications protocol. Using the data and address tables provided, the user can customize his installation.

GTC + Software

The user has access to the J-Bus protocol and, in addition, the associated software acquires system parameters (measurements, status conditions) and transforms them into diagrams, alarm messages and tables. With the click of a mouse, the user can locally or remotely supervise the UPS system (comprising one or many UPS units).

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Appendix C

Link to an IBM AS/400[®] Computer

The Galaxy PW[™] can dialogue with an IBM AS/400[®] computer via a link in compliance with IBM communications recommendations, thus enhancing the protection provided by your Galaxy PW[™].

The IBM AS/400[®] computer must be configured for the link. This section describes the physical connections required as well as the system values that must be modified on the AS/400[®]. For further information, consult the following IBM documents:

- ▶ "Planning Guide, Appendix E" concerning physical connections.
- ▶ "Back-up and Recovery Guide", chapter 7 "Power Loss Recovery" concerning configuration of the AS 400[®].

Connect and Configure the AS400 Link

Connections are made to the female client connector XR5 on the "Media Contacts 11" board. The corresponding male connector is supplied; see Figure 3-12 below for the wiring diagram. A five-wire cable (not supplied) is required.

1. On the AS/400[®] side, use a 9 or 15-pin SUB-D connector. (Depending on the type of AS/400[®].)
2. Certain values on the AS/400[®] must be configured to enable operation of the Galaxy PW[™] — AS/400[®] link. The values requiring modification and the corresponding procedures are presented in chapter 7 "Power Loss Recovery" of the "Back-up and Recovery Guide" for the AS/400[®].

Configuration values:

- ▶ QUPSMGQ: UPS message queue;
- ▶ QUPSDLTIM: Uninterruptible power supply delay time;
- ▶ QPWRRSTIPL: Power restore IPL.

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MGE Customer Care Center

Technical Support and Product Services



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

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

Part Number: _____

Assembly Number: _____

Serial number: _____

Who To Contact

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

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

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

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

Scheduling Field Service Engineer Support

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

Return Policy for Repair (RMA)

Should you require factory service for your equipment, contact MGE's Customer Support Services and obtain a Return Materials Authorization (RMA) prior to shipping your unit. Never ship equipment to MGE without first obtaining an RMA.

Date: _____

RMA Number: _____

Contact Name: _____

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Glossary

Term used	Definition/Meaning
@	At.
/	And/or.
+/-	Plus or Minus.
≤	Equal to or less than.
#	Number.
°C	Degree Celsius.
°F	Degree Fahrenheit.
∅	Phase angle.
Ω	Ohm. unit of resistance.
®	Trade Mark.
2nd	Second.
AC or ac	Alternating current, also implies root-mean-square (rms).
Ambient Temp.	Temperature of surrounding air.
Ambient noise	Acoustical noise of surrounding environment.
ANSI	American National Standard Institute.
AWG	American Wire Gauge.
Breaker	Electrical circuit interrupter.
BTU or Btu	British thermal unit. Defined as the amount of heat required to raise the temperature of one pound of water by 1°F.
BYPASS	See "Static Transfer switch".
BYPASS mode	See "off-line mode".
Carrier	The company or individual responsible for delivering goods from one location to another.
C	Common.
CB	Circuit breaker.
cm	Centimeter.
dB	Decibels.

DC	Direct current.
Conduit	A flexible or rigid tube enclosing electrical conductors.
C.S.S.	Customer Support Service.
Current rating	The maximum current that a conductor or equipment can carry reliably without damage.
dBA	Decibel Adjusted.
dBrnC	Decibel above reference noise.
DC or dc	Direct current, or voltage.
Digital Meter	The LCD display on the front panel of inverter system.
Earth ground	A ground circuit that has contact with the earth.
Electrician	Refers to an installation electrician qualified to install heavy-duty electrical components in accordance with local codes and regulations. Not necessarily qualified to maintain or repair electrical or electronic equipment.
FET	Field effect transistor.
Freq.	Frequency.
Frequency slew rate	The change in frequency per unit of time. Given in term of Hz per second (Hz/sec.).
GND	Ground (safety).
Hz	Hertz, frequency measurement unit, 1Hz is one cycle per second.
Inverter mode	See “on-line” mode.
I	Current.
IEC	International Electrotechnical Commission.
IEEE	Institute of Electrical and Electronic Engineers.
Input branch circuit	The input circuit from the building power panel to the equipment.
Inverter	An electrical circuit that generates an AC voltage source from a DC voltage source.
IGBT	Insulated gate bipolar transistors
kVA	KiloVolt-Ampere. is equal to 1000 Volt-Ampere.
L	Line.
LCD	Liquid-Crystal Display unit.
LED	Light Emitting Diode.
Mains or Mains 1	Main AC input source.
Mains 2	Bypass AC input source.
mA	Milliamperere.
MAX.	Maximum.

MCM	Thousand circular mil. standard wire sizes for multiple stranded conductors over 4/0 AWG in diameter. M is from Roman numerical system indicating 1000.
Module	Refers to individual power inverter module.
N	Neutral.
NC	Normally close.
NO	Normally open.
NEC	National Electrical Code.
NFPA	National Fire Protection Association.
NO. or No.	Part number.
On-line mode	Inverter output power is the primary energy source to load.
Off-line mode	Inverter output is off, and the load connected at the inverter output receives power from utility line via a static transfer switch or maintenance bypass relay.
OSHA	Occupational Safety and Health Agency.
PCB	Printed circuit assembly.
PCB	Printed circuit board.
PWM	Pulse Width Modulation.
SCR	Silicon controlled rectifier.
Shipping damage	Any damage done to an article while it is in transit.
SPDT	Single Pole Double Throw.
Static Transfer	An solid state switching mechanism electronically controlled to pass AC power directly from the utility to an output load.
Technician	Refers to an electronic technician qualified to maintain and repair electronic equipment. Not necessarily qualified to install electrical wiring.
Test connector	DB-9 type connector on the LCD panel allowing MGE UPS SYSTEMS Customer Support Service technician to access programmable and diagnostic features of the system.
V	Volts
VA	Volt amperes
VA	Volt-amps, unit for apparent power measurement, equal $V \times I$.
VAC or Vac	Voltage of AC type.
VDC or Vdc	Voltage of DC type.
ve	Battery voltage.
Via	By way of.

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