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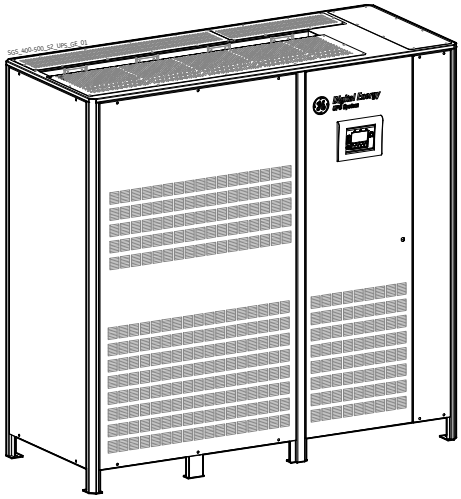

User Manual

Uninterruptible Power supply

SG Series 400 & 500

400 & 500 kVA / 480Vac UL / S2

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Dear Customer,

We thank you for selecting our products and are pleased to count you amongst our very valued customers at ***GE***.

We trust that the use of the ***SG Series 400 & 500*** Uninterruptible Power Supply system, developed and produced to the highest standards of quality, will give you complete satisfaction.

Please read carefully the *User Manual*, which contains all the necessary information and describes all you need to know about the use of the UPS.
Thank you for choosing ***GE*** !

START UP AND COMMISSIONING

A GE Global Services Field Engineer must perform start-up and commissioning of the UPS. Please Contact GE. Global Services at least two weeks prior to schedule start-up and commissioning at 1-800-637-1738, or by E-mail at pqservice@ge.com .

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Your service contact:

Preface

Congratulations on your choice of a *SG Series* Uninterruptible Power Supply (UPS). It will help eliminate *Load* disturbances due to unexpected power problems.

This *Manual* describes the function of the UPS module, the purpose and location of the switches, the meaning of the system events related to the front panel indication, and provides procedures for starting and stopping the equipment.

Please refer to the accompanying *Installations Guide*, which describes how to prepare the installation site, and it provides weight, dimensions and procedures for moving, installing and connecting the UPS.

While every care has been taken to ensure the completeness and accuracy of this manual, *GE* assumes no responsibility or liability for any losses or damages resulting from the use of the information contained in this document.

WARNING!

SG Series 400 & 500 is a product that needs to be installed by a licensed and knowledgeable contractor.

We recommend that this manual be kept next to the UPS for future references.
If any problems are encountered with the procedures contained in this manual, please contact your *Service Center* before you proceed.

This document shall not be copied or reproduced without the permission of *GE*.

Some of the information contained in this manual may be changed without notice to reflect technical improvements.

Safety instructions

Read the safety instructions contained on the following pages carefully before the installation of the UPS, options and battery system.

Pay attention to the rectangular boxes included in the text:
They contain important information and warning concerning electrical connections and personnel safety.

RPA
Redundant Parallel Architecture

Parallel version secured with RPA

When included in the text, this symbol refers to operation needed only for parallel system.

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1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for models ***SG Series 400 & 500*** that should be followed during installation and maintenance of the UPS and battery.

GENERAL

- Move the UPS in an upright position in its original package to the final destination room.
  To lift the cabinets, use a forklift or lifting belts with spreader bars.
- Check for sufficient floor and elevator loading capacity.
- Check the integrity of the UPS equipment carefully.
  If you notice visible damage, do not install or start the UPS.
  Contact the nearest *Service Center* immediately.
- WARNING! *RISK OF ELECTRICAL SHOCK*:
  Do not remove covers, there are no user serviceable parts inside.
- After switching off takes 5 minutes for the DC capacitors to discharge because a lethally high voltage remains at the terminals of the electrolytic capacitors.
- All maintenance and service work should be performed by qualified service personnel.
  The UPS contains its own energy source (battery).
- The field-wiring outlets may be electrically live, even when the UPS is disconnected from the utility.
- Dangerous voltages may be present during battery operation.
- The battery must be disconnected during maintenance or service work.
- This UPS contains potentially hazardous voltages.
- Be aware that the inverter can restart automatically after the utility voltage is restored.

INSTALLATION

- This UPS must be installed and connected only by trained personnel.
- Verify accurately during Commissioning and Maintenance of the UPS, for the following:
  Damaged components, squeezed wires and cables, or not correctly inserted plugs.
- After removing the sidewalls of the UPS, make sure that all earth connections when reassembling, are correctly reattached.
- This UPS is intended for use in a controlled indoor environment free of conductive contaminants and protected against animals intrusion.
- WARNING! HIGH EARTH LEAKAGE CURRENT:
  Earth connection is essential before connecting to AC input!
- Switching OFF the unit does not isolate the UPS from the utility.
- Do not install the UPS in an excessively humid environment or near water.
- Avoid spilling liquids on or dropping any foreign object into the UPS.
- The unit must be placed in a sufficiently ventilated area; the ambient temperature should not exceed 104°F (40°C).
- Optimal battery life is obtained if the ambient temperature does not exceed 77°F (25°C).
- It is important that air can move freely around and through the unit. Do not block the air vents.
- Avoid locations in direct sunlight or near heat sources.

STORAGE

- Store the UPS in a dry location; storage temperature must be within -13°F (-25°C) to 131°F (+55°C).
- The optimal temperature for Battery storage is 68°F (20°C) to 77°F (25°C) and shall never exceed the range -4°F (-20°C) to 104°F (40°C).
- If the unit is stored for a period exceeding 3 months, the battery must be recharged periodically (time depending on storage temperature).

BATTERY

- The battery-voltage is dangerous for person's safety.
- When replacing the battery, use the same cells number, voltage (V), capacity (Ah).
  All the battery used, shall be of the same manufacturer and date of production.
- Proper disposal or recycling of the battery is required.
  Refer to your local codes for disposal requirements.
- Never dispose of battery in a fire: they may explode.
- Do not open or mutilate battery: their contents (electrolyte) may be extremely toxic.
  If exposed to electrolyte, wash immediately with plenty of water.
- Avoid charging in a sealed container.
- Never short-circuit the batteries.
  When working with batteries, remove watches, rings or other metal objects, and only use insulated tools.
- In case of air shipment, the cables +/- going to the battery fuses/terminals shall be disconnected and isolated.

Safety instructions when working with battery

EXTERNAL BATTERY MUST BE INSTALLED AND CONNECTED TO THE UPS BY QUALIFIED SERVICE PERSONNEL ONLY.
INSTALLATION PERSONNEL MUST READ THIS ENTIRE SECTION BEFORE HANDLING THE UPS AND BATTERY.

DANGER!

Full voltage and current are always present at the battery terminals.
The battery used in this system can provide dangerous voltages, extremely high currents and a risk of electric shock.
If the terminals are shorted together or to ground they may cause severe injury.
You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation.
Do not touch uninsulated battery terminals.

A qualified service person, who is familiar with battery systems and required precautions, must install and service the battery.
The installation must conform to national and local codes.
Keep unauthorized personnel away from the battery.

The qualified service person must take these precautions:

1 Wear protective clothing, such as rubber gloves and boots and protective eye wear
Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated.
Remove rings and metal wristwatches or other metal objects and jewelry.
Do not carry metal objects in your pockets where the objects can fall into the battery cabinet.

2 Tools must have insulated handles and must be insulated so that they will not short battery terminals.
Do not allow a tool to short between individual or separate battery terminals or to the cabinet or rack.
Do not lay tools or metal parts on top of the battery, and do not lay them where they could fall onto the battery or into the cabinet.

3 Install the battery as shown on the drawing provided with the battery.
When connecting cables, never allow a cable to short across a battery's terminals, the string of battery, or to the cabinet or rack.

4 Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet or rack, even if the battery is moved.
Keep the cable away from any sharp metal edges.

5 Install the battery cables in such a way that the UPS or battery cabinet doors cannot pinch them.

6 Do not connect the battery terminal to Ground.
If any battery terminal is inadvertently grounded, remove the source of the ground.
Contacting any part of a grounded battery can cause a risk of electric shock.

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

8 Battery system chassis ground (earth) must be connected to the UPS chassis ground (earth).
If you use conduits, this ground conductor must be routed in the same conduit as the battery conductors.

9 Where conductors may be exposed to physical damage, protect the conductors in accordance with all applicable codes.

10 If you are replacing the battery or repairing battery connections, shut OFF the UPS and remove the battery fuses.

Safety symbols and warnings

Safety warnings

The text of this manual contains some warnings to avoid risk to the persons and to avoid damages to the UPS system and the supplied critical loads.

The non-observance of the warnings reminding hazardous situations could result in human injury and equipment damages.

Please pay attention to the meaning of the following warnings and symbols.

Throughout this manual the following symbols are defined:

	**WARNING, if instruction is not followed injury or serious equipment damage may occur!**
	**CAUTION, internal parts have dangerous voltage present.** **Risk of electric shock!**
	**PE (Earth) – GND (Ground)** **PROTECTIVE GROUNDING TERMINAL:** **A terminal which must be connected to earth ground prior to making any other connection to the equipment.**
	**A terminal to which or from which an alternating (sine wave) current or voltage may be applied or supplied.**
	**A terminal to which or from which a direct current or voltage may be applied or supplied.**
	**This symbol indicated the word "phase".**
	This symbol indicates the principal on/off switch in the on position.
	**This symbol indicates the principal on/off switch in the off position.**

2 LAYOUT

2.1 LAYOUT *SG Series 400 & 500*

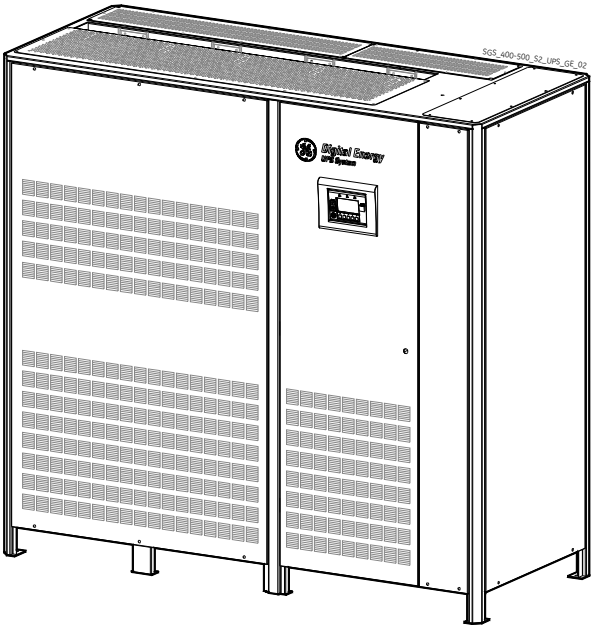


Fig. 2.1-1 SG Series 400 & 500 general view

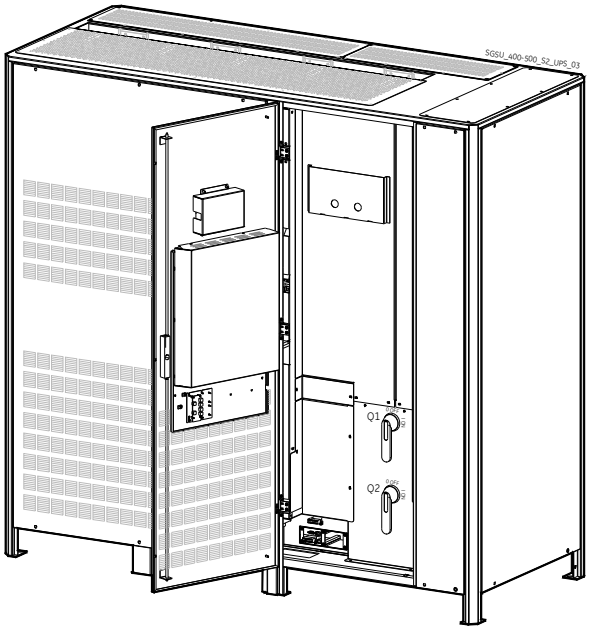


Fig. 2.1-2 SG Series 400 & 500 general view with open doors

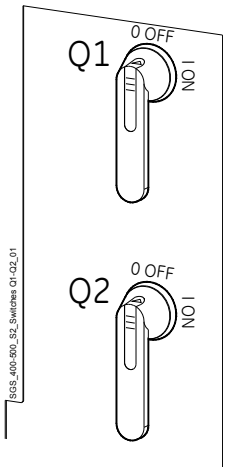


Fig. 2.1-3 Manual operated switches

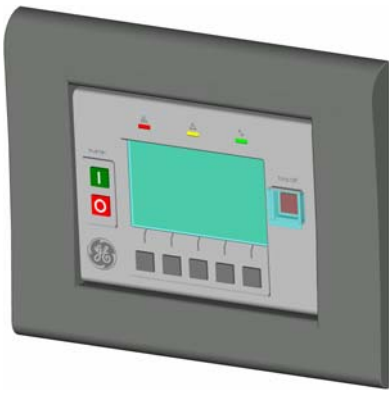


Fig. 2.1-4 Control panel

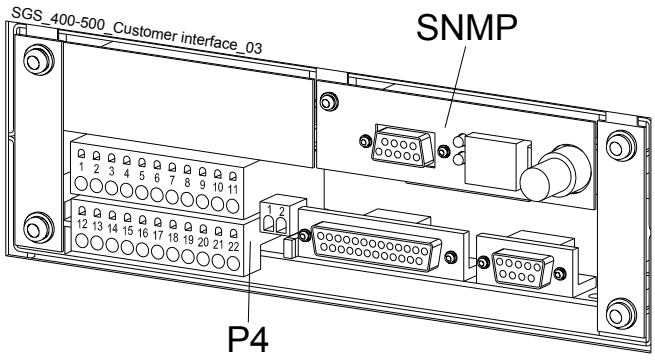


Fig. 2.1-5 Connectivity Rack

P4	Customer Interface Board
Q1	UPS output switch
Q2	Manual Bypass switch (option)
SNMP	3-ph SNMP/WEB plug-in adapter (option)
XA	Terminals for 24Vdc Auxiliary Power Supply connection
XB	Terminals for EPO (Emergency Power Off) connection

3 INTRODUCTION

An **Uninterruptible Power Supply** (UPS) provides the power for critical loads that need a reliable, continuous, disturbance free supply.

In case the power provided by the *Utility* fails, or exceeds the permitted tolerances, the power to supply the *Load* is provided by the *Battery* for the specified time at the rated *Load* (or longer at a reduced *Load*) or until the *Utility* power returns.

SG Series 400 & 500 is a true double conversion ***VFI*** *(Voltage Frequency Independent)* UPS system where the *Load* is continuously supplied by the *Inverter* through the *Rectifier*.

In case of trouble on the *Inverter Output Voltage*, or when overload or short-circuit on the output occur, the *Load* is instantly transferred to the *Utility* via the *Automatic Bypass*.

The UPS automatically returns to normal mode when the failure condition is restored.

Key features:

- **More Critical equipment supported**
  Rated at 0.9 Power Factor, *SG Series 400 & 500* delivers more real power than other UPS in the market.
  With today's trend toward power factor corrected loads, *SG Series 400 & 500* can support more total *Load* than any other UPS available, allowing you to support a greater number of today's enterprise computing Power Factor Corrected (PFC) equipment.

- **No single point of failure**
  Redundant Parallel Architecture (RPA) is an exclusive ***GE*** technology.
  With RPA, *SG Series 400 & 500* UPS are controlled in a true peer-to-peer configuration where all critical elements and functions (including *Bypass*) are redundant.
  SG Series 400 & 500 is designed to be the most reliable power protection system available on the market today.

- **High Efficiency**
  Using IGBT technology and Space Vector Modulation (SVM) strategy, *SG Series 400 & 500* offers low output voltage distortion and provides efficiencies up to 93%.

- **Fully digital**
  Digital Signal Processor (DSP), Flash memory and SVM strategy, are the technology corner stones of new age of power quality and power reliability.

- **Extremely flexible**
  Tailor made power protection to meet your individual installation requirements; *SG Series 400 & 500* offers various options like input harmonic filters and our comprehensive *GE Power Diagnostic* software suite for mission control and data protection to cover all your application needs.

4 DESCRIPTION

4.1 BLOCK DIAGRAM AND MAIN ELEMENTS

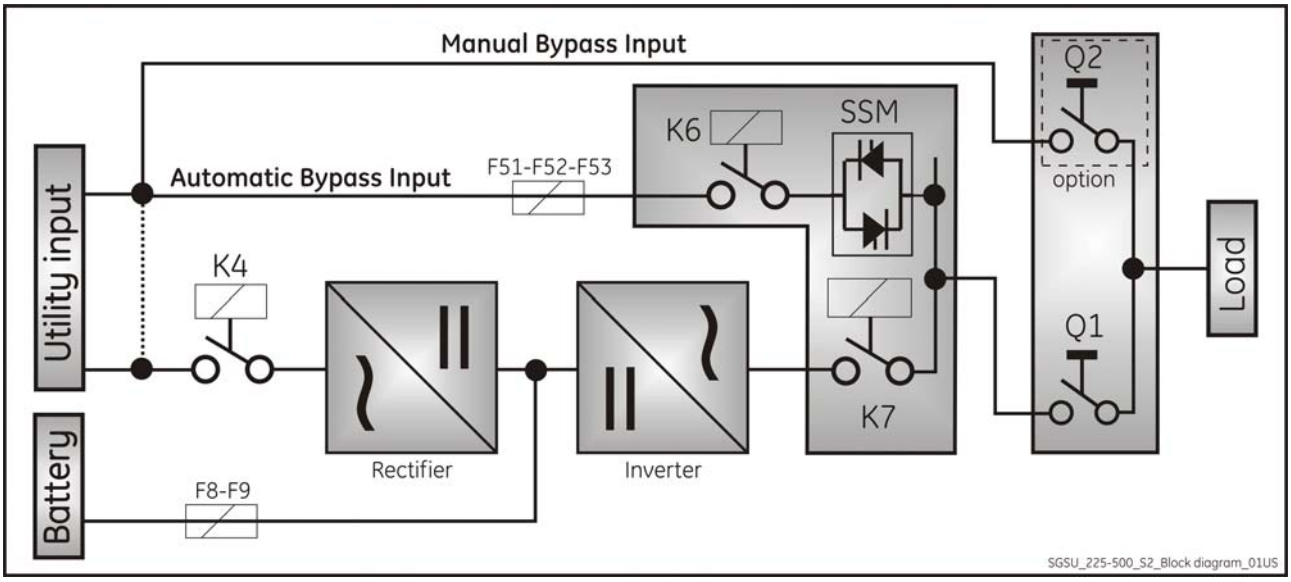


Fig. 4.1-1 Block diagram

The ***SG Series 400 & 500*** system can be divided into the following main elements:

Control System
SG Series 400 & 500 is designed with microprocessor-controlled signal processing circuits.
The interface between the operator and the unit is provided by the monitoring system on the front panel.
This monitoring system consists of an active mimic diagram, a keyboard and a backlit display.

Rectifier
The standard *Rectifier* consists of a 6-pulse SCR-bridge, which converts the 3-phase *Utility Voltage* into a controlled and regulated DC-voltage.
This regulated DC-voltage is used to supply power to the *Inverter*, and to provide charging power to the *Battery*.

Inverter
The *Inverter* converts the DC voltage into a three-phase AC-voltage with constant amplitude and frequency, which is completely independent and isolated from the AC-input voltage.

Automatic Bypass
The *Automatic Bypass* consists of a static semiconductor-switch *(SSM: Static Switch Module)*, used to provide an uninterrupted transfer of the *Load* from *Inverter to Utility*.

Back-feed Protection
All *SG Series* UPS's are equipped with an automatic system for the protection against voltage back feeding towards *Utility*, through the *Bypass* (Applied Standard IEC 62040-1).
This protection works automatically by opening *contactor K6* and eventually *K7*, and acts in case of internal defects of the system, or due to wrong manipulations on the *Manual Bypass Q2 (option)*.

Manual Bypass (option)
The *Manual Bypass* consists of a pair of manual switches *(Q1* and *Q2),* which removes the UPS from the *Load* for maintenance, while still supplying the *Load* with power directly from the *Utility*.

Battery
The *Battery* supplies the DC power to the *Inverter* when the *Utility* is out of accepted tolerances.

4.2 OPERATION MODES

4.2.1 Normal operation mode

During normal operation, the *Rectifier* converts input AC power to DC.
The DC power provides input power for the *Inverter* and charging power for the *Battery*.
The *Inverter* converts the DC power to continuous and regulated AC power, which supplies the critical load.
The control panel reports the *Battery* charge status and the expected backup time with the actual load.

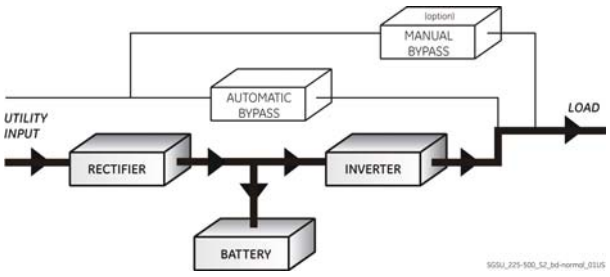


Fig. 4.2.1-1 Block diagram normal operation mode

4.2.2 eBoost™ operation mode (option)

eBoost™
e high efficiency (up to 99%)
Boost fast power transfer (< 4ms)

When the *eBoost™ Operation Mode* is selected, and the *Utility Power* is available, the *Load* is normally powered through the *Automatic Bypass*.

When the *Utility Voltage* is detected out of the prescribed tolerances, the *Load* is automatically transferred to the *Inverter*.

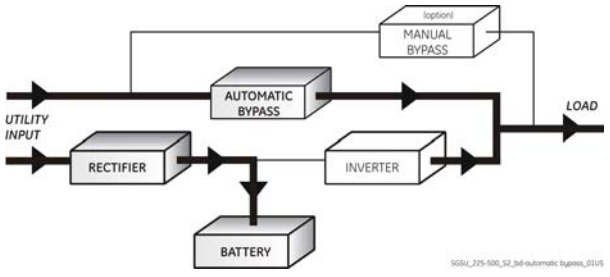


Fig. 4.2.2-1 Energy flow in eBoost™ Operation Mode

When the *Utility* recovers, the *Load* returns to the *Automatic Bypass* after a variable time defined by the control unit.

The *eBoost™ Operation Mode* can be configured directly by the user for scheduled activation, considering the *Utility* reliability and criticality of the *Load*.

The selection between the two operation modes "*VFI Mode* and *eBoost™ Operation Mode*", or switching between operation modes at required time, can be done through the UPS *control panel* (see *Section 7.4 / eBoost)*.

NOTE !

The *eBoost™ Operation Mode* is available only if enabled at the factory or by a GE GLOBAL SERVICES FIELD ENGINEER.

4.2.3 Utility failure operation

When the *Utility* is no longer within acceptable tolerances, the *Battery* will provide the DC power to the *Inverter*.
The *Inverter* will maintain continuous AC power to the *Load* until the *Battery Voltage* reaches the lower limit of the *Inverter* operation capability.
During the discharge, the *LCD screen* displays the estimated time the *Battery* can support the critical *Load*.
Prior to the *Battery* completely discharging, the "***stop operation***" alarm (shutdown imminent) warns the operator that the *Battery* is almost discharged and the UPS is about to shut down.

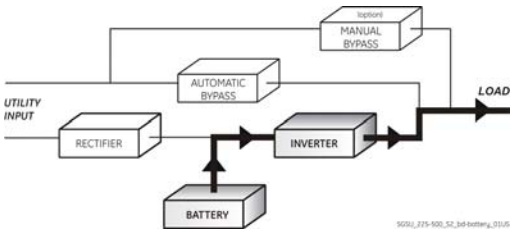


Fig. 4.2.3-1 Block diagram Utility Failure operation

RPA
Redundant Parallel Architecture

In case of parallel operation

With a parallel system for power capacity (see Section 4.3)

- *With the **Bypass Utility power available,** a low Battery warning on any unit will cause the Load to be transferred to Utility (after a selectable time delay).*
- *With **Bypass Utility power** not available, a low Battery warning on any unit will start the "**stop operation**" timer (adjustable). The Load will shut down at the end of the "**stop operation**" time period.*

With a parallel system for redundancy (see Section 4.3)

- *When a Battery low warning occurs on a unit not necessary to support the present load, this unit will shut down after a timeout period (selectable). The Load is shared between the other units.*
  *As the warning occurs on one unit necessary to support the present load, the system starts the "**stop operation**" timeout (selectable).*
  *The Load will shut down at the end of the "**stop operation**" time period.*

4.2.4 Utility recovery operation

As soon as the AC input power recovers, the *Rectifier* will start automatically, supplying DC power to the *Inverter* and recharging the *Battery*.
If the *Inverter* was previously shut down due to low *Battery*, the *Load* will be initially powered by *Utility* through the *Automatic Bypass*.
When the *Battery* is recharged enough to ensure a minimum time of operation with the present load, the *Inverter* will start automatically and the *Load* will be transferred back to the *Inverter*.

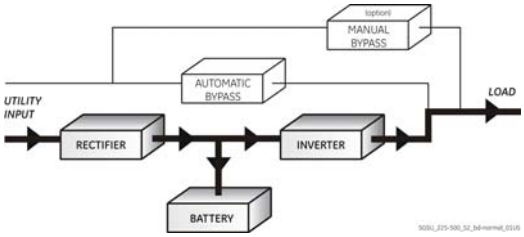


Fig. 4.2.4-1 Block diagram Utility recovery operation

RPA
Redundant Parallel Architecture

In case of parallel operation

*When the AC input power recovers, **the Rectifiers will start up sequentially,** according to their number in the parallel system. This minimizes the **initial inrush current.***
*The **Inverters will start up automatically**, but only when the Battery has recharged enough for a **minimum runtime** with the present load.*
When** enough Inverters to supply the Load have been restarted, **the Load will be transferred from the Automatic Bypass back to the Inverter output.

4.2.5 Automatic Bypass

In normal operation, the *Load* is supplied by the *Inverter*.

When the control system detects a fault in the *Inverter*, an overload condition or a short-circuit condition, the *Automatic Bypass* will transfer the critical *Load* to the *Utility* without interruption.

When the *Inverter* recovers, or the overload or short-circuit condition is corrected, the *Load* will be automatically transferred back to the *Inverter*.

If the UPS is unable to return to normal mode following an automatic transfer to *Bypass mode*, an alarm condition will be initiated.

A *Manual Bypass* (operator initiated) will not be considered as an alarm condition.

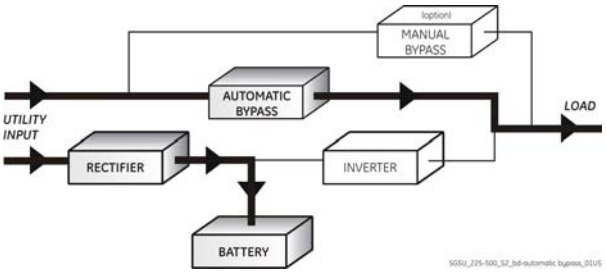


Fig. 4.2.5-1 Block diagram Automatic Bypass

RPA
Redundant Parallel Architecture

In case of parallel operation

Each unit has its own internal Bypass.

These units are continuously exchanging information, enabling all of the internal Bypass circuits in a parallel system to operate simultaneously.

If the Inverter of a unit fails, its Bypass circuit remains available to the Parallel System.

*It is excluded only if the unit is separated from the common bus by opening its output switch **Q1**.*

4.2.6 Manual Bypass (option)

The *Manual Bypass* circuit consists of ***Q1*** and ***Q2*** manual switches, which permits transfer of the *Load* directly to the unconditioned AC power without interruption, leaving the UPS available for maintenance.

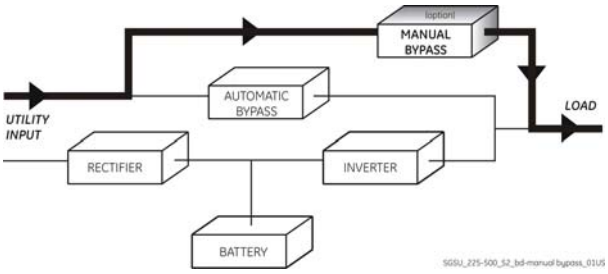


Fig. 4.2.6-1 Block diagram Manual Bypass

4.3 PARALLEL SYSTEM OPERATION

4.3.1 Introduction to the parallel system

Two or more equal power units can be paralleled to increase the output power (paralleling for capacity) or to improve the overall reliability of an UPS system (paralleling for redundancy).
The outputs of parallel units are connected to a common power bus, and in normal operation the units connected on the parallel bus share the *Load* equally.
The modular concept of *SG Series 400 & 500* allows parallel operation of **up to 6 units**, without using paralleling switchgear, external bypass circuits or common control circuitry (see *Fig. 4.3.1-1*).

Parallel units for power capacity
Several units can be paralleled in order to achieve output power greater than the maximum power of a single unit.
The maximum total power shared between the paralleled units is equal to the **total installed nominal power**.
In the event of a failure of one unit, the power supplied by the UPS system becomes insufficient and the *Load* will be transferred to the *Utility Bypass* source.

Parallel units for redundancy
The nominal power rating of the **n+1 out of n** redundant paralleled modules must be equal to or greater than the required *Load* power.
The *Load* will be equally shared by the **n units** connected on the output bus.
Should one of the **n** paralleled units trip Off-line, the remaining (n+1) modules will supply the load, maintaining conditioned power to the critical load.
From this results higher reliability and security for the *Load* plus a higher *MTBF (Mean Time Between Failures)*.

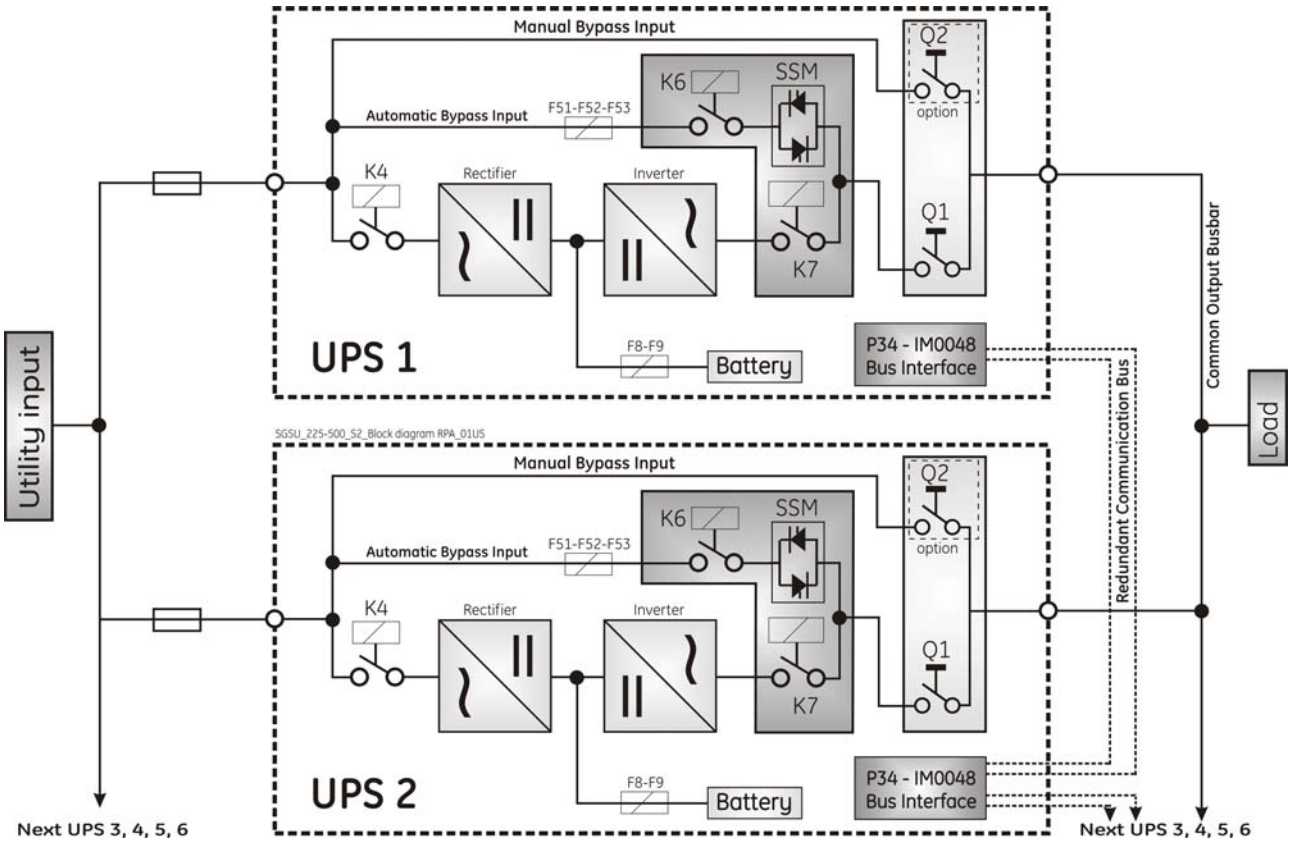


Fig. 4.3.1-1 Block diagram parallel system operation

4.3.2 Features of RPA parallel system

The ***SG Series 400 & 500 Parallel System*** is designed to provide a complete ***Redundant Parallel Architecture***, and is free from common equipment.
Not only the ***Inverters*** are redundant, but also the ***Bypass*** functions are designed with redundant modular concept.

When one UPS needs maintenance or service, the *Load* is powered by the other units supplying the *Load* bus.

The redundant communication bus to which all units are connected keeps each unit informed about the status of all the other units.

The ***control panel*** located on each unit allows controlling and monitoring the status of this unit.

4.3.3 System control

A **high-speed redundant, serial communication bus** guarantees the exchange of data and thus the communication between the CPU's of each unit.

Each module controls it's own function and operational status and communicates with all other modules, in order to act or react if necessary, adapting it to the new conditions.

4.3.4 Synchronization

All units are identical, but one unit is arbitrarily selected as the reference and all the other units synchronize to this unit, which in turn, synchronizes to the *Utility Bypass* voltage, as long as the later is within tolerances.

In case of reference failure, another unit in the parallel system is automatically chosen to take over the reference role.

The *Bypass Input* for all the units of the parallel system must be supplied from the same AC source (no phase shift allowed between them).

4.3.5 Load sharing

On each unit of the parallel system, *Inverter Output Voltage* and *Current* are measured and applied to a *Load* sharing bus.

An eventual difference between the units is therefore automatically equalized.

NOTE !

It is strongly recommended that no transformers, automatic circuit breakers or fuses should be inserted between the unit's output and the *Load* common bus bars.

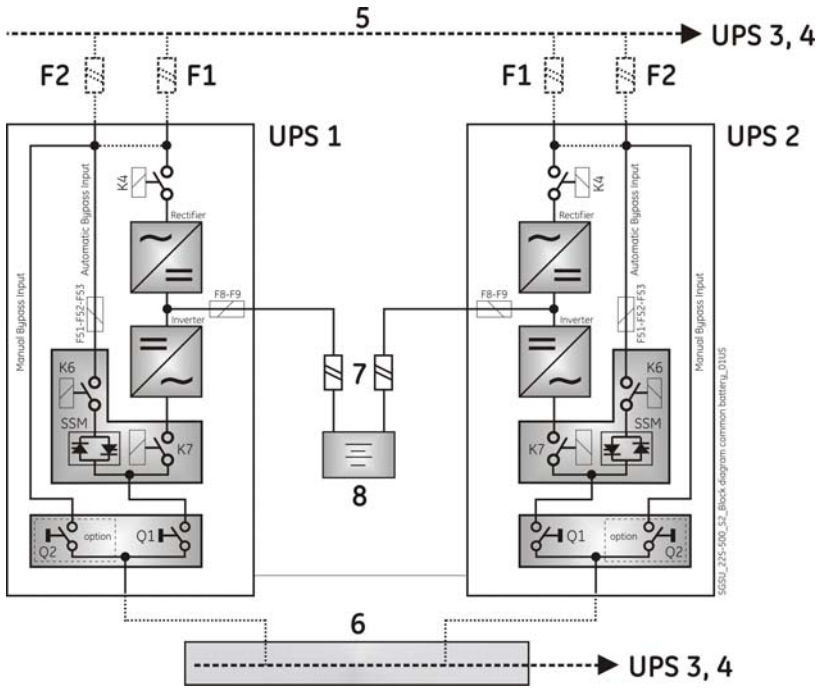
However, it is recommended that a disconnect or isolation switch be inserted.

4.4 RECTIFIERS PARALLELED ON THE SAME BATTERY

NOTE !

A parallel system with a *Common Battery* for two or more *Rectifiers*, requires a particular installation and adequate setting of some parameters, (accessible only through password), and can therefore only be done by a qualified engineer from GE.

Usually each *Rectifier-Inverter Unit* runs with its own *Battery*.
In case of parallel units are running with a *Common Battery* (max. 4 UPS - see *Fig 4.4-1*), the sharing circuit between individual *Rectifier* is integrated in the communication bus of the system in order to assure an equal sharing of the *Rectifiers* output currents.



1 – Rectifier
2 – Inverter
3 – Automatic Bypass
4 – Manual Bypass
5 – Utility Power
6 – Load Bus Bar
7 – External Battery Fuse
8 – Battery

Fig. 4.4-1 Diagram RPA system with Rectifiers on Common Battery

Pay attention to the following recommendations:

- The units delivered for this functioning mode needs a special parameters setting, so they must be prepared in advance before the installation.
- The installation must be performed only with the UPS system must be completely shut down.
- The AC *Rectifiers* input power (5) must be the same, with clockwise phase rotation for each unit.
- Each *Rectifier* must be set for the same floating DC voltage and the same *Battery* current limitation.
- It is mandatory to install the fuses / MCCB (7) on each line connecting the *Rectifiers* to the common *Battery* for maintenance / safety reasons.
- In case one must be powered down for maintenance, switch-OFF the concerned unit before open the DC fuses / MCCB on the *Battery* line (7).
- It is mandatory to connect an external NO free contact *"Battery Fuses"* to the UPS and to enable the function by setting the parameter (see *Section 4.1* of the *"Installation Guide")*.
- If an emergency generator set supply the UPS, and the free contact *"Generator ON"* is connected to the Customer interface, connect a separate NO free contact on each parallel unit.
- The parameters enabling the *Battery test*, both manual and automatic, must be set in the same mode on all the units having the *Rectifiers* on *Common Battery*.
- Do not connect the temperature sensor for automatic *battery floating voltage* compensation.
- Do not enable the function *Boost charge* (parameter 87).

4.5 RECYCLING AT THE END OF SERVICE LIFE

NOTE !

This product has been designed to respect the environment, using materials and components respecting eco-design rules.

It does not contain CFCs (chlorofluorocarbons) or HCFCs (hydrochlorofluorocarbons).

RECYCLING AT THE END OF SERVICE LIFE !

GE, in compliance with environment protection recommends to the *User* that the UPS equipment, at the end of its service life, must be recovered conforming to the local applicable regulations.

WARNING !

Leads contained in the batteries is a dangerous substance for the environment, therefore it must be correctly recycled by specialized companies!

5 CONTROL PANEL

5.1 CONTROL PANEL

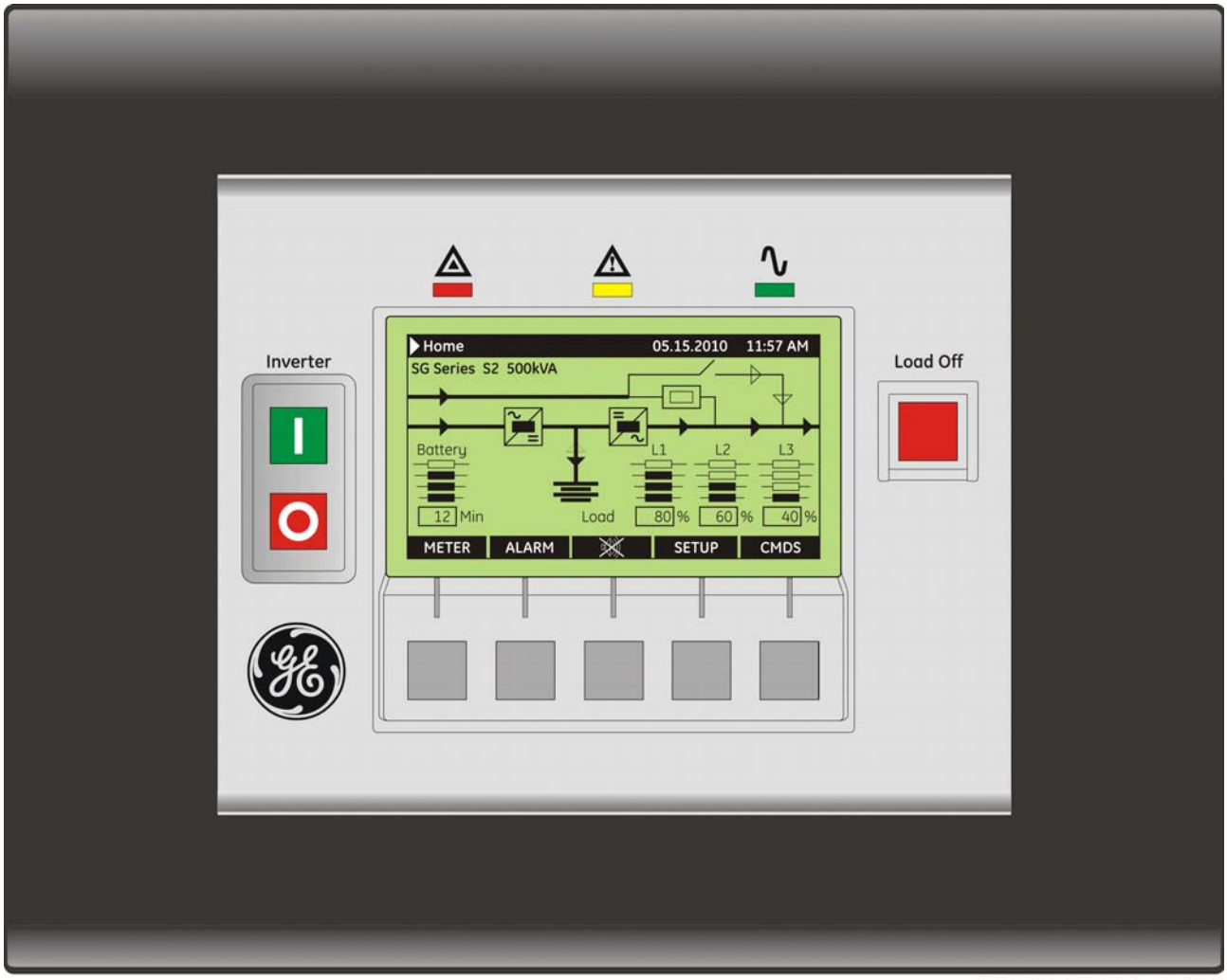


Fig. 5.1-1 Control panel

The control panel, positioned on the UPS front door, acts as the UPS user interface and comprises of the following elements:

- *Back lit Graphic Display (LCD) with the following characteristics:*
  - *Multilanguage communication interface:*
    English, German, Italian, Spanish, French, Finnish, Polish, Portuguese, Czech, Slovakian, Chinese, Swedish, Russian and Dutch;
  - *Synoptic Diagram indicating UPS status.*
- *Command pushbuttons and parameters setting.*
- *UPS status control LED.*

5.2 TABLE OF FUNCTIONS AND INDICATIONS ON CONTROL PANEL

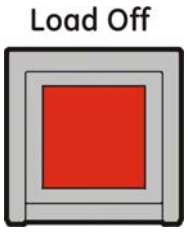
Key to switch the Inverter ON (I)

> **NOTE !**
> **When *eBoost™ Operation Mode* is enabled, control of Inverter status and selection of the feed path is done autonomously by the UPS control logic.**
> **Therefore, Inverter ON / Inverter OFF commands are disabled when *eBoost™ Operation Mode* is enabled.**

Key for Inverter shutdown (O)

Press the key to transfers the *Load to Utility*.
Keep pressed for 5 seconds to shutdown the *Inverter*.
This key is also used as the *EPO (Emergency Power Off)* reset.

> **NOTE !**
> **Inverter OFF command is disabled when *eBoost™ Operation Mode* is enabled.**



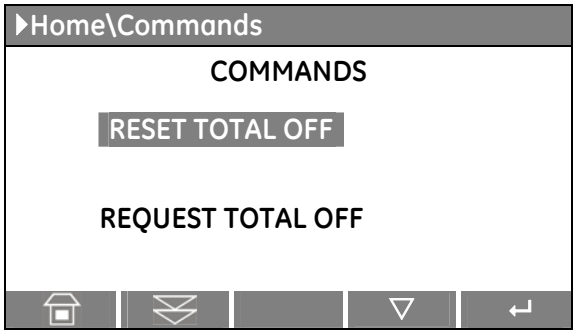
Key "Load Off"

The key *"Load Off"* is protected by a transparent cover.
By pressing it, you immediately separate the UPS from the *Load*.

It is possible to activate the command *"Load Off"* using the following links:
COMMANDS / ***TOTAL OFF REQUEST***. See *Section 6.5*.

To reset *"Load Off"*

Restore the command *"Load Off"* by entering the screen:
COMMANDS / ***RESET TOTAL OFF***



RPA
Redundant Parallel Architecture

For Parallel System:

*If "**Load Off**" is pressed on one unit connected to the parallel bus (switch Q1 closed), all the units are separated from the load.*
The "Load Off" reset must be done only on one unit connected to the parallel bus (switch Q1 closed).

> **NOTE !**
> **Special care must be taken in using this command, in order to avoid accidental *load* disconnection.**

LED Stop Operation (red color)

It warns about the imminent inverter stop (default parameter = 3 min.) and the consequent load shutdown as result of:

- The *battery* is fully discharged and the *load* cannot be transferred on *utility*.
- Overtemperature or overload condition (>125%) and the *load* cannot be transferred on *utility*.

LED Alarm (yellow color)

It blinks when one or more alarm is activated. The internal *buzzer* is *ON*.

The *LED* remains lighted (with the alarm condition still present) and the buzzer stops when the key *"MUTE"* is pressed.

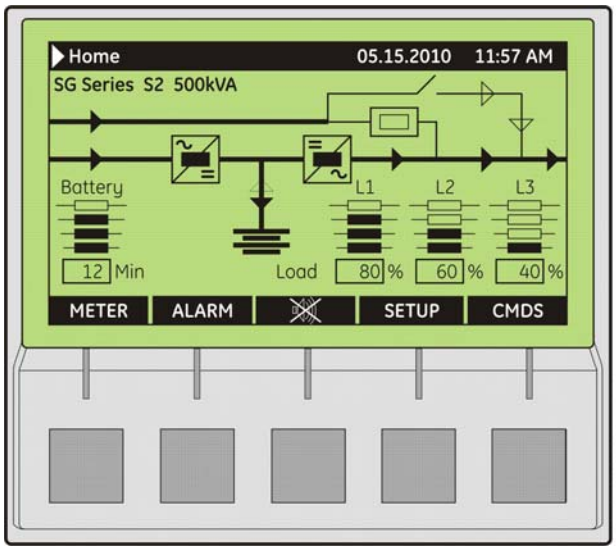
The *LED* is also lit when the *load* is not protected by UPS or in case *Q1 is open*.

LED Operation (green color)

When lit, indicates that the UPS is functioning correctly and the load is system protected *(Load* supplied from *inverter)*.

When blinking, indicates that a regular maintenance service is needed *(SERVICE REQUIRED)*.
May be reset by a service technician only.
See *Section 9 – Maintenance – Service check*.

The *LED* is *OFF* when the output switch *Q1* is open, indicating that the *Inverter* is in *service mode*, not supplying the *load*.



User LCD Interface

The user interface consists of *a Back lit Graphic Display (LCD)* having:

- Synoptic Diagram indicating UPS status.
- UPS operating, AC and DC metering information.
- History of events (alarms and messages).
- Functionality can be programmed to meet customer needs by changing parameters.
- Operation commands of the UPS.

6 LCD SCREEN

6.1 HOME SCREEN

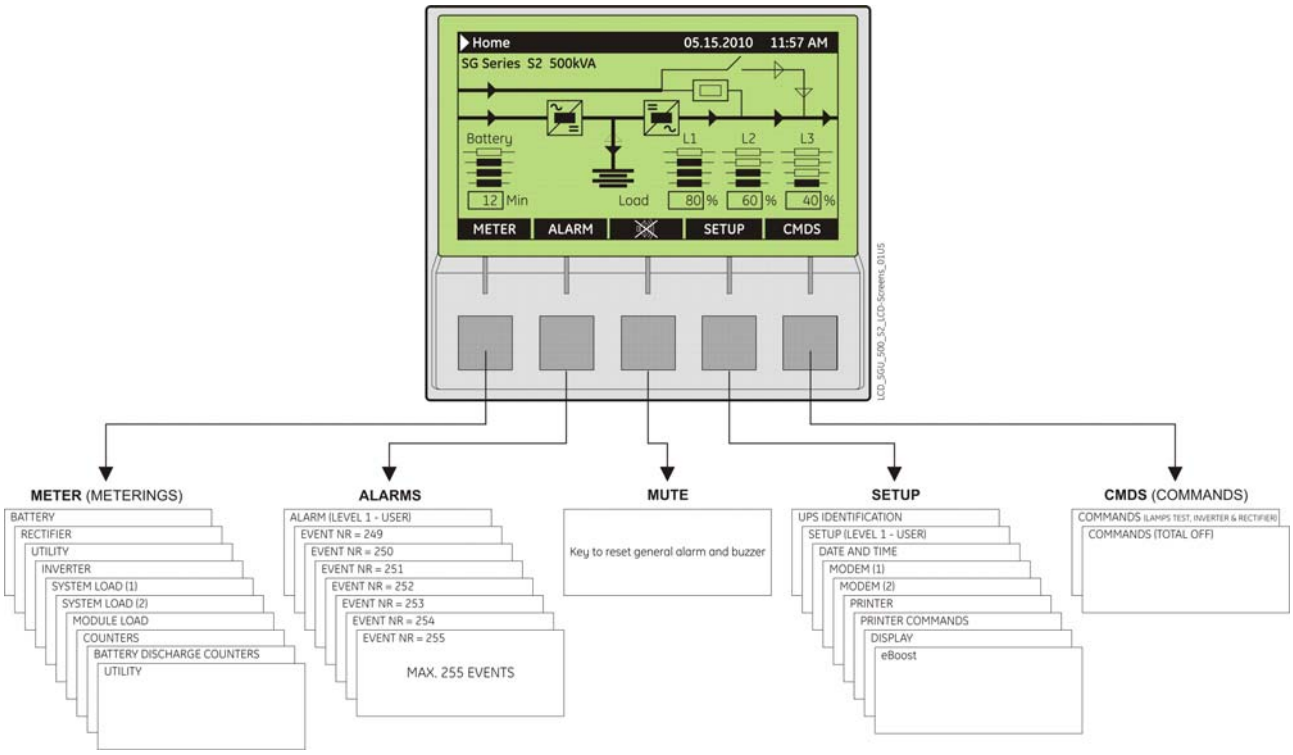


Fig. 6.1-1 LCD display

The buttons perform the following functions:

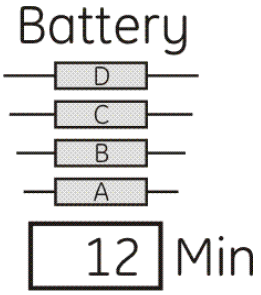
METER	METERING	View electric parameters values and statistics of use. See *Section 6.2*.
ALARM	ALARMS	Shows in chronological order, all the events occurred (alarms, messages, commands, handling, etc.). See *Section 6.3*.
	MUTE	Key to reset general alarm and buzzer.
SETUP	SETUP	Allows the user to customize some UPS functions to specific requirements and to view UPS identification data. See *Section 6.4*.
CMDS	COMMANDS	Allows the user to execute UPS operation commands. See *Section 6.5*.

The *LCD screen*, after 5 minutes of inactivity, shuts down the backlight.
To reactivate it, it is sufficient to press any pushbuttons.

If the keypad remains inactive for 5 minutes or longer, during the viewing of a screen such as *MEASURES*, *ALARMS*, *SETUP* or *COMMANDS*, the *LCD screen* returns automatically to the main screen.

It is possible to view any pushbutton functional description by pushing the button for more than 3 seconds.

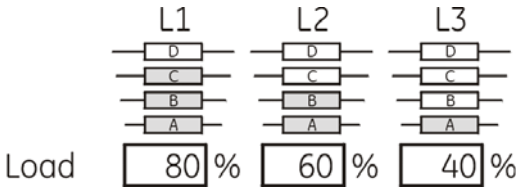
Pushing the pushbuttons *"METER" (1st button)* and *"ALARM" (2nd button)* together automatically sets the *LCD* communication for "ENGLISH".



Battery level LED

All lightning lit *LED* open indicate a battery autonomy of 100%.

LED A	Fixed:	indicates a battery autonomy between 6% and 25%.
	Blinking:	indicates a battery autonomy ≤5%.
LED A, B	Indicate a battery autonomy between 26% and 50%.	
LED A, B, C	Indicate a battery autonomy between 51% and 99%.	
Min:	Battery autonomy time in minutes estimates with actual load.	



Load level LED

All *LED Off* indicate a load status at ≤25%.

LED A	Indicates a load level between 26% and 50%.
LED A, B	Indicate a load level between 51% and 75%.
LED A, B, C	Indicate a load level between 76% and 100%.
LED A, B, C, D	Indicate a load level between 101% and 124%.
LED D blinking	Indicates a load level ≥125%.

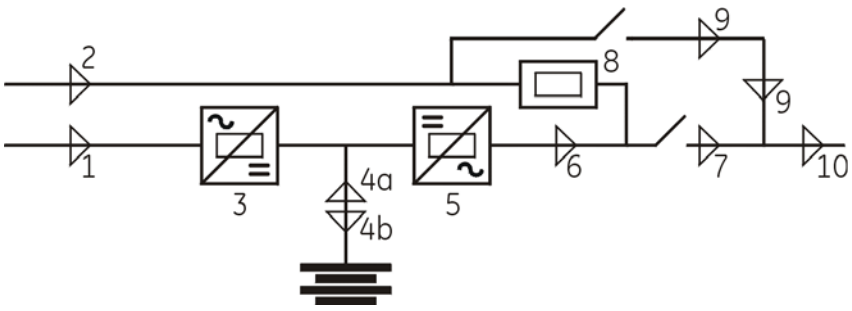


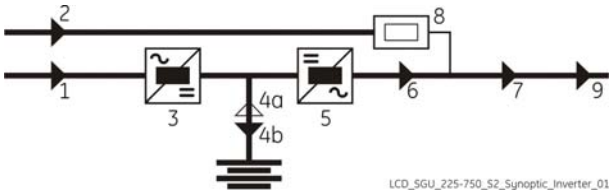
Fig. 6.1-2 LEDs on Synoptic Diagram

LEDs on Synoptic Diagram

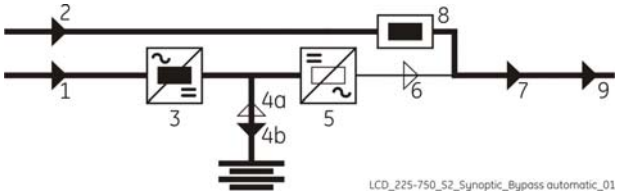
LED 1	Utility Rectifier OK
LED 2	Utility Bypass OK
LED 3	Rectifier ON
LED 4a	Discharging Battery
LED 4b	Charging Battery
LED 5	Inverter available
LED 6	Inverter ON
LED 7	Q1 closed (load on UPS)
LED 8	Automatic Bypass ON
LED 9	Manual Bypass Q2 ON
LED 10	Load on UPS

Examples of typical scenarios in the Synoptic Diagram:

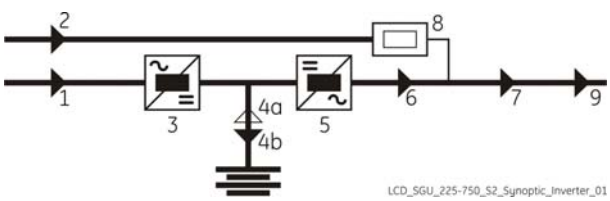
Load supplied by Inverter



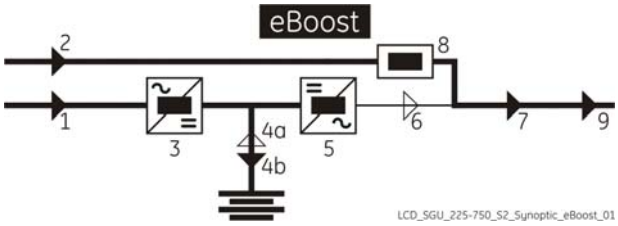
Load supplied by Automatic Bypass



Load supplied by Battery



Load supplied by eBoost™ Operation Mode (option)



When the *Load* is supplied by *eBoost™ Operation Mode the "eBoost"* text is displayed.

6.2 METERING

The *METERING mode* is entered any time the "**METER**" button is pressed.
The *LCD screen* will indicate a series of screenshots showing the measures of all electric parameters like AC, DC and various statistics.

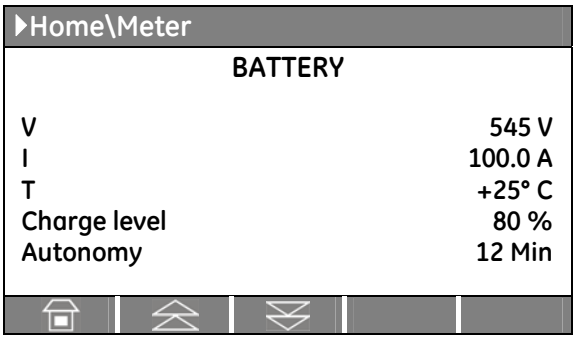
In this mode the buttons perform the following functions:

Return to HOME screen.

Scrolls backward to the previous screen.

Scrolls forward to the next screen.

It is possible to view any pushbutton functional description by pushing the button for more than 3 seconds.



Battery data screen

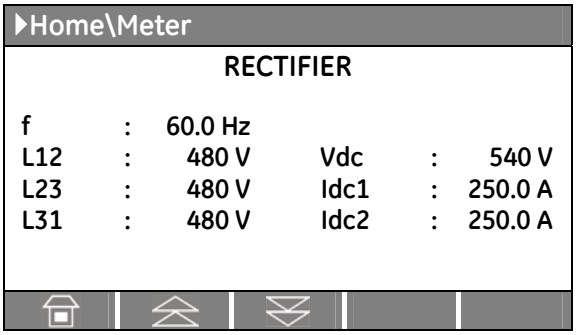
V The battery voltage.

I The battery current (negative values correspond to the discharge of the battery).

T The temperature of the battery ("SENSOR DISABLE" indicates sensor disabled).

Charge level The battery charge level.

Autonomy The estimated backup time with the present load.



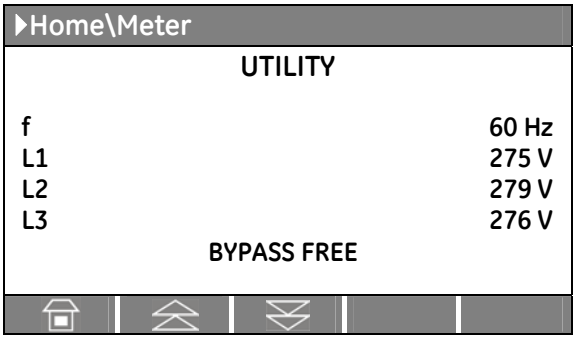
Rectifier utility data screen

f The input frequency of the rectifier.

L12
L23 The voltage levels between the three phases (line-to-line).
L31

Vdc Rectifier voltage output.

Idc1 Output current 1st *Rectifier bridge*.
Idc2 Output current 2nd *Rectifier bridge*.

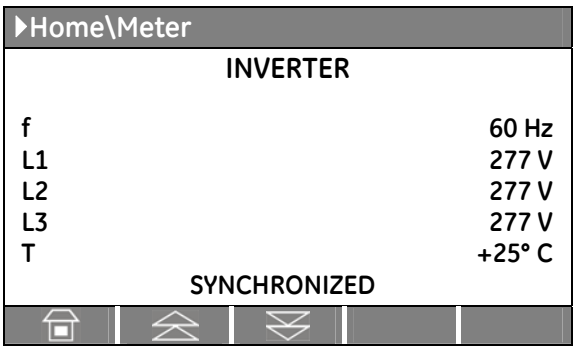


Bypass utility data screen

f The frequency of the utility.

L1
L2 3-phase utility voltage PHASE /NEUTRAL.
L3

Bypass Bypass status: FREE / LOCKED.



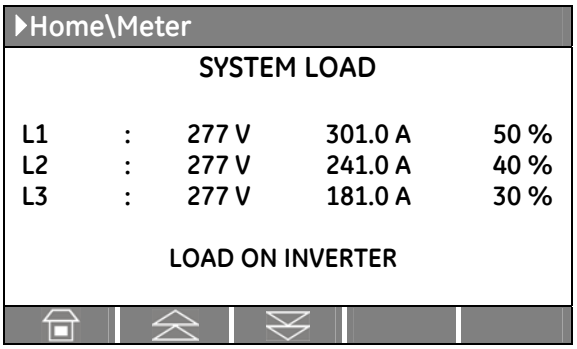
Inverter data screen

f The output frequency of the *Inverter*.

L1
L2 3-phase output voltage PHASE/NEUTRAL.
L3

T The temperature of the inverter bridge.

The synchronization status of the inverter with respect to utility (SYNCHRONIZED / NOT SYNCHRONIZED).



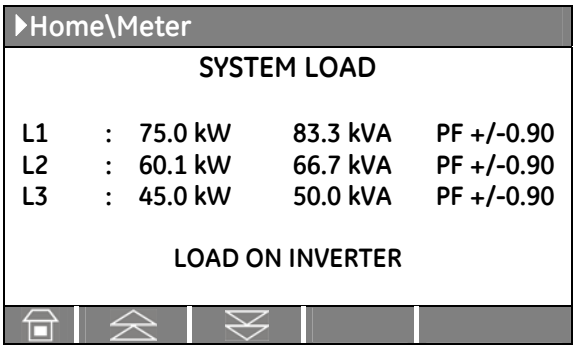
Load on phases screen 1

... V Output voltage PHASE/NEUTRAL for each phase.

... A The output current as RMS values (for RPA: total value of *Parallel System*).

... % The output load as percentage (for RPA: with respect to the rated power of *Parallel System*).

The source of the power supplied to the *load*:
- DETOUR ON (Q2 close)
- Q1 OPEN
- LOAD OFF
- ON BATTERY
- LOAD ON INVERTER
- LOAD ON BYPASS
- LOAD ON BYPASS (eBoost)



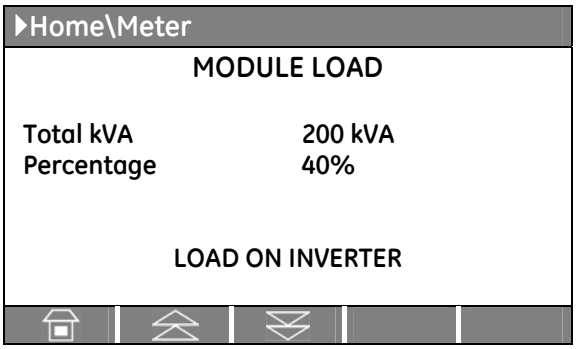
Load on phases screen 2

... kW The load active power (kW) (for RPA: total value of *Parallel System*).

... kVA The load apparent power (kVA) (for RPA: total value of *Parallel System*).

... PF The load power factor:
+ for inductive loads (lagging power factor).
- for capacitive loads (leading power factor).

The source of the power supplied to the *load*:
- DETOUR ON (Q2 close)
- Q1 OPEN
- LOAD OFF
- ON BATTERY
- LOAD ON INVERTER
- LOAD ON BYPASS
- LOAD ON BYPASS (eBoost)

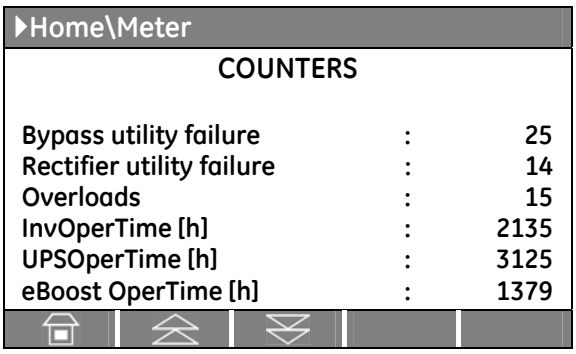


Module load screen

Total kVA
The load level in kVA (for RPA: only this unit).

Percentage
The load level as a percentage of the nominal rated load (for RPA: only this unit).

The source of the power supplied to the *load*:
- DETOUR ON (Q2 close)
- Q1 OPEN
- LOAD OFF
- ON BATTERY
- LOAD ON INVERTER
- LOAD ON BYPASS
- LOAD ON BYPASS (eBoost)



Statistics screen

The total number of bypass utility faults (bypass utility out of tolerance).

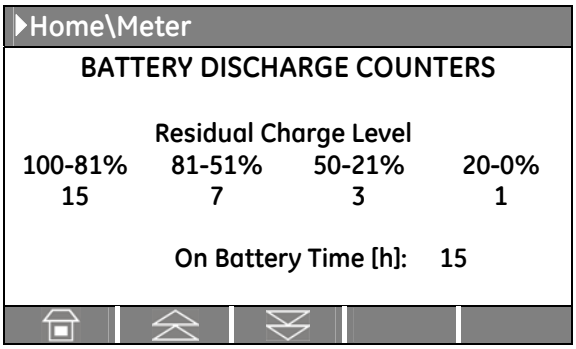
The total number of rectifier utility faults (rectifier utility out of tolerance).

The total number of detected output overloads.

The total operating time for the *Inverter* (in hours).

The total operating time for the UPS (in hours).

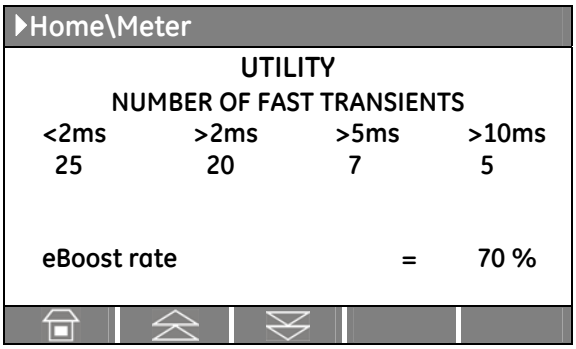
The total operating time for the UPS in *eBoost™ Operation Mode* (in hours).
This counter is displayed only when *eBoost™ Operation Mode* is available (option).



Statistics battery discharge screen

Residual Charge Level
The number of discharges combined with the percentage of the available residual battery capacity at the time utility power is restored.

On Battery Time [h]
The total operating time of the UPS on battery (in hours).



eBoost™ Operation Mode statistic screen

This screen is displayed only when *eBoost™ Operation Mode* is available.

The number of fast transients occurred on the *bypass utility* on the last seven days.

The statistic evaluation in % (100= good; 0= bad) of the *utility*, for the *eBoost™ Operation Mode*.

6.3 ALARMS

The *ALARMS mode* is entered any time the "**ALARM**" button is pressed.

The *LCD* will display a series of screens corresponding to the last **255 events**, two events per screen (LEVEL 1 USER).

In this mode the buttons perform the following functions:


Return to HOME screen.


Scrolls backward to the previous screen.


Scrolls forward to the next screen.

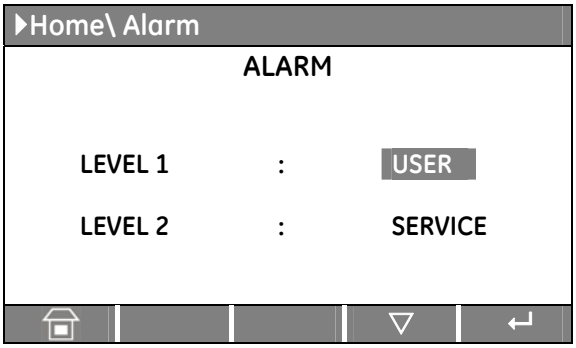

Move forward to the following event.


Move back to the following previous event.


Confirm the selection made.

It is possible to view any pushbutton functional description by pushing the button for more than 3 seconds.

The events displayed are the standard *GE* events as described in the ***Section 6.3.1 - EVENTS (Alarms and Messages)***.



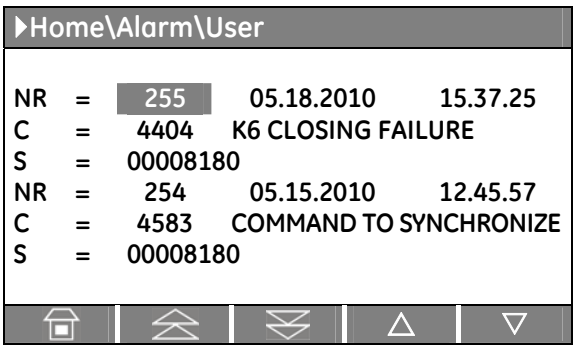
Alarms screen

LEVEL 1 USER

Chronologically view 2 events per screenshot.

LEVEL 2 SERVICE

Chronologically view 5 events per screenshot with service related info.



Screen of user alarms

NR Number chronologically assigned to an event (Nr. 255 is the more recent, Nr. 1 is the first).
Date and exact hour of the moment when the event occurred.

C Number of standard GE code of the event and an explicit text describing the event in the selected languages.

S Status code of the UPS.

6.3.1 Events (alarms and messages)

Each of the following listed events, alarm or message, can be displayed on the *LCD screen*, on a *PC* with the software *"GE Data Protection"* installed or with the monitoring system *"GE Power Diagnostic"*.

Alarms and *Messages* are differently specified because the ***alarms*** are indicating an abnormal functioning of the UPS (which are additionally signaled with the ***LED Alarm*** and acoustically with the ***buzzer***), while the **messages** indicate the various states of operation of the UPS (stored in the events list, but not activating the *LED alarm* and the *acoustical alarm*).

6.3.2 Alarms list

Code	*Alarms*	*Meaning*
4000	SETUP VALUES LOST	Parameters are lost and have been replaced with default values. Call nearest *Service Center* for intervention.
4001	REGULATION BOARD FAILURE	A blocked *DSP* on the *Control board* causes this alarm, and consequently the shutdown of *Rectifier* and *Inverter* and the opening of *K3*.
4004	UPS FAILURE ON PARALLEL SYSTEM	The master unit detected the slave unit missing on the communication bus even though switch *Q1* is still closed.
4006	BUS JA CRC FAILURE	The parallel communication bus system is subject to high errors rate on channel *JA*.
4007	BUS JB CRC FAILURE	The parallel communication bus system is subject to high errors rate on channel *JB*.
4008	BUS JA FAILURE	There is an interruption in the channel *JA* of the parallel communication bus system.
4009	BUS JB FAILURE	There is an interruption in the channel *JB* of the parallel communication bus system.
4010	CONNECTIVITY BUS FAILURE	The connectivity communication bus is faulty or interrupted.
4100	RECTIFIER FUSES FAILURE	The u-switch mounted on the *Rectifier Input Fuses* indicates a blown fuse, and consequently shut down. Clearance of this condition allows you to restart the *Rectifier*.
4102	K4 CLOSING FAILURE	*K4* not closed despite a closing command being issued. Signaled by auxiliary contact. *Rectifier* cannot start.
4103	K4 OPENING FAILURE	*K4* not open despite an opening command being issued. Signaled by auxiliary contact. *Utility* remains connected to *Rectifier Bridge*.
4104	BATTERY FUSES FAILURE	This function, when enabled on input programmable relays (password required), warns the user about the external *Battery Fuses* failure or *MCCB* opening, signaled by *NO free contact*.
4105	RECTIFIER OVERTEMPERATURE	Temperature sensor indicates an over temperature on the *Rectifier Bridge*. Only alarm is given. The *Rectifier*, when in Off state, cannot start as long as this condition persists.

Code	*Alarms*	*Meaning*
4106	RECTIFIER TRANSFORMER OVERTEMPERATURE	The temperature sensor inside the input transformer winding indicates over temperature. Only the alarm is given. The *Rectifier*, when in Off state, cannot start as long as this condition persists.
4110	RECTIFIER UTILITY OUT OF TOLERANCE	*Rectifier Input Utility* is out of tolerance (voltage, frequency or phase).
4115	LOW BATTERY VOLTAGE	The *Battery* has been discharged and reached *"stop operation"* time-out (default 3 minutes), and the *Inverter* will be shut down. It will restart automatically only when the *Battery* has recharged enough for a minimum runtime.
4116	HIGH BATTERY VOLTAGE	Dangerous high *DC Voltage* caused *Inverter* shutdown. *Inverter* restarts automatically after *Battery* returns to floating voltage.
4117	BATTERY EARTH FAULT	A leakage current to earth has been detected on the *DC circuit*.
4118	BATTERY FAULT	During *battery test* the voltage falls under the critical level (depending setting parameters). *Battery test* is stopped.
4121	HIGH DC RIPPLE	There is a high voltage ripple on the *DC Bus*. *Rectifier* might be working in current limiting mode. Decrease the load to stabilize *DC Bus*.
4130	TURN ON RECT. OR SHUTDOWN UPS	*Rectifier* and *Inverter* are OFF. The *DC Power Supply* is discharging the *Battery*. *Rectifier* must be restarted or *Battery* must be disconnected in order to avoid damage.
4140	RECTIFIER CONTROL FAILURE	*Rectifier Voltage* hasn't reached the set value (probably fault on regulation loop). *LED Rectifier* on control panel is blinking.
4165	INPUT FILTER FAILURE	An unbalancing on the three-phase current absorbed by the input harmonic filters 5th or 11th is detected causing the opening of the contactors C50 or C110. The reset alarm can be done only from Service Center.
4301	INVERTER FUSES FAILURE	*Inverter Output Fuses* blown (*F5*, *F6* and *F7*). *Inverter* can be started manually after replacement of the fuses.
4304	K7 CLOSING FAILURE	*K7* not closed despite a closing command being issued. Signaled by auxiliary contact. *Load* will be supplied by *Utility*.
4305	K7 OPENING FAILURE	*K7* not open despite an opening command being issued. Signaled by auxiliary contact. *Load* will be supplied by *Utility*.
4307	INVERTER TRANSFORMER OVERTEMPERATURE	The temperature sensor of the *Inverter Transformer* indicates over temperature. Elapsed *"stop operation"* time, *Inverter* shutdown. With *Utility OK*, *Load* is transferred on *Utility*.
4308	DC FUSES FAILURE	Blown input DC fuse(s) *F1* of the *Inverter*. *Inverter* cannot be started as long as present.

Code	*Alarms*	*Meaning*
4309	DRIVER FAILURE	An abnormal condition has been detected on one or more power modules of the *Inverter* (temperature or over current). *Inverter* shutdown and cannot be started as long as the alarm is present.
4312	INV. VOLTAGE OUT OF TOLERANCE	*Inverter Output Voltage* is out of the tolerances (± 10%). *Inverter* is switched OFF.
4320	ISMAX DETECTION	Detection of *Inverter Bridge* (Is) current limit causing the *Inverter OFF* and possible automatic restart. After 3 times the *Inverter* switches-Off, and it can be restarted manually.
4321	HIGH CURRENT SHARING	A high exchange current value is detected between the UPS of the parallel system.
4340	INVERTER CONTROL FAILURE	The *"Slave"* oscillator is not in synchronized with the Master; thus causing the shutdown of it's *Inverter*. If after a restart the condition remains, the *LED* inside the *Inverter* symbol on the panel will not light up, indicating that this *Inverter* cannot supply the *Load* anymore.
4400	BYPASS FUSE FAILURE	Either one or all the fuses in *bypass* line have blown.
4404	K6 CLOSING FAILURE	*K6* open despite a closing command being issued. Signaled by auxiliary contact. The *Load* cannot be supplied by *Automatic Bypass*.
4405	K6 OPENING FAILURE	*K6* closed despite an opening command being issued. Signaled by auxiliary contact.
4406	SSM FAILURE	A faulty current has been detected in the *static-switch* causing the opening of the contactor *K6* for 10 seconds. After 3 times *K6* remains definitively open. The alarm reset can be done only from *Service Center*.
4407	SSM OVERTEMPERATURE	Temperature sensor indicates an over temperature on the *Static-Switch*.
4410	BYPASS UTILITY OUT OF TOLERANCE	The *Utility Bypass Voltage* is out of the tolerances (± 10%). *K6* opens, synchronization with *Utility* is inhibited and transfer to *Utility* is blocked.
4520	NO INVERTER POWER	The *Load* supplied by *Utility* exceeds the *Inverter* power. The *Load* remains supplied by *Utility* until the alarm stays ON.
4522	FAN FAILURE	A malfunction on the UPS ventilation system was detected. No change for UPS operation. Call immediately *Service Center* for intervention.
4530	LOAD LOCKED ON UTILITY	*Load* is locked on *Utility* because 3 transfers on *Utility* have been detected in a short time (default 30 seconds). The transfer will be free after a time defined in parameter (default 30 seconds).
4531	LOAD ON UTILITY BY ERROR DETECTOR	*Load* is transferred to *Utility* because the error detector detected a disturbance on the output voltage.
4563	EMERGENCY OFF ACTIVATED	Alarm after detection of an *EPO* from an external safety device connected on *Customer Interface Board*. Consequently *K4*, *K6*, *K7* open, *Rectifier*, *Inverter* and *SSM* are switched Off.

Code	*Alarms*	*Meaning*
4570	OVERLOAD	The UPS-System is in an overload condition >125% on *Inverter*, or >150% on *Utility*. With *Utility* unavailable, a sequence of *"stop operation"* starts. Time out depends on *Load* quantity.
4571	OVERLOAD: LOAD ON UTILITY	With *Utility Bypass* supply available and load >115%, the *Load* is transferred on *Utility*. *Load* will be transferred again automatically on *Inverter* when *Load* <100%.
4581	INVERTER AND UTILITY NOT SYNCHRONIZED	The voltages of *Utility* and *Inverter* are not synchronized, which causes the opening of *K6*.
4608	ECO CONFIG FAILURE	The propagation of the *eBoost / IEMi* configuration to other units in a *Parallel System* failed.
4697	BATTERY OVERTEMPERATURE	Detection of *Battery* over temperature condition. Can be deactivated by *Service Center*.
4698	BATTERY POWER INSUFFICIENT	In case of *Utility Failure*, with the actual *Load*, the run time would be below stop operation time (default 3 minutes).
4700	DC LOW	Battery voltage is at the lowest limit. Will stay Off *Inverter* until the *battery voltage* reaches the value in parameter.
4701	POWER SUPPLY BOARD FAILURE	Failure detection on the +24V derived from the *DC-link voltage*.
4900	LOAD LOCKED ON INVERTER	The *Load* is locked on *Inverter* after 3 *Load* transfers within 30 seconds. After time out (default 30 seconds) *Bypass* will be free.
4955	OVERTEMPERATURE	An over-temperature condition has been detected on *Inverter*. Elapsed *"stop operation"* time, *Inverter* shutdown. With *Utility OK*, *Load* is transferred on *Utility*.
4998	LOAD OFF DUE TO EXTENTED OVERLOAD	*Load Off* after time-out of *"stop operation"* for overload on *Inverter* or *Bypass* (time depending on the % of overload).
4999	LOAD OFF DUE TO LOW BATT. OR TEMP.	*Load Off* after time-out of *"stop operation"* with missing *Utility* due to *Battery low voltage* or *over-temperature* condition.

6.3.3 Messages list

Code	*Message*	*Meaning*
4002	WATCHDOG RESET	The microprocessor has detected an incorrect operation: Transfers the *Load* on *Utility* and performs a program reset. The *Inverter* will restart automatically and will supply the *Load*.
4108	Q4 OPEN	The auxiliary contact indicates that the *input rectifier switch Q4* has been opened.
4108	Q4 CLOSED	The auxiliary contact indicates that the *input rectifier switch Q4* has been closed.
4111	RECTIFIER UTILITY OK	*Rectifier Input Utility* is again within the admitted tolerance (voltage, frequency and phase).
4119	BATTERY TEST STARTED	Start of *Manual* or *Automatic Battery Test*.
4120	BATTERY TEST STOPPED	End of *Manual* or *Automatic Battery Test*.
4122	MANUAL BOOST CHARGE ON	Start of *Manual Boost charge (only for lead open wet batteries)*.
4123	AUTOMATIC BOOST CHARGE ON	Start of *Automatic Boost charge (only for lead open wet batteries)*.
4124	BOOST CHARGE OFF	End of *Manual* or *Automatic Boost charge (only for lead open wet batteries)*.
4161	RECTIFIER ON	*Rectifier* started.
4162	RECTIFIER OFF	*Rectifier* shutdown.
4163	GENERATOR ON	*Customer Interface Board* (X1 - 11, 22) received a *Gen-set ON* signal. Operating mode depend on setting of Parameters.
4164	GENERATOR OFF	*Customer Interface Board* (X1 - 11, 22) received a *Gen-set OFF* signal. Function *Bypass* enabled depends on setting of parameter.
4302	INVERTER CANNOT BE TURNED ON	*Inverter* cannot be switched on because one of the following conditions is still present: *- Over Temperature* *- Low Battery Voltage* *- Inverter Fuses* *- Overload* *- K7 opening Failure* *- High Battery Voltage* *- DC Low* *- EPO*
4303	INVERTER CANNOT BE TURNED OFF	*Inverter* cannot be switched OFF, because the *Load* cannot be switched to *Utility* (voltage out of tolerance, not synchrony, BP blocked).
4361	INVERTER ON	The command to start the *Inverter* has been activated on the control panel.
4362	INVERTER OFF	The command to switch OFF the *Inverter* has been activated by the control panel or automatically for alarm presence.
4411	BYPASS UTILITY OK	*Bypass Input Utility* is again within tolerance (voltage, frequency and phase).
4500	COMMAND LOAD OFF	Disconnection of the *Load* by opening *K6* and *K7* for: *EPO / Load Off / Overload / Stop Operation*.
4521	NO BYPASS POWER	With the *Load* supplied by *Automatic Bypass*, a *Utility Failure* or *K6* opening occurred.

Code	*Message*	*Meaning*
4534	MULTIPLE LOAD TRANSFER	2 transfers *Inverter- Utility* have been detected in a short time, (default 30 seconds).
4535	BYPASS LOCKED	*Bypass* is not available. *Contactor K6* is open, *SSM* deactivated.
4536	BYPASS FREE	*Bypass* is enabled. *Contactor K6* is closed.
4561	LOAD OFF	The *"Load Off"* key on the UPS Control Panel has been pressed, with the output circuit switch *Q1* closed.
4562	DETOUR ON	The *auxiliary contact* indicates that *External Maintenance Bypass* has been closed.
4564	DETOUR OFF	The *auxiliary contact* indicates that *External Maintenance Bypass* was opened.
4567	COMMAND LOAD ON UTILITY	The control unit received a command to transfer the *Load* on *Utility*.
4568	COMMAND LOAD ON INVERTER	The control unit received a command to transfer the *Load* on *Inverter*.
4572	NO MORE OVERLOAD	End of the overload condition detected with alarm 4570.
4580	INVERTER AND UTILITY SYNCHRONIZED	The voltages of *Inverter* and *Utility Bypass* are synchronized.
4582	COMMAND NOT TO SYNCHRONIZE	Command not to synchronize with *Utility*.
4583	COMMAND TO SYNCHRONIZE	Command to synchronize with *Utility*.
4600	COMMAND UPS ON	The *eBoost™ Operation Mode* has been disabled or the programmed time is expired. The UPS returns to *VFI Operation Mode* supplying the *Load* normally by *Inverter*.
4601	COMMAND UPS STANDBY	The *eBoost™ Operation Mode* is enabled, and according to the time program the UPS will run in *eBoost™ Operation Mode*, supplying the *Load* normally by *Utility*.
4602	Q1 OPEN	The auxiliary contact indicates that the output switch *Q1* has been opened.
4603	Q1 CLOSED	The auxiliary contact indicates that the output switch *Q1* has been closed.
4604	COMMAND IEMi ON	The *IEMi Operation Mode* function is enabled, and according to the time program the UPS system will run in *IEMi mode*. The UPS returns to *VFI Operation Mode* supplying the *Load* normally by *Inverter*.
4605	COMMAND IEMi OFF	The *IEMi Operation Mode* has been disabled or the programmed time is expired.
4606	eBoost ACTIVATION ALLOWED	*eBoost/IEMi control* signal has been cleared on the *Customer Interface Board* (X1 - 11, 22). Operating mode depends on scheduled activation of the functions.
4607	eBoost ACTIVATION INHIBITED	*Customer Interface Board* (X1 - 11, 22) received an *eBoost/IEMi control* signal. *eBoost™ Operation Mode* and *IEMi Operation Mode* will be temporarily inhibited.

Code	*Message*	*Meaning*
4699	BATTERY TEST IMPOSSIBLE	*Automatic Battery Test* is not possible due to: - *No Utility Rectifier or Bypass.* - *Battery not fully charged.* - *Load is below 10% or above 80%.* Test is postponed for 1 week.
4763	REMOTE CONTROL ON	*Inverter* can be started or shutdown by remote control. Commands source can be chosen depending on the value of parameter (Service only): *0 = Only Local Panel.* *1 = Only Remote Control.* *2 = Both.*
4764	REMOTE CONTROL OFF	*Inverter* cannot be started or shutdown by remote control. Commands source can be chosen depending on the value of parameter (Service only): *0 = Only Local Panel.* *1 = Only Remote Control.* *2 = Both.*

6.3.4 Event report *SG Series 400 & 500*

In case of failure or malfunctioning, before calling the nearest *Service Center*, please note the most important data of your UPS and the most recent events.

In order to make the diagnosis easier from our *Diagnostic Center* we suggest you make a copy of this page, fill it out with the requested data and send it by fax.

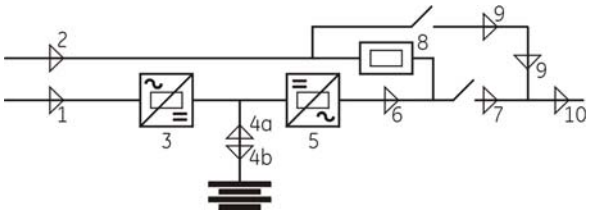
Unit No.: _ _ _ _ _ - _ _ _ _ - _ _ _ _ **Series No.**: ..... **UPS rating**: ..... kVA

Customer: ..... **Place**: .....

Date: ..... / ..... / ..... **Sent by**: .....

---

1. Record the exact **UPS status** on the panel when the failure appeared.



LED 1	❑ ON	❑ OFF
LED 2	❑ ON	❑ OFF
LED 3	❑ ON	❑ OFF
LED 4a	❑ ON	❑ OFF
LED 4b	❑ ON	❑ OFF
LED 5	❑ ON	❑ OFF
LED 6	❑ ON	❑ OFF
LED 7	❑ ON	❑ OFF
LED 8	❑ ON	❑ OFF
LED 9	❑ ON	❑ OFF
LED 10	❑ ON	❑ OFF
LOAD	.....	%
BATTERY	.....	minutes

Description of repair actions taken:

.....

.....

.....

Actual situation:

.....

.....

.....

Remarks:

.....

.....

.....

.....

2. On the LCD panel, enter the ***alarms mode*** and record the **alarms/messages** in the list below indicating at least 5 events before the failure time.

Remark: exact data and time are very important.

Event No.	Event Code	UPS Status	Date	Time h. m. s
255				
254				
253				
252				
251				
250				
249				
248				
247				
246				
245				
244				
243				
242				
241				
240				
239				
238				
237				
236				
235				
234				
233				
232				
231				
230				

6.4 SETUP

The *SETUP mode* is entered any time the "**SETUP**" button is pressed.

This screen allows the user to modify some parameters permitting to adapt some functions of the UPS to his/her needs, described as follows.

The *LCD* will display a series of screens containing the user parameters, accessible without password protection.

In this mode the buttons perform the following functions:

Return to HOME screen.

Scrolls backward to the previous screen.

Scrolls forward to the next screen.

Confirm selected choice of USER / SERVICE level.

Description of the pushbutton to set or modify the parameters:

Allows to exit a selected screen without making any modification.

Scrolls backward to the previous line.

Scrolls forward to the next line.

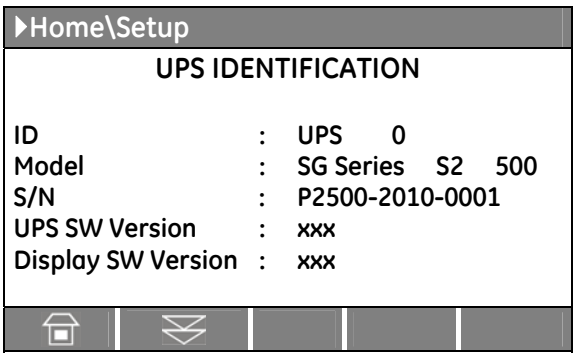
Allows to access a value to be set or modified.

Select, on the same line, the following value or letter to set or modify.

Set or modify the selected value.

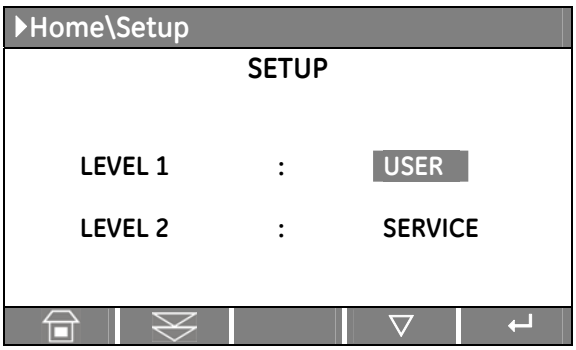
Save the set or modified value and return to the selected screen.

It is possible to view any pushbutton functional description by pushing the button for more than 3 seconds.



UPS identification screen

ID	Number of UPS in the RPA Parallel System (0 for single unit).
Model	UPS model, series number and power range
S/N	The UPS serial number.
UPS SW	The UPS software version.
Display SW	The LCD display software version.



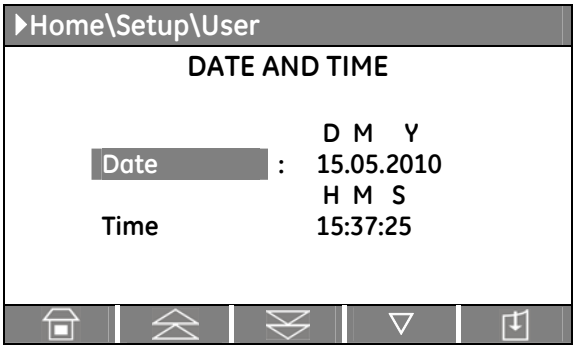
Setup screen

LEVEL 1 USER

Displays a sequence of screens with parameters which can be user defined.

LEVEL 2 SERVICE

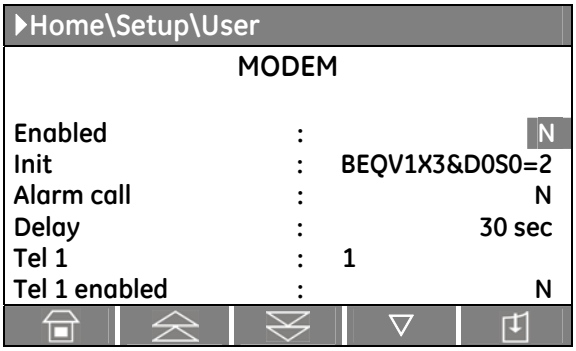
Only service is allowed.
At this level the parameters access is protected by a code.



Date and time screen

Date You can adjust the date of the real time clock existing in the UPS by the means of this parameter. The value you enter is thoroughly checked to be a correct date in the format *"DD.MM.YY"*.

Hour You can adjust the time of the real time clock existing in the UPS by means of this parameter. The value you enter is thoroughly checked to be a correct time in the format *"HH.MM.SS"*. The time is specified in 24-hour format.



Modem screen 1

Enabled
You can enable/disable with *Y/N* the remote control through modem calls by using this parameter.
For modem connection, the default setting is for serial port ***J3*** on *Customer Interface*.

Init
This parameter presents the modem initialization string.
It can be 40 characters long.

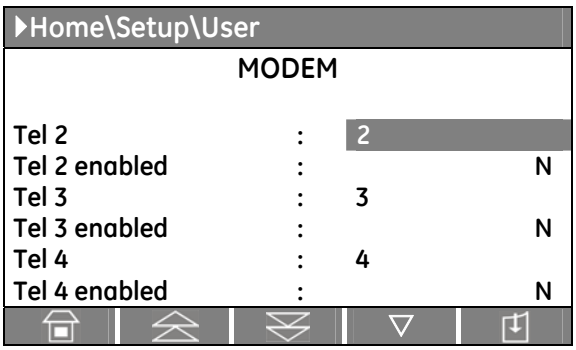
When editing this parameter the UPS considers that a blank character terminates the string.
If no blank character is found then all 40 characters are used.

Alarm call
This *Y/N* parameter controls the automatic events signaling through modem.
If this parameter is set to *Y (Yes)* the UPS itself will call the remote location when a new event occurs

Delay
This parameter controls the delay between the occurrence of a new event and the modem dialing.
It is useful because since the events typically do not occur isolated but in certain sequences, you can eliminate the need for multiple dial-outs for such a sequence of events.

Tel 1
This parameter specifies a *first telephone number* to be used for modem dial-out.
The telephone number has a maximum 40 characters and cannot contain blanks.
If the desired number is shorter than 40 characters, the string will finish with blanks.

Tel 1 enabled
This parameter *Y/N* specifies if the *first telephone number (Tel 1)* will be used for dial-out.



Modem screen 2

Tel 2
It records the *second dial-out number*.

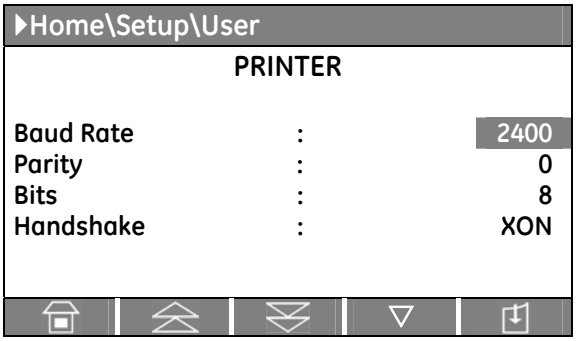
Tel 2 enabled
This parameter *Y/N* specifies if the *second telephone number* will be used for dial-out.

Tel 3 It records the *third dial-out number*.

Tel 3 enabled This parameter *Y/N* specifies if the *third telephone number* will be used for dial-out.

Tel 4 It records the *fourth dial-out number*.

Tel 4 enabled This parameter *Y/N* specifies if the *fourth telephone number* will be used for dial-out.



Printer setup screen

The UPS is capable of communicating to a serial printer, to printout disparate information.
Please be sure to have a serial printer with a serial *RS232* interface.
This is the only printer-interface supported by the UPS.

Baud Rate
This parameter controls the baud rate used for data transmission.

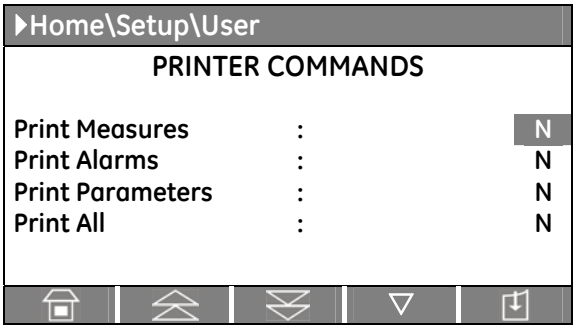
Parity This parameter controls the parity used for data transmission.
Odd (O) even (E) and *"No Parity" (NO)* can be selected.
In case *"No Parity" (NO)* has been set, automatically the parameter *"8 bits"* is used, independently of the value of *"Bits"* set.

Bits This parameter controls the length of the data word on the serial line during data transmission.

Handshake This parameter is used to determine the communication protocol used when printing.
Valid values are *"XON"* standing for the *XON/XOFF* protocol or *"NO"* standing for any protocol.

NOTE !

Please configure your printer with the following parameters: 2400/8/N (2400 bauds/sec, 8 bits, no parity).



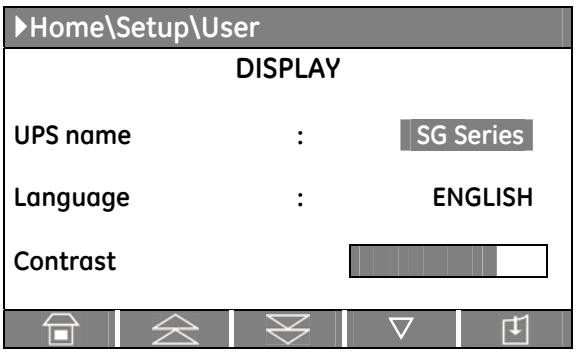
Printer command screen

Print Measures This *Y/N* parameter is used to print only the measurement data.

Print Alarms This *Y/N* parameter is used to print only the sequence of all Alarms/Events.

Print Parameters This *Y/N* parameter is used to print only the list of User and Service Parameters.

Print All This parameter *Y/N* is used to print all the available information in the sequence *metering*, *alarms*, *user* and *service parameters*.

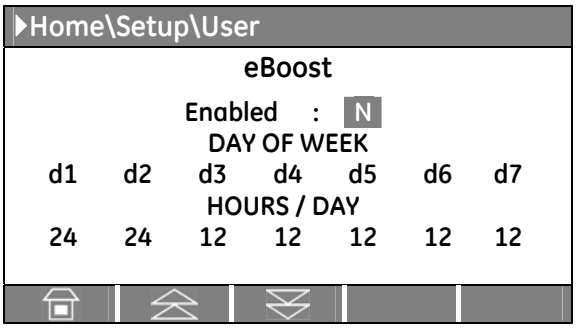


LCD Display screen

UPS Name The user can choose the name of the UPS model shown on the main page (max. 9 characters).

Language This parameter allows the choice of language used to display the information.
Valid choices are: *English, German, Italian, Spanish, French, Finnish, Polish, Portuguese, Czech, Slovakian, Chinese, Swedish, Russian and Dutch.*

Contrast This parameter controls the contrast of the *LCD screen* in ten steps (0 – 9).



eBoost™ Operation Mode screen (option)

This screen is displayed only when *eBoost™ Operation Mode* is available (option).

Enabled (Y / N / Wait)

Y/N This parameter (values *Y/N*) enables or disables the *eBoost™ Operation Mode*.
If the value is *Y* and the current time is in the interval for the current day, the *eBoost™ Operation Mode* is active.

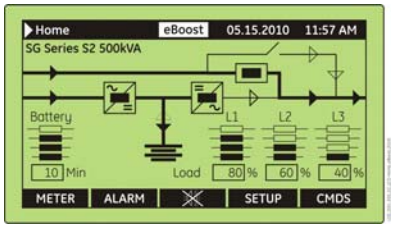
Wait The *eBoost™ Operation Mode* configuration is being updated.

RPA Redundant Parallel Architecture

In case of Parallel System
If *eBoost™ Operation Mode* is currently disabled *(N)* and *Q1* is closed, when programming it to enable *(Y)* the selected configuration will automatically be propagated to all units in the parallel system.

The activation / deactivation of *eBoost™ Operation Mode* is indicated each time in the event list.
In order to check the *inverter* function, at least *1 minute* of *VFI Operation Mode* must be programmed during the week (the *Y/N* parameter is automatically disabled if this condition is not satisfied).
In case this minimum time in *VFI Operation Mode* is not respected, the *eBoost™ Operation Mode* will be disabled.
If the value is *N*, the UPS is normally operating in *VFI / double conversion mode* at all times.

Status of the *Home Page* with UPS functioning in *eBoost™ Operation Mode*.



DAY OF WEEK (d1 ÷ d7): Enabling time in function of weekdays

Note: the configuration of the activation schedule can only be updated when *eBoost™ Operation Mode* is disabled *(Enabled: N)*.

For the weekdays from ***d1*** to ***d7*** *(Saturday to Friday)* the edit mode (edit day) allows to define time intervals when the UPS is operating in *eBoost™ Operation Mode*. The hour is given in 24-hour format.

These intervals are defined by:
eBoost START: The hour of the day after which the *eBoost™ Operation Mode* is enabled.
The *eBoost™ Operation Mode* is enabled until the following *eBoost STOP* time is reached (the *eBoost STOP* time of the same day if this is later than the *eBoost START* time, the *eBoost STOP* time of the following day otherwise).

eBoost STOP: The hour of the day before which the *eBoost™ Operation Mode* is enabled.

The *eBoost™ Operation Mode* is enabled starting from the preceding *eBoost START* time (the *eBoost START* time of the same day if this is earlier than the *eBoost STOP* time, the *eBoost START* time of the previous day otherwise).

Identical times for *eBoost START* and *eBoost STOP* maintain the existing mode only in case the previous command was *eBoost START* and the following command will be *eBoost STOP*.

HOURS / DAY:
The number of *eBoost™ Operation Mode* hours per weekday (from ***d1*** - *Saturday* to ***d7*** - *Friday*) is displayed in the operation mode parameter window (ceiling value).

To better understand the *eBoost*™ programming modes, some typical examples are shown:

Example 1:

For continuous ***eBoost*™ *Operation Mode*** set the ***eBoost START* times to 00:00** and the ***eBoost STOP* times to 23:59** for all weekdays, but almost **1 day must have 1 minute of *VFI*** programmation: i.e ***d2 - Sunday*** 00:00 to 23:58).

Weekday	*d1 - Saturday*	*d2 - Sunday*	*d3 - Monday*	*d4 - Tuesday*	*d5 - Wednesday*	*d6 - Thursday*	*d7 - Friday*
eBoost START	00:00	00:00	00:00	00:00	00:00	00:00	00:00
eBoost STOP	23:59	23:58	23:59	23:59	23:59	23:59	23:59

Example 2:

***eBoost STOP* before *eBoost START*.**
eBoost START 18:00, *eBoost STOP* 06:00 for weekday ***d4 - Tuesday***.
Means that on ***d4 - Tuesday*** the *eBoost*™ *Operation Mode* is active between 00:00 and 06:00 and between 18:00 and 23:59.

Weekday	*d1 - Saturday*	*d2 - Sunday*	*d3 - Monday*	*d4 - Tuesday*	*d5 - Wednesday*	*d6 - Thursday*	*d7 - Friday*
eBoost START	00:00	00:00	00:00	18:00	00:00	00:00	00:00
eBoost STOP	23:59	23:59	23:59	06:00	23:59	23:59	23:59

Example 3:

***eBoost*™ *Operation Mode* during the night and week-end.**
If the *eBoost*™ *Operation Mode* must be enabled all nights (***d3 - Monday ÷ d7 - Friday***) between 18:00 in the evening and 06:00 of the following morning and during all Saturday (*d1*) and Sunday (*d2*), the corresponding parameters are:

Weekday	*d1 - Saturday*	*d2 - Sunday*	*d3 - Monday*	*d4 - Tuesday*	*d5 - Wednesday*	*d6 - Thursday*	*d7 - Friday*
eBoost START	00:00	00:00	18:00	18:00	18:00	18:00	18:00
eBoost STOP	23:59	23:59	06:00	06:00	06:00	06:00	06:00

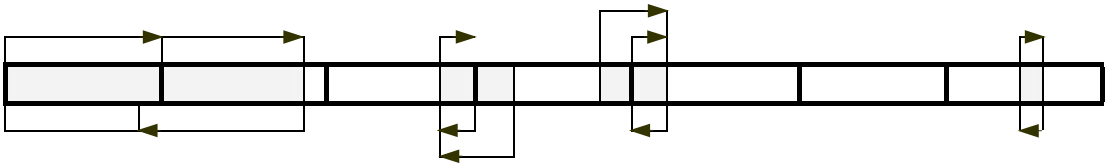
Example 4:

If the *eBoost*™ *Operation Mode* must be enabled on *Monday* (***d3***) and *Tuesday* (***d4***) between 18:00 in the evening and 06:00 of the following morning, on *Friday* (***d7***) between 12:00 and 13:00, during all *Saturday* (***d1***) and on *Sunday* (***d2***) until 20:00, the corresponding parameters are.

Weekday	*d1 - Saturday*	*d2 - Sunday*	*d3 - Monday*	*d4 - Tuesday*	*d5 - Wednesday*	*d6 - Thursday*	*d7 - Friday*
eBoost START	00:00	00:00	18:00	18:00	00:00	00:00	12:00
eBoost STOP	23:59	20:00	23:59	06:00	06:00	00:00	13:00

eBoost START

eBoost STOP



In dark color are displayed the times with *eBoost*™ *Operation Mode*.

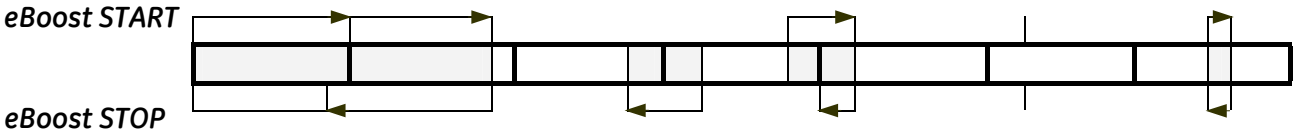
The arrows indicate the conditions given by the *eBoost START* and *eBoost STOP* times introduced with the parameters.

Note that on day ***d6 - Thursday*** the interval has length 0 (zero), therefore the *eBoost*™ *Operation Mode* is not enabled on this day.

Example 5:

An equivalent set of parameters for *Example 4* is.

Weekday	*d1 - Saturday*	*d2 - Sunday*	*d3 - Monday*	*d4 - Tuesday*	*d5 - Wednesday*	*d6 - Thursday*	*d7 - Friday*
eBoost START	00:00	00:00	18:00	18:00	06:00	09:00	12:00
eBoost STOP	23:59	20:00	18:00	06:00	06:00	09:00	13:00



The *eBoost™ Operation Mode* is active from 18:00 of weekday ***d3 - Monday*** until 06:00 of weekday ***d4 - Tuesday*** (as indicated by the *eBoost STOP* time of weekday *d4 - Tuesday*).

The *eBoost STOP* time of weekday ***d3 - Monday*** has no effect as it is followed by the *eBoost STOP* time of weekday ***d4 - Tuesday***.

It can be, without change of meaning, any time between 18:00 and 23:59.

Similarly, the *eBoost™ Operation Mode* is active from 18:00 of weekday ***d4 - Tuesday*** until 06:00 of weekday ***d5 - Wednesday***.

The *eBoost START* time of weekday ***d5 - Wednesday*** has no effect as it is preceded by the *eBoost START* time of weekday ***d4 - Tuesday***.

It can be, without change of meaning, any time between 00:00 and 06:00.

NOTE !

To avoid undesired *eBoost™ Operation Mode*, verify:

- **Date and Time (first page of parameter).**
- ***eBoost™* screen how many hours of *eBoost™ Operation Mode* have been selected for each day of the week.**

NOTE !

The *eBoost™ Operation Mode* will become active only if the *Load* is supplied from the *Inverter*.

6.5 COMMANDS

The *COMMANDS mode* is entered any time the "**CMDS**" button is pressed.

Allows the user to execute UPS operation commands.

In this mode the buttons perform the following functions:

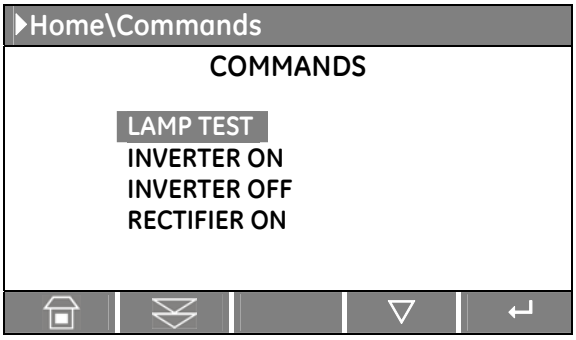
Return to HOME screen.

Scrolls forward to the next screen.

Scrolls forward to the next line.

Confirm the selection made.

It is possible to view any pushbutton functional description by pushing the button for more than 3 seconds.



Commands screen 1

LAMP TEST
Signaling *LEDs* test and *buzzer* test (all LED should be lit and blinking and the acoustical alarm should be activated).

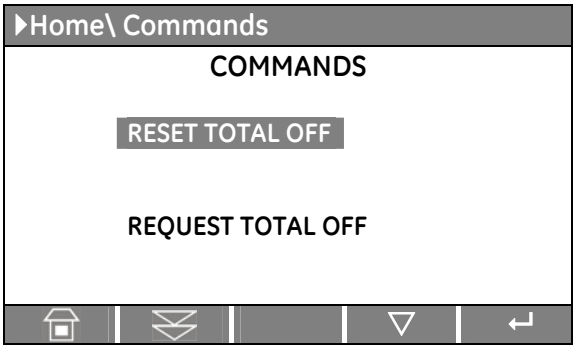
INVERTER ON Command to switch the inverter.

INVERTER OFF Command to shutdown the inverter.

RECTIFIER ON Command to switch the rectifier. Only for Service Center, the command access is protected by a code.

NOTE !

When *eBoost™ Operation Mode* is enabled, control of Inverter status and selection of the feed path is done autonomously by the UPS control logic.
Therefore, Inverter ON / Inverter OFF commands are disabled when *eBoost™ Operation Mode* is enabled.

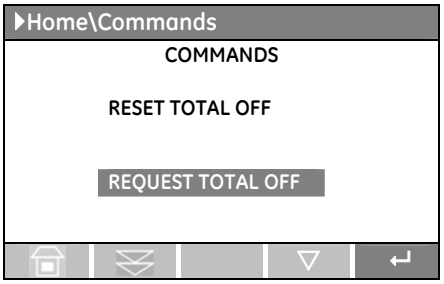


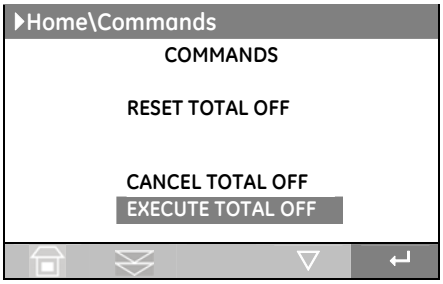
Commands screen 2

RESET TOTAL OFF
Reset *Total OFF* command should be executed to switch ON UPS after a *"Load Off"* operation.

REQUEST TOTAL OFF
Command *"Load Off"*.

Screen sequence to execute the command *"Load Off"*:





As the command procedure of *"Load Off"* is finished the "REQUEST TOTAL OFF" screen appears again.

7 OPERATION

START UP AND COMMISSIONING

A GE GLOBAL SERVICES FIELD ENGINEER must perform start-up and commissioning of the UPS. Please Contact GE. Global Services at least two weeks prior to schedule start-up and commissioning at 1-800-637-1738, or by E-mail at pqservice@ge.com .

RPA
Redundant Parallel Architecture

This symbol refers to the operations of a parallel system.

NOTE !

Verify for correct input/output cabling before connecting *Utility* to the UPS.

Open only the front door, do not remove any panels.

Check after every step for correct reaction of the UPS (LED's on the panel), and correct voltage and current measurements, before you proceed to the next step.

NOTE !

All operations (including start-up, shutdown, removing/adding a unit from/to a Parallel System) MUST BE PERFORMED with *eBoost™ Operation Mode* DISABLED.

Find on the following pages the descriptions of the various procedures of start-up and shutdown for *UPS single* and *UPS Parallel System*, divided into the following principal chapters:

7.1 PROCEDURES FOR SINGLE *SG Series 400 & 500*

7.2 PROCEDURES FOR *SG Series 400 & 500* PARALLEL SYSTEM STANDARD AND PARALLEL SYSTEM WITH COMMON BATTERY

7.1 PROCEDURES FOR SINGLE *SG Series 400 & 500*

7.1.1 Start-up of the *SG Series 400 & 500*

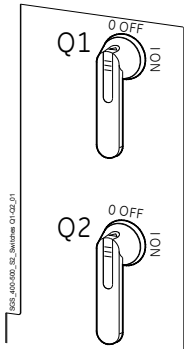
WARNING !

Before proceeding to Turn ON the UPS System, ensure that the AC and DC external isolators are OFF (Pos. O), and prevent their inadverted operation.

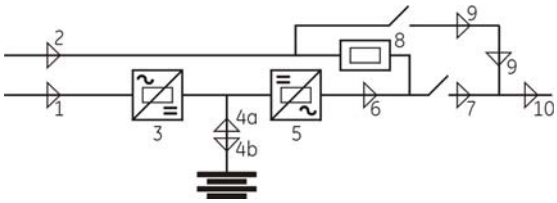
Ensure that the output load distribution can be powered and all the output isolators are open (Pos. O).

Open the front door and make sure that:

- All the ***connections*** to the input/output bus bars of the UPS have been made correctly.
- The ***safety screens*** are fixed in their position.
- The ***UPS Output Switch Q1***, ***Manual Bypass Switch Q2*** (option) and the ***External Battery Switch or Fuses*** **must be open (Pos. O)**.



Q1 *UPS Output switch*
Q2 *Manual Bypass switch (option)*

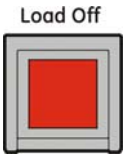


LEDs on Synoptic Diagram

LED 1	*Utility Rectifier OK*	*LED 6*	*Inverter ON*
LED 2	*Utility Bypass OK*	*LED 7*	*Q1 closed*
LED 3	*Rectifier ON*	*LED 8*	*Automatic Bypass ON*
LED 4a	*Discharging Battery*	*LED 9*	*Manual Bypass Q2 ON (option)*
LED 4b	*Charging Battery*	*LED 10*	*Load on UPS*
LED 5	*Inverter available*		

Key Inverter ON

Key Inverter OFF



Key Load Off

LED Stop Operation

LED Alarm

LED Operation

1. ***Switch-ON the Utility Voltage from the input distribution (both rectifier and bypass if separated).***
   At this stage the electronic power supply is switched ON.

   The UPS performs a *SELFTEST*.
   A successful termination of the tests will be indicated with Overall test results *"OK"*.
   Commissioning cannot be continued should one or more tests result to be negative.
   Please contact in this case your *Service Center*.

Overall test results	
Test1 OK	**Test7 OK**
Test2 OK	**Test8 OK**
Test3 OK	**Test9 OK**
Test4 OK	**Test10 OK**
Test5 OK	**Test11 OK**
Test6 OK	

   With *"Overall test results - OK"* the *Synoptic Diagram* is displayed.
   LED 1 (Utility Rectifier OK) and *LED 2 (Utility Bypass OK)* must be ON.
   The buzzer sounds, press the *"MUTE"* key to reset *acoustical alarm*. *LED Alarm* remains lit.

Continue ►

NOTE !

During the first commissioning *SG Series 400 & 500* requests a set up of the UPS configuration parameters presented in the following screens.

Without such configuration it is not possible to continue with the commissioning procedure.

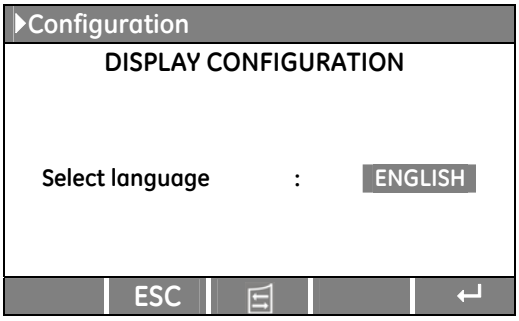
WARNING !

The setup of the UPS configuration parameters must be done only by a GE GLOBAL SERVICES FIELD ENGINEER.

The setup of mistaken values could compromise the integrity and reliability of the UPS.

In this mode the keys perform the following functions:

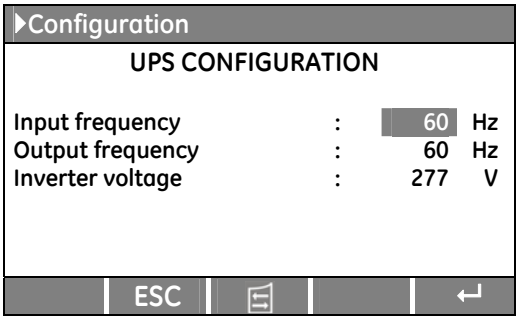
↵	Confirm the selection made and select the next parameter.
ESC	Re-establish default value.
	Modify or insert the selected value.
	Save the configuration of set parameters.



DISPLAY CONFIGURATION screen

Select language
This parameter allows the choice of language used to display the information.

Pushing the pushbuttons *"1st button" (METER)* and *"2nd button" (ALARM)* together automatically sets the *LCD* communication for "ENGLISH".



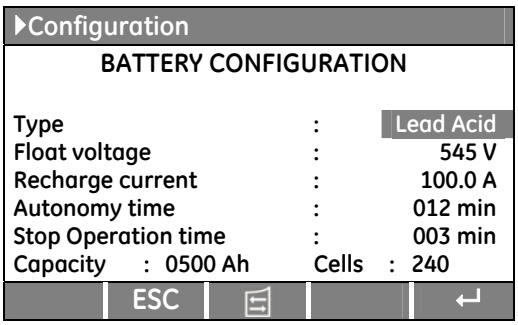
UPS CONFIGURATION screen

Input frequency
Rectifier input frequency value.
The default value is 60Hz and shall not be changed.

Output frequency
Inverter output frequency value.
The default value is 60Hz and shall not be changed.

Inverter voltage
Output voltage PHASE/NEUTRAL of the inverter (default 277V).

Continue ▶



BATTERY CONFIGURATION screen

Recharge type
Recharge type (Lead Acid / NiCd / Boost).

Lead Acid for: Sealed battery (VRLA), NiCd without boost-charge and open battery without boost-charge.

NiCd for: Nickel Cadmium battery with boost-charge.

Boost for: Open battery with boost-charge.

Float voltage
Voltage to maintain battery charging.
Float voltage = Number of battery cells x battery float voltage per cell.
Typical battery float voltage per cell (ask the battery manufacturer for confirmation):

Sealed battery (VRLA):	2.27Vdc for cell	240 cells x 2.27Vdc = **545Vdc**
NiCd without boost-charge:	1.41Vdc for cell	386 cells x 1.41Vdc = **545Vdc**
NiCd with boost-charge:	1.41 (1.55 boost-charge) Vdc for cell	351 cells x 1.41Vdc = **495** (545) **Vdc**
Open battery without boost-charge:	2.23Vdc for cell	240 cells x 2.23Vdc = **535Vdc**
Open battery with boost-charge:	2.23 (2.35 boost-charge) Vdc for cell	232 cells x 2.23Vdc = **518** (545) **Vdc**

Recharge current
Maximum battery recharge current.
Max 20% of battery capacity (Ah).
Example: 500Ah - max recharging current 100A.

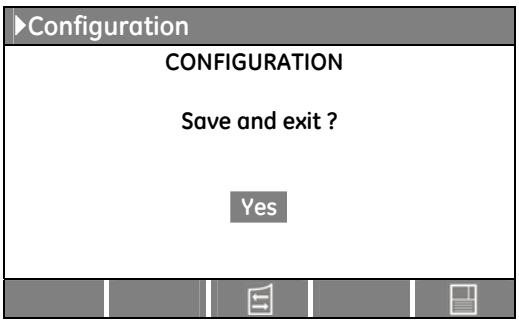
Autonomy time
The autonomy time of the battery.
UPS autonomy on battery mode at full load condition.
This value is calculated based on the *battery type*, *capacity* and *number of cells*.

Stop Operation time
Residual battery autonomy time before UPS forced shutdown.
Standard set 3 minutes. Settable from 1 minute to autonomy time in minutes (see tables).

Capacity
Ah capacity of the battery.

Cells
Number of cells of the battery, see "**Float voltage**".
Example: **240 battery cells** 40 blocks / 12Vdc battery 80 blocks / 6Vdc battery 240 blocks / 2Vdc battery

NOTE !
The values indicated above, must be considered as standard values.
The actual programmed values must be the ones defined from the battery manufacturer.



CONFIGURATION screen

Screen to save the configuration of set parameters.

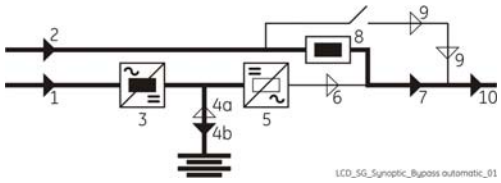
Any additional modification of setup parameters can be done only from a GE SERVICE PERSON as it requires an access code.

Continue ▶

2. *Close the UPS Output Switch Q1 (Pos. I).*

- The *Load* is supplied by the *Utility* through the *Automatic Bypass*.
- *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
- At the end of *Rectifier* Soft-start the *LED 3 (Rectifier ON)* remains lit.

The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



3. *Connect the Battery to the UPS by closing (Pos. I) the External Battery Switch or Fuses.*

Attention: to check the right DC polarities on both side of the switch/fuse holder!

LED 4b (Charging Battery) should be lit indicating *battery charge*.

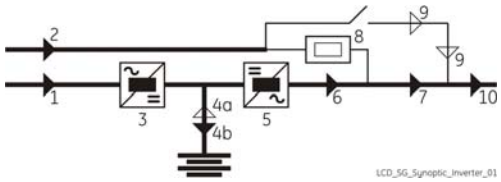
ATTENTION !

Before performing this operation, the *LED 3 (Rectifier ON)* must remain lit, thus indicating that the DC-Link has reached floating voltage (540Vdc)!

4. *Insert the Inverter by pressing the "Inverter ON" (I) key.*

- Soft-start of *Inverter* indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- Automatic transfer from *Automatic Bypass* to *Inverter*.
- UPS output *LED* indicates *Load on Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY INVERTER***".



5. *Load supply.*

SG Series 400 & 500 is now running, supplying power to the output.
Insert the *loads* one by one to the output of the UPS.
Check the output current value of *L1*, *L2* and *L3* and check for correct load balance.

6. *Operation mode selection.*

SG Series 400 & 500 is delivered normally selected for permanent *VFI* operation.
eBoost™ Operation Mode can be enabled if available, and the *eBoost START* time & *eBoost STOP* time can be programmed for each day of the week (see *Section 6.4 SETUP / eBoost).*

END OF PROCEDURE

NOTE !

The *Battery* must be charged for at least 10 hours, in order to ensure the full backup runtime in case of a *Utility Failure*.

7.1.2 UPS shutdown with Load transfer on Manual Bypass Q2 (option)

NOTE !

Not following this procedure can cause protected loads to shut down!

Never close or open either *UPS Output Switch Q1* and *Manual Bypass switch Q2* (option) with the *Inverter* running!

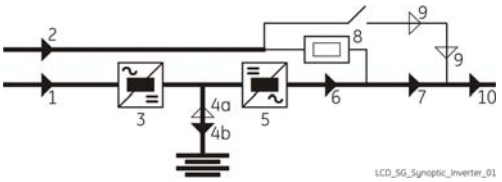
Initial situation: the *Load* is powered by the *Inverter*.

If *eBoost™* option is available, make sure that *eBoost™ Operation Mode* is disabled before starting this procedure.

The complete UPS system has to be turned OFF, while providing the *Load* power by *Utility* through the *Manual Bypass Q2* (option).

With the UPS in normal operation and the *inverter* supplying the *Load*, the ***UPS Output Switch Q1* is closed (Pos. I)** and the ***Manual Bypass Switch Q2 (option)* is open (Pos. O)**.
The ***External Battery Switch or Fuses* are closed (Pos. I)**.

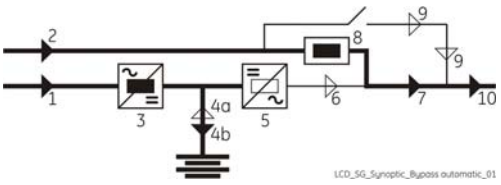
The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY INVERTER***".



1. ***Disconnect the Inverter by pressing the "Inverter OFF" (O) key and hold until the LED 5 (Inverter available) turns OFF.***

   - *Load* is transferred to *Utility* by *Automatic Bypass*.
   - *Inverter* shuts down. *LED 5 (Inverter available)* must be OFF.
   - *LED Alarm* is lit and the *LED Operation* is Off.

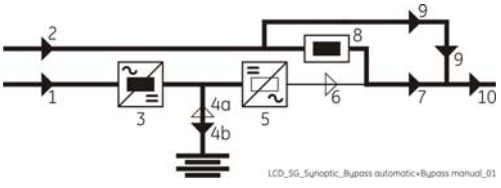
   The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



2. ***Close the Manual Bypass Switch Q2 (Pos. I).***

   - *Load* is now supplied parallel through *Automatic Bypass* and *Manual Bypass Q2*.
   - *LED 8 (Automatic Bypass ON)* and *LED 9 (Manual Bypass Q2 ON)* are lit.

   The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS AND MANUAL BYPASS Q2***".

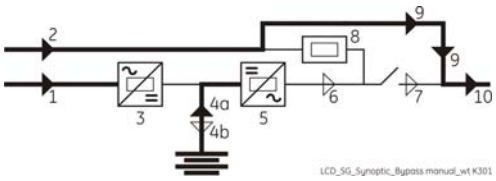


Continue ►

3. ***Open the UPS Output Switch Q1 (Pos. O) and then press the "Load Off" key.***

- The *load* is now supplied only through the *Manual Bypass Q2*.
- *Rectifier* shuts down and all output and input *Contactors* are opened.
- Press *"MUTE"* to reset the *alarm buzzer*.

The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY MANUAL BYPASS Q2**"*.



4. ***Disconnect the Battery from the UPS by opening (Pos. O) the External Battery Switch or Fuses.***

- **Wait *5 minutes*** for DC-Link Capacitors discharge.

The *Load* is now powered from the *Utility* through *Manual Bypass Q2 (option).*

END OF PROCEDURE

WARNING!

It will take a minimum of 5 minutes for the DC capacitors to discharge.

Open only the front door, do not open any other part of the UPS.

7.1.3 From Manual Bypass Q2 (option) to normal function VFI

NOTE !

UPS system has been turned *OFF* following the "*Maintenance shutdown (Load on Manual Bypass Q2)*" procedure and the *Load* is still powered by *Manual Bypass Q2 (option).*

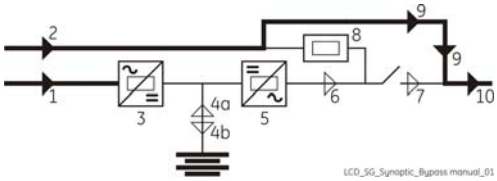
The *Load* must be transferred back to the *UPS system*.

Open the front door and make sure that:

- The ***safety screens*** are fixed in their position.
- The ***UPS Output Switch Q1*** and the ***External Battery Switch or Fuses*** are open (Pos. O).
- The ***Manual Bypass Switch Q2 (option)*** is closed (Pos. I).
- ***LED Alarm*** is lit.

Initial status:

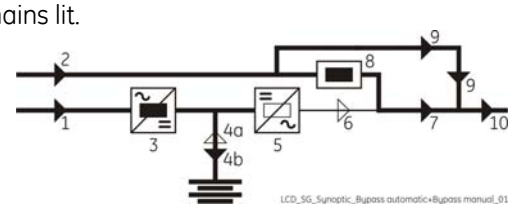
Load supplied from Manual Bypass Q2 (option).



1. ***If not already supplied (separate Utility Inputs), switch-ON the Utility power to the Rectifier input.***

2. ***Close the UPS Output Switch Q1 (Pos. I).***
   - *Load* is now supplied parallel through *Automatic Bypass* and *Manual Bypass Q2*. *LED 8 (Automatic Bypass ON)* and *LED 9 (Manual Bypass Q2 ON)* are lit.
   - *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
   - At the end of *Rectifier* Soft-start the *LED 3 (Rectifier ON)* remains lit.

   The *Synoptic Diagram* must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS AND MANUAL BYPASS Q2***".



3. ***Connect the Battery to the UPS by closing (Pos. I) the External Battery Switch or Fuses.***

   LED 4b (Charging Battery) should be lit indicating *battery charge*.

   ATTENTION !

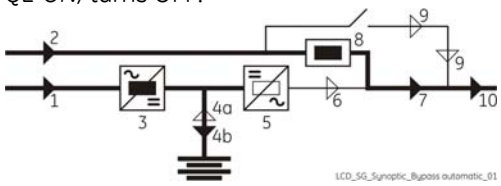
   Before performing this operation, the *LED 3 (Rectifier ON)* must remain lit, thus indicating that the DC-Link has reached floating voltage (540Vdc)!

Continue ▶

4. *Open the Manual Bypass Switch Q2 (Pos. O).*

- The *Load* is supplied by the *Utility* through the *Automatic Bypass.*
- *LED 8 (Automatic Bypass ON)* is lit and *LED 9 (Manual Bypass Q2 ON)* turns OFF.

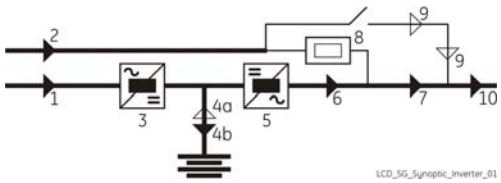
The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY AUTOMATIC BYPASS**"*.



5. *Insert the Inverter by pressing the "Inverter ON" (I) key.*

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available).*
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- Automatic transfer from *Automatic Bypass* to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY INVERTER**"*.



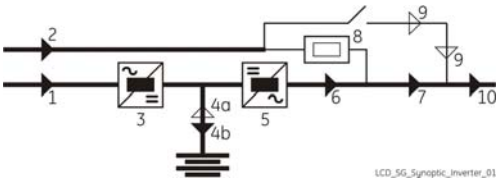
END OF PROCEDURE

7.1.4 Complete UPS shutdown

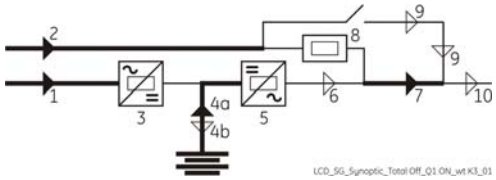
	**NOTE !** **Follow this procedure only in case the UPS system and the *Load* must be completely powered-down.** **If *eBoost™* option is available, make sure that *eBoost™ Operation Mode* is disabled before starting this procedure.**

Initial status:

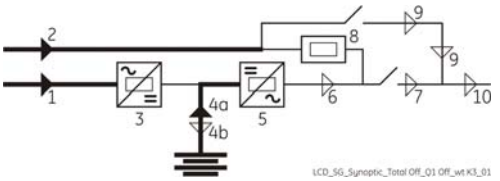
Load supplied from Inverter.



1. ***Press the "Load Off" key.***
   - *Load* is disconnected from *UPS*.
   - *Rectifier* and *Inverter* are shut down, all output and input *Contactors* will be opened.
   - *LED 3 (Rectifier ON), LED 5 (Inverter available)* and *LED 10 (Load on UPS)* are OFF.
   - *LED Alarm* is lit and the *LED Operation* is Off.

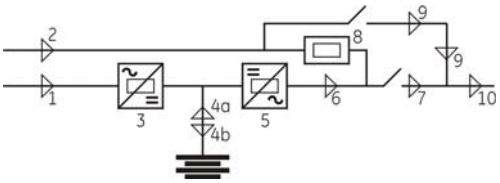


2. ***Open the UPS Output Switch Q1 (Pos. O).***



3. ***Disconnect the Battery from the UPS by opening (Pos. O) the External Battery Switch or Fuses.***
   - **Wait *5 minutes*** for DC-Link Capacitors discharge.

4. ***Disconnect the Utility from the input distribution.***
   - Complete power shutdown will OFF the *LCD Display Panel*.



END OF PROCEDURE

	**DANGER !** **It will take 5 minutes for the DC capacitors to discharge.** **Open only the front door, do not open any other part of the UPS.**

7.1.5 Restore to normal operation after "Load Off"

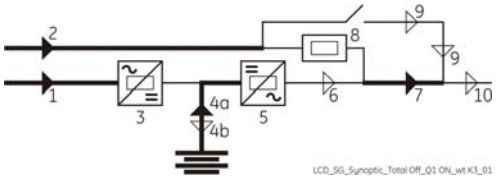
NOTE !

Make sure the UPS to be status of the activation of "*Load Off*", i. e. *UPS Output Switch Q1* closed (Pos. I), *Manual Bypass Switch Q2 (option)* open (Pos. O) and *External Battery Switch or Fuses* connected (Pos. I).

If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting this procedure.

View of the *Synoptic Diagram* after pressing the "*Load Off*" *key*.

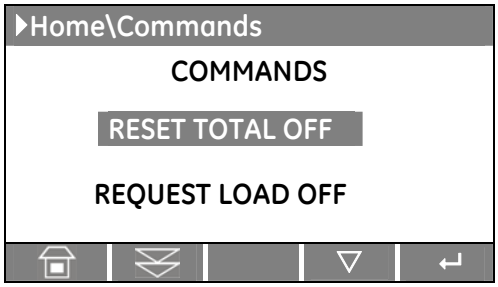
- **All *Contactors* are open.**
- ***Rectifier*, *Inverter* and *Static-Switch* shutdown.**
- ***LED Alarm* is lit.**



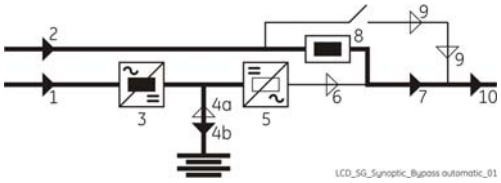
1. Reset "Load Off".

Restore the command *"Load Off"* by entering the screen: COMMANDS / **RESET TOTAL OFF**

- The *Load* is supplied by the *Utility* through the *Automatic Bypass*.
- *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
- At the end of Soft-start the *LED 3 (Rectifier ON)* remains lit.



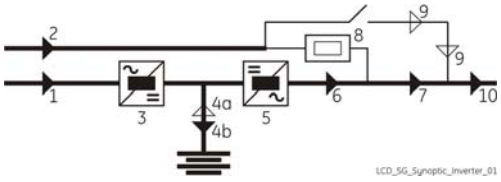
The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY AUTOMATIC BYPASS**"*.



2. Insert the Inverter by pressing the "Inverter ON" (I) key.

- Soft-start of *Inverter* indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- Automatic transfer from *Automatic bypass* to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY INVERTER**"*.



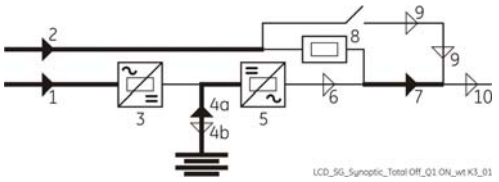
END OF PROCEDURE

7.1.6 Restore to normal operation after EPO (Emergency Power Off)

	**NOTE !** **Make sure the UPS to be status of the activation of *EPO*, i. e. *UPS Output Switch Q1* closed (Pos. I), *Manual Bypass Switch Q2 (option)* open (Pos. O) and *External Battery Switch or Fuses* connected (Pos. I).** **If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting this procedure.**

View of the *Synoptic Diagram* after activation of *EPO (Emergency Power Off)* with *Utility* available.

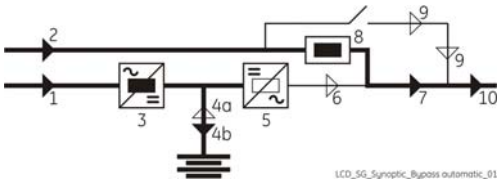
- **All *Contactors* are open.**
- ***Rectifier*, *Inverter* and *Static-Switch* shutdown.**
- ***LED Alarm* is lit.**



1. ***Reset the EPO (Emergency Power Off) key.***
   - Press the *"MUTE"* key to reset *alarm* and *acoustical alarm*.
   - *LED Alarm* remains lit.

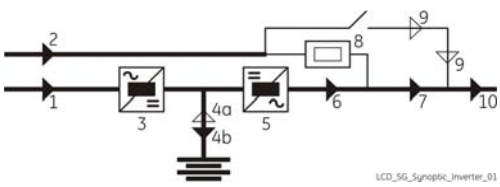
2. ***Press the "Inverter OFF" (O) key.***
   - *Load* is transferred to *Utility* by *Automatic Bypass*.
   - *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
   - At the end of *Rectifier* Soft-start the *LED 3 (Rectifier ON)* remains lit.

   The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY AUTOMATIC BYPASS**"*.



3. ***Insert the Inverter by pressing the "Inverter ON" (I) key.***
   - Soft-start of *Inverter* indicated with blinking *LED 5 (Inverter available)*.
   - At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
   - The *Load* will be automatically transferred from *Automatic Bypass* to *Inverter*.
   - *LED Alarm* turn Off and the *LED Operation* must be lit.

   The *Synoptic Diagram* must display the status *"**LOAD SUPPLIED BY INVERTER**"*.



END OF PROCEDURE

7.2 PROCEDURES FOR *SG Series 400 & 500* PARALLEL SYSTEM AND PARALLEL SYSTEM WITH COMMON BATTERY

7.2.1 *SG Series 400 & 500* Parallel System start-up

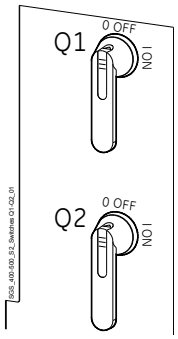
WARNING !

Before proceeding to Turn ON the UPS System, ensure that the AC and DC external isolators are OFF (Pos. O), and prevent their inadverted operation.

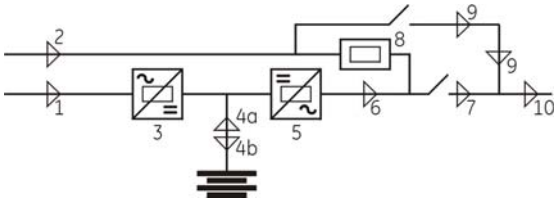
Ensure that the output load distribution can be powered and all the output isolators are open (Pos. O).

Open the front door on all UPS units and make sure that:

- All the ***connections*** to the input/output bus bars of the UPS have been made correctly.
- The ***safety screens*** are fixed in their position.
- The ***UPS Output Switch Q1***, ***Manual Bypass Switch Q2*** (option) and the ***External Battery Switch or Fuses*** **must be open (Pos. O)**.



Q1 *UPS Output Switch*
Q2 *Manual Bypass switch (option)*

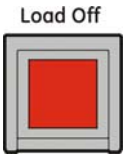


LEDs on Synoptic Diagram

LED 1	*Utility Rectifier OK*	*LED 6*	*Inverter ON*
LED 2	*Utility Bypass OK*	*LED 7*	*Q1 closed*
LED 3	*Rectifier ON*	*LED 8*	*Automatic Bypass ON*
LED 4a	*Discharging Battery*	*LED 9*	*Manual Bypass Q2 ON (option)*
LED 4b	*Charging Battery*	*LED 10*	*Load on UPS*
LED 5	*Inverter available*		

Key
Inverter ON

Key
Inverter OFF



Key
Load Off

LED
Stop Operation

LED
Alarm

LED
Operation

1. ***Switch-ON the Utility Voltage, on all UPS units, from the input distribution (both rectifier and bypass if separated).***
   At this stage the electronic power supply is switched ON.
   The UPS performs a *SELFTEST*.
   A successful termination of the tests will be indicated with Overall test results *"OK"*.
   Commissioning cannot be continued should one or more tests result to be negative.
   Please contact in this case your *Service Center*.

   With *"Overall test results - OK"* the *Synoptic Diagram* is displayed.
   LED 1 (Utility Rectifier OK) and *LED 2 (Utility Bypass OK)* must be ON.

   The buzzer sounds, press the *"MUTE"* key to reset *acoustical alarm*. *LED Alarm* remains lit.

Overall test results

Test1	**OK**	**Test7**	**OK**
Test2	**OK**	**Test8**	**OK**
Test3	**OK**	**Test9**	**OK**
Test4	**OK**	**Test10**	**OK**
Test5	**OK**	**Test11**	**OK**
Test6	**OK**		

Continue ►

NOTE !

During the first commissioning *SG Series 400 & 500* requests a set up of the UPS configuration parameters presented in the following screens.

Without such configuration it is not possible to continue with the commissioning procedure.

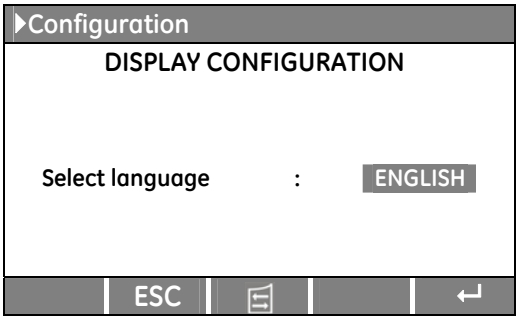
WARNING !

The setup of the UPS configuration parameters must be done only by a GE GLOBAL SERVICES FIELD ENGINEER.

The setup of mistaken values could compromise the integrity and reliability of the UPS.

In this mode the keys perform the following functions:

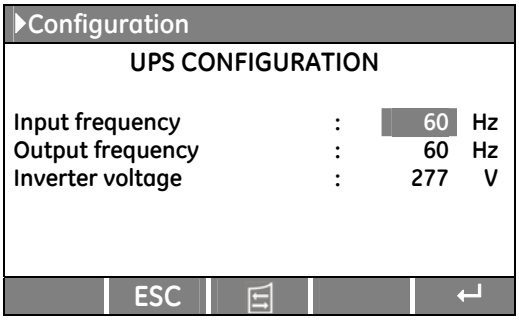
↵	Confirm the selection made and select the next parameter.
ESC	Re-establish default value.
	Modify or insert the selected value.
	Save the configuration of set parameters.



DISPLAY CONFIGURATION screen

Select language
This parameter allows the choice of language used to display the information.

Pushing the pushbuttons *"1st button" (METER)* and *"2nd button" (ALARM)* together automatically sets the *LCD* communication for "ENGLISH".



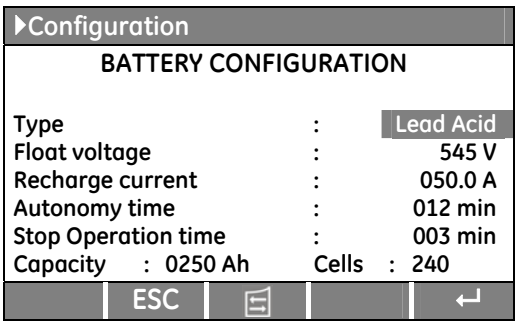
UPS CONFIGURATION screen

Input frequency
Rectifier input frequency value.
The default value is 60Hz and shall not be changed.

Output frequency
Inverter output frequency value.
The default value is 60Hz and shall not be changed.

Inverter voltage
Output voltage PHASE/NEUTRAL of the inverter (default 277V).

Continue ▶



BATTERY CONFIGURATION screen

Recharge type
Recharge type (Lead Acid / NiCd / Boost).

Lead Acid for: Sealed battery (VRLA), NiCd without boost-charge and open battery without boost-charge.

NiCd for: Nickel Cadmium battery with boost-charge.

Boost for: Open battery with boost-charge.

Float voltage
Voltage to maintain battery charging.
Float voltage = Number of battery cells x battery float voltage per cell.
Typical battery float voltage per cell (ask the battery manufacturer for confirmation):

Sealed battery (VRLA):	2.27Vdc for cell	240 cells x 2.27Vdc = **545Vdc**
NiCd without boost-charge:	1.41Vdc for cell	386 cells x 1.41Vdc = **545Vdc**
NiCd with boost-charge:	1.41 (1.55 boost-charge) Vdc for cell	351 cells x 1.41Vdc = **495** (545) **Vdc**
Open battery without boost-charge:	2.23Vdc for cell	240 cells x 2.23Vdc = **535Vdc**
Open battery with boost-charge:	2.23 (2.35 boost-charge) Vdc for cell	232 cells x 2.23Vdc = **518** (545) **Vdc**

Recharge current
Maximum battery recharge current.
Max 20% of battery capacity (Ah).
Example: 250Ah - max recharging current 50A.

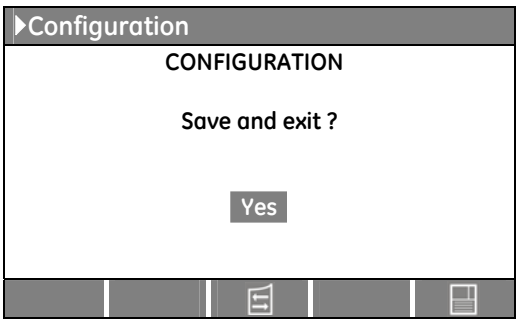
Autonomy time
The autonomy time of the battery.
UPS autonomy on battery mode at full load condition.
This value is calculated based on the *battery type*, *capacity* and *number of cells*.

Stop Operation time
Residual battery autonomy time before UPS forced shutdown.
Standard set 3 minutes. Settable from 1 minute to autonomy time in minutes (see tables).

Capacity
Ah capacity of the battery.

Cells
Number of cells of the battery, see "**Float voltage**".
Example: **240 battery cells** 40 blocks / 12Vdc battery 80 blocks / 6Vdc battery 240 blocks / 2Vdc battery

NOTE !
The values indicated above, must be considered as standard values.
The actual programmed values must be the ones defined from the battery manufacturer.



CONFIGURATION screen

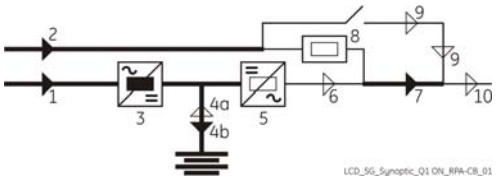
Screen to save the configuration of set parameters.

Any additional modification of setup parameters can be done only from a GE SERVICE PERSON as it requires an access code.

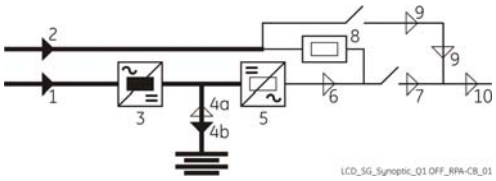
Continue ▶

2 *Close UPS Output Switch Q1 (Pos. I) on first Unit.*

- *Rectifiers* start automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
- At the end of *Rectifier* Soft-start, the *LED 3 (Rectifier ON)* remains lit.



Synoptic Diagram of first unit



Synoptic Diagram of other units

3. *Connect the Battery on first Unit by closing (Pos. I) its External Battery Switch or Fuses.*

Attention: to check the right DC polarities on both side of the switch/fuse holder!

LED 4b (Charging Battery) should be lit indicating *battery charge*.

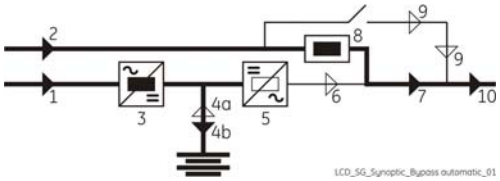
ATTENTION !

Before performing this operation, the *LED 3 (Rectifier ON)* must remain lit, thus indicating that the DC-Link has reached floating voltage (540Vdc)!

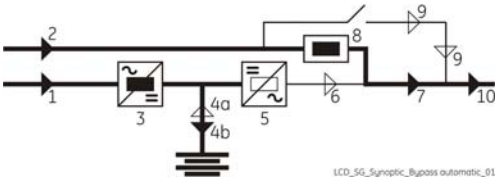
4. *Repeat the procedures 2 and 3 for each next Unit.*

- When closing *UPS output switch Q1* on the last unit of the *Parallel System*, the *Automatic Bypass* of all *Units* connects to the *Load*.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



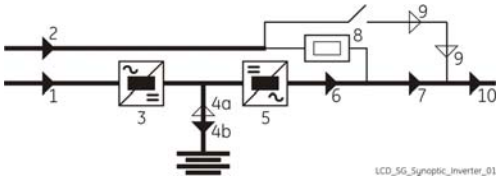
Synoptic Diagram of first unit



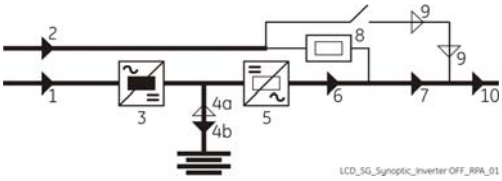
Synoptic Diagram of other units

5. *Insert the Inverter by pressing the "Inverter ON" (I) key on first unit.*

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.



Synoptic Diagram of first unit



Synoptic Diagram of other units

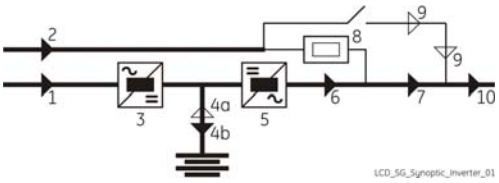
Continue ▶

6. *Insert the Inverter by pressing the "Inverter ON" (I) key on all other units.*

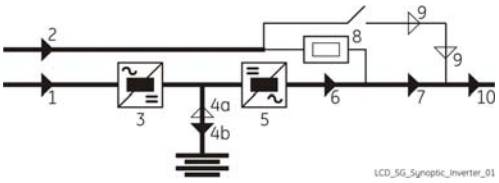
Do not start the next *Inverter* until the sequence of the previous ends.

- As soon as the output power of the *Inverters* is sufficient to supply the *Load*, the output of the units with running *Inverter* will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



Synoptic Diagram of first unit



Synoptic Diagram of other units

7. *Load supply.*

SG Series 400 & 500 Parallel System is now running, supplying power to the output.
Insert the *Loads* one by one to the output of the *SG Series 225 & 300 Parallel System.*
Check the output current value of *L1*, *L2* and *L3* and check for correct load balance.

8. *Operation mode selection.*

SG Series 400 & 500 Parallel System is delivered normally selected for permanent *VFI* operation.
eBoost™ Operation Mode can be enabled if available, and the *eBoost START* time & *eBoost STOP* time can be programmed for each day of the week (see *Section 6.4 SETUP / eBoost).*

END OF PROCEDURE

NOTE !

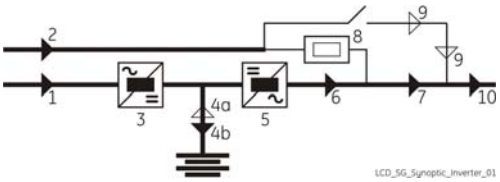
The *Battery* must be charged for at least 10 hours, in order to ensure the full backup runtime in case of a *Utility Failure*.

7.2.2 Parallel System shutdown with Load transfer on Manual Bypass Q2 (option)

	**NOTE !** **Not following this procedure can cause protected loads to shut down!** **Never close or open either *UPS Output Switch Q1* and *Manual Bypass switch Q2* (option) with the *inverter* running!** **Initial situation: the *Load* is powered by all *Inverters* of the *Parallel System*.** **If *eBoost™* option is available, make sure that *eBoost™ Operation Mode* is disabled before starting the shutdown procedure.** **The complete *UPS Parallel System* has to be turned OFF, while providing the *Load* power by *Utility* through all *Manual Bypass Q2* (option).**

With the *UPS Parallel System* in normal operation and the *Inverters* supplying the *Load*, the ***UPS Output Switches Q1* are closed (Pos. I)** and the ***Manual Bypass Switches Q2* (option) are open (Pos. O)**.
The ***External Battery Switch or Fuses* are closed (Pos. I)**.

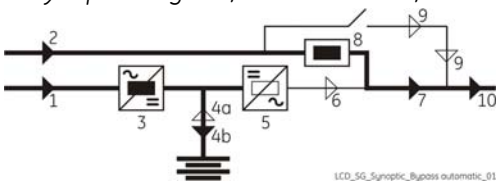
The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



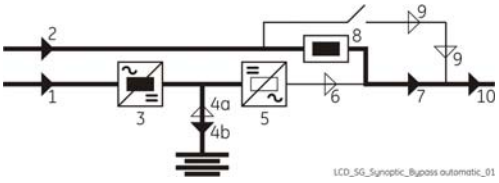
1. ***Disconnect the Inverter by pressing the "Inverter OFF" (O) key on all Units, and hold until the LED 5 (Inverter available) turns OFF.***

   - At no redundancy, the system will transfer to *Utility* supply. *LED 5 (Inverter available)* is Off.
   - *LED Alarm* is lit and the *LED Operation* is Off.

   The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



Synoptic Diagram of first unit

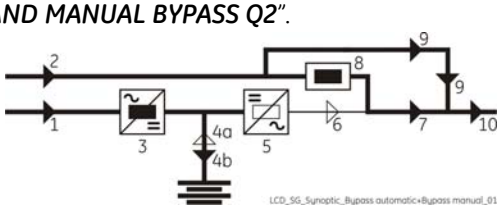


Synoptic Diagram of other units

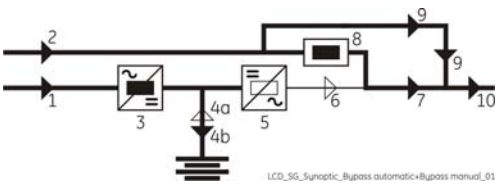
2. ***Close the Manual Bypass Switch Q2 (Pos. I) on all Units.***

   - *Load* is now supplied from *Utility* in parallel from *Automatic Bypass* and *Manual Bypass Q2* of all *Units*.
   - *LED 8 (Automatic Bypass ON)* and *LED 9 (Manual Bypass Q2 ON)* are lit.

   The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS AND MANUAL BYPASS Q2***".



Synoptic Diagram of first unit



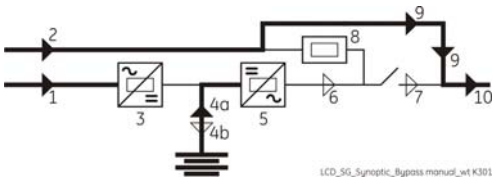
Synoptic Diagram of other units

Continue ▶

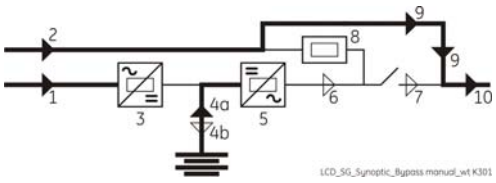
3. *Open the UPS Output Switch Q1 (Pos. O) and then press the "Load Off" key on all Units.*

- The *Load* is now supplied only through the *Manual Bypass Q2* of all *Units*.
- *LED 8 (Automatic Bypass ON)* turns OFF and *LED 9 (Manual Bypass Q2 ON)* stays lit.
- All *Rectifiers* are shutdown and all output and input *Contactors* are opened.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY MANUAL BYPASS Q2***".



Synoptic Diagram of first unit



Synoptic Diagram of other units

4. *Disconnect the Battery from on all Units by opening (Pos. O) the External Battery Switch or Fuses.*

- **Wait *5 minutes*** for DC-Link Capacitors discharge.

The *Load* is now powered from the *Utility* through all *Manual Bypass Q2 (option) of the Parallel System*.

END OF PROCEDURE

WARNING!

It will take a minimum of 5 minutes for the DC capacitors to discharge.

Open only the front door, do not open any other part of the UPS.

7.2.3 From Manual Bypass Q2 (option) to normal function VFI

	NOTE ! ***UPS Parallel System* has been turned *OFF* following the *"Maintenance shutdown (Load on Manual Bypass Q2)"* procedure and the *Load* is still powered by all *Manual Bypass Q2 (option).*** **The *Load* must be transferred back to the *UPS Parallel System*.**

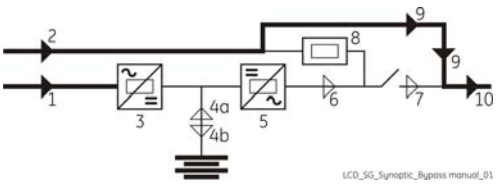
Open the front door on all UPS units and make sure that:

- The ***safety screens*** are fixed in their position.
- The ***UPS Output Switches Q1*** and the ***External Battery Switch or Fuses*** are open (Pos. O).
- The ***Manual Bypass Switches Q2 (option)*** are closed (Pos. I).
- ***LED Alarm*** are lit.

Initial status:

Load supplied from all Manual Bypass Q2 of the Parallel System.

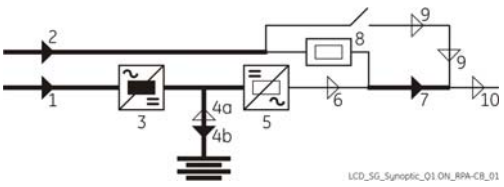
All Manual Bypass Switches Q2 of the Parallel System are closed.



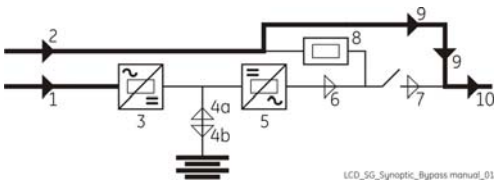
1. If not already supplied (separate utility inputs), switch-ON the utility power to the rectifier input on all UPS units.

2. Close the UPS output switch Q1 (Pos. I) on first Unit.

- *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
- At the end of *Rectifier* Soft-start, *LED 3 (Rectifier ON)* remains lit.



Synoptic diagram of first unit



Synoptic diagram of other units

3. Connect the Battery on first Unit by closing (Pos. I) its External Battery Switch or Fuses.

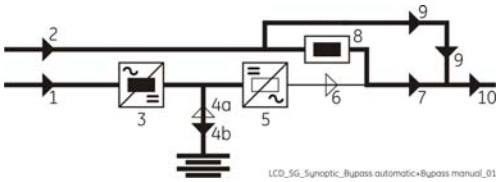
LED 4b (charging battery) should be lit indicating *battery charge*.

	ATTENTION ! **Before performing this operation, the *LED 3 (Rectifier ON)* must remain lit, thus indicating that the DC-Link has reached floating voltage (540Vdc)!**

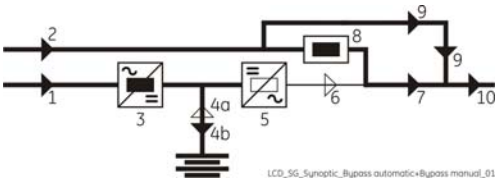
Continue ►

4. *Repeat the procedures 2 and 3 for each other Unit.*

- The *Rectifiers* will start automatically and at the closure of *UPS output switch Q1* of the *last Unit*, the output will be supplied parallel from *Automatic Bypass* and *Manual Bypass Q2* of all UPS units.
- *LED 8 (Automatic Bypass ON)* and *LED 9 (Manual Bypass Q2 ON)* are lit.



Synoptic Diagram of first unit

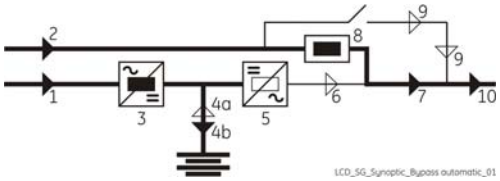


Synoptic Diagram of other units

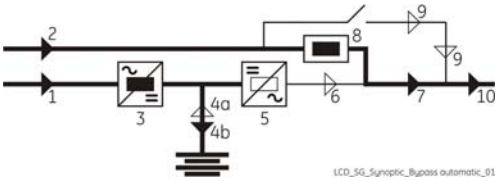
5. *Open the Manual Bypass Switch Q2 (Pos. O) on all Units.*

- The *Load* is supplied by the *Utility* through the *Automatic Bypass* of all *Units.*
- *LED 8 (Automatic Bypass ON)* is lit and *LED 9 (Manual Bypass Q2 ON)* turns OFF.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



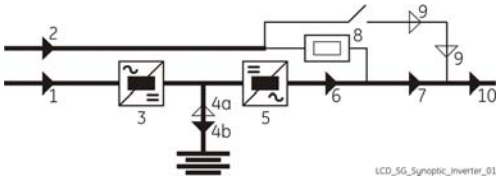
Synoptic Diagram of first unit



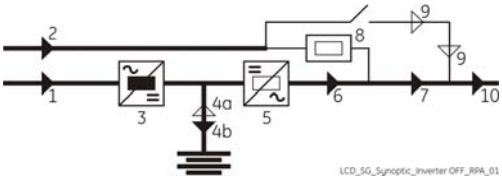
Synoptic Diagram of other units

6. *Insert the Inverter by pressing the "Inverter ON" (I) key on first unit.*

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available).*
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.



Synoptic Diagram of first unit



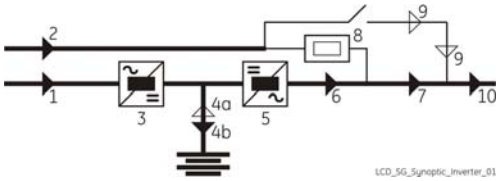
Synoptic Diagram of other units

7. *Insert the Inverter by pressing the "Inverter ON" (I) key on all other units.*

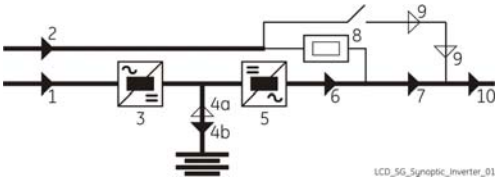
Do not start the next *Inverter* until the sequence of the previous one ends.

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available).*
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- As soon as the output power of the *Inverters* is sufficient to supply the *Load*, the output of the units with running *Inverter* will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



Synoptic Diagram of first unit



Synoptic Diagram of other units

END OF PROCEDURE

7.2.4 Separate a UPS Unit from the Parallel System (System Redundancy)

NOTE:

The *Load* is powered by the *UPS Redundant Parallel System*.
One UPS unit of the *Parallel System* has to be turned Off, while the *Load* is shared between the other units supplying the parallel bus.

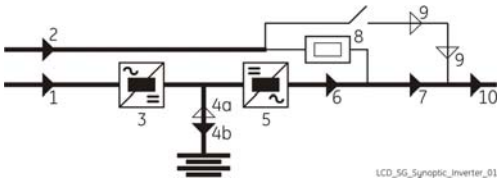
If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting the shutdown procedure.

WARNING!

The control bus cable connecting *J52 (A)* and *J62 (B)* cannot be connected or disconnected after the system has been powered on.

Initial status:

Load supplied from all Inverters of the Redundant Parallel System.



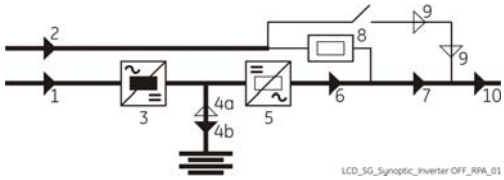
1. ***Disconnect the Inverter by pressing the "Inverter OFF" (O) key and hold until the LED 5 (Inverter available) turns OFF on the Unit to separate.***

   With *redundant system*, pressing the key OFF the *Inverter* shuts down and it will stay OFF.

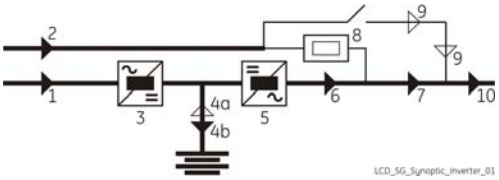
   If by pressing the key *"O"* the *Load* is transferred to the *Utility* and the *Inverter* remains operating, it means the system is not redundant.

   In this case is not possible to switch-OFF one unit without transferring the *Load* on *Utility*.

   - *Load* supplied from *Inverter(s)* of the other Unit(s) of the *Parallel System*.



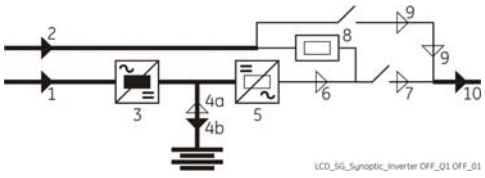
Synoptic Diagram of the unit to separate



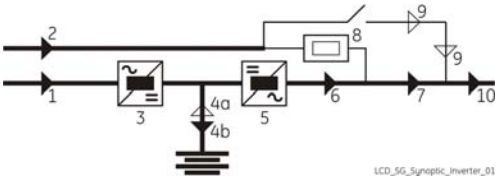
Synoptic Diagram of other units

2. ***Open the UPS Output Switch Q1 (Pos. O) on the Unit to separate.***

   - *LED Alarm* is lit and the *LED Operation* is Off.
   - *LED 6 (Inverter ON) and LED 7 (Q1 closed)* must be Off.



Synoptic Diagram of the unit to separate



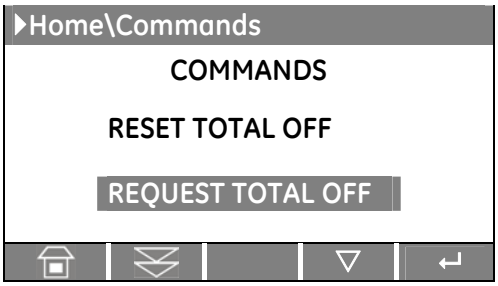
Synoptic Diagram of other units

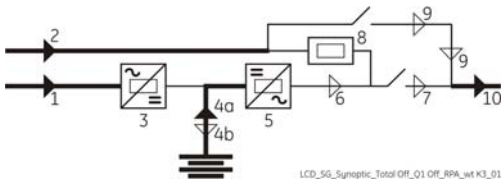
Continue ►

3. ***Perform the command "Load Off" on the Unit to separate only when the LED 7 (Q1 closed) is Off.***

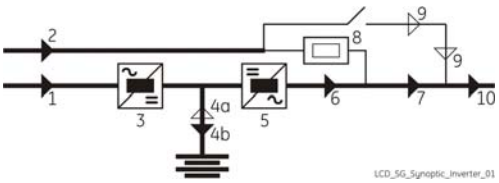
   Perform the command *"Load Off"* by entering the screen (see *Section 7.5)*:

   COMMANDS / **REQUEST TOTAL OFF**





Synoptic Diagram of the unit to separate



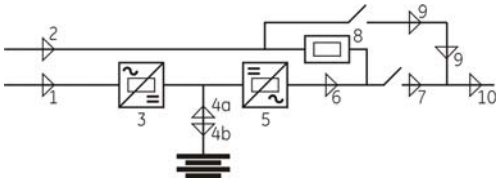
Synoptic Diagram of other units

4. ***Disconnect the Battery on the Unit to separate by opening (Pos. O) the External Battery Switch or Fuses.***

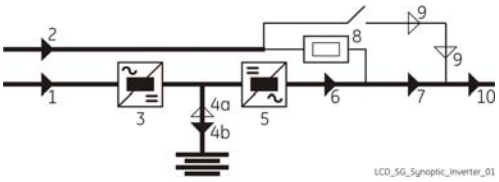
   - **Wait *5 minutes*** for DC-Link Capacitors discharge.

5. ***Disconnect the Utility supply on the Unit to separate.***

   - Complete power shutdown will OFF the *LCD Display Panel*.



Synoptic Diagram of the unit to separate



Synoptic Diagram of other units

END OF PROCEDURE

DANGER !

It will take 5 minutes for the DC capacitors to discharge.

Open only the front door, do not open any other part of the UPS.

NOTE !

For any further intervention contact nearest *Service Center*.

7.2.5 Reconnect a UPS unit to a Parallel System

NOTE:

The *Load* is still powered by the other units supplying the *Parallel Bus*.

This UPS unit will be powered on and connected to the *Parallel Bus* in order to share the *Load* with each other's.

If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting the shutdown procedure.

WARNING !

The *High Speed Bus Cable Connecting J52* (A) and *J62* (B) in any case cannot be connected or disconnected after the system has been powered ON.

The *Bus Terminals* must be properly connected before powering the additional unit.

Open the front door, of the Unit to reconnect, and make sure that:

- All the ***connections*** to the input/output bus bars of the UPS have been made correctly.
- The ***protection panels*** are fastened in their correct position.
- The ***UPS Output Switch Q1***, ***Manual Bypass Switch Q2*** (option) and the ***External Battery Switch or Fuses*** **must be open (Pos. O)**.

1. ***Switch-ON the Utility Voltage, on the Unit to reconnect, from the input distribution (both Rectifier and bypass if separated).***

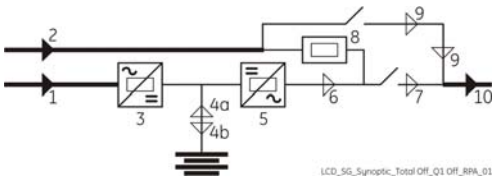
   At this stage the electronic power supply is switched ON.

   The UPS performs a *SELFTEST*.

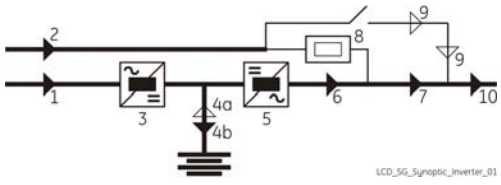
   A successful termination of the tests will be indicated with Overall test results *"OK"*.
   Commissioning cannot be continued should one or more tests result to be negative.
   Please contact in this case your *Service Center*.

Overall test results			
Test1	OK	Test7	OK
Test2	OK	Test8	OK
Test3	OK	Test9	OK
Test4	OK	Test10	OK
Test5	OK	Test11	OK
Test6	OK		

   With *"Overall test results - OK"* the *Synoptic Diagram* is displayed.
   LED 1 (Utility Rectifier OK) and *LED 2 (Utility Bypass OK)* must be lit.
   The buzzer sounds, press the *"MUTE"* key to reset *acoustical alarm*. *LED Alarm* remains lit.



Synoptic diagram of the unit to reconnect

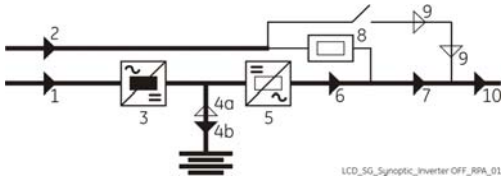


Synoptic diagram of other units

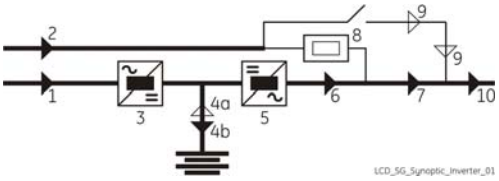
Continue ►

2. *Close the UPS Output Switch Q1 (Pos. I) on the Unit to reconnect.*

- *Rectifier* starts automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
- At the end of *Rectifier* Soft-start the *LED 3 (Rectifier ON)* remains lit.



Synoptic diagram of the unit to reconnect



Synoptic diagram of other units

3. *Connect the Battery on the Unit to reconnect by closing (Pos. I) the External Battery Switch or Fuses.*

LED 4b (Charging Battery) should be lit indicating *battery charge*.

ATTENTION !

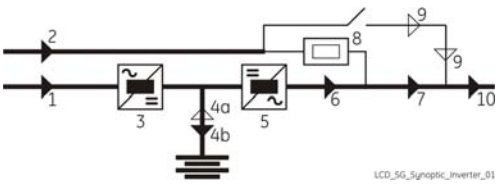
Before performing this operation, the *LED 3 (Rectifier ON)* must remain lit, thus indicating that the DC-Link has reached floating voltage (540Vdc)!

4. *Insert the Inverter by pressing the "Inverter ON" (I) key on the Unit to reconnect.*

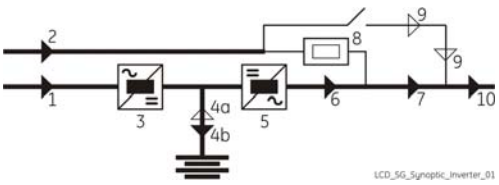
- The *inverter* will start up. *LED 5 (Inverter available)* must be blinking
  In a short time, when the *Inverter voltage* is confirmed, the *LED 5 (Inverter available)* will stop blinking and stay fixed lit.
  The *Load* will be automatically shared between the *Parallel Units* and this *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

Verify on display screen that the load should be equally shared between the parallel units.

The *synoptic diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



Synoptic Diagram of the unit to reconnect



Synoptic Diagram of other units

END OF PROCEDURE

7.2.6 Complete Parallel System shutdown

NOTE !

Follow this procedure only in case the *UPS Parallel System* and the *Load* must be completely powered-down.

If *eBoost™* option is available, make sure that *eBoost™ Operation Mode* is disabled before starting the shutdown procedure.

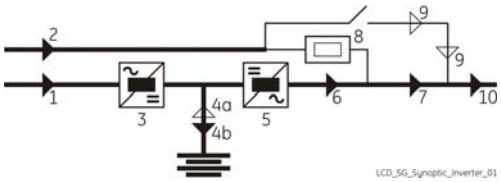
Initial situation:

The *Load* is powered by *SG Series 225 & 300 Parallel System* supplying the *Parallel Bus*.

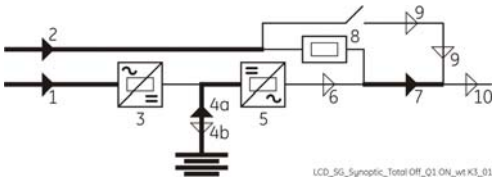
With the *UPS Parallel System* in normal operation and the *Inverters* supplying the *Load*, the ***UPS Output Switches Q1*** and the ***External Battery Switch or Fuses*** **are closed (Pos. I)** and the ***Manual Bypass Switches Q2*** (option) **are open (Pos. O)**.

Initial status:

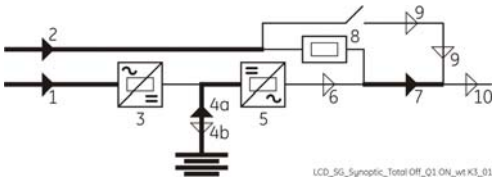
Load supplied from all Inverters of the Parallel System.



1. ***Press the "Load Off" key on anyone of the Parallel Units.***
   - *Load* is disconnected from *UPS Parallel System.*
   - *Rectifiers* and *Inverters* are shut down and all output and input *Contactors* will be opened.
   - *LED 3 (Rectifier ON), LED 5 (Inverter available)* and *LED 10 (Load on UPS)* are OFF.
   - *LED Alarm* is lit and the *LED Operation* is Off.

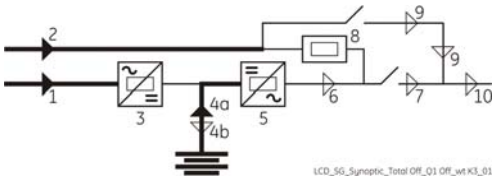


Synoptic Diagram of first unit

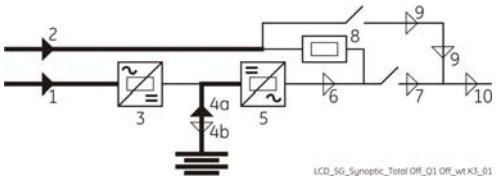


Synoptic Diagram of other units

2. ***Open the UPS Output Switch Q1 (Pos. O) on all Units.***
   - *LED 7 (Q1 closed)* is Off.



Synoptic Diagram of first unit



Synoptic Diagram of other units

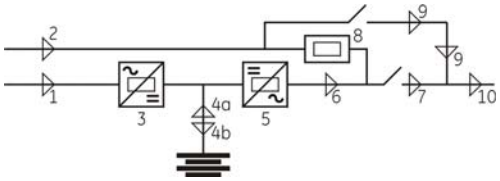
Continue ►

3. ***Disconnect on all Units the Battery from the UPS by opening (Pos. O) the External Battery Switch or Fuses.***

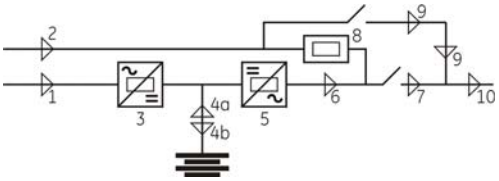
   - **Wait *5 minutes*** for DC-Link Capacitors discharge.

4. ***Disconnect the Utility supply on all Units.***

   - Complete power shutdown will OFF the *LCD Display Panel*.



Synoptic Diagram of first unit



Synoptic Diagram of other units

END OF PROCEDURE

DANGER !

It will take 5 minutes for the DC capacitors to discharge.

Open only the front door, do not open any other part of the UPS.

7.2.7 Restore to normal operation after "Load Off"

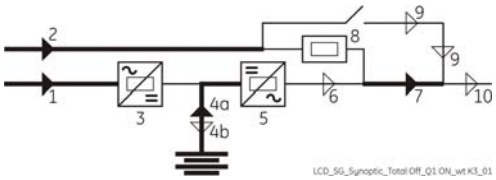
NOTE !

Make sure the all *Units* of the *Parallel System* to be status of the activation of "*Load Off*", i. e. *UPS Output Switches Q1* closed (Pos. I), *Manual Bypass Switches Q2 (option)* open (Pos. O) and *External Battery Switch or Fuses* connected (Pos. I).

If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting the shutdown procedure.

View of the *synoptic diagram*, on all UPS units, after pressing the "*Load Off*" *key*.

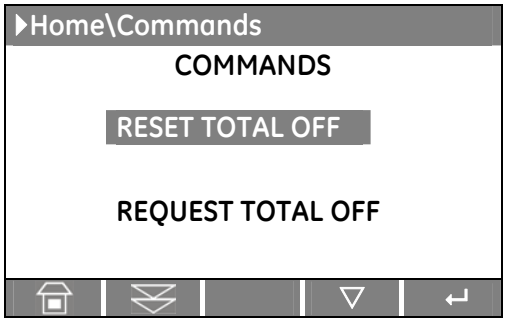
- **All *Contactors* are open.**
- ***Rectifier*, *Inverter* and *Static-Switch* shutdown.**
- ***LED Alarm* is lit.**



1. ***Reset "Load Off" of the Parallel System.***

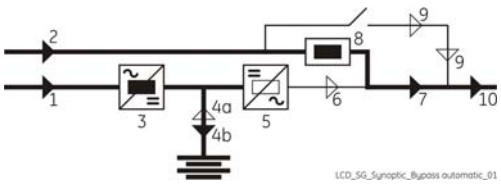
   Restore the command *"Load Off"*, on anyone of the *Parallel Units*, by entering the screen:

   COMMANDS / **RESET TOTAL OFF**

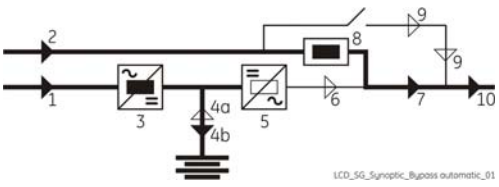


   - The *Load* is supplied by the *Utility* through the *Automatic Bypass* of all *Units*.
   - *Rectifiers* start automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
   - At the end of *Rectifier* Soft-start, the *LED 3 (Rectifier ON)* remains lit.
   - *LED Alarm* is lit.

   The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



Synoptic Diagram of first unit

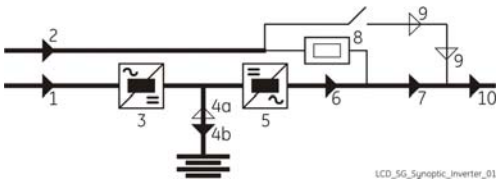


Synoptic Diagram of other units

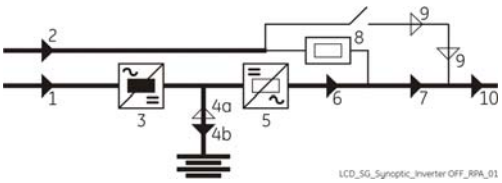
Continue ►

2 Insert the Inverter by pressing the "Inverter ON" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.



Synoptic Diagram of first unit



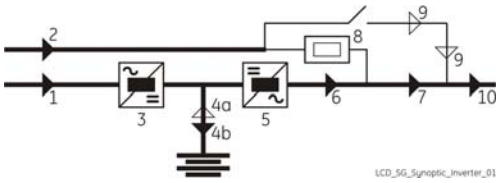
Synoptic Diagram of other units

3. Insert the Inverter by pressing the "Inverter ON" (I) key on all other units.

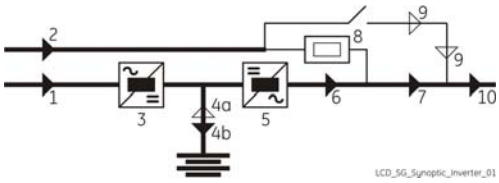
Do not start the next *Inverter* until the sequence of the previous ends.

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- As soon as the output power of the *Inverters* is sufficient to supply the *Load*, the output of the units with running *Inverter* will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



Synoptic Diagram of first unit



Synoptic Diagram of other units

END OF PROCEDURE

7.2.8 Restore to normal operation after EPO (Emergency Power Off)

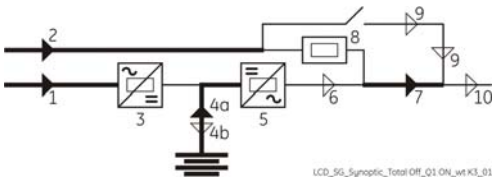
NOTE !

Make sure the all units of the *Parallel System* to be status of the activation of *EPO*, i. e. *UPS Output Switches Q1* closed (Pos. I), *Manual Bypass Switches Q2 (option)* open (Pos. O) and *External Battery Switch or Fuses* connected (Pos. I).

If *eBoost*™ option is available, make sure that *eBoost*™ *Operation Mode* is disabled before starting the shutdown procedure.

View of the *synoptic diagram*, on all UPS units, after activation of *EPO (Emergency Power Off)* with *Utility* available.

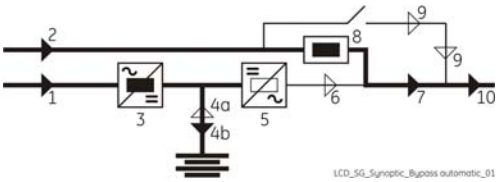
- **All *Contactors* are open.**
- ***Rectifier*, *Inverter* and *Static-Switch* shutdown.**
- ***LED Alarm* is lit.**



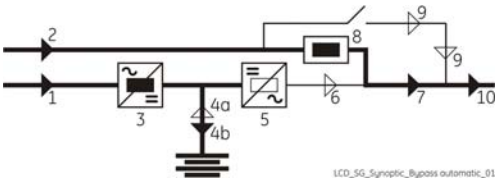
1. ***Reset the EPO (Emergency Power Off) button.***
   - Press the *"MUTE"* key to reset *alarm* and *acoustical alarm*.
   - *LED Alarm* remains lit.

2. ***Press "Inverter OFF" (O) key on all Units.***
   - *Rectifiers* start automatically, blinking *LED 3 (Rectifier ON)* indicates Soft-start.
   - At the end of *Rectifier* Soft-start, the *LED 3 (Rectifier ON)* remains lit.
   - After pressing the *"Inverter OFF"* key on the last unit of the *Parallel System*, the output of all *Units* connect to *Automatic Bypass*.

   The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY AUTOMATIC BYPASS***".



Synoptic Diagram of first unit

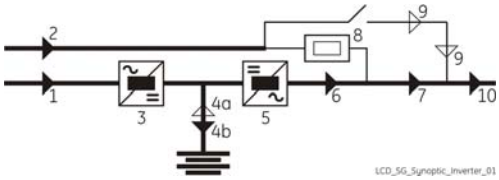


Synoptic Diagram of other units

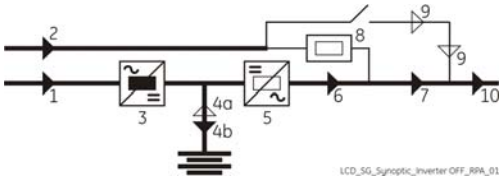
Continue ►

3 Insert the Inverter by pressing the "Inverter ON" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.



Synoptic Diagram of first unit



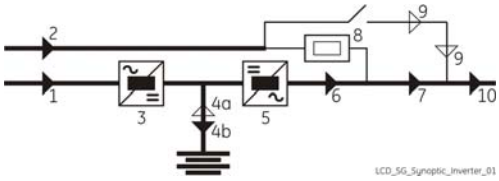
Synoptic Diagram of other units

4. Insert the Inverter by pressing the "Inverter ON" (I) key on all other units.

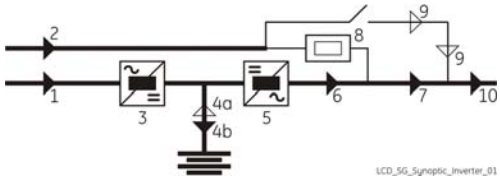
Do not start the next *Inverter* until the sequence of the previous ends.

- Soft-start of *Inverter*, indicated with blinking *LED 5 (Inverter available)*.
- At the end of Soft-start the *LED 5 (Inverter available)* remains lit.
- As soon as the output power of the *Inverters* is sufficient to supply the *Load*, the output of the units with running *Inverter* will transfer to *Inverter*.
- *LED Alarm* turn Off and the *LED Operation* must be lit.

The *Synoptic Diagram*, on all UPS units, must display the status "***LOAD SUPPLIED BY INVERTER***".



Synoptic Diagram of first unit

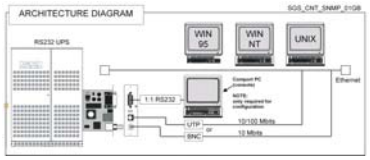


Synoptic Diagram of other units

END OF PROCEDURE

8 OPTIONS

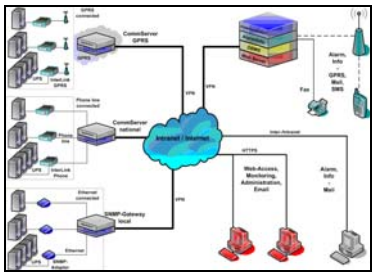
8.1 COMMUNICATION OPTIONS



3-ph SNMP/WEB plug-in adapter

SNMP - Simple Network Management Protocol

The *3-ph SNMP/WEB plug-in adapter* is an interface to the *Ethernet Network*, and provides UPS information via the standard *SNMP Protocol* (UPS-MIB (RFC-1628); GE Single MIB; GE Parallel MIB).
The UPS can therefore be managed by a *Network Management System (NMS)* or by our applications (for instance *GE Power Diagnostics, GE Data Protection* or *GE Service Software*), which uses this information to determine the state of the UPS in order to guarantee safe and orderly shutdown of the server, when needed.



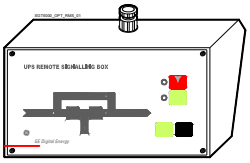
GE Power Diagnostics

GE Power Diagnostics is an anytime, anywhere concept in UPS status monitoring and alarm notification that has been successfully implemented in numerous of installations supporting up to multi-hundred UPS.
Based on the leading *Intelligent Remote Information System IRIS* all GE UPS types as well as 3rd party UPS are supported.
Accessing the latest site information via Web and being alerted by Email, SMS or Fax, it enables the user to make timely decisions in case of changing critical conditions.
With comprehensive data collection and analysis *IRIS* is not only a remote monitoring & diagnostics (RM&D) system but, the core of the integrated service offering *GE Power Diagnostics*.

GE Data Protection

GE Data Protection

GE Data Protection software can communicate with the UPS over *RS-232*, *USB* or *SNMP* to receive status information and measurement values of the UPS.
In case of a critical condition (time on battery, remaining battery autonomy time or low battery) for the load, the software starts a controlled shutdown.
An enhanced alarm management system provides the possibility to start applications, send messages, and send e-mails for every upcoming or disappearing alarm.



Remote Signaling Box (RSB)

Equipped with mimic diagram, general alarm, stop operation, alarm reset and lamp.

8.2 OPTIONS IN UPS CABINET

RPA
Redundant Parallel Architecture

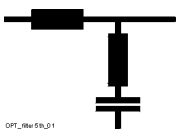
RPA Kit *(Redundant Parallel Architecture)*

Up to 6 units parallel possible for redundancy or capacity in RPA configuration.

eBoost™

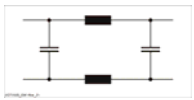
eBoost™ Operation Mode

High efficiency operating mode, where the load is supplied directly by utility and automatically transferred to inverter if the voltage is out of prescribed tolerances.



5th harmonic filter

Located inside UPS cabinet.



FCC Filter

Located inside UPS cabinet. Meets FCC Class A, Part 15 Standard for EMI suppression.

8.3 CONNECTION FOR OPTIONS

WARNING !

The installation and cabling of the options must be performed by QUALIFIED SERVICE PERSONNEL ONLY.
Make sure that the UPS installation is completely powered down.
Refer to the "*Safety prescriptions - Installation*" described on *Section 1*.

8.3.1 Remote Signaling Box (RSB)

The optional *Remote Signaling Box* allows monitoring of the operation of the UPS, using the potential free contacts fitted on the *"P4 - Customer Interface Board"* of the UPS.
It can be used by simply putting the box on a desktop or on a wall or, removing the box, it can be surface mounted.

The remote panel contains an internal buzzer and the following status indicators:

- ***Mimic diagram*** With *LEDs* indicating the operation of *Rectifier* and *Inverter*, and the power source supplying the critical *Load*.
- ***Alarm*** Indicating a critical situation on the UPS (LED light and audible alarm).
- ***Stop*** Indicating the UPS is preparing to shut down in a short time.
- ***Mute*** Push button, resets the buzzer.
- ***Test*** Push button checks all the LEDs and the buzzer of the remote panel.

The cable connecting the *RSB* to the UPS cabinet must be min. 16 wires / 0.25mm^2.
The ***plug B*** is included in the delivery of the option *RSB* (cable connecting *UPS* with *RSB* not included). Maximal allowable length: **985 ft** (300 m).
It must be wired at one end with a D - female plug- 25 pin (*J2 – P4 Customer Interface Board*).

NOTE !

The alarms on free potential contacts can be connected on terminals *X1* instead *J2* (see correlation *X1 – J2* in *Section 4.1* of the *Installation Guide*).

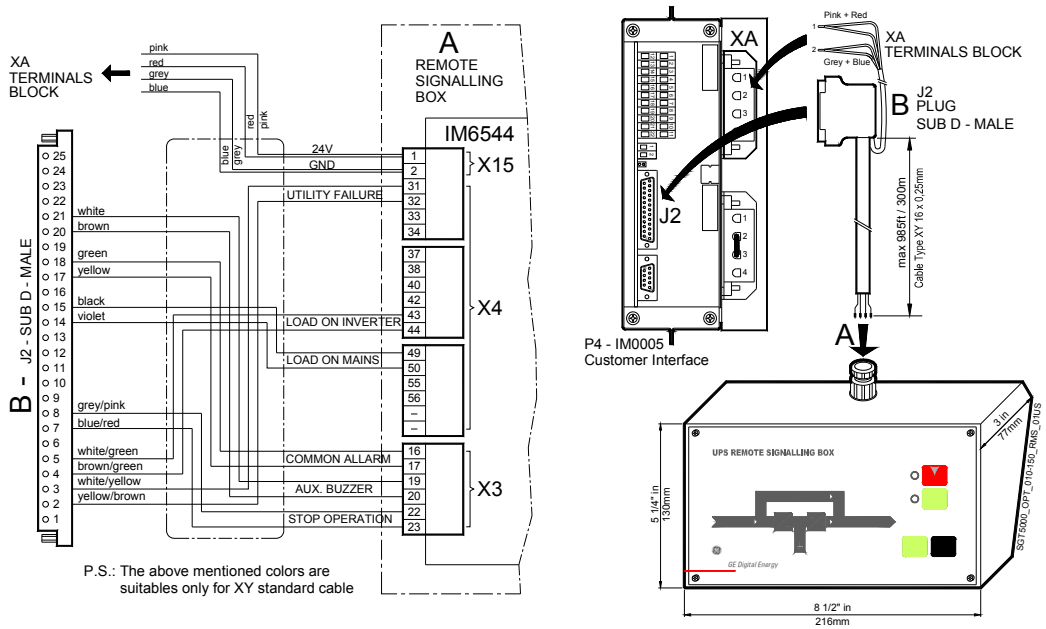


Fig. 8.3.1-1 Remote Signaling Box connection

A Terminals ***X3***, ***X4*** and ***X15*** fitted inside the *Remote Signaling Box*.
B Plug ***J2*** (sub D - male - 25 pin) must be connected to the connector ***J2*** (sub D - female-25 pin) located on *"P4 - Customer Interface Board"*.
XA Terminals block ***XA*** for 24Vdc supply *Remote Signaling Box*.

NOTE !

If the remote signal panel is plugged on connector *J2*, the terminal blocks *X1* cannot be used to drive an external alarms monitoring device, because it is supplied by the internal UPS low voltage power supply.

9 MAINTENANCE

WARNING !

All maintenance and service works must be performed by QUALIFIED SERVICE PERSONNEL ONLY.

9.1 MAINTENANCE

A UPS system, like other electrical equipment, needs periodic preventive maintenance.

A regular maintenance check of your installation guarantees higher reliability of your safe critical power supply.

Preventive maintenance work on the UPS can be done only by trained Service technicians.

We therefore recommend you sign a Maintenance and Service contract with GE Global Services @ **1-800-637-1738**

9.1.1 Service check

If the *LED Operation* blinking during normal operation, the unit has not been serviced for the last 20,000 hours by a *GE* trained technician.

We highly recommend that you contact your *Service Center* for preventive maintenance work.

9.1.2 Fans and ventilation

We recommend a periodic cleaning of the ventilation channels and grids on the UPS system, in order to guarantee proper air circulation in the unit and in the *Battery*.

We recommend replacement of the fans in the units every **20,000 hours**.

9.1.3 Other components with limited lifetime

We recommend the periodic replacement of the following components to guarantee higher reliability of the UPS.

Component	**Lifetime**	
	Ambient temperature	**At 100% load**
Filter Capacitors DC	Up to 77°F (25°C)	50,000 hours
	Up to 104°F (40°C)	20,000 hours
Filter Capacitors AC	Up to 104°F (40°C)	50,000 hours
Lithium Battery on the "P3 – Control board"	Up to 104°F (40°C)	50,000 hours

9.1.4 Battery

We recommend a periodic *Manual Battery Test*, especially if the *Automatic Battery Test* is disabled, in order to verify if the *Battery* can provide the expected backup time in case of *Utility Failure*.

We recommend this test be performed at least every **3 months**, especially if the *Battery* is not sufficiently discharged during normal operation.
The discharge time you use should be at least half of the *Battery* runtime.

For *Automatic Battery Test* setting, a special code is required to enter user set-up parameters.
The start up technician has access to this code and can program this feature during start up.

Please consider that, if you did a full *Battery Test* to verify the full runtime of the *Battery*, the charger needs at least **8 hours** to recharge the *Battery* up to 90% of its capacity.

9.1.5 Long shut-down periods of the UPS-system

To guarantee that the *Battery* is fully charged, the UPS system should be in operation for at least **12 hours every 3 months**.

If not the *Battery* may be permanently damaged.

9.1.6 UPS room conditions and temperature

The UPS room and the *Battery Room* have to be maintained clean and free from dust.

A high temperature of the UPS room and of the *Battery Room* affect the lifetime of several components inside the equipment.

The *Battery* is very sensitive to room temperatures above **77°F** (25°C).

9.1.7 Long shut-down periods of the UPS-system

a) Cleaning, a visual inspection and a mechanical inspection of the UPS modules.

b) Replacement of defective parts or the preventive replacement of parts with a defined lifetime

c) "Updating" of the equipment (technical improvements subsequent to the delivery).

d) Check the calibration of *DC voltage* and *Inverter Output Voltage* and *Frequency*.

e) Check of the settings of the electronic regulation, the control and the alarm circuits of the *Rectifier(s)* and *Inverter(s)*.

f) Functional checks on *Thyristors*, *Diodes*, *Transformers*, *Filter Components*, e.g. to ensure that they are operating within the specified design parameters.

g) Overall performance test including a *Utility Failure* simulation with and without the *Load*.

h) Monitoring *Battery* operation in discharge and recharge mode including any boost charge duties.

10 NOTES

10.1 NOTES FORM

It is recommended to note in this section ***Notes***, with date and short description all the operations performed on the UPS, as: maintenance, components replacement, abnormal situations, etc.

Date	*Description*	*Done by*