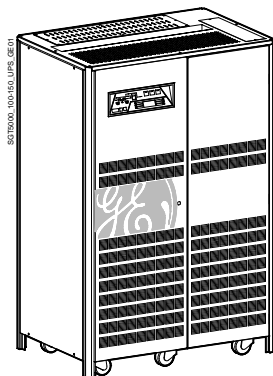


GE Digital Energy
Power Quality



Operating Manual Uninterruptible Power supply

Digital Energy™ *SG Series*

100 – 120 – 150 kVA
480 VAC UL / Series 0

Manufactured by:

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The illustrations and plans describing the equipment are intended as general reference only and are not necessarily complete in every detail.

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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** Uninterruptible Power Supply system, developed and produced to the highest standards of quality, will give you complete satisfaction.

Please read carefully the *Operating 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 pqservices@ge.com

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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.

NOTE !

SG Series 100 – 120 - 150 kVA 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.



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 100 - 120 - 150 kVA** 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 95°F (35°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).
- 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.
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 unauthorised 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 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 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 0.8 Power Factor, **SG Series** delivers more real power than other UPS in the market. With today's trend toward power factor corrected loads, **SG Series** 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** UPS are controlled in a true peer-to-peer configuration where all critical elements and functions (including *Bypass*) are redundant. **SG Series** 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** 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** offers various options like input harmonic filters and our comprehensive JUMP software suite for mission control and data protection to cover all your application needs.

3 DESCRIPTION

3.1 BLOCK DIAGRAM AND MAIN ELEMENTS

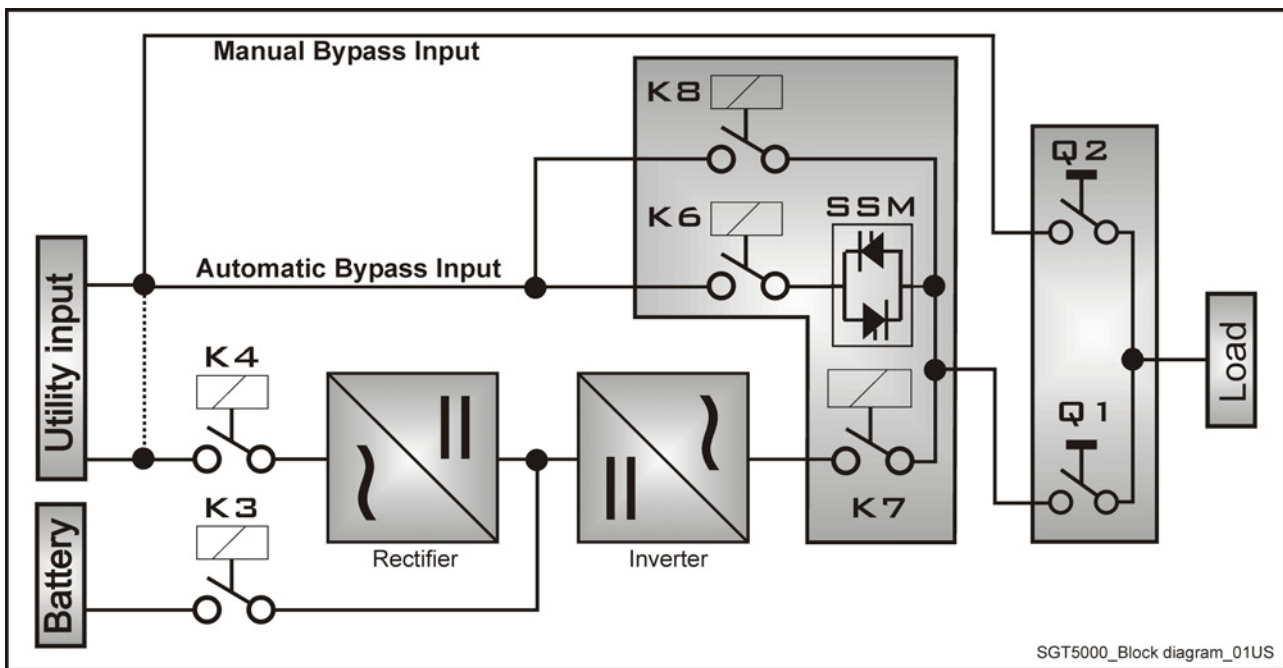


Fig. 3.1-1 Block diagram

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

Control System SG Series 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 K8* (in series with the thyristors of the static switch) and eventually *K7*, and acts in case of internal defects of the system, or due to wrong manipulations on the *Manual Bypass Q2*.

Manual Bypass 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.

3.2 OPERATION MODES

3.2.1 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.

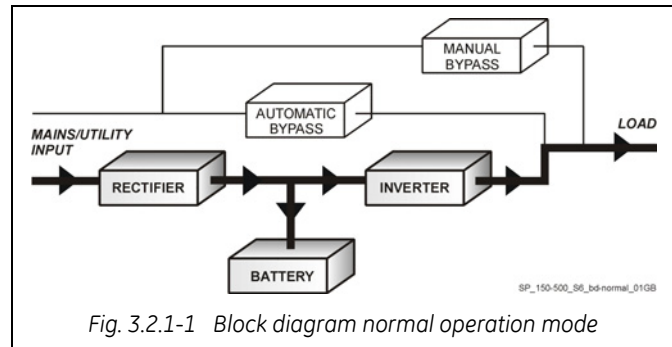


Fig. 3.2.1-1 Block diagram normal operation mode

3.2.2 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.

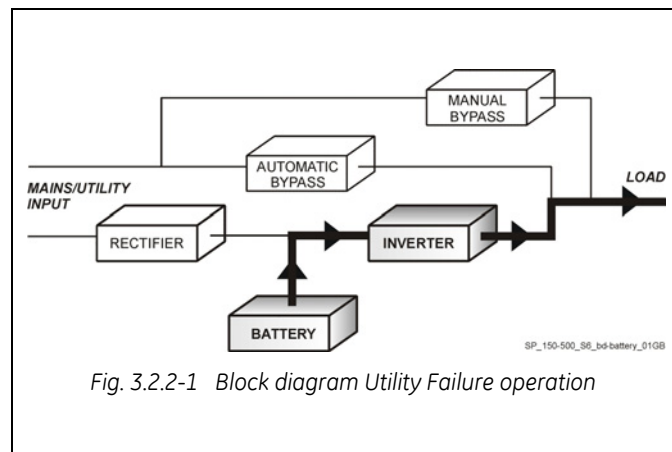


Fig. 3.2.2-1 Block diagram Utility Failure operation



In case of parallel operation

With a parallel system for power capacity (see Section 3.3)

- 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 3.3)

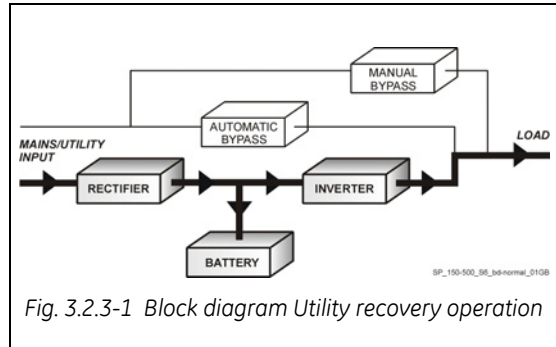
- When a Battery low warning occurs on a unit not necessary to support the present load, this unit will shut down after a timeout period (selectable).
The Load is shared between the other units
- As the warning occurs on one unit necessary to support the present load, the system starts the "**stop operation**"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

3.2.3 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*.



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.

3.2.4 Automatic Bypass

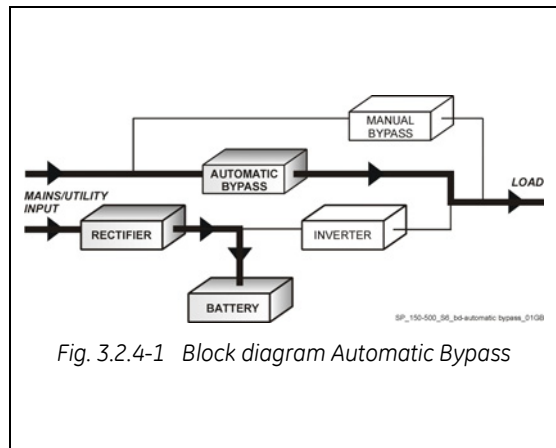
In normal operation, the *Load* is supplied by the *Inverter*.

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.



RPA

Redundant Parallel Architecture

In case of parallel operation

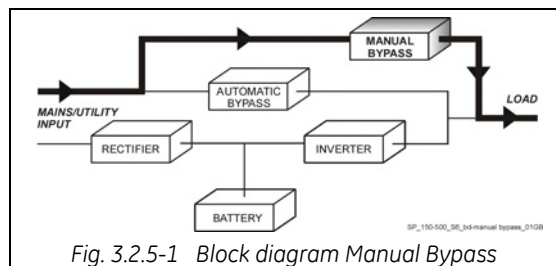
Each unit has its own internal Bypass. These units are continuously exchanging information, enabling all of the internal Bypass circuits in a parallel system to operate simultaneously.

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**.

3.2.5 Manual Bypass

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.



3.3 PARALLEL SYSTEM OPERATION

3.3.1 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** allows parallel operation of **up to 8 units**, without using paralleling switchgear, external bypass circuits or common control circuitry (see Fig. 3.3.1-1).

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).

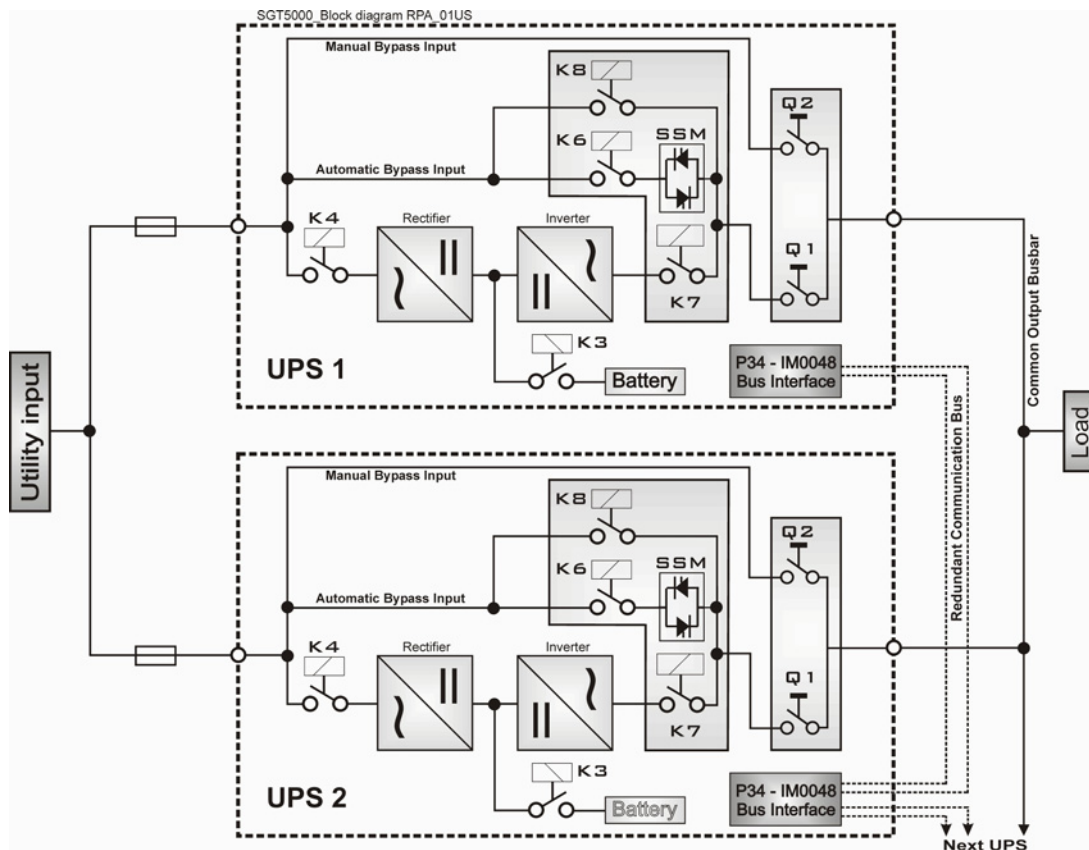


Fig. 3.3.1-1 Block diagram parallel system operation

3.3.2 Features of RPA parallel system

The **SG Series** 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.

3.3.3 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 its 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.

3.3.4 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 latter 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).

3.3.5 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.

3.4 RECTIFIERS PARALLELED ON THE SAME BATTERY

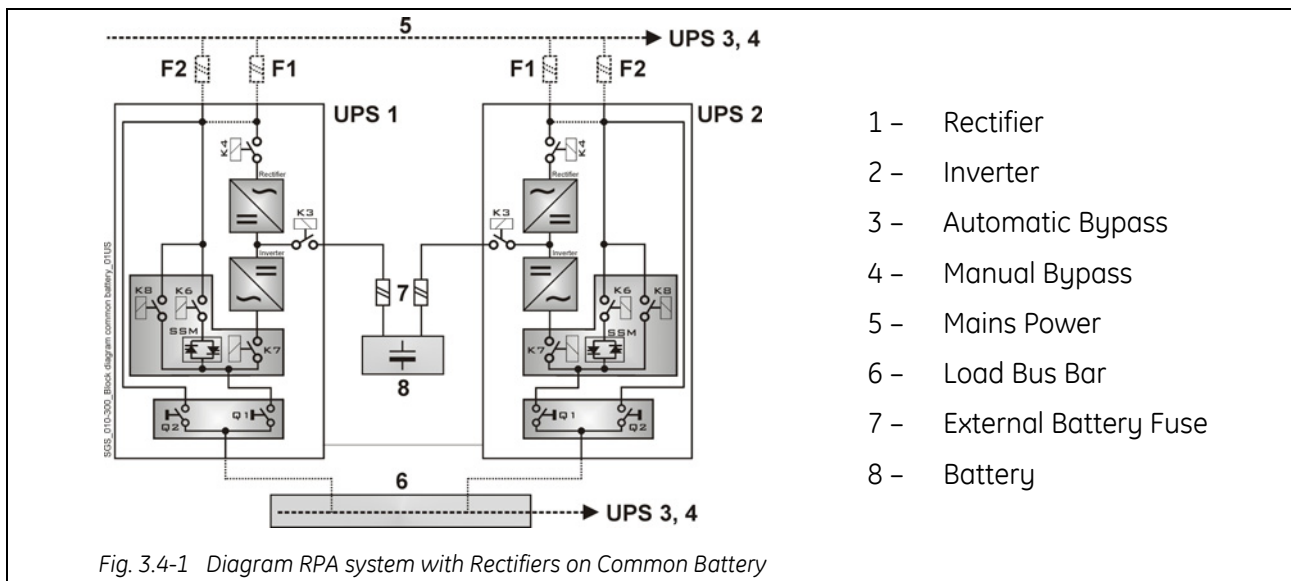


NOTE !

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 3.4-1), 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.



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 recommended to install the fuses / MCB (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 / MCB on the *Battery* line (7).
- It is recommended 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).

3.5 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 (Carbon Fluor Clorid) or HCFCs (Halogen Carbon Fluor Clorid).



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 specialised companies!

4 LAYOUT

4.1 LAYOUT SG Series 100 - 120 - 150 kVA

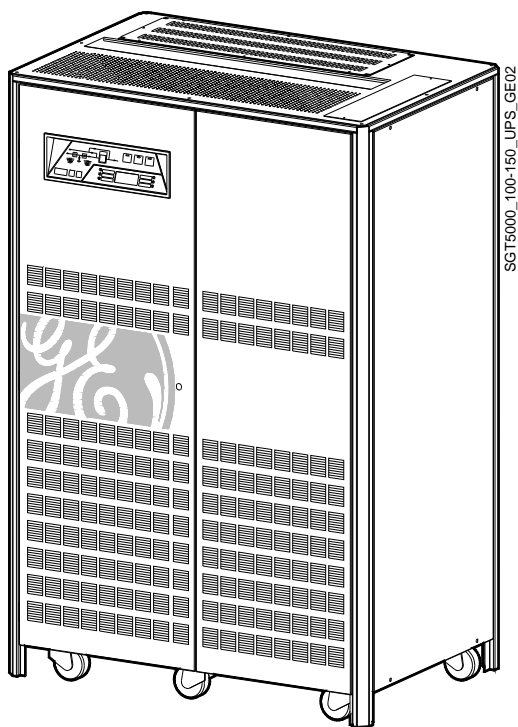


Fig. 4.1-1 SG Series general view

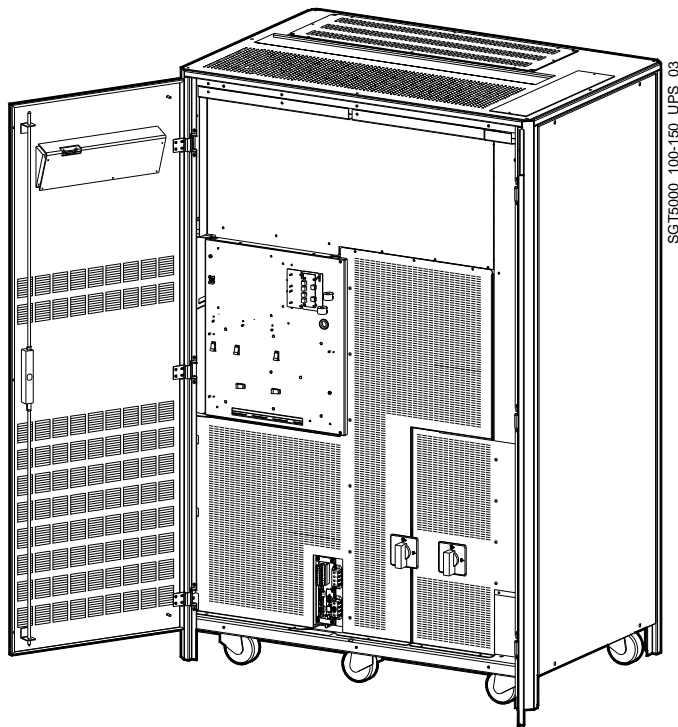


Fig. 4.1-2 SG Series general view with open doors

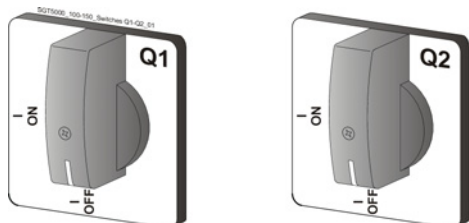


Fig. 4.1-3 Manual operated switches

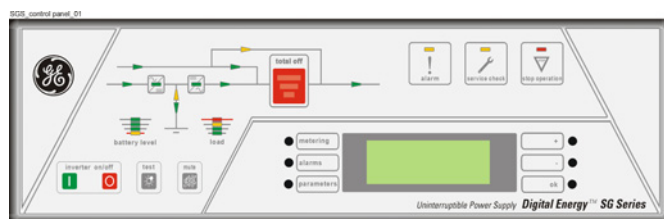


Fig. 4.1-4 Control Panel

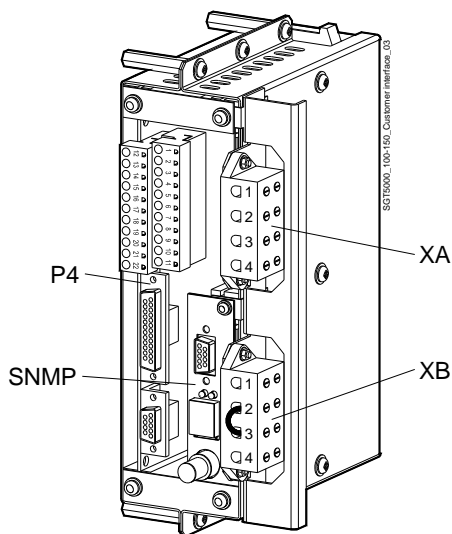


Fig. 4.1-5 Connectivity Rack

- P4** Customer Interface Board
- Q1** UPS output switch
- Q2** Manual Bypass switch
- SNMP** Advanced SNMP Card (option)
- XA** Terminals for 24VDC Auxiliary Power Supply connection
- XB** Terminals for EPO (Emergency Power Off) connection

5 CONTROL PANEL

5.1 CONTROL PANEL

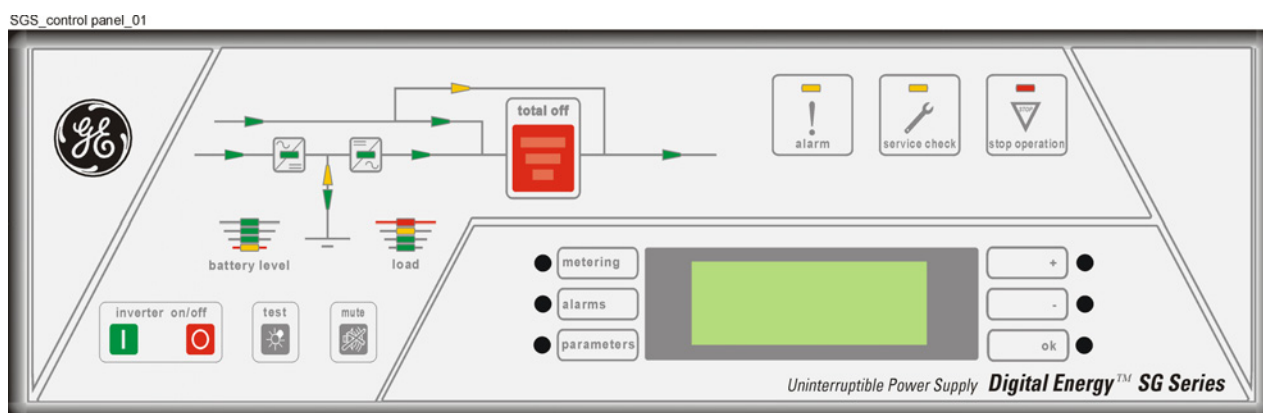
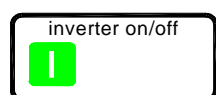


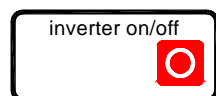
Fig. 5.1-1 Control Panel

5.2 TABLE OF FUNCTIONS AND INDICATIONS ON CONTROL PANEL



Key to switch the Inverter ON (I)

(This key is also used to **reset "total off"** if pressed simultaneously with **total off** push button).



Key for Inverter shutdown (O)

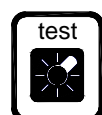
Press key to transfers the **Load to Utility**.

Keep pressed for 5 seconds to shutdown the **Inverter**.

This key is also used as the **EPO (Emergency Power Off)** reset.

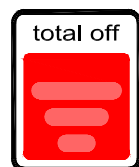


Key to **reset general alarm** and **buzzer**.



Key to **test** the control panel LEDs and buzzer.

(Pressing this key causes all the LEDs to light and the buzzer to sound 3 times).



The push-button **"total off"** is protected by a red cover.

By pressing it, you immediately **separate the UPS from Utility and the Load**.

Attention: **"total off"** cannot disconnect the UPS from the Load with Q2 closed.

To reset **"total off"**: push and hold the **"total off"** push-button and the **"I"** key (inverter on) simultaneously for some seconds.



For parallel system: if **"total off"** is pressed on one unit connected to the parallel bus (switch Q1 closed), all the units are separated from the **load**. The **"total 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.



General alarm condition

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

The **LED remains lighted** (with alarm condition still present) and the buzzer stops as the key "**mute**" has been pressed.



LED ON indicates that a regular maintenance service is needed.

May be reset by a service technician only.

See Section 11 – Maintenance.

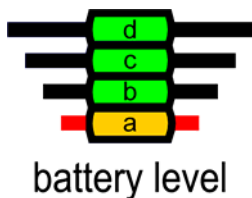
The **LED** is **ON** also when the output switch **Q1** is open, indicating that the *Inverter* is in **service mode, not supplying the load**.



a) **LED ON** indicates that the **Battery reserve lasts for only 3 more minutes** (selectable).

b) **LED ON** in case of **overtemperature or overload >125%** together with missing *Utility*.

After the timeout the Inverter will shut down.



All LEDs ON indicate that the Battery is fully charged

LED a

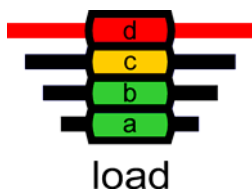
Yellow:

- Fixed: indicating last 25 % of Battery backup.
- Blinking: indicating Battery backup $\leq 5\%$.

LED b, c, d

Green:

- Each one indicating 25 % of Battery backup.



LEDs ON indicate the Load status of the UPS

LED d red ($\geq 100\%$ load)

LED c yellow (100% load)

LED b green (66% load)

LED a green (33% load)

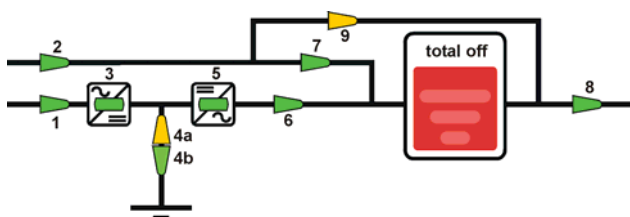


Fig. 5.2-1 LEDs on synoptic diagram

LEDs on synoptic diagram

LED 1 = Input Utility Rectifier (green)

LED 2 = Input Utility Bypass (green)

LED 3 = Rectifier ON (green)

LED 4a = Discharging (yellow)

LED 4b = Charging (green)

LED 5 = Inverter ON (green)

LED 6 = Load on Inverter (green)

LED 7 = Load on Utility (green)

LED 8 = Output Load Voltage (green)

LED 9 = Manual Bypass (Q2) ON (yellow)

User LCD Interface

Consist of an LCD screen, 4 lines with 20 characters each and six keys. It offers:

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

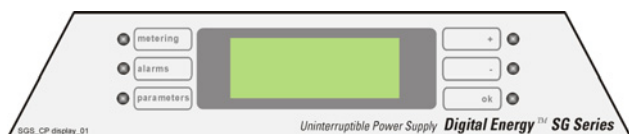
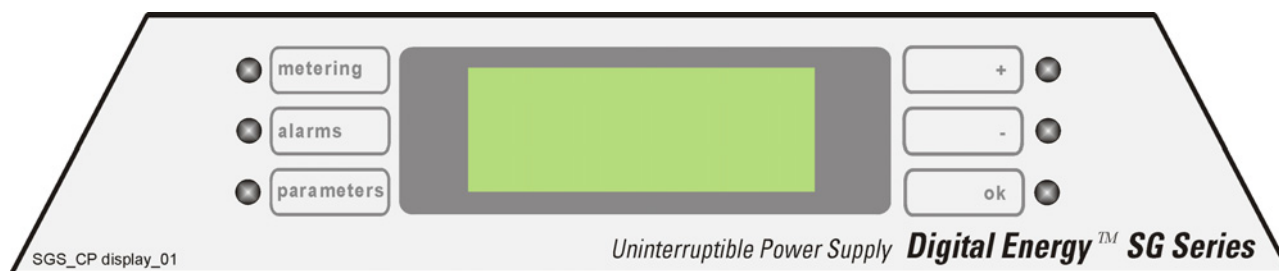


Fig. 5.2-2 LCD screen

6 LCD SCREEN



The user interface consists of **a back lit LCD screen** having:

- **4 lines with 20 characters** (standard version for Latin characters).

and

- **6 keys** (the function is described for each operating mode).

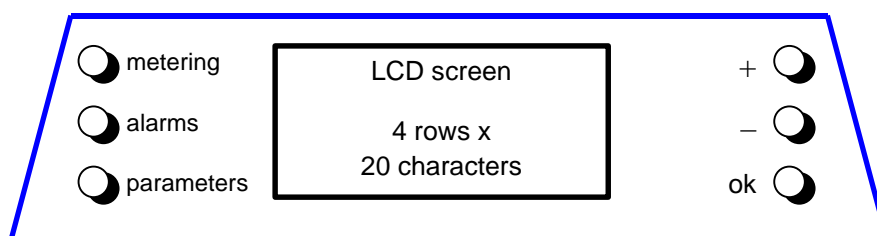
The operation is extremely simple and is structured on three important main menus related to the UPS operation, as follows:

metering A UPS must offer some metering information for the user to be able to examine the operating status at any time.

alarms In the event of *Utility* failures or abnormal functioning, the UPS must keep a history of what has happened as a series of events.

parameters The user must be able to program certain functions of the UPS (user parameters, accessible without password) to his needs.

LCD screen standard version



The 3 buttons existing on the left side of the screen are used to activate the operating modes, while the buttons on the right side are used to carry out functions inside these operating modes.

6.1 METERING MODE

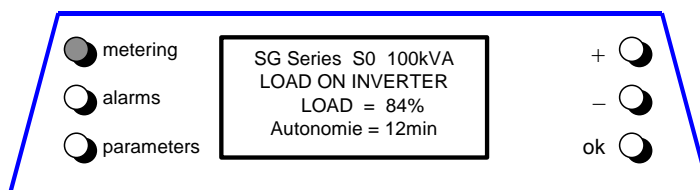
The *metering mode* is entered any time the **metering** button is pressed. While in this mode the LCD will display a series of screens containing metering information. In this mode the buttons perform the following functions:

metering	Scrolls forward to the next screen.
alarms	Abandons the <i>metering mode</i> and enters the <i>alarms mode</i> .
parameters	Abandons the <i>metering mode</i> and enters the <i>parameters mode</i> .
+	Scrolls forward to the next screen.
-	Scrolls backward to the previous screen.
ok	Displays the main screen for this mode.

Main screen

This screen displays the current status of the UPS in a condensed form. The information offered by this screen consists of:

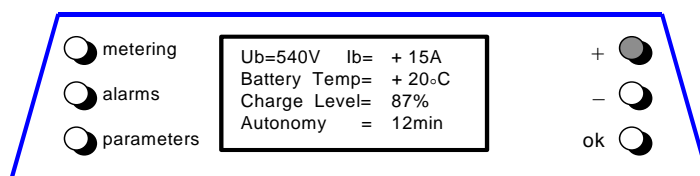
- The type of the machine: Family name, series number (P + unit number for parallel version from 1 to 8) and power range.
- The status of the load.
- The *Load* amount as a percentage of the nominal *Load* (referred to the most loaded phase).
- The estimated *Battery* backup time in minutes with the present load.



Battery data screen

This screen displays:

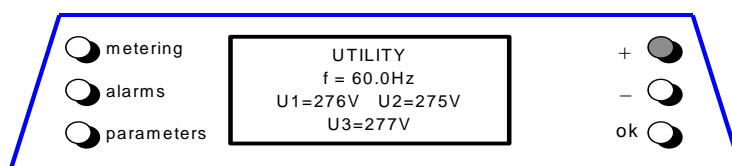
- The *Battery* voltage.
- The *Battery Current* (negative values correspond to the discharge of the *Battery*).
- The temperature of the *Battery* (XXX indicates sensor disabled).
- The current charge level.
- The estimated backup time with the present load.



Bypass Utility data screen

This screen refers to the AC source supplying the *Bypass*. This screen displays:

- The frequency.
- The voltage levels of the three phase voltages.

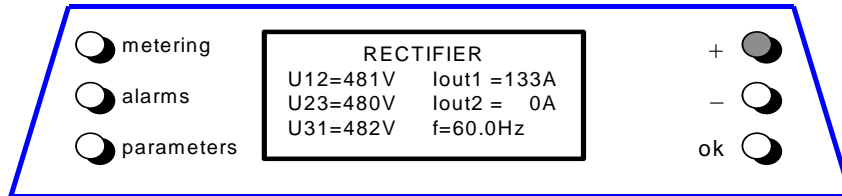


Rectifier Utility data screen

This screen refers to the AC source supplying the *Rectifier*.

This screen displays:

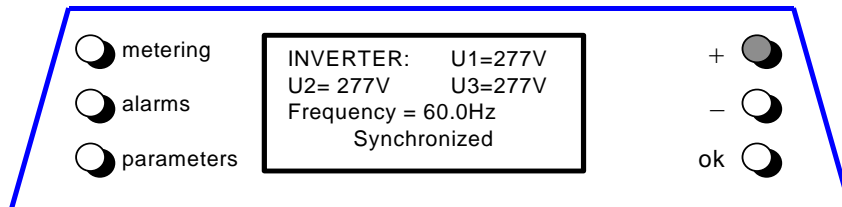
- Iout1 = output current *Rectifier Bridge*.
- Iout2 = output current 2nd *Rectifier Bridge* (optional 12 pulse *Rectifiers* only).
- The voltage levels between the three phases (line-to-line).
- The input frequency of the *Rectifier*.



Inverter data screen

This screen displays:

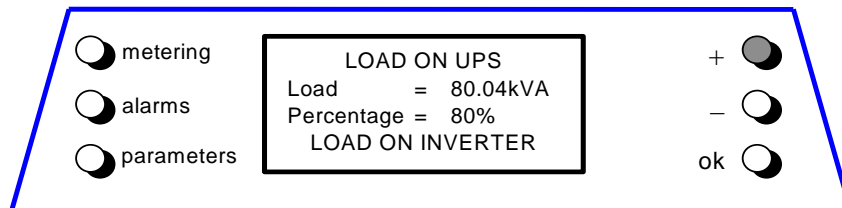
- The voltage level of the three phase voltages (line-to-neutral).
- The output frequency of the *Inverter*.
- The synchronization status of the *Inverter* with respect to *Utility*.



Status Load screen

This screen displays:

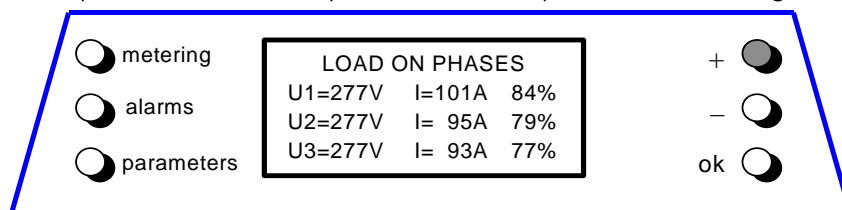
- The *Load* level in kVA (for RPA: only this unit).
- The *Load* level as a percentage of the nominal rated *Load* (for RPA: only this unit).
- The source of the power supplied to the *Load*.



Load on phases screen 1

This screen displays for each phase:

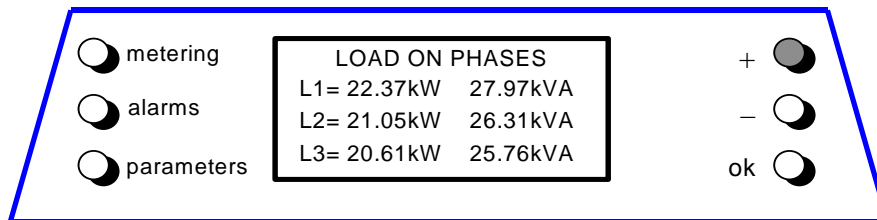
- The output phase voltage and current as RMS values (for RPA: total value of Parallel System).
- The output *Load* as percent (for RPA: respect to the rated power of Parallel System).



Load on phases screen 2

This screen displays for each phase:

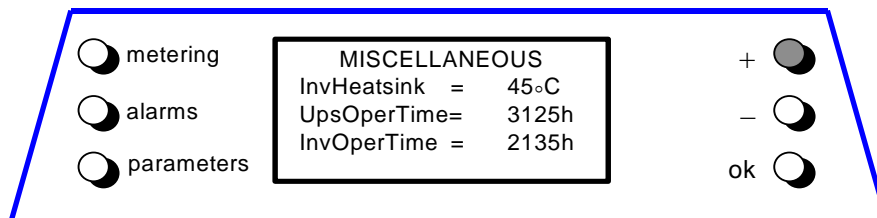
- The *Load* active power (kW) (for RPA: total value of Parallel System).
- The *Load* apparent power (kVA) (for RPA: total value of Parallel System).



Miscellaneous screen

This screen displays:

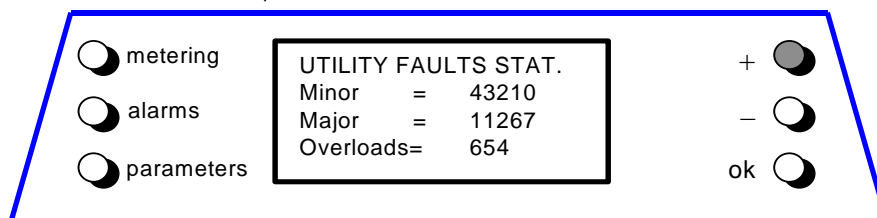
- The temperature of the *Inverter Bridge*.
- The total operating time for the UPS (in hours).
- The total operating time for the *Inverter* (in hours).



Utility Faults Statistics screen

This screen displays:

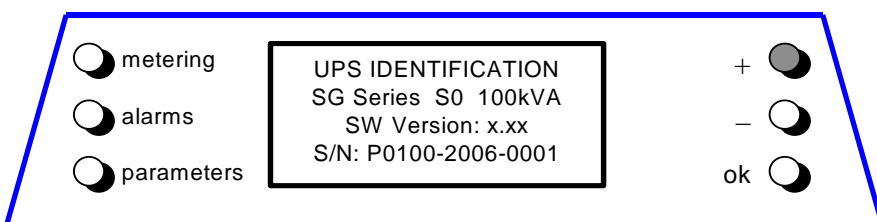
- The total number of minor *Utility* faults (*Bypass Utility* out of tolerance faults).
- The total number of major *Utility* faults (*Rectifier Utility* out of tolerance faults).
- The total number of detected output overloads.



UPS identification screen

This screen displays:

- The UPS family and the power range.
- The software version.
- The serial number.



6.2 ALARMS

The *alarms mode* is entered any time the **alarms** button is pressed.

The LCD will display a series of screens corresponding to the last 256 events, one event per screen.

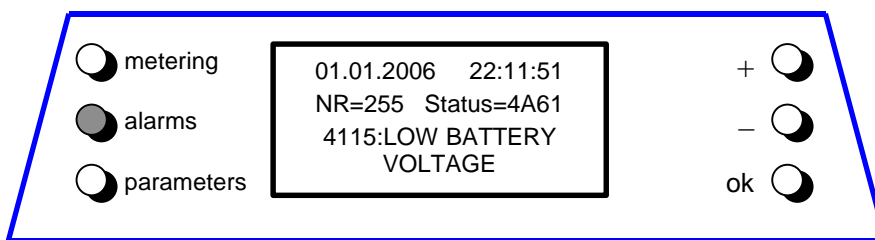
The buttons perform the following functions:

metering	Abandons <i>alarms mode</i> and enters <i>metering mode</i> .
alarms	Next screen.
parameters	Abandons the <i>alarms mode</i> and enters the <i>parameters mode</i> .
+	Scrolls forward to the next screen.
-	Scrolls backward to the previous screen.
ok	Display the main screen for this mode.

The events displayed are the standard **GE** events as described in the **Section 6.7 - EVENTS (Alarms and Messages)**.

The information displayed includes:

- The exact date and time when the event occurred.
- The number of the event, 255 being the most recent event, and 0 the oldest.
- The standard **GE** code for the event and the machine status word.
- An explicit text description of the event.



The initial screen of this mode is the one showing the most recent event.

6.3 PARAMETERS

The *parameters mode* is entered any time the **parameters** button is pressed.

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

The buttons perform the following functions:

metering	Abandon <i>parameters mode</i> and enter <i>metering mode</i> .
alarms	Abandon <i>parameters mode</i> and enter <i>alarms mode</i> .
parameters	Scroll forward to the next screen.
+	Scroll forward to the next screen.
-	Select from the current screen the parameter to edit.
ok	Start the editing for the currently selected parameter.



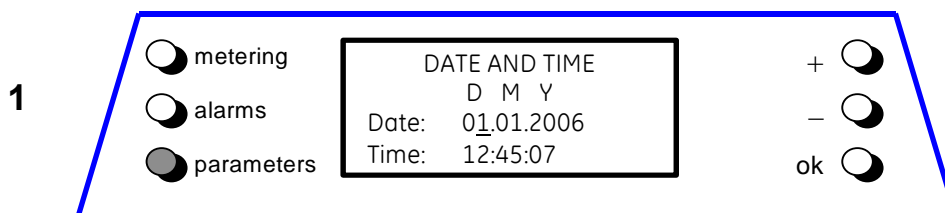
NOTE !

During *parameters mode* there is no means to perform scroll back on the display.

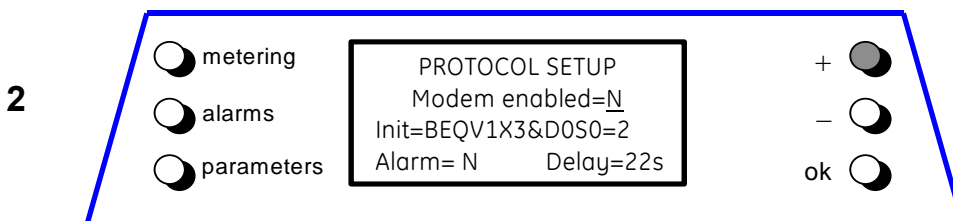
Example of operation within parameters mode:

Purpose: to correct a wrong telephone number previously stored in Tel2.

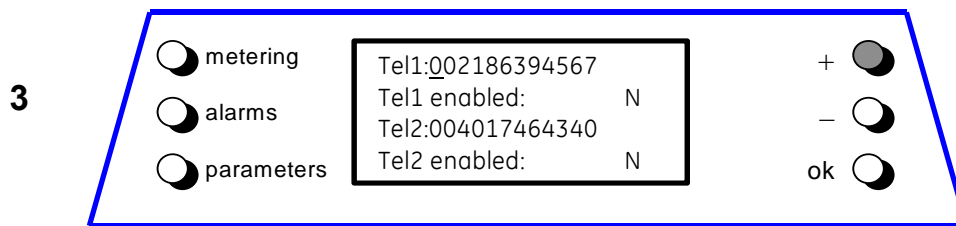
1 – Entering *parameters mode* (**parameters**). The first screen is displayed.



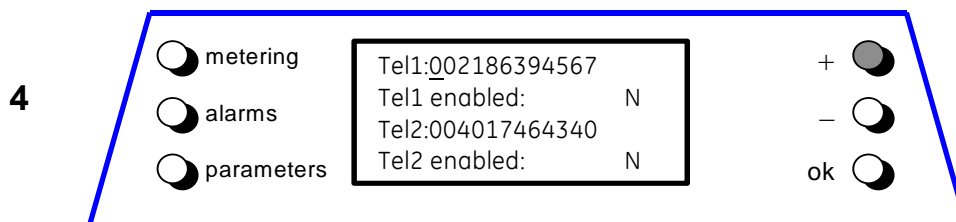
2 – Scroll to the next screen (+). The second screen is displayed.



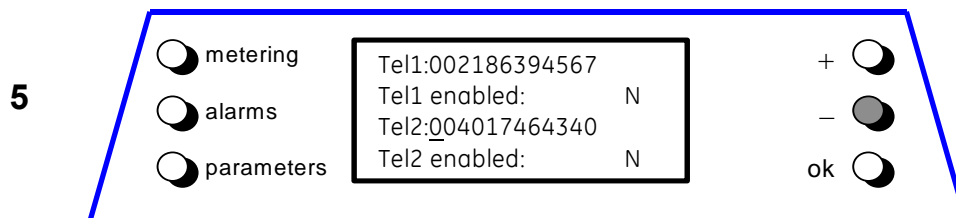
3 – Scroll to the next screen (+). The third screen is displayed.



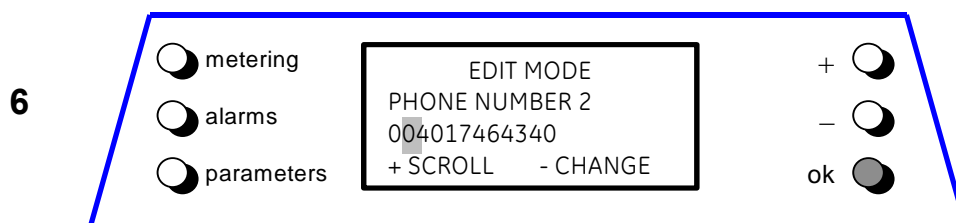
4 – Move the selection (underscore cursor) to the next parameter in this page (-).



5 – Move the selection to the next parameter in page (-).



6 – Enter Edit mode for the currently selected parameter (**ok**).



6.4 EDIT MODE

The *EDIT MODE* is entered from the *parameters mode* when the **ok** button is pressed. During this mode the LCD will display a special editing screen for the parameter being edited.

The screen contents during Edit mode is:

- First line: the special operating mode.
- Second line: the name of the parameter being edited.
- Third line: the current value of the parameter.
- Fourth line: contains a condensed help text.

During the Edit mode the buttons perform the following functions:

metering	Exits <i>Edit</i> mode and enters <i>metering</i> mode; any changes are discarded.
alarms	Exits <i>Edit</i> mode and enters <i>alarms mode</i> ; any changes are discarded.
parameters	Exits <i>Edit</i> mode and enters <i>parameters mode</i> ; any changes are discarded.
+	Scrolls from editable position to editable position.
-	Changes the currently selected editable position.
ok	Returns to <i>parameters mode</i> after saving the changes.

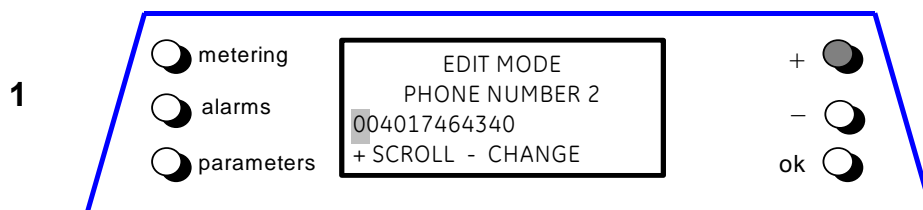
Examples of operation during Edit mode

There are **three types of parameters** they differ in behavior during Edit mode. Depending the type of parameters, there are different ways to select and to change the needed values.

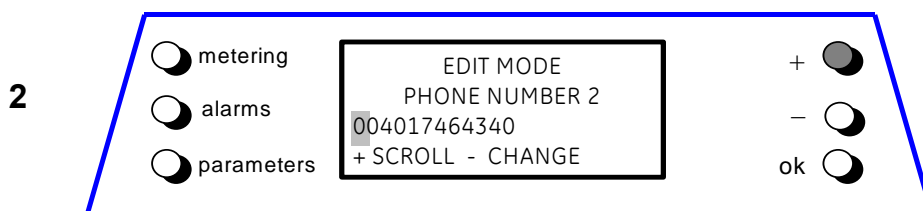
Type 1: Parameters having a large range of values (numeric value).

As continuation of the previous example, the telephone number stored in "Tel2" must be changed:

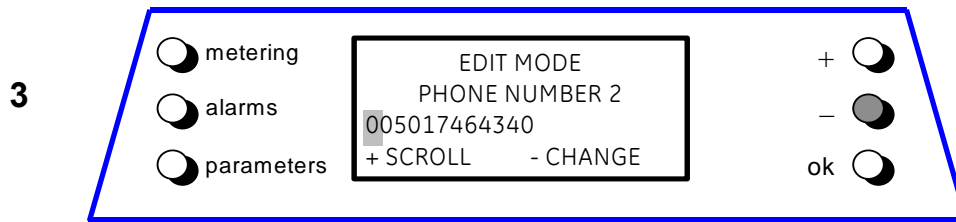
1 – Move the selection (**block cursor**) to the next character (+).



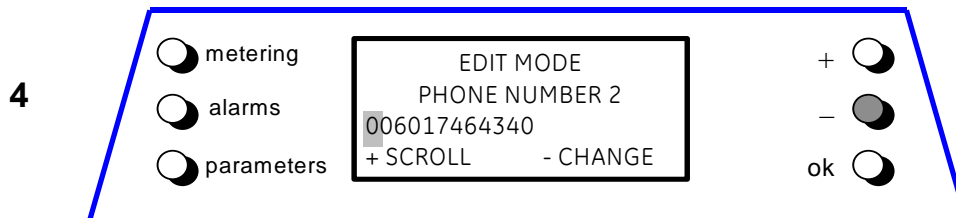
2 – Move the selection to the next character (+).



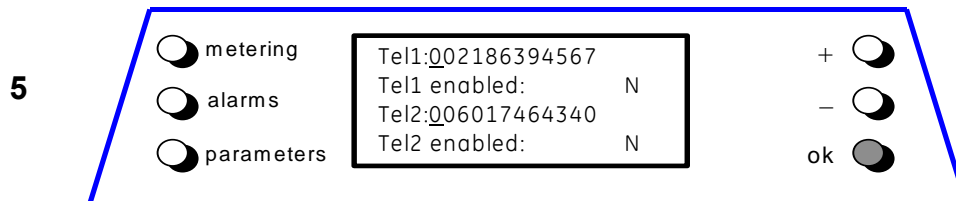
3 – Change the selected character (-).



4 – Change the selected character (-).



5 – Press **ok**: the screen will return to *parameters mode* saving the new value.



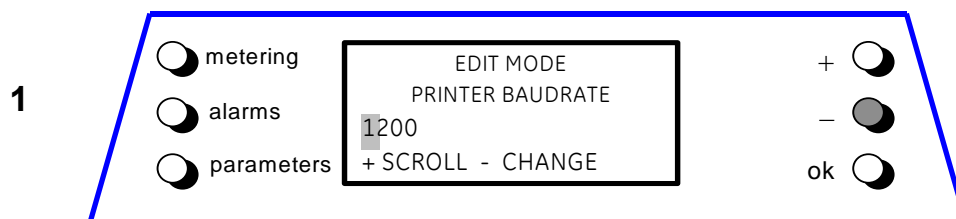
Type 2: Parameters having a limited range of values.

For example the parameter **Printer Baud Rate** has the range {600, 1200, 2400, 4800 and 9600}.

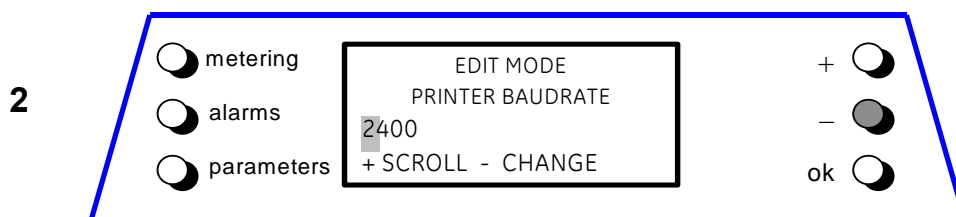
There is no need to edit this parameter digit by digit.

By pressing the [-] button the next value within the range is automatically provided by the software.

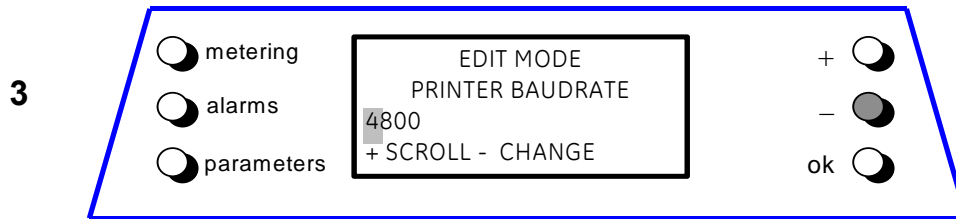
1 – Enter Edit mode for Printer Baud Rate, initial value = 1200.



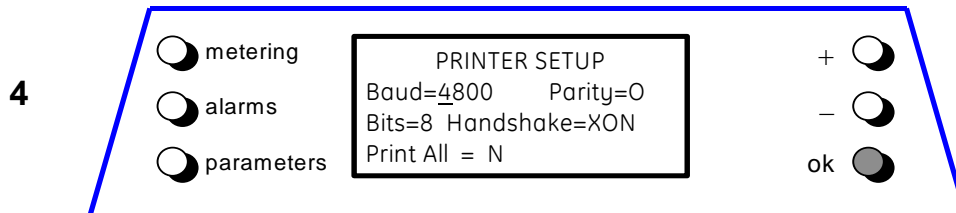
2 – Change to 2400.



3 – Change to 4800.



4 – Press **ok**: the screen will return to *parameters mode* saving the new value.



Type 3: Boolean parameters used to simulate command buttons.

The Boolean parameters have a range of **Yes/No**.
Only the user performs the modification of the value.

These “Type 3” parameters are used **to initiate an action**. There are two possibilities:

- A** 1 – The user wants the UPS to start the action => the user sets the parameter to “Yes”.
2 – The UPS finishes the action => the UPS sets the parameter to “No”.
- B** 1 – The user wants the UPS to start the action => the user sets the parameter to “Yes”.
2 – The user wants to abort the action => the user sets the parameter to “No”.

The actions that can be performed using such software buttons are:

- Print the metering information.
- Print the last 256 events.
- Print the values of the parameters.
- Print all the information obtainable from the UPS.

Returning from the Edit mode

Normally the **ok** button is used to return from the Edit mode.
Then the UPS will perform some validity tests on the new value.
If these tests are successful then the new value is saved and used.
If these tests fail the Edit mode is not exited.

	<p>NOTE !</p> <p>The validity tests performed by the UPS are not exhaustive. You should not rely exclusively on these tests. Care should be taken when modifying the values of the parameters.</p>
--	---

For all parameters except the *LCD Contrast* parameter **the new value is saved and used after the ok button was pressed**.

In the case of the *LCD Contrast* parameter the new value is used immediately in order to obtain a better visual feedback.

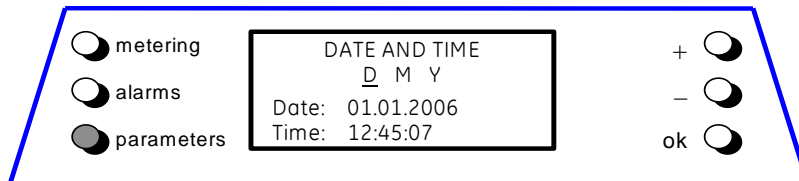
6.5 USER PARAMETERS

Pressing the **Parameters** button displays a series of screens containing the user parameters on the **LCD panel**.

This first parameter level is not protected by password, therefore the user can freely adapt these parameters to their needs.

The meaning of the user parameters and their use is described below (buttons performance is described to Section 7.3).

1. Date and Time set-up



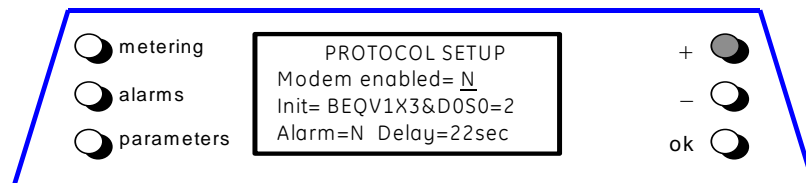
Date You can adjust the date of the real time clock existing in the UPS by the means of this parameter.

The value you enter is thoroughly checked to be a correct date in the format "dd.mm.yy".

Time 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.

2. Protocol Set-up



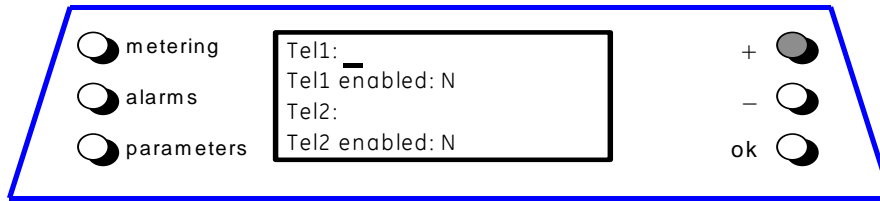
Modem enabled You can enable/disable with **Y/N** the remote control through modem calls by using this parameter.

Init This parameter presents the modem initialisation string.
It can be 39 characters long.
When editing this parameter the UPS considers that a blank character terminates the string.
If no blank character is found then all 39 characters are used.

Alarm This **Y/N** parameter controls the automatic events signalling through modem.
If this parameter is set to 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.

3. Telephone numbers



Tel1 This parameter specifies a **first telephone number** to be used for **modem dial-out**. The telephone number has a maximum **39 characters** and cannot contain **blanks**. If the desired number is shorter than 39 characters, the string will finish with blanks.

Tel1 enabled This parameter **Y/N** specifies if the **first** telephone number will be used for dial-out.

Tel2 A **second** dial-out number.

Tel2 enabled This parameter **Y/N** specifies if the **second** telephone number will be used for dial-out.

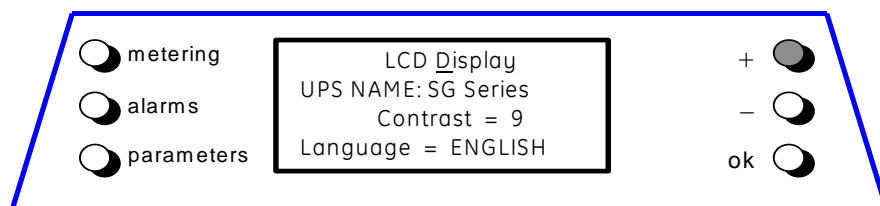
Tel3 A **third** dial-out number.

Tel3 enabled This parameter **Y/N** specifies if the **third** telephone number will be used for dial-out.

Tel4 A **fourth** dial-out number.

Tel4 enabled This parameter **Y/N** specifies if the **fourth** telephone number will be used for dial-out.

4. LCD Display



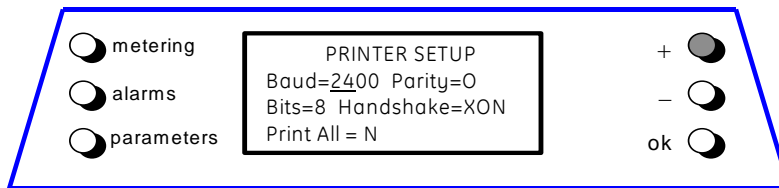
UPS Name The user can choose the name of the UPS model shown on the main page (max. 7 characters).

LCD Contrast This parameter controls the contrast of the LCD screen in ten steps. It can be adapted depending on the room lighting.

LCD Language This parameter allows the choice of language used to display the information. Valid choices are *English, German, Italian, Spanish, French, Finnish, Tschech, Slovak, Polish and Portuguese*.

5. Printer Set-up

The UPS is capable of communicating to a serial printer, to printout disparate information. Please be sure to have a **serial printer**, that is a 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. Although different values can be selected, you must select **2400 Baud**, which is the only valid parameter.

Parity This parameter controls the parity used for data transmission. Odd (**O**) even (**E**) and "no parity" (**X**) can be selected. Nevertheless the only valid value is **NO PARITY (X)**.

Bits This parameter controls the length of the data word on the serial line during data transmission **7** or **8** bits are offered as choice. Please select **8 bits**, as this is the only valid value.

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**.

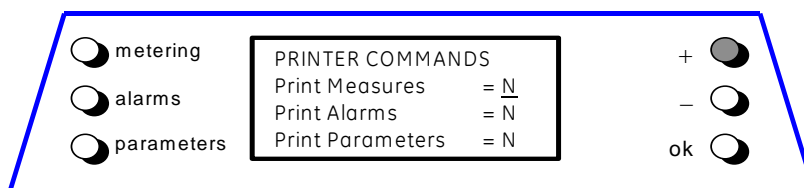
Print All This parameter **Y/N** is used to print **all the available information** in the sequence **metering, alarms, user** and **service parameters**.



NOTE !

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

6. Printer commands



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**



NOTE !

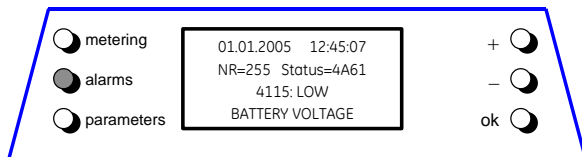
After each printing command the corresponding parameter will be set again to **N**.

6.6 EVENTS (ALARMS AND MESSAGES)

Each of the following listed events can be displayed on the *LCD screen* or on *PC* where the “*PowerJump Manager*” or “*PowerJump DataShield*” is installed.

Alarms and *Messages* are differently specified because the **alarms** are indicating an abnormal functioning of the UPS (which are additionally signalled 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 buzzer).

When in the **alarms mode**, the *LCD screen displays* a time ordered sequence of screens corresponding to the last 256 alarms and messages, each screen indicating:



- 1- The date and time when the event occurred.
- 2- The number of the event (255 = the most recent).
The standard code and the status word.
- 3- Code with an explicit text description of the events.

6.6.1 Alarms list

Code	Alarms	Meaning
4000	SETUP VALUES LOST	Parameters are lost and have been replaced with default values. Call nearest <i>Service Center</i> for intervention.
4004	UPS FAILURE	The master unit detected the slave unit missing on the communication bus even though switch <i>Q1</i> is still closed.
4100	RECTIFIER FUSES FAILURE	The u-switch mounted on the <i>Rectifier Input Fuses</i> indicates a blown fuse, and consequently shut down. Clearance of this condition allows you to restart the <i>Rectifier</i> .
4102	K4 CLOSING FAILURE	K4 not closed despite a closing command being issued. Signalled by auxiliary contact. <i>Rectifier</i> cannot start.
4103	K4 OPENING FAILURE	K4 not open despite an opening command being issued. Signalled by auxiliary contact. <i>Utility</i> remains connected to <i>Rectifier bridge</i> .
4104	BATTERY FUSES	This function, when enabled on input programmable relays (password required), warns the user about the external <i>Battery Fuses</i> failure or <i>MCB</i> opening, signalled by <i>NO free contact</i> .
4105	RECTIFIER OVERTEMPERATURE	Temperature sensor indicates an over temperature on the <i>Rectifier Bridge</i> . Only alarm is given. The <i>Rectifier</i> , when in Off state, cannot start as long as this condition persists.
4106	RECTIFIER TRANSFORMER OVERTEMPERATURE	The temperature sensor inside the input transformer winding indicates over temperature. Only the alarm is given. The <i>Rectifier</i> , when in Off state, cannot start as long as this condition persists.
4110	RECTIFIER UTILITY OUT OF TOLERANCE	<i>Rectifier Input Utility</i> is out of tolerance (voltage, frequency or phase).

Code	Alarms	Meaning
4115	LOW BATTERY VOLTAGE	The <i>Battery</i> has been discharged and reached “stop operation” time-out (default 3 minutes), and the <i>Inverter</i> will be shut down. It will restart automatically only when the <i>Battery</i> has recharged enough for a minimum runtime.
4116	HIGH BATTERY VOLTAGE	Dangerous high <i>DC Voltage</i> caused <i>Inverter</i> shutdown. <i>Inverter</i> restarts automatically after <i>Battery</i> returns to floating voltage.
4117	BATTERY EARTH FAULT	A leakage current to earth has been detected on the <i>DC circuit</i> .
4118	BATTERY FAULT	During <i>battery test</i> the voltage falls under the critical level (depending setting parameters). <i>Battery test</i> is stopped.
4130	TURN ON RECT. OR SHUTDOWN UPS	<i>Rectifier</i> and <i>Inverter</i> are OFF. The <i>DC power supply</i> is discharging the <i>Battery</i> . <i>Rectifier</i> must be restarted or <i>Battery</i> must be disconnected in order to avoid damage.
4140	RECTIFIER CONTROL FAILURE	<i>Rectifier Voltage</i> hasn't reached the set value (probably fault on regulation loop). <i>LED Rectifier</i> on control panel is blinking.
4301	INVERTER FUSES FAILURE	<i>Inverter Output Fuses</i> blown (<i>F5</i> , <i>F6</i> and <i>F7</i>). <i>Inverter</i> can be started manually after replacement of the fuses.
4304	K7 CLOSING FAILURE	<i>K7</i> not closed despite a closing command being issued. Signalled by auxiliary contact. <i>Load</i> will be supplied by <i>Utility</i> .
4305	K7 OPENING FAILURE	<i>K7</i> not open despite an opening command being issued. Signalled by auxiliary contact. <i>Load</i> will be supplied by <i>Utility</i> .
4307	INVERTER TRANSFORMER OVERTEMPERATURE	The temperature sensor of the <i>Inverter Transformer</i> indicates over temperature. Elapsed “stop operation” time, <i>Inverter</i> shutdown. With <i>Utility</i> OK, <i>Load</i> is transferred on <i>Utility</i> .
4308	DC FUSES FAILURE	Blown input DC fuse(s) <i>F1</i> of the <i>Inverter</i> . <i>Inverter</i> cannot be started as long as present.
4309	DRIVER FAILURE	An abnormal condition has been detected on one or more power modules of the <i>Inverter</i> (temperature or over current). <i>Inverter</i> shutdown and cannot be started as long as the alarm is present.
4312	INV. VOLTAGE OUT OF TOLERANCE	<i>Inverter Output Voltage</i> is out of the tolerances ($\pm 10\%$). <i>Inverter</i> is switched OFF.
4320	ISMAX DETECTION	Detection of <i>Inverter Bridge</i> (Is) current limit causing the <i>Inverter</i> OFF and automatic re-start. After 3 times the <i>Inverter</i> switches-Off, and it can be restarted manually.
4340	INVERTER CONTROL FAILURE	The “Slave” oscillator is not in synchronized with the Master; thus causing the shutdown of it's <i>Inverter</i> . If after a restart the condition remains, the <i>LED</i> inside the <i>Inverter</i> symbol on the panel will not light up, indicating that this <i>Inverter</i> cannot supply the <i>Load</i> anymore.
4404	K6 CLOSING FAILURE	<i>K6</i> open despite a closing command being issued. Signalled by auxiliary contact. The <i>Load</i> cannot be supplied by <i>Automatic Bypass</i> .

Code	Alarms	Meaning
4405	K6 OPENING FAILURE	K6 closed despite an opening command being issued. Signalled by auxiliary contact.
4406	SSM FAILURE	A faulty current has been detected in the <i>static-switch</i> 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 <i>Service Center</i> .
4408	K8 CLOSING FAILURE	K8 not closed despite a closing command being issued. Signalled by auxiliary contact. The <i>Load</i> cannot be supplied by <i>Automatic Bypass</i> .
4409	K8 OPENING FAILURE	K8 closed despite an opening command being issued. Signalled by auxiliary contact.
4410	BYPASS UTILITY OUT OF TOLERANCE	The <i>Utility Bypass Voltage</i> is out of the tolerances ($\pm 10\%$). K6 opens, synchronization with <i>Utility</i> is inhibited and transfer to <i>Utility</i> is blocked.
4420	K3 CLOSING FAILURE	K3 open despite a closing command. <i>Inverter</i> is switched OFF. It can be restarted manually after recovery of the alarm condition.
4421	K3 OPENING FAILURE	K3 not open despite an opening command. Be aware the <i>DC Capacitors</i> could remain charged.
4520	NO INVERTER POWER	The <i>Load</i> supplied by <i>Utility</i> exceeds the <i>Inverter</i> power. The <i>Load</i> remains supplied by <i>Utility</i> until the alarm stays ON.
4522	FAN FAILURE	A malfunction on the UPS ventilation system was detected. No change for UPS operation. Call immediately <i>Service Center</i> for intervention.
4530	LOAD LOCKED ON UTILITY	<i>Load</i> is locked on <i>Utility</i> because 3 transfers on <i>Utility</i> 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	<i>Load</i> is transferred to <i>Utility</i> because the error detector detected a disturbance on the output voltage.
4563	EMERGENCY OFF ACTIVATED	Alarm after detection of an <i>EPO</i> from an external safety device connected on <i>Customer Interface Board</i> . Consequently K3, K4, K6, K7, K8 open, <i>Rectifier</i> , <i>Inverter</i> and <i>SSM</i> are switched Off.
4570	OVERLOAD	The UPS-System is in an overload condition $>125\%$ on <i>Inverter</i> , or $>150\%$ on <i>Utility</i> . With <i>Utility</i> unavailable, a sequence of "stop operation" starts. Time out depends on <i>Load</i> quantity.
4571	OVERLOAD: LOAD ON UTILITY	With <i>Utility Bypass</i> supply available and load $>115\%$, the <i>Load</i> is transferred on <i>Utility</i> . <i>Load</i> will be transferred again automatically on <i>Inverter</i> when <i>Load</i> $<100\%$.
4581	INVERTER AND UTILITY NOT SYNCH.	The voltages of <i>Utility</i> and <i>Inverter</i> are not synchronized, which causes the opening of K6.
4697	BATTERY OVERTEMPERATURE	Detection of <i>Battery</i> over temperature condition. Can be deactivated by <i>Service Center</i> .
4698	BATTERY POWER INSUFFICIENT	In case of <i>Utility Failure</i> , with the actual <i>Load</i> , the run time would be below stop operation time (default 3 minutes).

Code	Alarms	Meaning
4700	DC LOW	Battery voltage is at the lowest limit. Will stay Off <i>Inverter</i> until the <i>battery voltage</i> reaches the value in parameter.
4900	LOAD LOCKED ON INVERTER	The <i>Load</i> is locked on <i>Inverter</i> after 3 <i>Load</i> transfers within 30 seconds. After time out (default 30 seconds) <i>Bypass</i> will be free.
4955	OVERTEMPERATURE	An over-temperature condition has been detected on <i>Inverter</i> . Elapsed “stop operation” time, <i>Inverter</i> shutdown. With <i>Utility</i> OK, <i>Load</i> is transferred on <i>Utility</i> .
4998	LOAD OFF DUE TO EXTENT. OVERLOAD	<i>Load</i> Off after time-out of “stop operation” for overload on <i>Inverter</i> or <i>Bypass</i> (time depending on the % of overload).
4999	LOAD OFF DUE TO UBATT. OR TEMP.	<i>Load</i> Off after time-out of “stop operation” with missing <i>Utility</i> due to <i>Battery low voltage</i> or <i>over-temperature</i> condition.

6.6.2 Messages list

Code	Message	Meaning
4002	WATCHDOG RESET	The microprocessor has detected an incorrect operation: Transfers the <i>Load</i> on <i>Utility</i> and performs a program reset. The <i>Inverter</i> will restart automatically and will supply the <i>Load</i> .
4111	RECTIFIER UTILITY OK	<i>Rectifier Input Utility</i> is again within the admitted tolerance (voltage, frequency and phase).
4119	BATTERY TEST STARTED	Start of <i>Manual</i> or <i>Automatic Battery Test</i> .
4120	BATTERY TEST STOPPED	End of <i>Manual</i> or <i>Automatic Battery Test</i> .
4161	RECTIFIER ON	<i>Rectifier</i> started.
4162	RECTIFIER OFF	<i>Rectifier</i> shutdown.
4163	GENERATOR ON	<i>Customer Interface Board</i> (X1 - 11, 22) received a <i>Gen-set ON</i> signal. Operating mode depend on setting of Parameters.
4164	GENERATOR OFF	<i>Customer Interface Board</i> (X1 - 11, 22) received a <i>Gen-set OFF</i> signal. Function <i>Bypass</i> enabled depends on setting of parameter.
4302	INVERTER CANNOT BE TURNED ON	<i>Inverter</i> cannot be switched on because one of the following conditions is still present: <ul style="list-style-type: none"> - <i>Over Temperature</i> - <i>Low Battery Voltage</i> - <i>Inverter Fuses</i> - <i>Overload</i> - <i>K7 opening Failure</i> - <i>High Battery Voltage</i> - <i>DC Low</i> - <i>EPO</i>
4303	INVERTER CANNOT BE TURNED OFF	<i>Inverter</i> cannot be switched OFF, because the <i>Load</i> cannot be switched to <i>Utility</i> (voltage out of tolerance, not synchrony, BP blocked).
4361	INVERTER ON	The command to start the <i>Inverter</i> has been activated on the control panel.
4362	INVERTER OFF	The command to switch OFF the <i>Inverter</i> has been activated by the control panel or automatically for alarm presence.
4411	BYPASS UTILITY OK	<i>Bypass Input Utility</i> is again within tolerance (voltage, frequency and phase).
4500	COMMAND LOAD OFF	Disconnection of the <i>Load</i> by opening K6 and K7 for: <i>EPO</i> / <i>total off</i> / <i>Overload</i> / <i>stop operation</i> .
4521	NO BYPASS POWER	With the <i>Load</i> supplied by <i>Automatic Bypass</i> , a <i>Utility Failure</i> or K6 opening occurred.
4534	MULTIPLE LOAD TRANSFER	2 transfers <i>Inverter- Utility</i> have been detected in a short time, (default 30 seconds).
4535	BYPASS LOCKED	<i>Bypass</i> is not available. <i>Contactor K6</i> and <i>K8</i> are open, <i>SSM</i> deactivated.
4536	BYPASS FREE	<i>Bypass</i> is enabled. <i>Contactor K6</i> is closed.

Code	Message	Meaning
4561	TOTAL OFF	Push-button " <i>total off</i> " on the UPS Control Panel has been pressed, with the output circuit switch Q1 closed.
4562	DETOUR ON	The <i>auxiliary contact</i> indicates that <i>Manual Bypass Q2</i> was closed.
4564	DETOUR OFF	The <i>auxiliary contact</i> indicates that <i>Manual Bypass Q2</i> was opened.
4567	COMMAND LOAD ON UTILITY	The control unit received a command to transfer the <i>Load</i> on <i>Utility</i> .
4568	COMMAND LOAD ON INVERTER	The control unit received a command to transfer the <i>Load</i> on <i>Inverter</i> .
4572	NO MORE OVERLOAD	End of the overload condition detected with alarm 4570.
4580	INVERTER AND UTILITY SYNCHRONIZED	The voltages of <i>Inverter</i> and <i>Utility Bypass</i> are synchronized.
4582	COMMAND NOT TO SYNCHRONIZE	Command not to synchronize with <i>Utility</i> .
4583	COMMAND TO SYNCHRONIZE	Command to synchronize with <i>Utility</i> .
4602	Q1 OPEN	The auxiliary contact indicates that the output switch Q1 was opened.
4603	Q1 CLOSED	The auxiliary contact indicates that the output switch Q1 was closed.
4699	BATTERY TEST IMPOSSIBLE	<i>Automatic Battery Test</i> is not possible due to: <ul style="list-style-type: none"> - <i>No Utility Rectifier or Bypass.</i> - <i>Battery not fully charged.</i> - <i>Load is below 10% or above 80%.</i> Test is postponed for 1 week.
4763	REMOTE CONTROL ON	<i>Inverter</i> can be started or shutdown by remote control. Commands source can be chosen depending on the value of parameter (Service only): 0 = <i>Only local panel.</i> 1 = <i>Only serial port on CI.</i> 2 = <i>Both.</i>
4764	REMOTE CONTROL OFF	<i>Inverter</i> cannot be started or shutdown by remote control. Commands source can be chosen depending on the value of parameter (Service only): 0 = <i>Only local panel.</i> 1 = <i>Only serial port on CI.</i> 2 = <i>Both.</i>

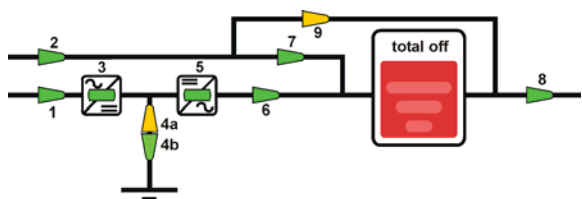
6.6.3 Event report SG Series

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 Centre* 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
 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				
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238				
237				
236				
235				
234				
233				
232				
231				
230				

7 OPERATION



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.

Now you can initiate the start-up procedure of the UPS system.
There is no need for specific knowledge if you follow carefully the step-by-step instructions given below.

But we recommend, that at least the initial procedure, should be performed by an instructed person.

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.

If you encounter any problems during the following procedures, you should not continue, but contact *GE Global Services*.

Find on the following pages the descriptions of the various procedures of start-up and shutdown for single and parallel UPS's, divided into the following principal chapters:

7.1 PROCEDURES FOR SINGLE UPS

7.2 PROCEDURES FOR UPS FUNCTIONING AS FREQUENCY CONVERTER

7.3 PROCEDURES FOR PARALLEL SYSTEM

7.4 PROCEDURES FOR PARALLEL SYSTEM WITH COMMON BATTERY

7.1 PROCEDURES FOR SINGLE UPS

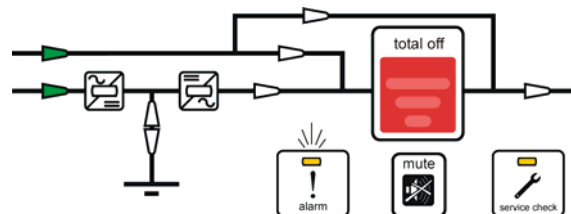
7.1.1 Start-up of the SG Series

Verify with open front door: Switch **Q1** and **Q2** must be open (Pos. O).

1. Connect the Utility power on the UPS.

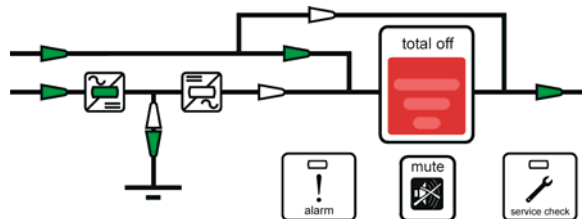
(In case of separate inputs for *Rectifier* and *Bypass*, connect both).

- Power supply starts up.
Indicated with flashing *alarm* and *buzzer* sound.
- LED's as indicated will be lit.
- Press *mute*, to reset *alarm* and *buzzer*.



2. Close Q1 (Pos. I).

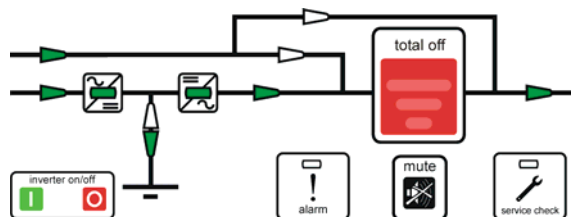
- *Bypass Utility* connects to the output.
- *Rectifier* starts automatically, blinking *LED* indicates Soft-start.
- At the end of *Rectifier* Soft-start, *LED* remains lit.



3. Connect the Battery to the UPS by closing the Battery Switch or Fuses, in case of External Battery.

4. Press "inverter on" (I) key.

- Soft-start of *Inverter* indicated with blinking *LED*.
- At the end of Soft-start the *LED* remains lit.
- Automatic transfer from *Bypass* to *Inverter*.
- UPS output *LED* indicates *Load on Inverter*.



The LCD must display on the main screen the status "LOAD ON INVERTER".

END OF PROCEDURE



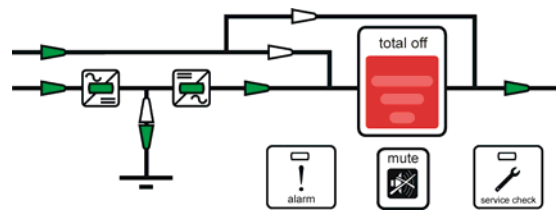
NOTE !

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

7.1.2 Maintenance shutdown (Load on Q2)

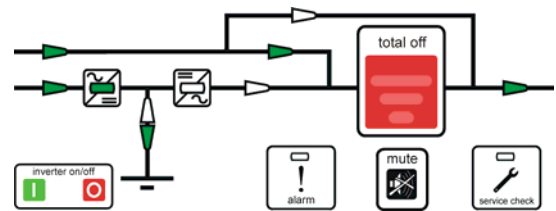
Initial status:

Load supplied from Inverter.



1. Press "inverter off" (O) key and hold until the LED inside the Inverter symbol turns OFF.

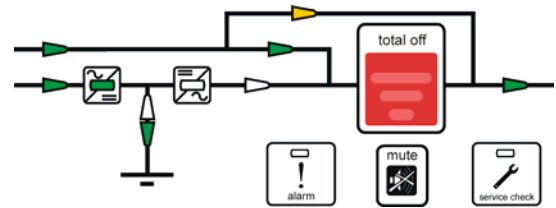
- Load is transferred to Utility.
- Inverter shuts down.
- LED Inverter must be OFF.



The LCD screen must display the status "LOAD ON BYPASS".

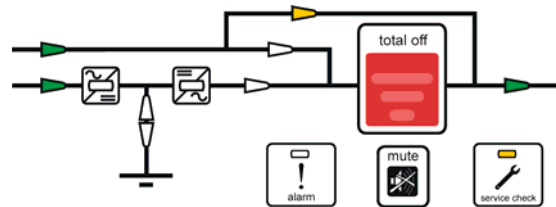
2. Close Q2 (Pos. I).

- Load is now supplied parallel through Bypass and Q2.
- LED for Manual Bypass lights up.



3. Open Q1 (Pos. O) and then press "total off" button.

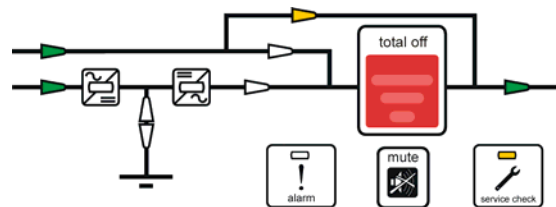
- Load is now supplied from Manual Bypass.
- Rectifier shuts down and all output and input contactors are opened.



The LCD panel must display the main screen, indicating the status "LOAD OFF".

4. Disconnect the Battery from the UPS in case of External Battery.

- Wait 5 minutes for DC-Link Capacitors discharge.

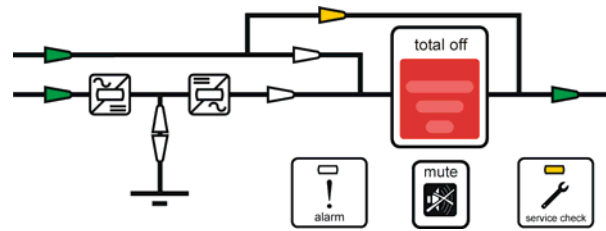


END OF PROCEDURE

7.1.3 From Manual Bypass (Q2) to normal function VFI

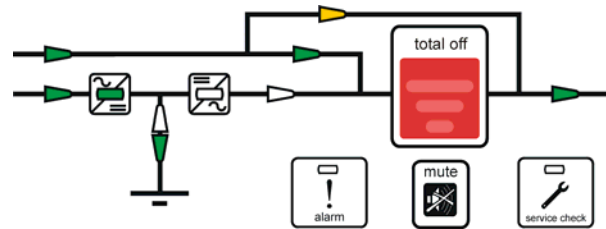
Initial status:

Load supplied from Manual Bypass.



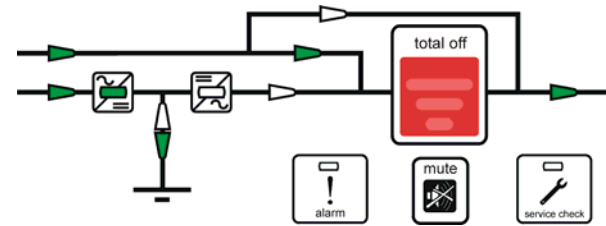
1. Close Q1 (Pos. I).

- Bypass connects to Load.
LED Load on Bypass lights up.
- Rectifier starts automatically and LED in Rectifier symbol and LED Battery charge light up.



2. Open Q2 (Pos. O).

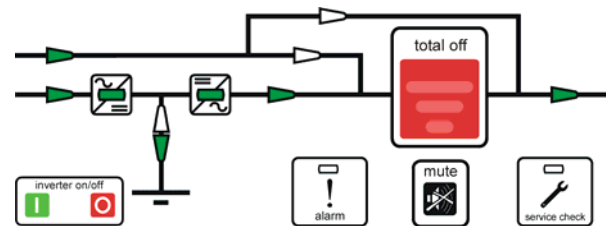
- LED Manual Bypass turns OFF.



3. Connect the Battery to the UPS by closing the Battery Switch or Fuses, in case of External Battery .

4. Press "inverter on" (I) key.

- Soft-start of Inverter, indicated with blinking LED.
- At the end of Soft-start the LED remains lit.
- Automatic transfer from Bypass to Inverter.
- UPS output LED indicates Load on Inverter.



The LCD must display on the main screen the status "LOAD ON INVERTER".

END OF PROCEDURE

7.1.4 Complete UPS shutdown (No Load supply)

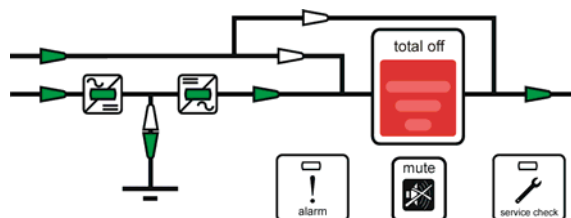


NOTE !

The *Load* must be disconnected.

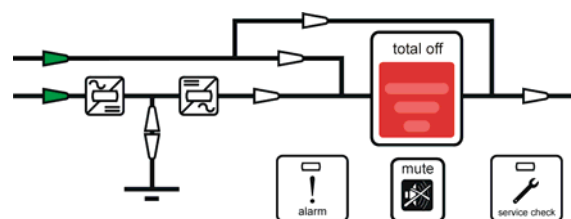
Initial status:

Load supplied from Inverter.



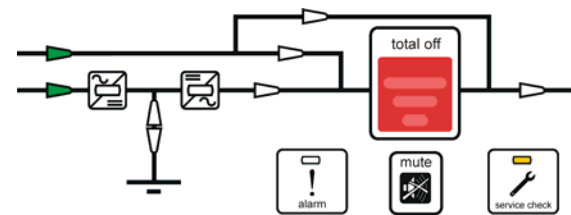
1. Press "total off" button.

- Load is disconnected from UPS.
- Rectifier is shut down and all output and input contactors will be opened.
- LED's, Rectifier, Inverter and Load are OFF.



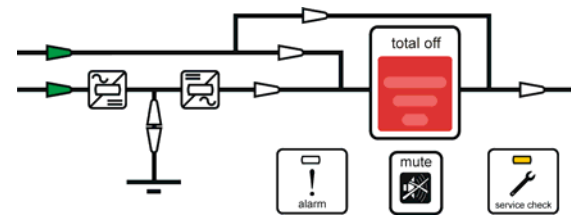
2. Open Q1 (Pos. 0).

- LED service check lights up.



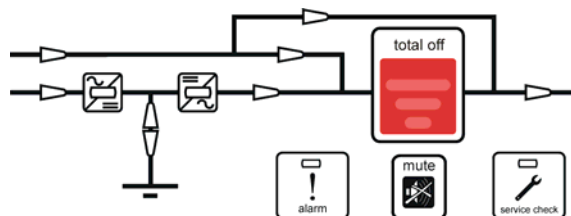
3. Disconnect the Battery from the UPS in case of External Battery.

- Wait 5 minutes for DC-Link Capacitors discharge.



4. Disconnect the Utility.

- All LED's are OFF.

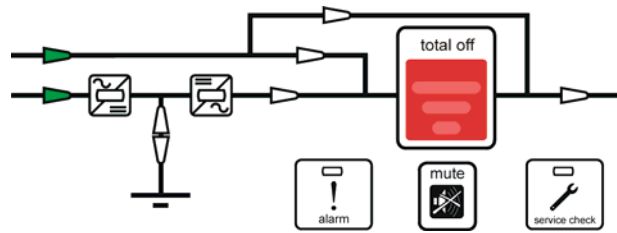


END OF PROCEDURE

7.1.5 Restore to normal operation after "total off"

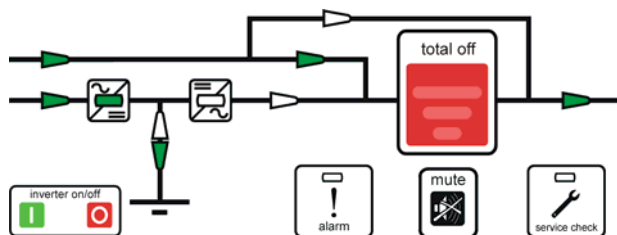
View of the panel after pressing the button "total off".

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



1. Reset "total off" by pressing and holding the "total off" button and then the "inverter on" (I) key simultaneously until Load is supplied from Bypass and the Rectifier starts.

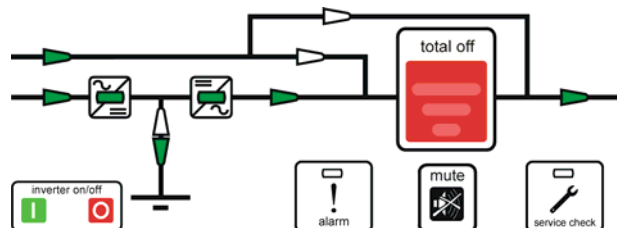
- Output connects to Bypass Utility.
- Rectifier starts with blinking LED.
- At the end of Soft-start the LED remains lit.
- The LCD screen shows: "LOAD ON BYPASS".
- Press *mute*, to reset *alarm* and *buzzer*.



2. Connect the Battery to the UPS by closing the Battery Switch or Fuses, in case of External Battery.

3. Press "inverter on" (I) key.

- Soft-start of Inverter indicated with blinking LED.
- At the end of Soft-start the LED remains lit.
- Automatic transfer from Bypass to Inverter.
- UPS output LED indicates Load on Inverter.



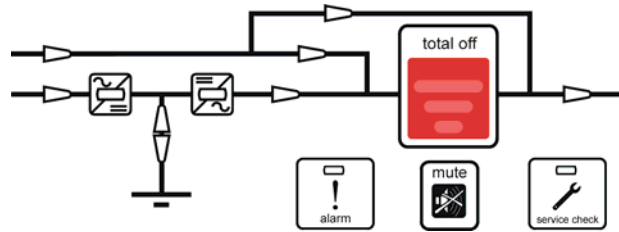
The LCD must display on the main screen the status "LOAD ON INVERTER".

END OF PROCEDURE

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

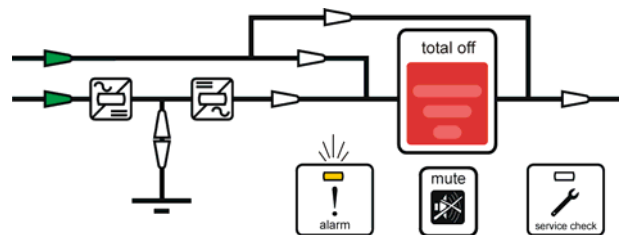


UPS panel after activation of EPO (Emergency Power Off) with Utility not available, i.e. complete shutdown of the UPS. In this case wait until Utility is again available, then proceed to restart the UPS as described below. Points 1 through 3.



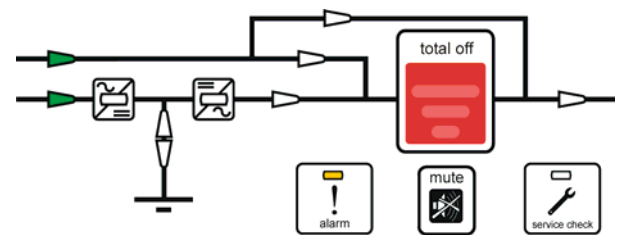
UPS panel after activation of EPO (Emergency Power Off) with Utility available.

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



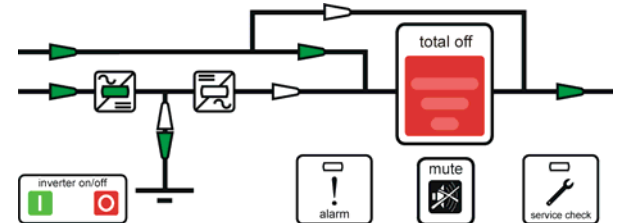
1. Reset the EPO (Emergency Power Off) button.

- Press *mute*, to reset *alarm* and *buzzer*.



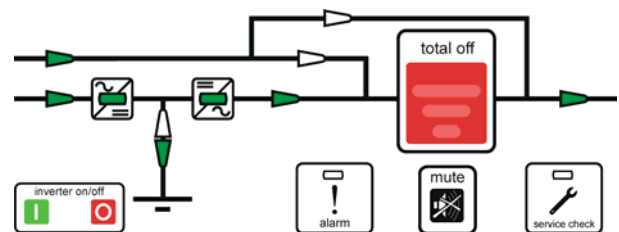
2. Press "inverter off" (O) key.

- Output connects to *Bypass Utility*.
 - Rectifier starts with blinking LED.
 - At the end of Soft-start the LED remains lit.
- The LCD screen shows: "LOAD ON BYPASS".



3. Press "inverter on" (I) key.

- Inverter starts with blinking LED.
- At the end of Soft-start the LED remains lit.
- Automatic transfer from *Bypass* to *Inverter*.
- UPS output LED and LCD screen indicate both: "LOAD ON INVERTER".



END OF PROCEDURE

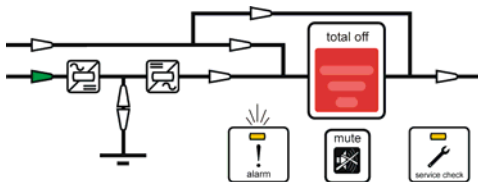
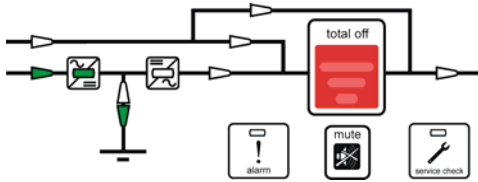
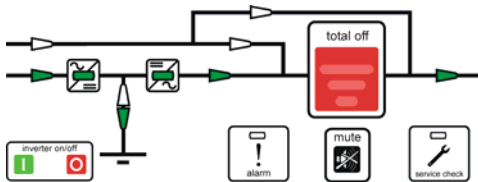
7.2 PROCEDURES FOR UPS FUNCTIONING AS FREQUENCY CONVERTER

When the **SG Series** functions as a *Frequency Converter*, the *Automatic Bypass* and *Manual Bypass* functions are disabled.

Therefore the *Load* cannot be transferred to *Utility* in case of overload, short circuit, or *Inverter* failure.

In situations where the UPS needs to be shutdown for maintenance purposes, also the *Load* must be shutdown or disconnected

7.2.1 Start-up of the SG Series as frequency converter

Verify with open front door: Switch Q1 must be open (Pos. O).	
1. Connect the Utility power on the UPS. <ul style="list-style-type: none"> Power supply starts up. Indicated with flashing <i>alarm</i> and <i>buzzer sound</i>. LED's as indicated will be lit. Press <i>mute</i>, to reset <i>alarm</i> and <i>buzzer</i>. 	
2. Close Q1 (Pos. I). <ul style="list-style-type: none"> <i>Rectifier</i> starts automatically, blinking <i>LED</i> indicates Soft-start. At the end of <i>Rectifier</i> Soft-start, <i>LED</i> remains lit. 	
3. Connect the Battery to the UPS by closing the Battery Switch or Fuses, in case of External Battery.	
4. Press "inverter on" (I) key. <ul style="list-style-type: none"> Soft-start of <i>Inverter</i> indicated with blinking <i>LED</i>. At the end of Soft-start the <i>LED</i> remains lit. UPS output <i>LED</i> indicates <i>Load on Inverter</i>. <p>The <i>LCD</i> must display on the main screen the status "LOAD ON INVERTER".</p>	
END OF PROCEDURE	



NOTE !

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

7.2.2 Complete UPS shutdown (No Load supply)

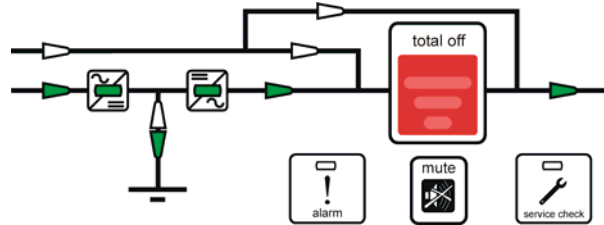


NOTE !

The *Load* must be disconnected.

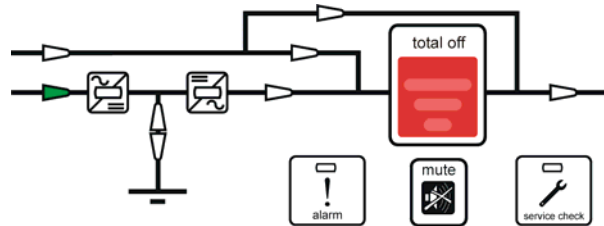
Initial status:

Load supplied from Inverter.



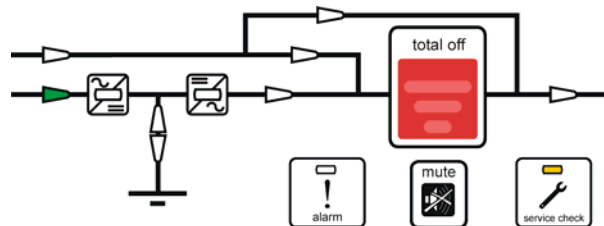
1. Press "total off" button.

- Load is disconnected from UPS.
- Rectifier is shut down and all output and input contactors will be opened.
- LED's, Rectifier, Inverter and Load are OFF.



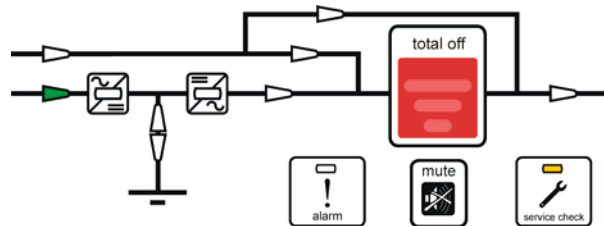
2. Open Q1 (Pos. 0).

- LED service check lights up.



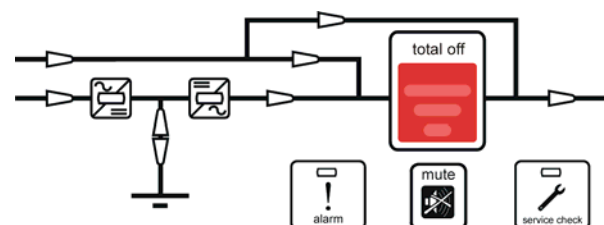
3. Disconnect the Battery from the UPS in case of External Battery.

- Wait 5 minutes for DC-Link Capacitors discharge.



4. Disconnect the Utility.

- All LED's are OFF.

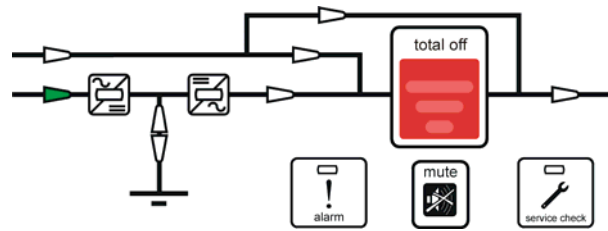


END OF PROCEDURE

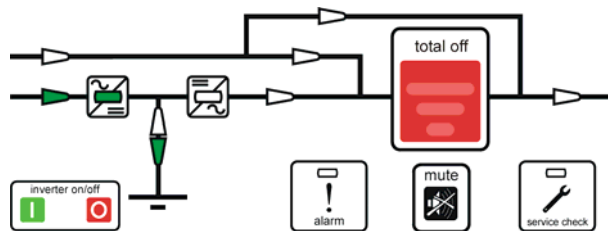
7.2.3 Restore to normal operation after "total off"

View of the panel after pressing the button "total off".

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



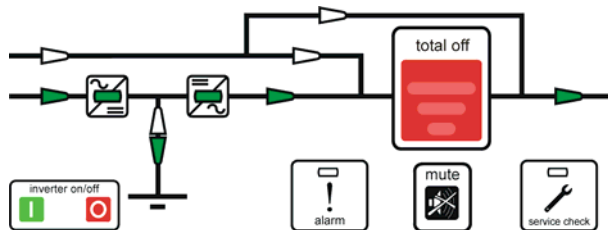
1. **Reset "total off"** by pressing and holding the "total off" button and the "inverter on" (I) key simultaneously until the Rectifier starts.



2. **Connect the Battery to the UPS by closing the Battery Switch or Fuses, in case of External Battery.**

3. **Press "inverter on" (I) key.**


- Soft-start of Inverter indicated with blinking LED.
- At the end of Soft-start the LED remains lit.
- UPS output LED indicates Load on Inverter.



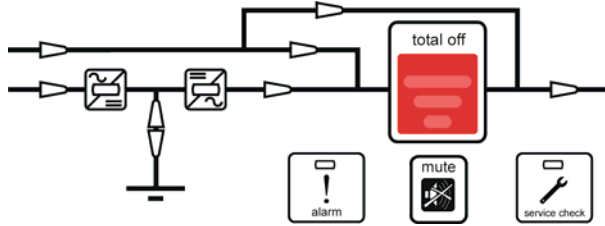
The LCD must display on the main screen the status "LOAD ON INVERTER".

END OF PROCEDURE

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

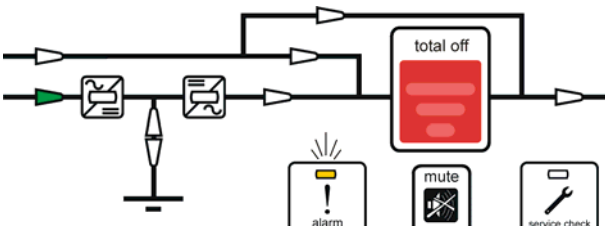


UPS panel after activation of EPO (Emergency Power Off) with Utility not available, i.e. complete shutdown of the UPS. In this case wait until *Utility* is again available, then proceed to restart the UPS as described below. Points 1 through 3.



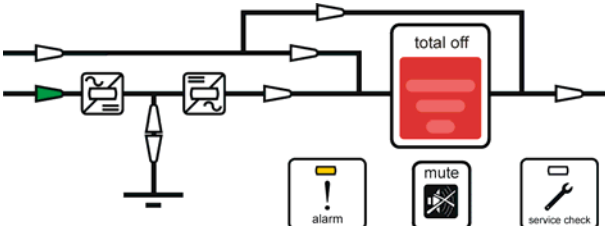
UPS panel after activation of EPO (Emergency Power Off) with Utility available.

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



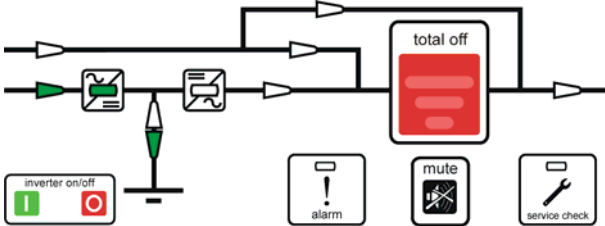
1. Reset the EPO (Emergency Power Off) button.

- Press *mute*, to reset alarm and buzzer.



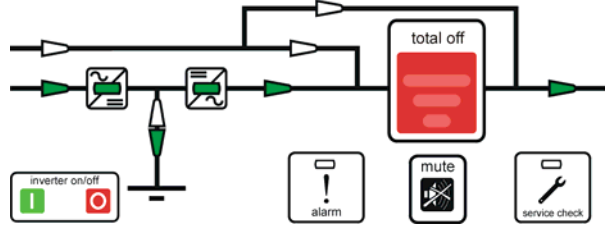
2. Press "inverter off" (O) key.

- Rectifier starts with blinking LED.
- At the end of Soft-start the LED remains lit.
- The LCD screen shows: "LOAD OFF".



3. Press "inverter on" (I) key.

- Inverter starts with blinking LED.
- At the end of Soft-start the LED remains lit.
- UPS output LED and LCD screen indicate both: "LOAD ON INVERTER".



END OF PROCEDURE

7.3 PROCEDURES FOR PARALLEL SYSTEM

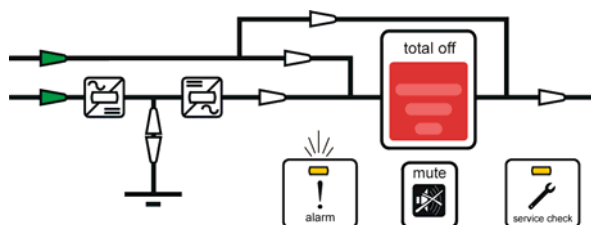
7.3.1 Parallel System start-up

Verify on all *Units*, with open front door: Switches **Q1** and **Q2 must be open** (Pos. O).

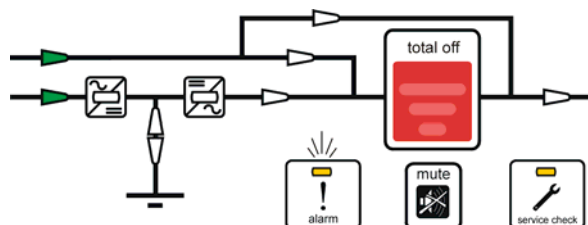
1. Connect the Utility power on all UPS's.

(In case of separate inputs for *Rectifier* and *Bypass*, connect both).

- Power supply starts up. Indicated with flashing *alarm* and *buzzer sounds*.
- LED's as indicated will be lit.
- Press *mute*, to reset *alarm* and *buzzer*.



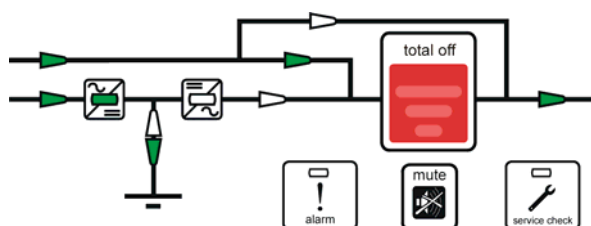
First operated unit



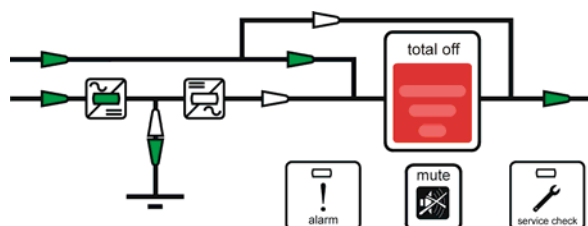
All other units of the system

2. Close Q1 (Pos. I) on all Units.

- When closing *Q1* on the last unit of the parallel system, the *Bypass* of all *Units* connects to the *Load*.
- *Rectifiers* start automatically, blinking *LED* indicates Soft-start.
- At the end of *Rectifier* Soft-start, the *LED* remains lit.
- *LED's* service check turn OFF.



First operated unit



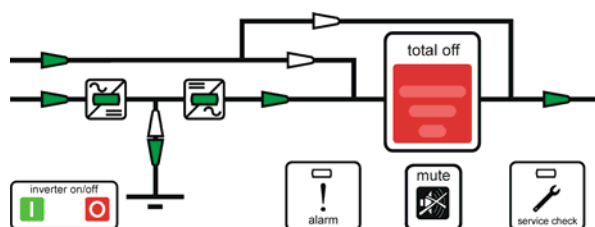
All other units of the system

3. Connect the Battery to all Units by closing the external Battery Switches or Fuses, in case of External Battery.

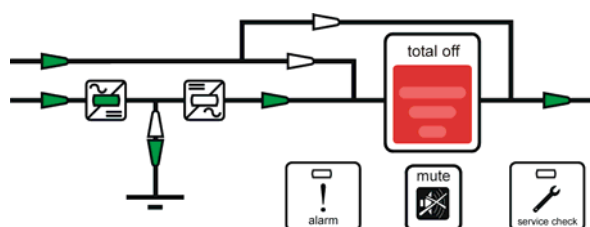
Continue ►

4. Press "inverter on" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status "*LOAD ON INVERTER*".



First operated unit

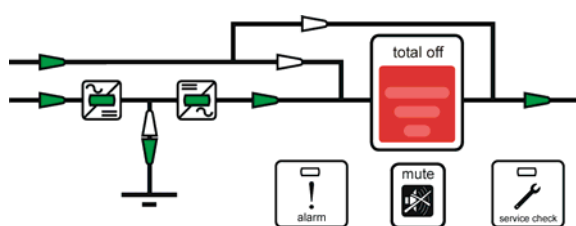


All other units of the system

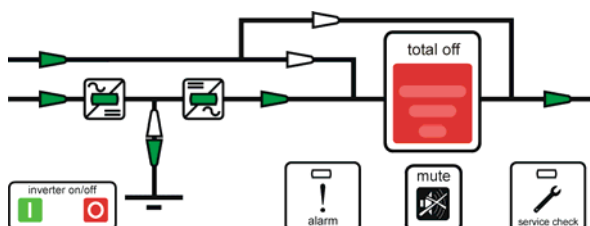
5. Press "inverter on" (I) key on all other units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load* supplied are ON.



First operated unit



All other units of the system

The *LCD* must display on the main screen on all *Units* the status "*LOAD ON INVERTER*".

END OF PROCEDURE

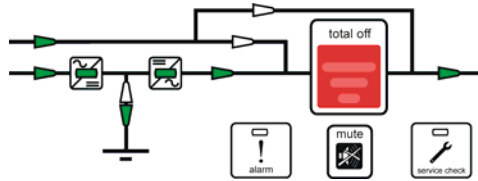


NOTE !

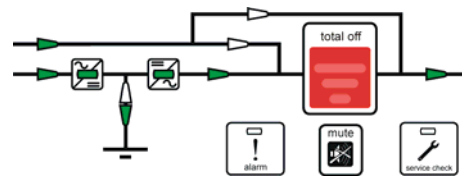
The *Battery* must be charged for at least 10 hours, in order to ensure the full backup runtime in the case of a *Utility Failure*.

7.3.2 Maintenance system shutdown (Load supplied from Q2 on all Units)

Initial status: **Load supplied from all Inverters.**



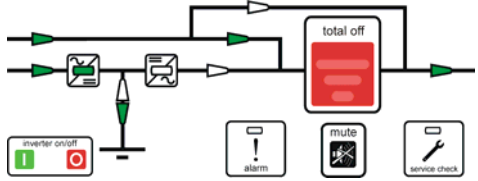
First operated unit



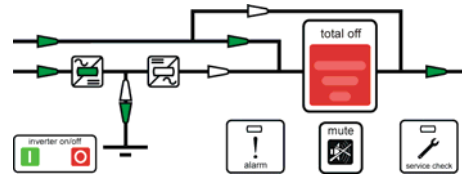
All other units of the system

1. Press "inverter off" (O) key on all Units, and hold until the LED inside the Inverter symbol turns OFF.

At no redundancy, the system will transfer to *Utility* supply.



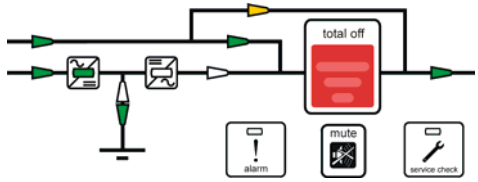
First operated unit



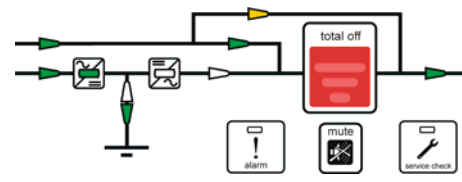
All other units of the system

2. Close Q2 (Pos. I) on all Units.

Load is now supplied from *Utility* in parallel from Bypass and Manual Bypass Q2 of all Units.



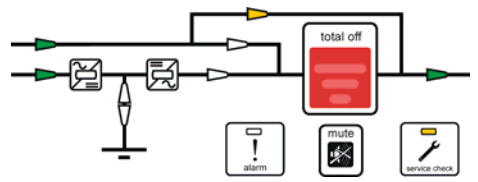
First operated unit



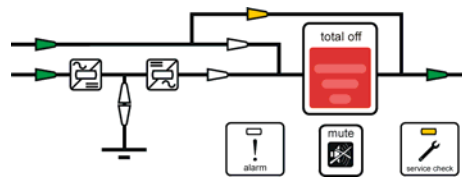
All other units of the system

3. Open Q1 (Pos. O) and then press "total off" button on all Units.

The Bypass of all Units will disconnect and all Rectifiers are shutdown.



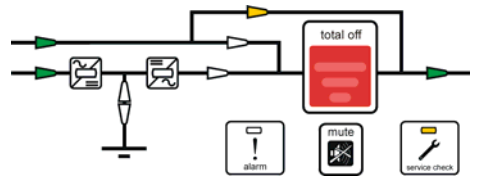
First operated unit



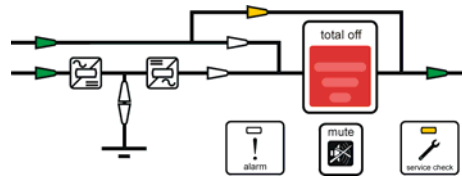
All other units of the system

4. Disconnect the Battery, in case of External Battery, from all Units.

- Wait 5 minutes for DC-Link Capacitors discharge.



First operated unit



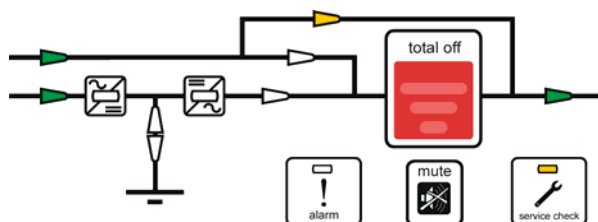
All other units of the system

END OF PROCEDURE

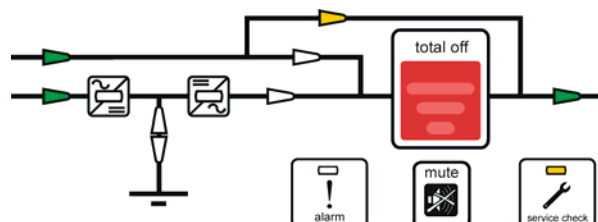
7.3.3 From Manual Bypass (Q2) to normal function VFI

Initial status: **Load supplied from Manual Bypass.**

All Q2 of the system are closed.



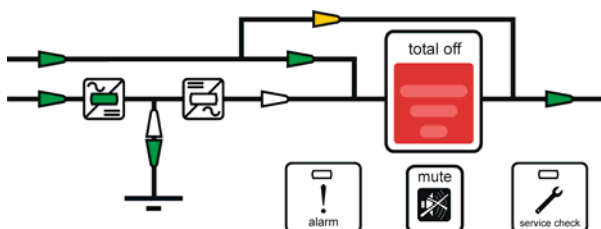
First operated unit



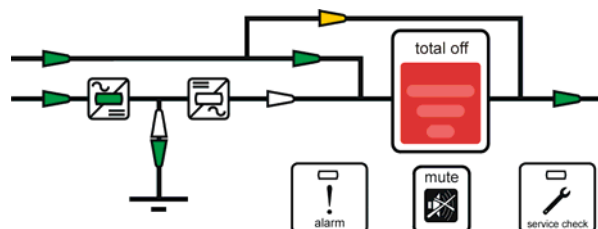
All other units of the system

1. Close Q1 (Pos. I) on all Units.

The Rectifiers will start automatically and at the closure of Q1 of the last Unit, the Bypass of all Units will be activated.



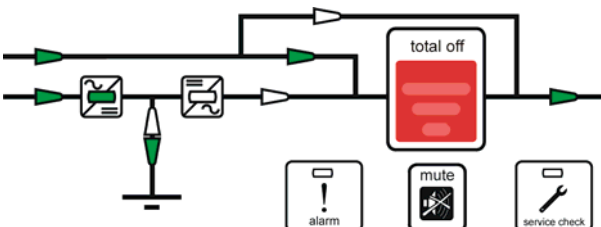
First operated unit



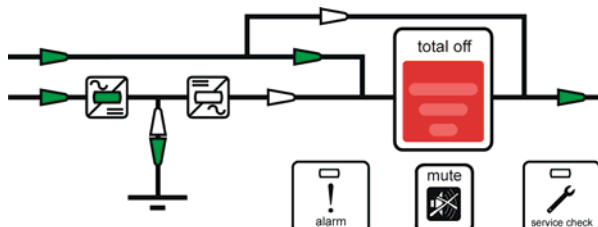
All other units of the system

2. Connect the Battery to all Units by closing the external Battery Switches or Fuses, in case of External Battery.

3. Open Q2 (Pos. O) on all Units.



First operated unit

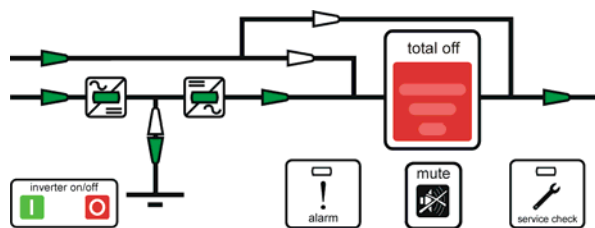


All other units of the system

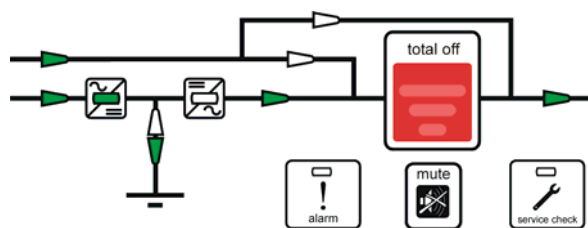
Continue ►

4. Press "inverter on" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status "LOAD ON INVERTER".



First operated unit

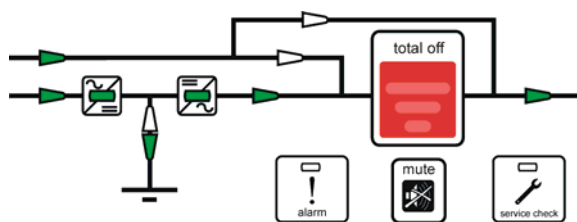


All other units of the system

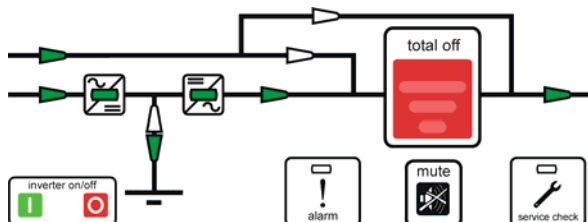
5. Press "inverter on" (I) key on all other units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load* supplied are ON.



First operated unit



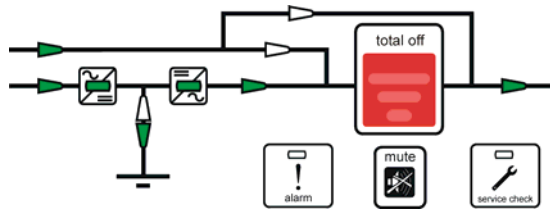
All other units of the system

The *LCD* must display on the main screen on all *Units* the status "LOAD ON INVERTER".

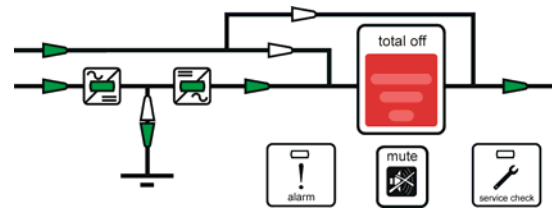
END OF PROCEDURE

7.3.4 Separate a Unit from the parallel system (System Redundancy)

Initial status: **Load supplied from all Inverters.**

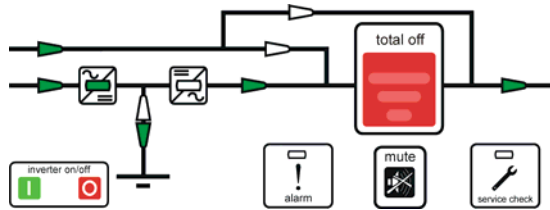


First operated unit

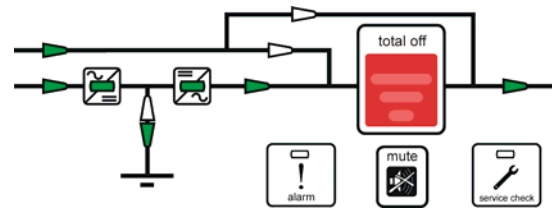


All other units of the system

1. **Press and hold "inverter off" (O) key on the Unit to separate, until the LED turns OFF.**
Load supplied from Inverter(s) of the other Unit(s) of the parallel system.

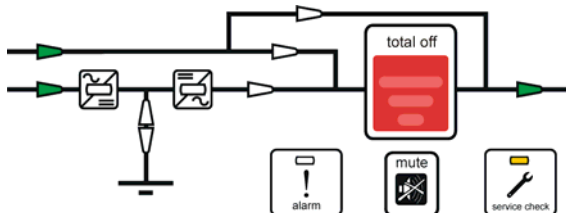


First operated unit

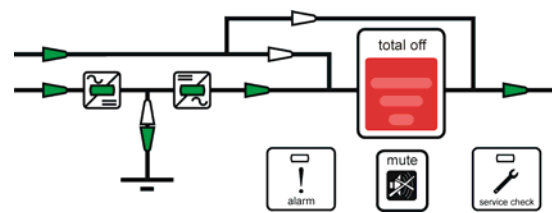


All other units of the system

2. **Open Q1 (Pos. 0) and, only when the LED service check is ON, press "total off" button on the Unit to separate.**



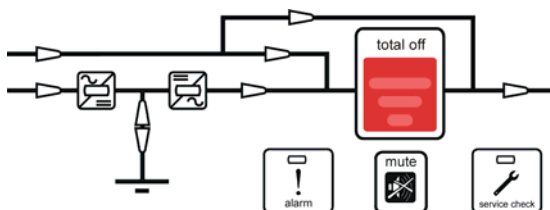
First operated unit



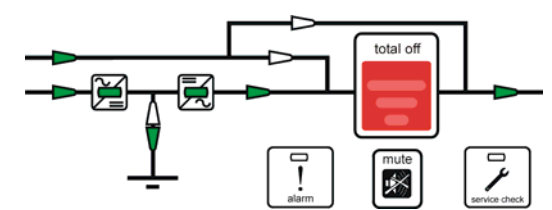
All other units of the system

3. **Disconnect the Battery, in case of External Battery, from the Unit to separate.**
 - Wait 5 minutes for DC-Link Capacitors discharge.

4. **Disconnect the Utility supply from the separated Unit.**



First operated unit



All other units of the system

END OF PROCEDURE



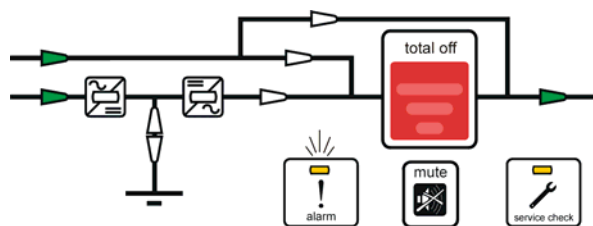
NOTE !

For any further intervention could nearest **Service Center**.

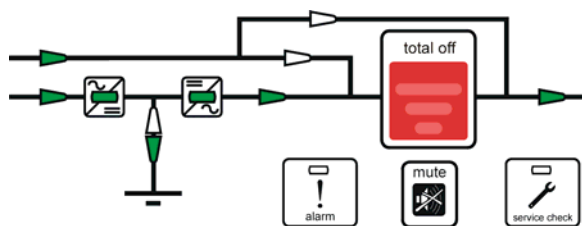
7.3.5 Reconnect a Unit to a parallel system

1. Connect the Utility supply on the separated Unit.

- Press *mute*, to reset alarm and buzzer.



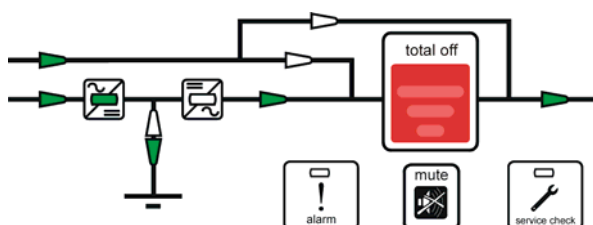
First operated unit



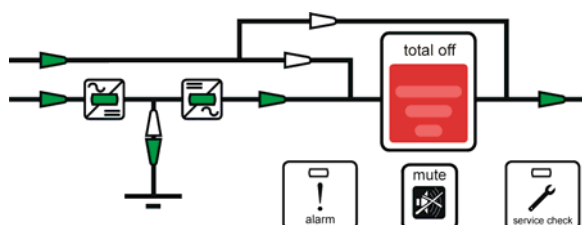
All other units of the system

2. Close Q1 (Pos. I) on the separated Unit.

Rectifier starts automatically.



First operated unit



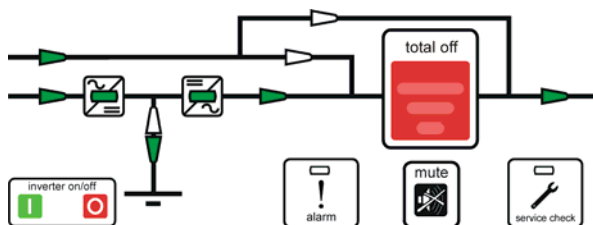
All other units of the system

3. Connect the Battery, in case of External Battery, to the UPS on the separated Unit by closing the external Battery Switch or Fuses.

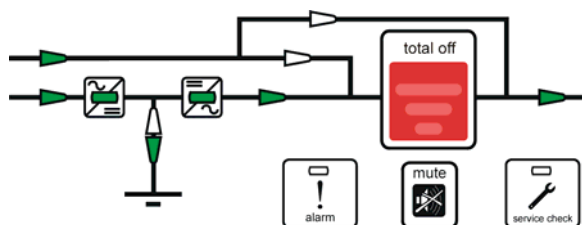
4. Press "inverter on" (I) key on the separated Unit.

After Soft-start of the *Inverter*, the *Inverter* connects automatically to the other Units of the parallel system.

- The LCD must display on the main screen the status "LOAD ON INVERTER".



First operated unit



All other units of the system

END OF PROCEDURE

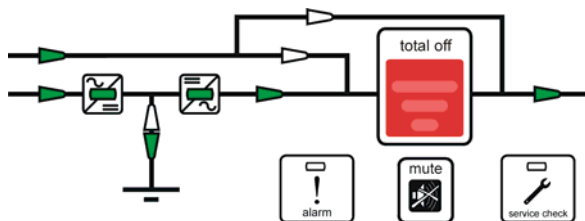
7.3.6 Parallel system shutdown (No Load supply)



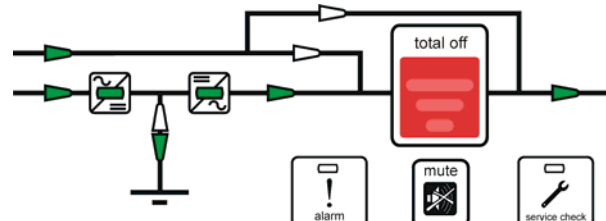
NOTE !

The *Load* must be disconnected.

Initial status: **Load supplied from all Inverters.**



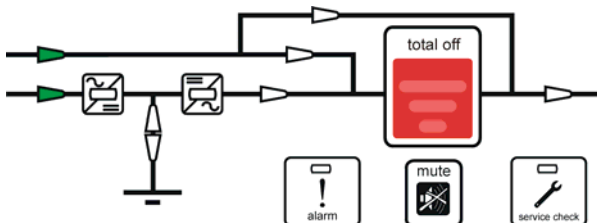
First operated unit



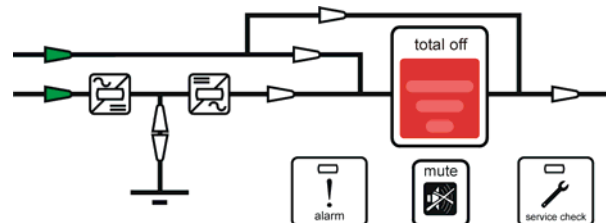
All other units of the system

1. Press "total off" button on any one on the Units.

- Load is disconnected from UPS.
- Rectifier and Inverter are shut down and all output and input Contactors will be opened.
- LED's, Rectifier, Inverter and Load are OFF.

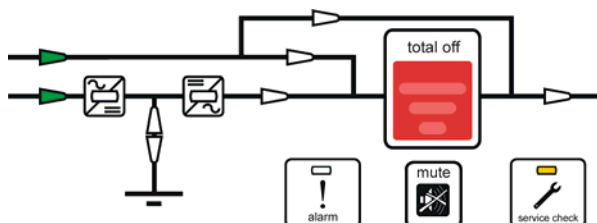


First operated unit

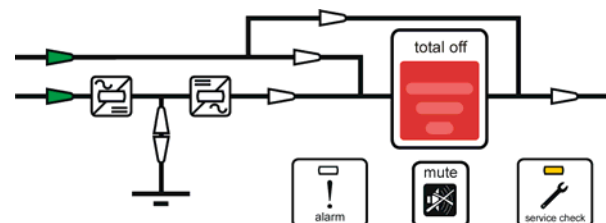


All other units of the system

2. Open Q1 (Pos. 0) on all Units.



First operated unit

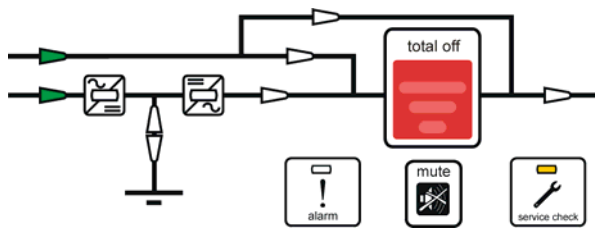


All other units of the system

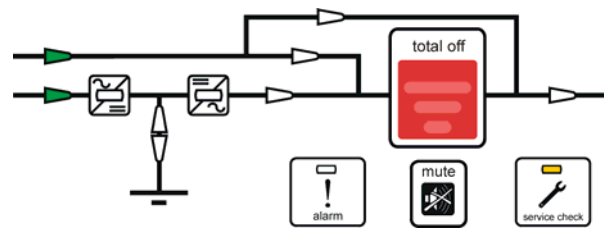
Continue ►

3. Disconnect the Battery, in case of External Battery, from all Units.

- Wait 5 minutes for DC-Link Capacitors discharge.



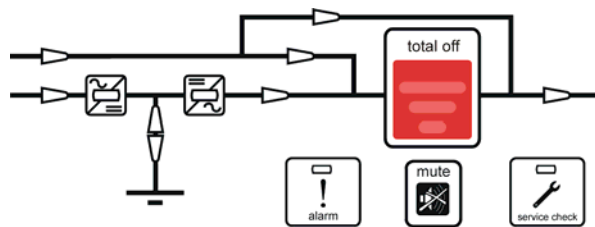
First operated unit



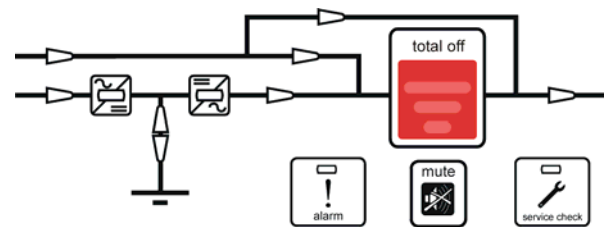
All other units of the system

4. Disconnect the Utility supply from all Units.

- All LED's are OFF.



First operated unit



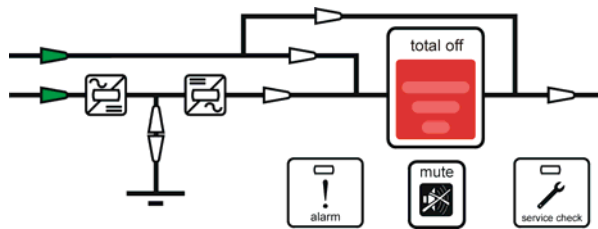
All other units of the system

END OF PROCEDURE

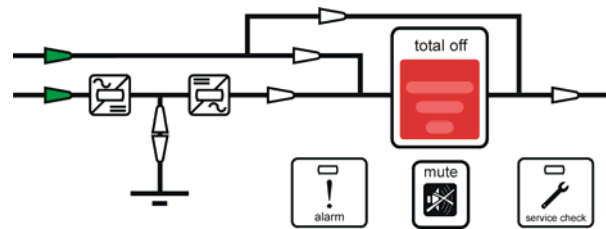
7.3.7 Restore to normal operation after "total off"

View of the panel after pressing the button "total off".

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



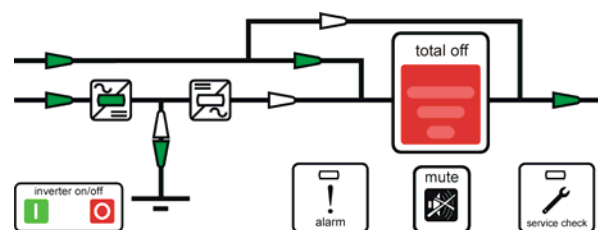
First operated unit



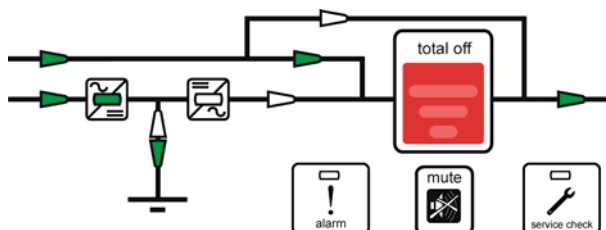
All other units of the system

1. **Reset "total off"** by pressing and holding the "**total off**" button and then the "**inverter on**" (I) key, on any of the Units simultaneously, until Load is supplied from Bypass and the Rectifiers start.

- System output connects to Bypass Utility.
- Rectifiers start with blinking LED.
- At the end of Soft-start the LED's remains lit.
- The LCD screen on all Units shows "LOAD ON BYPASS".



First operated unit



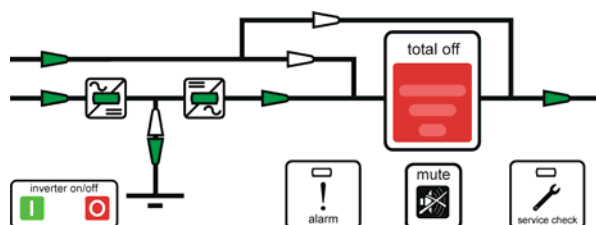
All other units of the system

2. **Connect the Battery to all Units by closing the external Battery Switches or Fuses, in case of External Battery.**

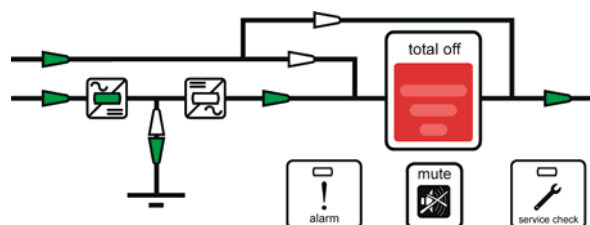
Continue ►

3 Press "inverter on" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status "LOAD ON INVERTER".



First operated unit

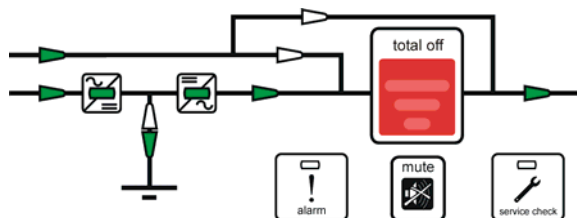


All other units of the system

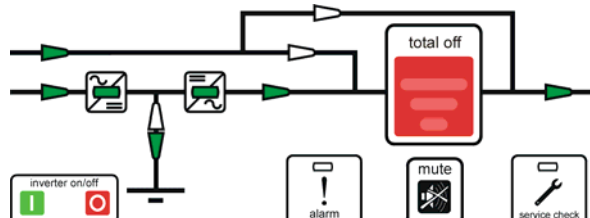
4. Press "inverter on" (I) key on all other units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load* supplied are ON.



First operated unit




All other units of the system

The *LCD* must display on the main screen on all *Units* the status "LOAD ON INVERTER".

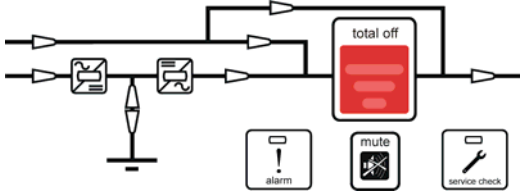
End of procedure

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

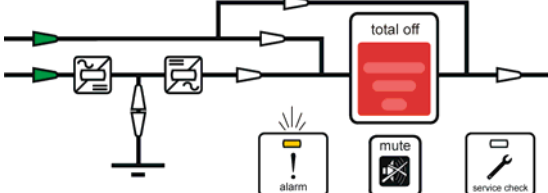


UPS panel after activation of EPO (Emergency Power Off) with Utility not available, i.e. complete shutdown of the UPS and LCD screen OFF.

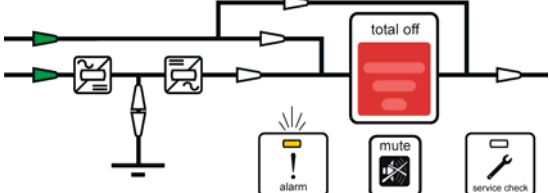
In this case wait until *Utility* is again available, then proceed to restart the UPS as described below Points 1 through 3.



UPS panel after activation of EPO (Emergency Power Off) with Utility available.
All Contacts are open. Rectifier, Inverter and Static-Switch shutdown.



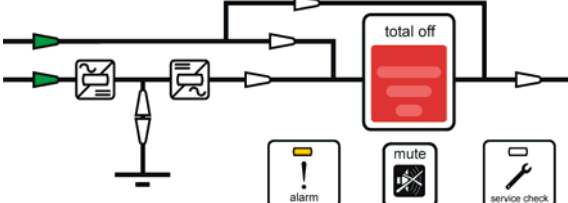
First operated unit



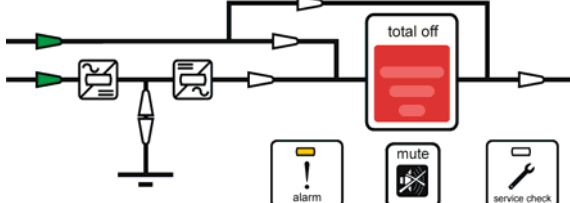
All other units of the system

1. Reset the EPO (Emergency Power Off) button.

- Press *mute*, to reset alarm and buzzer.



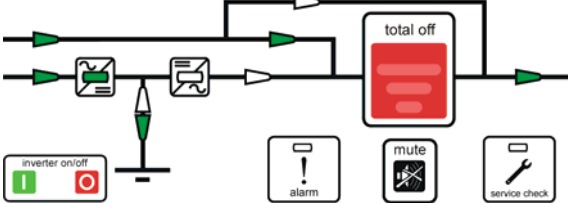
First operated unit



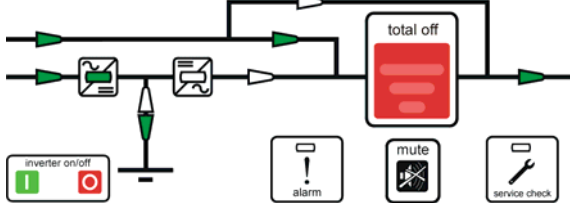
All other units of the system

2. Press "inverter off" (O) key on all Units.

- Rectifiers start with blinking LED.
- After pressing the "inverter off" key on the last unit of the parallel system, the output of all Units connect to Bypass Utility.
- The LCD screen shows: "LOAD ON BYPASS".



First operated unit



All other units of the system

Continue ►

4. Press "inverter on" (I) key on first Unit.

-
- First operated unit
- All other units of the system

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

-
- First operated unit*
- All other units of the system*

END OF PROCEDURE

7.4 PROCEDURES FOR PARALLEL SYSTEM WITH COMMON BATTERY

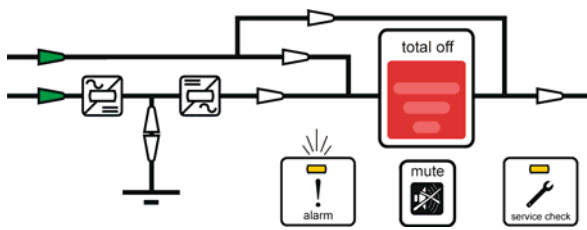
7.4.1 Parallel System start-up

Verify on all *Units*, with open front door: Switches **Q1** and **Q2** must be open (Pos. O).

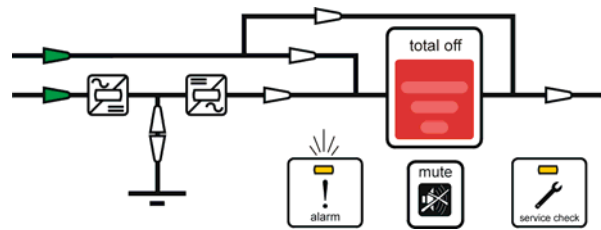
1. Connect the Utility power on all UPS's.

(In case of separate inputs for *Rectifier* and *Bypass*, connect both).

- Power supply starts up. Indicated with flashing *alarm* and *buzzer sounds*.
- LED's as indicated will be lit.
- Press *mute*, to reset *alarm* and *buzzer*.



First operated unit

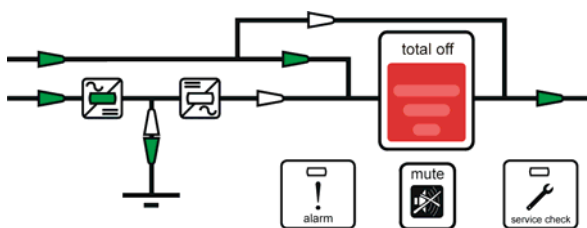


All other units of the system

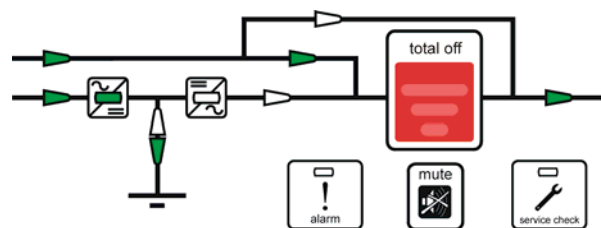
2. Connect the Battery to all Units by closing the external Battery Switch(es) or Fuses.

3. Close Q1 (Pos. I) on all Units.

- *Rectifiers* start automatically, blinking *LED* indicates Soft-start.
- At the end of *Rectifier* Soft-start, the *LED* remains lit.
- When closing *Q1* on the last *Unit* of the parallel system, the *Bypass* of all *Units* connects to the *Load*.
- *LED's* *service check* turn OFF.



First operated unit

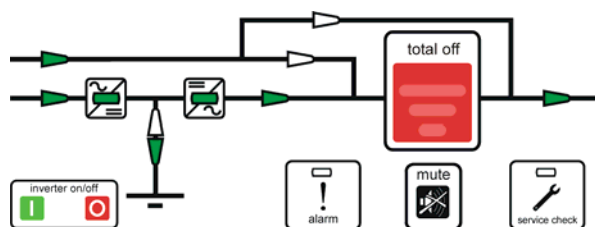


All other units of the system

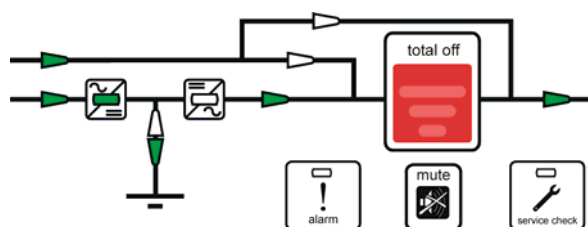
Continue ►

4. Press "inverter on" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status "*LOAD ON INVERTER*".



First operated unit

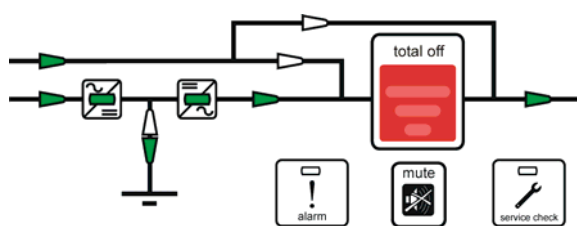


All other units of the system

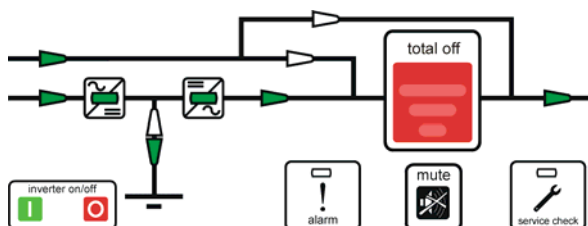
5. Press "inverter on" (I) key on all other units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load* supplied are ON.



First operated unit



All other units of the system

The *LCD* must display on the main screen on all *Units* the status "*LOAD ON INVERTER*".

END OF PROCEDURE

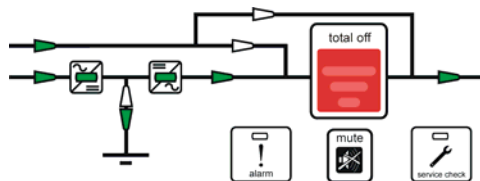


NOTE !

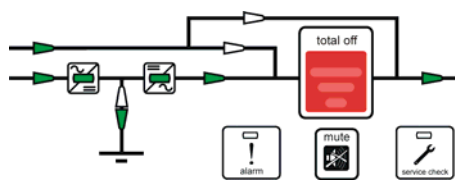
The *Battery* must be charged for at least 10 hours, in order to ensure the full backup runtime in the case of a *Utility Failure*.

7.4.2 Maintenance system shutdown (Load supplied from Q2 on all Units)

Initial status: **Load supplied from all Inverters.**



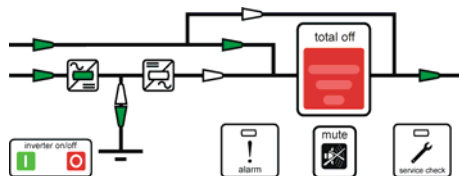
First operated unit



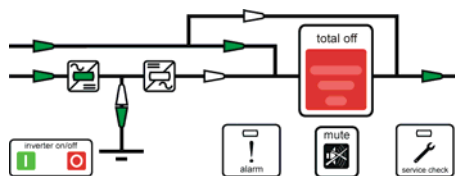
All other units of the system

1. **Press and hold "inverter off" (O) key on all Units, until the LED inside the Inverter symbol turns OFF.**

At no redundancy, the system will transfer to *Utility* supply.



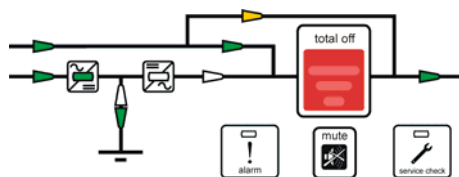
First operated unit



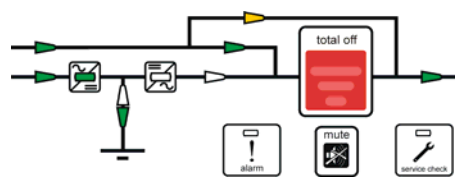
All other units of the system

2. **Close Q2 (Pos. I) on all Units.**

Load is now supplied from *Utility* in parallel from *Bypass* and *Manual Bypass Q2* of all Units.



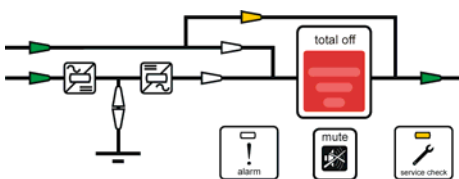
First operated unit



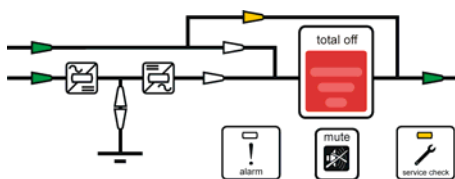
All other units of the system

3. **Open Q1 (Pos. O) and press "total off" button on all Units.**

The *Bypass* of all Units will disconnect and *all Rectifiers* are shutdown.



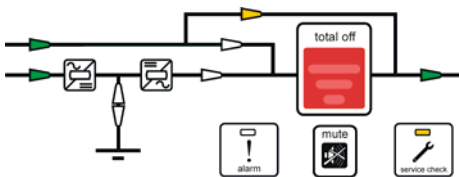
First operated unit



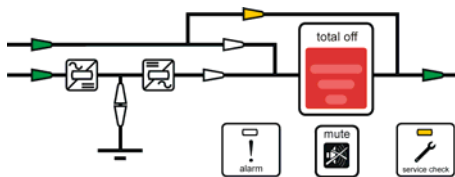
All other units of the system

4. **Disconnect the Battery from all Units.**

- Wait 5 minutes for DC-Link Capacitors discharge.



First operated unit



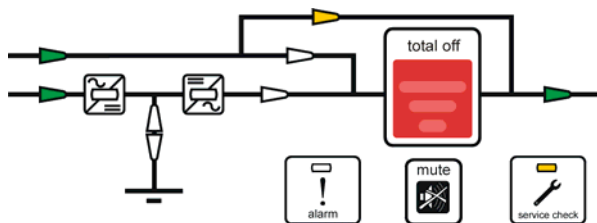
All other units of the system

END OF PROCEDURE

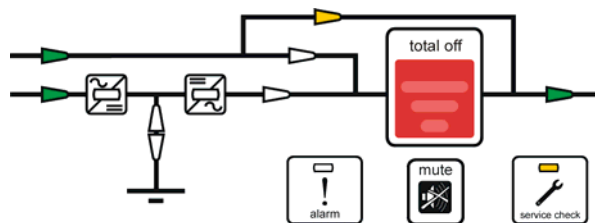
7.4.3 From Manual Bypass (Q2) to normal function VFI

Initial status: **Load supplied from Manual Bypass.**

All Q2 of the system closed.



First operated unit

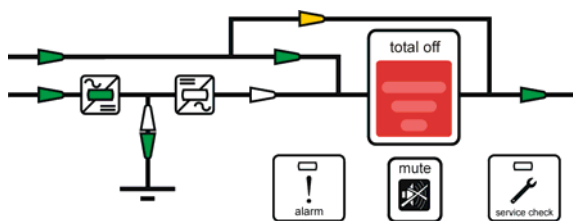


All other units of the system

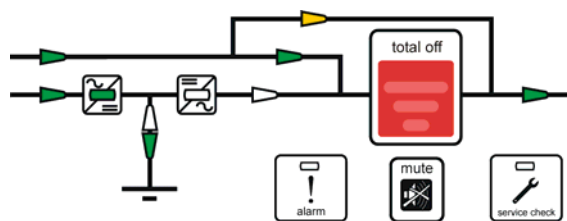
1. Connect the Battery to all Units by closing the external Battery Switch(es) or Fuses.

2. Close Q1 (Pos. I) on all Units.

The Rectifiers will start automatically and at the closure of Q1 of the last Unit, the Bypass of all Units will be activated.

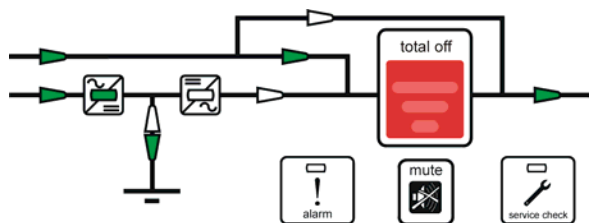


First operated unit

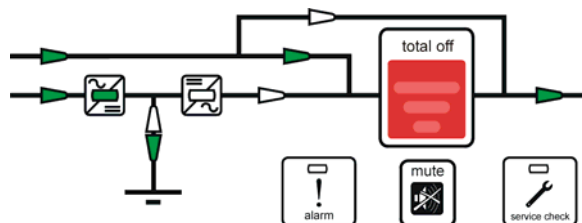


All other units of the system

3. Open Q2 (Pos. O) on all Units.



First operated unit

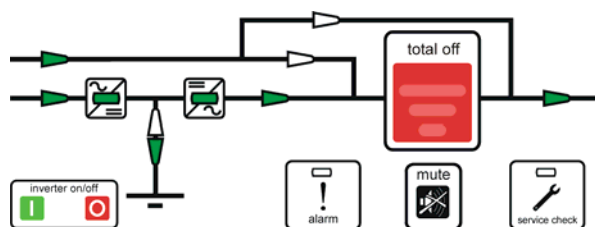


All other units of the system

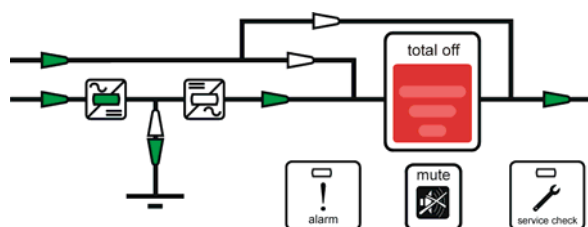
Continue ►

4. Press “inverter on” (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status “LOAD ON INVERTER”.



First operated unit

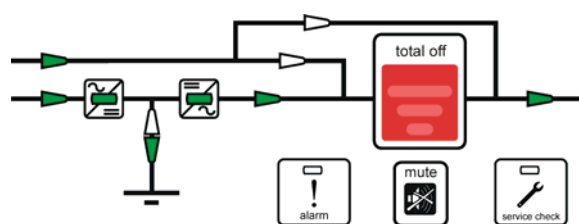


All other units of the system

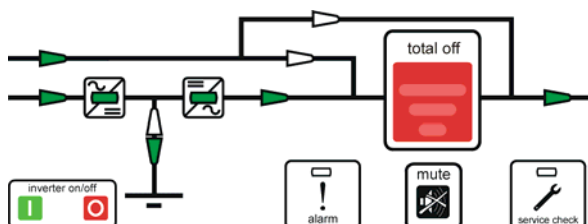
5. Press “inverter on” (I) key on all other units.

(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*.
- All *LED*'s *Inverter*, *Load on Inverter* and *Load* supplied are ON.



First operated unit



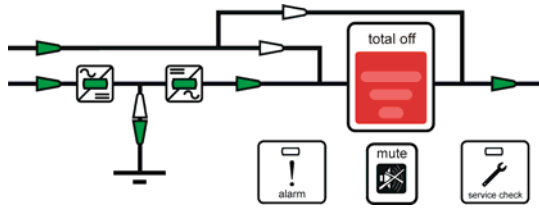
All other units of the system

The *LCD* must display on the main screen on all *Units* the status “LOAD ON INVERTER”.

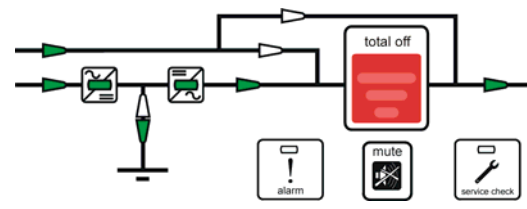
END OF PROCEDURE

7.4.4 Separate a Unit from the parallel system (System Redundancy)

Initial status: **Load supplied from all Inverters.**

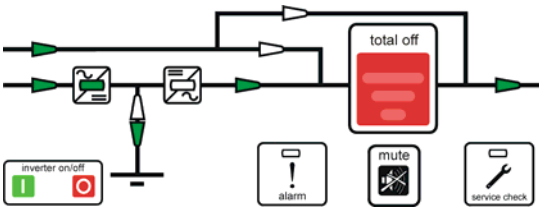


First operated unit

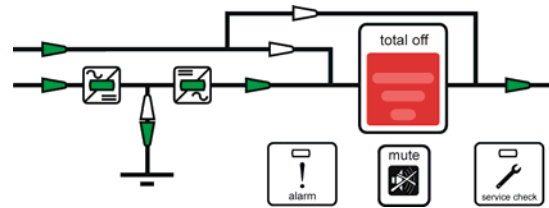


All other units of the system

1. **Press and hold "inverter off" (O) key on the Unit, to separate, until the LED turns OFF.**
Load supplied from Inverter(s) of the other Unit(s) of the parallel system.

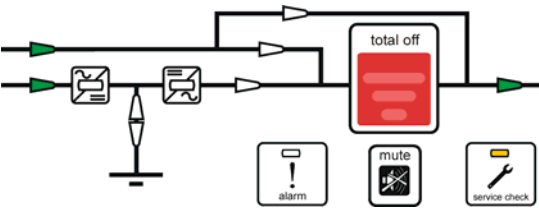


First operated unit

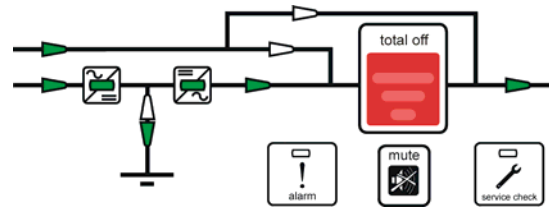


All other units of the system

2. **Open Q1 (Pos. 0) and, only when the LED service check is ON, press "total off" button on the Unit to separate.**



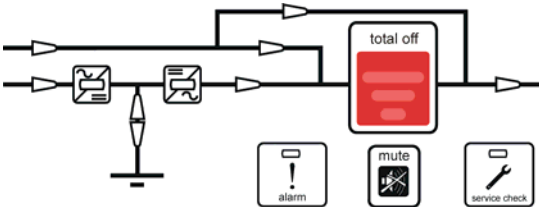
First operated unit



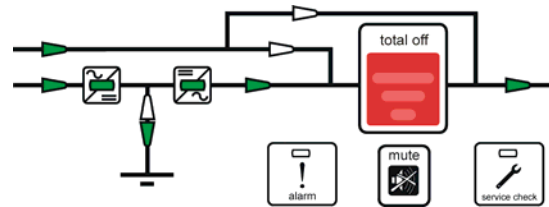
All other units of the system

3. **Disconnect the Battery from the Unit to separate.**
 - Wait 5 minutes for DC-Link Capacitors discharge.

4. **Disconnect the Utility supply from separated Unit.**



First operated unit



All other units of the system

END OF PROCEDURE



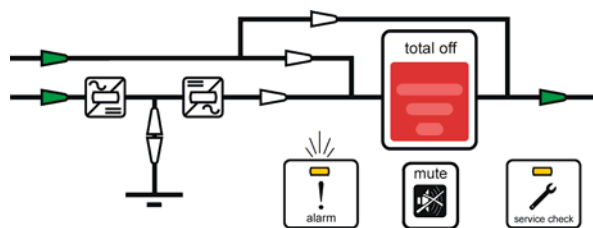
NOTE !

For any further intervention could nearest Service Center.

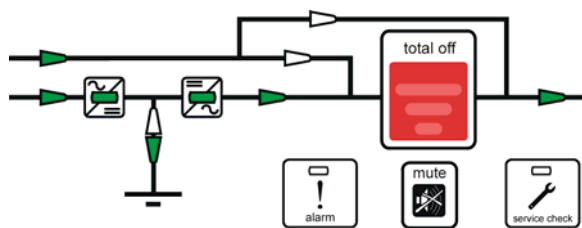
7.4.5 Reconnect a Unit to a parallel system

1. Connect the Utility supply on the separated Unit.

- Press *mute*, to reset alarm and buzzer.



First operated unit

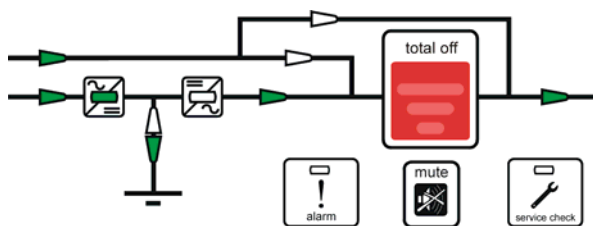


All other units of the system

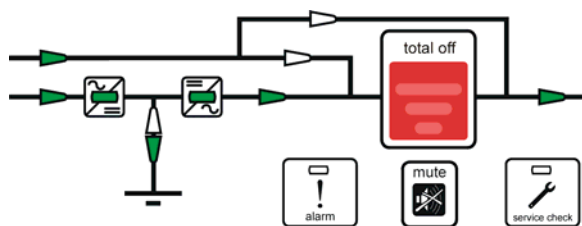
2. Connect the Battery to the UPS separated by closing the external Battery Switch or Fuses.

3. Close Q1 (Pos. I) on the separated Unit.

Rectifier starts automatically.



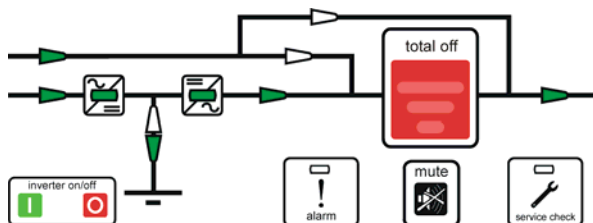
First operated unit



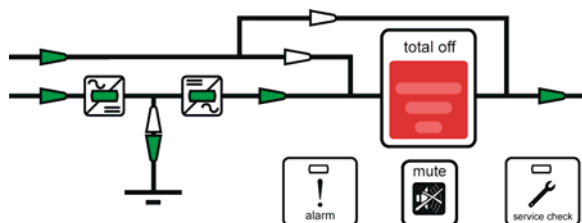
All other units of the system

4. Press "inverter on" (I) key on the separated Unit.

After Soft-start of the Inverter, the Inverter connects automatically to the other Units of the parallel system.



First operated unit



All other units of the system

END OF PROCEDURE

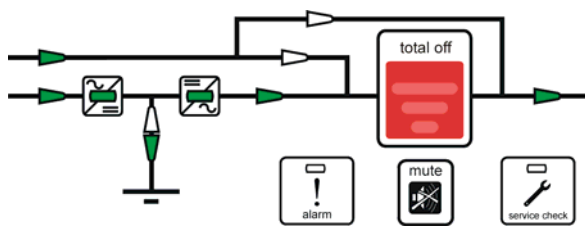
7.4.6 Parallel system shutdown (No Load supply)



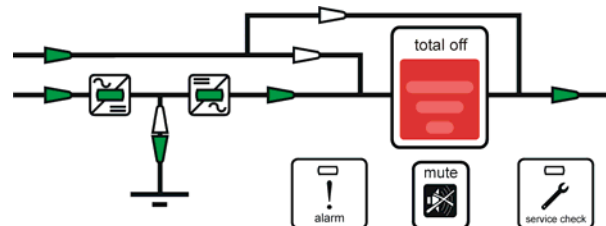
NOTE !

The *Load* must be disconnected.

Initial status: **Load supplied from all Inverters.**



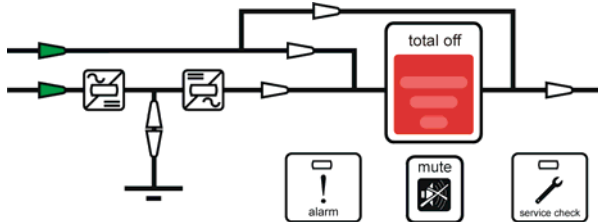
First operated unit



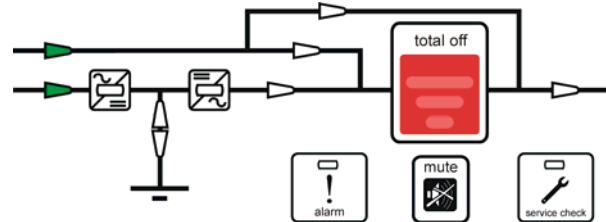
All other units of the system

1. Press "total off" button on any one on the units.

- Load is disconnected from UPS.
- Rectifier and Inverter are shut down and all output and input contactors will be opened.
- LED's, Rectifier, Inverter and Load are OFF.

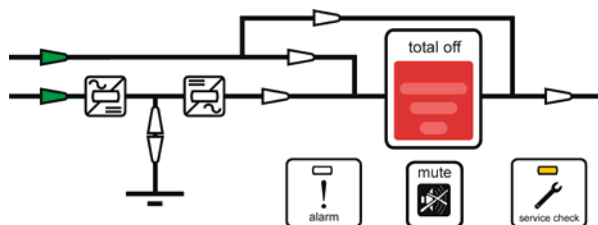


First operated unit

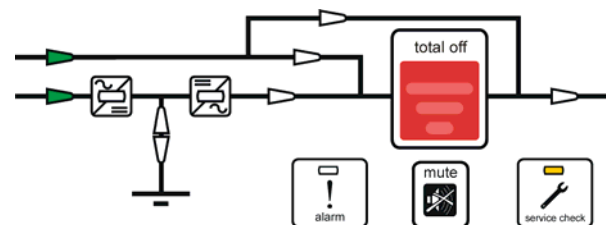


All other units of the system

2. Open Q1 (Pos. 0) on all Units.



First operated unit

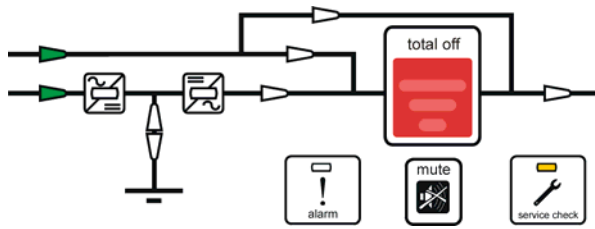


All other units of the system

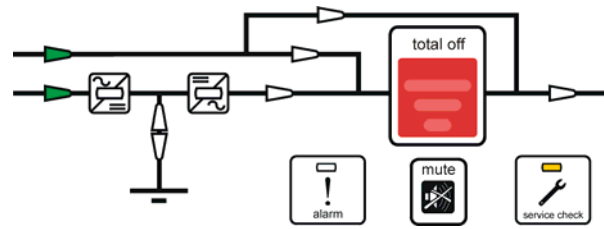
Continue ►

3. Disconnect the Battery from all Units.

- Wait 5 minutes for DC-Link Capacitors discharge.



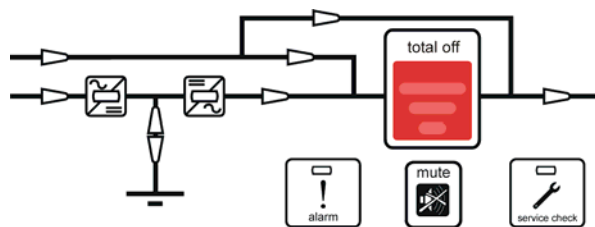
First operated unit



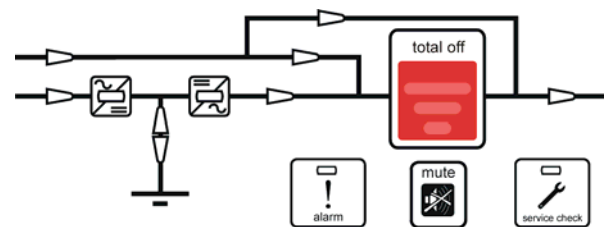
All other units of the system

4. Disconnect the Utility supply from all Units.

- All LED's are OFF.



First operated unit



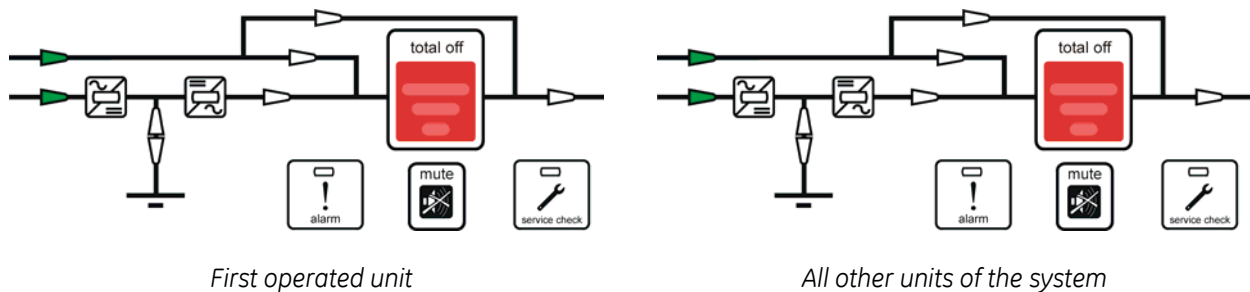
All other units of the system

END OF PROCEDURE

7.4.7 Restore to normal operation after "total off"

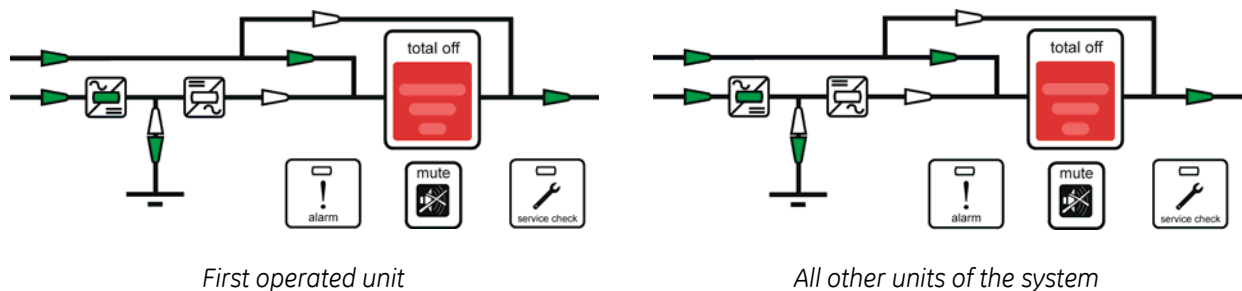
View of the panel after pressing the button "total off".

- All Contacts are open.
- Rectifier, Inverter and Static-Switch shutdown.



1. **Reset "total off"** by pressing and holding the "**total off**" button and then the "**inverter on**" (I) key, on any of the Units simultaneously, until Load is supplied from Bypass and the Rectifiers start.

- System output connects to *Bypass Utility*.
- *Rectifiers* start with blinking LED.
- At the end of Soft-start the LED's remains lit.
- The LCD screen on all Units shows: "LOAD ON BYPASS".

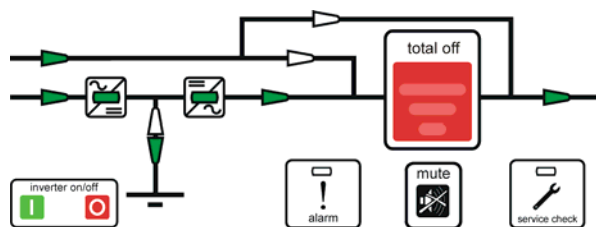


2. **Connect the Battery to all Units by closing the external Battery Switch(es) or Fuses.**

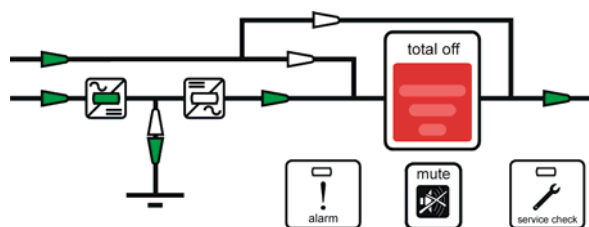
Continue ►

3. Press "inverter on" (I) key on first unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- UPS output *LED* indicates *Load on Inverter* and the LCD must display on the main screen the status "*LOAD ON INVERTER*".



First operated unit

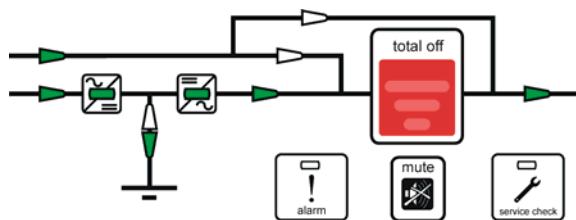


All other units of the system

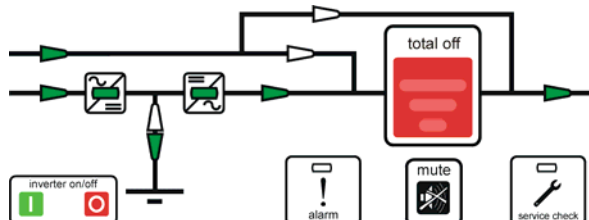
4. Press "inverter on" (I) key on all other units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load supplied* are ON.



First operated unit




All other units of the system

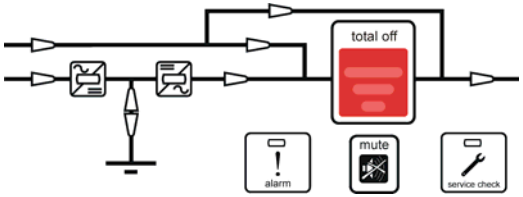
The *LCD* must display on the main screen on all *Units* the status "*LOAD ON INVERTER*".

END OF PROCEDURE

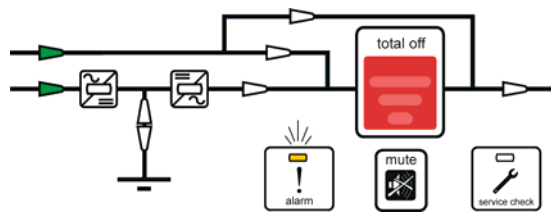
7.4.8 Restore to normal operation after EPO (Emergency Power Off)



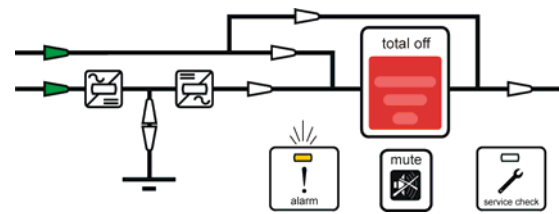
UPS panel after activation of EPO (Emergency Power Off) with Utility not available, i.e. complete shutdown of the UPS and LCD screen OFF. In this case wait until Utility is again available, then proceed to restart the UPS as described below Points 1 through 3.



UPS panel after activation of EPO (Emergency Power Off) with Utility available. All Contacts are open. Rectifier, Inverter and Static-Switch shutdown.



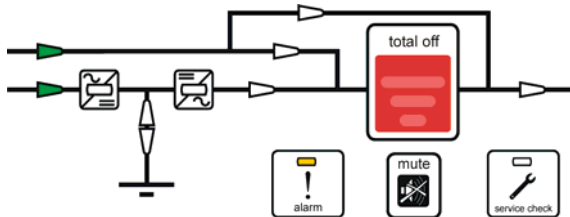
First operated unit



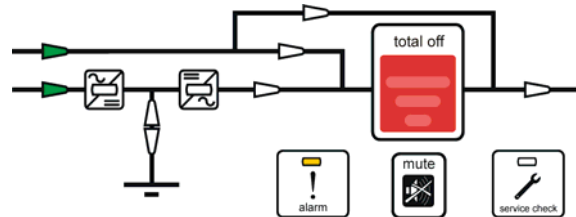
All other units of the system

1. Reset the EPO (Emergency Power Off) button.

- Press mute, to reset alarm and buzzer.



First operated unit

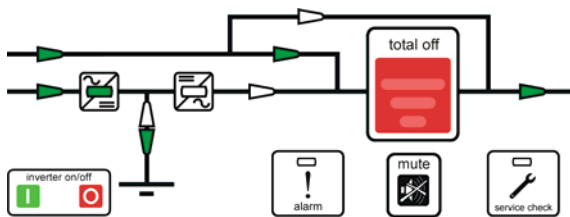


All other units of the system

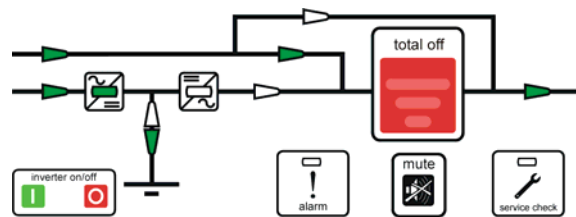
2. Connect the Battery to all Units by closing the external Battery Switch(es) or Fuses.

3. Press "inverter off" (O) key on all Units.

- Rectifiers start with blinking LED.
- After pressing the "inverter off" key on the last unit of the parallel system, the output of all Units connect to Bypass Utility.
- The LCD screen shows: "LOAD ON BYPASS".



First operated unit

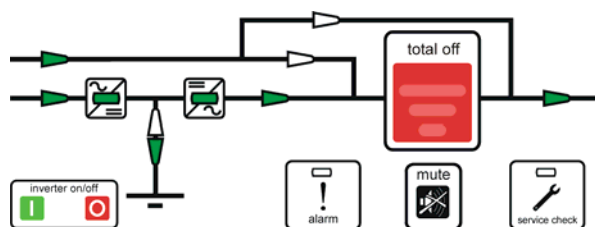


All other units of the system

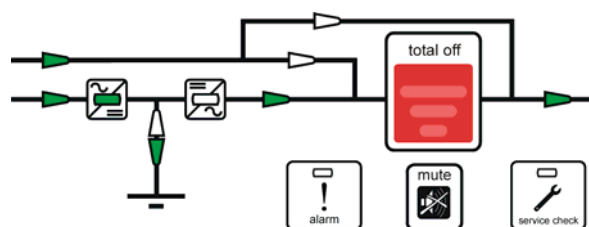
Continue ►

4. Press "inverter on" (I) key on first Unit.

- Soft-start of *Inverter*, indicated with blinking *LED*.
- At the end of Soft-start the *LED Inverter* remains lit.
- In case of sufficient output power, the output will transfer to *Inverter*.
- *UPS output LED* indicates *Load on Inverter* and the *LCD* must display on the main screen the status "*LOAD ON INVERTER*".



First operated unit

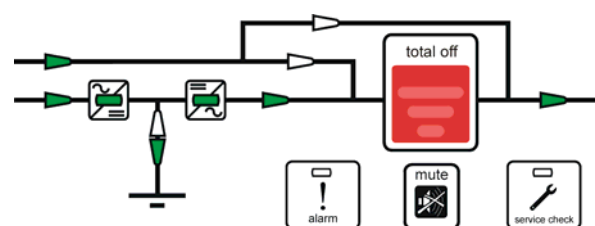


All other units of the system

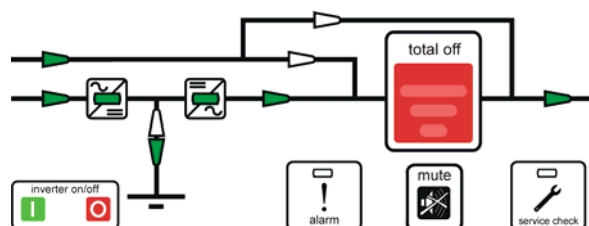
5. Press "inverter on" (I) key on all other Units.

(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*.
- All *LED's Inverter*, *Load on Inverter* and *Load supplied* are ON.



First operated unit



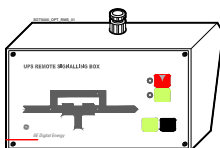
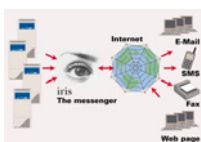
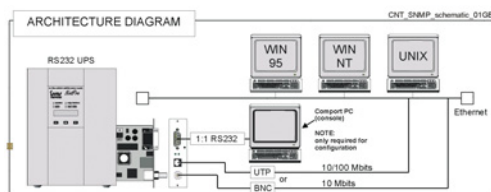
All other units of the system

The *LCD* must display on the main screen on all *Units* the status "*LOAD ON INVERTER*".

END OF PROCEDURE

8 OPTIONS

8.1 COMMUNICATION OPTIONS



Advanced SNMP Card

Simple Network Management Protocol

The *Advanced SNMP Card* 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 *JUMP*), which uses this information to determine the state of the UPS in order to guarantee safe and orderly shutdown of the server, when needed.

IRIS Service

Internet Remote Information System

Internet Remote Information System for UPS System.

JUMP Software Suite

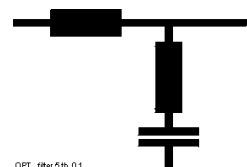
Java Universal Management Protocol

Software application for the control and monitoring of the UPS.

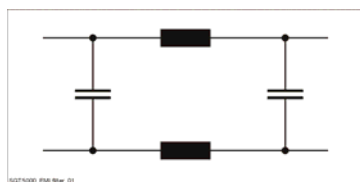
Remote Signalling Box (RSB)

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

8.2 OPTIONS IN UPS CABINET



OPT_filter 5th_01



OPT5000_5th filter_01

RPA Kit

Redundant Parallel Architecture

Up to 8 units parallel possible for redundancy or capacity in RPA configuration.

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 Signalling Box (RSB)

The optional *Remote Signalling 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 / 0.25mm².

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*).

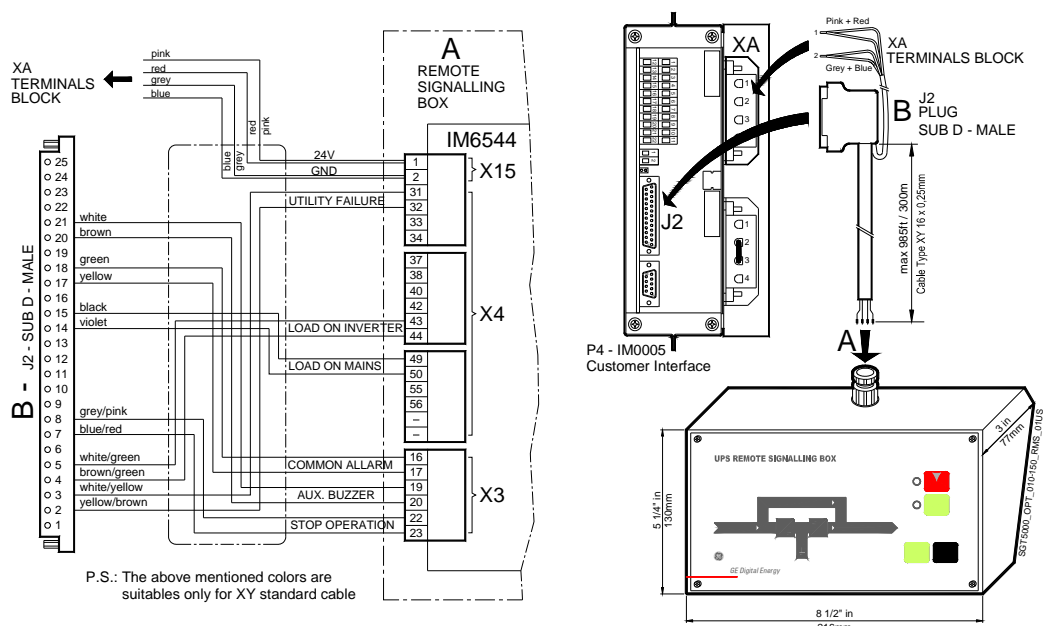


Fig. 8.3.1-1 Remote Signalling Box connection

- A** Terminals *X3*, *X4* and *X15* fitted inside the *Remote Signalling 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 24 VDC supply *Remote Signalling 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.

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 this lamp lights up during the normal operation, that means that 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 Centre* 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 replacement of components such as *Filter Capacitors* and *Lithium Battery* for the backup of data on the control boards of the units every **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.

[illegible]