UPS USER MANUAL

MANUEL DE L'UTILISATEUR DE L'ASI

UTILIZZO DELL'UPS

Index / Indice

Index of pictures / Indice delle figure

ENGLISH LANGUAGE

1 SCOPE

The instructions contained in the operating manual are applicable to the UPS systems listed below.

- *BSL46* KEOR HPE 60 kVA
- *BSM46* KEOR HPE 80 kVA
- *BSK93* KEOR HPE 100 kVA
- *BSM47* KEOR HPE 125 kVA
- *BSM10* KEOR HPE 160 kVA

Storing documentation

This manual and any other supporting technical documentation relating to the product must be stored and made accessible to personnel in the immediate vicinity of the UPS.

Further information

In the event that the information provided in this manual is not sufficiently exhaustive, please contact the manufacturer of the device, whose details are available in the "Contacts" section.

2 SAFETY RULES AND WARNINGS

Injury hazard due to electric shock!

Always respect all the safety instructions and, in particular:

- any work on the unit must be carried out by qualified personnel;
- internal components can only be accessed after disconnecting the device from supply sources;
- always use protective devices designed for each type of activity;
- the instructions contained in the manuals must be strictly followed.

Injury hazard due to device failure

Potentially hazardous situations may arise in case of UPS failure.

- Do not use the device if visibly damaged.
- Maintain the device regularly to identify possible failure.

Possible device damage

Whenever work is carried out on the device, make sure all actions are taken in order to avoid electrostatic discharges which might damage the electronic components of the system.

Read the technical documentation

Before installing and using the device, make sure you have read and understood all the instructions contained in the present manual and in the technical supporting documentation.

3 GENERAL UPS DESCRIPTION

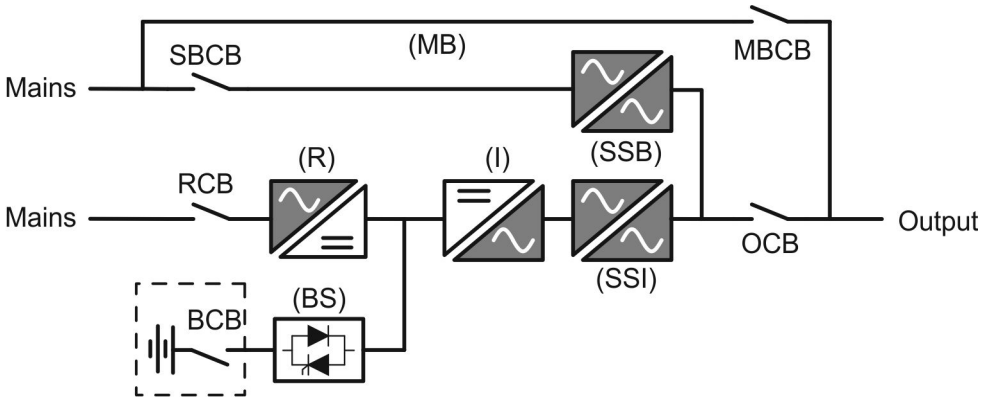
3.1 TYPOLOGY

The UPS described in this manual is on-line, double conversion; the inverter included in the UPS always supplies energy to the load, whether mains is available or not (according to the battery autonomy time).

This configuration guarantees the best service to the User, as it supplies clean power uninterruptedly, ensuring voltage and frequency stabilization at nominal value. Thanks to the double conversion, it makes the load completely immune from micro-interruptions and from excessive mains variations, and prevents damage to critical loads (Computer - Instrumentation - Scientific equipment etc.).

Output voltage present

The line connected to the UPS output is energized even during mains failure, therefore in compliance with the prescriptions of IEC EN62040-1, the installer will have to identify the line or the plugs supplied by the UPS making the User aware of this fact.



Picture 1 – Block diagram

The UPS uses IGBT technology with a high switching frequency in order to allow a low distortion of the current re-injected into the supply line, as well as high quality and stability of output voltage. The components used assure high reliability, very high efficiency and maintenance easiness.

3.2 SYSTEM DESCRIPTION

3.2.1 Rectifier

It converts the three-phase voltage of the AC mains into continuous DC voltage.

It uses a three-phase fully-controlled IGBT bridge with a low harmonic absorption.

The control electronics uses a 32 bit µP of latest generation that allows to reduce the distortion of the current absorbed by mains (THDi) to less than 3%. This ensures that the rectifier does not distort the supply mains, with regard to the other loads. It also avoids cable overheating due to the harmonics circulation.

The rectifier is so sized as to supply the inverter at full load and the battery at the maximum charging current.

3.2.2 Inverter

It converts the direct voltage coming from the rectifier or from the DC battery into alternating AC voltage stabilized in amplitude and frequency.

The inverter uses IGBT technology with a high switching frequency of approximately 8 kHz.

The control electronics uses a 32 Bit µP of latest generation that, thanks to its processing capability, generates an excellent output sine-wave.

Moreover, the fully digital control of the output sine-wave allows to achieve high performances, among which a very low voltage distortion even in presence of high-distorting loads.

3.2.3 Battery and battery charger

The battery is installed outside the UPS. It is generally housed in an external battery cabinet.

The battery charger logic is completely integrated in the rectifier's control electronics.

The battery is charged, according to the DIN 41773 Standard, every time it has been partially or completely discharged. When its full capacity is restored, it is disconnected from the DC bus by means of a static switch, in order to save energy, reduce the stress due to the AC ripple thus increasing the lifetime. This operating mode is called *Green Conversion*.

It is however periodically charged but the prevailing state is of complete rest.

3.2.4 Static bypass

The Static Bypass allows to transfer the load between Inverter and Emergency Mains, and vice-versa, in a very short time, and uses SCR's as power commutation elements.

3.2.5 Manual bypass

The Manual Bypass is used to cut off the UPS completely, supplying the load directly from the input mains in case of maintenance or serious failure.

Follow the procedures contained in the manual

The sequence of manual bypass switching and return must be carried out with respect to the procedure indicated in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

External manual bypass

In the UPS system the manual bypass isolator is optional and installed outside the unit.

3.3 OPERATING STATUS

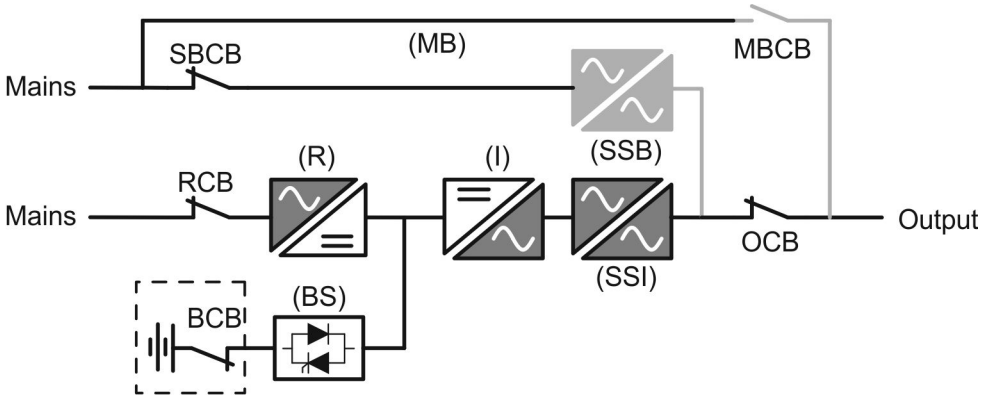
The UPS has five different operating modes, as described below:

- Normal operation
- Green Conversion
- Bypass operation
- Battery operation
- Manual bypass

3.3.1 Normal operation

During normal operation all the circuit breakers/isolators are closed, except for MBCB (maintenance bypass).

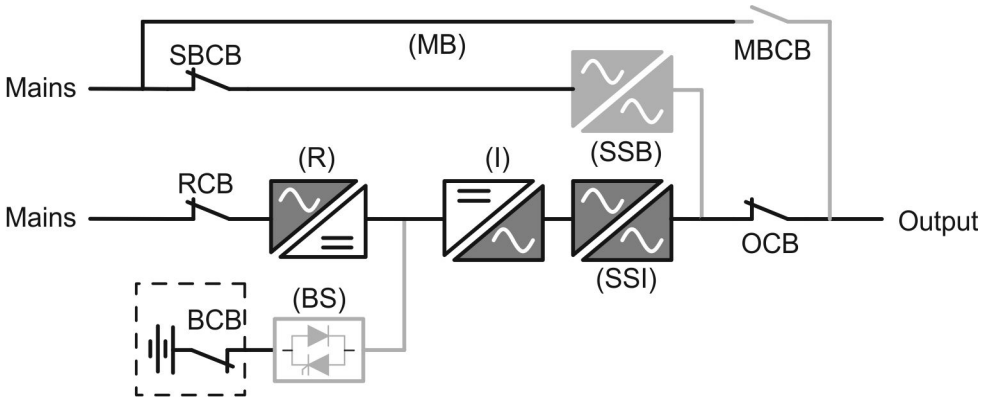
The rectifier is supplied by the AC three-phase input voltage which, on its turn, feeds the inverter and compensates mains voltage as well as load variations, keeping the DC voltage constant. At the same time, it provides to charge the battery. The inverter converts the DC voltage into an AC sine-wave with stabilized voltage and frequency, and also supplies the load via its static switch SSI.



Picture 2 – Normal operation

3.3.2 Green Conversion

During the operation in *Green Conversion* mode the battery is disconnected from the DC bus by means of a static switch (see picture) and the rectifier works at reduced DC voltage; a control algorithm provides to periodically re-connect the battery for recharge purposes (intermittent charging).



Picture 3 – Green Conversion

When the *Green Conversion* algorithm is active the rectifier operates at reduced DC voltage and supplies the inverter alone, since the battery is disconnected from the DC bus. The battery charge is controlled by a specific algorithm. In case no mains outage events have occurred, and so no battery discharges have occurred too, the control logic provides to start a charging cycle once every 25 days. The battery-charger restores the capacity lost due to the self-discharge and remains in floating charge for additional 12 hours. As this time has elapsed the battery static switch is opened and the battery is disconnected from the DC bus.

In case a discharge event occurs, the control logic provides to calculate the capacity which has been lost during the discharge; as the mains is restored a charging cycle is started, which is extended for an additional time that depends on the percentage of lost capacity, referred to the rated value.

- Lost capacity < 10% → Additional charge for **12 hours**
- Lost capacity between 10% and 20% → Additional charge for **48 hours**
- Lost capacity > 20% → Additional charge for **96 hours**

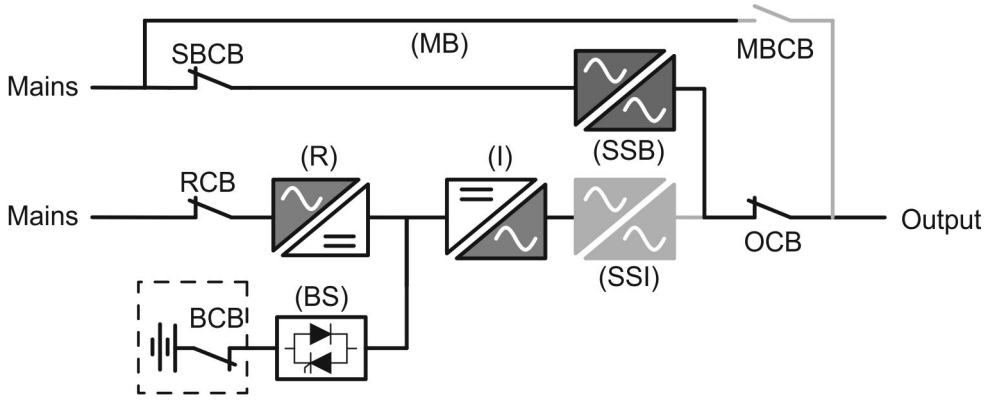
Such values complies with the recommendations of the main battery manufacturers.

Set the right battery capacity

The UPS front panel allows the setting of the battery parameters, including the rated capacity. Considering the importance that such value assumes for the correct execution of the charge control algorithm, it is highly recommended to verify the correctness of the programmed value.

3.3.3 Bypass operation

The load can be switched to bypass either automatically or manually. The manual changeover is due to the BYPASS SWITCH which forces the load to bypass. In case of failure of the bypass line, the load is switched back to inverter without interruption.



Picture 4 – Load supplied by bypass

3.3.4 Battery operation

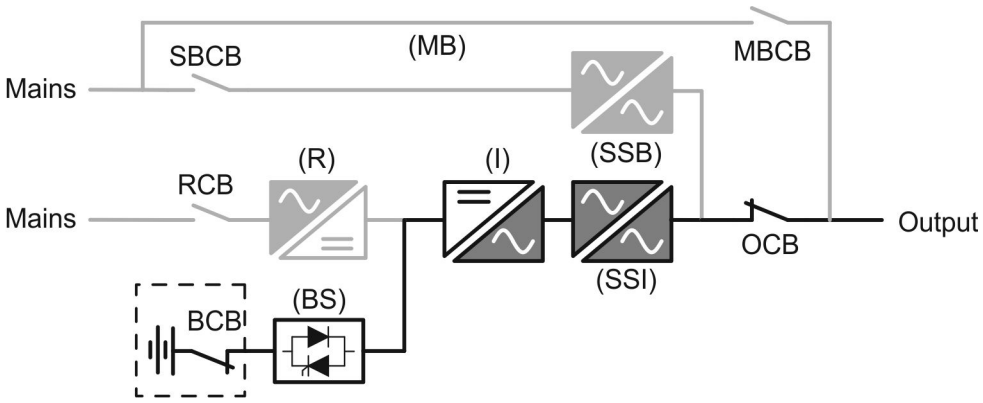
In case of power failure or rectifier fault, the battery feeds the inverter without interruption. The battery voltage drops based on the amplitude of the discharging current. The voltage drop has no effect on the output voltage, which is kept constant by changing the PWM modulation. An alarm is activated when the battery is near the minimum discharge value.

In case the supply is restored before the battery is completely discharged, the system will be switched back to normal operation automatically. In the opposite case, the inverter shuts down and the load is switched to the bypass line (bypass operation). If the bypass line is not available or is out of tolerance, the loads supply is interrupted as soon as the battery reaches the discharge limit threshold (*black-out*).

As soon as the supply is restored, the rectifier will recharge the battery. In the standard configuration, the loads are supplied again via static switch SSB when mains is available again. The inverter is restarted when the battery has partially restored its capacity.

The system restart from the *black-out* condition can be customized based on the requirements of the plant, in three different modes:

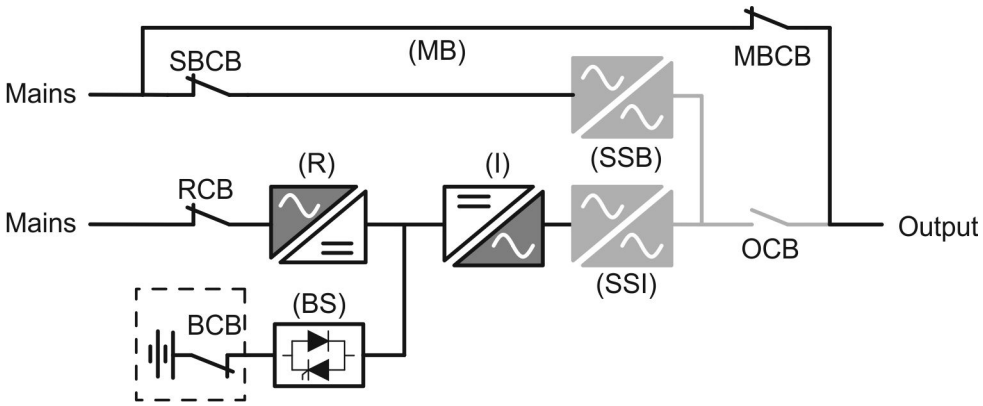
- Bypass → loads are supplied as soon as the bypass line is available (factory configuration).
- Inverter → loads are supplied by the inverter (even if the bypass line is available) when the battery voltage has reached a programmed threshold, after the rectifier restart.
- Man. Inverter → the output supply is NOT restored automatically. The system requires a confirmation to restart which can only be done manually by the user via the front panel.



Picture 5 – Battery operation

3.3.5 Manual bypass

The manual bypass operation is necessary whenever the UPS functionality is tested, or during maintenance or repair work.



Picture 6 – Manual bypass for functional checks

Follow the procedures contained in the manual

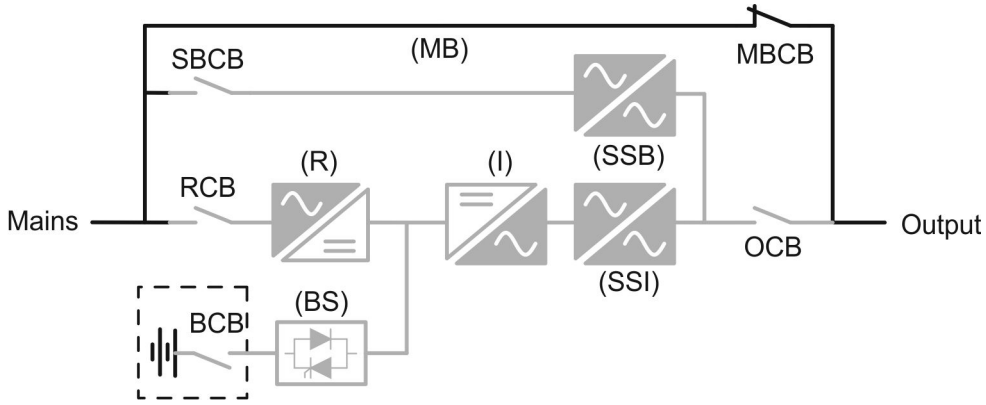
The sequence of manual bypass switching and return must be carried out with respect to the procedure indicated in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

Wiring of the auxiliary contacts

Carry out a proper electrical installation by wiring the auxiliary contacts of the manual bypass and output isolators to the dedicated terminals on board the UPS. This will allow the control logic to acquire the status of the switches and guide the operator during the start-up and manual bypass procedures.

For further information refer to the section "Installation and start-up".

During the manual bypass due to repair or maintenance, the UPS is completely shut down and the load is directly supplied by the bypass line.



Picture 7 – Manual bypass for repair or maintenance works

3.4 CONTROL AND OPERATION DEVICES

The control and operation devices of the UPS are indicated below:

- Isolator on rectifier input (RCB)
- Isolator on bypass input (SBCB)
- Isolator on UPS output (OCB)
- Manual bypass isolator (MBCB)
- Battery Isolator / Circuit breaker (BCB) - External, inside the battery cabinet
- Emergency power off button (EPO)
- Normal/Bypass selector
- LCD control panel

Check the personnel training

The use of the operation and control devices of the UPS is intended for authorized personnel only. We recommend to check the training of the personnel responsible for the use and maintenance of the system.

3.4.1 Isolators

The isolators provided on the UPS are used to isolate the power components of the device from the AC supply line, from the storage battery and from the load.

Voltage present on terminals

The isolators do not isolate the UPS completely, since AC voltage is still present on the UPS input terminals. Before carrying out any maintenance on the unit:

- Isolate the device completely by operating the external circuit breakers;
- Wait at least 5 minutes in order to allow the capacitors to discharge.

3.4.2 Emergency power off command (EPO)

The emergency power off command is used to disconnect the UPS output immediately, interrupting the loads supply. It also shuts down the inverter.

Operate the command only in case of real emergency

The components of the system are subject to a high stress when the emergency power off command is operated under load presence.

- Use the emergency power off button only in case of real emergency.

Supply reset

Reset the output supply only when the causes which led to the emergency shutdown have been eliminated and you are sure that there is no hazard to persons and things.

3.4.3 Normal/Bypass selector

The Normal/Bypass selector is installed externally, on the rear of UPS. It is generally used during the manual bypass procedure, when it is necessary to isolate the UPS for maintenance or repair.

Follow the procedures contained in the manual

The Normal/Bypass selector shall only be operated in accordance with the procedures specified in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

3.4.4 LCD control panel

The control panel of the UPS is used in order to:

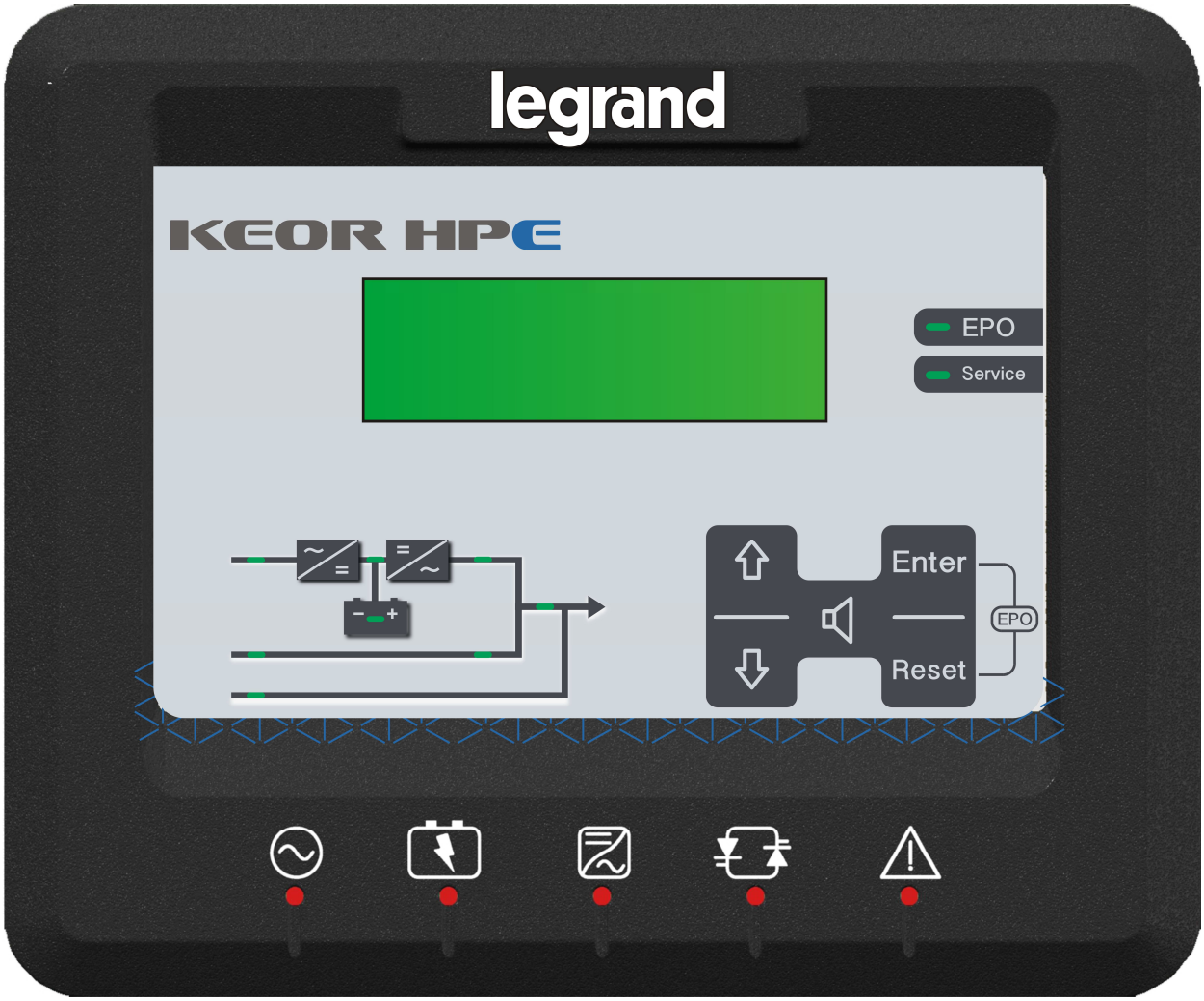
- Check the operating parameters of the device
- Check the alarms present
- Access the event log
- Display the information on the device
- Modify the operating parameters

The menu which allows to change the parameters is password-protected in order to prevent access to unauthorized personnel.

4 FRONT PANEL

The front panel of the UPS, consisting of four rows alphanumeric display plus 5 function keys, allows the complete monitoring of the UPS status.

The mimic flow helps to understand the operating status of the UPS.



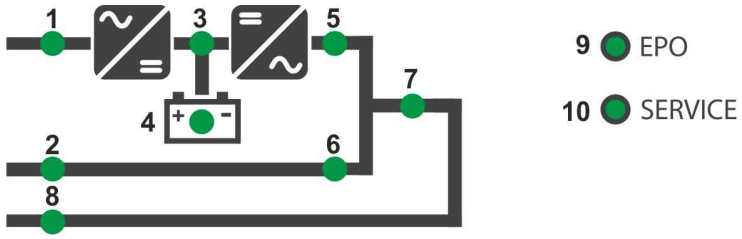
Picture 8 – UPS front panel

4.1 FUNCTION BUTTONS

The front panel of the UPS is provided with 5 buttons whose functions are indicated in the following table:

Button	Assigned functions
	➢ Scrolls up the menus ➢ Increases the values by one unit ➢ Selects a value
	➢ Scrolls down the menus ➢ Decreases the values by one unit ➢ Selects a value
	➢ Selects a menu ➢ Confirms changes
	➢ Silences the buzzer (activated due to an alarm or a failure)
	➢ Returns to the previous menu

4.2 MIMIC PANEL LED'S



Picture 9 – UPS mimic panel

LED 1	GREEN	AC line on rectifier input within tolerance
	GREEN	AC mains failure / Wrong phase rotation
LED 2	GREEN	AC bypass line within tolerance
	GREEN	Wrong phase rotation
	OFF	AC bypass line out of tolerance / failure
LED 3	GREEN	Rectifier off or faulty
	RED	DC voltage out of tolerance
	GREEN	Rectifier on and DC voltage within tolerance
LED 4	GREEN	Circuit breaker BCB closed and battery charging
	GREEN	Battery discharging or under TEST
	ORANGE	Circuit breaker BCB open
	RED	Battery fault (following a battery test)
	OFF	Battery not available
LED 5	GREEN	Inverter voltage within tolerance and static switch closed
	GREEN	Inverter overload or short-circuit
	OFF	Inverter off or voltage out of tolerance
LED 6	ORANGE	Re-transfer blocked
	ORANGE	Static bypass switch closed
	OFF	Static bypass switch open
LED 7	GREEN	Output circuit breaker OCB closed
	OFF	Output circuit breaker OCB open
LED 8	ORANGE	Manual bypass switch MBCB closed
	OFF	Manual bypass switch MBCB open
LED 9	RED	Emergency power off (EPO) activated
	OFF	Normal operation
LED 10	ORANGE	Maintenance request (slow blinking)
	ORANGE	Critical alarm (fast blinking)
	OFF	Normal operation

4.3 LED'S BAR

Picture 10 – LED's bar

LED 11		GREEN	AC line on rectifier input within tolerance
		GREEN	Wrong phase rotation (fast blinking)
		GREEN	Unbalanced AC voltage (slow blinking)
		OFF	AC mains failure
LED 12		GREEN	Circuit breaker BCB closed and battery charging
		ORANGE	Battery discharging or under TEST (fast blinking)
		ORANGE	Circuit breaker BCB open (slow blinking)
		RED	End of battery autonomy / Battery fault
LED 13		GREEN	Inverter voltage within tolerance and static switch closed
		ORANGE	Inverter overload or short-circuit
		RED	Inverter critical alarm
		OFF	Inverter off
LED 14		GREEN	AC bypass line within tolerance
		RED	Wrong phase rotation (fast blinking)
		RED	AC bypass line out of tolerance / failure
LED 15		GREEN	Programmed maintenance required (slow blinking)
		GREEN	Critical alarm (fast blinking)

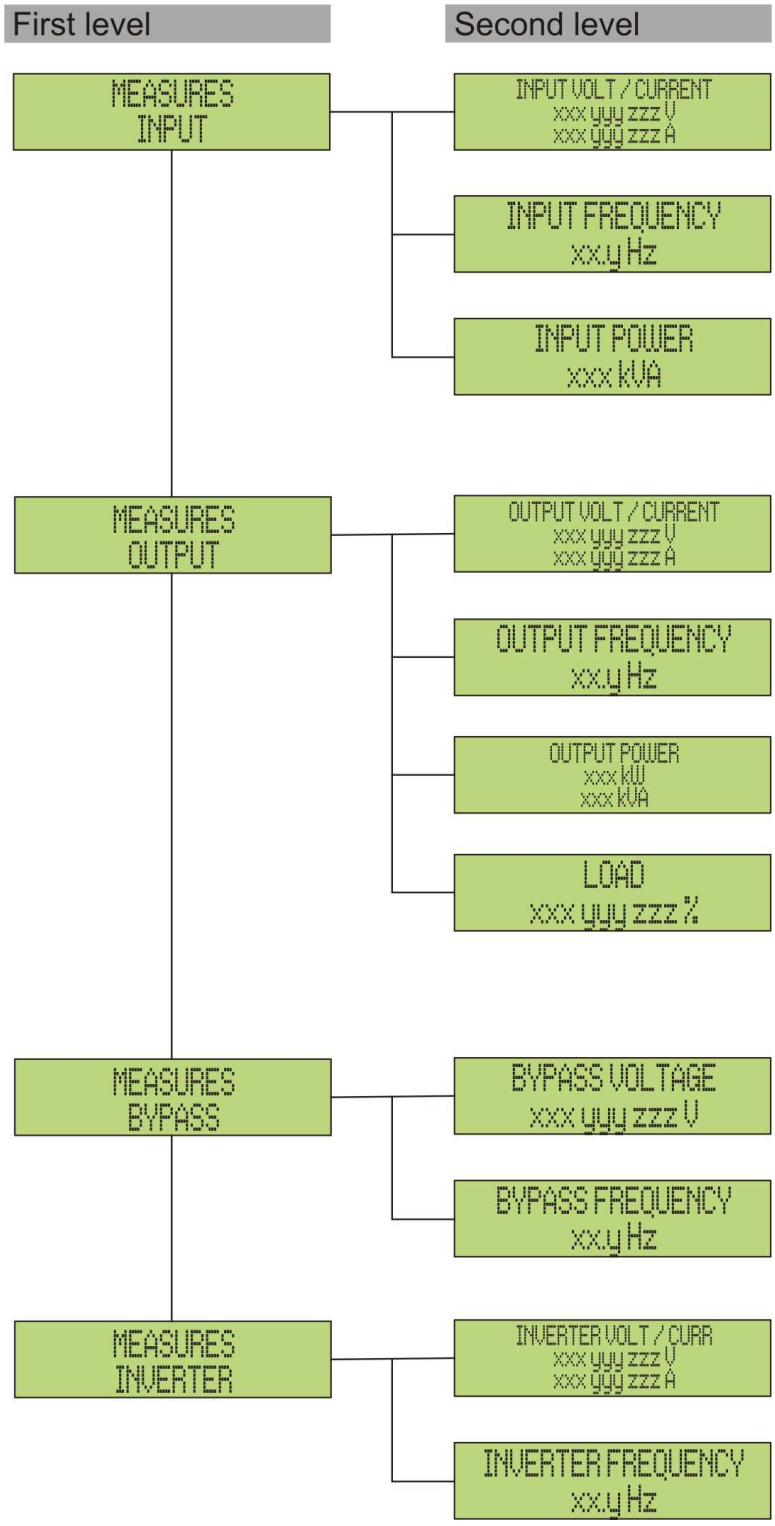
5 HANDLING THE LCD PANEL

5.1 MAIN MENUS

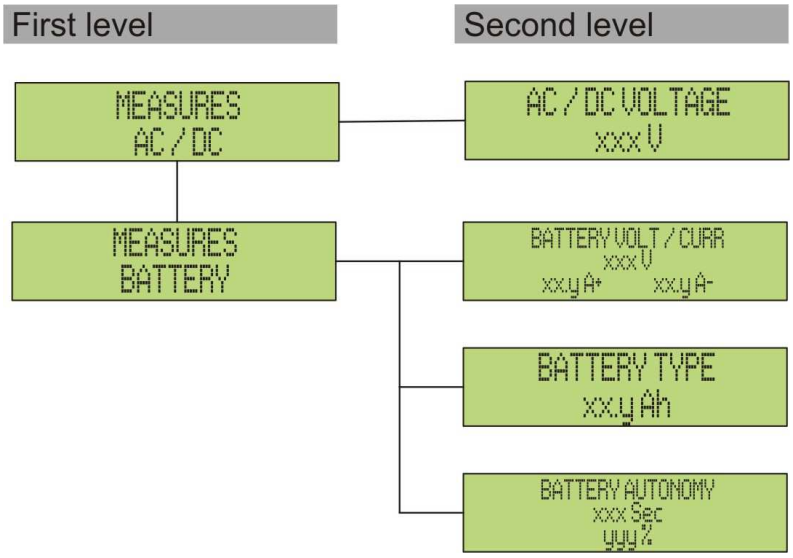
UPS NAME xxx kVA	Main screen (nominal power of the UPS)
UPS NAME MEASURES	UPS measures regarding basic parameters (voltage, current, etc.)
UPS NAME ALARMS	UPS operating status, possible alarms present and alarms history
UPS NAME SPECIAL	Setting of parameters and special functions
UPS NAME INFO	General information regarding the UPS

5.2 MEASURE DISPLAY

The MEASURES menu is structured as follows:



Picture 11 – Structure of MEASURES menu (1 of 2)



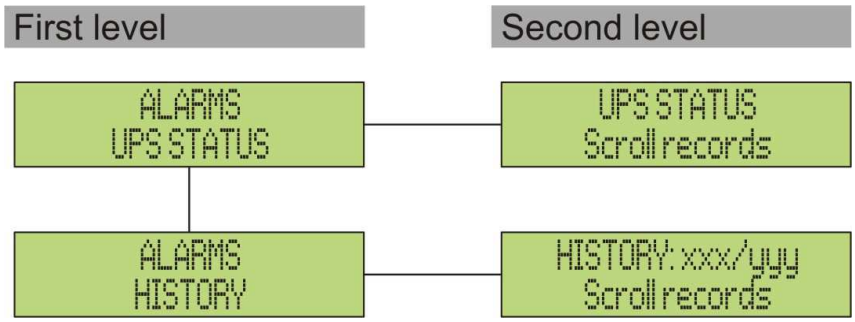
Picture 12 – Structure of MEASURES menu (2 of 2)

Sub-menu	Displayed data	Accuracy
INPUT	Rectifier input voltage (1) (2)	1 V
	Rectifier input current (3)	1 A
	Frequency	0.1 Hz
	Input power	1 kVA
OUTPUT	Voltage (1) (2)	1 V
	Current (3)	1 A
	Frequency	0.1 Hz
	Active power	1 kW
	Apparent power	1 kVA
	Load percentage	1 %
BYPASS	Voltage (1) (2)	1 V
	Frequency	0.1 Hz
INVERTER	Voltage (1) (2)	1 V
	Frequency	0.1 Hz
AC/DC	Rectifier output voltage	1 V
BATTERY	Voltage and current	1 V / 1 A
	Nominal capacity	1 Ah
	Residual autonomy	1 min / 1 %

(1) The voltage measures are always referred to the phase-to-neutral value
(2) The three voltages are displayed in one screen as "xxx yyy zzz V"
(3) The three line currents are displayed in one screen as "xxx yyy zzz A"

5.3 BASIC DIAGNOSTICS

The ALARMS menu allows to display the current operating status of the device and to access the event log, based on the following structure.



Picture 13 – Structure of ALARMS menu

Sub-menu	Displayed data
UPS STATUS	Alarms present and operating statuses
HISTORY	Event log

The LCD panel displays the ALARMS menu automatically whenever an alarm occurs. The audible indicator, if enabled, is activated to show the occurred failure. The audible alarm is silenced pressing the key 🔊 (BUZZER).

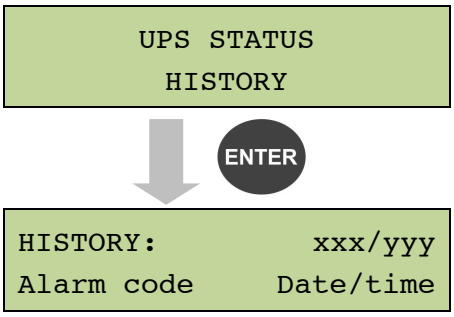
UPS STATUS alarm/status no. 1	Display of the first alarm present (if no alarm is present, the operating status is displayed)
UPS STATUS Last alarm/status	Press the key ▼ to browse the menu and to go to the next alarm/status (in alphabetical order)

Automatic erasure of alarms

Should an alarm occur and then the conditions that originated it no longer exist, the alarm will be automatically cancelled and the system restarted.

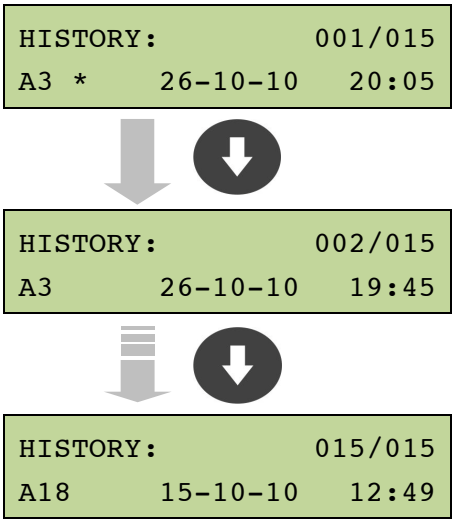
5.3.1 Display of alarms history

All the events are recorded in the alarms history.



The first event shown is the latest one in order of time; a new event makes all the other events automatically shift one position, clearing the oldest event.

The quantity of stored events is displayed on the first line (xxx/yyy), which contains the data currently displayed (position in the list) and the total number of stored data (maximum number equal to 500) respectively. An asterisk indicates the automatic reset of the alarm.



Latest event stored (in order of time)
- E.g.: automatic reset of alarm "A3 – BOOSTER STOPPED"

Immediately prior event
- E.g.: alarm "A3 – BOOSTER STOPPED"

First event stored (in order of time)

5.3.2 Alarms and operating status

ALARMS

A1	MAINS FAULT	**A28**	CRITICAL FAULT
A2	INPUT WRONG SEQ	**A29**	MAINTENANCE REQ
A3	BOOSTER STOPPED	**A30**	COMMON ALARM
A4	BOOSTER FAULT	**A31**	MBCB BUS CLOSED
A5	DC VOLTAGE FAULT	**A32**	EPO BUS CLOSED
A6	BATTERY IN TEST	**A33**	ASYMMETRIC LOAD
A7	BCB OPEN	**A34**	SERVICE REQUIRED
A8	BATTERY DISCHARGE	**A35**	DIESEL MODE
A9	BATTERY AUT END	**A36**	DC FASTSHUTDOWN
A10	BATTERY FAULT	**A38**	INV --> LOAD
A11	SHORT CIRCUIT	**A39**	INV ERROR LOOP
A12	STOP TIMEOUT SC	**A40**	SSI FAULT
A13	INV OUT OF TOL	**A41**	RECT ERROR LOOP
A14	BYPASS WR SEQ	**A43**	CURR ERROR LOOP
A15	BYPASS FAULT	**A46**	PAR LOST REDUND
A16	BYPASS --> LOAD	**A45**	HIGH TEMP SSW
A17	RETRANSFER BLOCK	**A47**	SEND PARAM ERROR
A18	MBCB CLOSED	**A48**	RCV PARAM ERROR
A19	OCB OPEN	**A49**	TEST MODE ERROR
A20	OVERLOAD	**A50**	SSW BLOCKED
A21	THERMAL IMAGE	**A51**	BATT TEMPERATURE
A22	BYPASS SWITCH	**A52**	INVERTER BLOCK
A23	EPO PRESSED	**A53**	FIRMWARE ERROR
A24	HIGH TEMPERATURE	**A54**	CAN ERROR
A25	INVERTER OFF	**A55**	PAR CABLE DISC
A26	COMMUNIC ERROR	**A56**	MAINS UNBALANCE
A27	EEPROM ERROR	**A63**	START SEQ BLOCK

STATUSES

S1	BOOSTER OK
S2	BATTERY OK
S3	INVERTER OK
S4	INVERTER --> LOAD
S5	INV BYPASS SYNC
S6	BYPASS OK
S7	BYPASS --> LOAD
S9	INV MASTER SYNC
S12	BATT STANDBY
S13	BATT CHARGING
S14	BATT FLOATING

Display and recording mode of alarms

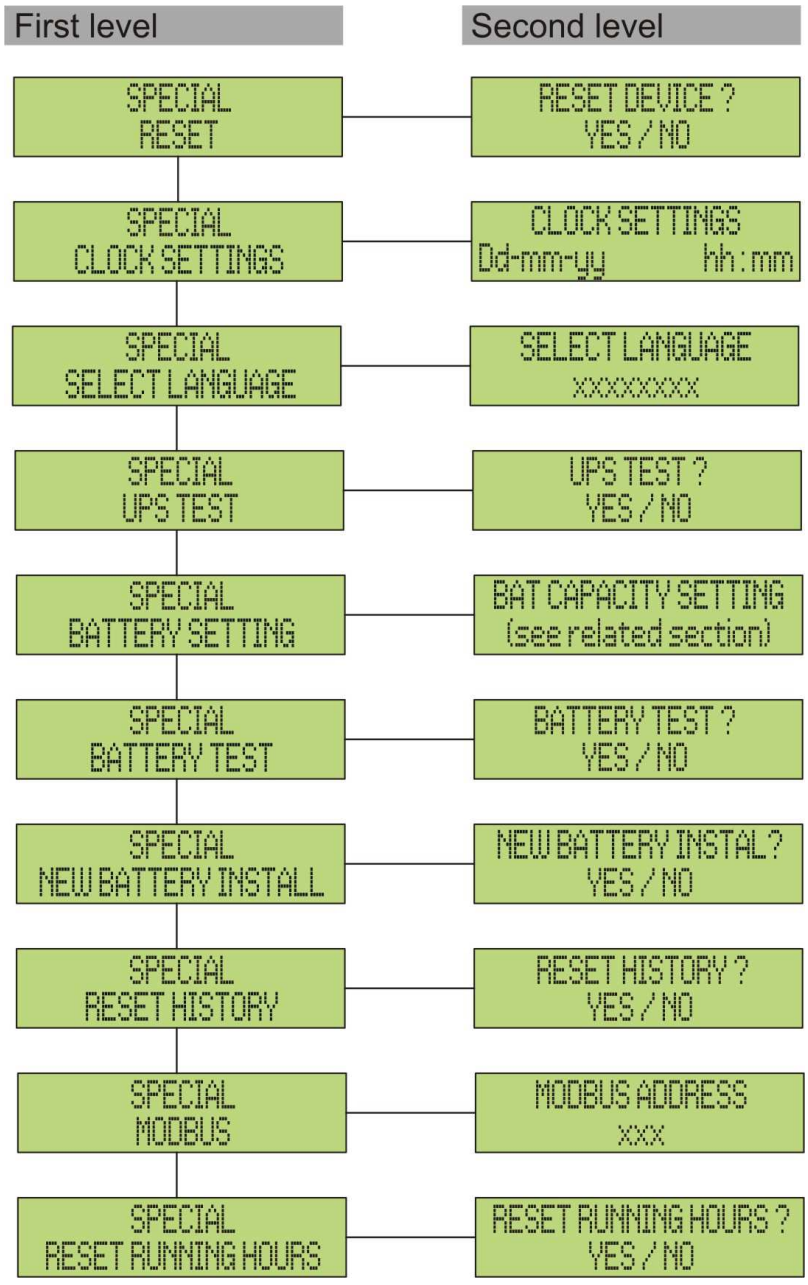
- The statuses are always displayed in ascending order when the ALARMS – STATUSES menu is entered.
- The alarms are shown when they are present and must be silenced with the buzzer.
- The alarms remain displayed whilst they are present and they are automatically stored in the event log with date and time.

Description of alarms and statuses

For a more detailed description of the alarms and statuses, see the "Faults and alarms" section of the present manual.

6 SETTINGS AND ADVANCED OPERATIONS

Some operating parameters of the UPS can be set via the SPECIAL menu, which is structured as follows:



Picture 14 – Structure of SPECIAL menu

Sub-menu	Programmable data
RESET	Reset of failure conditions
CLOCK SETTINGS	System date and time
SELECT LANGUAGE	Display language setting
UPS TEST	Performs a commutation test
BATTERY SETTING	Battery parameter setting
BATTERY TEST	Performs a battery test
NEW BATTERY INSTALL	Sets autonomy to 100%
RESET HISTORY	Event log reset
MODBUS	MODBUS address of device
RESET RUNNING HOURS	Reset the hour counter related to the UPS running time

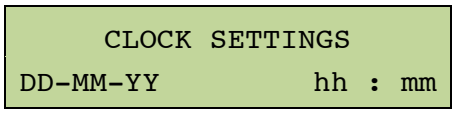
Password-protected access

The SETTINGS menu is protected by a password set by the factory in order to prevent access to unauthorized personnel.

- We recommend minimum disclosure of the access password.
- Changes to the operating parameters and starting operations on the UPS may be potentially dangerous for the device and for persons.

6.1 SETTING DATE AND TIME

Date and time may be set via the CLOCK menu.



The single digits can be modified via the arrow keys (▲ / ▼) and confirmed by pressing ↵ (ENTER).

Setting the current date and time correctly

The correct setting of the date and time is essential for the recording of the event log.

6.2 DISPLAY LANGUAGE SETTING

The table below shows the languages which can be set for the display.

Parameter	Standard	Range
LANGUAGE	ITALIAN	ITALIAN GERMAN FRENCH ENGLISH PORTUGUESE SPANISH POLISH TURKISH

The parameters are changed via the arrow buttons (▲ / ▼) to increase the digits, and the ↵ button is used to confirm the entry.

6.3 NEW BATTERY INSTALLATION

The NEW BATTERY INSTALLATION menu is used in case battery circuit breaker BCB is not closed, when requested, in the start-up phase. In this case the system will start considering the battery completely discharged and activating the alarm "A10 – BATTERY FAULT".

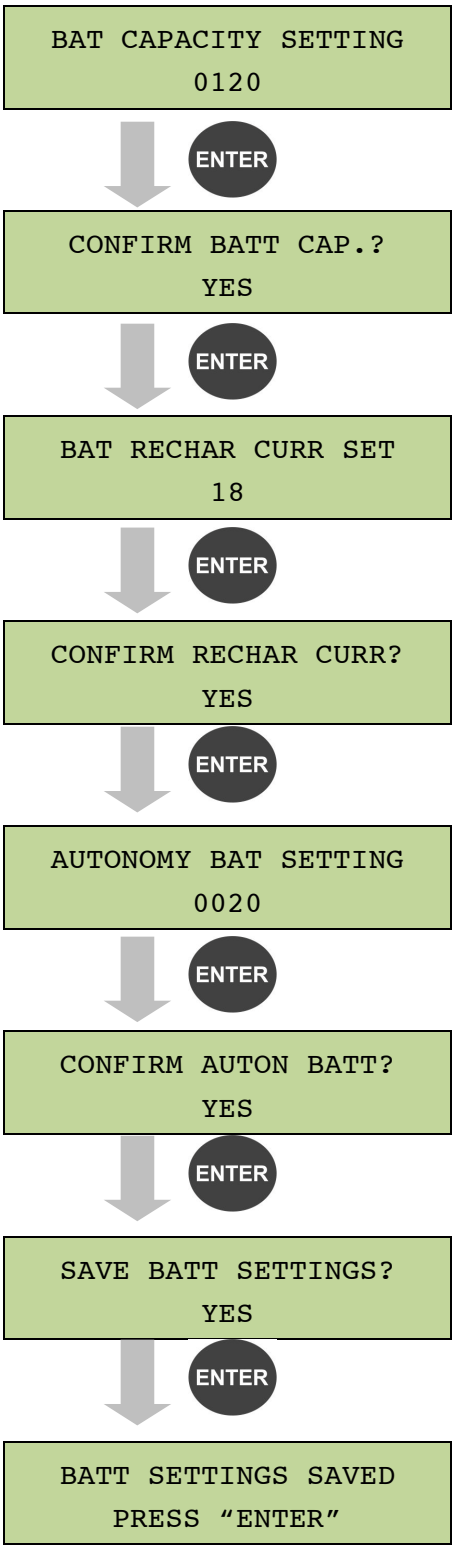
To set the battery autonomy to 100% it is necessary to access the menu and press the ↵ button to confirm.

6.4 BATTERY CONFIGURATION

In case the UPS has been tested without knowing the characteristic data of the storage battery, the BATTERY CONFIGURATION menu allows to set such data. In particular, the following data can be set:

- Battery capacity in Ampere-hours (Ah)
- Recharging current in Amperes (A)
- Nominal autonomy in minutes

Access the menu by pressing the ↵ button (ENTER).



The single digits can be modified via the arrow keys (▲ / ▼) and confirmed by pressing ↵ (ENTER).

Confirmation screen of the parameter set

The single digits can be modified via the arrow keys (▲ / ▼) and confirmed by pressing ↵ (ENTER).

Confirmation screen of the parameter set

The single digits can be modified via the arrow keys (▲ / ▼) and confirmed by pressing ↵ (ENTER).

Confirmation screen of the parameter set

Confirmation screen for the configuration

Setting all the parameters

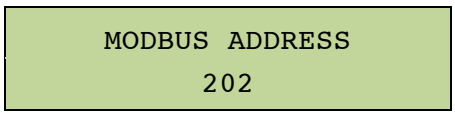
To save all the parameters it is necessary to reach the end of the guided procedure until the last screen previously shown.

If the procedure is interrupted earlier, none of the parameters previously set will be saved.

6.5 SETTING THE MODBUS PARAMETERS

The parameters regarding the communication via RS485 interface can be set in the MODBUS menu.

- Modbus address

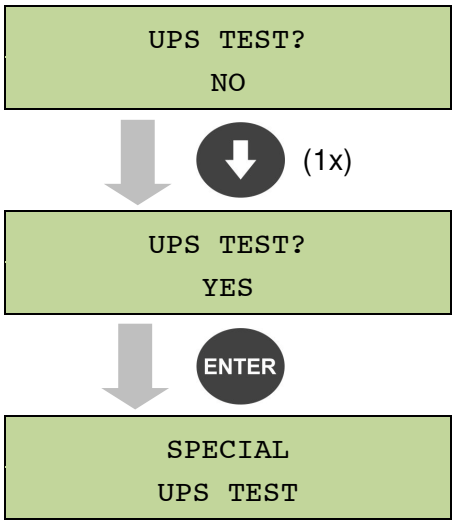


The single digits can be modified via the arrow keys (▲ / ▼) and confirmed by pressing ↵ (ENTER).

Parameter	Standard	Range
MODBUS ADDRESS	1	1 …. 247

6.6 UPS TEST

The UPS TEST menu allows to carry out a switching test of the inverter. The inverter is switched off and the load is transferred to the bypass supply. The inverter supply is automatically restored after a few seconds.



The value on the second line is ready to be changed

The parameter is changed. The change is confirmed by pressing ↵ (ENTER)

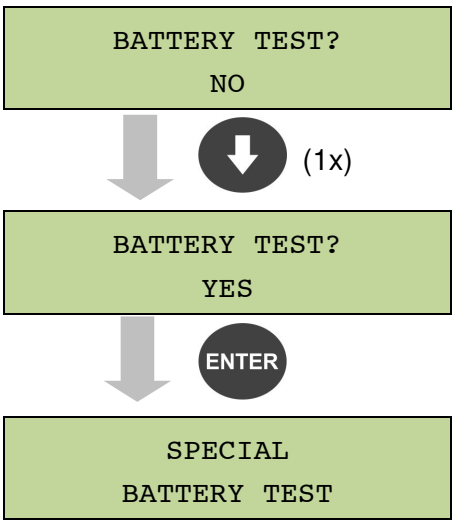
The system performs a test and returns to the previous screen

Possible loss of supply

In case of power failure while the test is being performed, the immediate operation of the inverter is not guaranteed.

6.7 BATTERY TEST

The BATTERY TEST menu allows to carry out a short discharge test of the battery. In case the battery is not efficient, the alarm "A10 – Battery fault" is generated at the end of the test.



The value on the second line is ready to be changed

The parameter is changed. The change is confirmed by pressing ↵ (ENTER)

The system performs a reset and returns to the previous screen

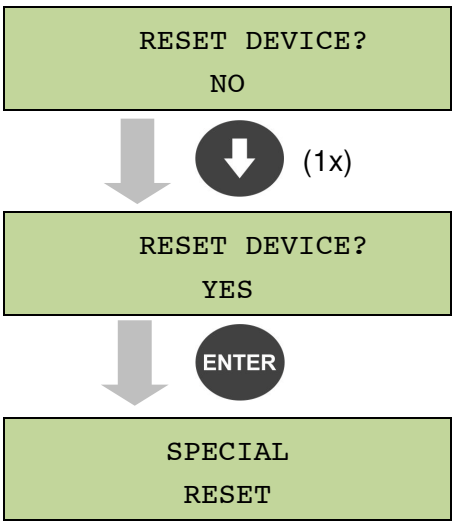
Possible loss of supply

This test can affect the continuity of supply to the loads if the battery is not fully charged.

6.8 SYSTEM RESET

The UPS is equipped with internal protections which block the system or some of its sections. The alarm can be cleared and normal operation can be resumed via the RESET menu. In case the failure persists, the UPS will return to the previous failure condition.

In some cases the RESET is necessary to simply reset a failure signal, then the UPS will resume operation.



The value on the second line is ready to be changed

The parameter is changed. The change is confirmed by pressing ↵ (ENTER)

The system performs a reset and returns to the previous screen

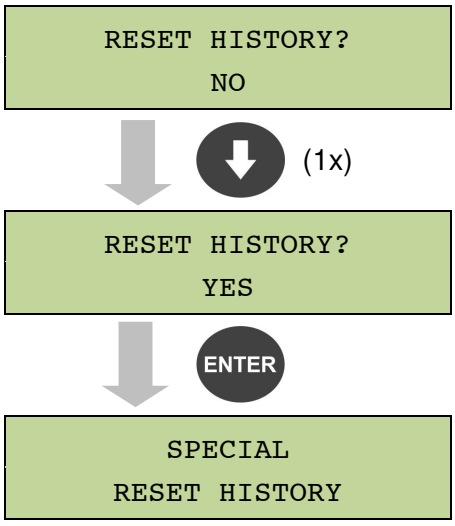
The failure conditions which impose a manual reset are:

- Static switch re-transfer block (alarm A17)
- Inverter shutdown due to the operation of the IGBT desaturation sensor (alarm A44)
- Inverter shutdown due to short-circuit timeout (alarm 12)
- Inverter shutdown due to thermal image protection (alarm 21)
- Inverter shutdown due to the operation of the quick disconnect sensor (alarm A36)
- Inverter shutdown due to voltage control loop error (alarm A39)
- Booster shutdown due to voltage control loop error (alarm A41)
- Booster shutdown due to current control loop error (alarm A43)
- Static switch blocked (alarm A50)
- Booster shutdown due to the operation of the load symmetry sensor (alarm A33)
- Activation of the battery fault alarm (alarm A10)
- Scheduled maintenance request (alarm A29).

For a description of the UPS status in each of the failure conditions listed above, please refer to the "Faults and alarms" section.

6.9 ALARMS HISTORY RESET

Access the RESET HISTORY menu.



The value on the second line is ready to be changed

The parameter is changed. The change is confirmed by pressing ↵ (ENTER)

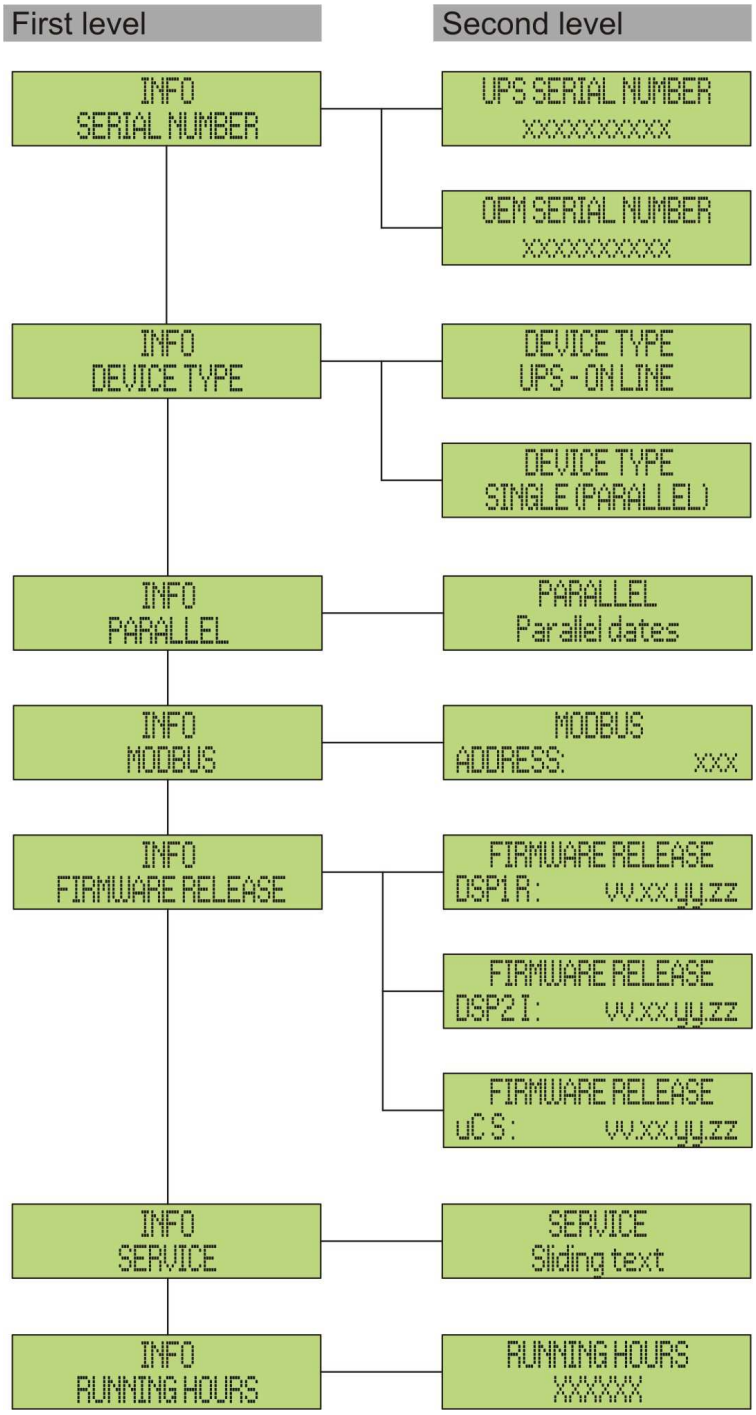
The system performs a reset of the alarms history and returns to the previous screen

Loss of data

The alarms history contains very important data to monitor the device behaviour over time. We recommend to save the data before deleting it.

7 SYSTEM INFORMATION

The INFO menu provides general information regarding the UPS based on the structure indicated below.



Picture 15 – Structure of INFO menu

All data shown in the various sections are set by the factory via a special interface software and cannot be altered, except by personnel authorized by the manufacturer.

The only adjustable parameters are the MODBUS settings (see SPECIAL menu).

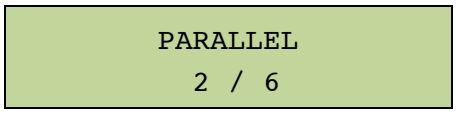
Sub-menu	Displayed data
SERIAL NUMBER	Device serial number given by the manufacturer and by an OEM distributor, if any
DEVICE TYPE	The device type can be: ➢ ON LINE - UPS ➢ FREQUENCY CONVERTER ➢ ECO MODE - UPS ➢ SINGLE UPS ➢ PARALLEL
PARALLEL (1)	Data regarding the parallel configuration
MODBUS	MODBUS address of device
FIRMWARE RELEASE	Firmware versions installed on the system
SERVICE	Scrolling text string with information regarding technical service
RUNNING HOURS	Dates related to hours number of UPS running time

(1) the menu is only active if the UPS belongs to a Parallel or Load Sync system

7.1 PARALLEL OPERATION INFORMATION

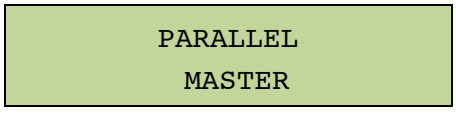
The PARALLEL menu is only active if the UPS belongs to a parallel or load-sync system.

7.1.1 UPS position



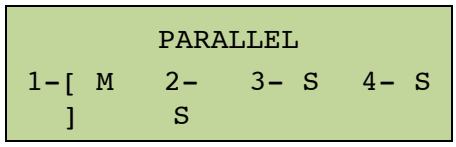
The first number on the second line identifies the *position* of that specific UPS within the parallel system. The second number represents the total number of UPS units.

7.1.2 Master / Slave priority



The string on the second line may have two values, "MASTER" or "SLAVE". Only one *MASTER UPS* can be present in the system; if not there will be a conflict on the data communication bus.

7.1.3 Communication bus monitoring



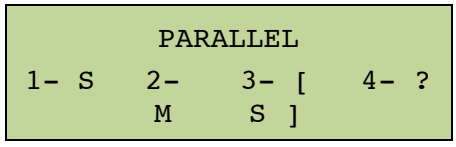
The second line of this menu gives a general indication regarding the communication between the UPS units composing the system.

- The numbers represent the single UPS units.
- The letters M and S stand for MASTER and SLAVE respectively.
- The brackets [ ] around a letter indicate that we are working on that specific UPS unit.
- A question mark next to a number indicates that that UPS unit is not communicating on the data bus.

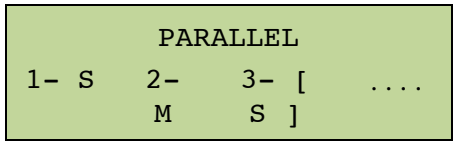
Let us assume to have the following situation:

- system composed of 4 UPS units;
- UPS2 is currently the MASTER UPS;
- we are checking the data communication on UPS3;
- UPS4 is not communicating.

The menu will be as shown below.

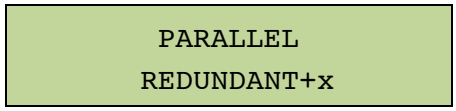


In case there are more than four paralleled devices, the menu will be as follows.



The dots indicate the presence of a further menu which shows the status of the other UPS units in the system.

7.1.4 Parallel type



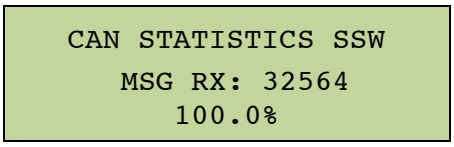
The string on the second line may have two values, "POWER" or "REDUNDANT+x".

- POWER means that the parallel system is so set as to require the presence of all the UPS units to feed the load.

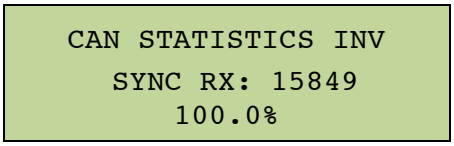
- REDUNDANT+x means that the system is redundant and the redundancy index is indicated by number "X". For example, in a system composed of 3 UPS units, "REDUNDANT+2" means that only one of the UPS units is sufficient to feed the load.

7.1.5 Message statistics

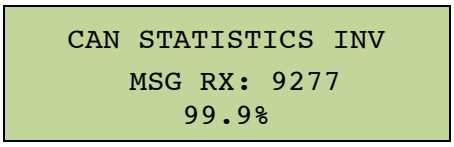
The statistics section regarding the messages exchanged on the communication buses consists of three different menus.



Number of messages received and percentage of reception accuracy regarding the status of the static switches. The messages are exchanged between all the UPS units, therefore the number will increase on all of them.



Number of messages received and percentage of reception accuracy regarding the synchronism signals. The messages are sent by the MASTER UPS, therefore the number will only increase on the SLAVE UPS units.



Number of messages received and percentage of reception accuracy regarding the status of the system. The messages are exchanged between all the UPS units, therefore the number will increase on all of them.

7.2 SERVICE INFORMATION

The SERVICE menu provides important information regarding the technical service on the UPS.

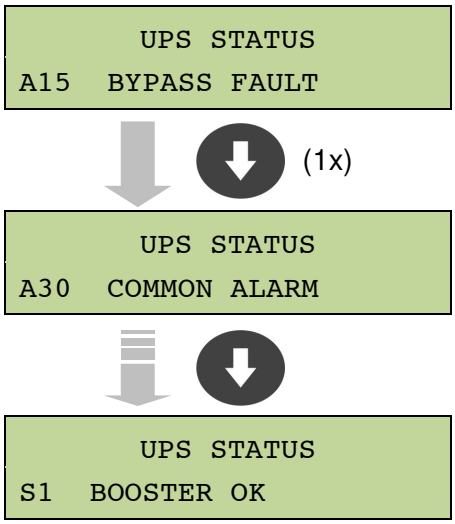
The information is displayed via a text string of max. 60 characters which scrolls on the second display line.

However, please also see the addresses and contact numbers indicated in the present manual.

8 FAULTS AND ALARMS

As indicated in the previous chapters, the system is provided with basic diagnostics which allow immediate visualization of the operating conditions.

The LCD panel displays the alarms screen immediately, and an audible indicator is activated (if enabled). Each screen displays the alphanumeric alarm code and a short description of the alarm.



The display shows the first alarm in chronological order

The other alarms present are displayed by scrolling the menu

After the last alarm present, the operating statuses are displayed

Injury hazard due to electric shock!

Before carrying out any operation on the UPS, make sure that all the safety precautions are adhered to:

- Any work on the unit must be carried out by qualified personnel;
- Internal components can only be accessed after disconnecting the device from supply sources;
- Always use protective devices designed for each type of activity;
- The instructions contained in the manuals must be strictly followed;
- In case of doubt or impossibility of solving the problem, please contact Borri immediately.

8.1 OPERATING STATUS DEFINITION

Status	S1	BOOSTER OK
Description	The rectifier section is working properly.	
Operating condition	The rectifier supplies the inverter and keeps the battery charged.	

Status	S2	BATTERY OK
Description	The battery is connected to the UPS.	
Operating condition	The battery is kept charged by the rectifier and is ready to feed the inverter.	

Status	S3	INVERTER OK
Description	The inverter voltage and frequency are within the allowed range.	
Operating condition	The inverter is ready to feed the load.	

Status	S4	INVERTER --> LOAD
Description	The inverter feeds the load.	
Operating condition	The load is fed via the static inverter switch.	

Status	S5	INV BYPASS SYNC
Description	The inverter is synchronized with the bypass.	
Operating condition	The synchronization between the inverter and the bypass is locked, and the static switch can change over from one source to the other.	

Status	S6	BYPASS OK
Description	The bypass voltage and frequency are within the allowed range.	
Operating condition	The bypass line is ready for changeover in case of inverter failure.	

Status	S7	BYPASS --> LOAD
Description	Load fed by the bypass line.	
Operating condition	The load is fed by the bypass via the static switch, waiting for the inverter to restart.	

Status	S9	INV MASTER SYNC
Description	The inverter is synchronized with the MASTER UPS.	
Operating condition	This status is only present on the SLAVE UPS units, and shows that the inverter is synchronized with the signal sent by the MASTER UPS.	

Status	S12	BATT STANDBY
Description	The battery is in standby mode.	
Operating condition	The battery static switch is open and the battery is disconnected from the DC bus.	

Status	S13	BATT CHARGING
Description	The battery is charging.	
Operating condition	The battery is connected to the DC bus and absorbing charging current.	

Status	S14	BATT FLOATING
Description	The battery cyclic charge is activated.	
Operating condition	The battery static switch is closed and the battery is connected to the DC bus for the cyclic charge (no discharge has occurred over the last 25 days).	

8.2 TROUBLESHOOTING

Alarm	A1	MAINS FAULT
Description	The voltage or frequency of the input line are out of tolerance.	
Possible causes	➢ Mains instability or failure. ➢ Wrong phase rotation.	
Solutions	1. Check the connections to the mains. 2. Check the stability of mains voltage. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A2	INPUT WRONG SEQ
Description	The phase rotation on the rectifier input line is wrong.	
Possible causes	➢ Wrong connection of power cables.	
Solutions	1. Check the phase rotation. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A3	BOOSTER STOPPED
Description	The rectifier has been temporarily disconnected and the inverter is fed by the battery.	
Possible causes	➢ Instability of the AC line voltage or frequency. ➢ Possible fault in the rectifier control circuit.	
Solutions	1. Check the parameters of the AC line voltage. 2. Restart the device. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A4	BOOSTER FAULT
Description	The rectifier has been disconnected due to an internal fault.	
Possible causes	➢ Possible fault in the rectifier control circuit.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. Restart the device. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A5	DC VOLTAGE FAULT
Description	The measured DC voltage is out of tolerance.	
Possible causes	➢ The battery has reached the discharge voltage due to a power failure. ➢ Measuring circuit failure.	
Solutions	1. Check the actual value of the measured DC voltage. 2. In case of mains failure, wait for the AC voltage to be restored. 3. Check which alarms are present and carry out the indicated procedures. 4. Restart the device. 5. If the alarm persists, contact our Technical Support Service.	

Alarm	A6	BATTERY IN TEST
Description	The rectifier voltage is reduced to start a short controlled discharge of the battery.	
Possible causes	➢ A battery test has been started automatically (if set), or manually by the user.	
Solutions	1. Wait for the test to end, and check possible battery faults.	

Alarm	A7	BCB OPEN
Description	The battery isolator is open.	
Possible causes	➢ Battery isolator open.	
Solutions	1. Check the status of the battery isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. Check the connection between the auxiliary contact of the isolator and the auxiliary terminals of the UPS (if provided). 4. If the alarm persists, contact our Technical Support Service.	

Alarm	A8	BATTERY DISCHARGE
Description	The battery is discharging.	
Possible causes	➢ The battery is discharging due to a mains failure. ➢ Rectifier failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A9	BATTERY AUT END
Description	The battery has reached the pre-alarm discharge level.	
Possible causes	➢ The battery is discharging due to a mains failure. ➢ Rectifier failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A10	BATTERY FAULT
Description	Fault following a battery test.	
Possible causes	➢ Battery fault.	
Solutions	1. Check the battery. 2. Reset the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A11	SHORT CIRCUIT
Description	The current sensor has detected a short-circuit at the output.	
Possible causes	➢ Load problem. ➢ Measuring circuit failure.	
Solutions	1. Check the loads connected to the UPS output. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A12	STOP TIMEOUT SC
Description	Inverter shutdown due to an extended short-circuit during a power failure, or due to an overcurrent on the inverter bridge input.	
Possible causes	➢ Short-circuit on the loads during a power failure. ➢ Inverter bridge fault. ➢ Temporary current peak.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A13	INV OUT OF TOL
Description	The inverter voltage or frequency are out of tolerance.	
Possible causes	➢ Inverter shutdown due to an alarm. ➢ Inverter failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A14	BYPASS WR SEQ
Description	The phase rotation of the bypass line is wrong.	
Possible causes	➢ Wrong connection of power cables.	
Solutions	1. Check the phase rotation. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A15	BYPASS FAULT
Description	The voltage or frequency of the bypass line are out of tolerance.	
Possible causes	➢ Bypass line instability or failure. ➢ Wrong phase rotation.	
Solutions	1. Check the connections to the mains. 2. Check the stability of mains voltage. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A16	BYPASS --> LOAD
Description	The load is fed by the bypass line.	
Possible causes	➢ Temporary changeover due to inverter failure.	
Solutions	1. Verify the inverter status and check whether other alarms are present. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A17 RETRANSFER BLOCK
Description	The load is blocked on the bypass line.
Possible causes	➢ Very frequent changeovers due to load in-rush currents. ➢ Static switch problems.
Solutions	1. Reset the system. 2. Check the in-rush currents of the loads. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A18 MBCB CLOSED
Description	The manual bypass isolator is closed.
Possible causes	➢ Manual bypass isolator closed.
Solutions	1. Check the status of the manual bypass isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A19 OCB OPEN
Description	The output isolator is open.
Possible causes	➢ Output isolator open.
Solutions	1. Check the status of the output isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A20 OVERLOAD
Description	The current sensor has detected an overload at the output. If the alarm persists, the thermal image protection will be activated (alarm A21).
Possible causes	➢ Output overload. ➢ Measuring circuit failure.
Solutions	1. Check the loads connected to the UPS output. 2. Contact our Technical Support Service.

Alarm	A21	THERMAL IMAGE
Description	The thermal image protection has been activated after an extended inverter overload. The inverter is shut down for 30 minutes and then restarted.	
Possible causes	➢ Output overload. ➢ Measuring circuit failure.	
Solutions	1. Check the loads connected to the UPS output. 2. Should you need to restore the inverter supply immediately, reset the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A22	BYPASS SWITCH
Description	The "Normal/Bypass" selector has been operated.	
Possible causes	➢ Maintenance operation.	
Solutions	1. Check the selector position. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A23	EPO PRESSED
Description	The system is blocked due to the activation of the emergency power off button.	
Possible causes	➢ Activation of the (local or remote) emergency power off button.	
Solutions	1. Release the emergency power off button and reset the alarm. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A24	HIGH TEMPERATURE
Description	High temperature of the heat sink on the inverter bridge or tripping of the DC fuses which protect the inverter bridge.	
Possible causes	➢ Fault of the heat sink cooling fans. ➢ The room temperature or cooling air temperature is too high. ➢ Tripping of the DC protection fuses.	
Solutions	1. Check the fans operation. 2. Clean the ventilation grids and the air filters, if any. 3. Check the air conditioning system (if present). 4. Check the status of the DC fuses on the inverter bridge input. 5. If the alarm persists, contact our Technical Support Service.	

Alarm	A25 INVERTER OFF
Description	The inverter is blocked due an operation failure.
Possible causes	➢ Various.
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A26 COMMUNIC ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. If the alarm persists, contact our Technical Support Service.

Alarm	A27 EEPROM ERROR
Description	The controller has detected an error in the parameters stored in EEPROM.
Possible causes	➢ Wrong parameters entered during programming.
Solutions	1. Contact our Technical Support Service.

Alarm	A28 CRITICAL FAULT
Description	An alarm has been activated which causes the shutdown of part of the UPS (rectifier, inverter, static switch).
Possible causes	➢ System failure.
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A29 MAINTENANCE REQ
Description	It is necessary to carry out maintenance work.
Possible causes	➢ The time limit since the last maintenance work has elapsed.
Solutions	1. Contact our Technical Support Service.

Alarm	A30	COMMON ALARM
Description	Common alarm.	
Possible causes	➢ At least one alarm is present.	
Solutions	1. Check which alarms are present and carry out the indicated procedures.	

Alarm	A31	MBCB BUS CLOSED
Description	The manual bypass isolator is closed.	
Possible causes	➢ Manual bypass isolator closed.	
Solutions	1. Check the status of the manual bypass isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A32	EPO BUS CLOSED
Description	The system is blocked due to the activation of the emergency power off button.	
Possible causes	➢ Activation of the (local or remote) emergency power off button.	
Solutions	1. Release the emergency power off button and reset the alarm. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A33	ASYMMETRIC LOAD
Description	The positive and negative voltages measured on the DC capacitors towards the middle point are different.	
Possible causes	➢ Possible failure on the measuring circuit. ➢ Possible fault of DC capacitors.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A34	SERVICE REQUIRED
Description	A UPS check is necessary.	
Possible causes	➢ Possible UPS fault.	
Solutions	1. If the alarm persists, contact our Technical Support Service.	

Alarm	A35	DIESEL MODE
Description	The UPS is supplied by the diesel generator.	
Possible causes	➢ The auxiliary contact which activates the diesel generator connected to the UPS is closed, and imposes this operating mode.	
Solutions	1. Wait for the diesel generator to stop as soon as the mains voltage is restored. 2. Check the connection of the auxiliary contact which signals the diesel generator start, to terminals XD1/XD2. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A36	DC FASTSHUTDOWN
Description	Inverter shutdown due to the operation of the protection sensor as a result of sudden DC voltage variations.	
Possible causes	➢ Battery fault.	
Solutions	1. Check the battery. 2. Reset the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A38	INV --> LOAD
Description	The load is fed by the inverter. This alarm is active for UPS systems in "ECO" mode, where the preferential supply is from the bypass line.	
Possible causes	➢ Temporary changeover due to bypass line failure.	
Solutions	1. Verify the status of the bypass line and check whether other alarms are present. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A39	INV ERROR LOOP
Description	The control is not able to regulate the inverter voltage precisely.	
Possible causes	➢ Regulation system failure.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A40	SSI FAULT
Description	The system has detected a failure in the static inverter switch.	
Possible causes	➢ Possible problems on the loads. ➢ Static switch fault.	
Solutions	1. Check the absorption of the loads and the presence of DC components, if any, on AC current. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A41	RECT ERROR LOOP
Description	The control is not able to regulate the rectifier output voltage precisely.	
Possible causes	➢ Regulation system failure.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A43	CURR ERROR LOOP
Description	The control is not able to regulate the rectifier output current precisely.	
Possible causes	➢ Regulation system failure.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A45	HIGH TEMPERATURE SSW
Description	High temperature of the heat sink on the static switch.	
Possible causes	➢ Fault of the heat sink cooling fans. ➢ The room temperature or cooling air temperature is too high.	
Solutions	1. Check the fans operation. 2. Clean the ventilation grids and the air filters, if any. 3. Check the air conditioning system (if present). 4. If the alarm persists, contact our Technical Support Service.	

Alarm	A46 PAR LOST REDUND
Description	This alarm is only active on PARALLEL systems. Continuity is not ensured in the event of a fault on one of the UPS units.
Possible causes	➢ The total load is higher than the maximum expected value. ➢ Possible failure on the measuring circuit.
Solutions	1. Check the load fed by the system. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A47 SEND PARAM ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A48 RCV PARAM ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A49 TEST MODE ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A50 SSW BLOCKED
Description	The static switch is blocked. The load is no longer supplied.
Possible causes	➢ Loads failure. ➢ Possible UPS fault.
Solutions	1. Check the loads for possible failures. 2. Reset the system. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A51	BATT TEMPERATURE
Description	The battery temperature is out of tolerance. This alarm is only active when the temperature probe is installed and enabled on the battery.	
Possible causes	➢ Anomalous temperature in the battery cabinet. ➢ Possible failure on the measuring circuit.	
Solutions	1. Check the temperature on the batteries and remove the cause of the alarm, if any. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A53	FIRMWARE ERROR
Description	The controller has detected an incompatibility in the control software.	
Possible causes	➢ The software update was not performed properly.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A54	CAN ERROR
Description	Internal error.	
Possible causes	➢ Microcontroller communication problems.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A55	PAR CABLE DISC
Description	Parallel cable doesn't communicate.	
Possible causes	➢ Parallel cable disconnected or damaged.	
Solutions	1. Check the connection of cable 2. Contact our Technical Support Service.	

Alarm	A56	MAINS UNBALANCE
Description	The rectifier input voltage is unbalanced.	
Possible causes	➢ Problems on the LV or MV distribution network ➢ Defect of the measuring circuit	
Solutions	1. Check the input voltage 2. Contact our Technical Support Service.	

Alarm	**A63** **START SEQ BLOCK**
Description	During the UPS start-up a failure prevented the proper execution of the sequence.
Possible causes	➢ Control devices in wrong position or operated improperly. ➢ Possible internal fault.
Solutions	1. Make sure the position of the control devices (isolators, selectors) is as specified in the procedures (see "Installation and start-up" section). 2. If the alarm persists, contact our Technical Support Service.

UPS USER MANUAL

MANUEL DE L'UTILISATEUR DE L'ASI

UTILIZZO DELL'UPS

Index / Indice

Index of pictures / Indice delle figure

ENGLISH LANGUAGE

1 SCOPE

The instructions contained in the operating manual are applicable to the UPS systems listed below.

- *BSP06* KEOR HPE 200 kVA
- *BSO02* KEOR HPE 250 kVA
- *BSS98* KEOR HPE 300 kVA

Storing documentation

This manual and any other supporting technical documentation relating to the product must be stored and made accessible to personnel in the immediate vicinity of the UPS.

Further information

In the event that the information provided in this manual is not sufficiently exhaustive, please contact the manufacturer of the device, whose details are available in the "Contacts" section.

2 SAFETY RULES AND WARNINGS

Injury hazard due to electric shock!

Always respect all the safety instructions and, in particular:

- any work on the unit must be carried out by qualified personnel;
- internal components can only be accessed after disconnecting the device from supply sources;
- always use protective devices designed for each type of activity;
- the instructions contained in the manuals must be strictly followed.

Injury hazard due to device failure

Potentially hazardous situations may arise in case of UPS failure.

- Do not use the device if visibly damaged.
- Maintain the device regularly to identify possible failure.

Possible device damage

Whenever work is carried out on the device, make sure all actions are taken in order to avoid electrostatic discharges which might damage the electronic components of the system.

Read the technical documentation

Before installing and using the device, make sure you have read and understood all the instructions contained in the present manual and in the technical supporting documentation.

3 GENERAL UPS DESCRIPTION

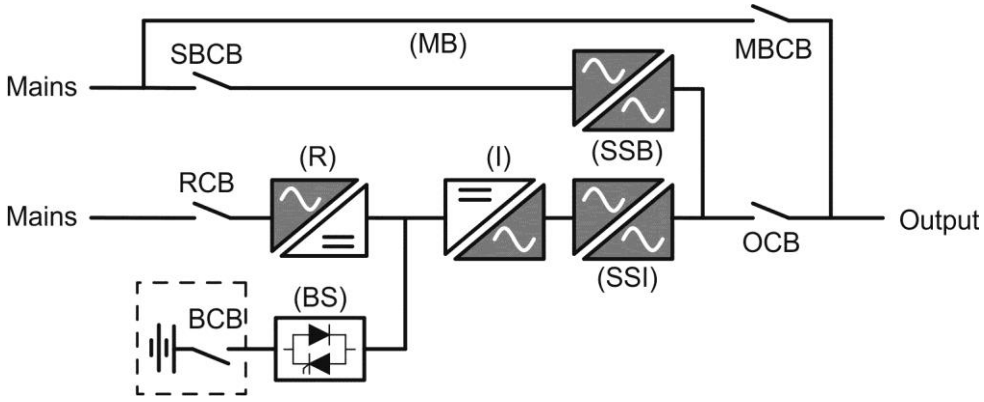
3.1 TYPOLOGY

The UPS described in this manual is on-line, double conversion; the inverter included in the UPS always supplies energy to the load, whether mains is available or not (according to the battery autonomy time).

This configuration guarantees the best service to the User, as it supplies clean power uninterruptedly, ensuring voltage and frequency stabilization at nominal value. Thanks to the double conversion, it makes the load completely immune from micro-interruptions and from excessive mains variations, and prevents damage to critical loads (Computer - Instrumentation - Scientific equipment etc.).

Output voltage present

The line connected to the UPS output is energized even during mains failure, therefore in compliance with the prescriptions of IEC EN62040-1-2, the installer will have to identify the line or the plugs supplied by the UPS making the User aware of this fact.



Picture 1 – Block diagram

The UPS uses IGBT technology with a high switching frequency in order to allow a low distortion of the current re-injected into the supply line, as well as high quality and stability of output voltage. The components used assure high reliability, very high efficiency and maintenance easiness.

3.2 SYSTEM DESCRIPTION

3.2.1 Rectifier

It converts the three-phase voltage of the AC mains into continuous DC voltage.

It uses a three-phase fully-controlled IGBT bridge with a low harmonic absorption.

The control electronics uses a 32 bit μP of latest generation that allows to reduce the distortion of the current absorbed by mains (THDi) to less than 3%. This ensures that the rectifier does not distort the supply mains, with regard to the other loads. It also avoids cable overheating due to the harmonics circulation.

The rectifier is so sized as to supply the inverter at full load and the battery at the maximum charging current.

3.2.2 Inverter

It converts the direct voltage coming from the rectifier or from the DC battery into alternating AC voltage stabilized in amplitude and frequency.

The inverter uses a 3-level power conversion bridge with IGBT technology in order to work with a high switching frequency of approximately 8 kHz.

The control electronics uses a 32 Bit μP of latest generation that, thanks to its processing capability, generates an excellent output sine-wave.

Moreover, the fully digital control of the output sine-wave allows to achieve high performances, among which a very low voltage distortion even in presence of high-distorting loads.

3.2.3 Battery and battery charger

The battery is installed outside the UPS. It is generally housed in an external battery cabinet.

The battery charger logic is completely integrated in the rectifier's control electronics.

The battery is charged, according to the DIN 41773 Standard, every time it has been partially or completely discharged. When its full capacity is restored, it is disconnected from the DC bus by means of a static switch, in order to save energy, reduce the stress due to the AC ripple thus increasing the lifetime. This operating mode is called *Green Conversion*.

It is however periodically charged but the prevailing state is of complete rest.

3.2.4 Static bypass

The Static Bypass allows to transfer the load between Inverter and Emergency Mains, and vice-versa, in a very short time, and uses SCR's as power commutation elements.

3.2.5 Manual bypass

The Manual Bypass is used to cut off the UPS completely, supplying the load directly from the input mains in case of maintenance or serious failure.

Follow the procedures contained in the manual

The sequence of manual bypass switching and return must be carried out with respect to the procedure indicated in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

External manual bypass

In the UPS system the manual bypass isolator is optional and installed outside the unit.

3.3 OPERATING STATUS

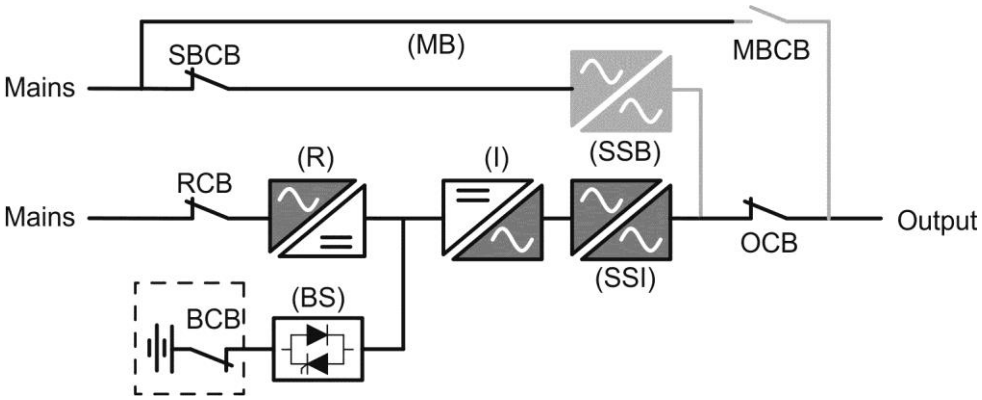
The UPS has five different operating modes, as described below:

- Normal operation
- Green Conversion
- Bypass operation
- Battery operation
- Manual bypass

3.3.1 Normal operation

During normal operation all the circuit breakers/isolators are closed, except for MBCB (maintenance bypass).

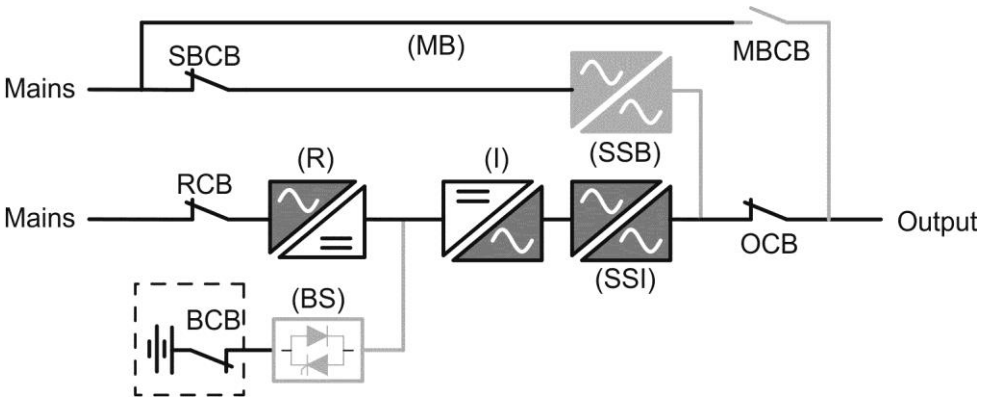
The rectifier is supplied by the AC three-phase input voltage which, on its turn, feeds the inverter and compensates mains voltage as well as load variations, keeping the DC voltage constant. At the same time, it provides to charge the battery. The inverter converts the DC voltage into an AC sine-wave with stabilized voltage and frequency, and also supplies the load via its static switch SSI.



Picture 2 – Normal operation

3.3.2 Green Conversion

During the operation in *Green Conversion* mode the battery is disconnected from the DC bus by means of a static switch (see picture) and the rectifier works at reduced DC voltage; a control algorithm provides to periodically re-connect the battery for recharge purposes (intermittent charging).



Picture 3 – Green Conversion

When the *Green Conversion* algorithm is active the rectifier operates at reduced DC voltage and supplies the inverter alone, since the battery is disconnected from the DC bus. The battery charge is controlled by a specific algorithm. In case no mains outage events have occurred, and so no battery discharges have occurred too, the control logic provides to start a charging cycle once every 25 days. The battery-charger restores the capacity lost due to the self-discharge and remains in floating charge for additional 12 hours. As this time has elapsed the battery static switch is opened and the battery is disconnected from the DC bus.

In case a discharge event occurs, the control logic provides to calculate the capacity which has been lost during the discharge; as the mains is restored a charging cycle is started, which is extended for an additional time that depends on the percentage of lost capacity, referred to the rated value.

- Lost capacity < 10% → Additional charge for **12 hours**
- Lost capacity between 10% and 20% → Additional charge for **48 hours**
- Lost capacity > 20% → Additional charge for **96 hours**

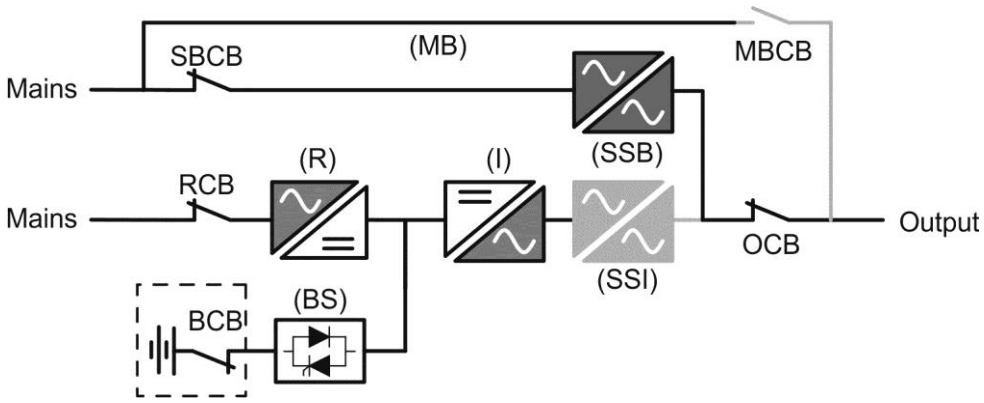
Such values complies with the recommendations of the main battery manufacturers.

Set the right battery capacity

The UPS front panel allows the setting of the battery parameters, including the rated capacity. Considering the importance that such value assumes for the correct execution of the charge control algorithm, it is highly recommended to verify the correctness of the programmed value.

3.3.3 Bypass operation

The load can be switched to bypass either automatically or manually. The manual changeover is due to the BYPASS SWITCH which forces the load to bypass. In case of failure of the bypass line, the load is switched back to inverter without interruption.



Picture 4 – Load supplied by bypass

3.3.4 Battery operation

In case of power failure or rectifier fault, the battery feeds the inverter without interruption. The battery voltage drops based on the amplitude of the discharging current. The voltage drop has no effect on the output voltage, which is kept constant by changing the PWM modulation. An alarm is activated when the battery is near the minimum discharge value.

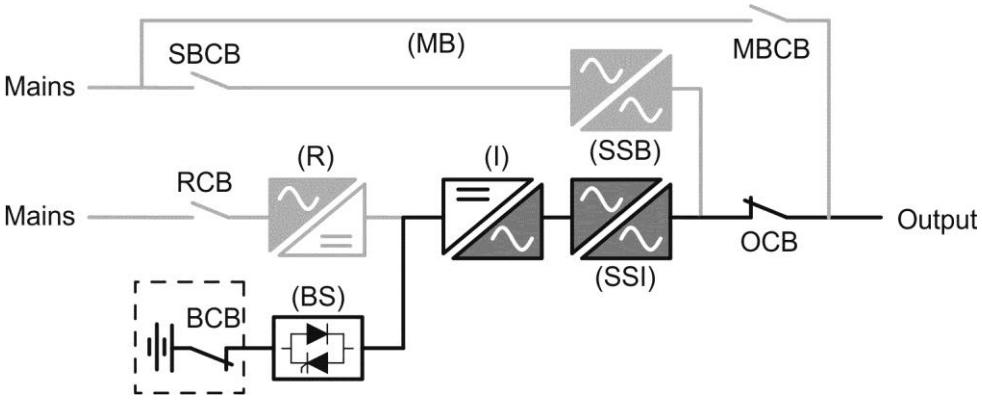
In case the supply is restored before the battery is completely discharged, the system will be switched back to normal operation automatically. In the opposite case, the inverter shuts down

and the load is switched to the bypass line (bypass operation). If the bypass line is not available or is out of tolerance, the loads supply is interrupted as soon as the battery reaches the discharge limit threshold (*black-out*).

As soon as the supply is restored, the rectifier will recharge the battery. In the standard configuration, the loads are supplied again via static switch SSB when mains is available again. The inverter is restarted when the battery has partially restored its capacity.

The system restart from the *black-out* condition can be customized based on the requirements of the plant, in three different modes:

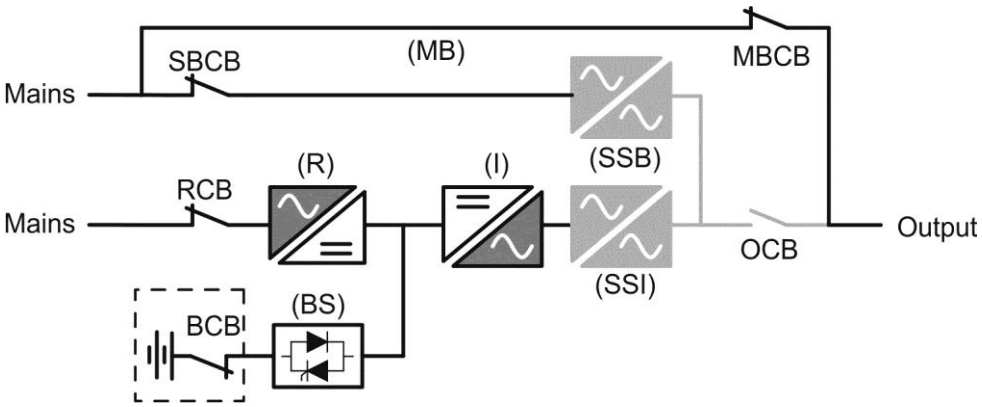
- Bypass → loads are supplied as soon as the bypass line is available (factory configuration).
- Inverter → loads are supplied by the inverter (even if the bypass line is available) when the battery voltage has reached a programmed threshold, after the rectifier restart.
- Man. Inverter → the output supply is NOT restored automatically. The system requires a confirmation to restart which can only be done manually by the user via the front panel.



Picture 5 – Battery operation

3.3.5 Manual bypass

The manual bypass operation is necessary whenever the UPS functionality is tested, or during maintenance or repair work.



Picture 6 – Manual bypass for functional checks

Follow the procedures contained in the manual

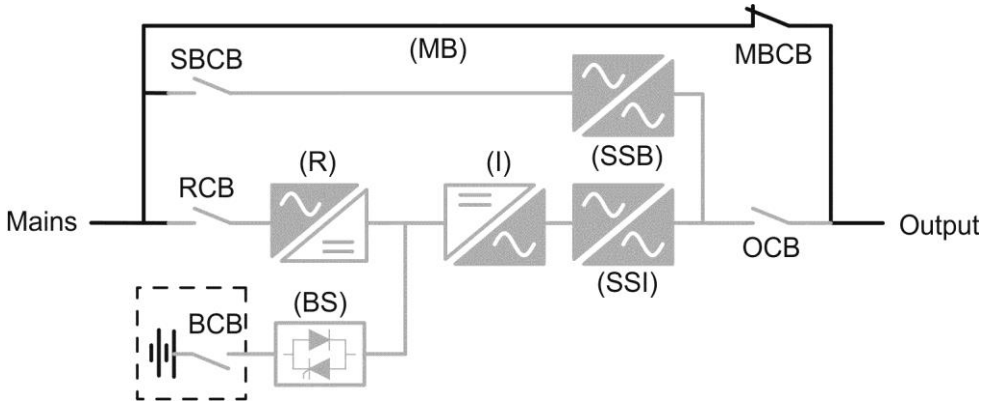
The sequence of manual bypass switching and return must be carried out with respect to the procedure indicated in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

Wiring of the auxiliary contacts

Carry out a proper electrical installation by wiring the auxiliary contacts of the manual bypass and output isolators to the dedicated terminals on board the UPS. This will allow the control logic to acquire the status of the switches and guide the operator during the start-up and manual bypass procedures.

For further information refer to the section "Installation and start-up".

During the manual bypass due to repair or maintenance, the UPS is completely shut down and the load is directly supplied by the bypass line.



Picture 7 – Manual bypass for repair or maintenance works

3.4 CONTROL AND OPERATION DEVICES

The control and operation devices of the UPS are indicated below:

- Isolator on rectifier input (RCB)
- Isolator on bypass input (SBCB)
- Isolator on UPS output (OCB)
- Manual bypass isolator (MBCB)
- Battery Isolator / Circuit breaker (BCB) - External, inside the battery cabinet
- Emergency power off button (EPO)
- Normal/Bypass selector
- Touch screen control panel

Check the personnel training

The use of the operation and control devices of the UPS is intended for authorized personnel only. We recommend to check the training of the personnel responsible for the use and maintenance of the system.

3.4.1 Isolators

The isolators provided on the UPS are used to isolate the power components of the device from the AC supply line, from the storage battery and from the load.

Voltage present on terminals

The isolators do not isolate the UPS completely, since AC voltage is still present on the UPS input terminals. Before carrying out any maintenance on the unit:

- Isolate the device completely by operating the external circuit breakers;
- Wait at least 5 minutes in order to allow the capacitors to discharge.

3.4.2 Emergency power off command (EPO)

The emergency power off command is used to disconnect the UPS output immediately, interrupting the loads supply. It also shuts down the inverter.

Operate the command only in case of real emergency

The components of the system are subject to a high stress when the emergency power off command is operated under load presence.

- Use the emergency power off button only in case of real emergency.

Supply reset

Reset the output supply only when the causes which led to the emergency shutdown have been eliminated and you are sure that there is no hazard to persons and things.

3.4.3 Normal/Bypass selector

The Normal/Bypass selector is installed externally, on the rear of UPS. It is generally used during the manual bypass procedure, when it is necessary to isolate the UPS for maintenance or repair.

Follow the procedures contained in the manual

The Normal/Bypass selector shall only be operated in accordance with the procedures specified in the installation and start-up section. The manufacturer cannot accept responsibility for damages arising from incorrect operation.

3.4.4 LCD control panel

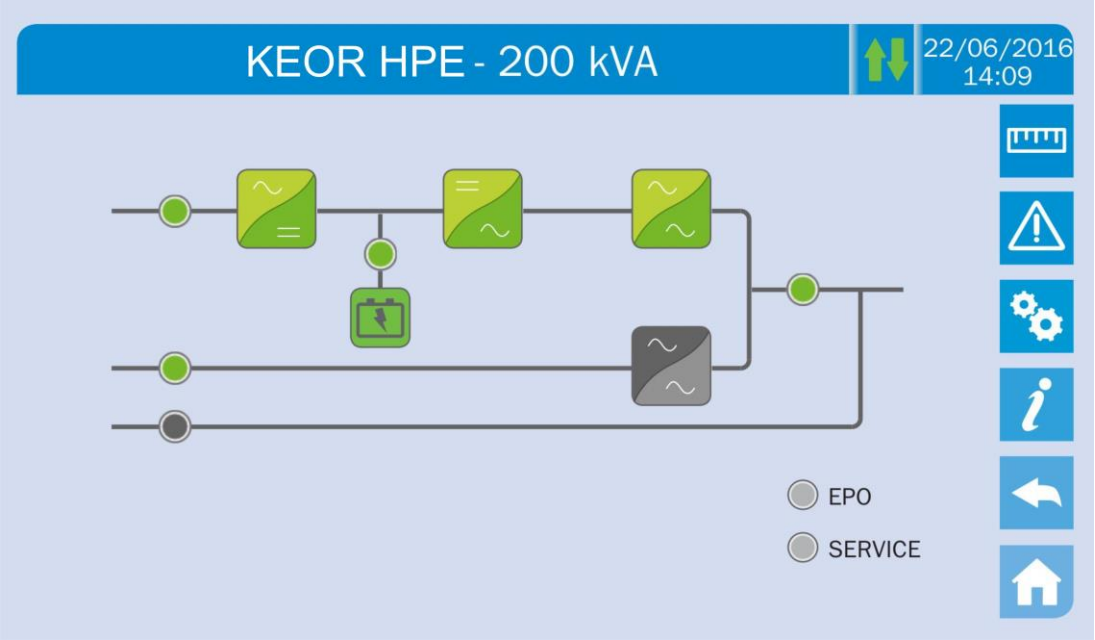
The control panel of the UPS is used in order to:

- Check the operating parameters of the device
- Check the alarms present
- Access the event log
- Display the information on the device
- Modify the operating parameters

The menu which allows to change the parameters is password-protected in order to prevent access to unauthorized personnel.

4 CONTROL PANEL

The UPS control panel is a 10.1" *touch screen* which dialogues with the I/O module control logic via serial protocol. The main page (***Home***) shows the system flow diagram, from which all the UPS operating variables can be displayed.



Picture 8 – UPS front panel, Home page

4.1 ICONS

Browsing through the pages of the *touch screen* is possible through the six icons provided on the right hand side; the icon with the up-down arrows controls the display communication.

Icon		Assigned functions
	Measures	Enters the *Measures* section
	Alarms	Enters the *Alarms* section and resets the buzzer if activated
	Settings	Enters the *Settings* section
	Info	Enters the *Info* section
	Back	Goes back one page
	Home	Goes back to the *Home* page
	Communication	Controls the communication between the panel and the UPS electronics

4.1.1 Icons colours

The icons can take on different colours on the basis of the UPS operating condition; in general the basic colours are:

- Light blue → It indicates that the section is related to the UPS.
- Grey → The keys turn grey (disabled) when the key specific section is entered.
- Red → The ***Alarms*** key will turn red in case an alarm occurs.

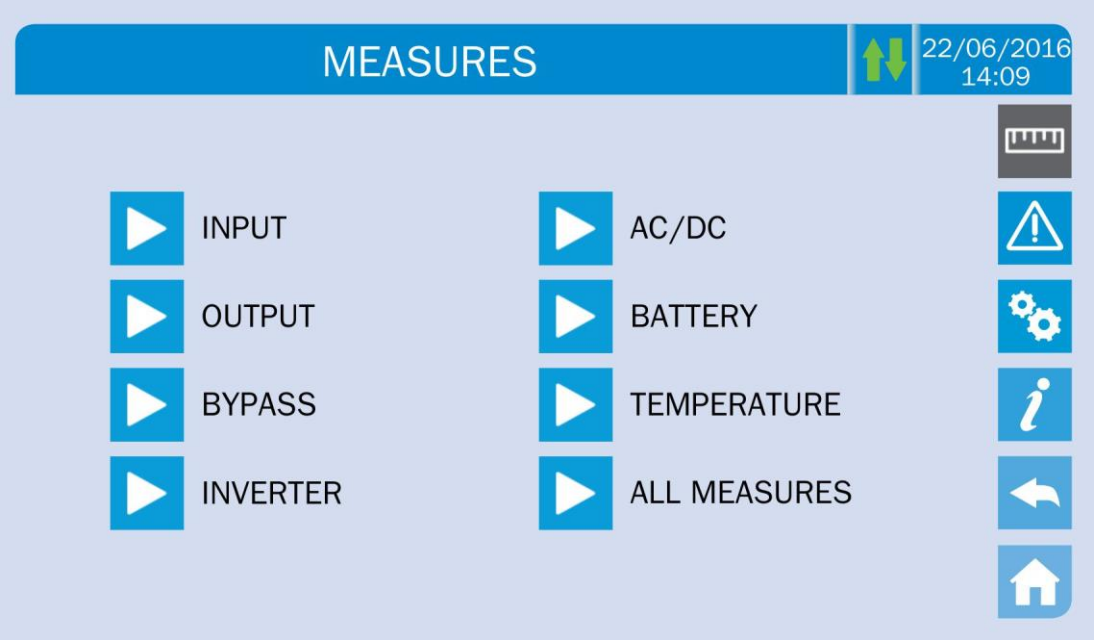
For what concern the *Communication* icon, it turns red in case of communication error between the *touch screen* and the UPS control logic.

5 *TOUCH SCREEN* – MANAGING THE UPS

The UPS operating parameters can be managed by entering the various sections of the control panel from the *Home* page directly.

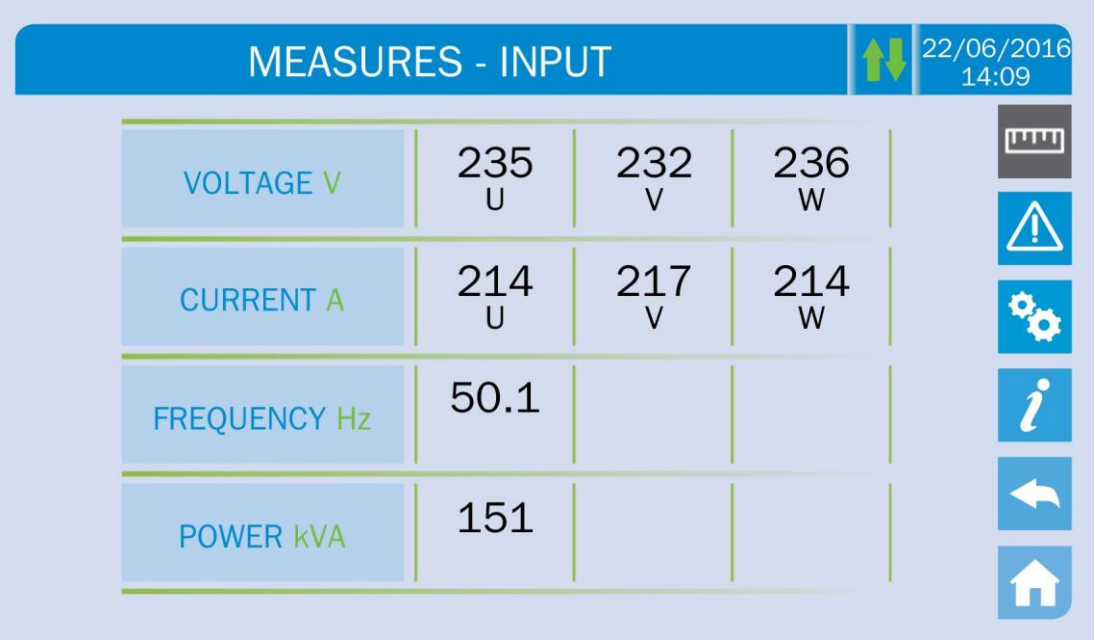
5.1 DISPLAYING THE MEASURES

Press on the *Measures* icon to enter the main page.



Picture 9 – MEASURES section

The measures page of a specific section of the UPS is entered pressing one of the arrows. A typical *Measures* page is shown below.



Picture 10 – Input measures page

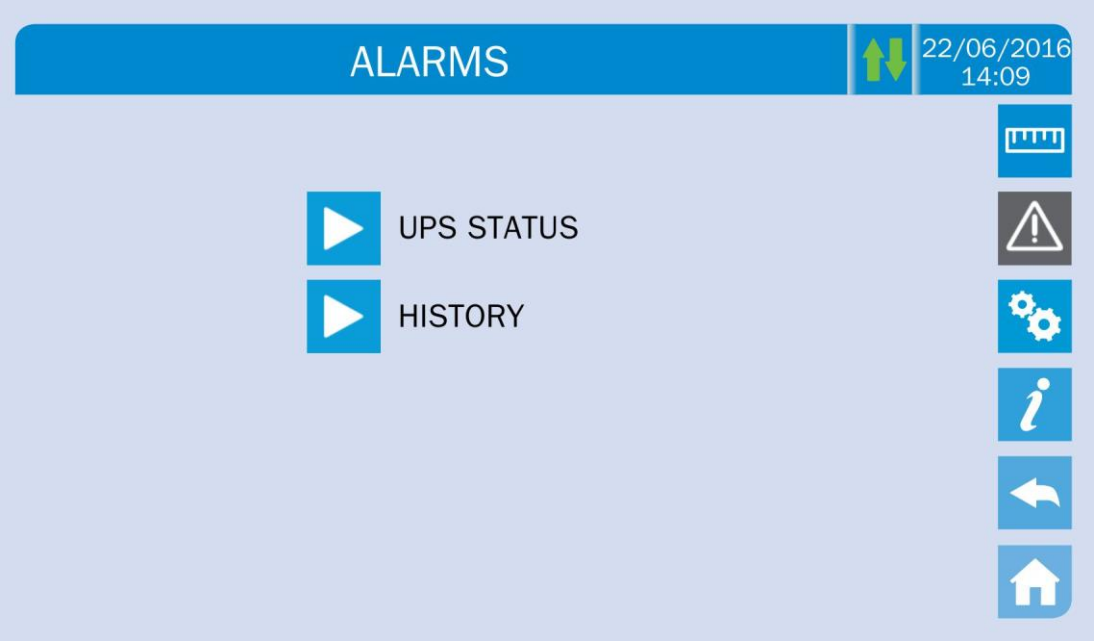
The list of all the available measures is given below.

Sub-page	Displayed data	Accuracy
INPUT	Rectifier input voltage (1)	1 V
	Rectifier input current	1 A
	Frequency	0,1 Hz
	Input power	1 kVA
OUTPUT	Voltage (1)	1 V
	Current	1 A
	Load percentage	1 %
	Active power	1 kW
	Apparente power	1 kVA
	Frequency	0,1 Hz
BYPASS	Voltage (1)	1 V
	Frequency	0,1 Hz
INVERTER	Voltage (1)	1 V
	Frequency	0,1 Hz
AC / DC	Rectifier output voltage	1 V
BATTERY	Voltage and current	1 V / 1 A
	Rated capacity	1 Ah
	Residual autonomy	1 min / 1 %
TEMPERATURE (2)	Battery	0,1° C
	UPS	0,1° C

(1) The voltage measures are always given referred to the phase-to-neutral value
(2) The temperatures are displayed only if the relevant probe is installed

5.2 BASIC DIAGNOSTICS

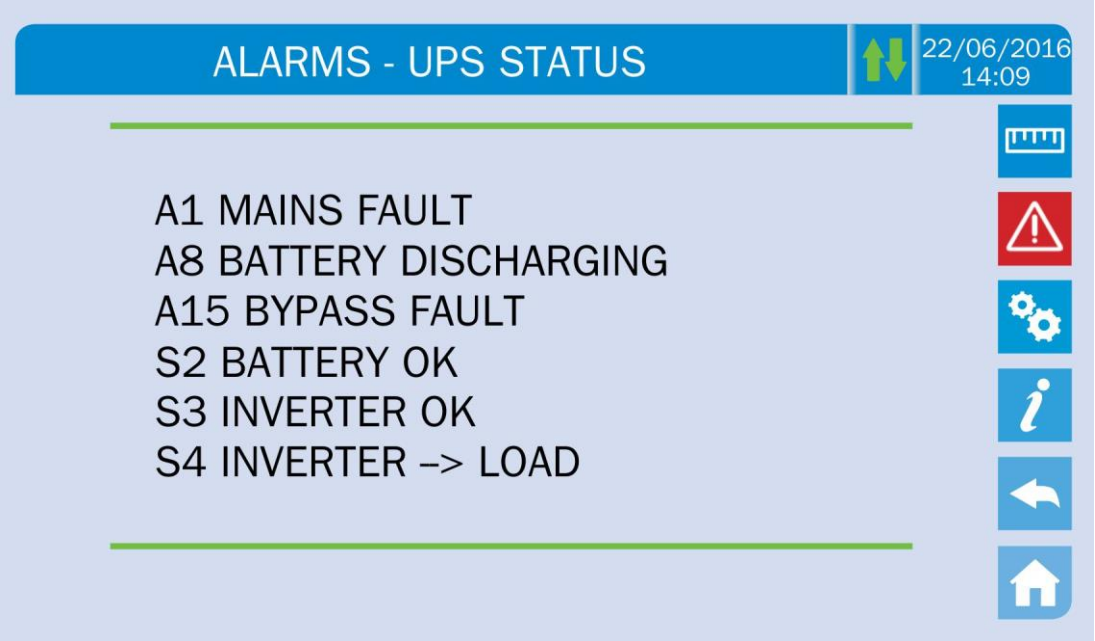
Pressing the *Alarms* icon will open the page where either the UPS operating status or the history log can be selected.



Picture 11 – ALARMS section

5.2.1 Displaying the operating status

Press *UPS status* to show the UPS operating status, which includes possible active alarms.



Picture 12 – ALARMS section

The current system status is shown; in case the list is longer than the page capacity (8 lines) it can be scrolled by sliding a finger on the screen.

5.2.2 Icons colours

The icons *Alarms* and *Home* take on different colours on the basis of both the UPS operating condition and the displayed page.

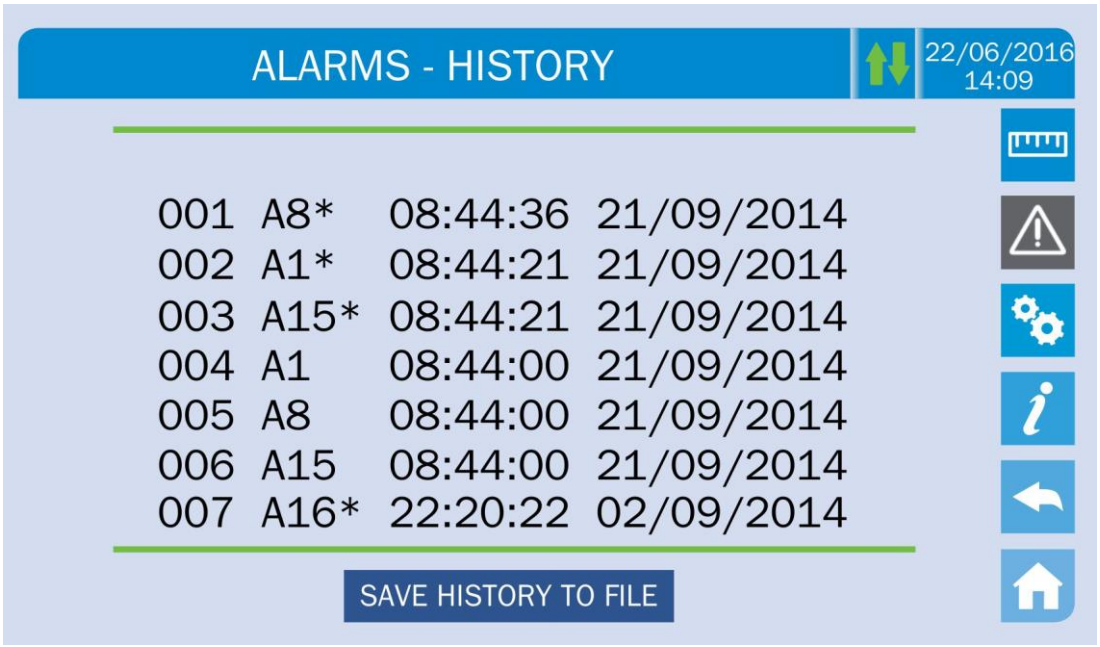
Icon	Colour	Meaning
	*Light blue* *Dark blue*	No active alarms
	*Grey*	No active alarms A page of the *Alarms* section is currently displayed
	*Red*	Active alarm; if the alarm is affecting one of the modules the relevant icon in the *Home* page will turn *Orange* or *Red*
	*Light blue*	No active alarms
	*Red*	Active alarms in the I/O module while a page of one of the power modules sections is currently displayed

The audible indicator, if enabled, is activated to show the occurred failure. The audible alarm is silenced by pressing the *Alarms* icon.

Automatic erasure of alarms

Should an alarm occur and then the conditions that originated it no longer exist, the alarm will be automatically cancelled and the system restarted.

5.2.3 Displaying the alarms history



Picture 13 – History log, page 1

The first event shown is the latest one in order of time; a new event makes all the other events automatically shift one position, clearing the oldest event.

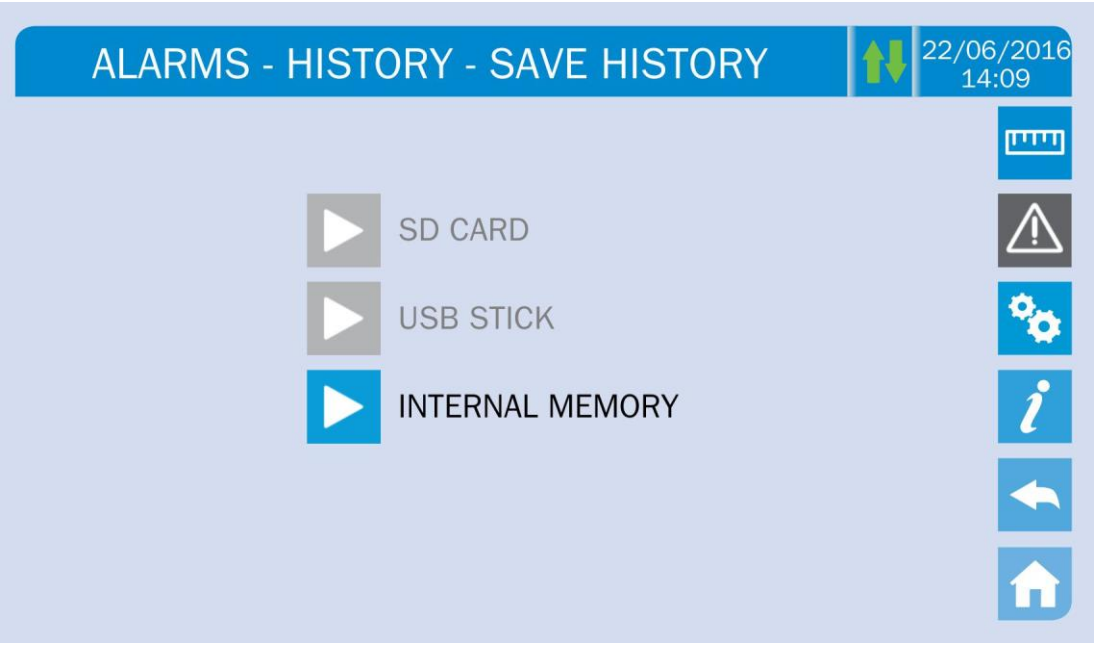
Each line shows the number of the event (position within the list), the alarm code and date and time; an asterisk indicates the automatic reset of the alarm.

The maximum number of events which can be shown is equal to 250.

The events log can be scrolled by sliding a finger on the screen.

Picture 14 – History log, page 2

Pressing the key *Save history to file* will open the following page.



Picture 15 – Saving the history log

The *touch screen* automatically recognizes when an external memory support (USB stick or SD card) is inserted, and changes the colour of the relevant icon from grey (disabled) to blue (enabled).

The text file that will be saved contains the same information available on the *History* pages, completed with the decription of each event.

5.2.4 Alarms and operating status

ALARMS

A1	MAINS FAULT
A2	INPUT WRONG SEQ
A3	BOOSTER STOPPED
A4	BOOSTER FAULT
A5	DC VOLTAGE FAULT
A6	BATTERY IN TEST
A7	BCB OPEN
A8	BATTERY DISCHARGE
A9	BATTERY AUT END
A10	BATTERY FAULT
A11	SHORT CIRCUIT
A12	STOP TIMEOUT SC
A13	INV OUT OF TOL
A14	BYPASS WR SEQ
A15	BYPASS FAULT
A16	BYPASS --> LOAD
A17	RETRANSFER BLOCK
A18	MBCB CLOSED
A19	OCB OPEN
A20	OVERLOAD
A21	THERMAL IMAGE
A22	BYPASS SWITCH
A23	EPO PRESSED
A24	HIGH TEMPERATURE
A25	INVERTER OFF
A26	COMMUNIC ERROR
A27	EEPROM ERROR
A28	CRITICAL FAULT
A29	MAINTENANCE REQ
A30	COMMON ALARM
A31	MBCB BUS CLOSED
A32	EPO BUS CLOSED
A33	ASYMMETRIC LOAD
A34	SERVICE REQUIRED
A35	DIESEL MODE
A36	DC FASTSHUTDOWN
A38	INV --> LOAD
A39	INV ERROR LOOP
A40	SSI FAULT
A41	RECT ERROR LOOP
A44	DESATURATION
A45	HIGH TEMP SSW
A46	PAR LOST REDUND
A47	SEND PARAM ERROR
A48	RCV PARAM ERROR
A49	TEST MODE ERROR
A51	BATT TEMPERATURE
A52	INVERTER BLOCK
A53	FIRMWARE ERROR
A54	CAN ERROR
A55	PAR CABLE DISC
A56	MAINS UNBALANCE
A57	INPUT CURRENT UNBALANCE
A58	INVERER CURRENT UNBALANCE
A59	BACKFEED RELAY ON
A61	LOSS OF. RED. SUPLLY
A62	MAINS OVERVOLTAGE
A63	START SEQ BLOCK
A64	MAINS UNDERVOLTAGE

STATUSES

S1	BOOSTER OK
S2	BATTERY OK
S3	INVERTER OK
S4	INVERTER --> LOAD
S5	INV BYPASS SYNC
S6	BYPASS OK
S7	BYPASS --> LOAD
S8	INV MASTER SYNC
S10	RECTIFIER STAND-BY
S11	INVERTER STAND-BY
S12	BATT STAND-BY
S14	BATT CHARGE I
S15	BATT CHARGE U

Display and recording mode of alarms

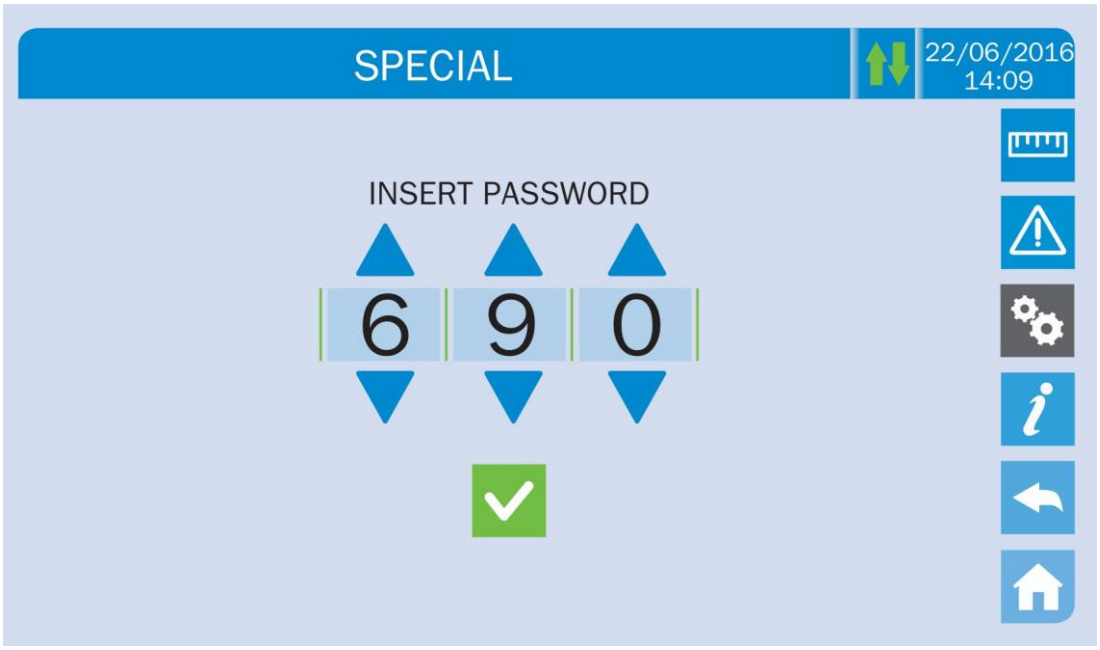
- The statuses are always displayed in ascending order when the ALARMS – STATUS menu is entered.
- The alarms are shown when they are present and must be silenced with the buzzer.
- The alarms remain displayed whilst they are present and they are automatically stored in the event log with date and time.

Description of alarms and statuses

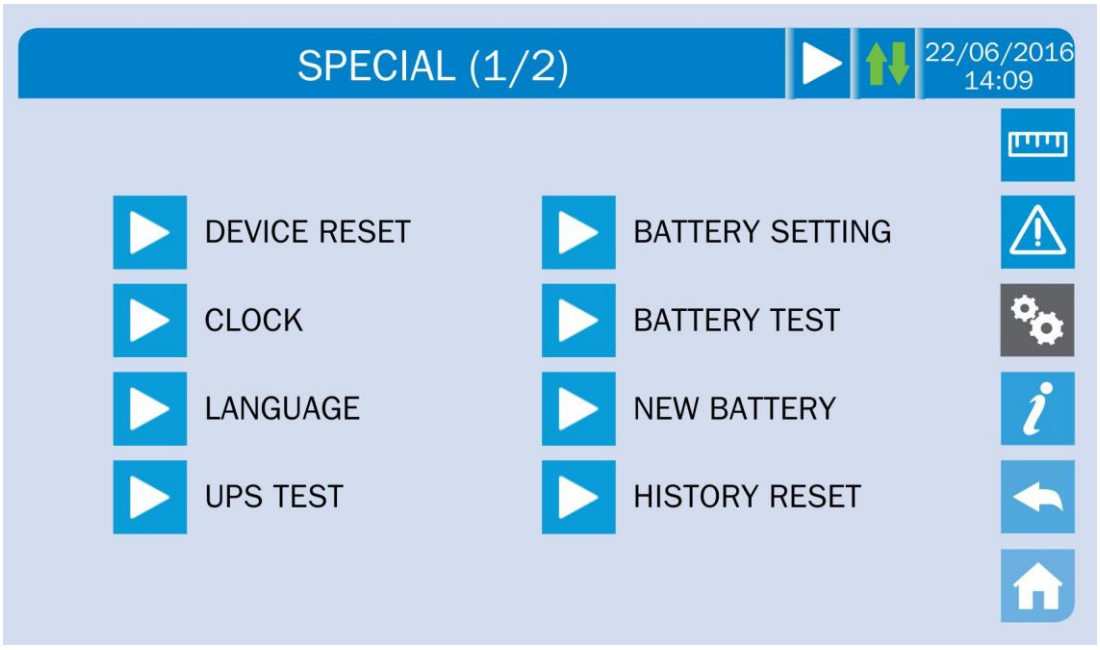
For a more detailed description of the alarms and statuses, see the "Faults and alarms" section of the present manual.

5.3 SETTINGS AND ADVANCED OPERATIONS

Pressing the *Settings* icon will show the setting section access page, protected by password.

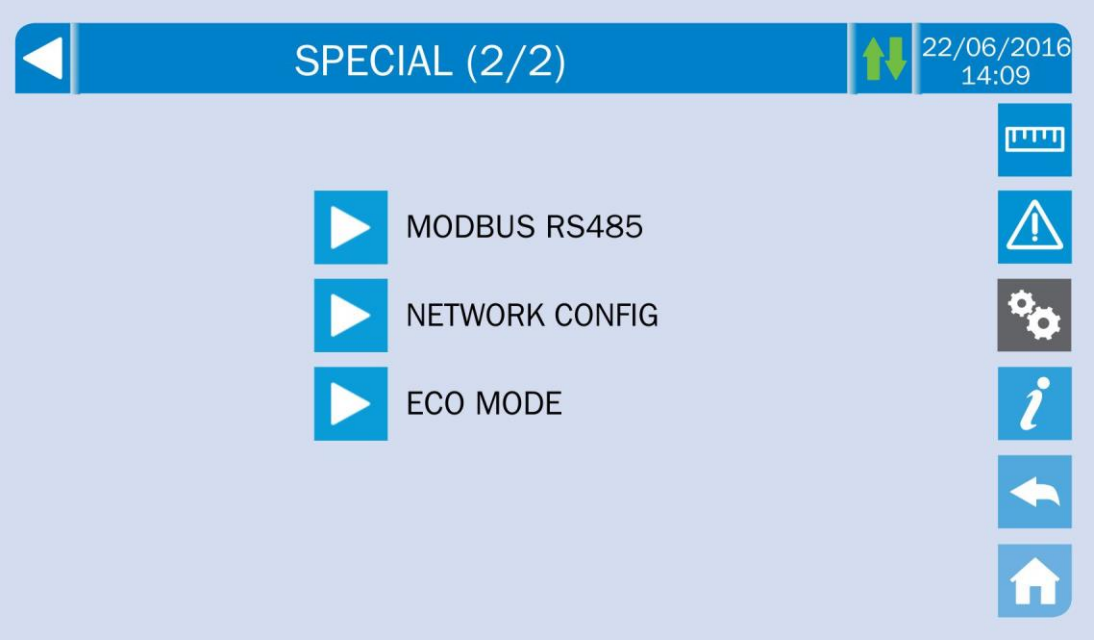


Picture 16 – Access password to the Settings section



Picture 17 – SETTINGS section, page 1

The arrow in the upper main bar indicates that the section contains further pages.



Picture 18 – SETTINGS section, page 2

Password-protected access

The SETTINGS menu is protected by a password set by the factory in order to prevent access to unauthorized personnel.

- We recommend minimum disclosure of the access password.
- Changes to the operating parameters and starting operations on the UPS may be potentially dangerous for the device and for persons.

5.3.1 Resetting the device

The UPS is equipped with internal protections which block the system or some of its sections. The alarm can be cleared and normal operation can be resumed via the *DEVICE RESET* page. In case the failure persists, the UPS will return to the previous failure condition.

In some cases the RESET is necessary to simply reset a failure signal, then the UPS will resume operation. The failure conditions which impose a manual reset are:

- Activation of the battery fault alarm (alarm A10)
- Static switch re-transfer block (alarm A17)
- Scheduled maintenance request (alarm A29)
- Booster shutdown due to the operation of the load symmetry sensor (alarm A33)
- Inverter shutdown due to voltage control loop error (alarm A39)
- Booster shutdown due to voltage control loop error (alarm A41)
- Booster shutdown due to current control loop error (alarm A43)
- Block due to the disconnection of one parallel cable (alarm A50)
- Block due to the disconnection of two parallel cables (alarm A55)

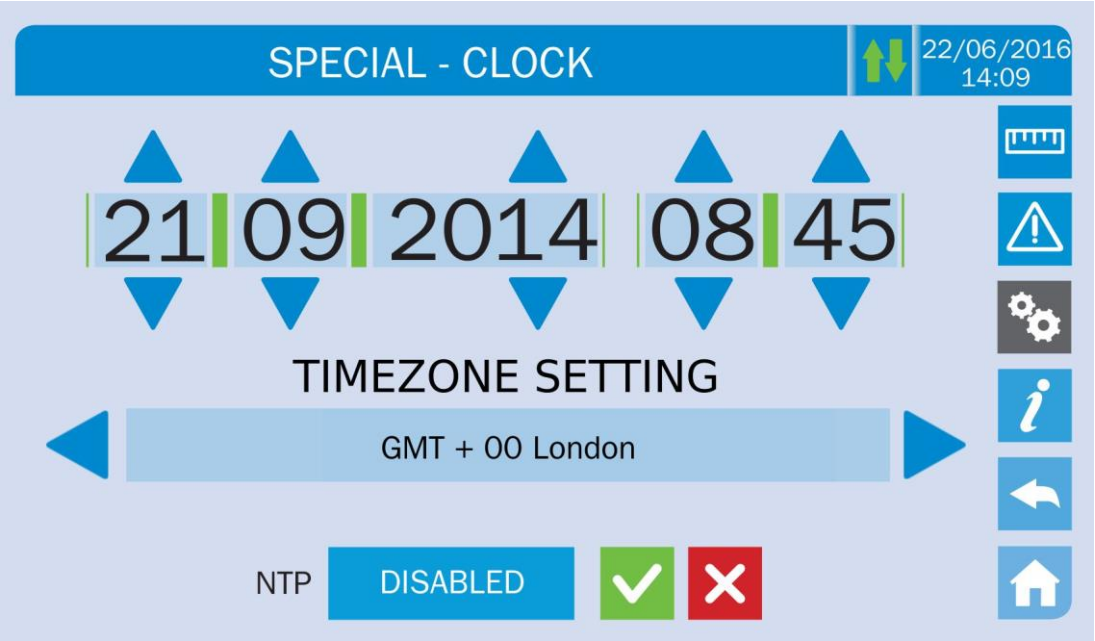
- System restart after a shutdown due to EPO activation

Several specific blocking conditions of the power modules can only be cleared by directly entering the *Settings* section of the modules (see relevant paragraph).

For a description of the UPS status in each of the failure conditions listed above, please refer to the "Faults and alarms" section.

5.3.2 Setting date and time

Date and time may be set via the *CLOCK* page.

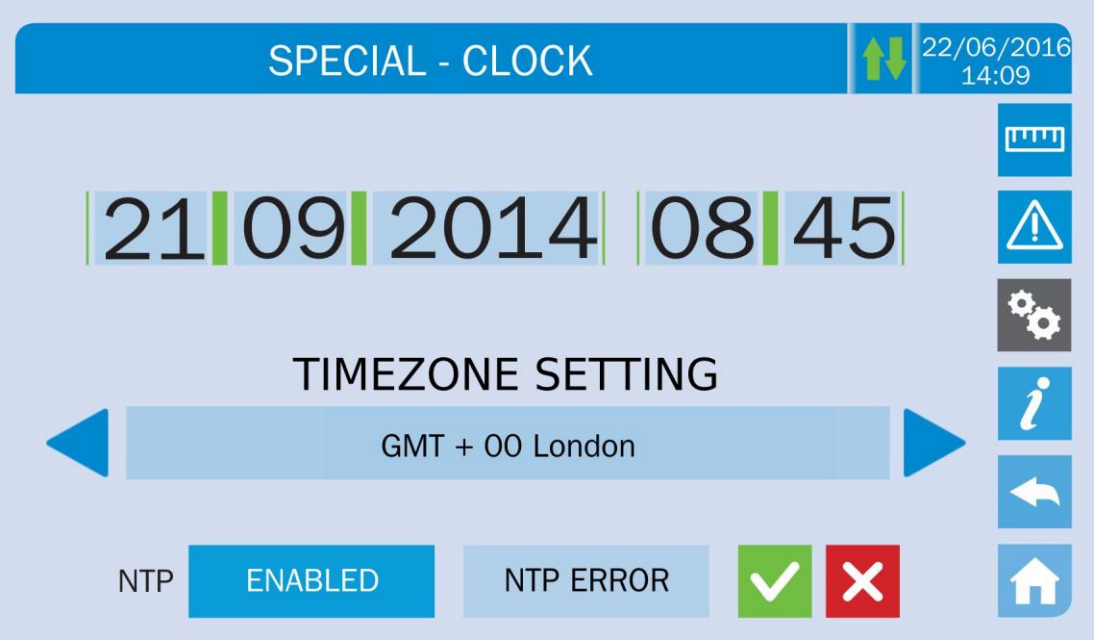


Picture 19 – Clock manual setting

Setting the current date and time correctly

The correct setting of the date and time is essential for the recording of the event log.

The system also allows the setting of a NTP server for the synchronization of date and time. Such configuration mode is enabled by pressing the label *Disabled*. As the NTP server is enabled the data can't be manually entered anymore.



Picture 20 – Clock automatic setting

The NTP server access parameters can be configured via the *Network configuration* pages in the *Settings* section. In case the server does not respond or the LAN connection is lacking, the message *NTP ERROR* will be displayed.

5.3.3 Setting the display language

The following picture shows the languages that can be set.

Picture 21 – Language setting

The language selection is made pressing one of the flags.

5.3.4 Resetting the history log

The history log can be reset by entering the *HISTORY RESET* section; the operation requires a further confirmation.

Loss of data

The alarms history contains very important data to monitor the device behaviour over time. We recommend to save the data before deleting it.

5.3.5 Setting the RS485 user interface parameters

The parameters regarding the communication via RS485 interface can be set in the *MODBUS RS485* section.

This section allows to set the ModBus address, the communication mode and the data transmission speed.

5.3.6 New battery

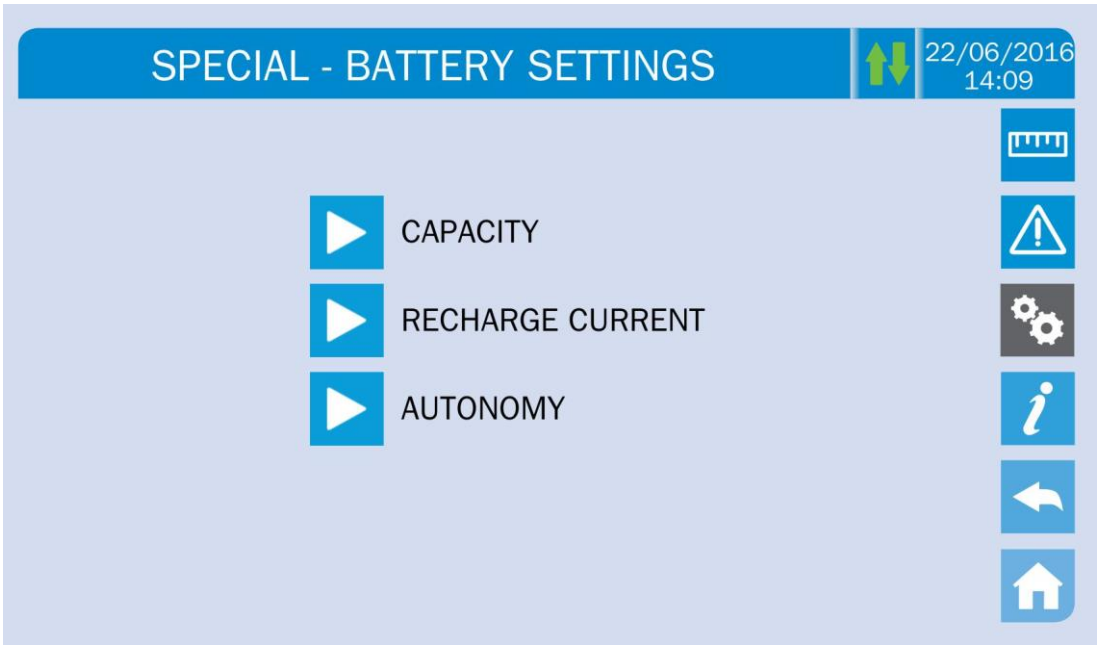
The page *NEW BATT* is used in case battery circuit breaker BCB is not closed, when requested, in the start-up phase. In this case the system will start considering the battery completely discharged and activating the alarm "A10 – BATTERY FAULT".

To set the battery autonomy to 100% it is necessary to access the section and confirm the operation in the confirmation page.

In case of distributed battery configuration such section is disabled and can be found in the *Settings* section of each power module.

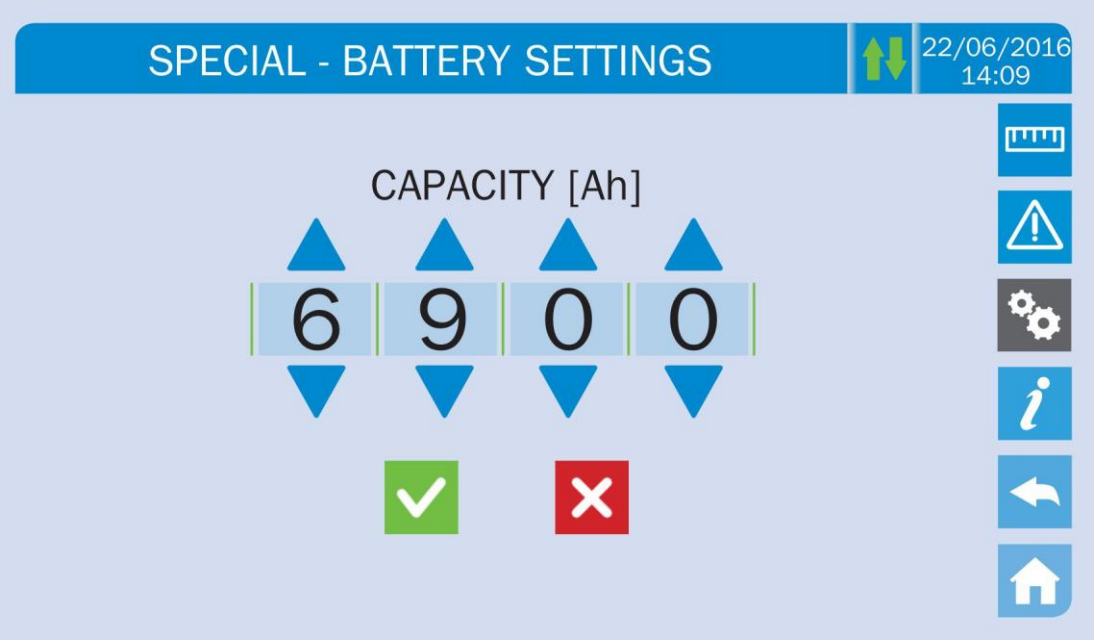
5.3.7 Setting the battery

In case the UPS has been tested without knowing the characteristic data of the storage battery, the *BATTERY SETTING* section allows to set such data. Each single settable parameter can be accessed via the following page.



Picture 22 –Battery parameters setting

The various parameters setting pages are similar to each other and requires the operator to enter and confirm the value; the setting page of the battery capacity is given below as a reference.



Picture 23 – Battery parameters setting

5.3.8 Battery test

The *BATTERY TEST* section allows to carry out a short discharge test of the battery. In case the battery is not efficient, the alarm "A10 – Battery fault" is generated at the end of the test.

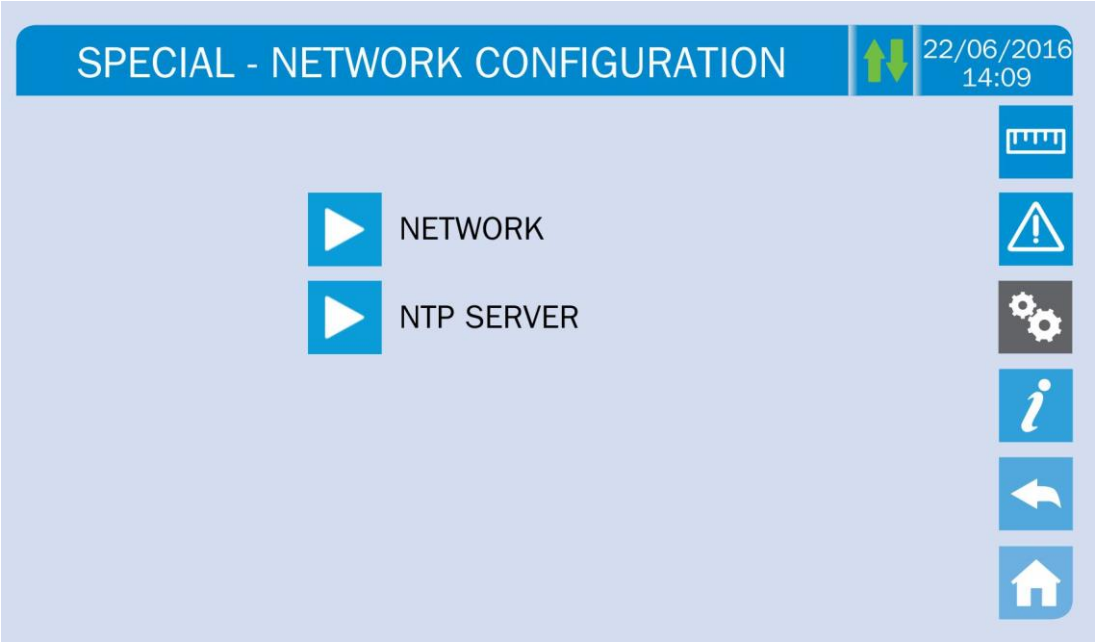
Possible loss of supply

This test can affect the continuity of supply to the loads if the battery is not fully charged.

5.3.9 Setting the display network parameters

The *NETWORK CONFIG* section allows to configure the parameters related to the LAN network and to the system time synchronization server.

All the parameters that can be set in this section are related to the communication ports (LAN and RS485) available on-board the *touch screen*.

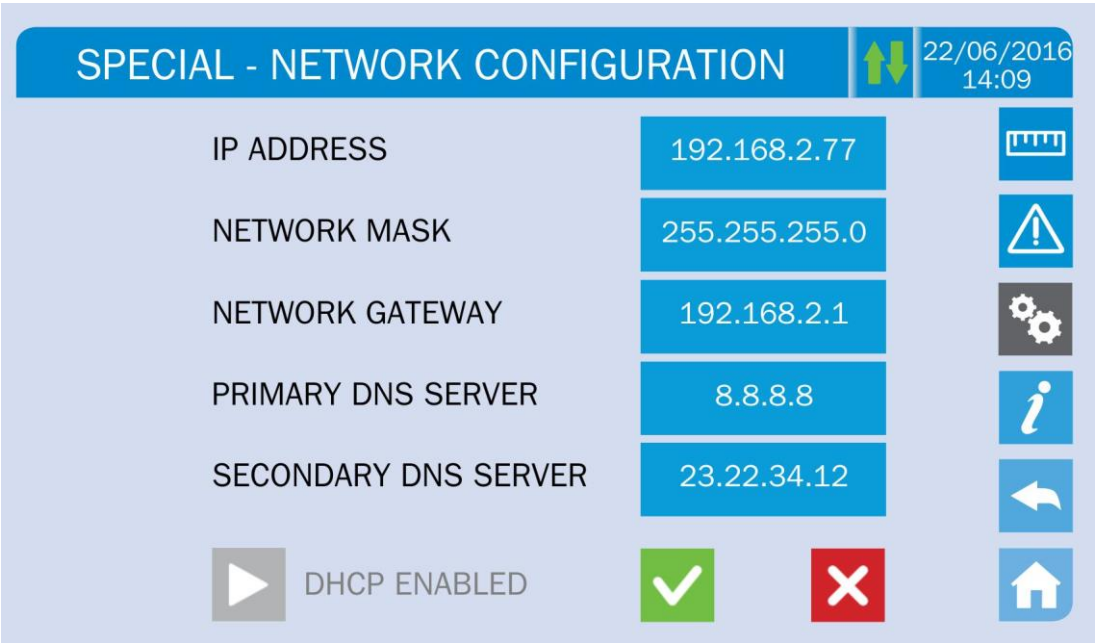


Picture 24 – Touch screen network parameters setting

5.3.9.1 Setting the LAN parameters

The LAN network parameters which can be set are the following:

- IP address
- Network mask
- Network gateway
- Primary DNS server
- Secondary DNS server
- DHCP Enabling / Disabling

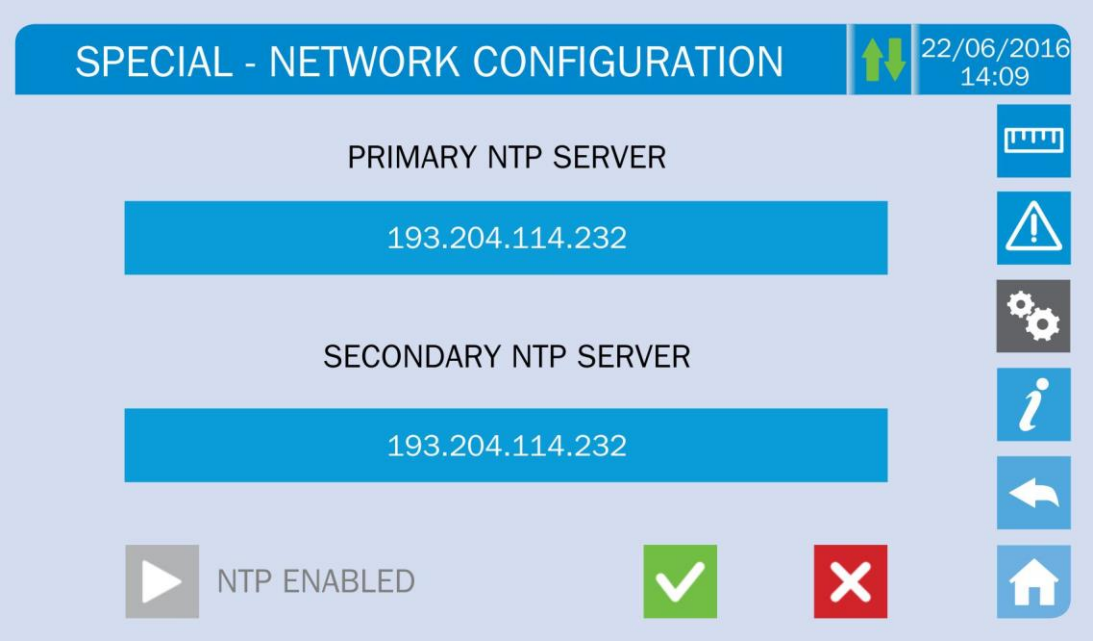


Picture 25 – LAN parameters setting

5.3.9.2 Setting the NTP parameters

The NTP service parameters which can be set are the following:

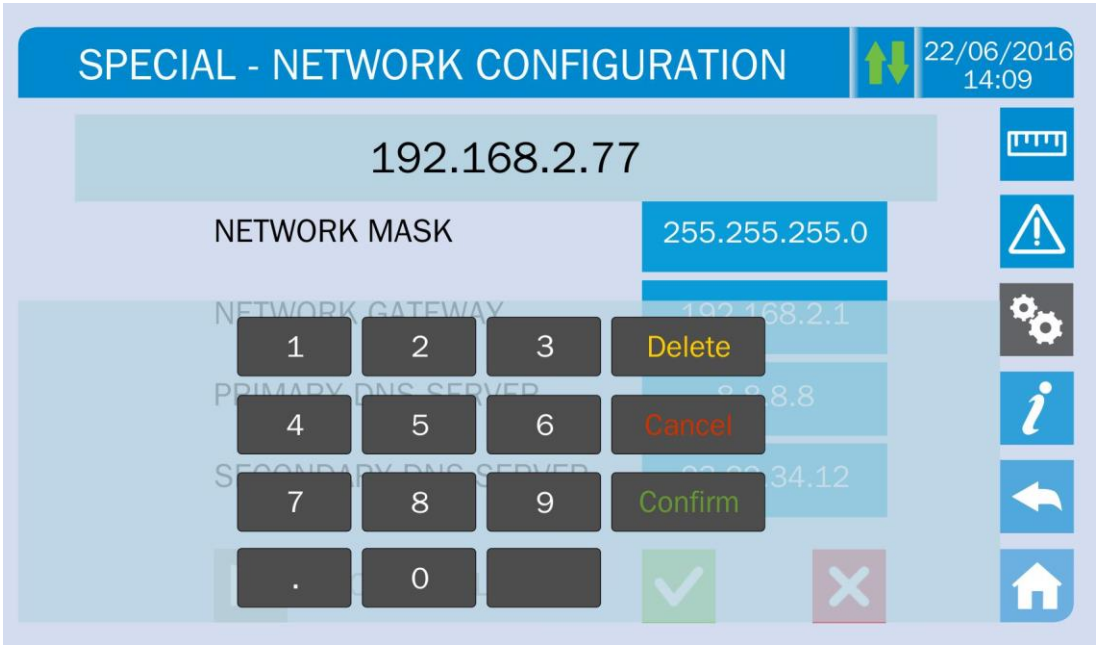
- Primary NTP server address
- Primary NTP server address
- NTP Enabling / Disabling



Picture 26 – NTP parameters setting

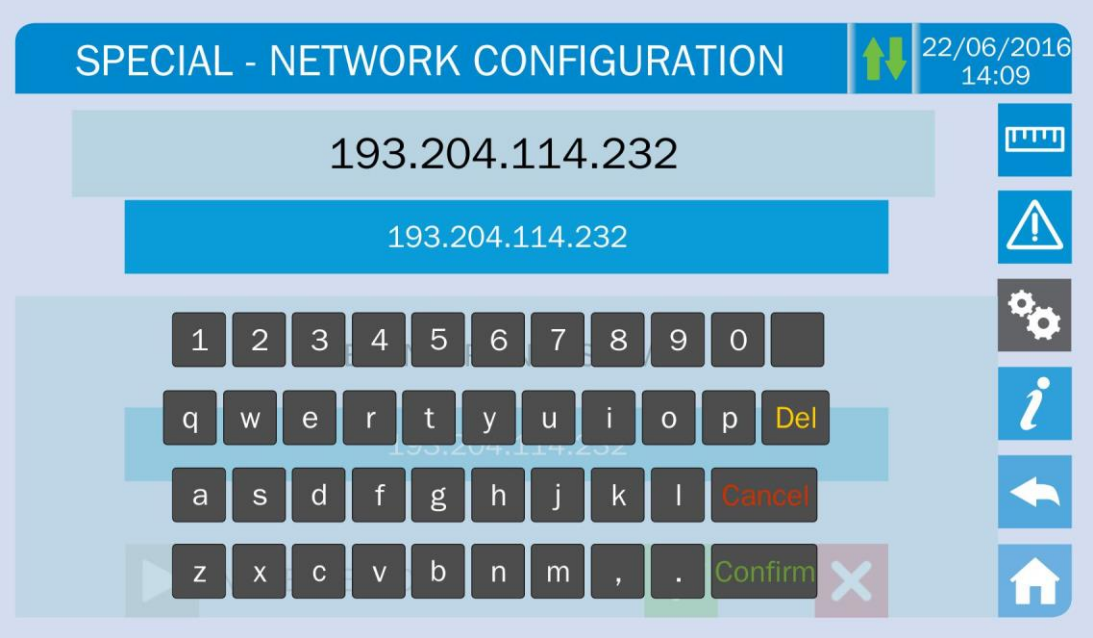
5.3.9.3 Modifying the parameters

The modification of the parameters is performed pressing on the field that is to be modified; the parameter will be displayed on the editable string in the upper part of the page, together with a keypad.



Picture 27 – Modification of numerical parameters

The fields related to the NTP servers may either be numerical (IP address of the remote server) or alphanumerical when the remote server can be reached via a web address. In such case the keypad that will appear in the page is complete.



Picture 28 – Modification of NTP address parameters

5.3.10 Modifying the operating mode – ECO MODE

The section *ECO MODE* allows the modification of the UPS operating mode, from the VFI – Voltage Frequency Independent operation (on-line double conversion) to VFD – Voltage Frequency Dependent. In such mode the load is directly supplied by the AC and the inverter is turned on, ready to take over in case of anomalies of the mains. The transfer occurs in a maximum time of 10 ms.

The stability of the AC mains is controlled bu a specific algorithm which provides to automatically de-activate the *LINE INTERACTIVE* mode in case the voltage or frequency are not compliant with the programmed requirements.

Modifying the UPS operating mode – ECO MODE

The modification of the UPS operating mode is reserved to skilled personnel.

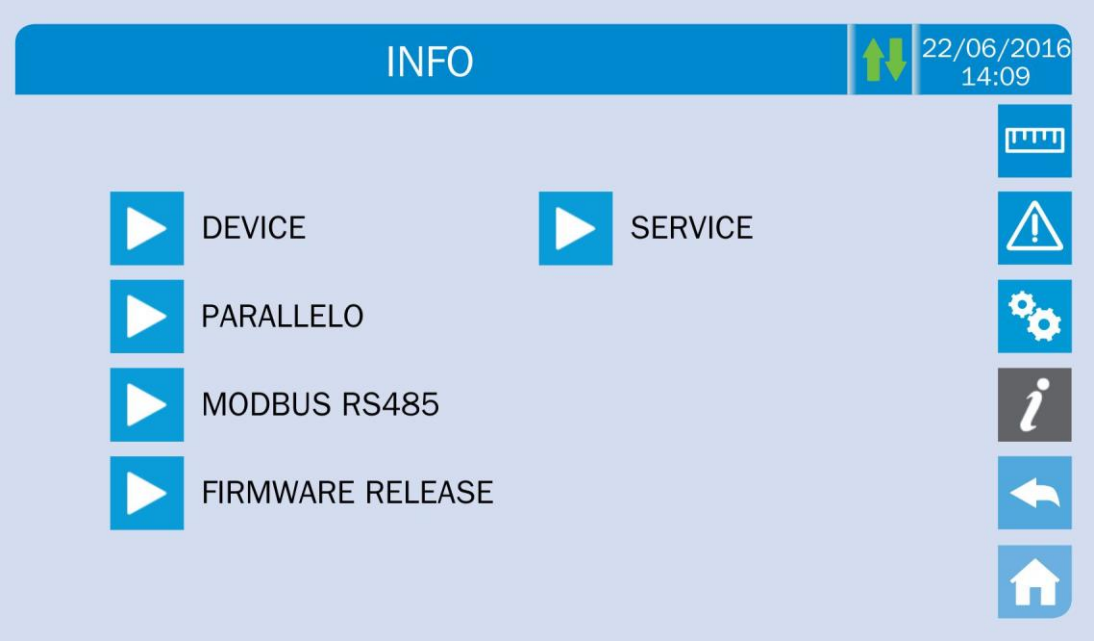
Before setting the system in *ECO MODE* verifiy that the load is suitable for operating in such mode, and that it withstand voltage interruptions for a maximum duration of 10 ms.

It is recommended to operate under the supervision of manufacturer's personnel or following its specific indications.

The manufacturer cannot be considered liable for any damages due to incompetence or inexperience of the customer's authorized personnel.

5.4 SYSTEM INFORMATION

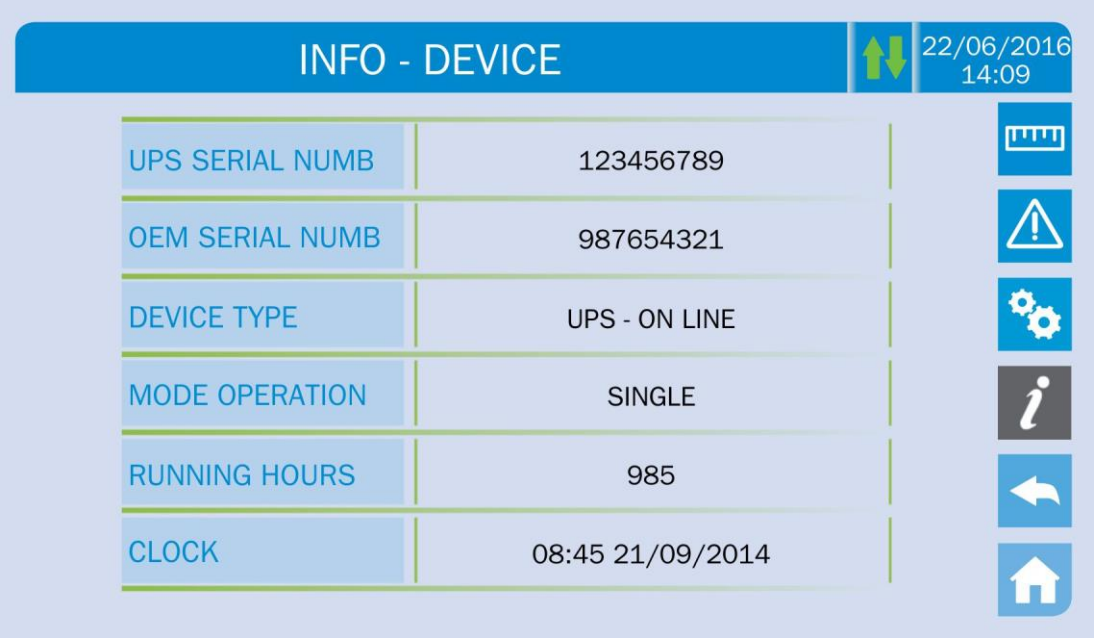
The *INFO* section provides general information about the UPS; press the related icon to open the main page.



Picture 29 – INFO section

All the data shown in the varius sections are set during the factory test via a specific interface software and cannot be modified by anyone, except for personnel authorized by the manufacturer.

5.4.1 Device information

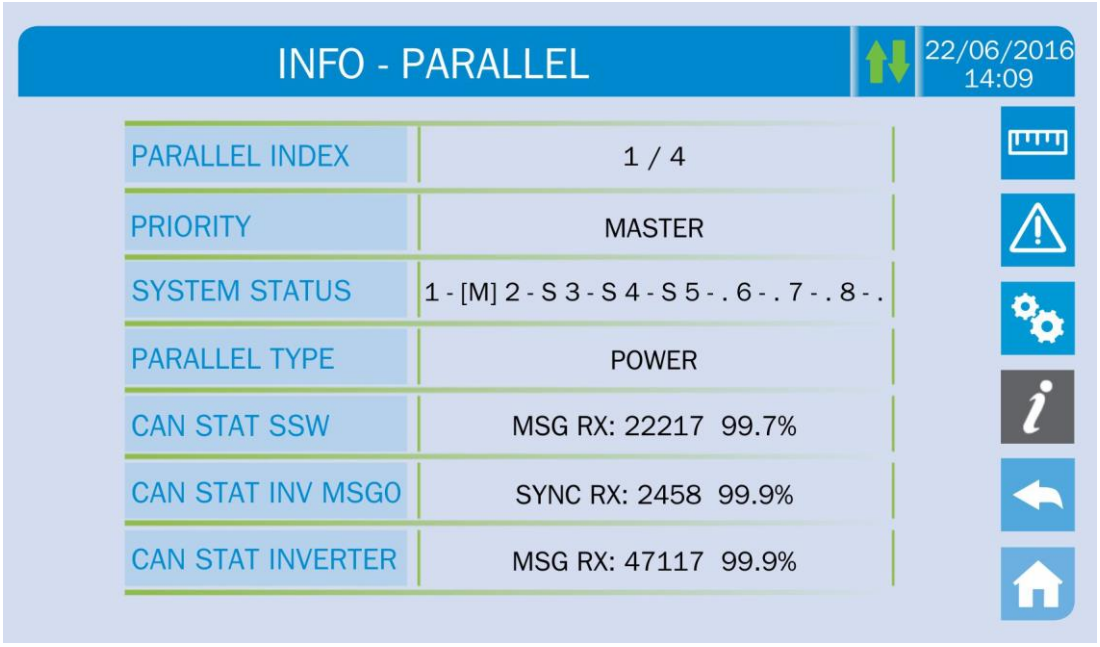


Picture 30 – Device information

Sub-page	Displayed data
SERIAL NUMBER	Serial number assigned by the manufacturer and by a possible OEM distributor
DEVICE TYPE	Device type (ON LINE, ECO,ecc.)
MODE OPERATION	It may be *SINGLE*, or *PARALLEL* in case the system is in parallel with other *UPSaver* UPS's
RUNNING HOURS	Equipment operating hours
CLOCK	Current system date and time setting

5.4.2 Parallel information

The page containing the information about the parallel is only enabled if the UPS is in parallel with other *UPSaver* systems.



Picture 31 – Parallel information

5.4.2.1 Parallel index

The first number identifies the *position* of that specific UPS within the parallel system. The second number represents the total number of *UPSaver* units.

5.4.2.2 Master / Slave priority

The string on the second line may have two values, "MASTER" or "SLAVE". Only one *MASTER UPS* can be present in the system; if not there will be a conflict on the data communication bus.

5.4.2.3 System status (communication bus monitoring)

This field gives a general indication regarding the communication between the UPS units composing the system.

- The numbers represent the single UPS units.
- The letters M and S stand for MASTER and SLAVE respectively.
- The brackets [ ] around a letter indicate that we are working on that specific UPS unit.
- A question mark next to a number indicates that that UPS unit is not communicating on the data bus.

Let us assume to have the following situation:

- system composed of 4 UPS units;
- UPS2 is currently the MASTER UPS;
- we are checking the data communication on UPS3;
- UPS4 is not communicating.

The section will be as shown below.

Picture 32 – Parallel bus communication status

5.4.2.4 Parallel type

The string may have two values, "POWER" or "REDUNDANT+x".

- POWER means that the parallel system is so set as to require the presence of all the UPS units to feed the load.
- REDUNDANT+x means that the system is redundant and the redundancy index is indicated by number "X". For example, in a system composed of 3 UPS units, "REDUNDANT+2" means that only one of the UPS units is sufficient to feed the load.

5.4.2.5 Message statistics

The statistics section regarding the messages exchanged on the communication buses consists of three different parts.

STAT CAN SSW → Number of messages received and percentage of reception accuracy regarding the status of the static switches. The messages are exchanged between all the UPS units, therefore the number will increase on all of them.

STAT CAN INV MSG0 → Number of messages received and percentage of reception accuracy regarding the synchronism signals. The messages are sent by the MASTER UPS, therefore the number will only increase on the SLAVE UPS units.

STAT CAN INVERTER → Number of messages received and percentage of reception accuracy regarding the status of the system. The messages are exchanged between all the UPS units, therefore the number will increase on all of them.

5.4.3 Firmware release

Picture 33 – Firmware release

The second page of the firmware release info contains the license contract related to the *touch screen* operating software.

5.4.4 Service information

The SERVICE menu provides important information regarding the technical service on the UPS. The information is displayed via a text string which chows the contact main details.

However, please also see the addresses and contact numbers indicated in the present manual

5.4.5 RS485 communication information

The *MODBUS RS485* section provides information about the settings of the communication port, as regards the assigned ModBus address, the communication mode and the data transmission speed.

6 FAULTS AND ALARMS

As indicated in the previous chapters, the system is provided with basic diagnostics which allow immediate visualization of the operating conditions.

The *Alarms* icon turns red and the acoustic signal is activated (if enabled). In the *UPS Statis* page both the alarm code and a brief description are shown.

Injury hazard due to electric shock!

Before carrying out any operation on the UPS, make sure that all the safety precautions are adhered to:

- Any work on the unit must be carried out by qualified personnel;
- Internal components can only be accessed after disconnecting the device from supply sources;
- Always use protective devices designed for each type of activity;
- The instructions contained in the manuals must be strictly followed;
- In case of doubt or impossibility of solving the problem, please contact Astrid Energy Enterprises immediately.

6.1 OPERATING STATUS DEFINITION

Status	S1	BOOSTER OK
Description	The rectifier section is working properly.	
Operating condition	The rectifier supplies the inverter and keeps the battery charged.	

Status	S2	BATTERY OK
Description	The battery is connected to the UPS.	
Operating condition	The battery is kept charged by the rectifier and is ready to feed the inverter.	

Status	S3	INVERTER OK
Description	The inverter voltage and frequency are within the allowed range.	
Operating condition	The inverter is ready to feed the load.	

Status	S4	INVERTER --> LOAD
Description	The inverter feeds the load.	
Operating condition	The load is fed via the static inverter switch.	

Status	S5	INV BYPASS SYNC
Description	The inverter is synchronized with the bypass.	
Operating condition	The synchronization between the inverter and the bypass is locked, and the static switch can change over from one source to the other.	

Status	S6	BYPASS OK
Description	The bypass voltage and frequency are within the allowed range.	
Operating condition	The bypass line is ready for changeover in case of inverter failure.	

Status	S7	BYPASS --> LOAD
Description	Load fed by the bypass line.	
Operating condition	The load is fed by the bypass via the static switch, waiting for the inverter to restart.	

Status	S8	INV MASTER SYNC
Description	The inverter is synchronized with the MASTER UPS.	
Operating condition	This status is only present on the SLAVE UPS units, and shows that the inverter is synchronized with the signal sent by the MASTER UPS.	

Status	S10	RECT STANDBY (NOT AVAILABLE)
Description	The rectifier is in standby mode.	
Operating condition	The rectifier is off and ready to be started to charge the battery (*Green Conversion* algorithm).	

Status	S11	INV STANDBY (NOT AVAILABLE)
Description	The inverter is in standby mode.	
Operating condition	The inverter is off and ready to be started in case of anomaly of the bypass mains.	

Status	S12	BATT STANDBY (NOT AVAILABLE)
Description	The battery is in standby mode.	
Operating condition	The battery static switch is open and the battery is disconnected from the DC bus.	

Status	S14	BATT CHARGE I
Description	The battery is charging.	
Operating condition	The battery static switch is closed and the battery is in the first phase of the I/U charging mode (DIN 41773), with constant current and increasing voltage.	

Status	S15	BATT CHARGE U
Description	The battery is charging.	
Operating condition	The battery static switch is closed and the battery is in the second and final phase of the I/U charging mode (DIN 41773), with constant voltage and decreasing current.	

6.2 TROUBLESHOOTING

Alarm	A1	MAINS FAULT
Description	The voltage or frequency of the input line are out of tolerance.	
Possible causes	➢ Mains instability or failure. ➢ Wrong phase rotation.	
Solutions	1. Check the connections to the mains. 2. Check the stability of mains voltage. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A2	INPUT WRONG SEQ
Description	The phase rotation on the rectifier input line is wrong.	
Possible causes	➢ Wrong connection of power cables.	
Solutions	1. Check the phase rotation. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A3	BOOSTER STOPPED
Description	The rectifier has been temporarily disconnected and the inverter is fed by the battery.	
Possible causes	➢ Instability of the AC line voltage or frequency. ➢ Possible fault in the rectifier control circuit.	
Solutions	1. Check the parameters of the AC line voltage. 2. Restart the device. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A4	BOOSTER FAULT
Description	The rectifier has been disconnected due to an internal fault.	
Possible causes	➢ Possible fault in the rectifier control circuit.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. Restart the device. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A5	DC VOLTAGE FAULT
Description	The measured DC voltage is out of tolerance.	
Possible causes	➢ The battery has reached the discharge voltage due to a power failure. ➢ Measuring circuit failure.	
Solutions	1. Check the actual value of the measured DC voltage. 2. In case of mains failure, wait for the AC voltage to be restored. 3. Check which alarms are present and carry out the indicated procedures. 4. Restart the device. 5. If the alarm persists, contact our Technical Support Service.	

Alarm	A6	BATTERY IN TEST
Description	The rectifier voltage is reduced to start a short controlled discharge of the battery.	
Possible causes	➢ A battery test has been started automatically (if set), or manually by the user.	
Solutions	1. Wait for the test to end, and check possible battery faults.	

Alarm	A7	BCB OPEN
Description	The battery isolator is open.	
Possible causes	➢ Battery isolator open.	
Solutions	1. Check the status of the battery isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. Check the connection between the auxiliary contact of the isolator and the auxiliary terminals of the UPS (if provided). 4. If the alarm persists, contact our Technical Support Service.	

Alarm	A8	BATTERY DISCHARGE
Description	The battery is discharging.	
Possible causes	➢ The battery is discharging due to a mains failure. ➢ Rectifier failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A9	BATTERY AUT END
Description	The battery has reached the pre-alarm discharge level.	
Possible causes	➢ The battery is discharging due to a mains failure. ➢ Rectifier failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A10	BATTERY FAULT
Description	Fault following a battery test.	
Possible causes	➢ Battery fault.	
Solutions	1. Check the battery. 2. Reset the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A11	SHORT CIRCUIT
Description	The current sensor has detected a short-circuit at the output.	
Possible causes	➢ Load problem. ➢ Measuring circuit failure.	
Solutions	1. Check the loads connected to the UPS output. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A12	STOP TIMEOUT SC
Description	Inverter shutdown due to an extended short-circuit during a power failure, or due to an overcurrent on the inverter bridge input.	
Possible causes	➢ Short-circuit on the loads during a power failure. ➢ Inverter bridge fault. ➢ Temporary current peak.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A13	INV OUT OF TOL
Description	The inverter voltage or frequency are out of tolerance.	
Possible causes	➢ Inverter shutdown due to an alarm. ➢ Inverter failure.	
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A14	BYPASS WR SEQ
Description	The phase rotation of the bypass line is wrong.	
Possible causes	➢ Wrong connection of power cables.	
Solutions	1. Check the phase rotation. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A15	BYPASS FAULT
Description	The voltage or frequency of the bypass line are out of tolerance.	
Possible causes	➢ Bypass line instability or failure. ➢ Wrong phase rotation.	
Solutions	1. Check the connections to the mains. 2. Check the stability of mains voltage. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A16	BYPASS --> LOAD
Description	The load is fed by the bypass line.	
Possible causes	➢ Temporary changeover due to inverter failure.	
Solutions	1. Verify the inverter status and check whether other alarms are present. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A17 RETRANSFER BLOCK
Description	The load is blocked on the bypass line.
Possible causes	➢ Very frequent changeovers due to load in-rush currents. ➢ Static switch problems.
Solutions	1. Reset the system. 2. Check the in-rush currents of the loads. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A18 MBCB CLOSED
Description	The manual bypass isolator is closed.
Possible causes	➢ Manual bypass isolator closed.
Solutions	1. Check the status of the manual bypass isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A19 OCB OPEN
Description	The output isolator is open.
Possible causes	➢ Output isolator open.
Solutions	1. Check the status of the output isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A20 OVERLOAD
Description	The current sensor has detected an overload at the output. If the alarm persists, the thermal image protection will be activated (alarm A21).
Possible causes	➢ Output overload. ➢ Measuring circuit failure.
Solutions	1. Check the loads connected to the UPS output. 2. Contact our Technical Support Service.

Alarm	A21 THERMAL IMAGE
Description	The thermal image protection has been activated after an extended inverter overload. The inverter is shut down for 30 minutes and then restarted.
Possible causes	➢ Output overload. ➢ Measuring circuit failure.
Solutions	1. Check the loads connected to the UPS output. 2. Should you need to restore the inverter supply immediately, reset the system. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A22 BYPASS SWITCH
Description	The "Normal/Bypass" selector has been operated.
Possible causes	➢ Maintenance operation.
Solutions	1. Check the selector position. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A23 EPO PRESSED
Description	The system is blocked due to the activation of the emergency power off button.
Possible causes	➢ Activation of the (local or remote) emergency power off button.
Solutions	1. Release the emergency power off button and reset the alarm. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A24 HIGH TEMPERATURE
Description	High temperature of the heat sink on the inverter bridge or tripping of the DC fuses which protect the inverter bridge.
Possible causes	➢ Fault of the heat sink cooling fans. ➢ The room temperature or cooling air temperature is too high. ➢ Tripping of the DC protection fuses.
Solutions	1. Check the fans operation. 2. Clean the ventilation grids and the air filters, if any. 3. Check the air conditioning system (if present). 4. Check the status of the DC fuses on the inverter bridge input. 5. If the alarm persists, contact our Technical Support Service.

Alarm	A25 INVERTER OFF
Description	The inverter is blocked due an operation failure.
Possible causes	➢ Various.
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A26 COMMUNIC ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. If the alarm persists, contact our Technical Support Service.

Alarm	A27 EEPROM ERROR
Description	The controller has detected an error in the parameters stored in EEPROM.
Possible causes	➢ Wrong parameters entered during programming.
Solutions	1. Contact our Technical Support Service.

Alarm	A28 CRITICAL FAULT
Description	An alarm has been activated which causes the shutdown of part of the UPS (rectifier, inverter, static switch).
Possible causes	➢ System failure.
Solutions	1. Check which alarms are present and carry out the indicated procedures. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A29 MAINTENANCE REQ
Description	It is necessary to carry out maintenance work.
Possible causes	➢ The time limit since the last maintenance work has elapsed.
Solutions	1. Contact our Technical Support Service.

Alarm	A30 COMMON ALARM
Description	Common alarm.
Possible causes	➢ At least one alarm is present.
Solutions	1. Check which alarms are present and carry out the indicated procedures.

Alarm	A31 MBCB BUS CLOSED
Description	The manual bypass isolator is closed.
Possible causes	➢ Manual bypass isolator closed.
Solutions	1. Check the status of the manual bypass isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A32 EPO BUS CLOSED
Description	The system is blocked due to the activation of the emergency power off button.
Possible causes	➢ Activation of the (local or remote) emergency power off button.
Solutions	1. Release the emergency power off button and reset the alarm. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A33 ASYMMETRIC LOAD
Description	The positive and negative voltages measured on the DC capacitors towards the middle point are different.
Possible causes	➢ Possible failure on the measuring circuit. ➢ Possible fault of DC capacitors.
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A34 SERVICE REQUIRED
Description	A UPS check is necessary.
Possible causes	➢ Possible UPS fault.
Solutions	1. If the alarm persists, contact our Technical Support Service.

Alarm	A35	DIESEL MODE
Description	The UPS is supplied by the diesel generator.	
Possible causes	➢ The auxiliary contact which activates the diesel generator connected to the UPS is closed, and imposes this operating mode.	
Solutions	1. Wait for the diesel generator to stop as soon as the mains voltage is restored. 2. Check the connection of the auxiliary contact which signals the diesel generator start, to terminals XD1/XD2. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A36	DC FASTSHUTDOWN
Description	Inverter shutdown due to the operation of the protection sensor as a result of sudden DC voltage variations.	
Possible causes	➢ Battery fault.	
Solutions	1. Check the battery. 2. Reset the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A38	INV --> LOAD
Description	The load is fed by the inverter. This alarm is active for UPS systems in "ECO" mode, where the preferential supply is from the bypass line.	
Possible causes	➢ Temporary changeover due to bypass line failure.	
Solutions	1. Verify the status of the bypass line and check whether other alarms are present. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A39	INV ERROR LOOP
Description	The control is not able to regulate the inverter voltage precisely.	
Possible causes	➢ Regulation system failure.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A40	SSI FAULT
Description	The system has detected a failure in the static inverter switch.	
Possible causes	➢ Possible problems on the loads. ➢ Static switch fault.	
Solutions	1. Check the absorption of the loads and the presence of DC components, if any, on AC current. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A41	RECT ERROR LOOP
Description	The control is not able to regulate the rectifier output voltage precisely.	
Possible causes	➢ Regulation system failure.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A44	DESATURATION (NOT AVAILABLE)
Description	The inverter is blocked due to the operation of the desaturation sensor of the IGBT drivers.	
Possible causes	➢ Inverter bridge fault.	
Solutions	1. Reset the system. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A45	HIGH TEMPERATURE SSW
Description	High temperature of the heat sink on the static switch.	
Possible causes	➢ Fault of the heat sink cooling fans. ➢ The room temperature or cooling air temperature is too high.	
Solutions	1. Check the fans operation. 2. Clean the ventilation grids and the air filters, if any. 3. Check the air conditioning system (if present). 4. If the alarm persists, contact our Technical Support Service.	

Alarm	A46 PAR LOST REDUND
Description	This alarm is only active on PARALLEL systems. Continuity is not ensured in the event of a fault on one of the UPS units.
Possible causes	➢ The total load is higher than the maximum expected value. ➢ Possible failure on the measuring circuit.
Solutions	1. Check the load fed by the system. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A47 SEND PARAM ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A48 RCV PARAM ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A49 TEST MODE ERROR
Description	Internal error.
Possible causes	➢ Microcontroller communication problems.
Solutions	1. Contact our Technical Support Service.

Alarm	A51	BATT TEMPERATURE
Description	The battery temperature is out of tolerance. This alarm is only active when the temperature probe is installed and enabled on the battery.	
Possible causes	➢ Anomalous temperature in the battery cabinet. ➢ Possible failure on the measuring circuit.	
Solutions	1. Check the temperature on the batteries and remove the cause of the alarm, if any. 2. If the alarm persists, contact our Technical Support Service.	

Alarm	A53	FIRMWARE ERROR
Description	The controller has detected an incompatibility in the control software.	
Possible causes	➢ The software update was not performed properly.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A54	CAN ERROR
Description	Internal error.	
Possible causes	➢ Microcontroller communication problems.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A55	PAR CABLE DISC
Description	Parallel cable doesn't communicate.	
Possible causes	➢ Parallel cable disconnected or damaged.	
Solutions	1. Check the connection of cable 2. Contact our Technical Support Service.	

Alarm	A56	MAINS UNBALANCE
Description	The rectifier input voltage is unbalanced.	
Possible causes	➢ Problems on the LV or MV distribution network ➢ Defect of the measuring circuit	
Solutions	1. Check the input voltage 2. Contact our Technical Support Service.	

Alarm	A59 BACKFEED RELAY ON
Description	The backfeed protection has been activated. Alarms present only in the history log.
Possible causes	➢ Problems on the bypass static switch
Solutions	1. Check the static switch thyristors 2. Contact our Technical Support Service.

Alarm	A61 LOSS OF REDUNDANT POWER SUPPLY
Description	Failure of the redundant auxiliary power supply .
Possible causes	➢ Internal fault.
Solutions	1. Contact our Technical Support Service.

Alarm	A62 MAINS OVERVOLTAGE
Description	Sudden increase of the AC input voltage (fast sensor)
Possible causes	➢ Voltage spike on the AC mains. ➢ Possible internal fault.
Solutions	1. Check the mains voltage. 2. If the alarm persists, contact our Technical Support Service.

Alarm	A63 START SEQ BLOCK
Description	During the UPS start-up a failure prevented the proper execution of the sequence.
Possible causes	➢ Control devices in wrong position or operated improperly. ➢ Possible internal fault.
Solutions	1. Make sure the position of the control devices (isolators, selectors) is as specified in the procedures (see "Installation and start-up" section). 2. If the alarm persists, contact our Technical Support Service.

Alarm	A64 MAINS UNDERVOLTAGE
Description	Sudden drop of the AC input voltage (fast sensor)
Possible causes	➢ Voltage drop on the AC mains (brown-out). ➢ Possible internal fault.
Solutions	1. Check the mains voltage. 2. If the alarm persists, contact our Technical Support Service.