ИБП Borri UPsaver - руководство по эксплуатации. Юниджет

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UPS OPERATING MANUAL

UPSaver 400-1600 kVA

WARNING: This is a product for commercial and industrial application in the second environment - installation restrictions or additional measures may be needed to prevent disturbance

UPS OPERATING MANUAL

Index of the sections		Code
1 –	WARNINGS AND GENERAL INFORMATION	OMH44148
2 –	INSTALLATION AND START-UP	OMH44149
3 –	UPS USER MANUAL	OMH44150

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					Codice / Code		
					OMH44147		

WARNINGS AND GENERAL INFORMATION

Index

Thank you for choosing a Borri product. This section of the manual contains indications regarding the symbols used in the UPS documentation as well as basic information about the product, including the factory warranty terms.

1 CONVENTIONS USED

The following symbols have been used to indicate potential dangers and to highlight useful information, so as to minimize the risks to persons and property.

HAZARD

"HAZARD" statements contain characteristics and basic instructions for the safety of persons. Non-compliance with such indications may cause serious injury or death.

WARNING

"WARNING" statements contain characteristics and basic instructions for the safety of persons. Non-compliance with such indications may cause injury.

CAUTION

"CAUTION" statements contain characteristics and important instructions for the safety of things. Non-compliance with such indications may cause damage to materials.

NOTE

"NOTE" statements contain characteristics and important instructions for the use of the device and for its optimal operation.

2 DOCUMENTATION NOTES

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.

3 CONTACTS

For any information about the UPS systems manufactured by BORRI, please contact:

Borri S.p.A.
Via 8 Marzo, 2
52010 Soci - Bibbiena
AREZZO
Tel. 0575 5351
Fax 0575 561438
info@borri.it
www.borri.it

For help with technical problems or for information concerning device use and maintenance, please contact the technical help service by phoning the above-indicated telephone number, specifying the following data:

- Type of device and its nominal power
- Serial number
- Error code, if applicable.

4 FACTORY WARRANTY

The factory warranty provided by Borri S.p.A. is subject to the terms indicated below.

Validity

a) The present warranty terms only apply to the UPS systems manufactured by Borri and to their storage batteries, when supplied by Borri.

Duration

a) The factory warranty provided by Borri S.p.A. has a validity of 12 (twelve) months from the startup date of the UPS. The warranty expires at the latest 18 (eighteen) months from the purchasing date (invoicing).

General conditions

a) The execution of one or more repairs within the warranty time will not alter the original expiry of the warranty.

b) If a unit is faulty and/or damaged within the time frame covered by the warranty, it will be repaired or replaced with an equivalent or similar product.

Costs

a) The warranty covers all the costs resulting from repairs and/or spares to restore the correct operation of the product covered by our factory warranty.

b) All other costs, particularly shipping costs, travel and accommodation costs for the service personnel of Borri S.p.A. for on-site repairs, as well as costs for the customer's own employees, will not be covered by the factory warranty and will be charged to the end customer.

c) In case of service performed following a call made by mistake, or in case our technicians incur extra time and/or costs due to the site inaccessibility or due to work interruptions required by the customer, such costs will be invoiced in accordance with ANIE rates CLASS III COLUMN B.

Modes required

a) In the event of a fault covered by the warranty, the customer shall notify Borri S.p.A. in writing of the occurred fault, providing a short description of the fault.

b) The customer shall also provide documents showing the validity of the warranty (receipt/purchasing invoice with serial number of the product – report indicating the start-up date).

Service at the installation site

a) During preventive maintenance visits or emergency service, access shall be ensured to the installation site, and the device shall be made available in order to ensure maintenance or repair with no waiting time.

b) During the intervention, the customer's representative must attend service operations at the installation site, so that he/she may operate the control devices outside the equipment.

c) In case entry permits are necessary in order to enter the installation site, Borri S.p.A. must be notified of the time necessary to obtain the documentation required, if any.

d) In case of customer's non-compliance, Borri S.p.A. reserves the right to refuse warranty service. Borri S.p.A. will not accept any product returned for repair or replacement without prior agreement.

Exclusions

a) Our warranty does not cover the products which are faulty or damaged due to:
   - Transport,
   - Installation or start-up defects caused by the customer's non-compliance with the installation and use instructions provided by Borri S.p.A.
   - Tampering, alterations or repair attempts made without the specific written approval by Borri S.p.A.
   - Damage caused by work done by personnel not authorized by Borri S.p.A.
   - Damage to the device caused by improper use, negligence, voluntary damage or use of the device beyond the allowed limits;
   - Damage caused by external factors such as dirt, fire, flooding, failed operation of the air conditioning system, etc.;
   - Non-compliance with applicable safety standards;
   - Force majeure (e.g. lightning, surges, natural disasters, fire, acts of war, riots, etc.);
   - Fall or displacement due to incorrect installation;
   - Ordinary wear caused by proper and continuous use of the device.

b) Protective devices inside the units (fuses and dischargers) are also excluded from the warranty, unless the failure is due to component faults.

Responsibility

a) In no event shall Borri S.p.A. be liable for direct or indirect damage, or any damage whatsoever connected with the execution of warranty services (e.g. possible voltage interruptions during the repair period or assembly and dismantling costs), except for the cases provided for by mandatory laws.

b) The present warranty terms do not affect the purchaser's mandatory rights as by law.

5 LIMITATION OF LIABILITY

All the information contained in the present documentation is the exclusive property of Borri S.p.A. Written consent by Borri S.p.A. is required in order to wholly or partially publish or disclose this information.

- The present manual constitutes an integral part of the product technical support documentation. Read the warnings with attention, as they give important instructions concerning safe usage.
- The equipment must be destined exclusively for the use for which it was expressly designed. Any other use is considered improper and therefore hazardous. The manufacturer cannot be held responsible for possible damage arising from improper, erroneous or unreasonable usage.
- Borri assumes responsibility for the equipment in its original configuration.
- Any intervention that alters the structure or the operating cycle of the equipment must be carried out and authorized directly by Borri.
- Borri will not be held responsible for the consequences arising from the use of non-original spare parts.
- Borri reserves the right to make technical modifications to the present manual and to the equipment without prior warning. Whenever typographical or other errors are found, the corrections will be included in new versions of the manual.
- Borri assumes responsibility for the information given in the original version of the manual in Italian language.

UPSAVER INSTALLATION AND START-UP

Index

Index of the pictures

1 APPLICABILITY

The instructions contained in the operating manual are applicable to the UPS systems of the *UPSaver* series, in all their possible power configurations.

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

2.1 USING THE DEVICE

Congratulations on choosing a product from Borri S.p.A. for the safety of your equipment. To obtain the best performance from your *UPSaver* system, we suggest that you take your time to read the following manual.

The purpose of this manual is to give a short description of the parts composing the UPS and to guide the installer or the user through the installation of the unit in its using environment.

The installer or the user must read and correctly perform the instructions included in the present manual, with particular reference to the requirements regarding safety, in compliance with the current regulations.

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.

2.2 SYSTEM RATING

The UPS *UPSaver* is provided with an identification plate containing the operation rating parameters. The plate is fixed on the inside of the I/O module door.

BORRI	**UPSaver GPU**
UPS	**800kVA - 3Φ+N**
RETE 1 - MAINS 1 - NETZ 1	
Uin (Vac)	400 -20/+15%
Iin (A)	1209
Frequenza - Frequency - Frequenz	50÷60Hz ±10%
RETE 2 - MAINS 2 - NETZ 2	
Uin (Vac)	380/400/415 ±10%
Iin (A)	1155
Imax (A)	1733
Frequenza - Frequency - Frequenz	50÷60Hz ±10%
USCITA - OUTPUT - AUSGANG	
Uout (Vac)	380/400/415
Iout (A)	1155 *
Frequenza - Frequency - Frequenz	50÷60Hz
Potenza - Power rating - Leistung	800kVA 800kW (* @ 400V)
Articolo - Code - Code	**BSH44-800-004**
N° Serie - Serial number - Seriennummer	**F13S09001**
Numero unità-Unit number-Stuck :	**1/1**
	690 kg
CE **Made in ITALY**	**According to ISO9001:2008 ISO14001**
Service: www.borri.it	

Picture 1 – UPSaver rating plate

Check the technical characteristics

Before carrying out any installation or start-up operation on the UPS, make sure its technical characteristics are compatible with the AC supply line and with the output loads.

System ratings related to the I/O module

The data indicated in the rating plate are related to the maximum power configuration of the I/O module. Refer to the following paragraph for further information.

2.2.1 Actual power configuration

The *UPSaver* system is, by definition, a modular UPS, that can be initially configured for a certain power, which can be increased at a later stage by adding power modules. The maximum power cannot exceed the I/O module rating.

For such reason the rating plate is integrated with an additional section, which indicates the possible system configurations, on the basis of the number of installed power modules (see following picture).

The system test configuration is marked with a tick; the plate can be replaced in case of increase (or decrease) of the UPS rated power, that is in case power modules are added or removed.

UPSaver GPU 800kVA - F13S09001

Configurazione moduli di potenza - Power modules configuration - Konfiguration leistungs-module

200 kVA	400 kVA	600 kVA	800 kVA
☐	☐	☐	☐

UPSaver GPU 1600kVA - F17S12001

Configurazione moduli di potenza - Power modules configuration - Konfiguration leistungs-module

1000 kVA	1200 kVA	1400 kVA	1600 kVA
☐	☐	☐	☐

Picture 2 – Actual power configuration plates

2.3 SPECIAL SAFETY WARNINGS

2.3.1 General warnings

The *UPSaver* UPS is provided with various stickers with indications regarding specific dangers. These stickers must be always well visible and replaced in case they are damaged.

The present documentation must be always available in proximity to the device. In case of loss we recommend to request a copy to the manufacturer, whose details are available in the "Contacts" section.

2.3.2 Personnel

Any operation on the *UPSaver* UPS must be carried out by qualified personnel.

By qualified and trained person we mean someone skilled in assembling, installing, starting up and checking the correct operation of the product, who is qualified to perform his/her job and has entirely read and understood this manual, especially the part regarding safety. Such training and qualification shall be considered as such, only when certified by the manufacturer.

2.3.3 Transport and handling

Avoid bending or deforming the components and altering the insulation distances while transporting and handling the product.

Undistributed weight

The weight of the UPS is not uniformly distributed. Pay attention when lifting.

Please inspect the device before installing it. In case any damage is noticed from the conditions of the package and/or from the outside appearance of the equipment, contact the shipping company or your dealer immediately. The damage statement must be made within 6 days from receipt of the product and must be notified to the shipping carrier directly. Should the product need to be returned to the manufacturer, please use the original package.

Injury hazard due to mechanical damage

Mechanical damage to the electrical components constitutes a serious danger to persons and property. In case of doubt regarding the non-integrity of the package or of the product contained therein, contact the manufacturer before carrying out the installation and/or the start-up.

2.3.4 Installation

The product must be installed in strict compliance with the instructions contained in the technical back-up documentation, including the present safety instructions. In particular, the following points must be taken into account:

- The product must be placed on a base suitable to carry its weight and to ensure its vertical position;
- The UPS must be installed in a room with restricted access, according to the EN62040-1 standard;
- Never install the equipment near liquids or in an excessively damp environment;

- Never let a liquid or foreign body penetrate inside the device;
- Never block the ventilation grates;
- Never expose the device to direct sunlight or place it near a source of heat.

Special environmental conditions

The *UPSaver* UPS is designed for normal climatic and environmental operating conditions as defined in the technical specification: altitude, ambient operating temperature, relative humidity and environmental transport and storage conditions. It is necessary to implement specific protective measures in case of unusual conditions:

- harmful smoke, dust, abrasive dust;
- humidity, vapour, salt air, bad weather or dripping;
- explosive dust and gas mixture;
- extreme temperature variations;
- bad ventilation;
- conductive or radiant heat from other sources;
- strong electromagnetic fields;
- radioactive levels higher than those of the natural environment;
- fungus, insects, vermin.

Use authorized personnel only

All transport, installation and start-up operations must be carried out by qualified and trained personnel.

The installation of The *UPSaver* UPS must be carried out by authorized personnel, in compliance with national and local regulations.

Do not modify the device

Do not modify the device in any way: this may result in damage to the equipment itself as well as to objects and persons. Maintenance and repair must be carried out by authorized personnel only. Contact the manufacturer for details of the nearest service centre.

2.3.5 Electrical connection

The UPS connection to the AC power must be carried out in compliance with the current regulations.

Make sure the indications specified on the identification plate correspond to the AC power system and to the actual electrical consumption of all of the equipment connected.

Check the conformity to the Standards

The UPS must be installed in compliance with the standards in force in the country of installation.

IT system

The UPS is also designed to be connected to an IT power distribution system.

All the electrical connections must be carried out by authorized personnel. Before connecting the device make sure that:

- the connection cable to the AC line is properly protected;
- the nominal voltages, the frequency and the phase rotation of the AC supply are respected;
- the polarities of the DC cables coming from the battery have been checked;
- no leakage current to earth is present.

The device is connected to the following voltage supplies:

- DC battery voltage;
- AC mains voltage;
- AC bypass voltage.

Injury hazard due to electric shock!

The device is subject to high voltages, thus all safety instructions must be scrupulously adhered to before performing any operation on the *UPSaver* UPS:

- Isolate the battery via DC circuit breakers before connecting it to the UPS;
- Connect the ground cable to the relevant bar before carrying out any other connection inside the device.

Injury hazard due to electric shock!

If primary power isolators are installed in an area other than the UPS one, you must stick the following warning label on the UPS. “ISOLATE THE UNINTERRUPTIBLE POWER SUPPLY (UPS) BEFORE WORKING ON THIS CIRCUIT”

2.3.6 Operation

The installations to which the UPS systems belong must comply with all the current safety standards (technical equipment and accident-prevention regulations). The device can be started, operated and disconnected only by authorized personnel.

The settings can only be changed using the original interface software.

Injury hazard due to electric shock!

During operation, the *UPSaver* UPS converts power characterized by high voltages and currents.

- All the doors and the covers must remain closed.

Injury hazard due to contact with toxic substances

The battery supplied with the UPS contains small amounts of toxic materials. To avoid accidents, the directives listed below must be observed:

- Never operate the UPS if the ambient temperature and relative humidity are higher than the levels specified in the technical documentation.
- Never burn the battery (risk of explosion).
- Do not attempt to open the battery (the electrolyte is dangerous for the eyes and skin).

Comply with all applicable regulations for the disposal of the battery.

2.3.7 Maintenance

Service and repairs must be carried out by skilled and authorized personnel. Before carrying out any maintenance operation, the *UPSaver* UPS must be disconnected from AC and DC supply sources.

The device is provided with internal isolators which allow to isolate the internal power circuits. However the voltages of the supply sources are present on the terminals. To isolate the device completely, provide external circuit breakers on the lines.

The device contains dangerous voltages even after shutdown and disconnection from the supply sources, due to the internal capacitors which discharge slowly. Thus we recommend to wait at least 5 minutes before opening the device doors.

Injury hazard due to electric shock!

Any operation must be carried out only when voltage is absent and in compliance with safety directives.

- Make sure the battery circuit breaker that may be placed near the battery has been opened.
- Isolate the device completely by operating the external circuit breakers.
- Wait at least 5 minutes in order to allow the capacitors to discharge.

After switching off and disconnecting the device there still might be very hot components (magnetic parts, heat sinks); therefore we recommend to use protective gloves.

High temperature of components

It is strongly recommended to use protective gloves due to the high temperatures that may be reached during the operation.

2.3.8 Storage

If the product is stored prior to installation, it should remain stored in its original package in a dry place with a temperature ranging from -10°C to +45°C.

Special environmental conditions

It is necessary to implement specific protective measures in case of unusual environmental conditions:

- harmful smoke, dust, abrasive dust;
- humidity, vapour, salt air, bad weather or dripping;
- explosive dust and gas mixture;
- extreme temperature variations;
- bad ventilation;
- conductive or radiant heat from other sources;
- fungus, insects, vermin.

2.4 ENVIRONMENTAL PROTECTION

2.4.1 ISO 14001 certification

Borri S.p.A. is particularly sensitive to the environmental impact of its products. That is why the *UPSaver* UPS has been manufactured with cutting-edge eco-design criteria (ISO 14001 certification).

Special care was taken in using fully recyclable materials and in reducing the amounts of raw materials used.

2.4.2 Recycling of packing materials

Packing materials must be recycled or disposed of in compliance with applicable local and national laws and regulations.

2.4.3 Device disposal

At the end of their product life, the materials composing the device must be recycled or disposed of in compliance with the current local and national laws and regulations.

3 INSTALLATION

3.1 RECEIPT OF THE UPS

Please inspect the device before installing it. In case any damage is noticed from the conditions of the package and/or from the outside appearance of the equipment, contact the shipping company or your dealer immediately. The damage statement must be made within 6 days from receipt of the product and must be notified to the shipping carrier directly. Should the product need to be returned to the manufacturer, please use the original package.

Danger to persons due to transport damages

Mechanical damage to the electrical components constitutes a serious danger to persons and property. In case of doubt regarding the non-integrity of the package or of the product contained therein, contact the manufacturer before carrying out the installation and/or the start-up.

3.1.1 Storage

The package normally ensures protection from humidity and possible damages during transport. Do not store the UPS outdoor.

Risk of damage due to inappropriate storage

- For the environmental storage conditions, refer to the indications given for the installation of the device.
- The device must only be stored in rooms protected from dust and humidity.
- The device cannot be stored outdoor.

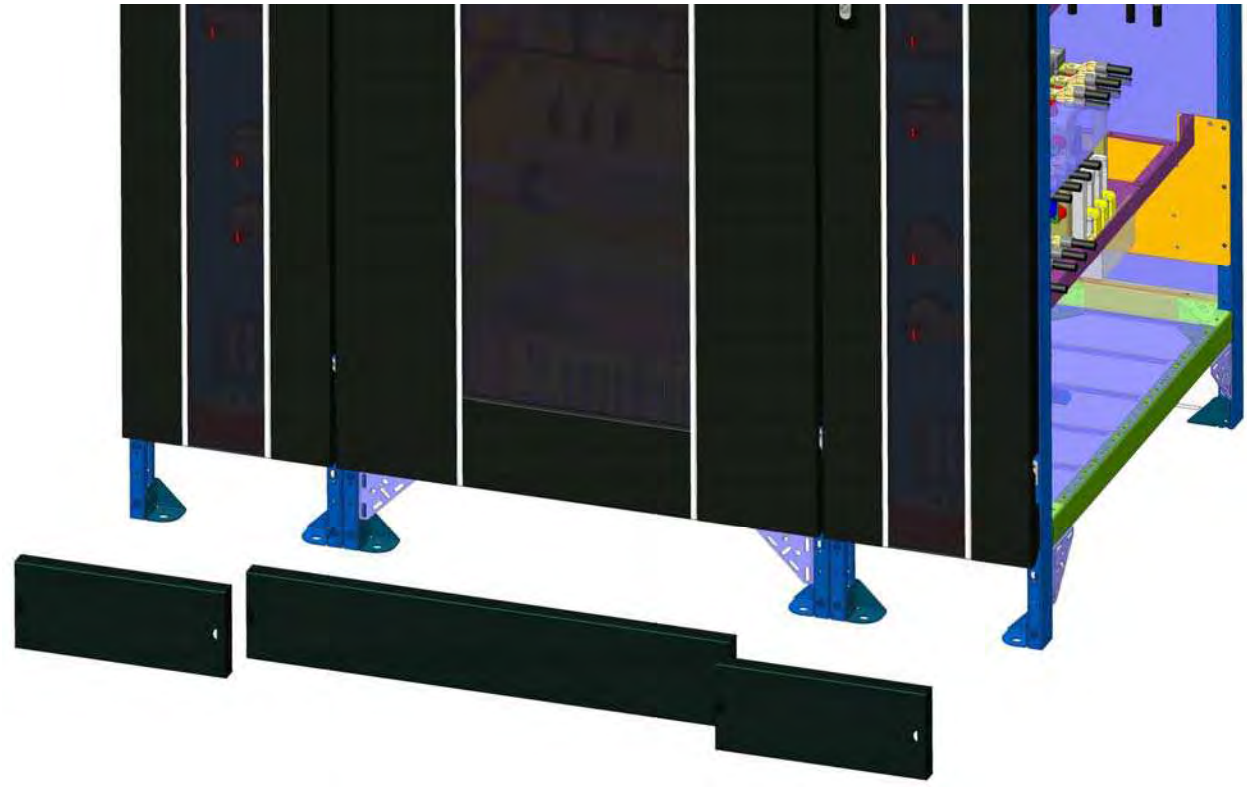
3.2 HANDLING THE UPS

The various parts composing the UPS are packed on wooden pallet; they are handled from the transport vehicle to the installation (or storage) place by a fork lift.

The device has a heavy weight

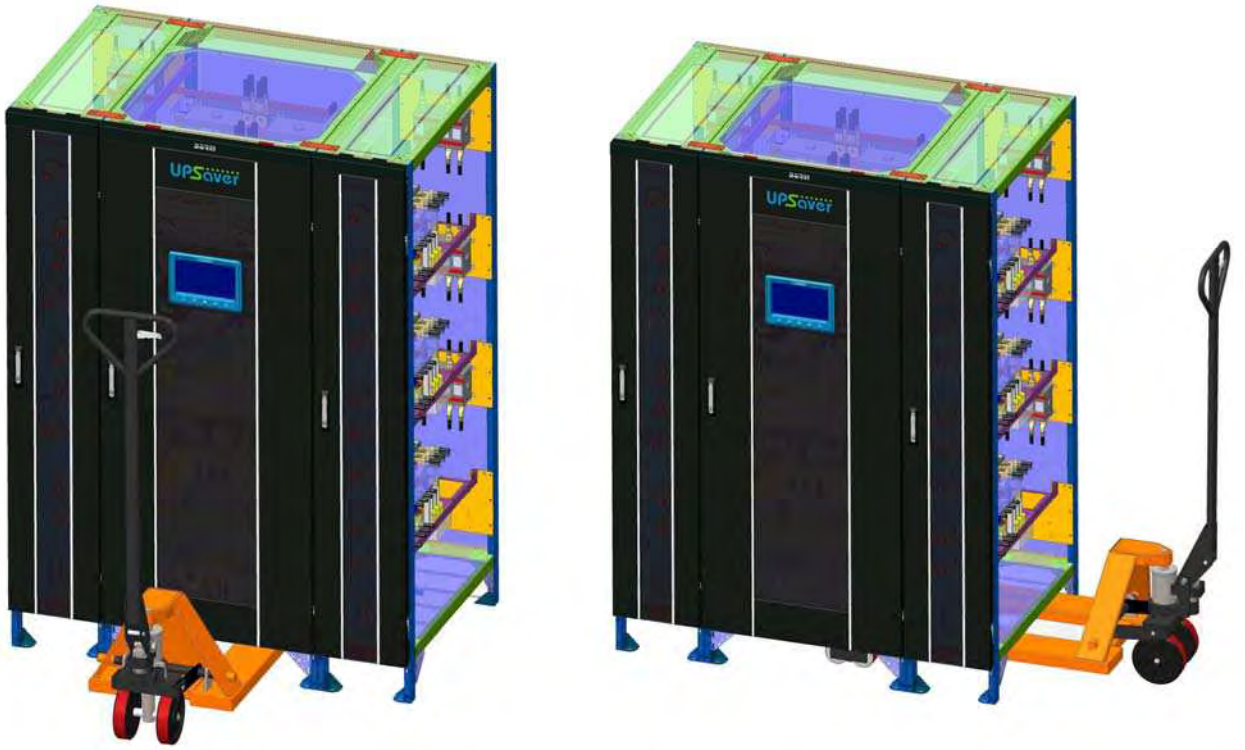
- Avoid turnover during the transport of the UPS.
- Cabinets must always be handled in upright position.
- During loading and unloading operations, always respect the indications regarding the device barycentre marked on the package.

To handle the UPS remove the lower front and rear panel and insert the forks of a fork lift.



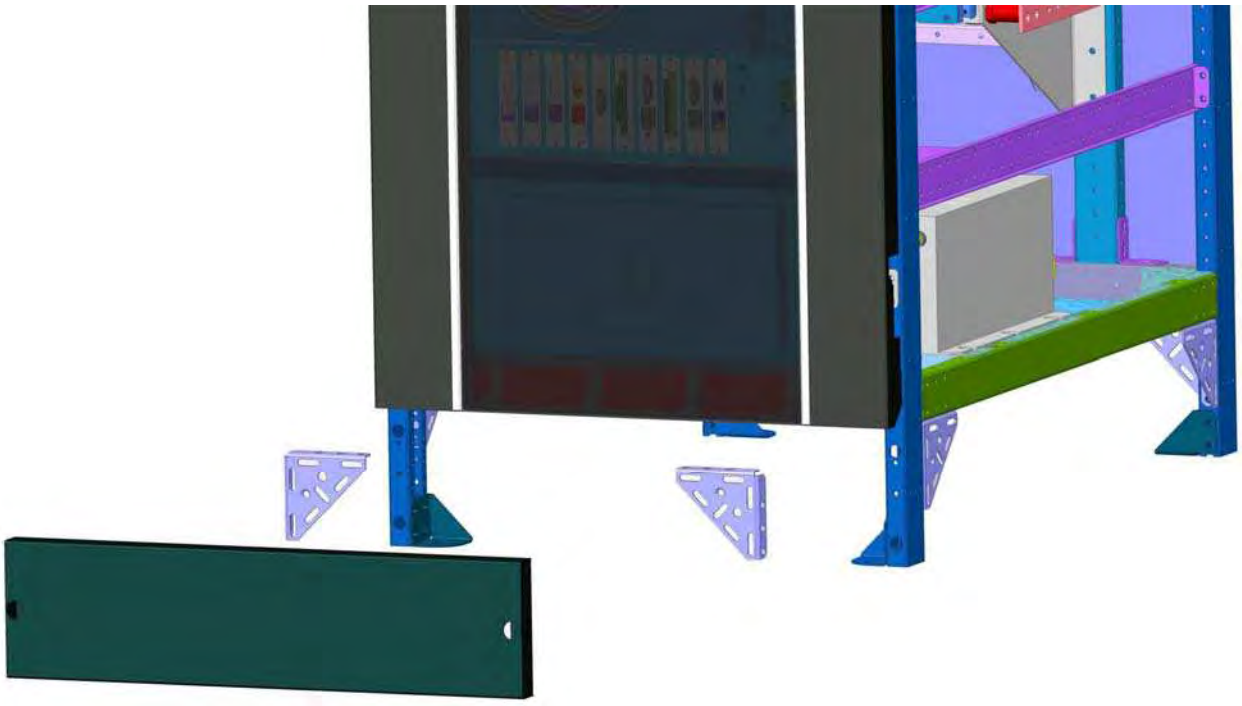
Picture 3 – Panels removal on I/O module

The I/O module can be handled both from the front and from the side according to the available spaces, as shown by the following picture.



Picture 4 – Handling of the I/O module

In order to handle the power module remove the front and rear covers and the two front triangular supports which would otherwise obstruct the way to the fork lift's forks.



Picture 5 – Panels removal on power module

After having removed the panels insert the fork lift and move the power module.

Picture 6 – Handling of the power module

3.3 INFORMATION FOR THE INSTALLATION

The *UPSaver* UPS must be installed indoor, in a clean and dry room, preferably without dust or humidity infiltrations. For the environmental conditions in the place of installation, in compliance with the current legislation, please refer to the “Wall clearances and ventilation” section.

Special environmental conditions

It is necessary to implement specific protective measures in case of unusual environmental conditions:

- harmful smoke, dust, abrasive dust;
- humidity, vapour, salt air, bad weather or dripping;
- explosive dust and gas mixture;
- extreme temperature variations;
- bad ventilation;
- conductive or radiant heat from other sources;
- fungus, insects, vermin.

The positioning and the mechanical and electrical installation of the various modules (interconnections) which compose the *UPSaver* system is generally performed either by manufacturer's engineers or specialized service centres who hold the specific instructions.

3.3.1 *UPSaver* basic configuration

As outlined in the previous paragraphs, the *UPSaver* system is essentially composed by two modular elements:

- power module;
- input/output (I/O) module.

The input/output module (**I/O**) is composed of a central section containing the connection terminal boards, the sectioning devices and the centralized static switches, when provided. It is furthermore provided of side distribution columns which contain the power modules' input/output switches.

Combining the power modules with the proper I/O module allows to obtain several system typologies for what concern the configuration of the battery and the static bypass switch.

CB → Centralized Battery

A single battery for the *UPSaver* UPS is provided; a single battery static switch is installed in the I/O module.

DB → Distributed Battery

Each power module which compose the *UPSaver* UPS is provided with its own battery. The connection of the various battery banks is carried out in the I/O module, but each power module is provided with its own battery static switch.

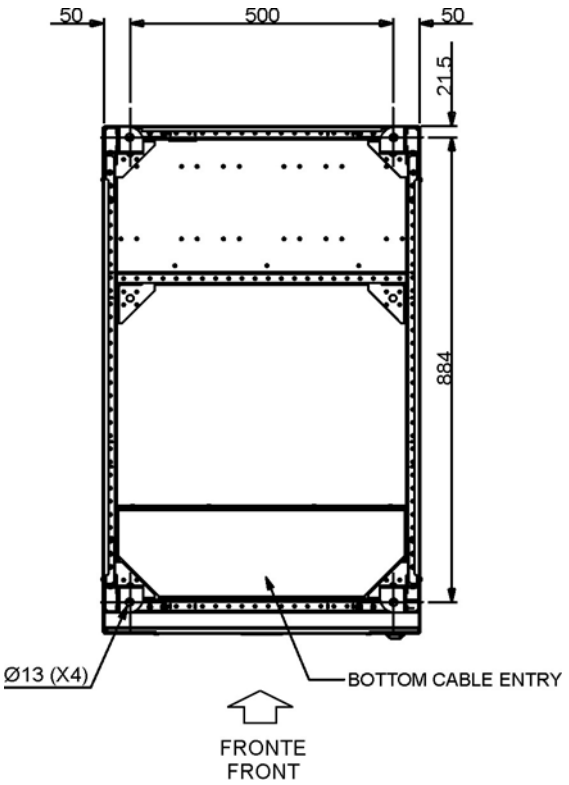
CSB → Centralized Static Bypass switch

A single bypass static switch is provided, which is installed in the I/O module.

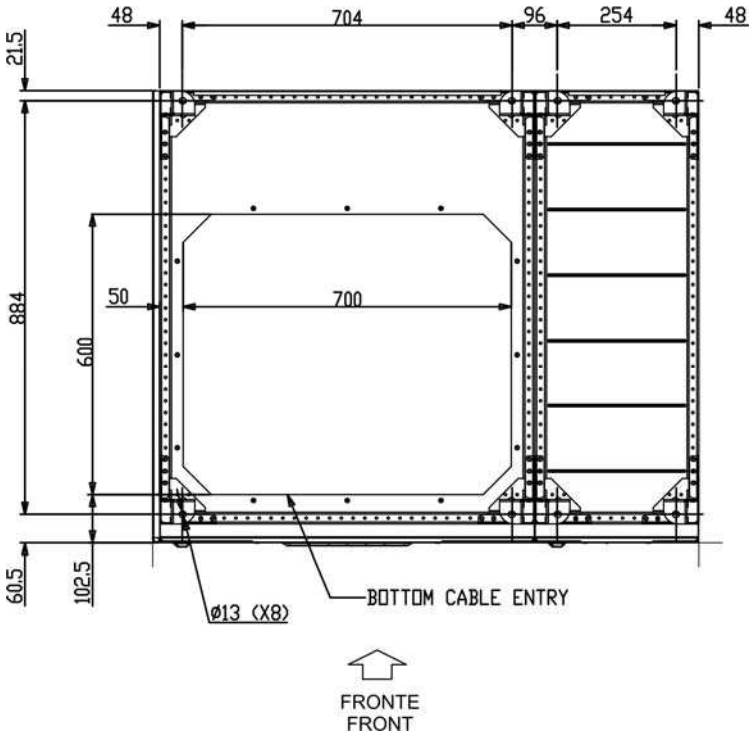
DSB → Distributed Static Bypass switch

Each power module which compose the *UPSaver* UPS is provide with its own bypass static switch.

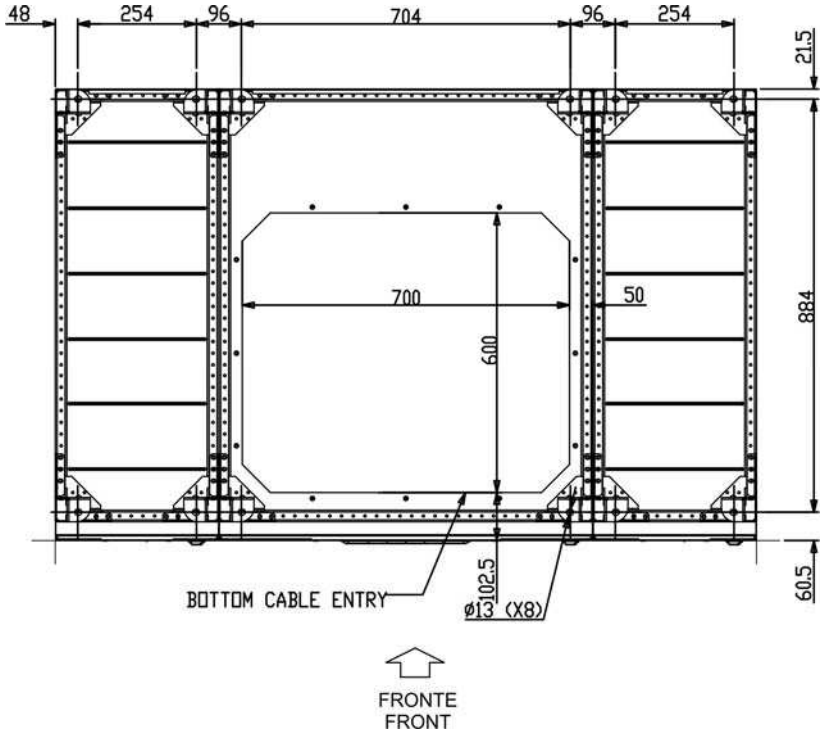
3.3.2 Base plan, static load and weights



Picture 7 – Power module base plan

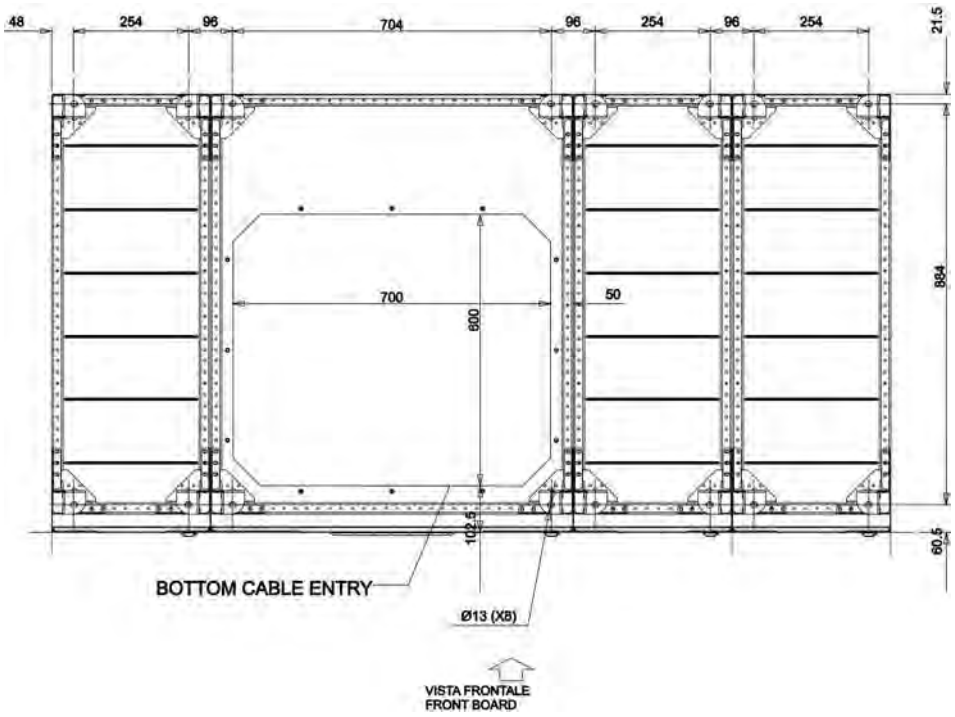


Picture 8 – 600kVA I/O module base plan

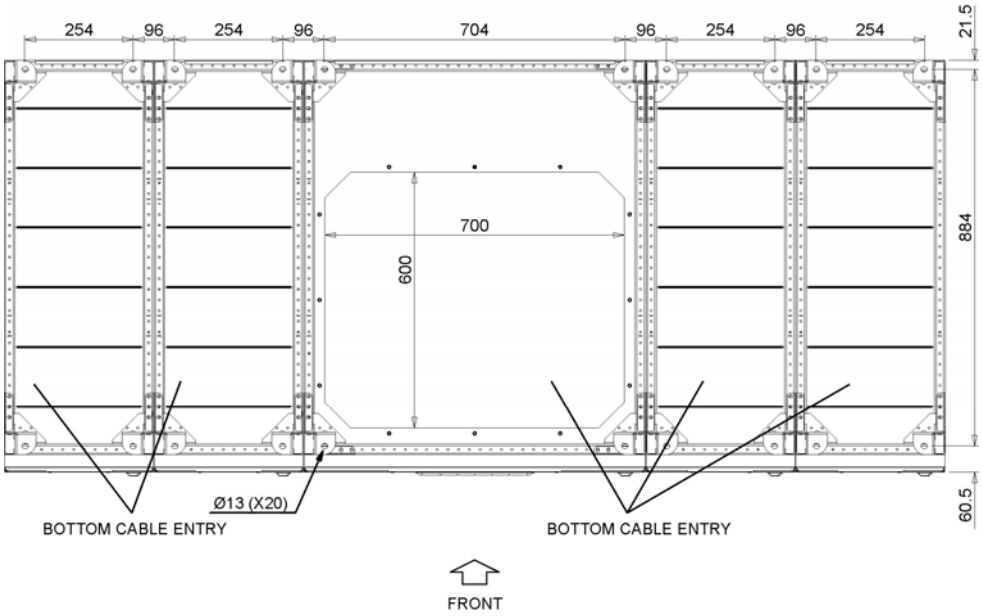


Picture 9 – 800-1200kVA I/O module base plan

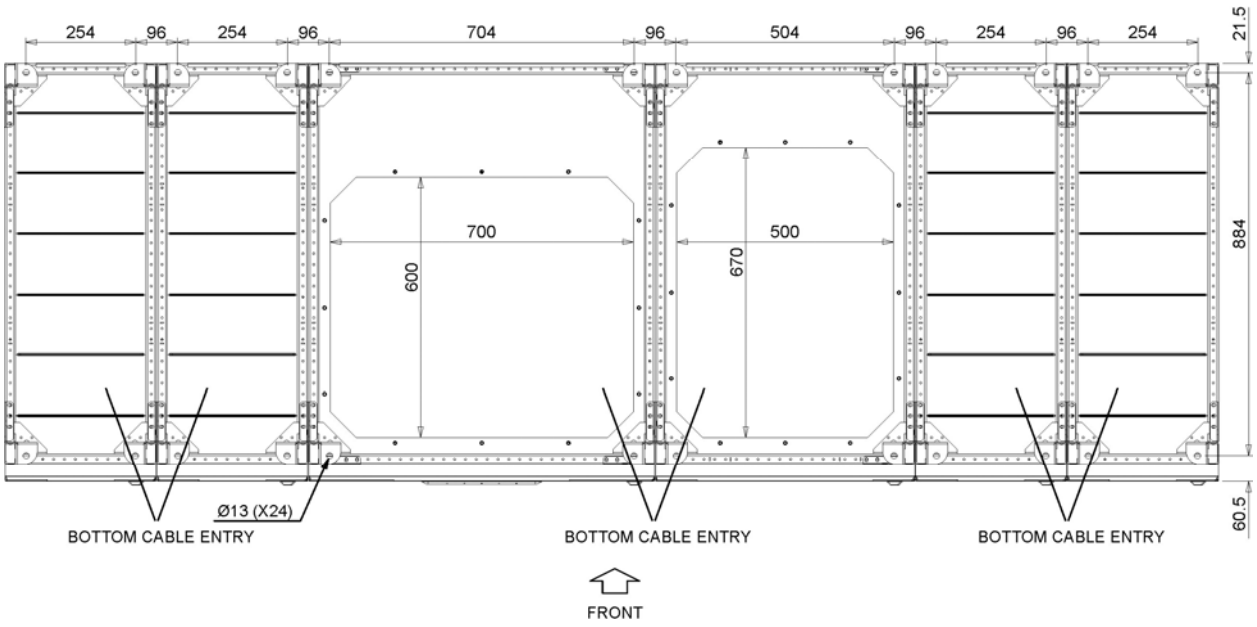
The previous picture, for what concern the 1200 kVA I/O module, is strictly related to the system configuration with distributed battery static switch (DB + DSB / DB + CSB).



Picture 10 – 1200kVA I/O module base plan (with centralized battery static switch)



Picture 11 – 1400kVA I/O module base plan



Picture 12 – 1600kVA I/O module base plan

The supporting base of the UPS must be designed to carry the UPS weight and to ensure its steady and safe support.

Its carrying capacity must be adequate to the static loads indicated in the table below.

	Weight [kg]				**Static load [kg/m^2]**			
Config. UPSaver →	**CB+CSB**	**CB+DSB**	**DB+CSB**	**DB+DSB**	**CB+CSB**	**CB+DSB**	**DB+CSB**	**DB+DSB**
Power module	570				1030			
400 kVA I/O module	660	650	650	520	620	610	610	490
600 kVA I/O module	690	680	680	550	650	640	640	520
800 kVA I/O module	780	770	770	640	560	560	560	460
1000 kVA I/O module	1140	890	990	740	670	520	720	540
1200 kVA I/O module	1170	920	1020	770	690	540	740	560
1400 kVA I/O module	Contact the manufacturer			1450	Contact the manufacturer			560
1600 kVA I/O module	Contact the manufacturer			1490	Contact the manufacturer			575

3.3.3 System layout and overall dimensions

Picture 13 – UPSaver power module

Picture 14 – UPSaver I/O module up to 600 kVA

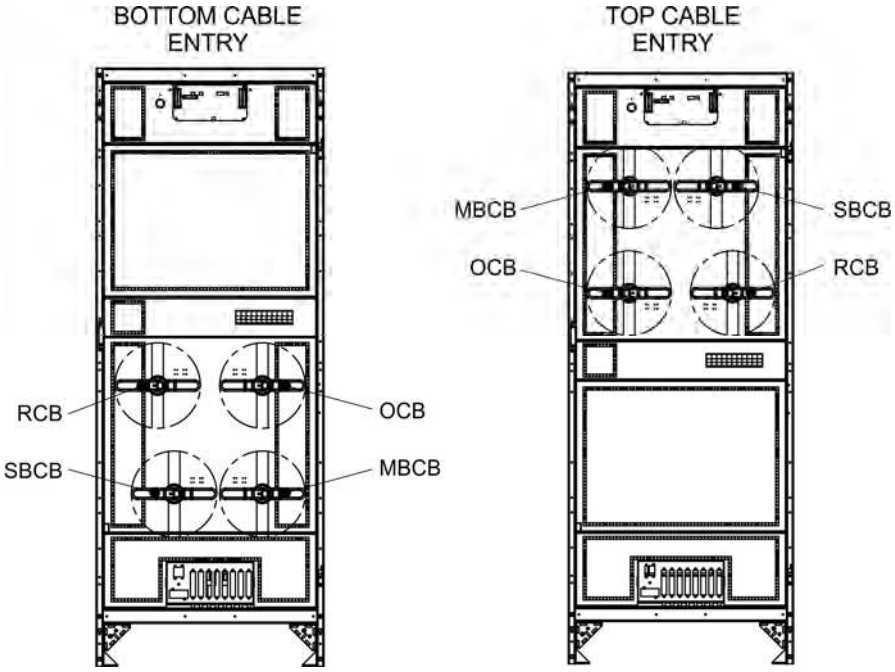
Picture 15 – UPSaver 800 kVA and 1200kVA (DB+DSB / DB+CSB) I/O module

Picture 16 – UPSaver 1000-1200 kVA I/O module with centr. battery st. sw. (CB+DSB / CB+CSB)

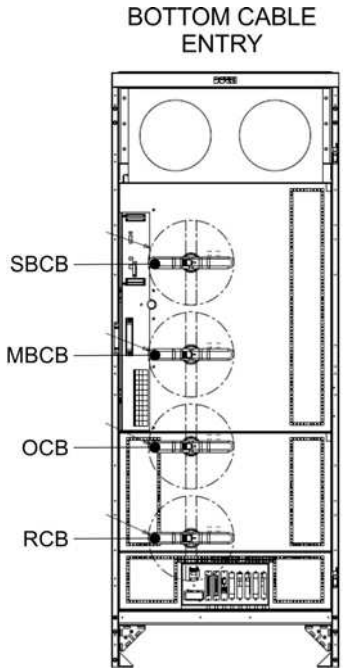
Picture 17 – UPSaver 1200 kVA I/O module top cable entry with centr. battery and distributed static switches (CB+DSB)

Picture 18 – UPSaver 1400 kVA I/O module top cable entry with centr. battery and distributed static switches (CB+DSB)

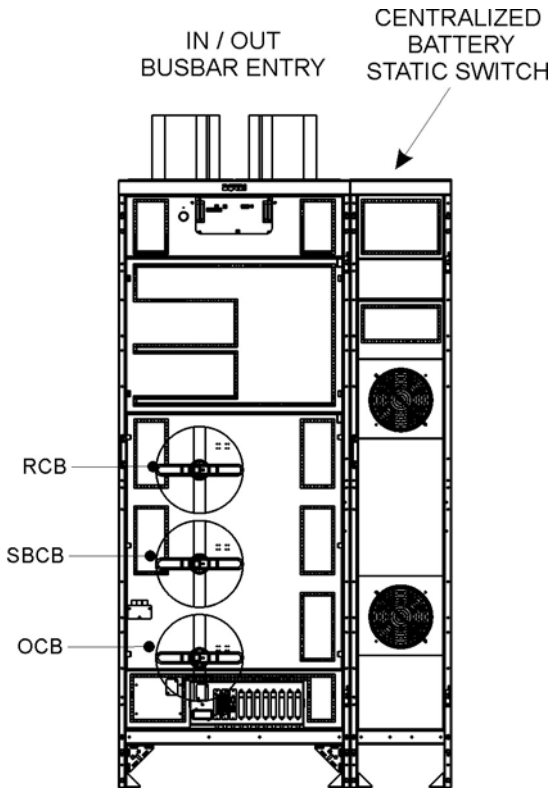
Picture 19 – UPSaver 1600 kVA I/O module with distributed static switches (DB+DSB)



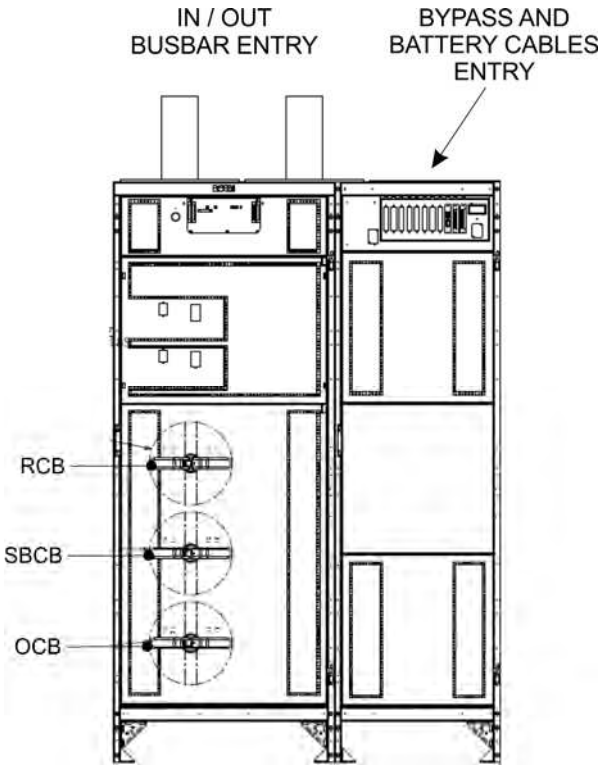
Picture 20 – I/O module breakers position (up to 800kVA)



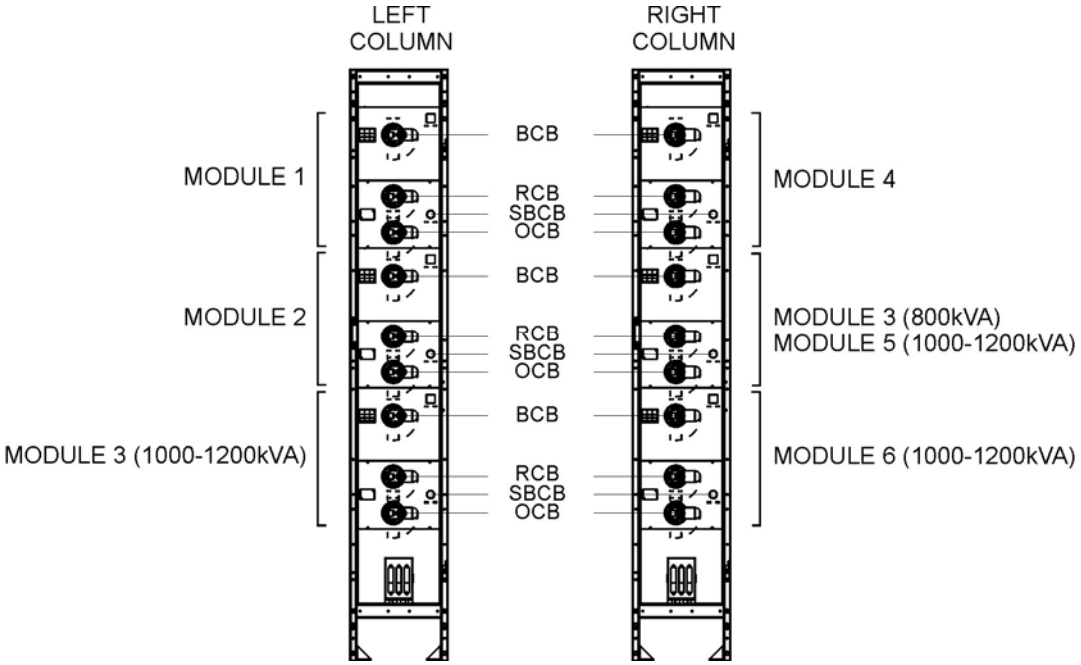
Picture 21 – I/O module breakers position (1000-1200kVA)



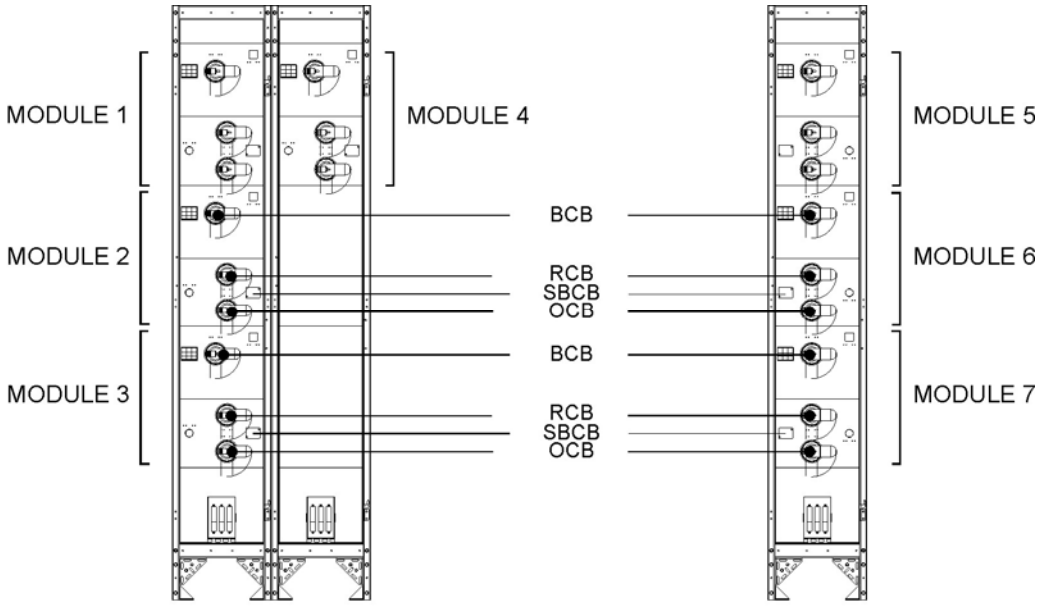
Picture 22 – I/O module breakers position (1200-1400kVA)



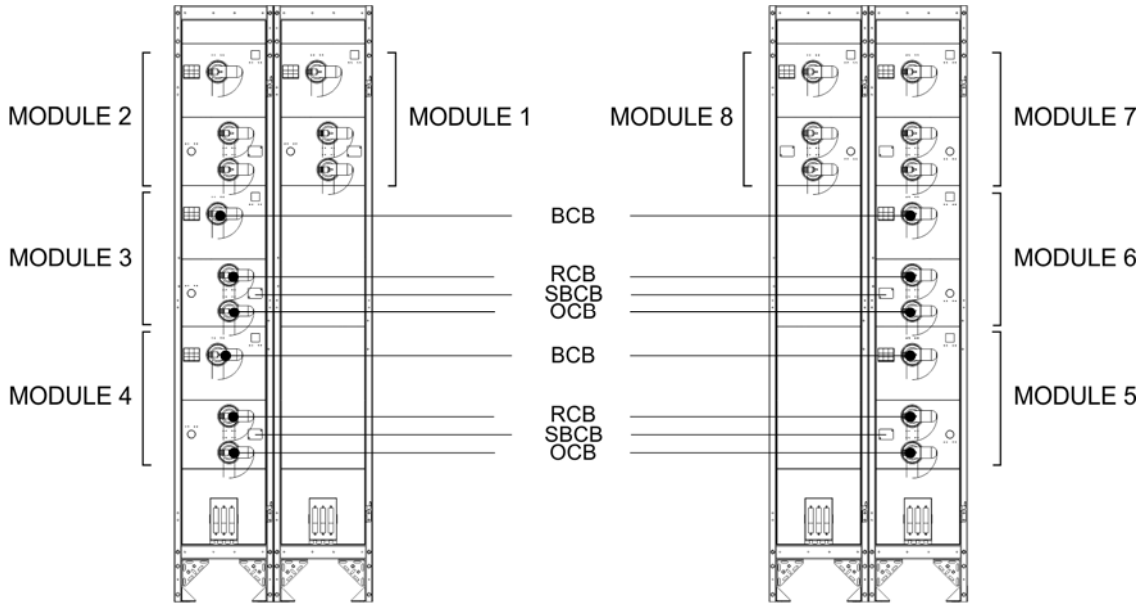
Picture 23 – I/O module breakers position (1600kVA)



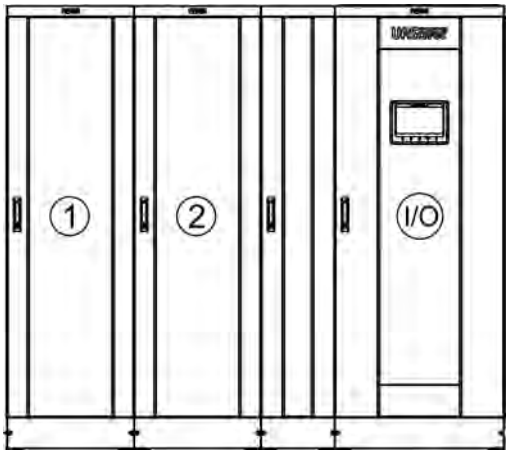
Picture 24 – I/O module distribution columns breakers position (up to 1200kVA)



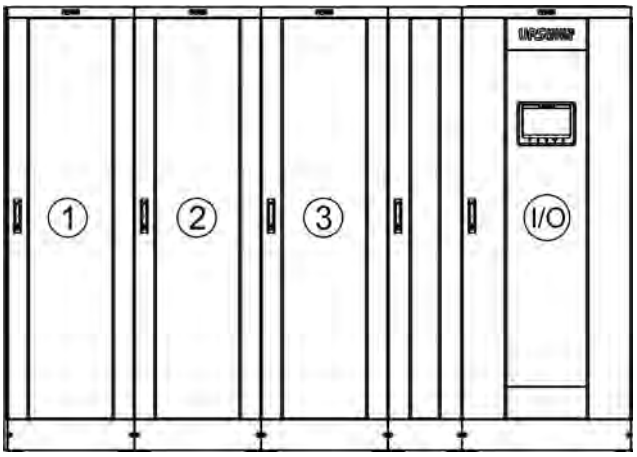
Picture 25 – 1400kVA I/O module distribution columns breakers position



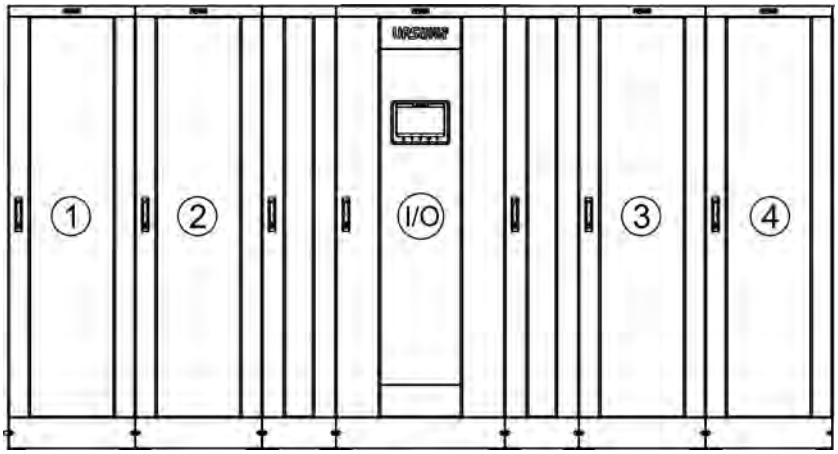
Picture 26 – 1600kVA I/O module distribution columns breakers position



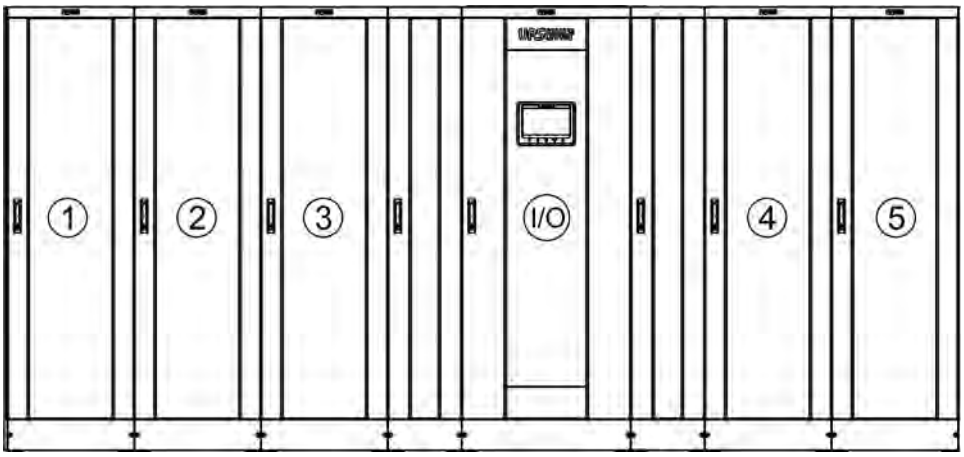
Picture 27 – 400kVA UPSaver layout



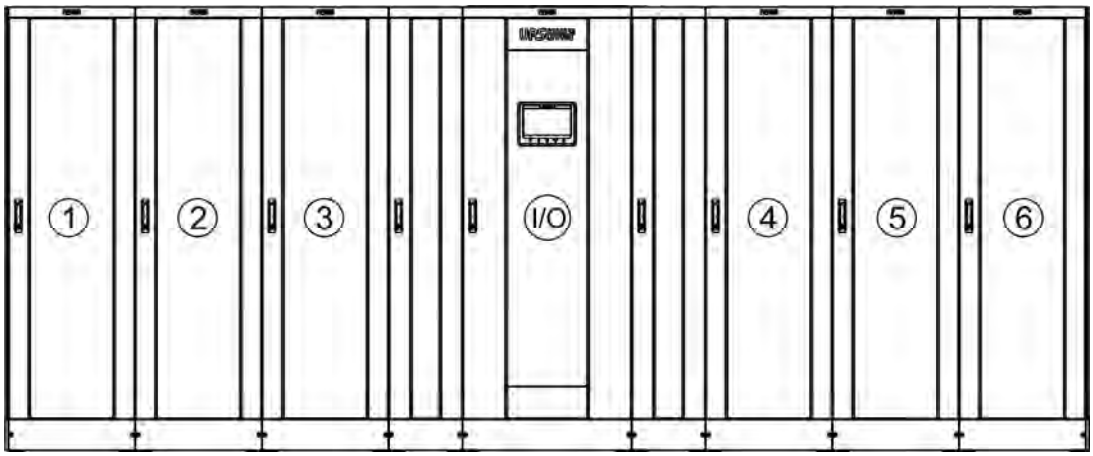
Picture 28 – 600kVA UPSaver layout



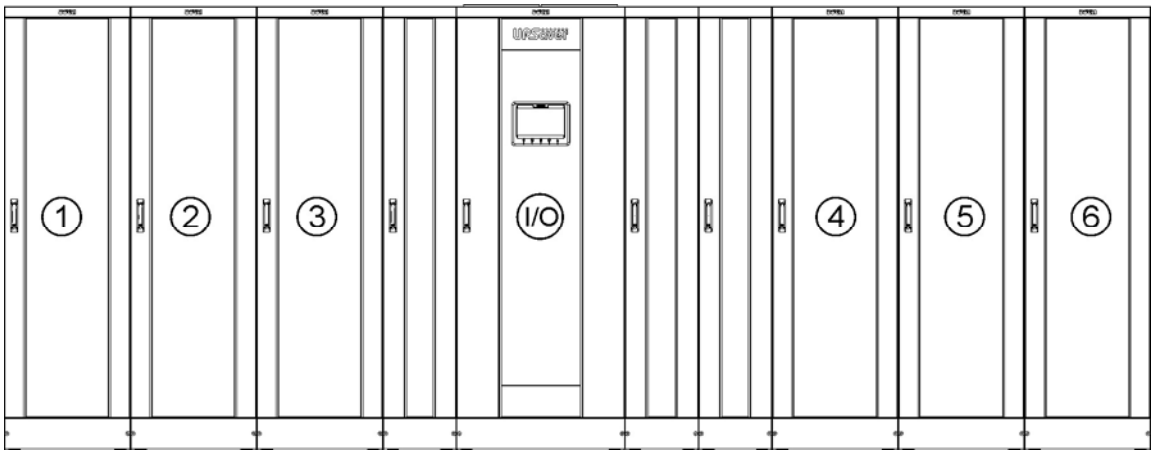
Picture 29 – 800kVA UPSaver layout



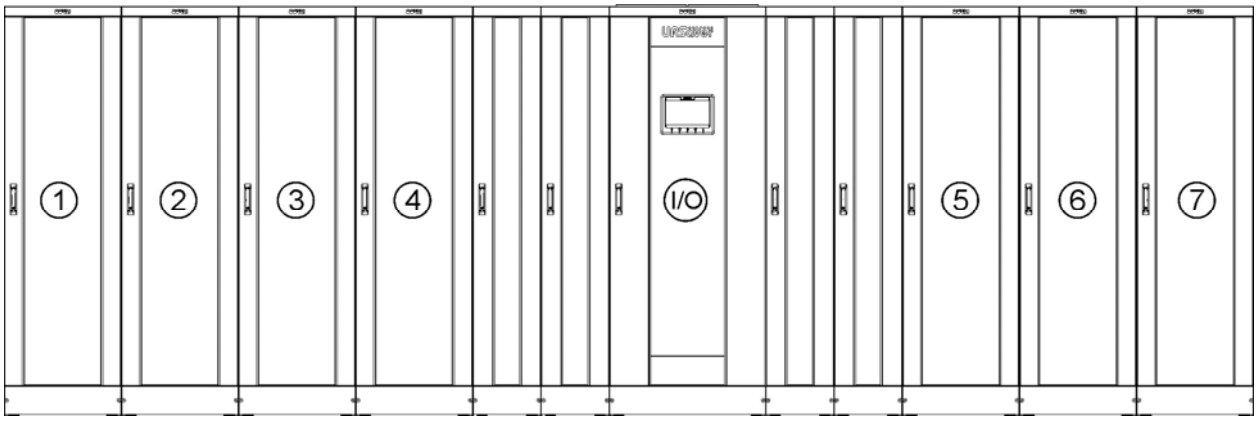
Picture 30 – 1000kVA UPSaver layout



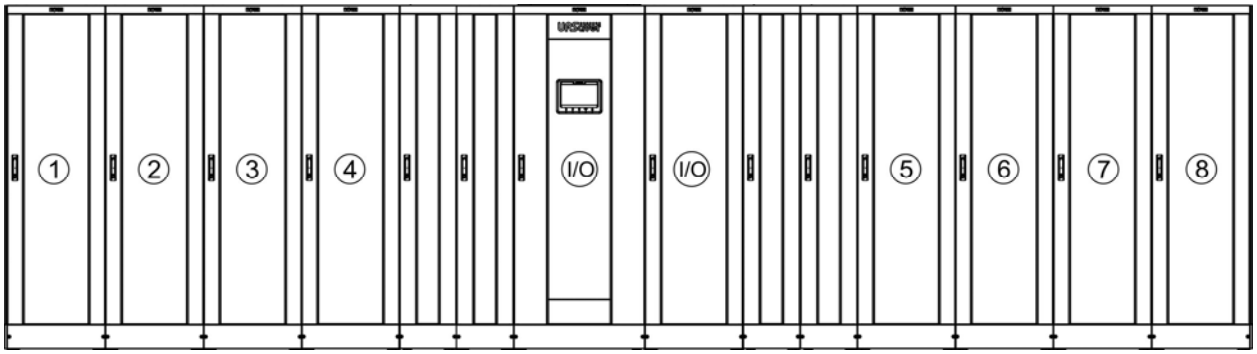
Picture 31 – 1200kVA UPSaver layout



Picture 32 – Battery centralized 1200kVA UPSaver layout



Picture 33 – Battery centralized 1400kVA UPSaver layout



Picture 34 – 1600kVA UPSaver layout

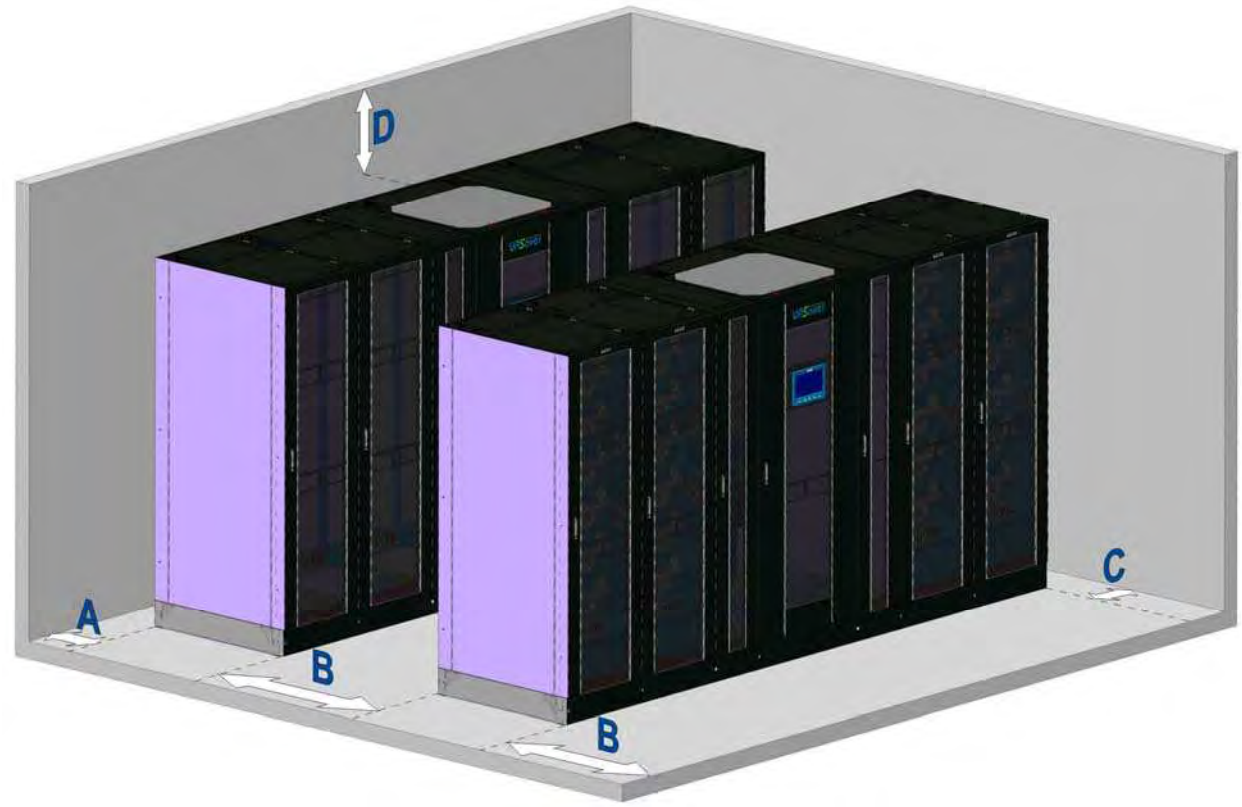
		Config. ↓	***UPSaver* rating (kVA)**						
			400	**600**	**800**	**1000**	**1200**	**1400**	**1600**
Width (mm)	**L**	CB+CSB	2350	2950	3900	4850	5450	6400	-
		CB+DSB						-	-
		DB+CSB				4500	5100	-	-
		DB+DSB						7000	7600
Depth (mm)	**P**	All	970						
Height (mm)	**H**	All	2100					2150 (1)	

(1) The 1600kVA I/O module is provided of an additional iron frame (h = 50 mm) for the routing of the interconnection cables with the power modules.

3.3.4 Wall clearances and ventilation

The UPS must be so installed as to ensure its serviceability and to allow a correct air flow as much as possible.

With regard to the minimum distances from the walls, for all of the UPS sizes the same installation conditions apply as indicated in the table below.



Picture 35 – Wall clearances

	A (mm)	B (mm)	C (mm)	D (mm)
Recommended clearances	**50**	**1200**	**50**	**600**
Minimum clearances	0	1200	0	400

The table below shows the air volume required for an optimal ventilation and cooling of the equipment. The values are referred to the on-line double-conversion operation with rated load applied.

Power (kVA)	**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**
Air volume (m^3/h)	5000	6600	8200	9800	11400	12800	14500

3.3.5 Environmental installation conditions

The air is classified by the EN 60721-3-3 standard (Classification of environmental parameters and their severities – Stationary use at weather-protected locations) based on climatic and biological conditions as well as on mechanically and chemically active substances.

Therefore the place of installation must meet specific requirements to ensure compliance with the conditions for which the UPS was designed.

➢ **Climatic conditions according to the *UPSaver* technical specification**

Environmental parameter	
Minimum operating temperature (°C)	– 10
Maximum operating temperature (°C)	+ 40
Minimum relative humidity (%)	5
Maximum relative humidity (%)	95
Condensation	NO
Rainfall with wind (rain, snow, hail, etc.)	NO
Water with an origin other than rain	NO
Ice formation	NO

➢ **Classification of biological conditions (EN 60721-3-3)**

Environmental parameter	Class		
	3B1	3B2	3B3
a) Flora	NO	Presence of mildew, fungus, etc.	Presence of mildew, fungus, etc.
b) Fauna	NO	Presence of rodents and other animals that are harmful to products, excluding termites	Presence of rodents and other animals that are harmful to products, including termites

➢ **Classification of mechanically active substances (EN 60721-3-3)**

Environmental parameter	Class			
	3S1	3S2	3S3	3S4
a) Sand [mg/m^3]	No	30	300	3000
b) Dust (suspension) [mg/m^3]	0,01	0,2	0,4	4,0
c) Dust (sedimentation) [mg/(m^2·h)	0,4	1,5	15	40
Places where precautions have been taken to minimize the presence of dust. Places away from dust sources	X			
Places without any special precaution to minimize the presence of sand or dust, however not in proximity to sand or dust sources		X		
Places in proximity to sand or dust sources			X	
Places in proximity to working processes that generate sand or dust, or in geographic areas having a high proportion of sand brought by the wind or of dust suspended in the air				X

➢ **Classification of chemically active substances (EN 60721-3-3)**

Environmental parameter	Class					
	3C1R	3C1L	3C1	3C2	3C3	3C4
a) Sea salt	No	No	No	Salt fog	Salt fog	Salt fog
b) Sulphur dioxide [mg/m^3]	0,01	0,1	0,1	1,0	10	40
c) Hydrogen sulphide [mg/m^3]	0,0015	0,01	0,01	0,5	10	70
d) Chlorine [mg/m^3]	0,001	0,01	0,1	0,3	1,0	3,0
e) Hydrochloric acid [mg/m^3]	0,001	0,01	0,1	0,5	5,0	5,0
f) Hydrofluoric acid [mg/m^3]	0,001	0,003	0,003	0,03	2,0	2,0
g) Ammonia [mg/m^3]	0,03	0,3	0,3	3,0	35	175
h) Ozone [mg/m^3]	0,004	0,01	0,01	0,1	0,3	2,0
i) Nitric oxide (expressed in equivalent values of nitrogen dioxide) [mg/m^3]	0,01	0,1	0,1	1,0	9,0	20
Places where atmosphere is strictly monitored and regulated (“clean spaces” category)	X					
Places where atmosphere is permanently monitored		X				
Places located in rural and urban regions where industrial activities are few and where traffic is moderate			X			
Places located in urban regions with industrial activities and/or considerable traffic				X		
Places in proximity to industrial sources with chemical emissions					X	
Places located in industrial installations. Emissions of highly concentrated chemical pollutants						X

The *UPSaver* UPS is designed to be installed in an environment that meets the following classifications.

K	Climatic conditions	**In accordance with the technical specification**
B	Biological conditions	**3B1 (EN 60721-3-3)**
C	Chemically active substances	**3C2 (EN 60721-3-3)**
S	Mechanically active substances	**3S2 (EN 60721-3-3)**

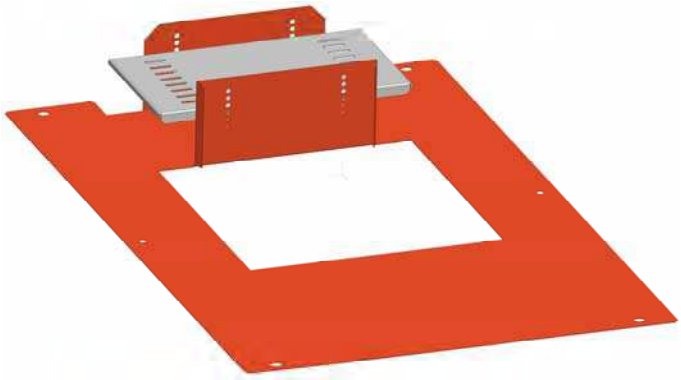
In the event that the environmental conditions of the installation room do not comply with the specified requirements, additional precautions must be taken to reduce excessive values to the specified limits.

3.4 SYSTEM POSITIONING AND INSTALLATION

3.4.1 Positioning the I/O module

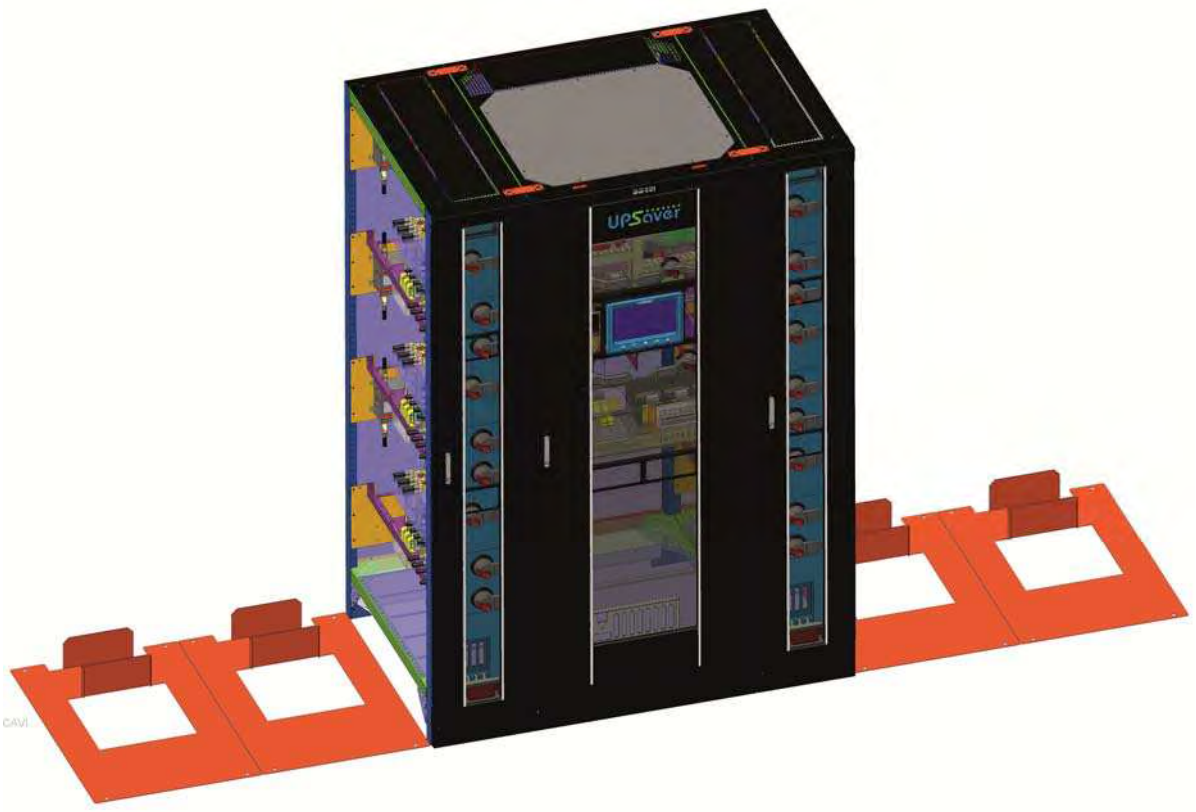
The *UPSaver* system can be positioned on an iron base specifically prepared and placed on the base of a floating floor. In this case the space underneath the UPS bearing surface is used as a opening to where the interconnection cables between the I/O module and the power modules can be laid.

When the floating floor is not installed (for top cables entry for example) it will be necessary to install cables routing bases on the sides of the I/O module, just where the power modules will be placed.



Picture 36 – Cable routing base

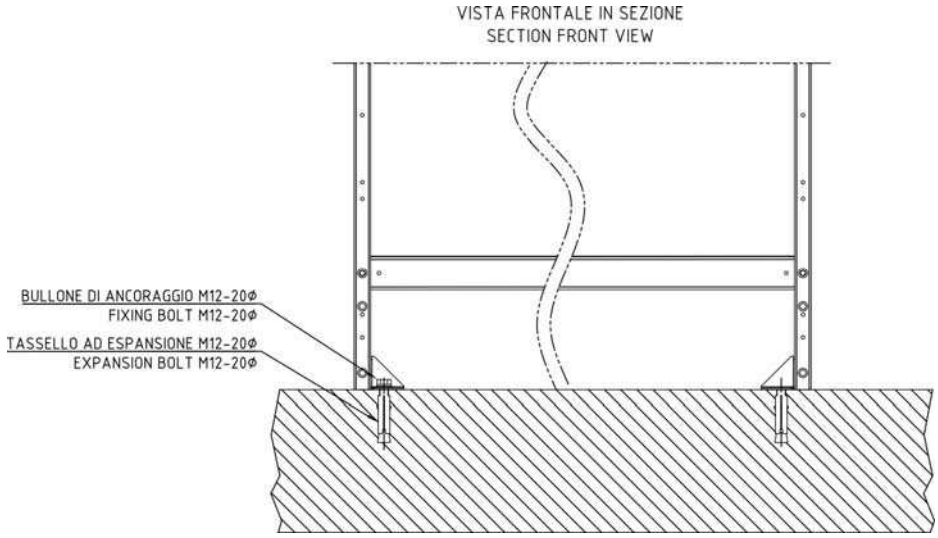
A Installation example of cables routing bases for a 800 kVA *UPSaver* system is shown in the following picture.



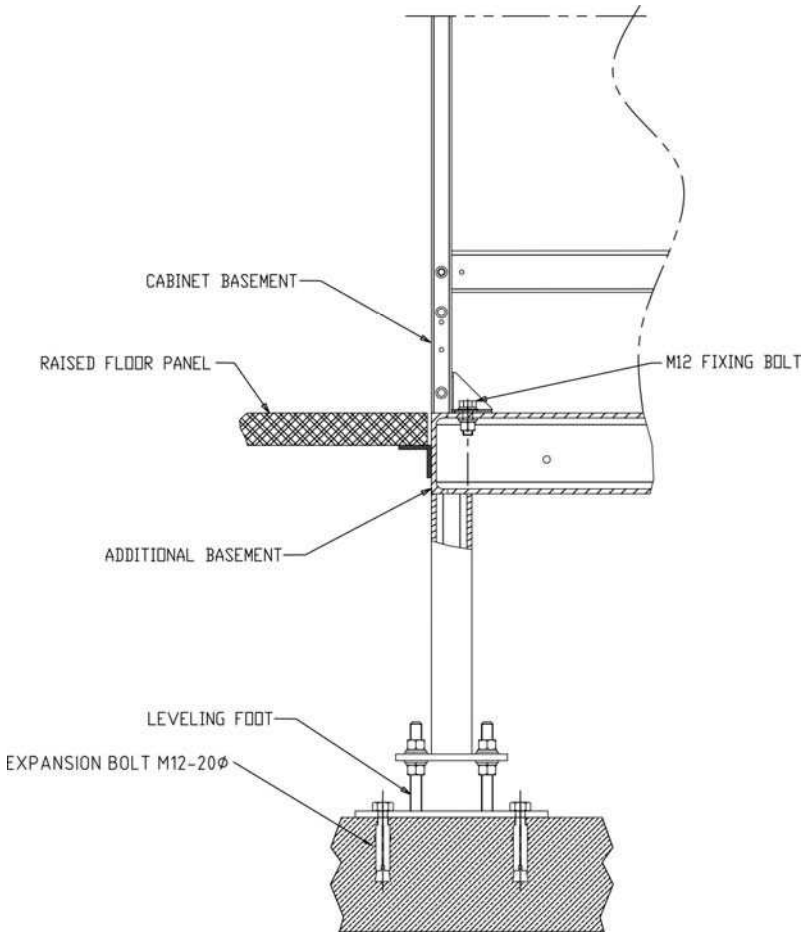
Picture 37 – Installation of cable routing bases on 800 kVA UPSaver

3.4.2 Floor fixing

The floor fixing method for the various modules which compose the *UPSaver* system varies depending on the UPS bearing surface, being it a concrete floor or a iron base.



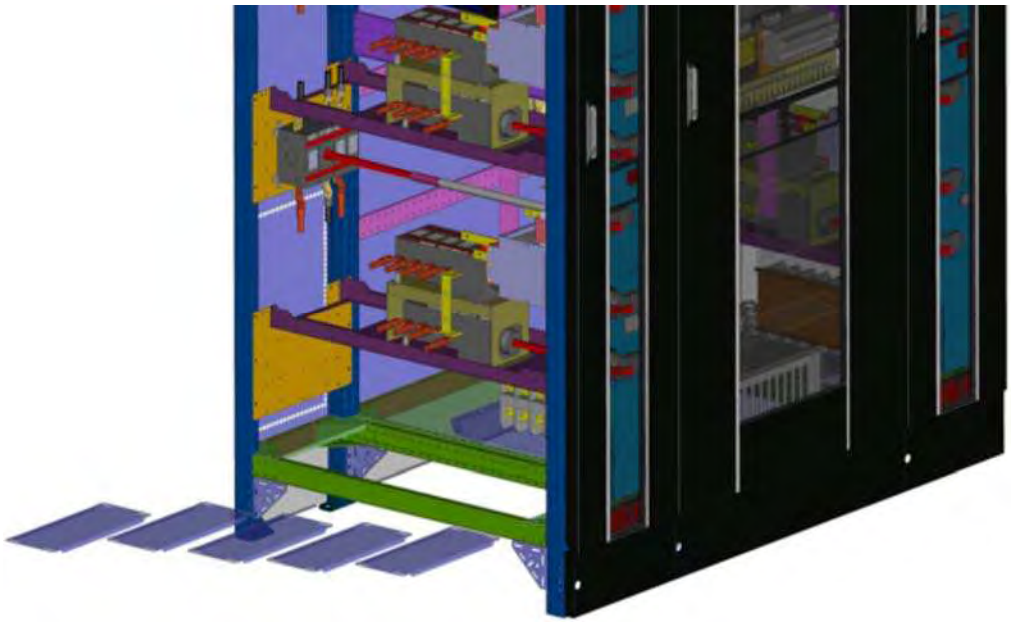
Picture 38 – Floor fixing



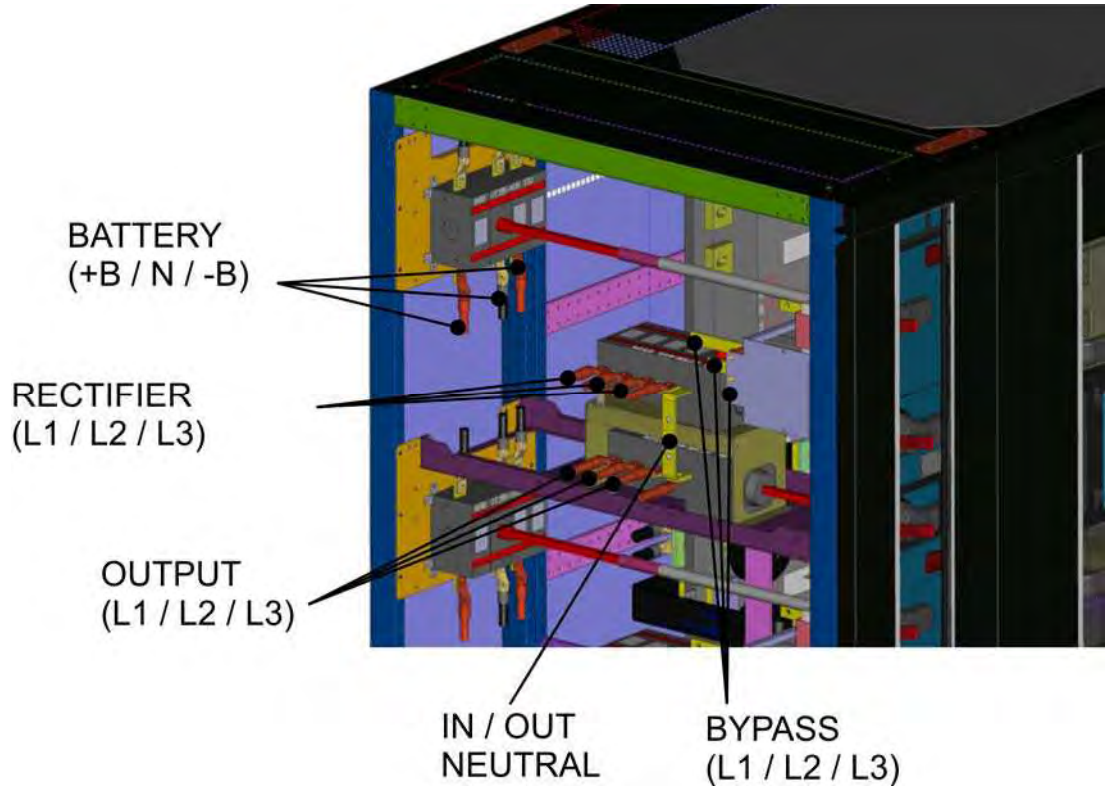
Picture 39 – Iron base fixing

3.4.3 Connection of the interconnection cables

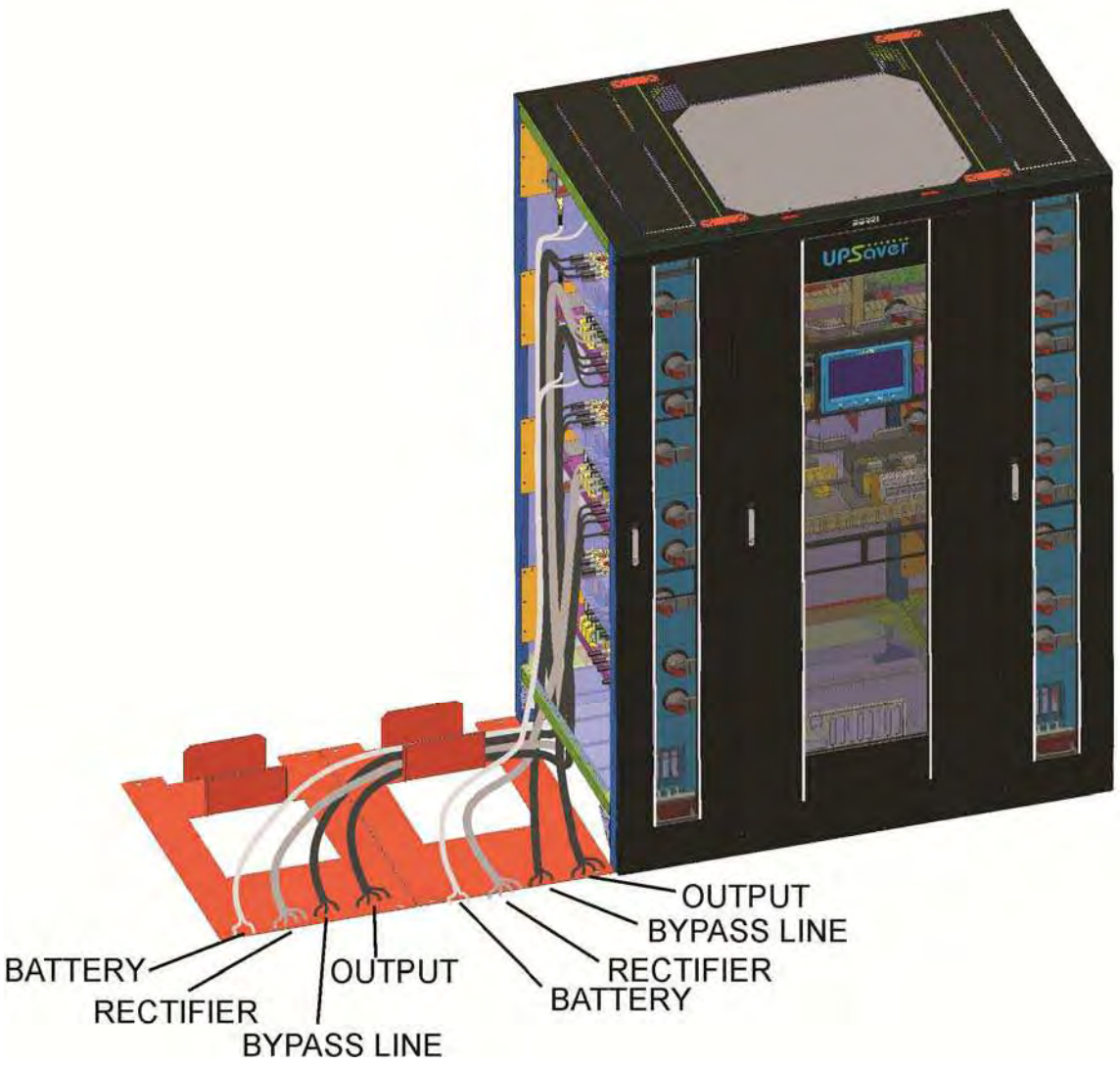
After having positioned the I/O module the cable routing bases (if provided) it is necessary to lay and connect the interconnection cables among the modules. The pictures which follow show the cable routing on the metal bases; in case a floating floor is present the cables will obviously run in the available between the system bearing surface and the underlying concrete floor.



Picture 40 – Cabinet base plates removal



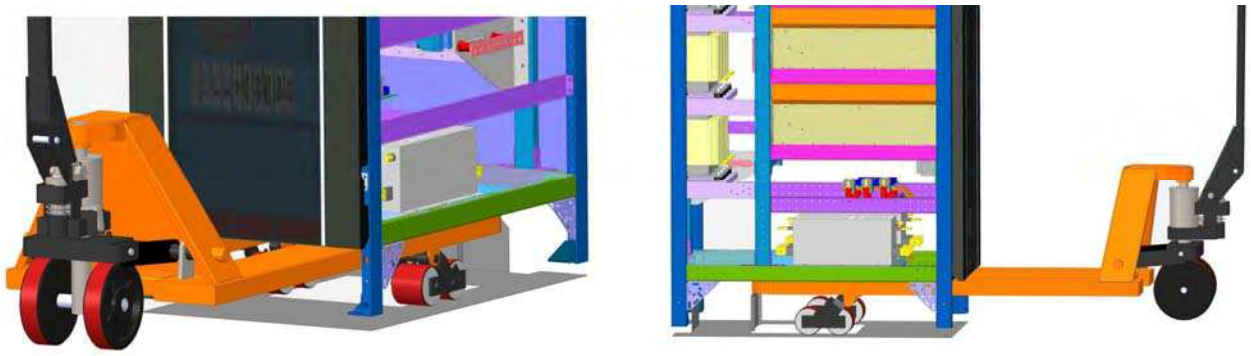
Picture 41 – Interconnection cables connection points



Picture 42 – Routing of the interconnection cables

3.4.4 Positioning the power modules

When the interconnection cables connection and routing are completed it is possible to proceed to the positioning of the power modules; pay attention to place the module in such a way that the fixing holes in the module frame coincide with the holes prearranged on the cables routing bases or on the iron base.

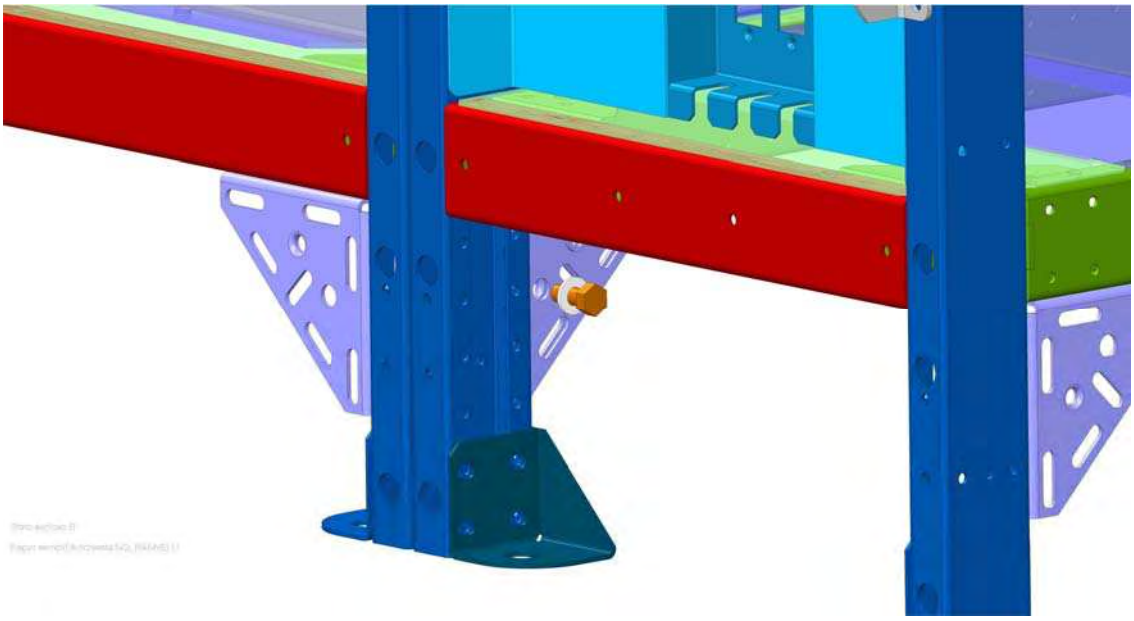


Picture 43 – Positioning the power module

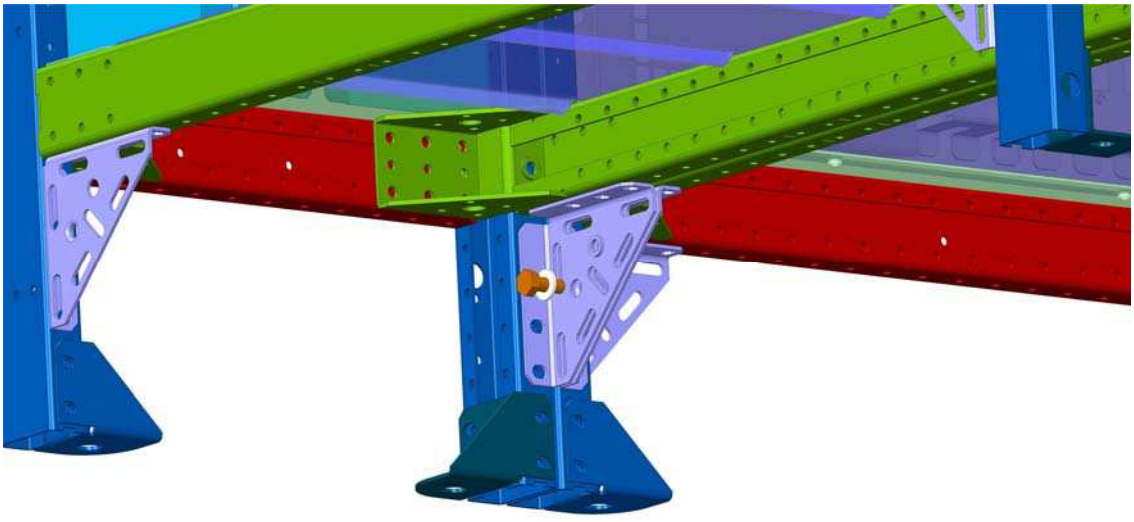
3.4.5 Cabinets alignment and fixing

Before connecting the power cables to the various modules it is strongly advised to align the cabinets and proceed with the mechanical fixing.

The triangular metal supports placed laterally down at each cabinet are provided with threaded holes, specifically arranged to mechanically connect the frames. It is suggested to connect the cabinets both at the front and the rear, using a **M8x20** hexagonal-head bolt.

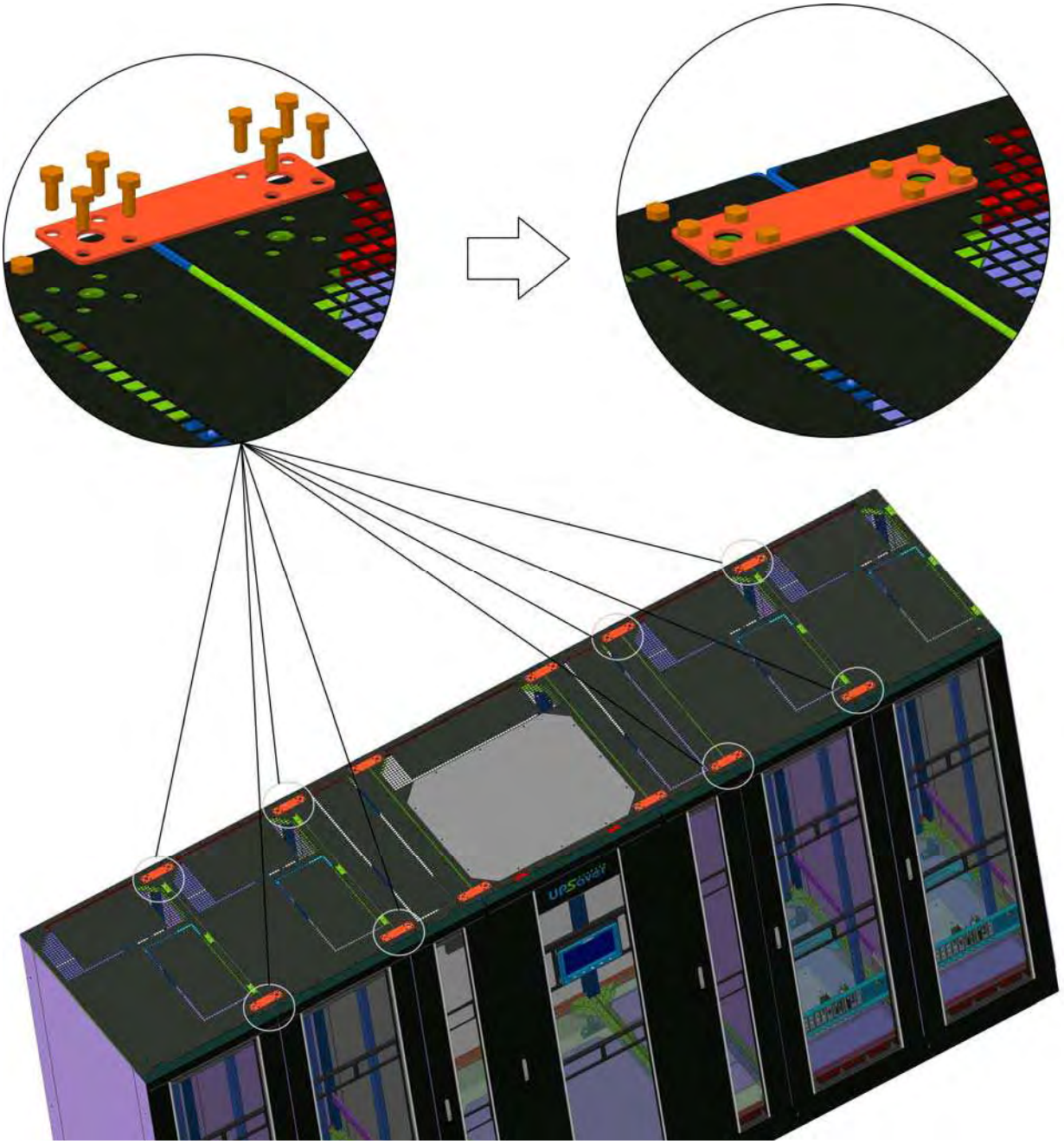


Picture 44 – Cabinets front fixing



Picture 45 – Cabinet rear fixing

Then, the cabinets can be correctly aligned by connecting the upper cross bars through the specific metal plates. It is suggested to use nr. 8 **M6x15** self-threading screws for each plate.



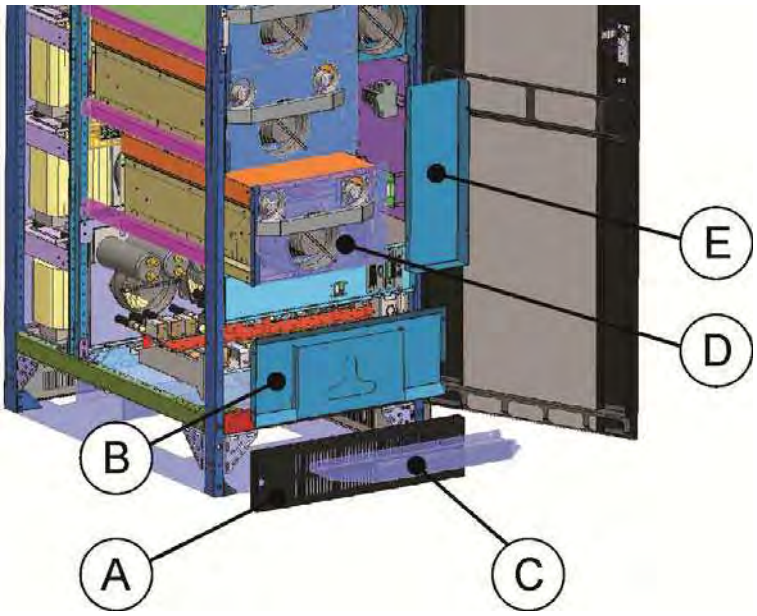
Picture 46 – UPS cabinets upper fixing

3.4.6 Power modules electrical connection

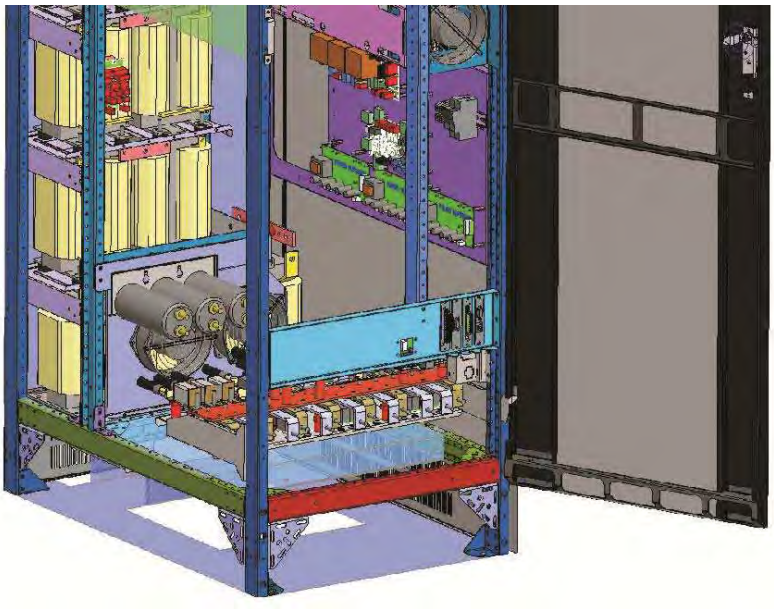
In order to connect the interconnection cables of the power module it is necessary to remove:

- front socket cover (A);
- terminals protection plate (B);
- cables passage covering plate (C).

In order to ease cables connection work it is advisable to remove the lower power conversion module (D) and the side protection plate (E).

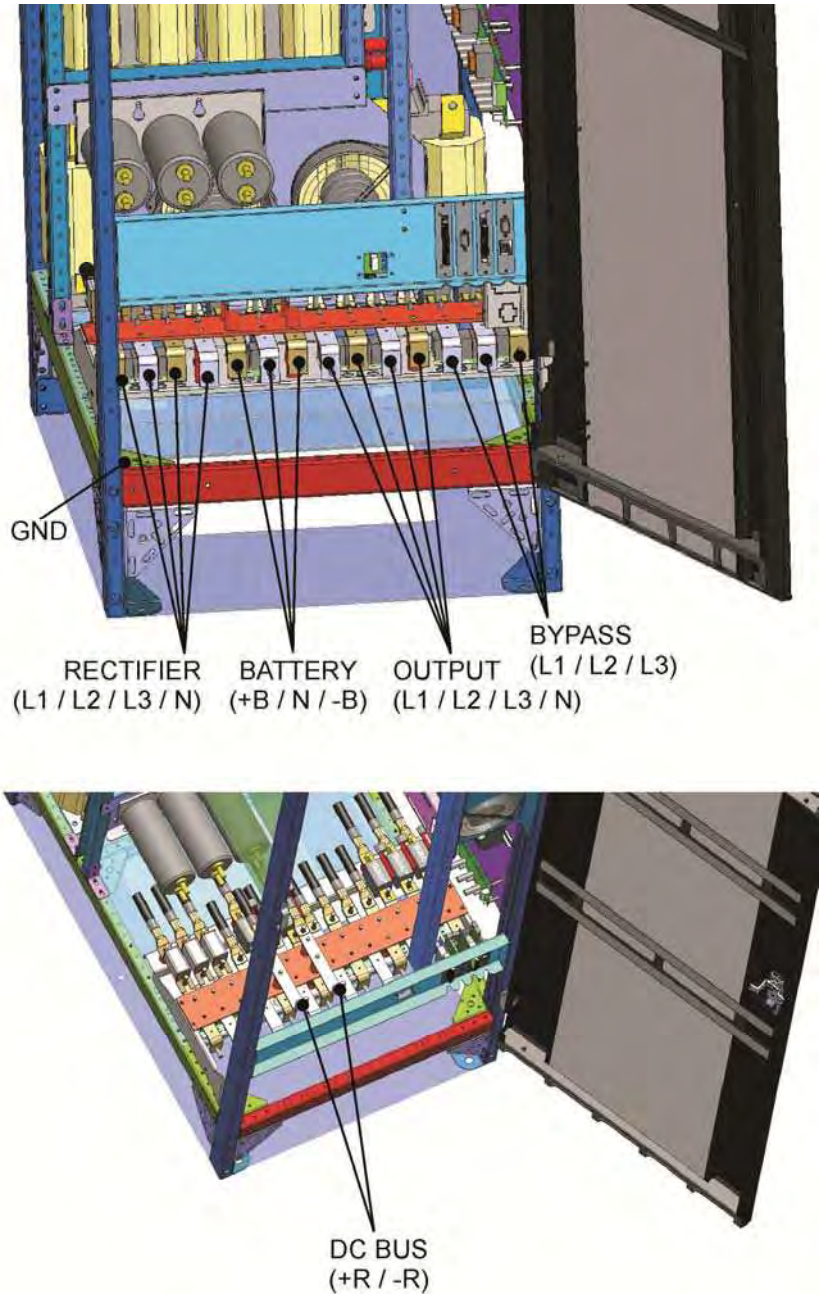


Picture 47 – Parts to be removed for cables connection



Picture 48 – Power modules with parts removed

The connection terminals are available on the front of the cabinet and located as shown in the following picture.



Picture 49 – Power module cables terminals

Interconnection terminals			
I/O module [1]		**Power module**	
L1INP - Mx	→	1-L1	RECTIFIER
L2INP - Mx	→	1-L2	
L3INP - Mx	→	1-L3	
NING - Mx	→	1-N [2]	
L1BYP - Mx	→	2-L1	BYPASS
L2BYP - Mx	→	2-L2	
L3BYP - Mx	→	2-L3	
L1BYP - Mx	→	3-L1	OUTPUT
L2BYP - Mx	→	3-L2	
L3BYP - Mx	→	3-L3	
NING - Mx	→	3-N [2]	

Interconnection terminals CENTRALIZED BATTERY			
I/O module [1]		**Power module**	
+B - Mx	→	+B	BATTERY
N - Mx	→	N	
–B - Mx	→	–B	

Interconnection terminals DISTRIBUTED BATTERY			
I/O module [1]		**Power module**	
+R - Mx	→	+R	DC BUS
–R - Mx	→	–R	
+Bx	→	+B	BATTERY [3]
Nx	→	N	
–Bx	→	–B	

[1] In the distribution column the terminals are identified as "Mx", where "x" is the number which identifies which power module must be connected to those terminals.

[2] The interconnection of the output neutral conductor is not provided. The connection is performed inside the power module, using a cable which connects the rectifier input and module output neutral terminals.

[3] The battery terminals are not located inside the distribution column, they are positioned inside the I/O module.

3.4.7 Connecting the bus cable

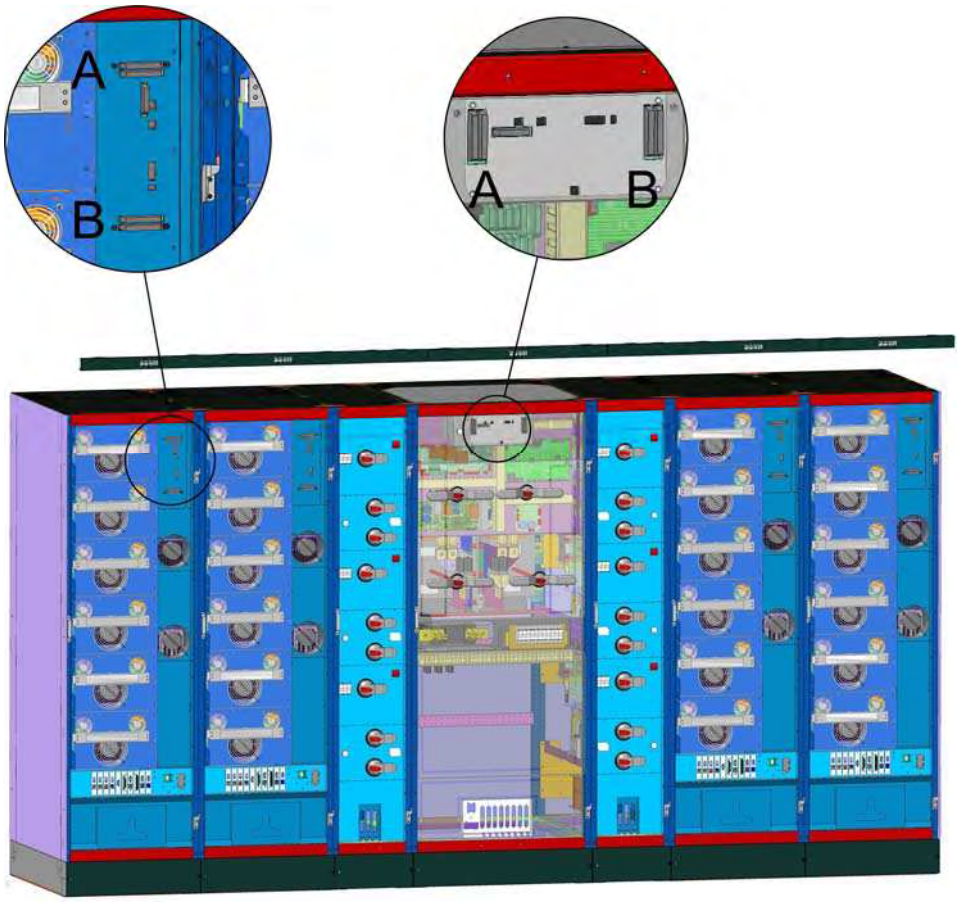
The connection of the bus cable is the last operation to be performed to accomplish the installation of the *UPSaver* system.

For the cable routing specific raceways above the cabinet front doors are provided, that must be removed.

Picture 50 – Bus cable raceways

Picture 51 – Removing the bus cable raceways

Both the I/O module and the power modules are equipped with a specific connection card, provided with two connectors which are doubled at each end (see following picture). The cable must be connected in such a way that the "A" connector of one card is connected to the "B" connector of the next card; the A⇔A or B⇔B connection is not allowed.



Picture 52 – Bus cable connection cards

The cable must be connected so as to form a loop, thus to guarantee the first-fault system immunity.

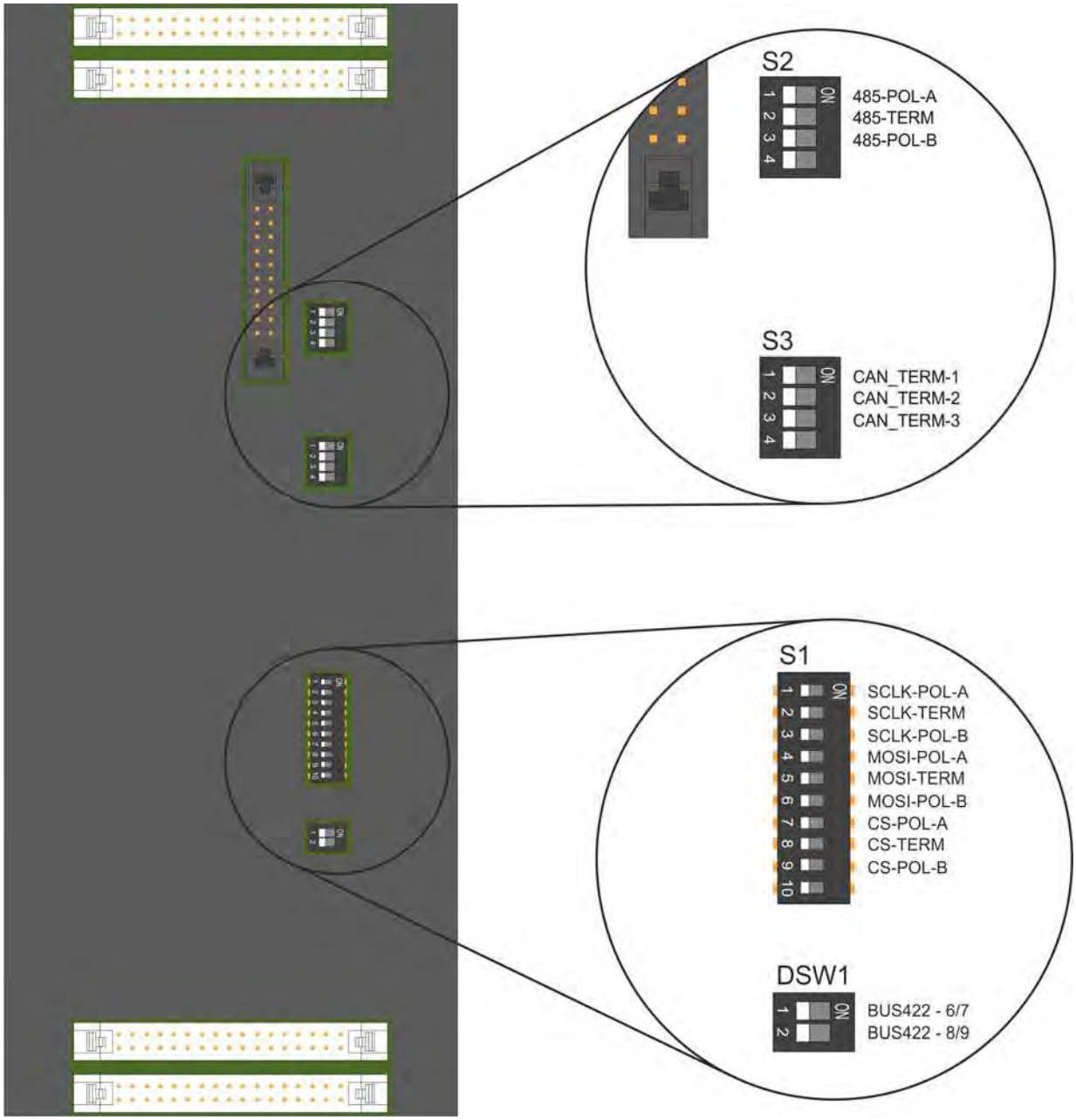
Picture 53 – Connecting the bus cable

Once the cable has been connected, fix it to the cabinet upper cross-bars and put the metal raceways back in place.

Picture 54 – Raceways re-positioning

3.4.8 Parallel cards dip-switch setting

The parallel card, where the bus cable is connected, is provided with dip-switches that are used to supply and/or terminate the data connection among the modules.



Picture 55 – Detail of the parallel card dip-switches

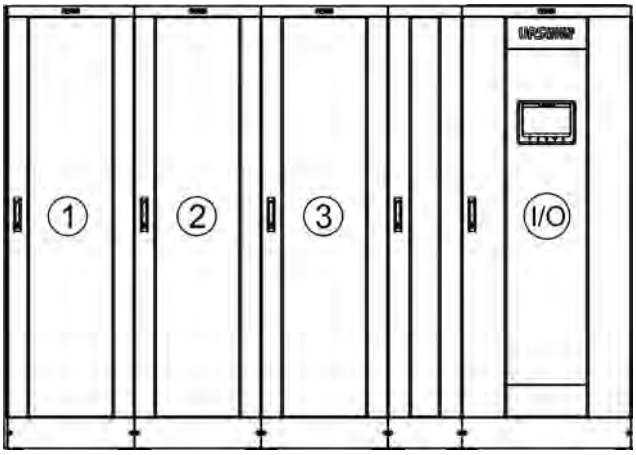
The dip-switches must be set according to the physical position of the device within the system. In particular the following switches must always be set to OFF:

- switch **S2**, dip **4**;
- switch **S3**, dip **4**;
- switch **S1**, dip **9**;
- switch **DSW1**, dip **1**.

All the other dips must be set as follows:

- **ON**, all the dips of the two peripheral devices, being them the I/O module and one power module or two power modules;
- **ON**, the *dip 2* of *DSW1*;
- **OFF**, all the dips of the other devices.

Let's suppose we have to configure a 600 kVA *UPSaver*, installed as shown in the following picture.



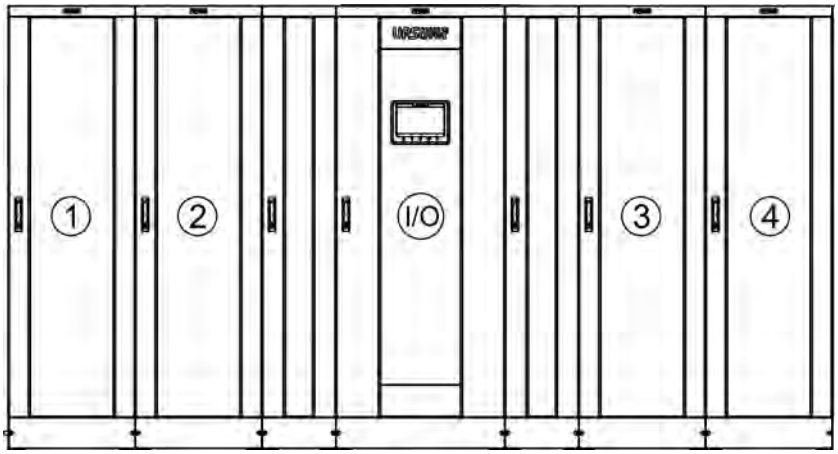
Picture 56 – 600kVA UPSaver

The configuration of the dip-switches for the various devices will be as follows:

DIP-SW		MODULE			
		I/O	**1**	**2**	**3**
S1	1	**ON**	**ON**	OFF	OFF
	2	**ON**	**ON**	OFF	OFF
	3	**ON**	**ON**	OFF	OFF
	4	**ON**	**ON**	OFF	OFF
	5	**ON**	**ON**	OFF	OFF
	6	**ON**	**ON**	OFF	OFF
	7	**ON**	**ON**	OFF	OFF
	8	**ON**	**ON**	OFF	OFF
	9	**ON**	**ON**	OFF	OFF
	10	OFF	OFF	OFF	OFF
S2	1	**ON**	**ON**	OFF	OFF
	2	**ON**	**ON**	OFF	OFF
	3	**ON**	**ON**	OFF	OFF
	4	OFF	OFF	OFF	OFF
S3	1	**ON**	**ON**	OFF	OFF
	2	**ON**	**ON**	OFF	OFF
	3	**ON**	**ON**	OFF	OFF
	4	OFF	OFF	OFF	OFF
DSW1	1	OFF	OFF	OFF	OFF
	2	**ON**	**ON**	**ON**	**ON**

In the examined case one of the peripheral devices is the I/O module, whose parallel card will have to be conveniently configured.

In the situation shown below, a 800 kVA *UPSaver* system, the peripheral devices are both power modules.



Picture 57 – 800kVA UPSaver

The configuration of the dip-switches must be as follows:

DIP-SW		MODULE				
		I/O	**1**	**2**	**3**	**4**
S1	1	OFF	**ON**	OFF	OFF	**ON**
	2	OFF	**ON**	OFF	OFF	**ON**
	3	OFF	**ON**	OFF	OFF	**ON**
	4	OFF	**ON**	OFF	OFF	**ON**
	5	OFF	**ON**	OFF	OFF	**ON**
	6	OFF	**ON**	OFF	OFF	**ON**
	7	OFF	**ON**	OFF	OFF	**ON**
	8	OFF	**ON**	OFF	OFF	**ON**
	9	OFF	**ON**	OFF	OFF	**ON**
	10	OFF	OFF	OFF	OFF	OFF
S2	1	OFF	**ON**	OFF	OFF	**ON**
	2	OFF	**ON**	OFF	OFF	**ON**
	3	OFF	**ON**	OFF	OFF	**ON**
	4	OFF	OFF	OFF	OFF	OFF
S3	1	OFF	**ON**	OFF	OFF	**ON**
	2	OFF	**ON**	OFF	OFF	**ON**
	3	OFF	**ON**	OFF	OFF	**ON**
	4	OFF	OFF	OFF	OFF	OFF
DSW1	1	OFF	OFF	OFF	OFF	OFF
	2	**ON**	**ON**	**ON**	**ON**	**ON**

3.4.9 Connecting the signal cables

The routing of the signal cables between the I/O module and the power modules can be carried out after the complete installation of the system. Simply for the matter of a easier execution of the routing it is recommended to lay the signal cables down before putting the power modules in place. In order to make the cables connection easier, sockets can be installed in the I/O module.

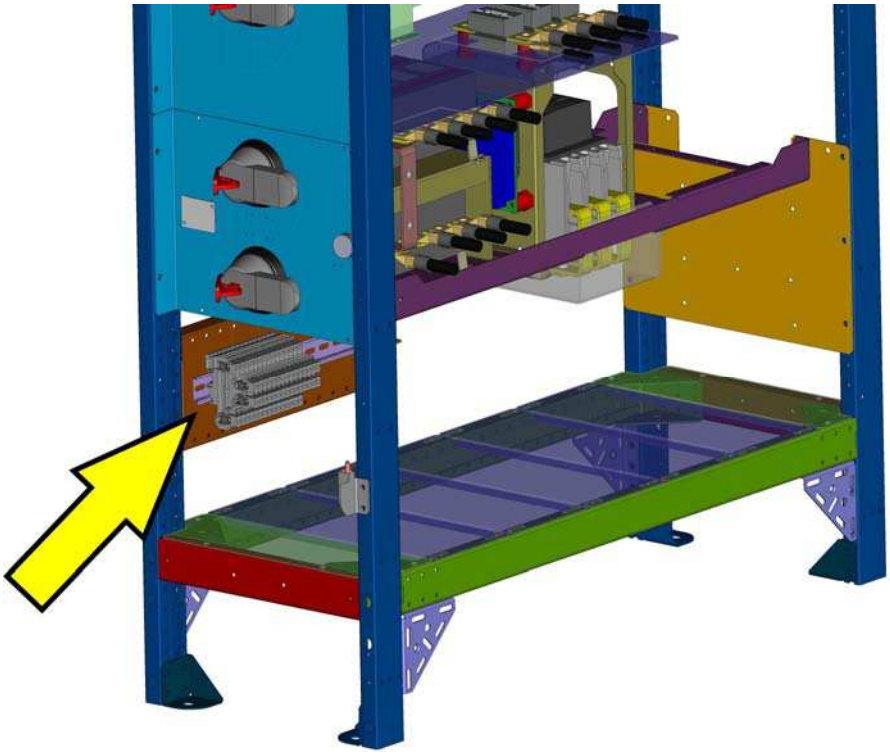
Signal cables interconnection table

I/O module		Power module		I/O module		Power module	
X21.1	→	X2.1	MODULE 1	X25.1	→	X2.1	MODULE 5
X21.2	→	X2.2		X25.2	→	X2.2	
X21.3	→	X2.3		X25.3	→	X2.3	
X21.4	→	X2.4		X25.4	→	X2.4	
X31.1	→	5 - EXT-INP (1)		X35.1	→	5 - EXT-INP (1)	
X31.2	→	6 - EXT-INP		X35.2	→	6 - EXT-INP	
XB1.1	→	9 - EXT-INP		XB5.1	→	9 - EXT-INP	
XB1.2	→	10 - EXT-INP		XB5.2	→	10 - EXT-INP	
L1.1	→	11 - SRC-2 (2)		L5.1	→	11 - SRC-2 (2)	
X1.1	→	12 - SRC-2		X1.5	→	12 - SRC-2	
X22.1	→	X2.1	MODULE 2	X26.1	→	X2.1	MODULE 6
X22.2	→	X2.2		X26.2	→	X2.2	
X22.3	→	X2.3		X26.3	→	X2.3	
X22.4	→	X2.4		X26.4	→	X2.4	
X32.1	→	5 - EXT-INP (1)		X36.1	→	5 - EXT-INP (1)	
X32.2	→	6 - EXT-INP		X36.2	→	6 - EXT-INP	
XB2.1	→	9 - EXT-INP		XB6.1	→	9 - EXT-INP	
XB2.2	→	10 - EXT-INP		XB6.2	→	10 - EXT-INP	
L2.1	→	11 - SRC-2 (2)		L6.1	→	11 - SRC-2 (2)	
X1.2	→	12 - SRC-2		X1.6	→	12 - SRC-2	
X23.1	→	X2.1	MODULE 3	X27.1	→	X2.1	MODULE 7
X23.2	→	X2.2		X27.2	→	X2.2	
X23.3	→	X2.3		X27.3	→	X2.3	
X23.4	→	X2.4		X27.4	→	X2.4	
X33.1	→	5 - EXT-INP (1)		X37.1	→	5 - EXT-INP (1)	
X33.2	→	6 - EXT-INP		X37.2	→	6 - EXT-INP	
XB3.1	→	9 - EXT-INP		XB7.1	→	9 - EXT-INP	
XB3.2	→	10 - EXT-INP		XB7.2	→	10 - EXT-INP	
L3.1	→	11 - SRC-2 (2)		L7.1	→	11 - SRC-2 (2)	
X1.3	→	12 - SRC-2		X1.7	→	12 - SRC-2	
X24.1	→	X2.1	MODULE 4	X28.1	→	X2.1	MODULE 8
X24.2	→	X2.2		X28.2	→	X2.2	
X24.3	→	X2.3		X28.3	→	X2.3	
X24.4	→	X2.4		X28.4	→	X2.4	
X34.1	→	5 - EXT-INP (1)		X38.1	→	5 - EXT-INP (1)	
X34.2	→	6 - EXT-INP		X38.2	→	6 - EXT-INP	
XB4.1	→	9 - EXT-INP		XB8.1	→	9 - EXT-INP	
XB4.2	→	10 - EXT-INP		XB8.2	→	10 - EXT-INP	
L4.1	→	11 - SRC-2 (2)		L8.1	→	11 - SRC-2 (2)	
X1.4	→	12 - SRC-2		X1.8	→	12 - SRC-2	

(1) Interconnection card on-board the power module.

(2) Interconnection card on-board the power module.

The signal terminal boards or connectors in the I/O module are located at the bottom of the right hand side distribution column, as indicated in the picture below.



Picture 58 – I/O module signal position

4 ELECTRICAL CONNECTION

The electrical connection is part of the work which is normally provided by the company that carries out the product installation. For this reason, the UPS manufacturer shall not be held responsible for any damages due to wrong connections.

Use qualified personnel only

All the operations related to the electric connection must be carried out by qualified and trained personnel.

Work in compliance with the local standards

The installation of *UPSaver* UPS must be carried out in compliance with national and local regulations.

Connection of ground cable

The grounding of the UPS via the relevant terminal is mandatory. It is strongly recommended to connect the ground terminal as first terminal.

The electrical connection is part of the work which is normally provided by the company that carries out the electrical installation and not by the UPS manufacturer. For this reason, the following recommendations are only an indication, as the UPS manufacturer is not responsible for the electrical installation. In any case we recommend to carry out the installation and the electrical input and output connections in compliance with the local standards.

Cables must be selected bearing in mind technical, financial and safety aspects. The selection and the sizing of cables from a technical viewpoint depend on the voltage, on the current absorbed by the UPS, on the bypass line and on the batteries, on the ambient temperature and on the voltage drop. Finally, the kind of cable laying must be taken into particular consideration.

For more explanations regarding the selection and the sizing of cables, please refer to the relevant IEC standards and technical guides.

“Short-circuit currents” (very high currents with a short duration) and “overload currents” (relatively high currents with a long duration) are among the main causes of cable damage. The protection systems normally used to protect the cables are: thermal magnetic circuit breakers or fuses. Protection circuit breakers must be selected according to the maximum short-circuit current (max Isc) that is needed to determine the breaking power of automatic circuit breakers, and to the minimum current (min Isc) that is needed to determine the maximum length of the line protected. The protection against short-circuit must operate on the line before any thermal and electro thermal effects of the overcurrents may damage the cable and relevant connections.

During the electrical installation take particular care to respect the phase rotation. The terminal boards for cables connection are positioned inside the I/O module, further details are available at the paragraph "Terminal boards".

Mains connection

The connection to the mains must be carried out with protection fuses between the mains and the UPS.

The use of differential protection devices in the line supplying the UPS is unadvisable. The leakage current to ground due to the RFI filters is rather high and it can cause spurious tripping of the protection device.

According to CEI EN62040-1 standard, in order to take into account the UPS' leakage current, residual current devices having adjustable threshold can be used.

4.1 CONNECTING THE POWER CABLES

For the electric connection of the *UPSaver* UPS, connect the following cables:

- DC supply from the battery (*+B*, *-B*, *N*);
- AC supply from the rectifier supply mains (*1-L1*, *1-L2*, *1-L3)*;
- Neutral conductors of the input lines (*1-N*, *2-N)*
- AC supply from the bypass supply mains (*2-L1*, *2-L2*, *2-L3)*;
- AC output to the loads (*3-L1*, *3-L2*, *3-L3*, *3-N)*.

Injury hazard due to electric shock!

Very high voltages are present at the ends of the cables coming from the battery:

- Isolate the battery via DC circuit breakers before connecting it to the UPS;
- Connect the ground cable to the relevant bar before carrying out any other connection inside the device.

Risk of damages to the device due to insufficient insulation

- The cables must be protected from short-circuits and leakage currents to earth;
- The connection points must be hermetically sealed to prevent the air from being sucked through the cable passage.

Risk of damages to the device due to incorrect wiring

To connect the device, follow the electrical drawing scrupulously and respect the polarity of cables.

Details of the electrical connections								
Potenza (kVA)		**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**
Input fuses [A]								
Rectifier		800	1250	1600	2x 1000	2x 1250	2x 1250	2x 1600
Bypass		1000	1600	2x 1000	2x 1250	2x 1600	2x 1600	2x 2000
Phase conductor cross sect. [mm²]								
Rectifier		2x150	2x300	3x240	4x240	4x240	Barra 3200A	
Bypass		2x150	2x240	3x240	3x240	4x240	5x240	6x240
Output		2x150	2x240	3x240	3x240	4x240	Barra 3200A	
Battery [1]	CB [2]	2x150	2x300	3x240	4x240	4x300	-	-
	DB [3]	1x150 (x 2)	1x150 (x 3)	1x150 (x 4)	1x150 (x 5)	1x150 (x 6)	1x150 (x 7)	1x150 (x 8)
Neutral conductor cross section								
Linear load		Same as the phase conductor						
NON-linear load		**1,5** x phase conductor cross section						
Earth conductor cross sect. [mm²]		1x185	2x150	2x185	2x240	2x300	2x300	3x240
Power connections								
Type		Copper / aluminium bars						
Conductor max. cross section [mm²]		300						
Max. number of conductors		4						
Fixing bolt dimension		M16						
Tightening torque [Nm]		170 +/- 20%						

[1] For the battery connection 3 groups of cables are needed, one for each polarity plus the central point (N)

[2] Suggested cables for centralized battery configuration (**single battery**)

[3] Suggested cables for distributed battery configuration (**one battery for each power module**)

The data detailed in the table above are indicative only. In designing the cables the rated current carrying capacities given by the CEI-UNEL35024/1 table have been taken into account, related to copper cables with PVC insulation sheath, with a maximum temperature of 70° C, without applying any de-rating factor. The given cross sections do not take into account the overload currents allowed by each line, which are detailed in the product Technical Specification. In case of different installation methods or operating temperatures higher than 70° C, apply the corrective factor according to the standards in force in the country of installation.

Rated current (at full load and battery recharging)							
Power (kVA)	**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**
Rectifier input [A] [1]	677	1015	1353	1690	2029	2367	2705
Bypass input / Output [A] [1] [2]	577	866	1155	1443	1732	2021	2309
Battery [A] [3]	347						

[1] Values referred to 400Vac rated voltage

[2] For the overload values please refer to the Technical Specification

[3] Current drawn by each power module at the minimum discharge voltage

4.2 BACK-FEED PROTECTION DEVICE

The back-feed protection device is installed inside the I/O module on *UPSaver* systems with distributed static bypass switch.

The device is a contactor for each power module, which automatically disconnects the bypass line in case of failure of the static switch, in order to avoid voltage feed-back on the input terminals during a mains failure.

The use of a device installed inside the UPS allows a higher flexibility of use, as only the bypass line is cut leaving the rectifier battery charger in operation.

The use of an external device forces the user to separate the UPS supply lines (rectifier and bypass) if the flexibility and availability of the UPS are supposed to be kept unaltered.

The *UPSaver* systems with centralized static bypass switch are provided with voltage-free contacts which can be used to operate the shunt trip coil of the external sectioning device; the external device is not part of the UPS supply and is provide and installed at customer care.

The following table shows the main electrical characteristics of the external sectioning device.

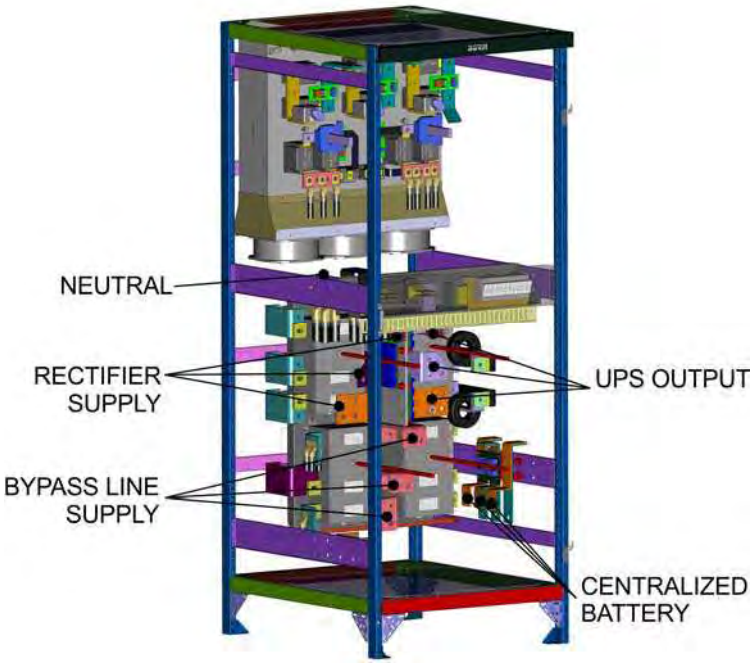
Back-feed protection device

UPS power (kVA)	**400**	**600**	**800**	**1000**	**1200**	**1400**	**1600**
Maximum operating voltage (Vac)	690						
Minimum rated current (A)	800	1250	1600	2000	2500	3200	3200
Category	AC-1						

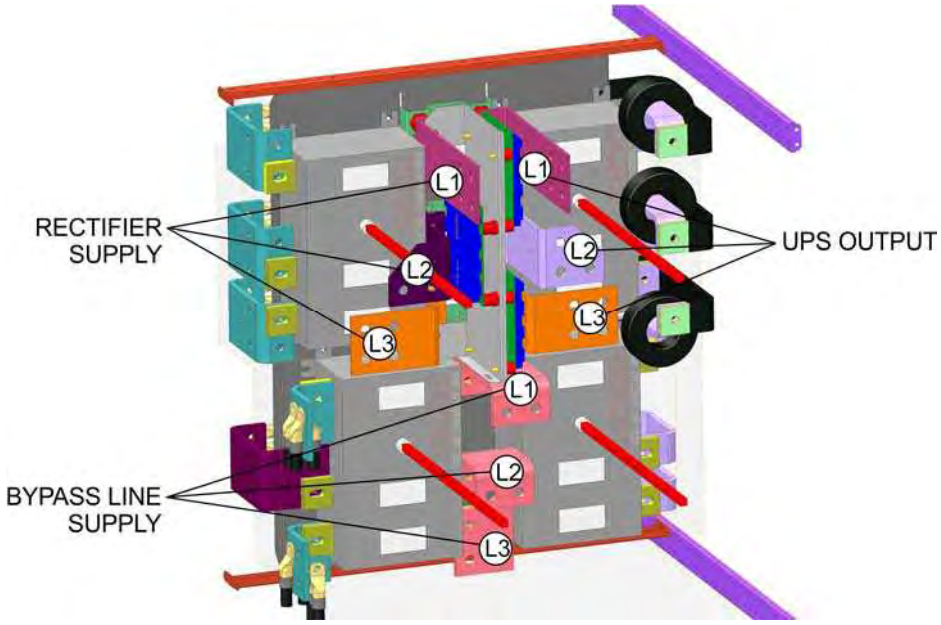
4.3 TERMINAL BOARDS

The *UPSaver* UPS is provided with terminal boards, located inside the I/O module, for the connection of power cables and of the auxiliary connections.

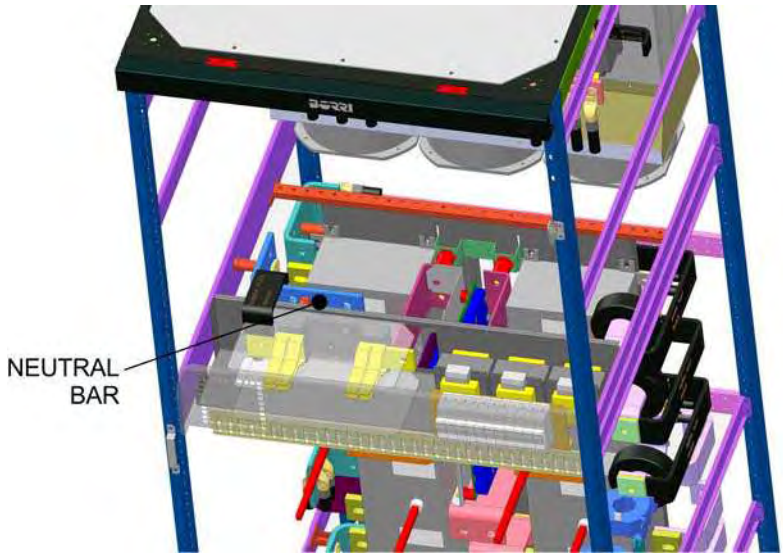
The cables entry can be provided either from the bottom or the top, on the basis of the plant requirements; the *UPSaver* basic configuration provides for bottom cables entry.



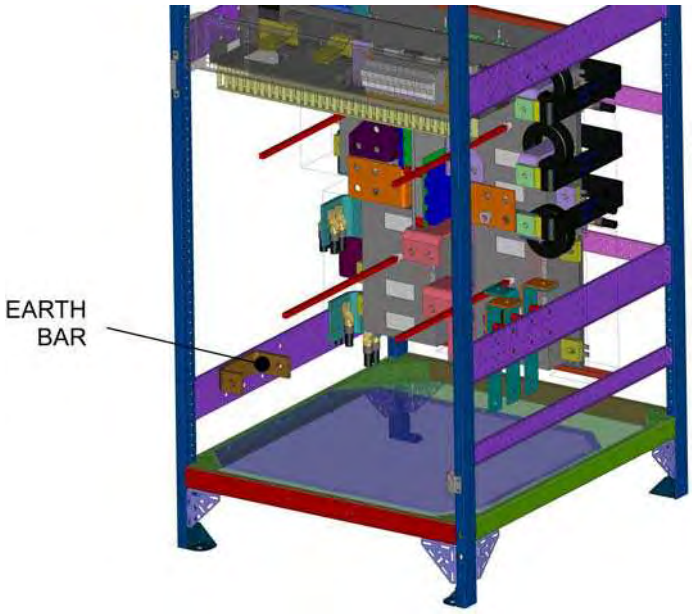
Picture 59 – 600-800kVA UPSaver, I/O module terminal boards (bottom cables entry)



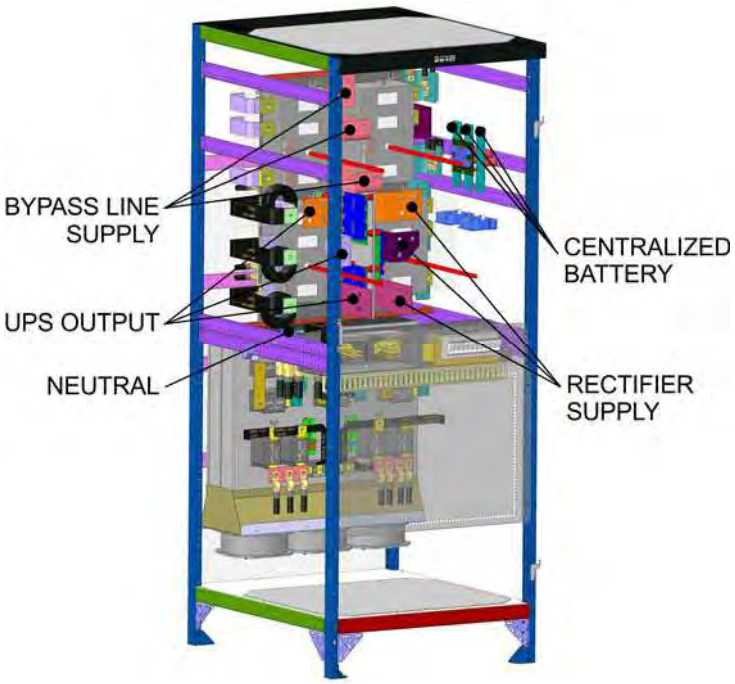
Picture 60 – 600-800kVA UPSaver, detail of the I/O module power terminals (bottom cables entry)



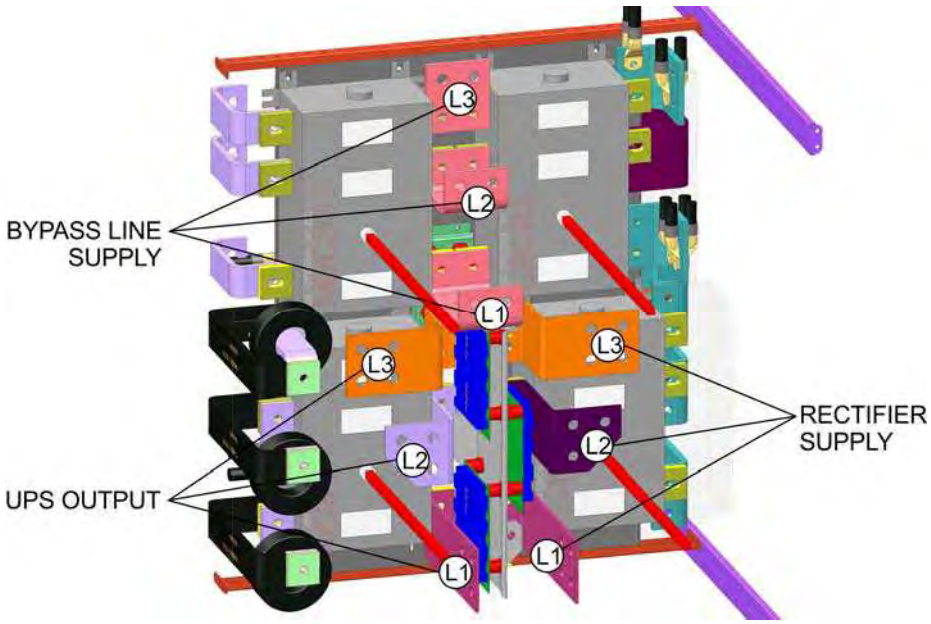
Picture 61 – 600-800kVA UPSaver, I/O module neutral connection bar (bottom cables entry)



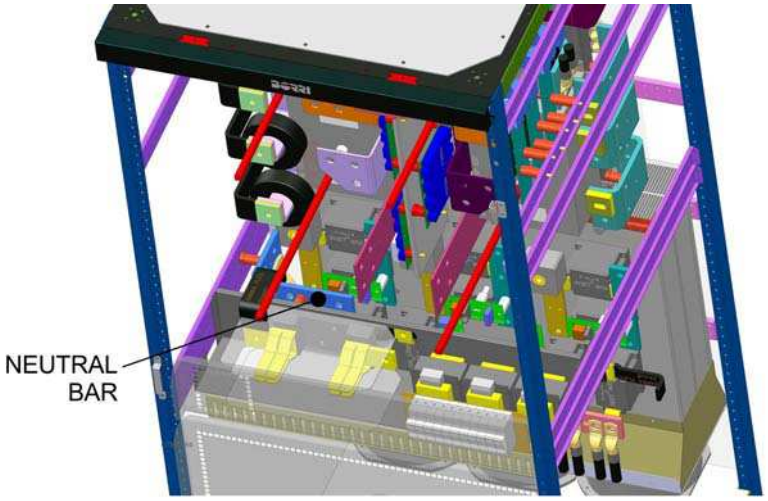
Picture 62 – 600-800kVA UPSaver, I/O module earth connection bar (bottom cables entry)



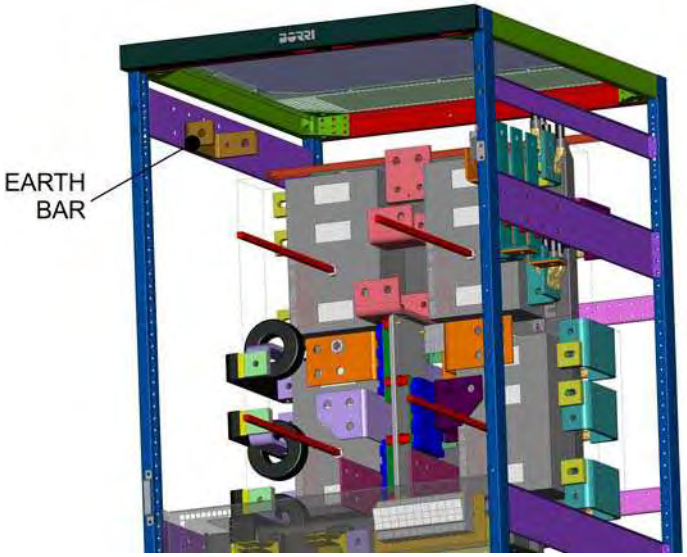
Picture 63 – 600-800kVA UPSaver, I/O module terminal boards (bottom cables entry)



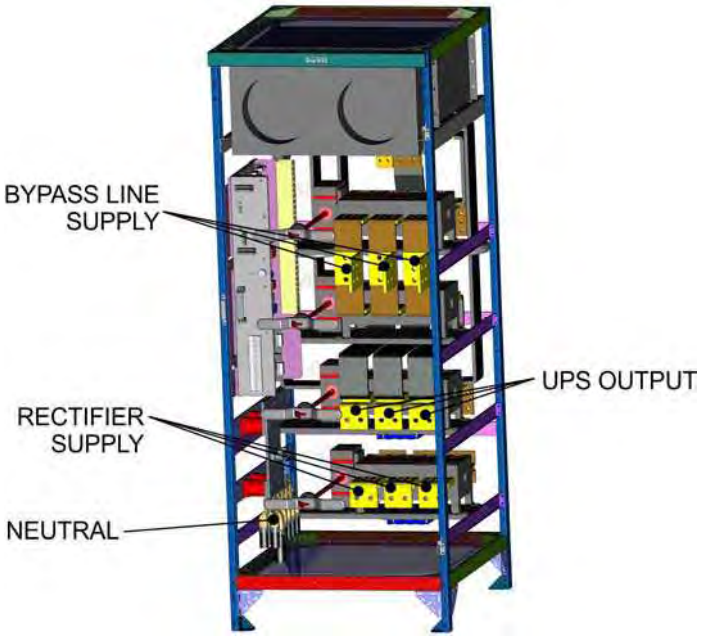
Picture 64 – 600-800kVA UPSaver, detail of the I/O module power terminals (bottom cables entry)



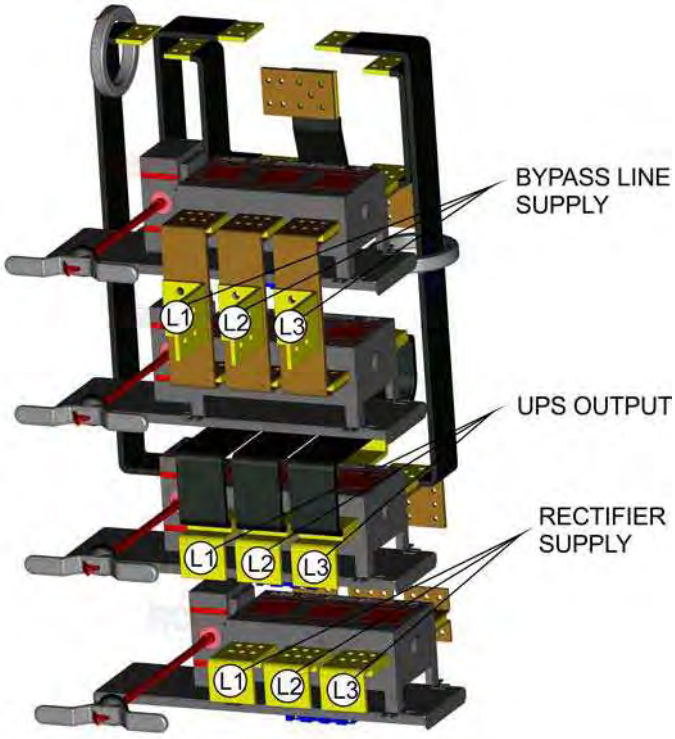
Picture 65 – 600-800kVA UPSaver, I/O module neutral connection bar (top cables entry)



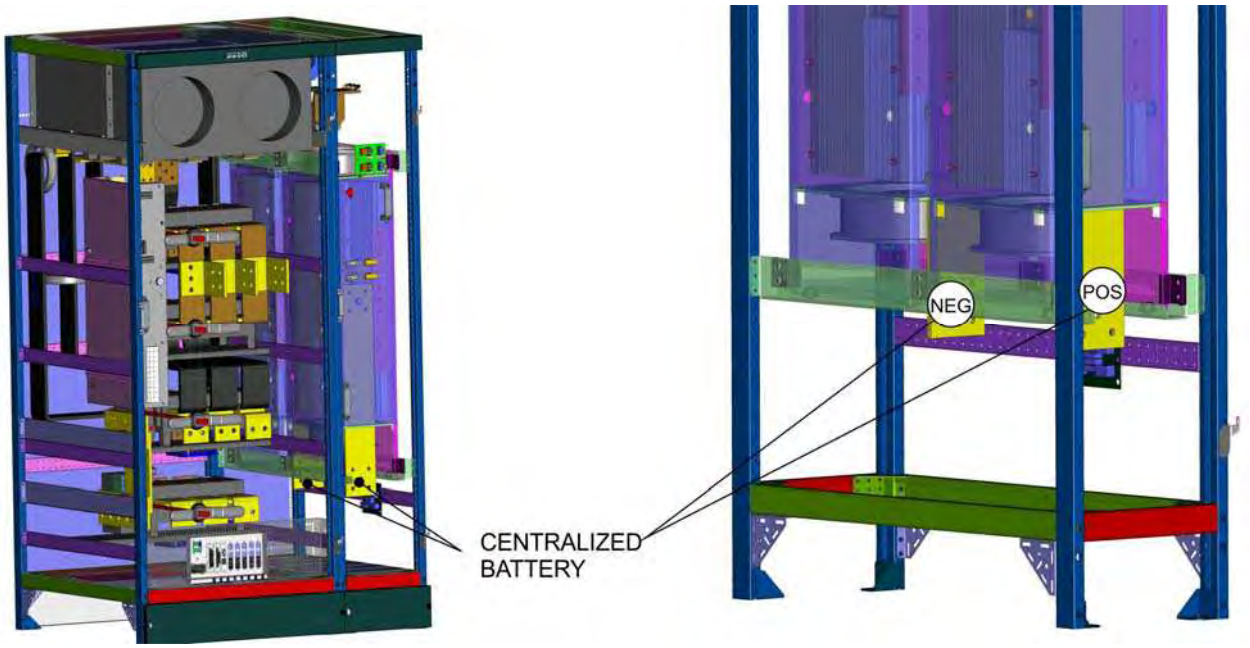
Picture 66 – 600-800kVA UPSaver, I/O module earth connection bar (top cables entry)



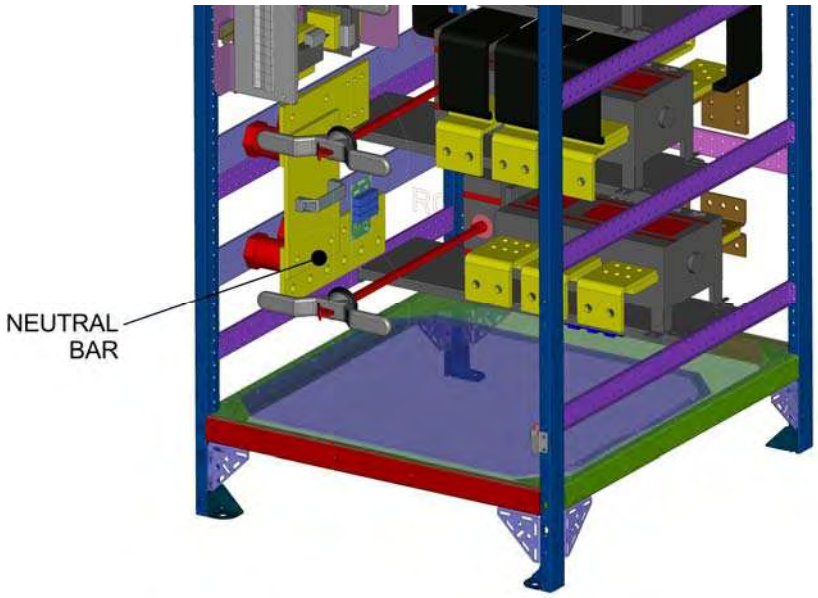
Picture 67 – 1200kVA UPSaver, I/O module terminal boards (bottom cables entry)



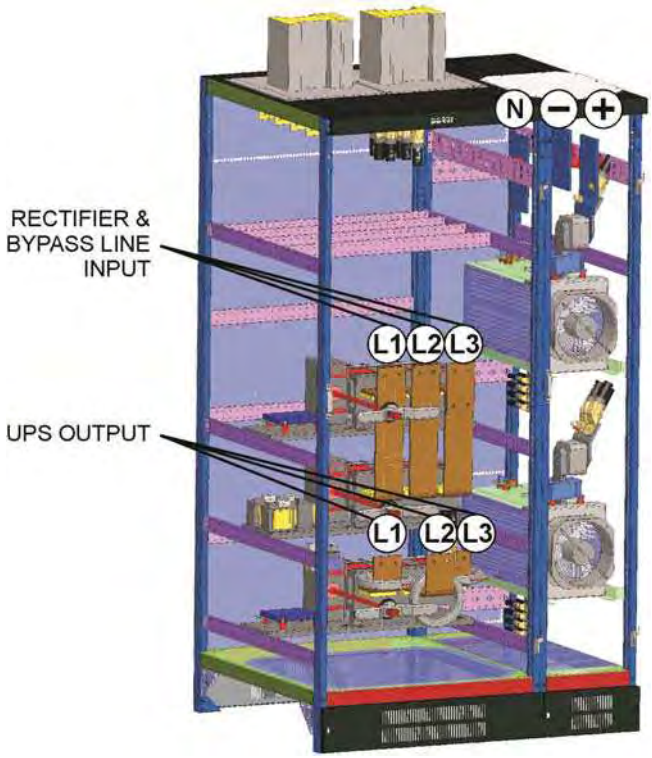
Picture 68 – 1200kVA UPSaver, detail of the I/O module power terminals (bottom cables entry)



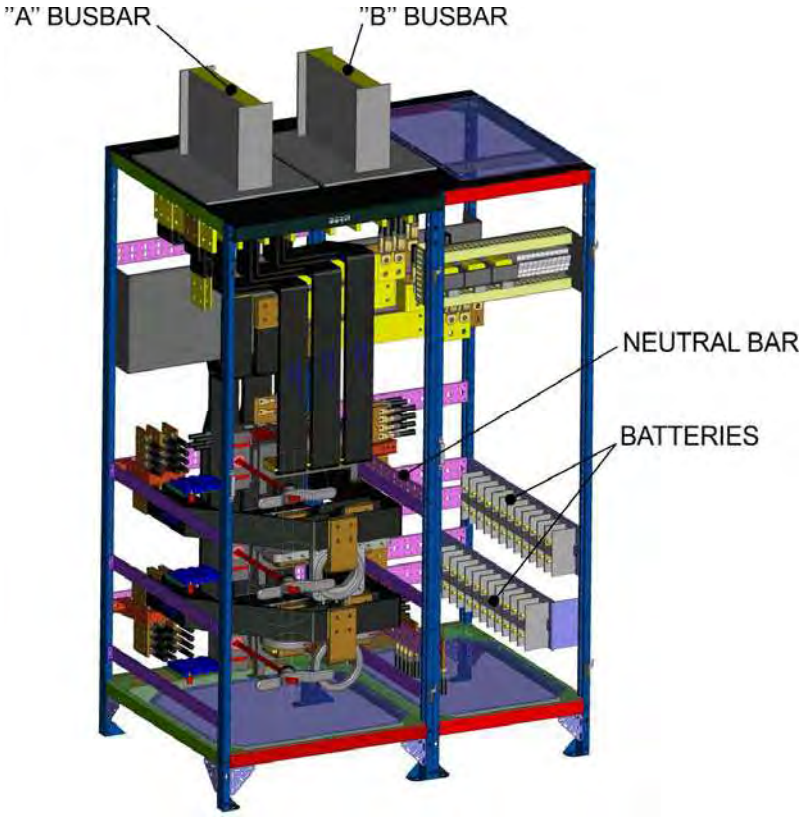
Picture 69 – 1200kVA UPSaver, centralized battery power terminals (bottom cables entry)



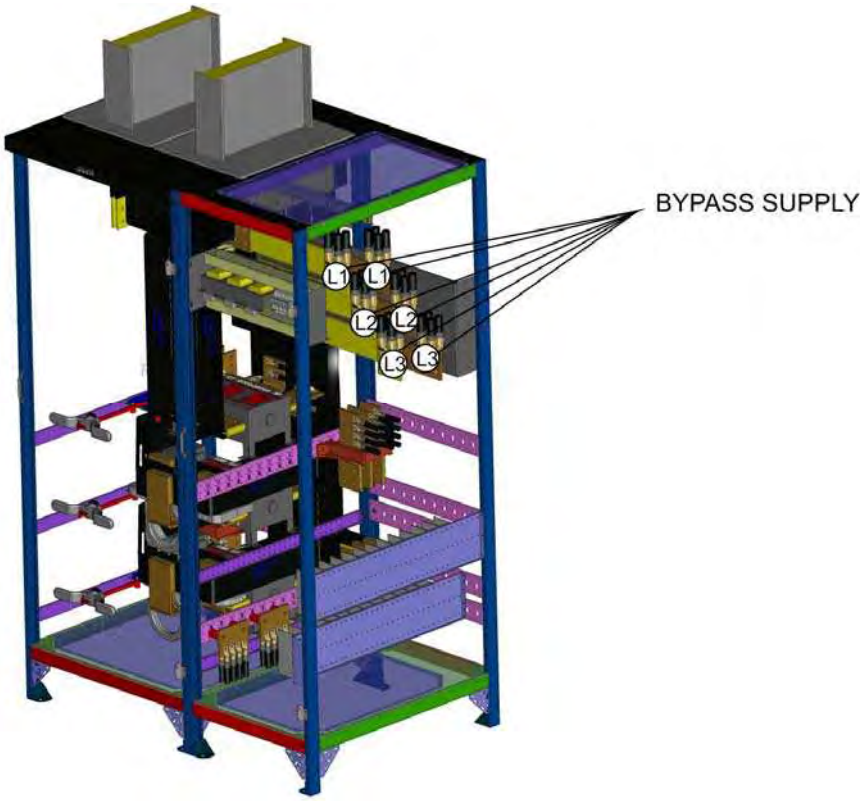
Picture 70 – 1200kVA UPSaver, I/O module neutral connection bar (bottom cables entry)



Picture 71 – 1200kVA-1400kVA UPSaver, centralized battery power terminals (top cables entry)



Picture 72 – 1600kVA UPSaver, detail of the I/O module power terminals



Picture 73 – 1600kVA UPSaver, detail of the I/O module power terminals

The 1600kVA I/O module, in its typical configuration, is arranged for input and putput power bus-bars, while for the bypass line and the batteries are used copper bars and terminals repsectively.

The configuration of the power bus-bars can be varied during the manufacturing phase, therefore the previous pictures must be considered purely indicative. Contact the manufacturer for detailed drawings related to the power connections.

4.3.1 Connection bars position

The tables that follow indicates the distance of the connection bars from a defined reference point:

- For **bottom** cables entry the distance is given **from the ground** (cabinet base)
- For **top** cables entry the distance is given **from the roof** (cables entry plate)

The distance is referred to the first available hole.

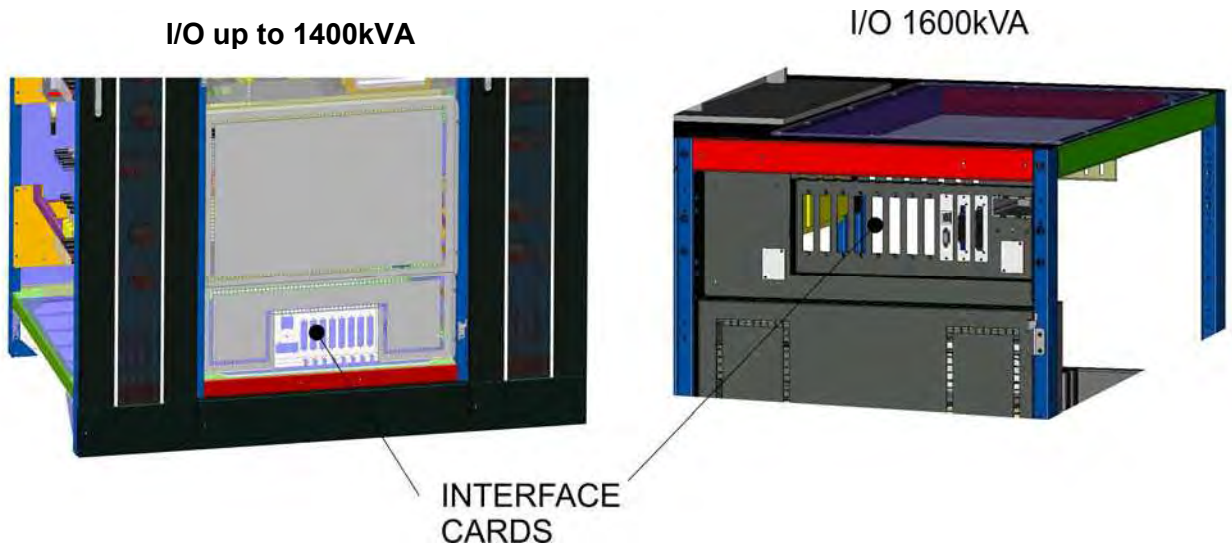
Bottom cables entry		**Distance from ground [mm]**		
Connection	**Bar**	**I/O 800kVA**	**I/O 1200kVA**	**I/O 1600kVA**
Rectifier	L1	1060	415	Contact the manufacturer
	L2	900	415	
	L3	770	415	
Bypass	L1	680	1235	
	L2	520	1235	
	L3	380	1235	
UPS output	L1	1060	715	
	L2	900	715	
	L3	770	715	
Battery	+B	415	500	
	N			
	-B			
Rect. / Byp. / Out. Neutral	N	1200	430	
PE	Earth	375	430	

Top cables entry		Distance from roof [mm]		
Connection	**Barra**	**I/O 800kVA**	**I/O 1200kVA**	**I/O 1600kVA**
Rectifier	L1	870	Contact the manufacturer	Contact the manufacturer
	L2	710		
	L3	575		
Bypass	L1	490		
	L2	320		
	L3	185		
UPS output	L1	870		
	L2	710		
	L3	575		
Battery	+B	215		
	N			
	-B			
Rect. / Byp. / Out. Neutral	N	1010		
PE	Earth	155		

4.4 INTERFACE CARDS

The UPS is provided with interface cards for the external communication of the operating status and parameters. Access to the card is possible opening the I/O module front door.

- RS232/USB: used for connection to the proprietary programming and control software.
- MODBUS: used for the transmission of data to the outside via MODBUS protocol (RS485).
- PARALLEL (OPTIONAL): used for the communication among *UPSaver* systems in parallel configuration.
- SNMP (OPTIONAL): is used for the external transmission of data via LAN.
- EXT-INP: used for connecting the external contacts.
- EXT-INP-3 (OPTIONAL): used for connecting the external contacts.
- SRC-2: relay card for the remote signalisation of the UPS status and alarms.
- THERMAL PROBE (OPTION): used for connecting an external thermal probe in order to acquire the temperature of the battery room.



Picture 74 – Location of the UPSaver interface cards

4.5 CONNECTING THE AUXILIARY CABLES

The *UPSaver* UPS can be connected to external controls and components specifically provided for enhancing the safety and reliability of the equipment.

For such a purpose dedicated interface cards are installed, so that the interconnection wires coming from external components can be connected. For what concern the position of the cards refer to the following paragraph.

On the ***EXT-INP*** card the following signals can be connected:

- *Diesel Mode* enabling contact (from Diesel Generator);
- external bypass switch;
- Remote shut-down contact (EPO);
- Auxiliary contact of the centralized battery isolator.

On the ***EXT-INP-3*** card the following signals can be connected:

- Auxiliary contact of the external manual bypass switch;
- Auxiliary contact of the external UPS output switch;

The connection of the auxiliary wires is made using a dedicated terminal board on the interface cards, to which cables with a maximum cross section of 1,5 mm^2 can be connected.

4.5.1 *DIESEL MODE activation*

Auxiliary contact from the Diesel Generator; terminals 3-4 card *EXT-INP*.

A normally open contact is required; when the contact is closed (if the Diesel Mode operation is enabled) the microprocessor will acquire its status and vary the battery recharge voltage to the pre-set value.

4.5.2 External *Bypass_SW* contact

Contact of an external Normal/Bypass selector; terminals 5-6 card *EXT-INP*.

A normally closed contact is required; when the contact is opened the load is switched from inverter to bypass (or vice-versa in case of ECO MODE, where the bypass is the priority line).

4.5.3 Remote shut-down (EPO)

Auxiliary EPO contact; terminals 7-8 card *EXT-INP*.

The voltage supply to the loads can be interrupted from a remote location by using this contact (i.e. for safety requirements). A normally closed contact is required; when this contact is open the static inverter and by-pass switches are opened so that the output supply is interrupted.

4.5.4 Battery switch auxiliary contact

Battery isolator auxiliary contact; terminals 9-10 card *EXT-INP*.

This auxiliary contact is necessary to indicate the position of the isolator (open-closed) and the fuse status (if the fuse indicator is wired in series with the battery isolator auxiliary contact).

4.5.5 External manual bypass

Auxiliary contact of the External Manual Bypass Switch (MBCB), if provided for; terminals 1-2 card *EXT-INP-3*.

A normally open contact is required; when the contact is closed (see Manual Bypass procedure), the microprocessor will acquire the status of the contact and shut down the inverter.

4.5.6 External UPS output switch

Auxiliary contact of the external UPS output switch (OCB), if provided for; terminals 3-4 card *EXT-INP-3*.

This auxiliary contact must concordant with the position of the switch order to activate the alarm when the switch is opened.

4.6 *SRC-2* RELAY CARD CONNECTION

The *UPSaver* is provided with a relay card for the remote repetition of operating statuses and alarms, named *SRC-2*. The connection of the user cables is made directly on the card terminals; the card is located in the area reserved to the I/O module interface cards.

Relay	Alarms/Status	Status	M1		Led	
			Pins	Status in normal operation	Name	Status in normal operation
RL1	Alarm = A30 COMMON ALARM	Not energized if alarm is present	2-3	Closed	DL1	On
			1-2	Open		
RL2	Alarm = A1 MAINS FAULT	Not energized if alarm is present	5-6	Closed	DL2	On
			4-5	Open		
RL3	Alarm = A9 BATTERY AUT END	Not energized if alarm is present	8-9	Closed	DL3	On
			7-8	Open		
RL4	Alarm = A13 INV OUT OF TOL	Not energized if alarm is present	11-12	Closed	DL4	On
			10-11	Open		
RL5	**NORMAL MODE** Alarm = A16 BYPASS → LOAD	Not energized if alarm is present	13-14 14-15	Closed Open	DL5	On
	ECO MODE Status = S7 BYPASS → LOAD	Energized if status is present	14-15 13-14	Closed Open		

Relay output characteristics:

250 Vac voltage 1 A current
30 Vdc voltage 1 A current resistive load

5 STARTUP AND SHUTDOWN

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.

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.

5.1 PRELIMINARY CHECKS

Before starting up the unit, make sure that:

- all installation and electric connection works have been performed professionally;
- all power and control cables have been properly and tightly connected to the relevant terminal boards;
- the ground cable is properly connected;
- the battery polarity is correct and the voltage is within the operating values;
- the phase rotation of the line is correct and the voltage is within tolerance with the operating values;
- the emergency power off "EPO" push-button, if installed, is not pressed (if not, press it back to the rest position).

5.2 START-UP PROCEDURE

First system start-up

During the first start-up of the *UPSaver* system the I/O module and the power modules are configured and the system redundancy is defined.

The first start-up is performed either by the manufacturer's technical personnel or authorized service centres.

EPO push-button and phase rotation

Before switching the UPS on, make sure that:

1) the emergency power off “EPO” push-button, if installed, is not pressed. If not, press it back to the rest position;
2) the input and output phase rotation is correct.

Circuit breaker BCB

In case of centralized battery configuration the switch *BCB* is installed externally to the UPS system.

Do not close the battery breaker BCB before it’s required by the front panel. Serious damages to the UPS internal parts and/or to the battery may occur.

The *UPSaver* system start-up is completely guided; the indications available by the *touch screen* allows the complete comprehension of the various steps and helps the operator in performing the requested operations in the correct sequence.

However, all the sectioning devices must be mandatorily manoeuvred under the supervision and control of engineers who are qualified to operate on electrical circuits.

Use qualified personnel only

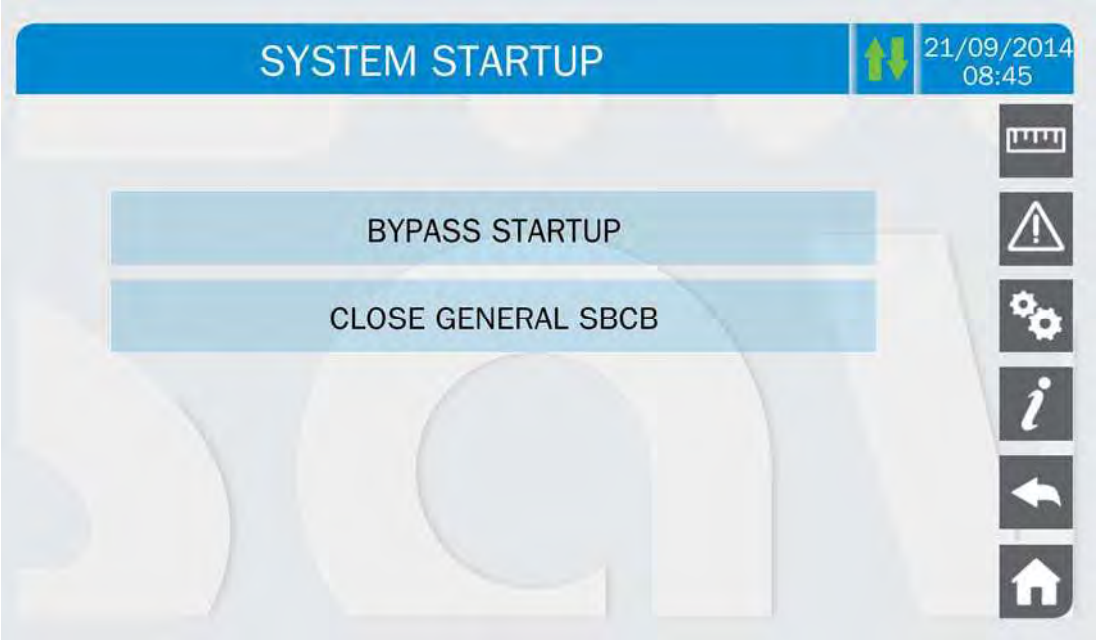
Any electrical manoeuvre must be carried out by qualified and trained personnel.

The system start-up is essentially split into three phases:

- I/O module (*centralizer*) supply and control logic start-up;
- power modules start-up by closing the switches located in the distribution column at the sides of the I/O module;
- Closure of the general switches inside the I/O module.

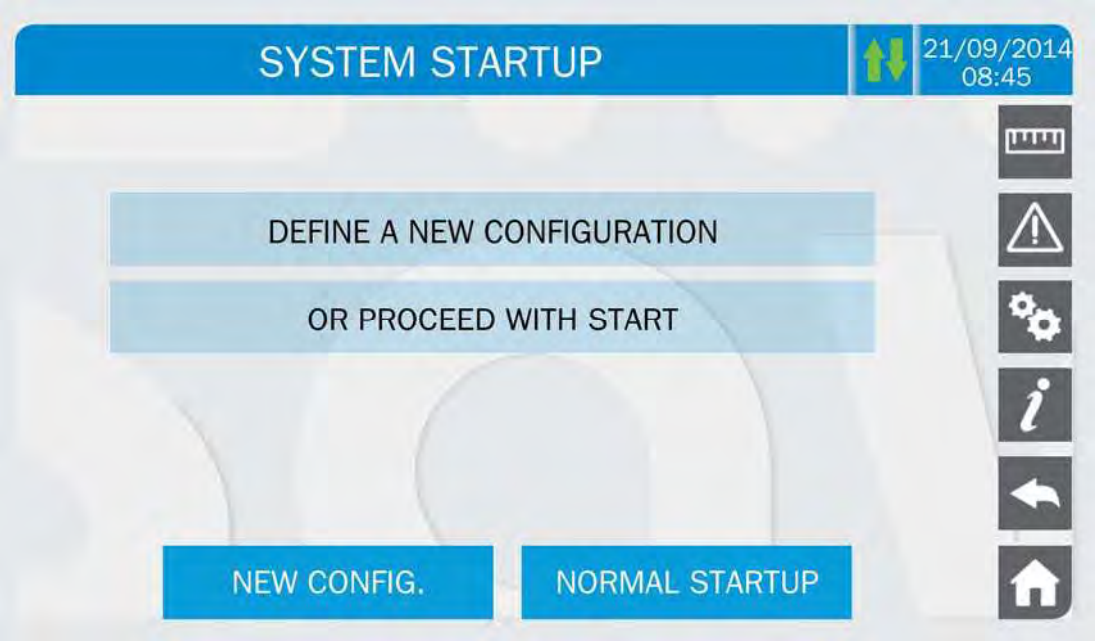
1) Close the general switch RCB inside the I/O module. After some seconds the *touch screen* will start, which will shown the start-up screen with the *UPSaver* logo.

Picture 75 – Touch screen start-up image



Picture 76 – I/O module start-up

2) After the software loading phase the control logic will acquire the system status and the operation of the RCB switch, and will give the first operating instruction as shown in the picture below. Close the general switch SBCB as requested.

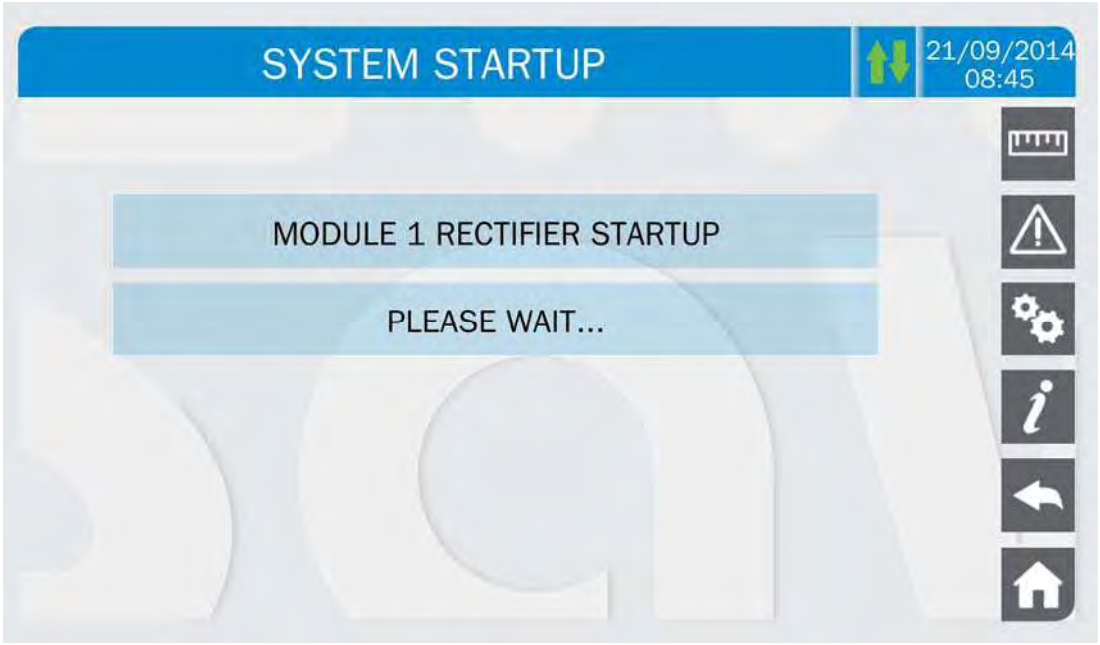


Picture 77 – Choice of the start-up mode

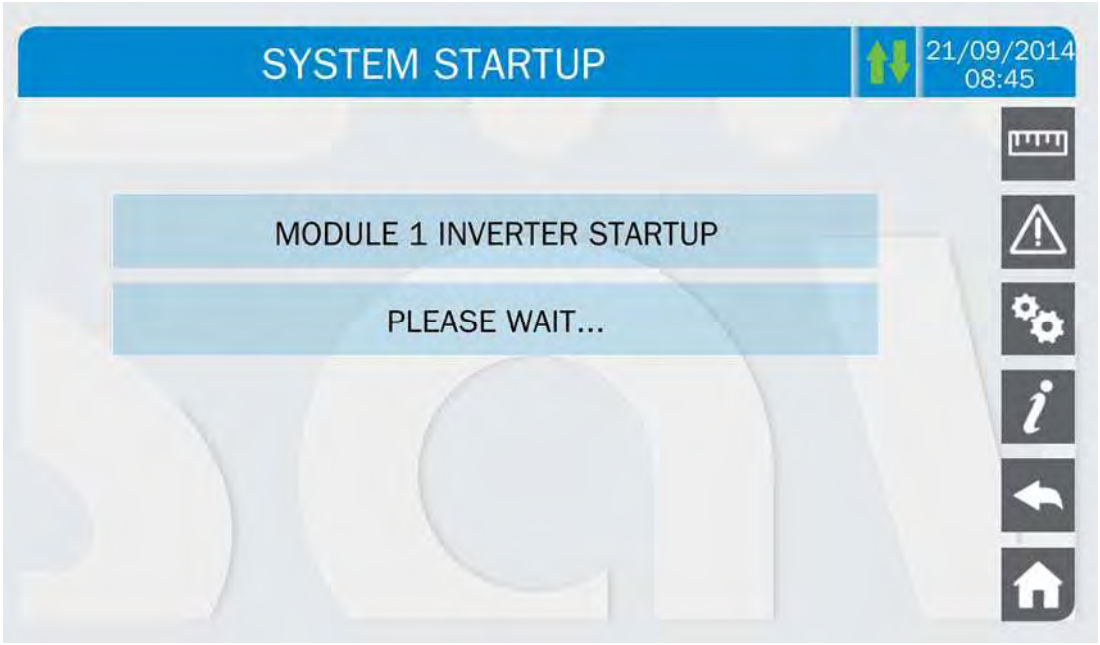
3) Press on the *NORMA* STARTUP button. The *NEW CONFIG.* section is generally used during the first start-up and is reserved to trained personnel.

Picture 78 – Module 1 start-up

4) Close the switch RCB1 in order to start the module 1 control logic. The module start-up can be skipped by pressing the *SKIP* button; the display will immediately switch to the following module. The skipped module can be started at a later stage using the *Module insertion* procedure.



Picture 79 – Module 1 start-up

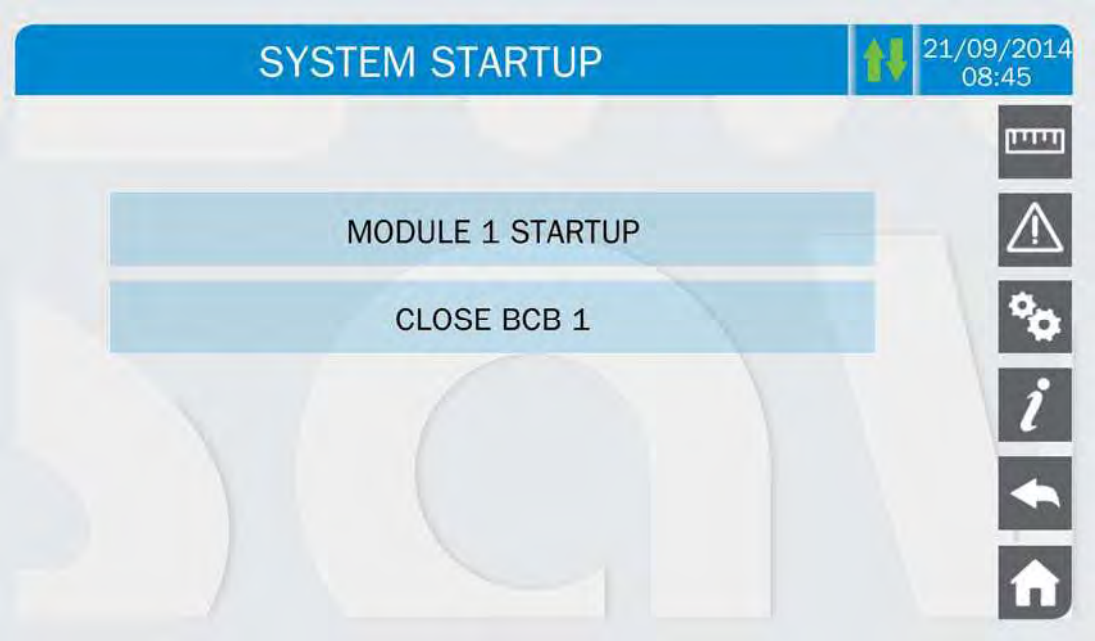


Picture 80 – Module 1 start-up

5) The module 1 rectifier and inverter are started in sequence; once these phases are completed the battery voltage is checked and the green lamp located next to the battery switch BCB1 will turn on. Close the switch BCB1 as requested.

In case of centralized battery configuration (CB) the BCBx closure connects the module "x" DC bus to the I/O module common DC bus, and subsequently to the battery by the closure of the general switch BCB.

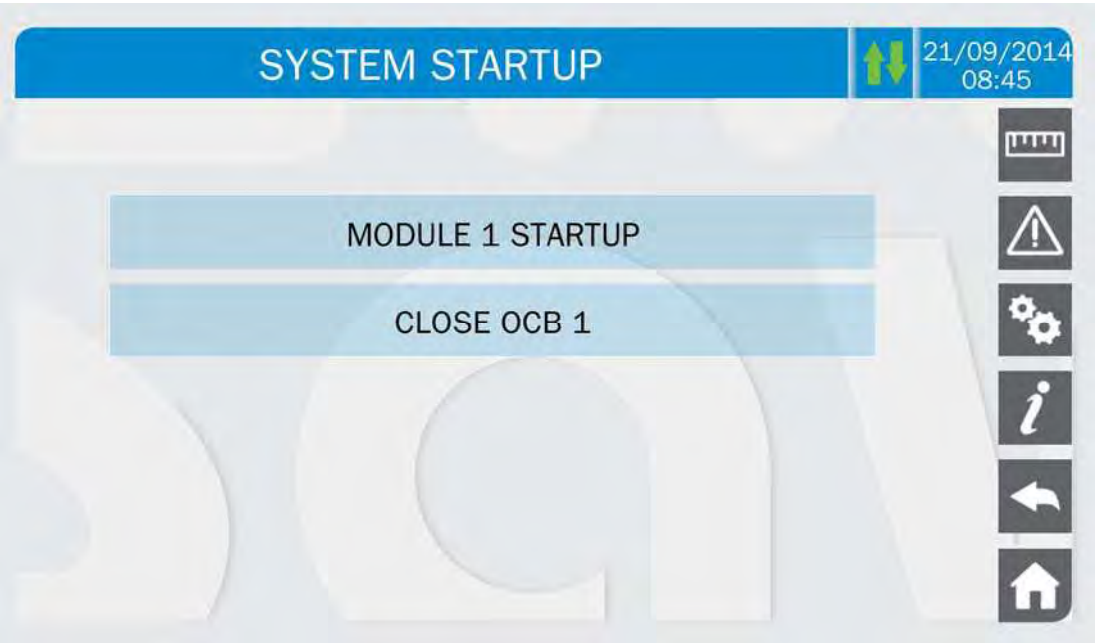
In case of distributed battery configuration (DC, one battery bank for each module) the BCBx closure connects the module "x" to its own battery.



Picture 81 – Module 1 start-up

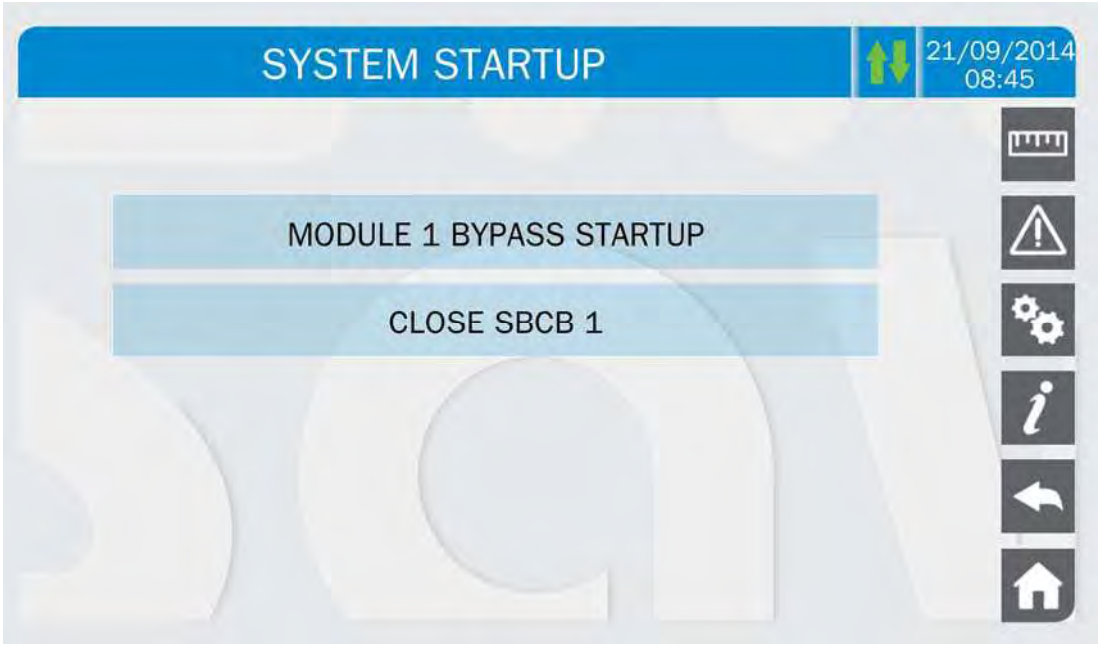
Operation on BCB switch

The switches BCBx, located in the distribution column, can only be closed if the relevant green lamp is on. Serious damages both to the battery and the equipment may occur if the breaker is closed before the front panel requires it.



Picture 82 – Module 1 start-up

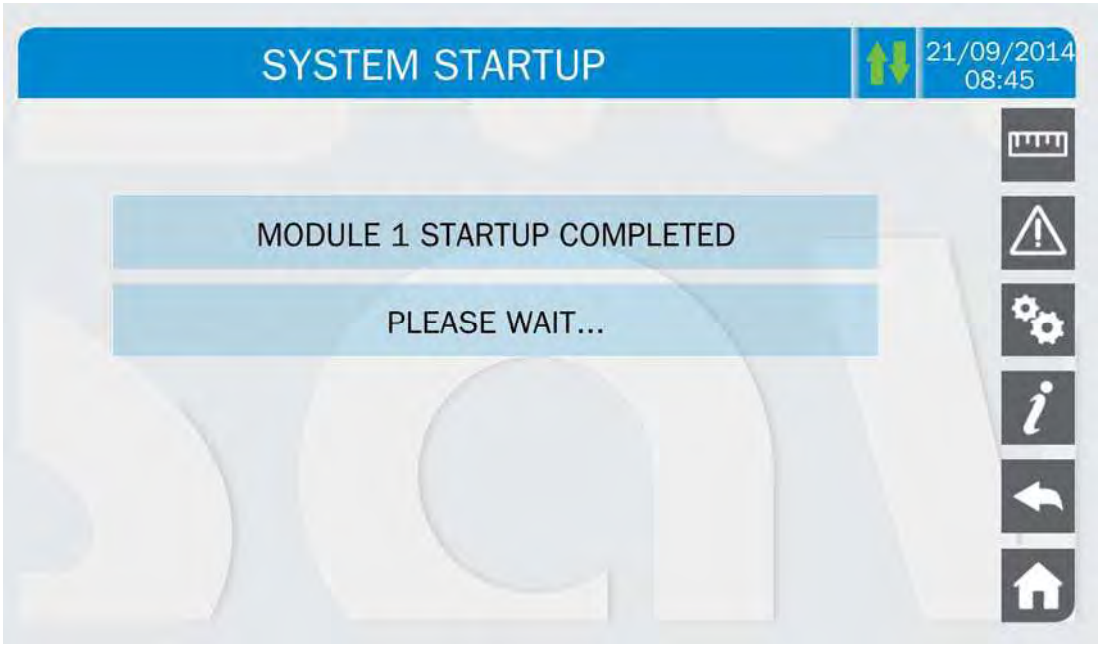
6) Close OCB1 to connect the module 1 output to the I/O module common output bus.



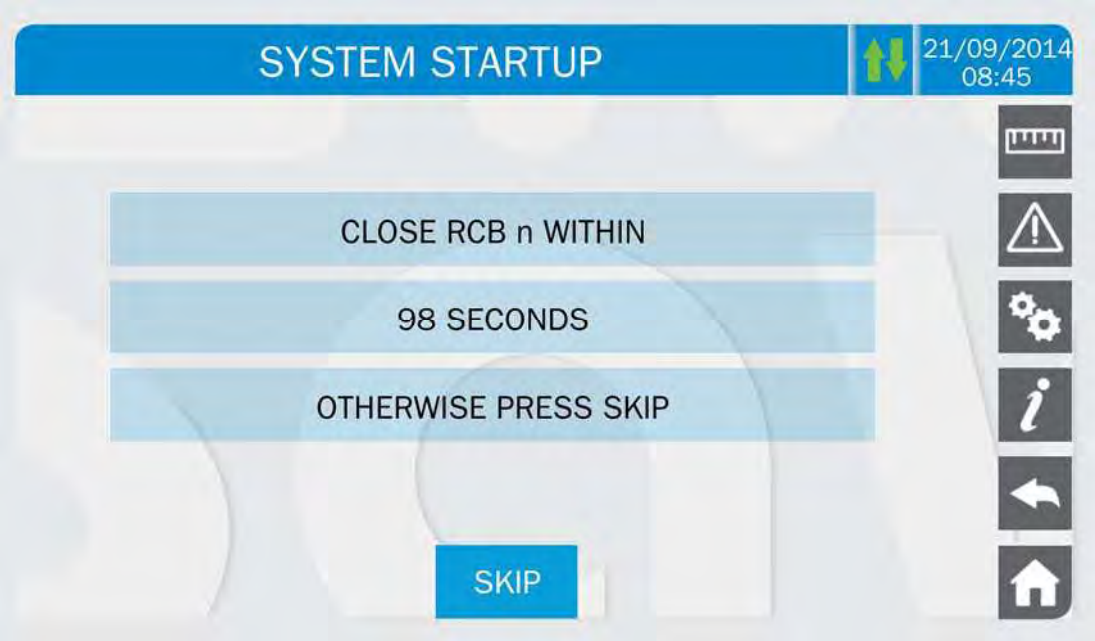
Picture 83 – Module 1 start-up

7) Press the button SBCB1 to supply the module 1 bypass line and wait for the closure of the back-feed contactor located inside the I/O module.

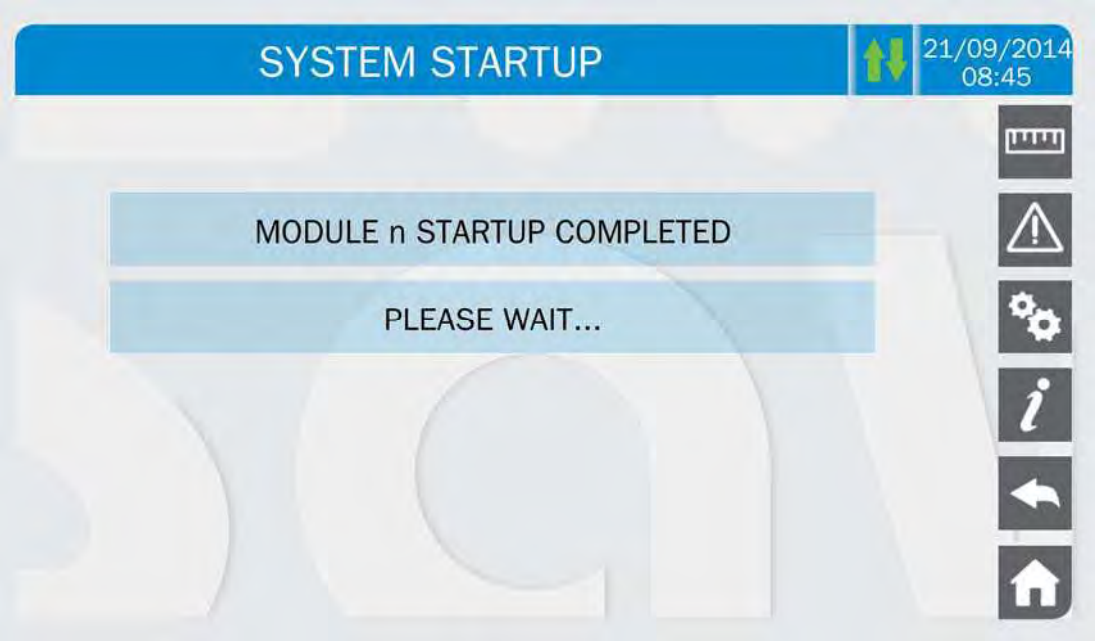
In case of centralized static bypass switch configuration (CSB, single static switch located inside the I/O module) such phase is not present, since the bypass line is not connected to the power modules.



Picture 84 – Module 1 start-up

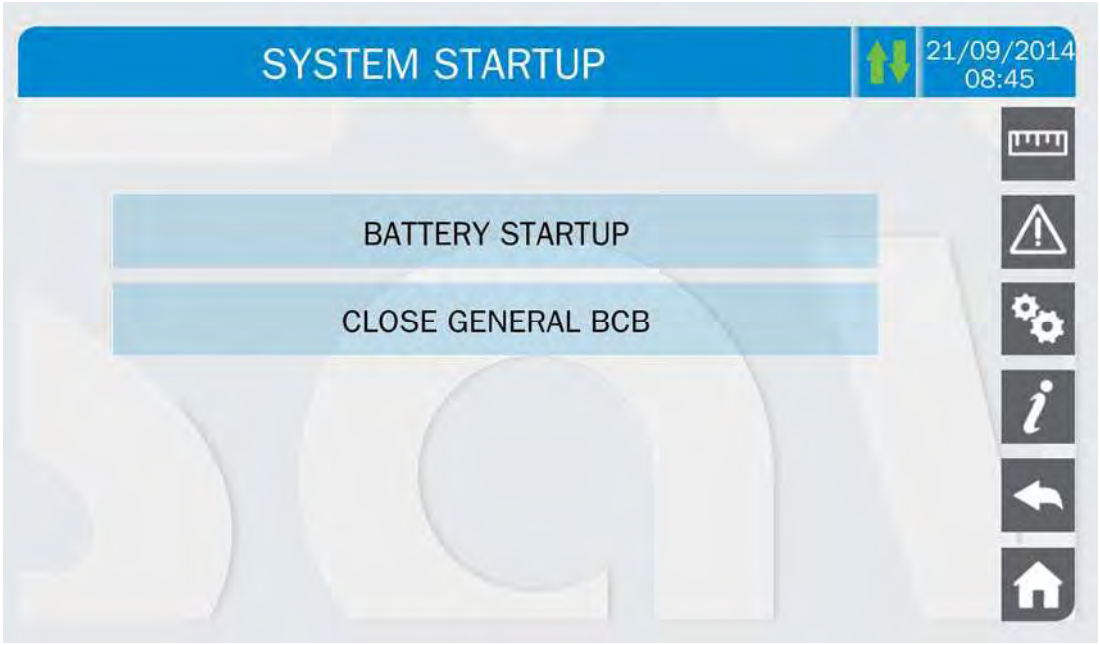


Picture 85 – Module "n" start-up



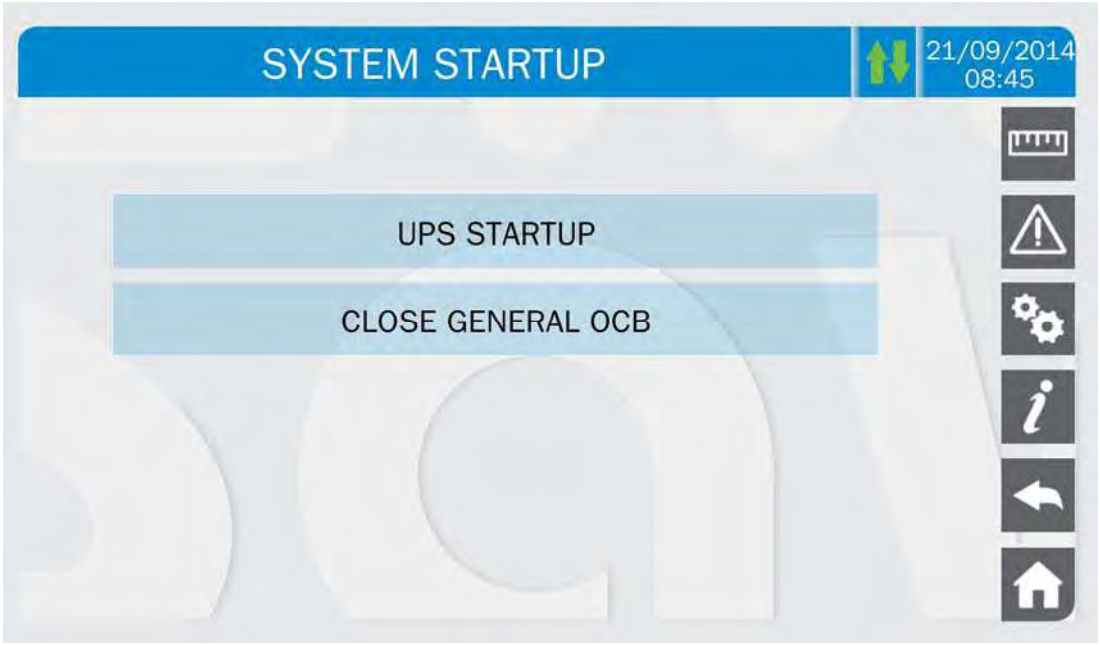
Picture 86 – Module "n" start-up

8) Once the module 1 is started (or the following module in case the module 1 had been skipped), the sequence will go on repeating the same operations, until the last module is started.



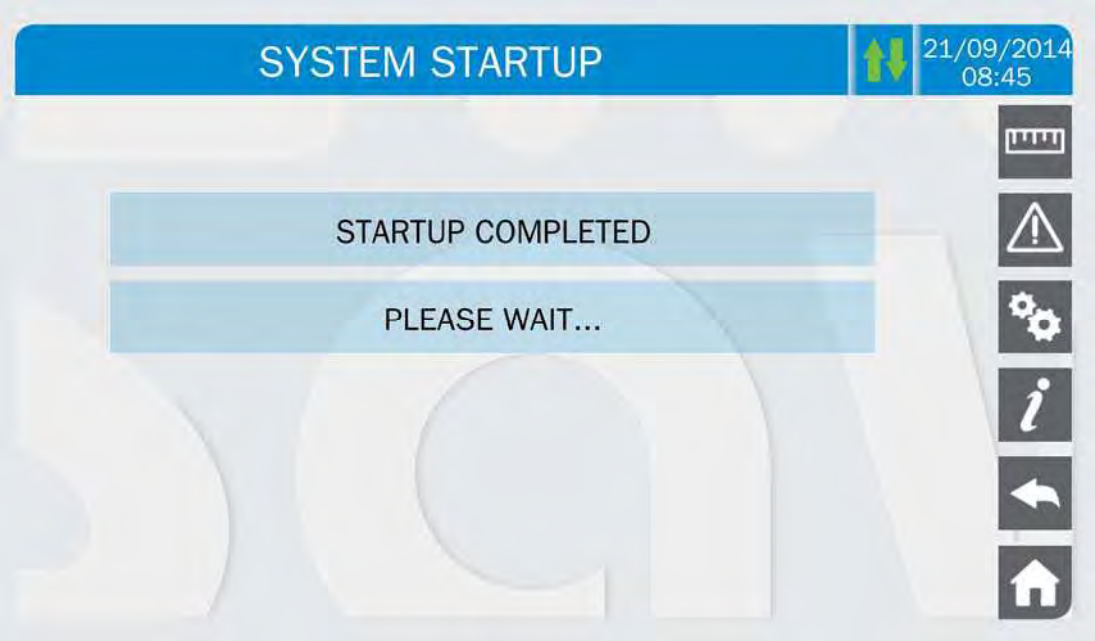
Picture 87 – Battery start-up

9) All the modules are now started and connected, either to their own battery (DB, distributed battery configuration) or in parallel to the common DC bus in the I/O module (CB, centralized battery configuration). Close the battery switch BCB (external) in order to connect the centralized battery (CB) to the *UPSaver* system. In case of distributed battery (DB) such operation is not necessary and the sequence does not show it.

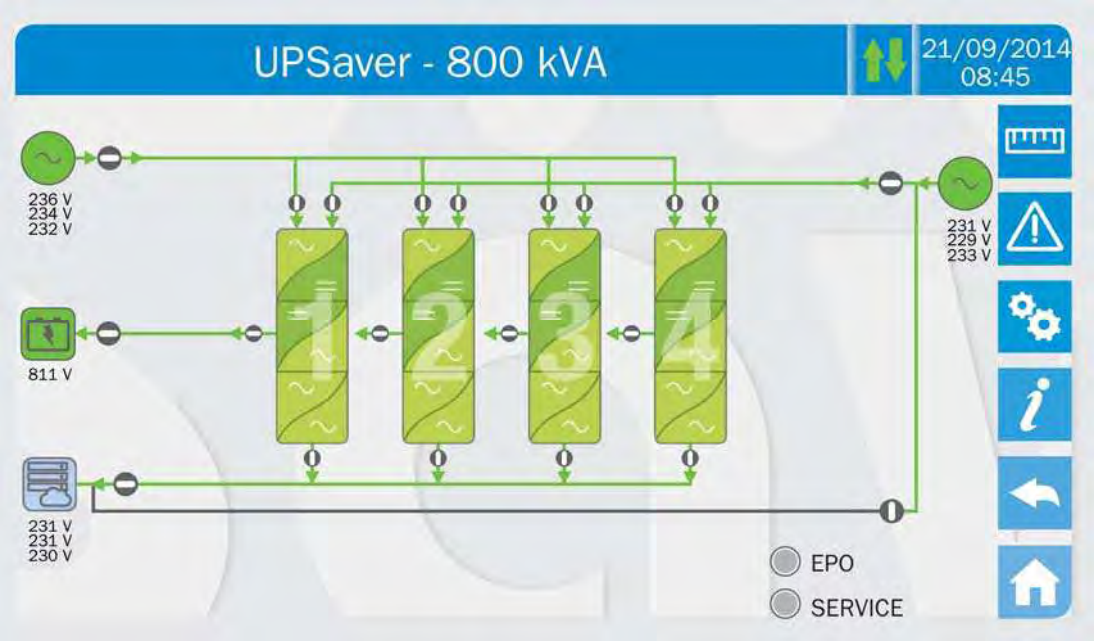


Picture 88 – Connection of the system to the load

10) Close the general switch OCB to connect the *UPSaver* system to the load.



Picture 89 – Start-up completed



Picture 90 – Flow diagram

11) At the end of the start-up sequence the *touch screen* shown the system flow diagram with the main parameters shown next to each supply source.

5.3 SHUT-DOWN PROCEDURE

It is advisable to shut-down the *UPSaver* system by using the emergency power off push-button (EPO) and then proceed to open the general switches OCB, SBCB, BCB and RCB. Operating the EPO push-button allows the control logic to stop the system in a controlled manner, so that whatever operation will follow, it will be done in complete safety.

In case the EPO push-button is not installed, or the operator needs to operate in a different way, proceed as indicated below.

1) Stop all power modules using, for each one of them, the procedure indicated at paragraph 5.6.
2) Open the general switch **OCB**.
3) Open the general switch **BCB**.
4) Open the general switch **RCB**.
5) Open the general switch **SBCB**.

5.4 SWITCHING PROCEDURE TO MANUAL BYPASS

The load is transferred to Manual Bypass with no interruption of supply to the loads. In this configuration, the system can be restarted via the return procedure from load on manual bypass, without the need to de-energize the loads.

Manual bypass

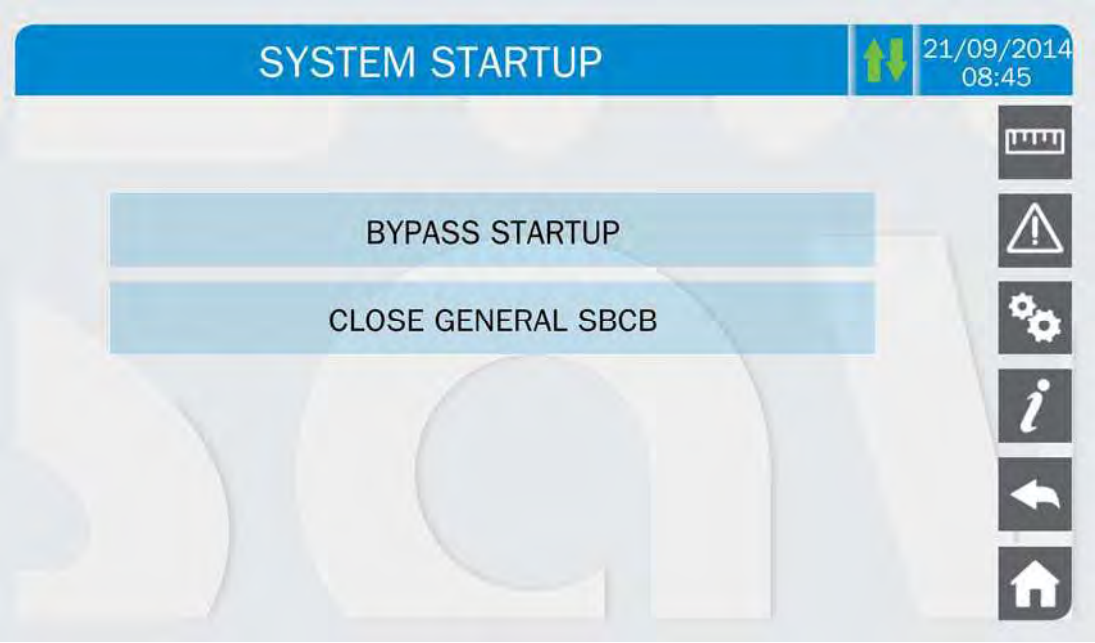
To perform the switching procedure correctly, make sure no alarms are present on the system.
During Manual Bypass the load is supplied directly by the input mains, therefore continuous supply cannot be guaranteed to the loads.

1) Move the *Bypass_SW* selector to the **BYPASS** position.
2) Close the switch MBCB.
3) Stop all power modules using, for each one of them, the procedure indicated at paragraph 5.6.
4) Open the general switch **OCB**.
5) Open the general switch **BCB**.
6) Open the general switch **RCB**.
7) Open the general switch **SBCB**.

5.5 RESTART FROM MANUAL BYPASS

Before restarting the UPS from manual by-pass, make sure the *Bypass_Sw* selector is in **BYPASS** position and the MBCB isolator is closed.

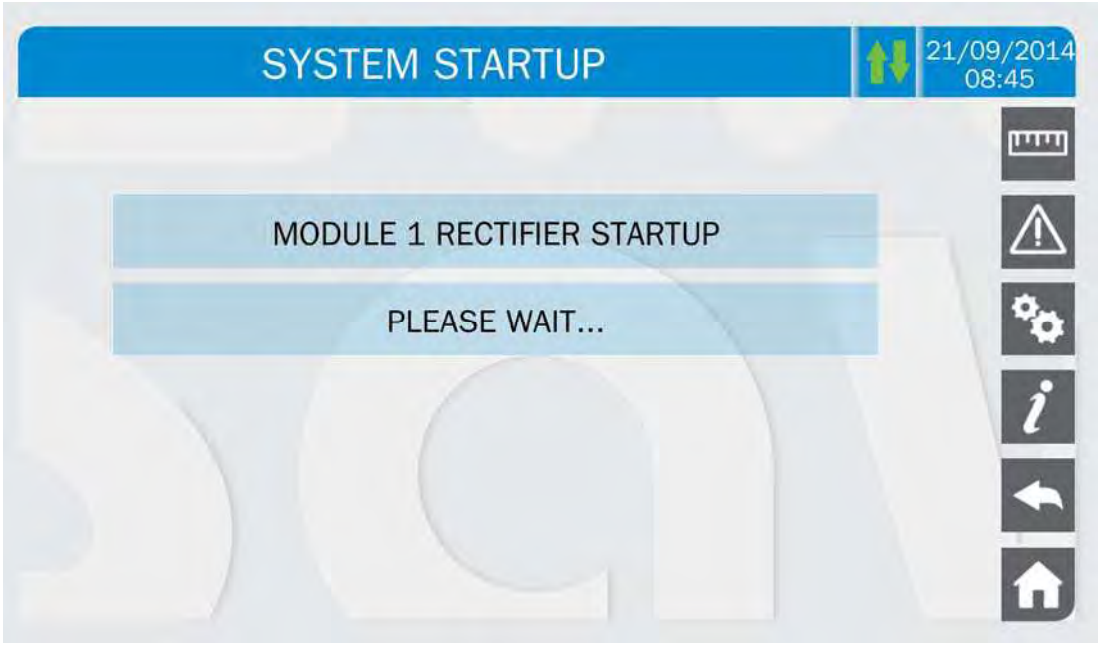
1) Close the general switch RCB inside the I/O module. After some seconds the *touch screen* will start, which will shown the start-up screen with the *UPSaver* logo.
2) After the software loading phase the control logic will acquire the system status and the operation of the RCB switch, and will give the first operating instruction as shown in the picture below. Choose the *NORMAL STARTUP* option and then close the general switch SBCB as requested.



Picture 91 – I/O module start-up

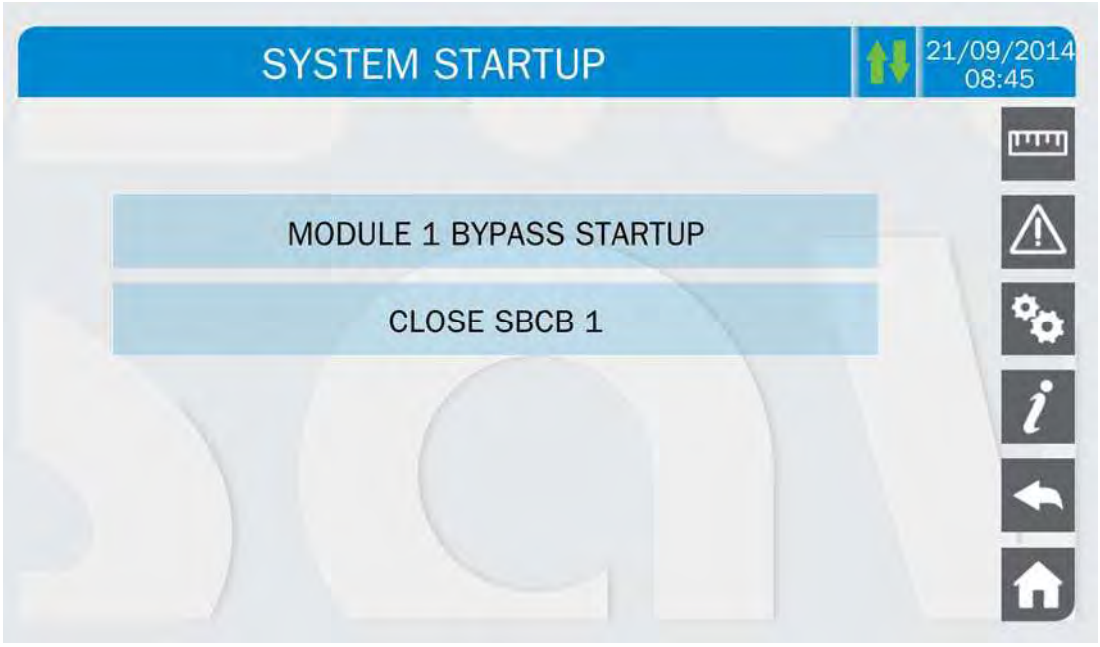
Picture 92 – I/O module start-up

3) Close the switch RCB1 in order to start the module 1 control logic. The module start-up can be skipped by pressing the *SKIP* button; the display will immediately switch to the following module. The skipped module can be started at a later stage using the *Module insertion* procedure.



Picture 93 – Module 1 start-up

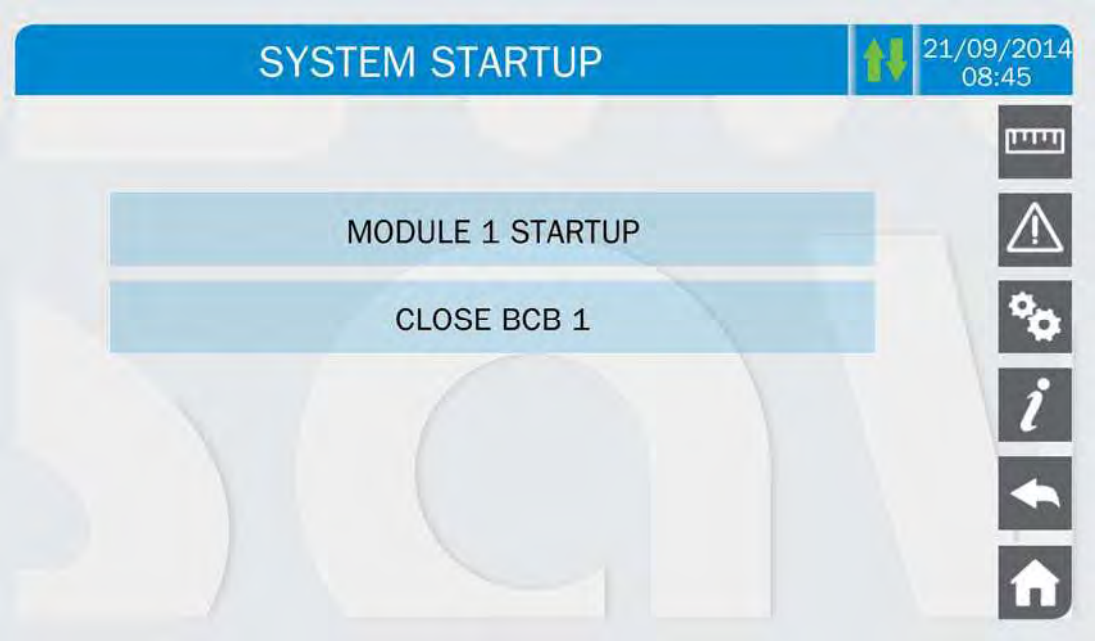
4) The module 1 rectifier is started; at the end of this phase the sequence requires the bypass line to be supplied.



Picture 94 – Module 1 start-up

5) Press the button SBCB1 to supply the module 1 bypass line and wait for the closure of the back-feed contactor located inside the I/O module.

In case of centralized static bypass switch configuration (CSB, single static switch located inside the I/O module) such phase is not present, since the bypass line is not connected to the power modules.



Picture 95 – Module 1 start-up

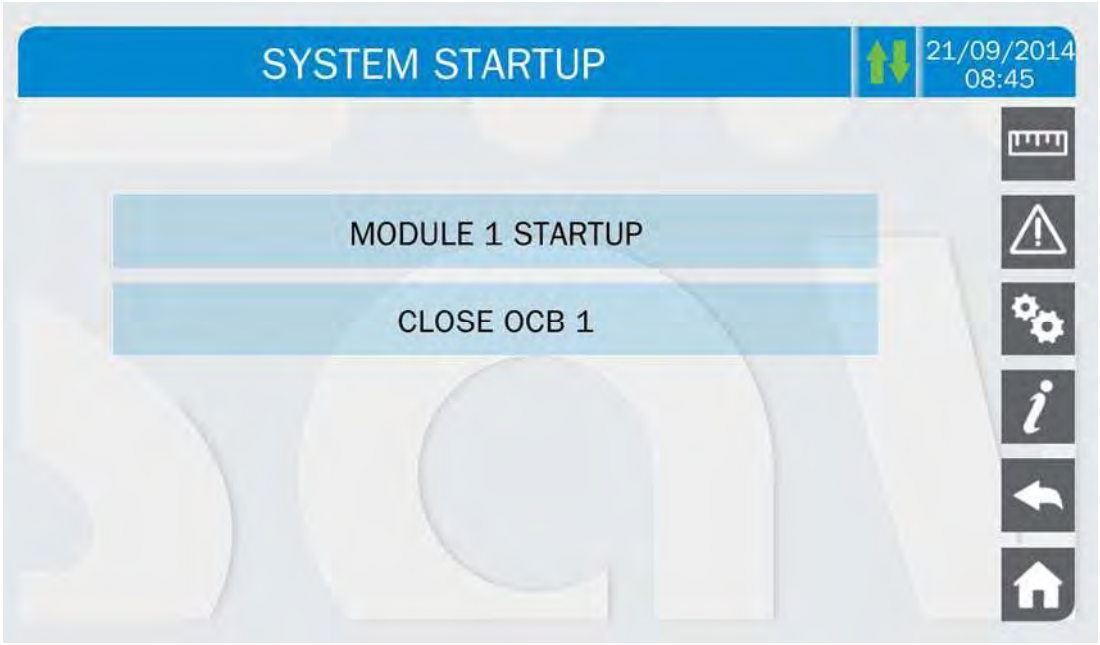
6) Once the bypass line is started the battery voltage is checked and the green lamp located next to the battery switch BCB1 will turn on. Close the switch BCB1 as requested.

In case of centralized battery configuration (CB) the BCBx closure connects the module "x" DC bus to the I/O module common DC bus, and subsequently to the battery by the closure of the general switch BCB.

In case of distributed battery configuration (DC, one battery bank for each module) the BCBx closure connects the module "x" to its own battery.

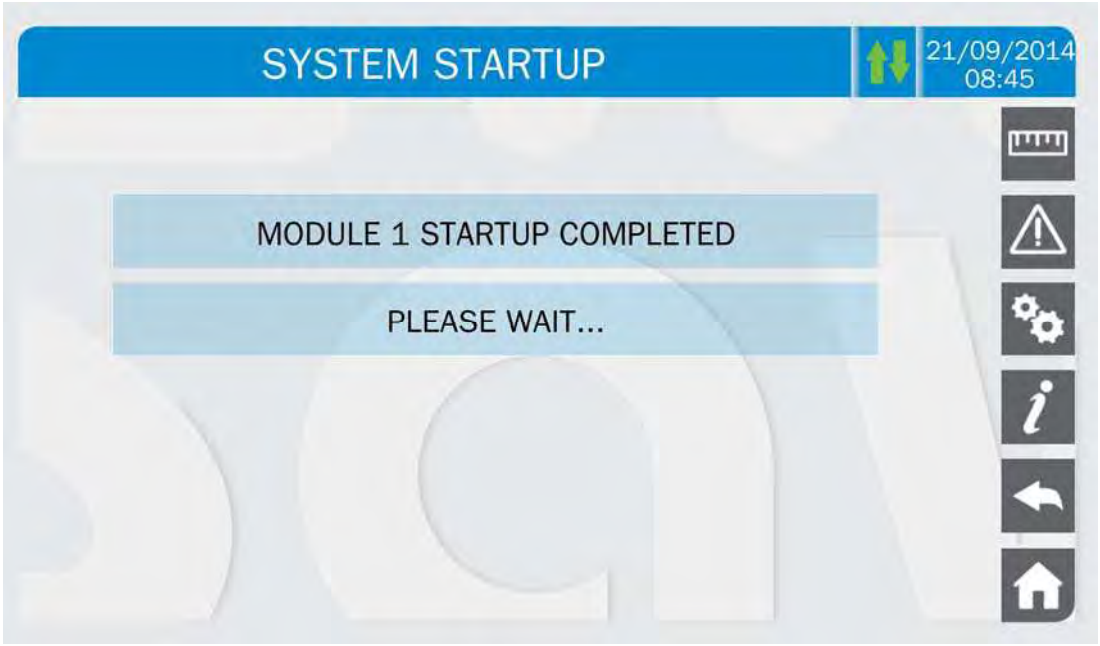
Operation on BCB switch

The switches BCBx, located in the distribution column, can only be closed if the relevant green lamp is on. Serious damages both to the battery and the equipment may occur if the breaker is closed before the front panel requires it.

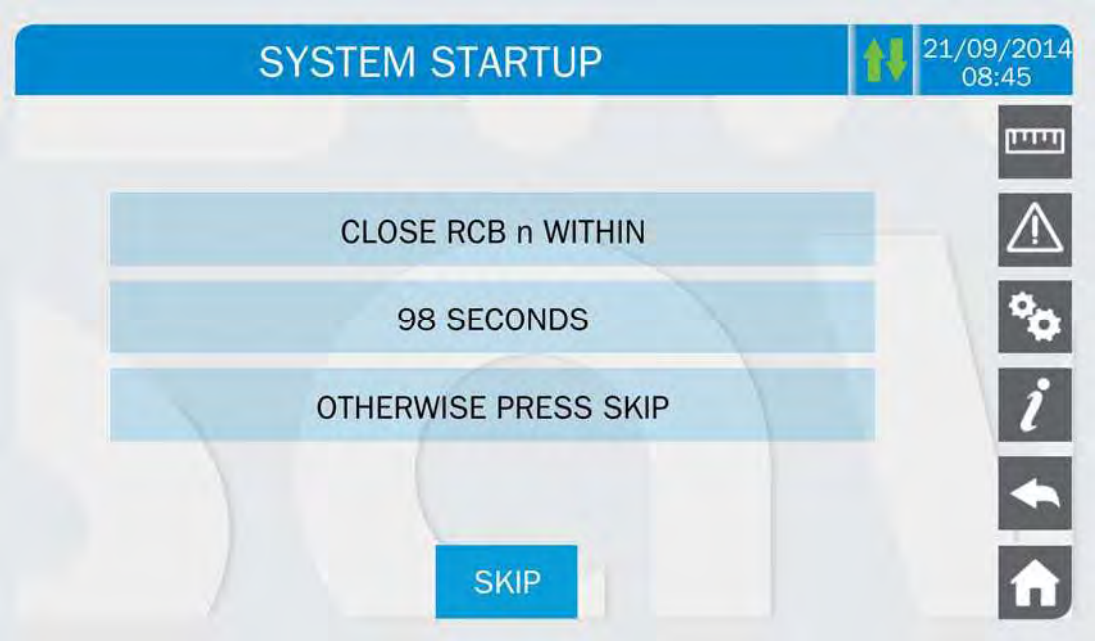


Picture 96 – Module 1 start-up

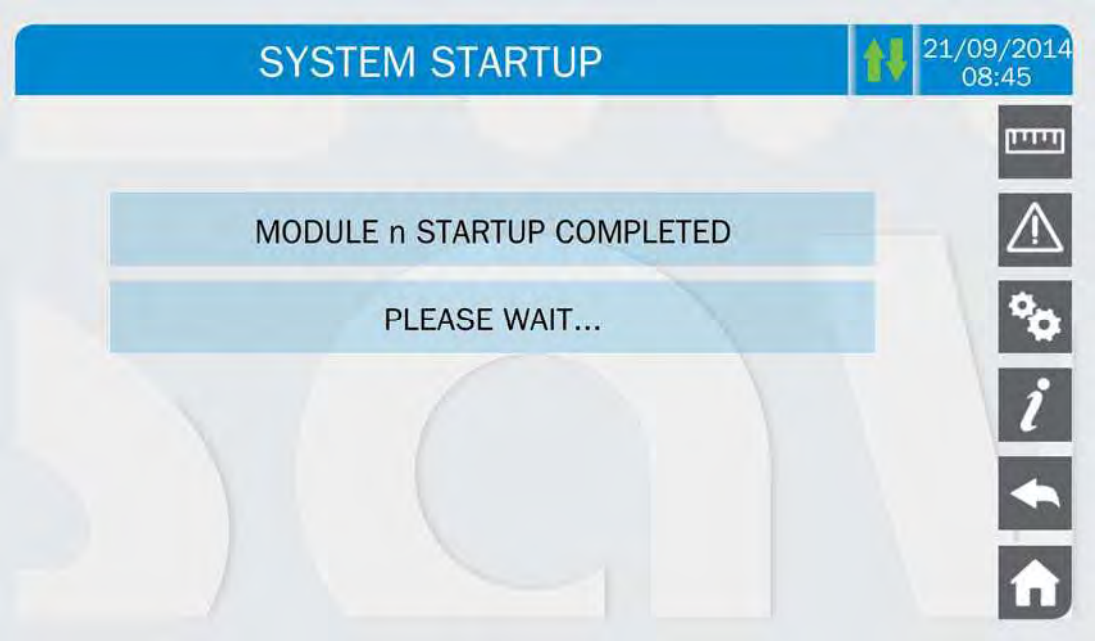
7) Close OCB1 to connect the module 1 output to the I/O module common output bus.



Picture 97 – Module 1 start-up

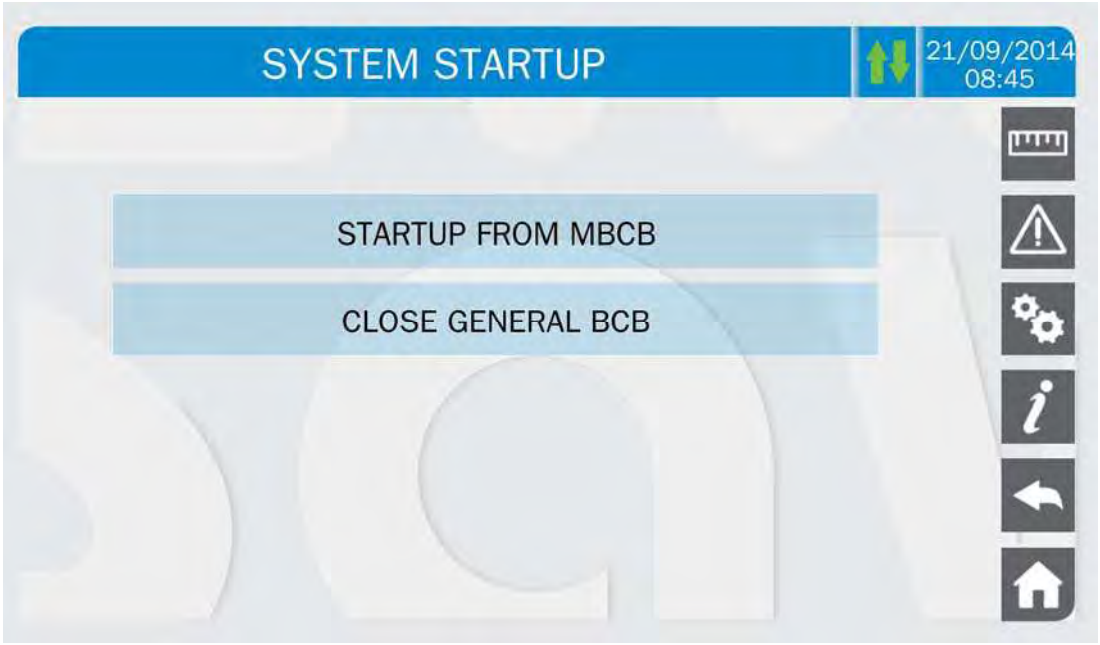


Picture 98 – Module "n" start-up



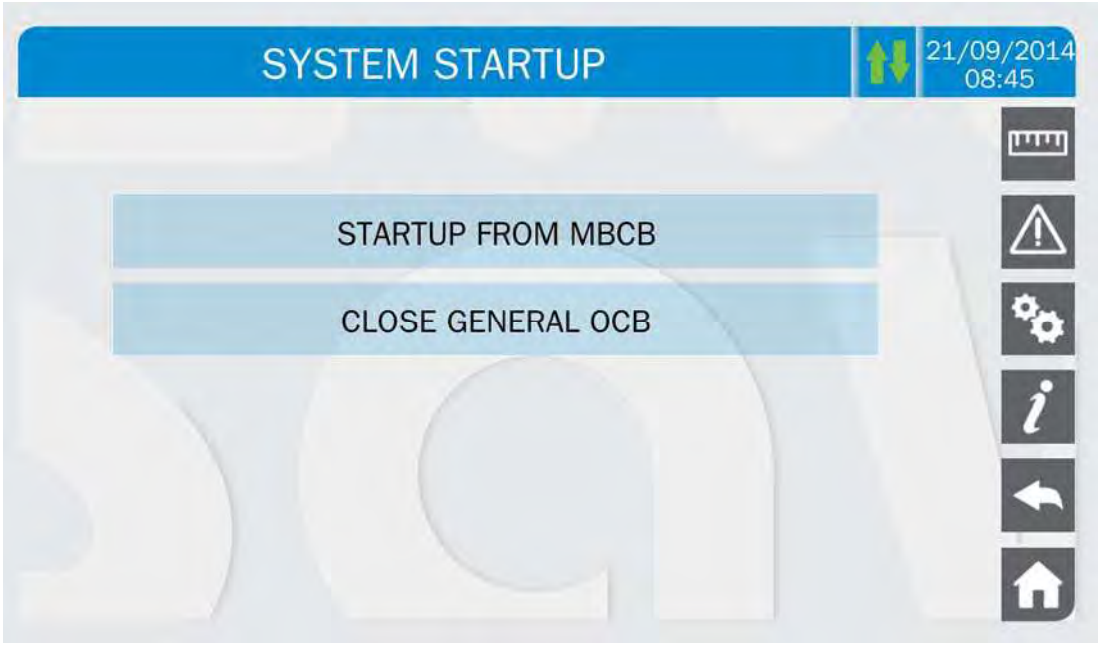
Picture 99 – Module "n" start-up

8) Once the module 1 is started (or the following module in case the module 1 had been skipped), the sequence will go on repeating the same operations, until the last module is started.



Picture 100 – Start-up from MBCB

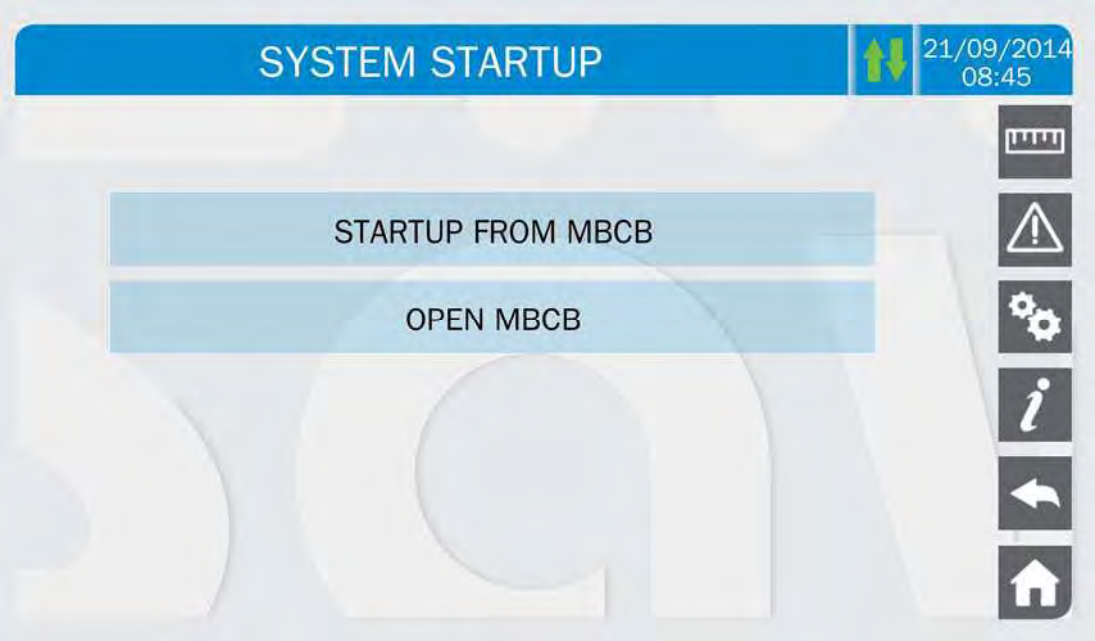
9) All the modules are now started and connected, either to their own battery (DB, distributed battery configuration) or in parallel to the common DC bus in the I/O module (CB, centralized battery configuration). Close the battery switch BCB (external) in order to connect the centralized battery (CB) to the *UPSaver* system. In case of distributed battery (DB) such operation is not necessary and the sequence does not show it.



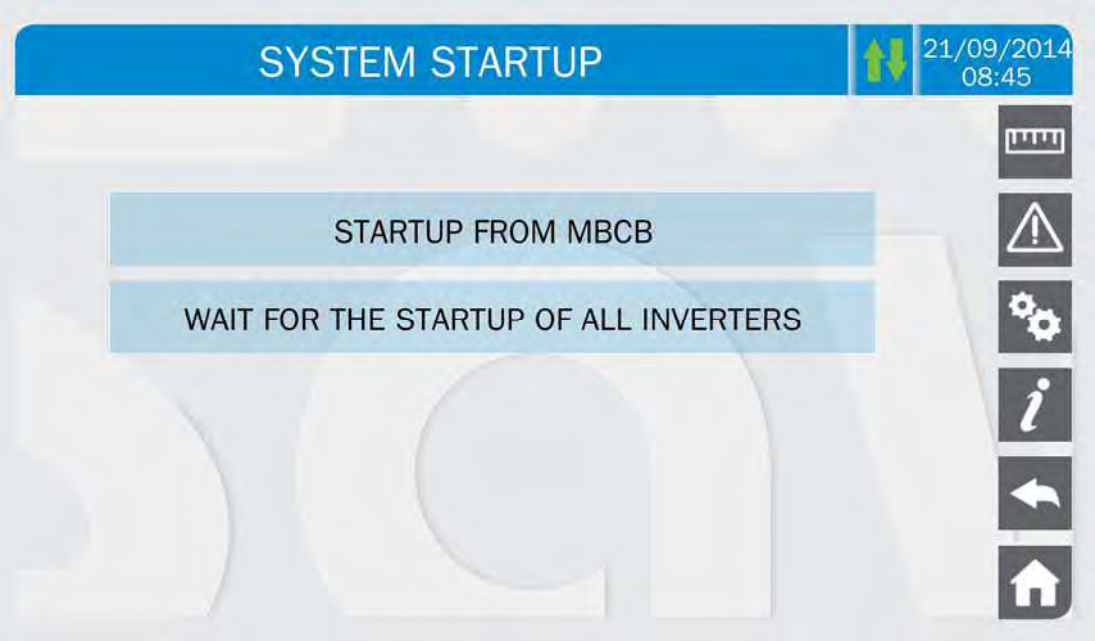
Picture 101 – Start-up from MBCB

10) Close the general switch OCB to connect the *UPSaver* system to the load.

At this stage the load is supplied both through the MBCB switch and the bypass static switch. The following operation will be the opening of the switch MBCB.

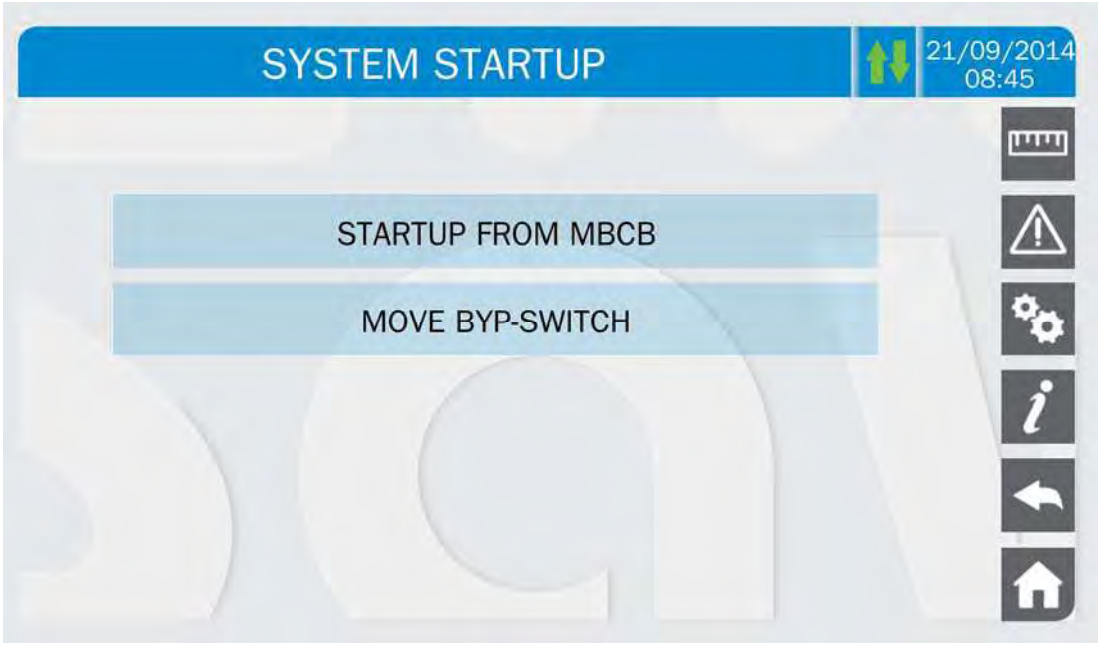


Picture 102 – Start-up from MBCB



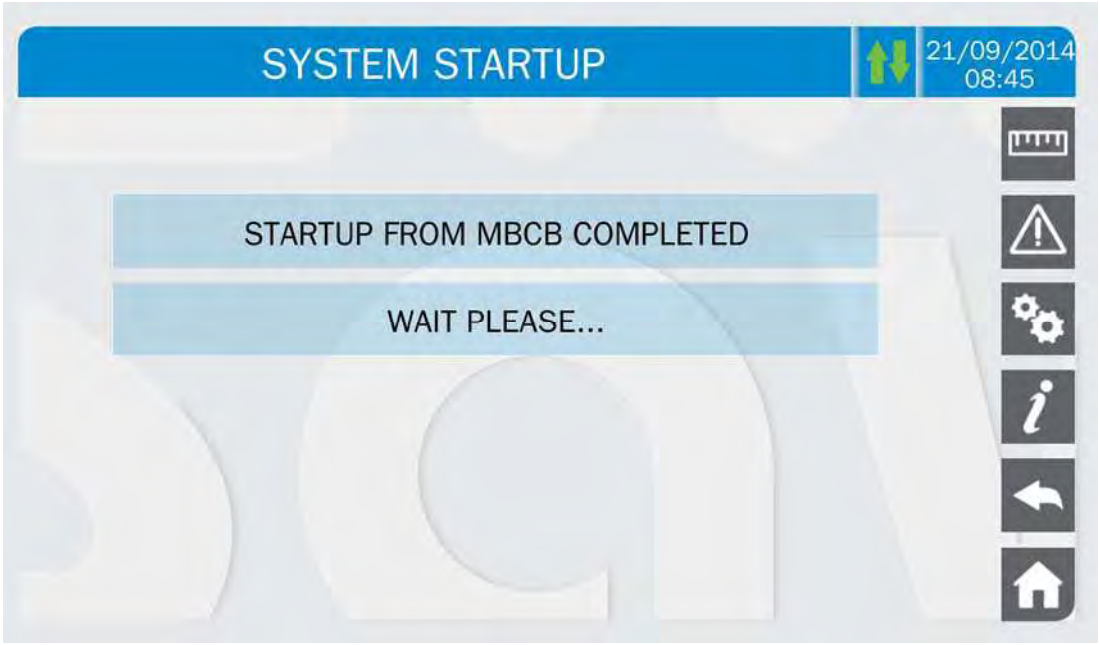
Picture 103 – Inverters start-up

11) Opening MCB will enable the start-up of all the power modules' inverters, which will start and synchronize with the bypass line.



Picture 104 – Inverters start-up

12) Move the *Bypass-SW* selector to the **NORMAL** position per to transfer the load to the inverter.



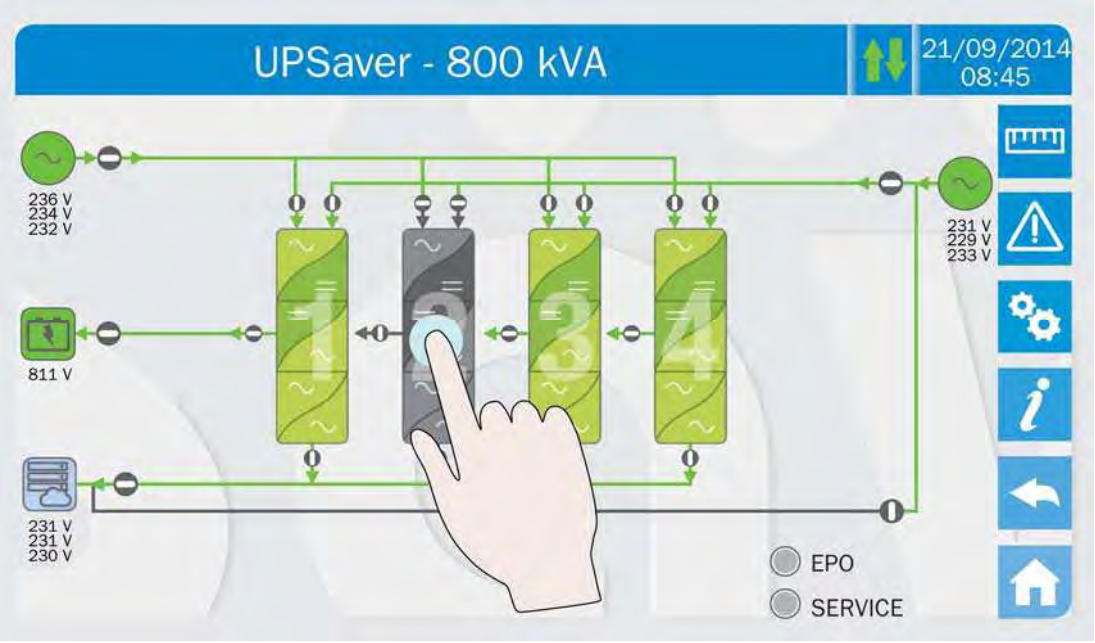
Picture 105 – Start-up from MBCB completed

13) At the end of the start-up sequence the *touch screen* shown the system flow diagram with the main parameters shown next to each supply source.

5.6 STARTING-UP A POWER MODULE

Starting-up a power module from the "completely off" condition is possible by simply following the indications given by the *touch screen*, according to the following procedure.

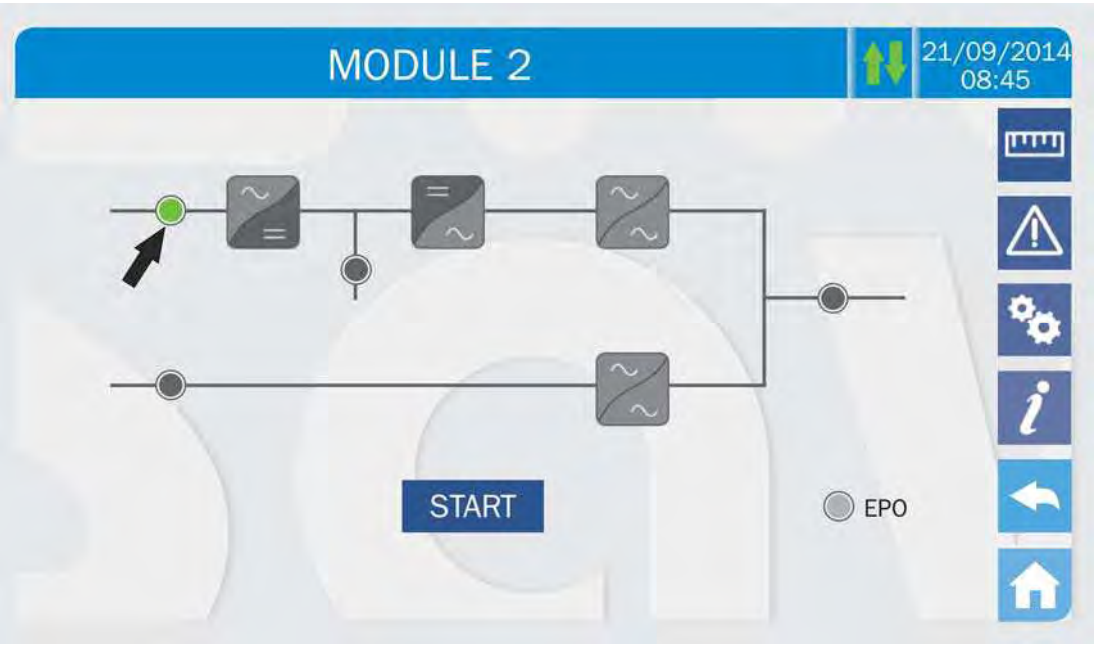
1) From the *Home* page (flow diagram), press on the power module which is supposed to be started.



Picture 106 – Identification of the module to start-up

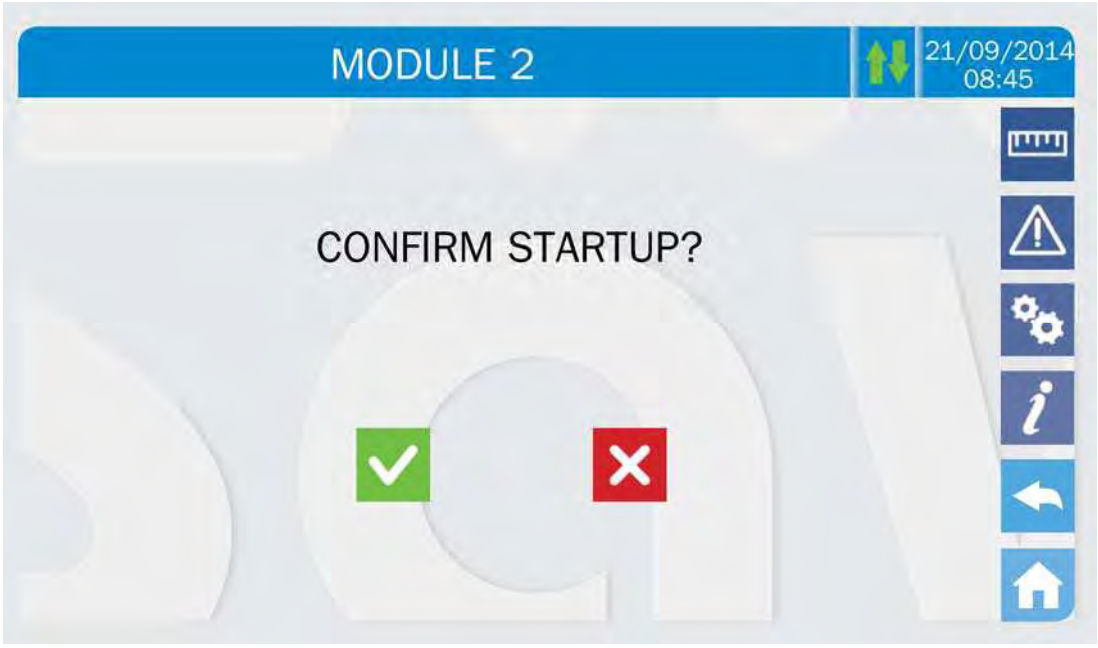
2) The *touch screen* will show the module flow diagram, without any inscriptions.

3) Close the switch ***RCBx***, related to the module in question, and wait for the green LED which indicates that the mains is present to turn on.



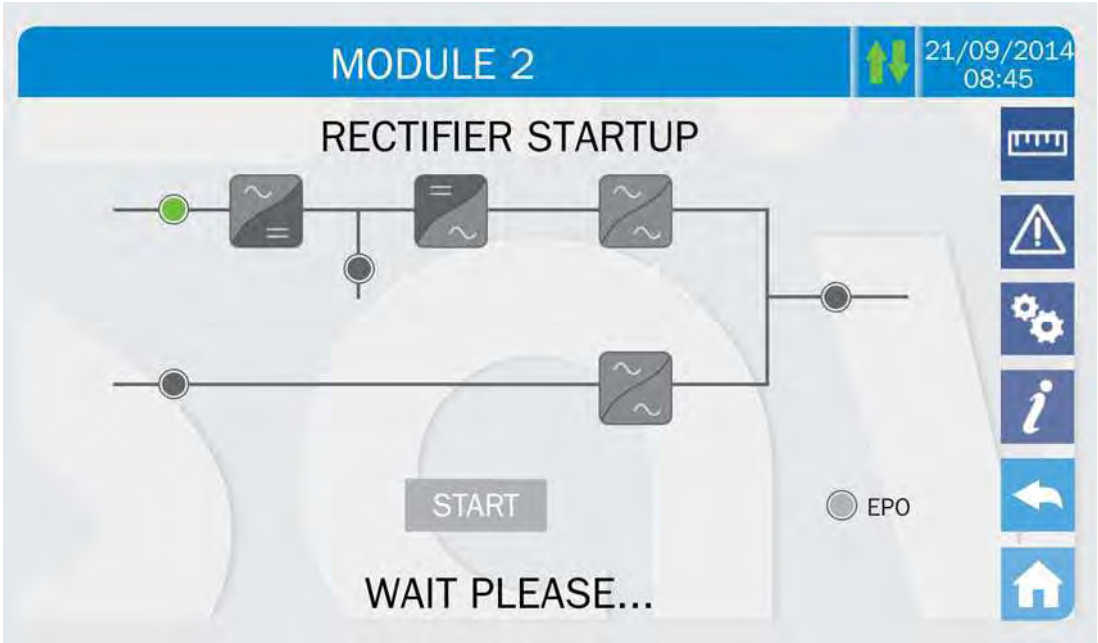
Picture 107 – Power module flow diagram

4) Press on the ***START*** button and confirm the operation in the following page.

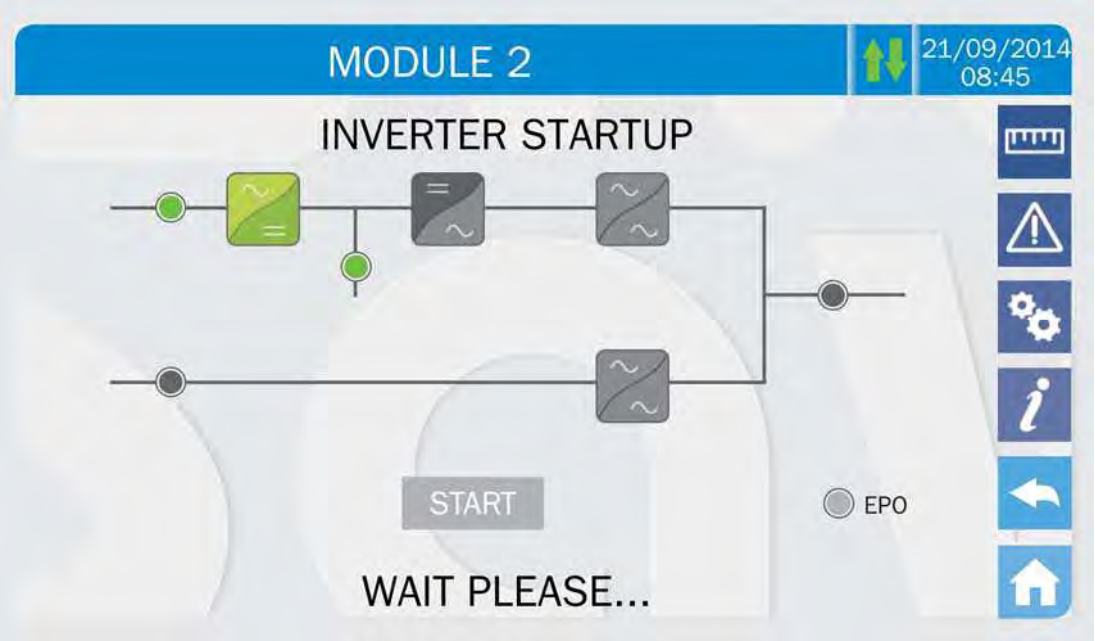


Picture 108 – Module start-up confirmation

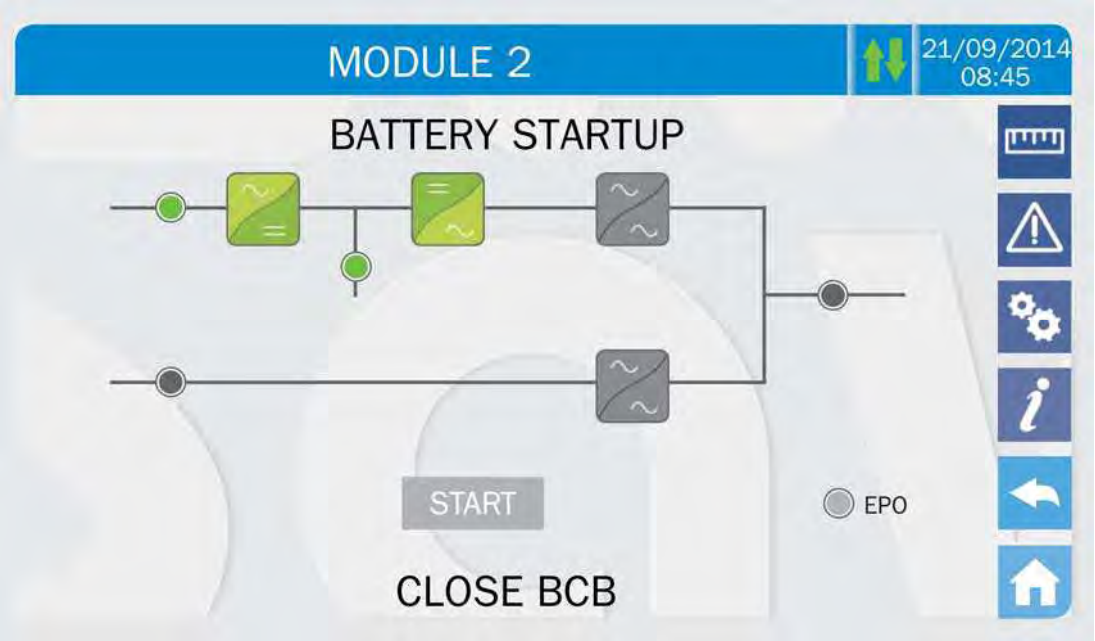
5) The rectifier and inverter are started in sequence.



Picture 109 – Module start-up



Picture 110 – Module start-up

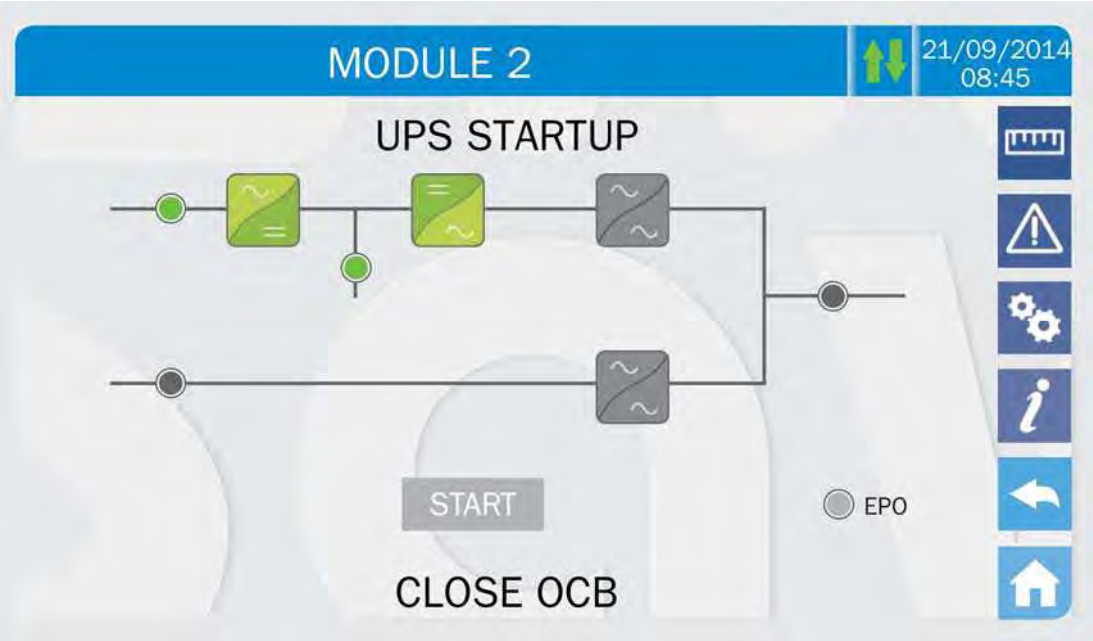


Picture 111 – Module start-up

6) Once these phases are completed the battery voltage is checked and the green lamp located next to the battery switch ***BCBx*** will turn on. Close the switch ***BCBx*** as requested.

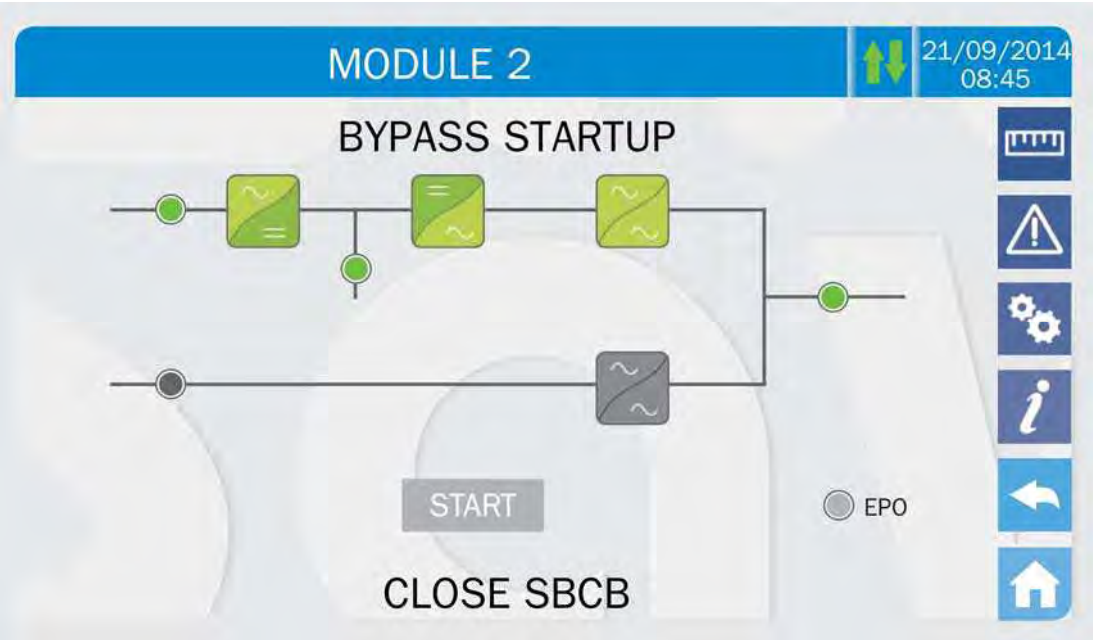
Operation on BCB switch

The switches BCBx, located in the distribution column, can only be closed if the relevant green lamp is on. Serious damages both to the battery and the equipment may occur if the breaker is closed before the front panel requires it.



Picture 112 – Module start-up

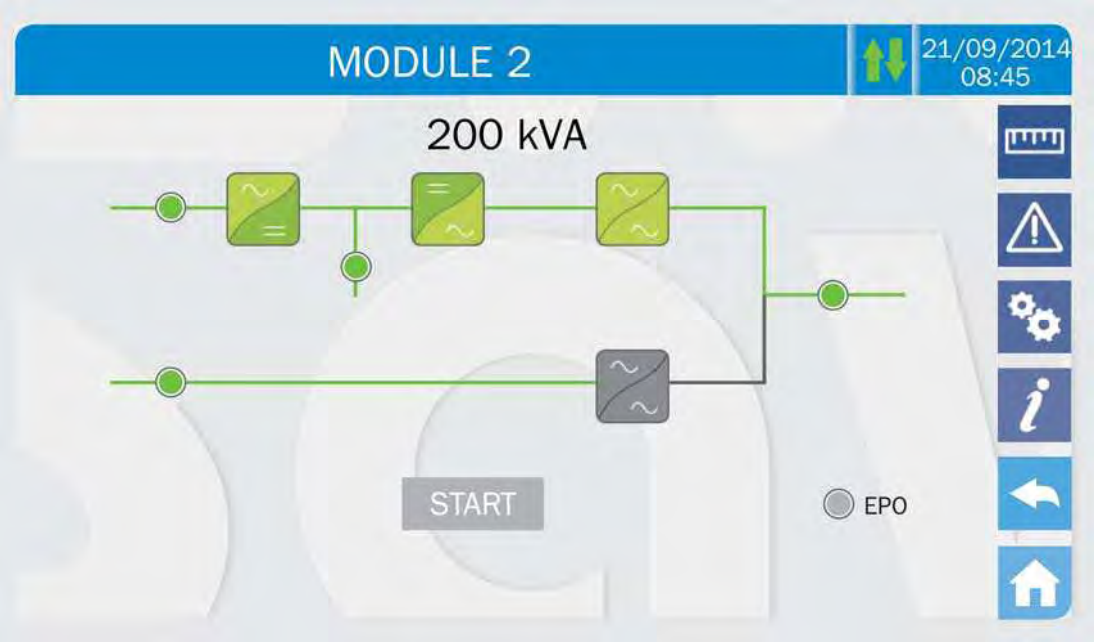
7) Close ***OCBx***, related to the module in question.



Picture 113 – Module start-up

8) Press the button ***SBCBx*** to supply the module 1 bypass line and wait for the closure of the back-feed contactor located inside the I/O module.

In case of centralized static bypass switch configuration (CSB, single static switch located inside the I/O module) such phase is not present, since the bypass line is not connected to the power modules.



Picture 114 – Module start-up completed

UPS USER MANUAL

Index

Index of the pictures

1 APPLICABILITY

The instructions contained in the operating manual are applicable to the UPS systems of the *UPSaver* series, in all their possible power configurations.

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

UPSaver is a completely adaptable multi-functional, high-efficiency structured system for the protection of the energy supply.

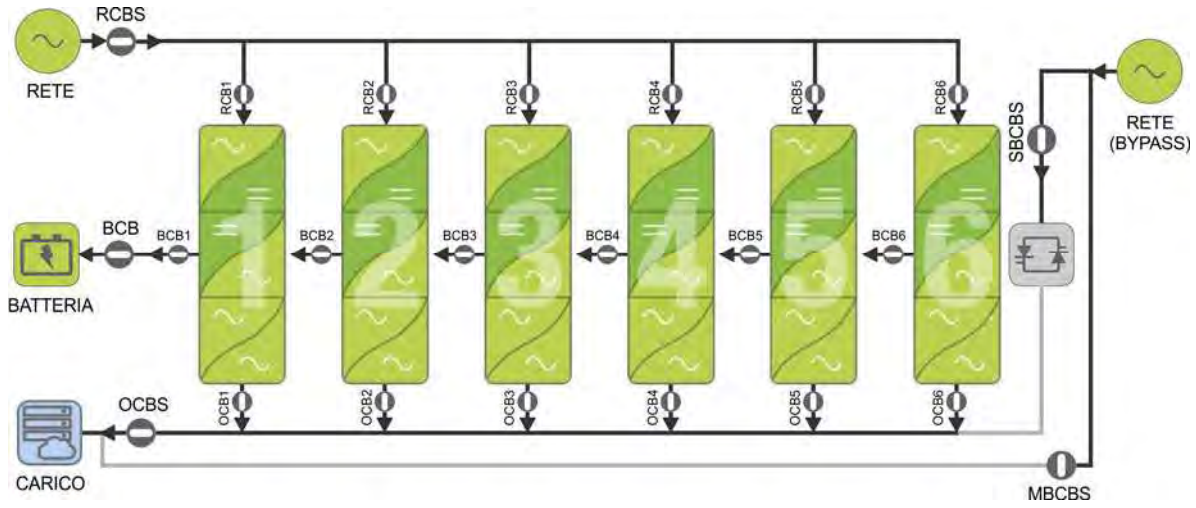
The system flexibility is achieved by using hot-swappable power modules in order to easily expand the system power up to 1600 kVA.

The *UPSaver* power modules uses IGBT technology with a high changeover 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.

UPSaver can operate with different modalities that can be defined by the user on the basis of both the power supply quality and the type of loads supplied by the system.

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 – 1200 kVA UPSaver typical block diagram

The picture above shows a typical block diagram of the *UPSaver* UPS, in its configuration with six power modules in parallel, suitable for the supply of AC loads up to 1200 kVA, or 1000 KVA with one redundant module.

The *UPSaver* system is basically made of two modular elements:

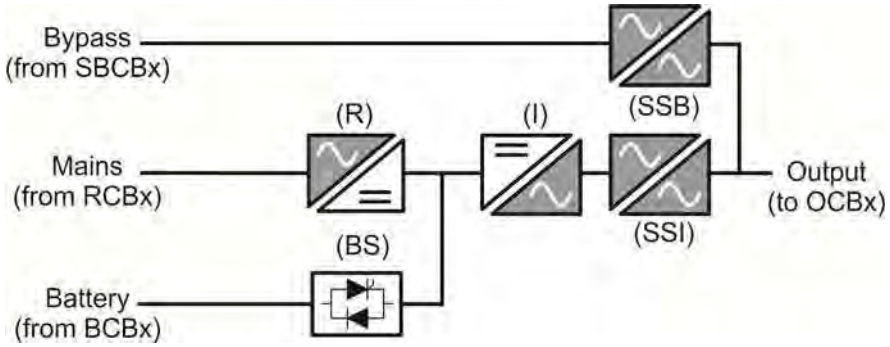
- power module (BPU);
- input/output module.

The input/output module (**I/O**) is composed of a central section which contains the connection terminal boards, the input and output isolator switches and the centralized static switches, when provided. It is furthermore provided with side distribution columns containing the power modules input/output isolator switches.

3.1 POWER MODULE (BPU)

The power module, part of the *UPSaver* UPS, is composed of the following main sections:

- rectifier / battery-charger;
- inverter;
- battery static switch;
- inverter and bypass static switches.



Picture 2 – Power module (BPU) block diagram

The power module is not provided with isolator switches, which are all installed in the distribution columns of the I/O module.

3.1.1 Rectifier / Battery-charger

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.

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.

3.1.2 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.

3.1.3 Battery static switch

The battery static switch consists of two diode-SCR couples connected in anti-parallel, one for each polarity, and allows to control the connection and disconnection of the battery to the DC bus, in order to reduce the losses and optimize the battery expected lifetime.

3.1.4 Bypass static switch

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 *UPSAVER* CONFIGURATIONS

The combination of the power modules with the specific I/O module allows to obtain several system typologies, for what concern the configuration of the battery and the static bypass switch.

CB → Centralized Battery

Only one battery bank for the *UPSaver* UPS is provided, and consequently only one battery static switch is necessary, which is installed inside the I/O cabinet.

DB → Distributed Battery

One battery bank for each module that compose the *UPSaver* UPS is provided for. The connection of the various batteries is carried out inside the I/O module, but each power module is provided with its own battery static switch.

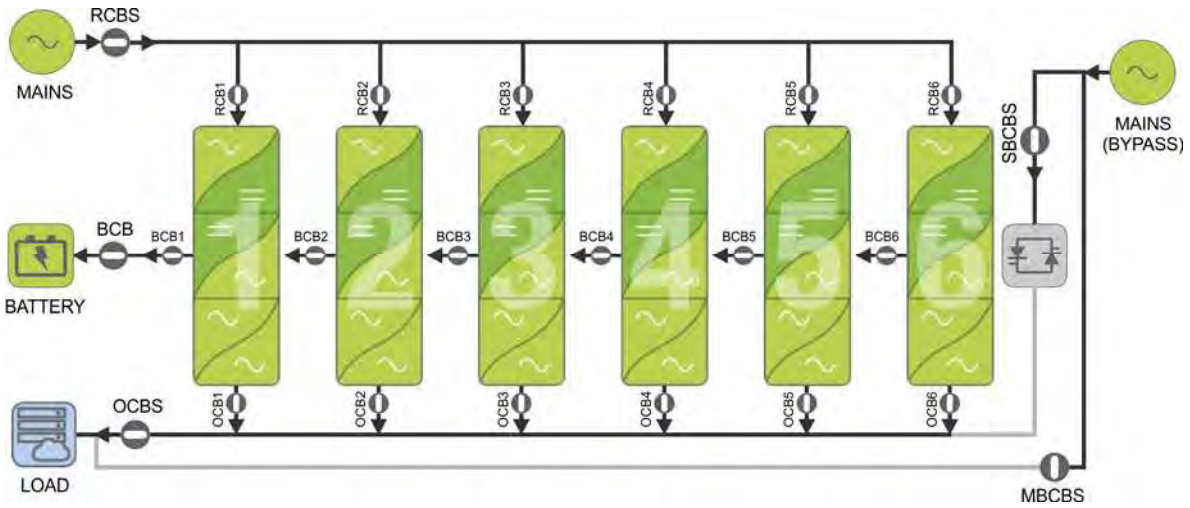
CSB → Centralized Static Bypass switch

Only one bypass static switch is provided, which is installed inside the I/O cabinet.

DSB → Distributed Static Bypass switch

One bypass static switch for each module that compose the *UPSaver* UPS is provided.

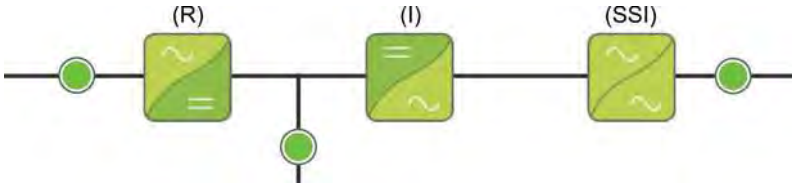
3.2.1 "CB+CSB" configuration



Picture 3 – 1200 kVA UPSaver, "CB+CSB" configuration

In the "CB+CSB" configuration the battery bank is single for the whole *UPSaver* system, and is connected to the I/O module common DC bus. Each power module is connected to the DC bus via the isolators *BCBx*, located in the I/O module side distribution columns. Each module proportionally contributes to the battery charge, which is charged in parallel by all the modules, providing a fraction of the current. The battery static switch is installed inside the I/O module.

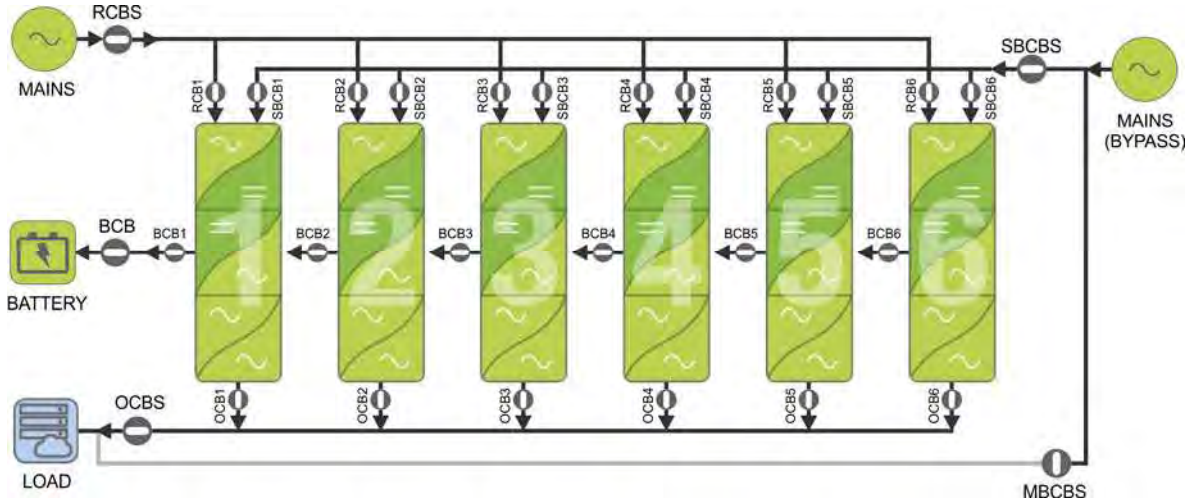
The static bypass switch is single and centralized as well, and is installed inside the I/O module.



Picture 4 – UPSaver "CB+CSB", power module configuration

Neither the bypass nor the battery static switches are installed in the power module (BPU).

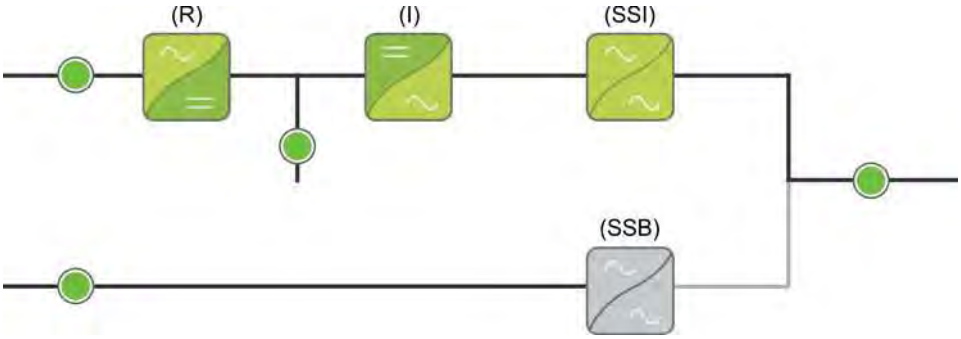
3.2.2 "CB+DSB" configuration



Picture 5 – 1200 kVA UPSaver, "CB+DSB" configuration

In the "CB+DSB" configuration the battery bank is single for the whole *UPSaver* system, and is connected to the I/O module common DC bus. Each power module is connected to the DC bus via the isolators *BCBx*, located in the I/O module side distribution columns. Each module proportionally contributes to the battery charge, which is charged in parallel by all the modules, providing a fraction of the current. The battery static switch is installed inside the I/O module.

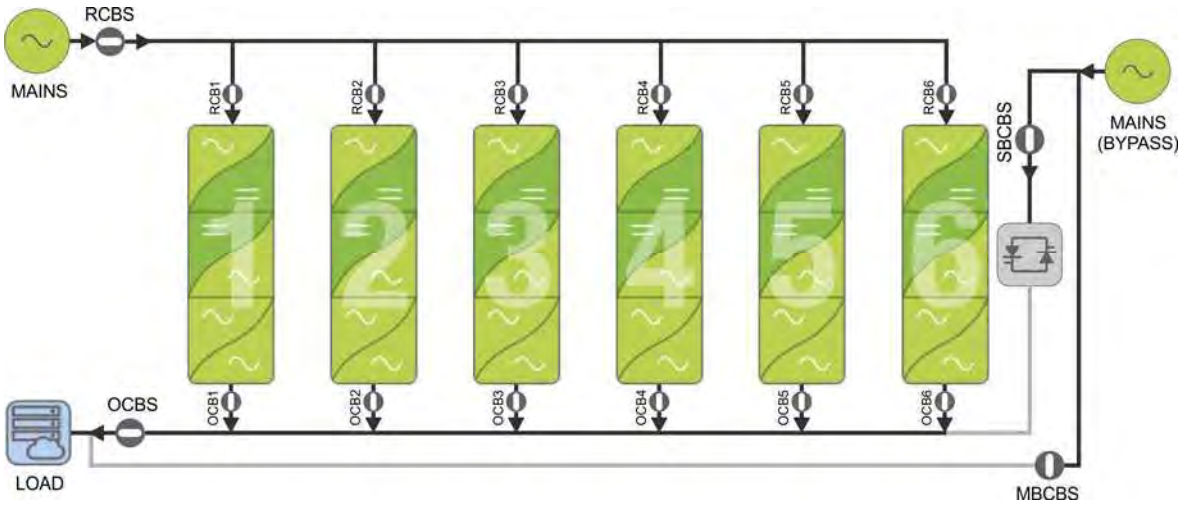
The bypass static switch is distributed, therefore it is provided in each power module. The pus-buttons *SBCBx*, which allows the operation of the back-feed contactor and the supply of the power modules bypass line, are installed in the distribution columns.



Picture 6 – UPSaver "CB+DSB", power module configuration

The battery static switch is not installed in the power module (BPU).

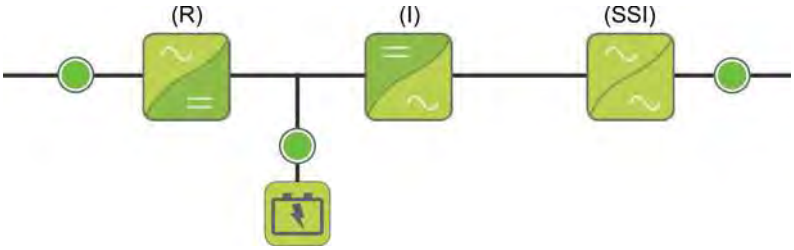
3.2.3 "DB+CSB" configuration



Picture 7 – 1200 kVA UPSaver, "DB+CSB" configuration

In the "DB+CSB" configuration the battery is distributed, that is each power module is provided with its own battery and battery static switch, which are independent from the others. The isolators *BCBx*, located in the distribution colums at the sides of the I/O module, directly connects the DC bus of each module to its battery.

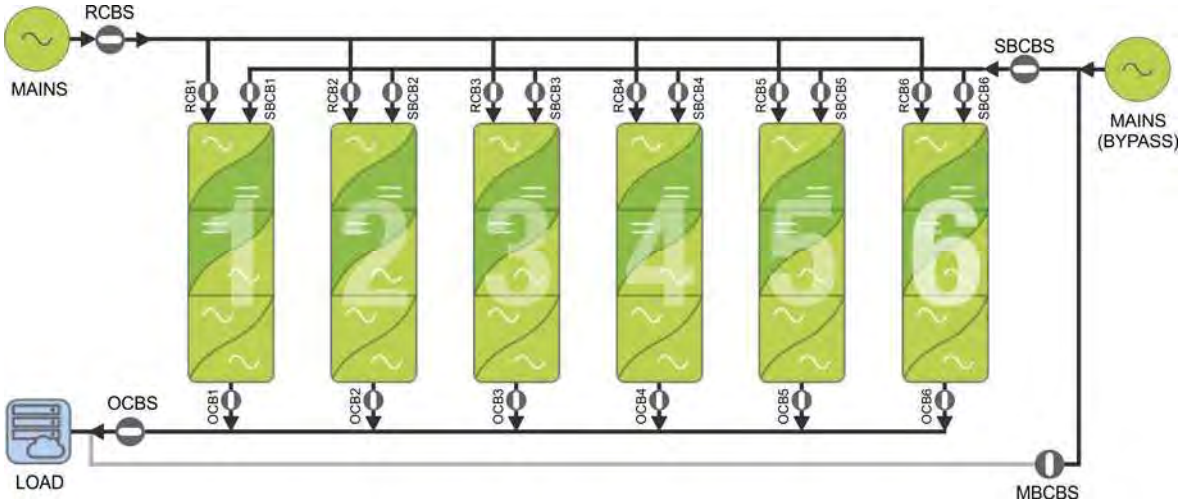
The static bypass switch is single and centralized, and is installed inside the I/O module.



Picture 8 – UPSaver "DB+CSB", power module configuration

The bypass static switch is not installed in the power module (BPU).

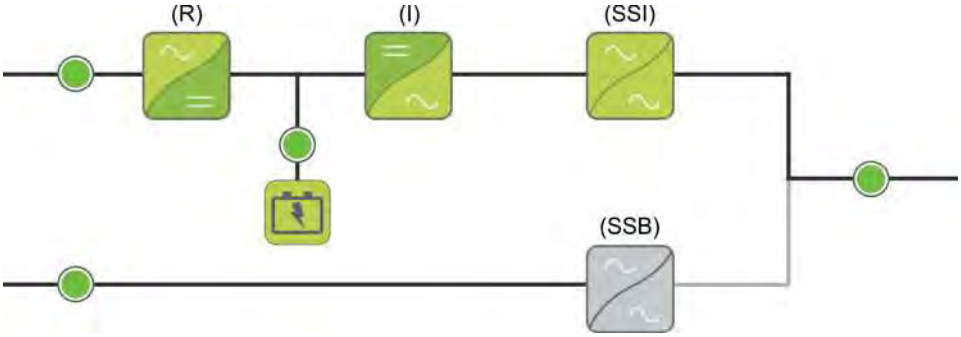
3.2.4 "DB+DSB" configuration



Picture 9 – 1200 kVA UPSaver, "DB+DSB" configuration

In the "DB+DSB" configuration the battery is distributed, that is each power module is provided with its own battery and battery static switch, which are independent from the others. The isolators BCBx, located in the distribution colums at the sides of the I/O module, directly connects the DC bus of each module to its battery.

The bypass static switch is distributed, therefore it is provided in each power module. The pus-buttons *SBCBx*, which allows the operation of the back-feed contactor and the supply of the power modules bypass line, are installed in the distribution columns.



Picture 10 – UPSaver "DB+DSB", power module configuration

The power module is in its complete configuration, being provided with both the bypass and the battery static switches.

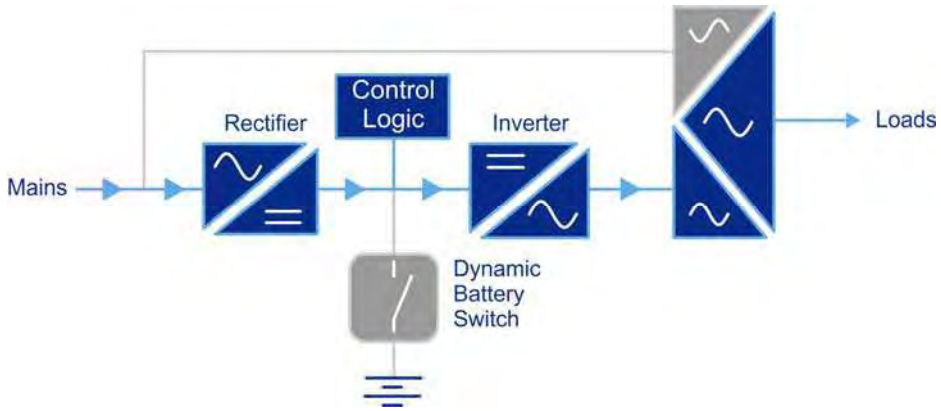
3.3 OPERATING STATUS

The *UPSaver* UPS can be programmed ot operate in four different modes:

- DHE (Double High Efficiency)
- VHE (Very High Efficiency), Line Interactive
- ECO
- UHE (Ultra High Efficiency)

3.3.1 DHE mode – Double High Efficiency

The *DHE* mode is basically the on-line double-conversion operation (VFI – Voltage Frequency Independent), where the *Green Conversion* algorithm, which allows the losses reduction and the consequent system efficiency increase, is active.



Picture 11 – DHE Green Conversion mode

The AC loads are directly supplied from the inverter output, that is the parallel of the inverters of the single power modules (BPU). When the *Green Conversion* algorithm is active the rectifier operates at reduced DC voltage and supplied 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.

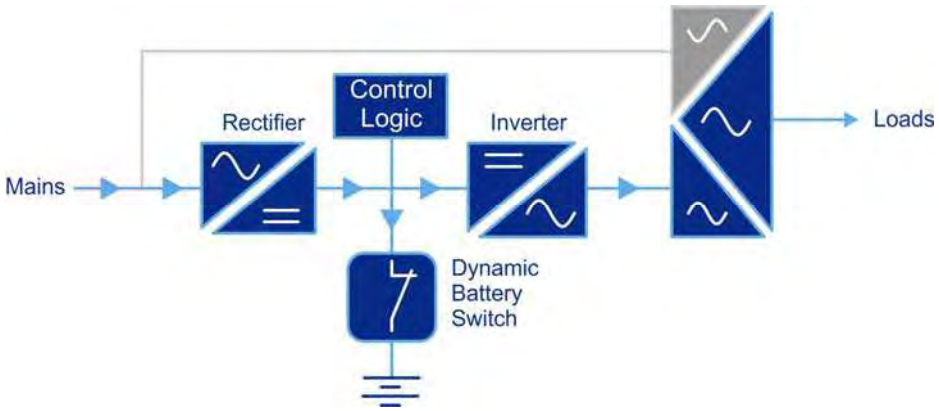
In case a discharge event occurs, the control logic provides to calculate the capacity which has been lost during the discharge; as the mains is restored a charging cycle is started, which is extended for an additional time that depends on the percentage of lost capacity, referred to the rated value.

- 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

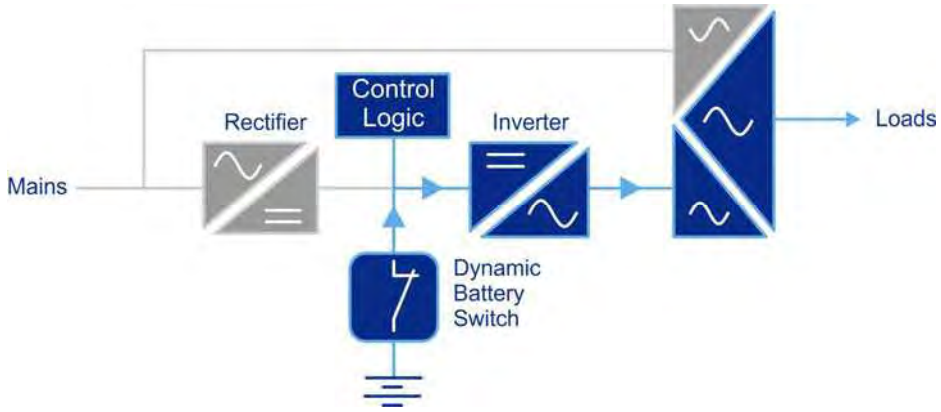
The UPS front panel allows the setting of the battery parameters, including the rated capacity. Considering the importance that such value assumes for the correct execution of the charge control algorithm, it is highly recommended to verify the correctness of the programmed value.



Picture 12 – DHE mode with battery charging

The battery static switch, as previously mentioned, can be single in case the system is configured with a centralized battery, or multiple (one for each power module), in case of distributed battery configuration.

In case of power failure or rectifier fault, the battery static switch is immediately activated and the load is fed by 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.



Picture 13 – Battery discharging

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.

Should the inverter fail, or in case the *Bypass_SW* selector is manually operated, the load is transferred to the bypass line and supplied via the bypass static switch. The re-transfer to inverter, which represent the primary source in the *DHE* mode, occurs automatically and without any interruptions once the anomaly is ceased.

3.3.1.1 Optimization of the efficiency by power modules rotation

In the *DHE* operating mode the *UPSaver* system can be programmed for the automatic management of the redundancy of the power modules.

On the basis of the supplied load the control logic calculates the number of modules needed to guarantee a sufficient power, keeping into account the need to have at least one redundant, or "reserve" module (n+1).

As a consequence, 2x 200 kW modules will be turned on for an output load up to 200 kVA, 3x modules for a load up to 400 kVA, and so on. The redundant module is used as a reserve of power to absorb possible load peaks, in order to avoid the system commutation to static bypass in the event of a sudden increase of the putput power.

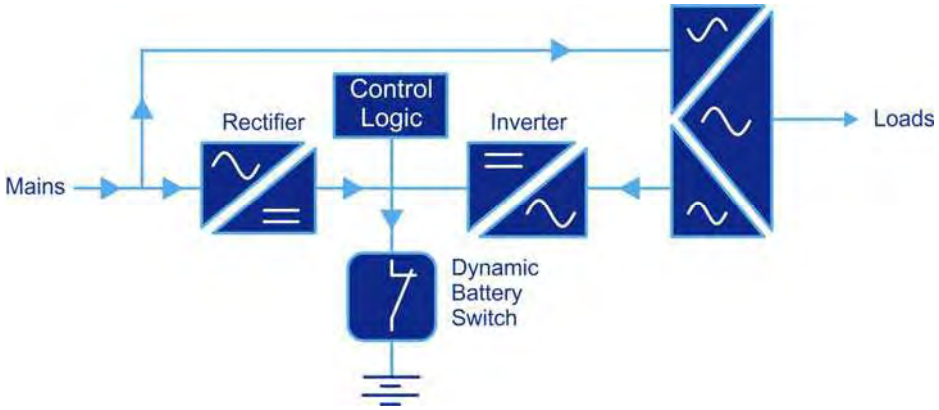
In addition to the automatic start-up and shut-down of the modules, the system also manages their rotation, in such a way to guarantee a linear agewing of all the parts. Each power module has an integrated counter which counts the operating hours. Whenever the rotation algorithm is activated the control logic provides to turn on all the modules, and after that it shuts down those which have worked for longer time. The rotation is dependent on the automatic

redundancy algorithm, which has been explained previously, therefore is is activated only if the output load is such to allow to have at least one power module off to be used as "reserve".

3.3.2 VHE mode – Very High Efficiency (Line Interactive)

In the *VHE* mode the load is supplied by the mains via the static bypass switch; the inverter operates as a active filter to stabilize the output voltage should the mains parameters be beyond the availability and stability pre-defined limits, which are controlled by a dedicated algorithm (VI – Voltage Independent). Such function can be enabled and is automatically managed by the above mentioned algorithm on the basis of both the load and AC supply conditions.

In case of mains outage or anomaly occurring on the bypass line the load is transferred to the inverter.

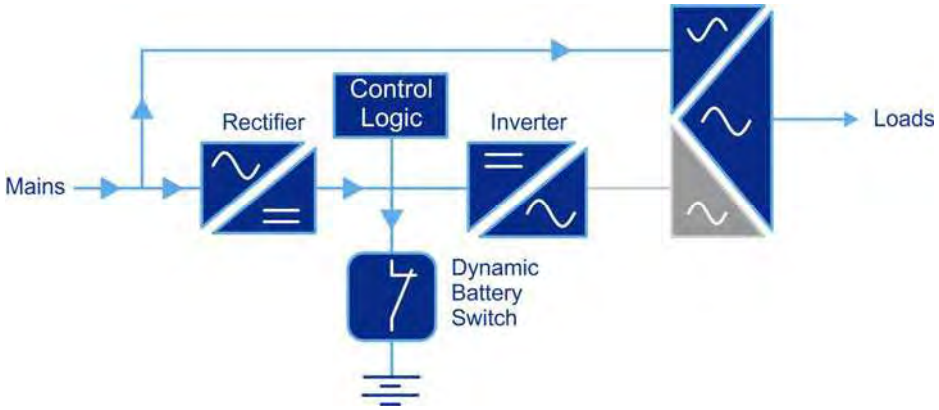


Picture 14 – VHE mode

3.3.3 ECO mode

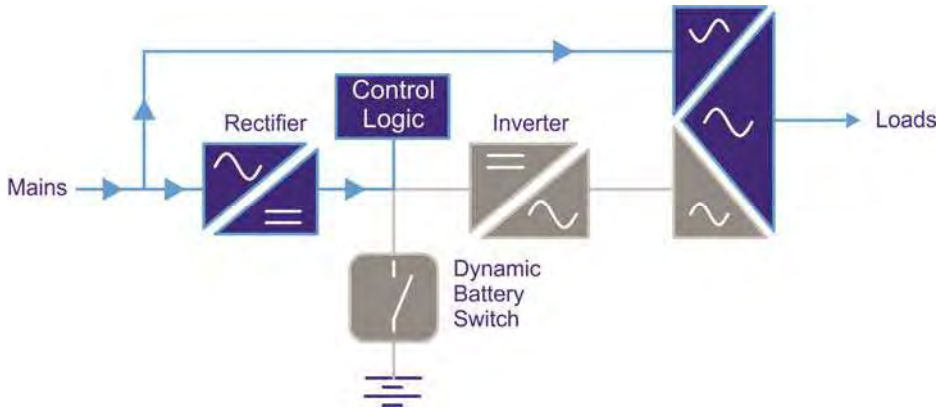
Similarly to the VHE mode, the load is supplied by the mains in the *ECO* mode as well; it differs from the VHE mode because the inverter is on, in stand-by. Therefore it doesn't make any "conditioning" on the output voltage, which is therefore dependent on the variation of the AC input parameters (VFD – Voltage Frequency Dependent).

In case of mains outage or anomaly occurring on the bypass line the load is transferred to the inverter; the transfer occurs with a short interruption of maximum 10 ms.



Picture 15 – ECO mode

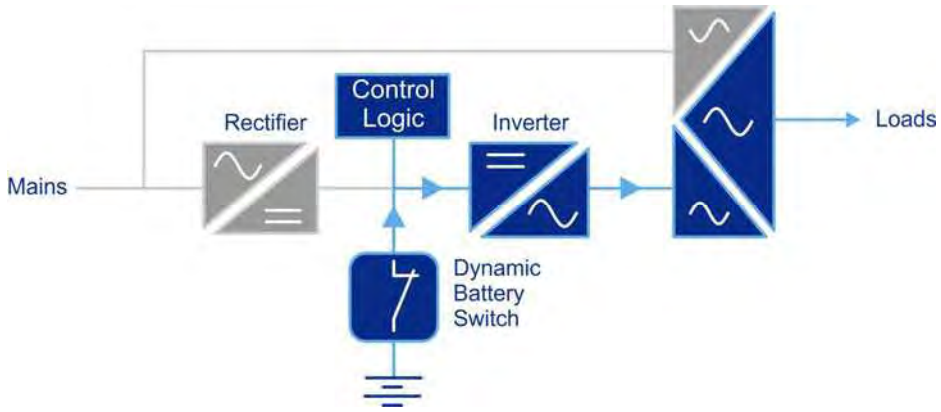
3.3.4 UHE mode – Ultra High Efficiency



Picture 16 – UHE mode

The *UHE* mode is the one that guarantees the higher efficiency, since during the normal operation all the system power converters (rectifier and inverter) are off and the loads are directly supplied by the mains via the static switch. In such configuration a section of the rectifier is permanently on in order to supply the control logic and safeguard the battery which would otherwise supply energy, although in a very limited quantity. Therefore the battery static switch is kept open and is operated only in case of mains failure.

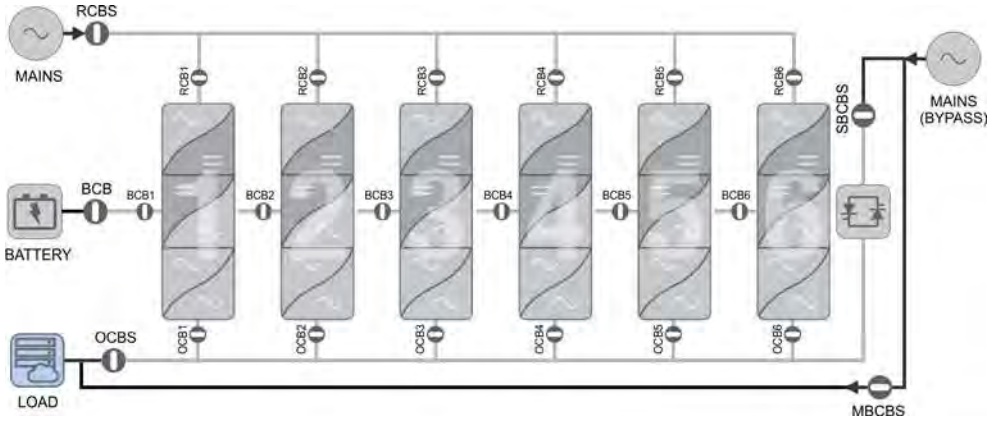
Should the mains fail the inverter is started and the load is transferred through the static switch. The disturbance on the output voltage is fully within both the limits defined by the ITIC (information Technology Industry Council) and the curve 3 of the dynamic performance defined by the EN 62040-3 standard.



Picture 17 – UHE mode, mains failure

3.3.5 Manual bypass

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



Picture 18 – Manual bypass

In such condition all the switches are generally open, both the general switches and those related to each power module, and the only closed isolator is MBCB.

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.

3.4 CONTROL AND OPERATION DEVICES

The control and operating devices of the UPS are listed below.

- Rectifiers input line isolator (RCBS)
- Bypass input line isolator (SBCBS)
- UPS output isolator (OCBS)
- Manual bypass isolator (MBCBS)
- Battery Isolator / Circuit breaker (BCB) - External, inside the battery cabinet
- Emergency power off button (EPO)
- Normal/Bypass selector
- *Touch screen* control panel

The distribution column located at the I/O module sides houses the isolating devices of the power modules, as indicated below.

- Rectifier input isolator (RCBx)
- Bypass line inout AC contactor (Kx)
- Pulsante ON/OFF di avvio bypass statico (SBCBx)
- Module output isolator (OCBx)
- Battery isolator (BCBx)

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 (AC inputs, battery and AC output)

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 loads.

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.

Isolating the power modules

The power modules isolating devices are located inside the I/O module, therefore the modules are isolated from the input/output sources when the isolators are open. before carrying out any maintenance operation on the power modules let the capacitors discharge for at least 5 minutes.

3.4.2 Contactors

The bypass line supply contactor of each module is installed inside the distribution column an commanded by the ON/OFF push-button SBCBx; the contactor also fulfils the back-feed protection function.

In case the system is configured with centralized static bypass (CSB) the contactor SBCBx are not installed.

3.4.3 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.

3.4.4 Normal/Bypass selector

The Normal/Bypass selector *Bypass_SW* is installed inside the I/O module. 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.

3.4.5 *Touch screen* control panel

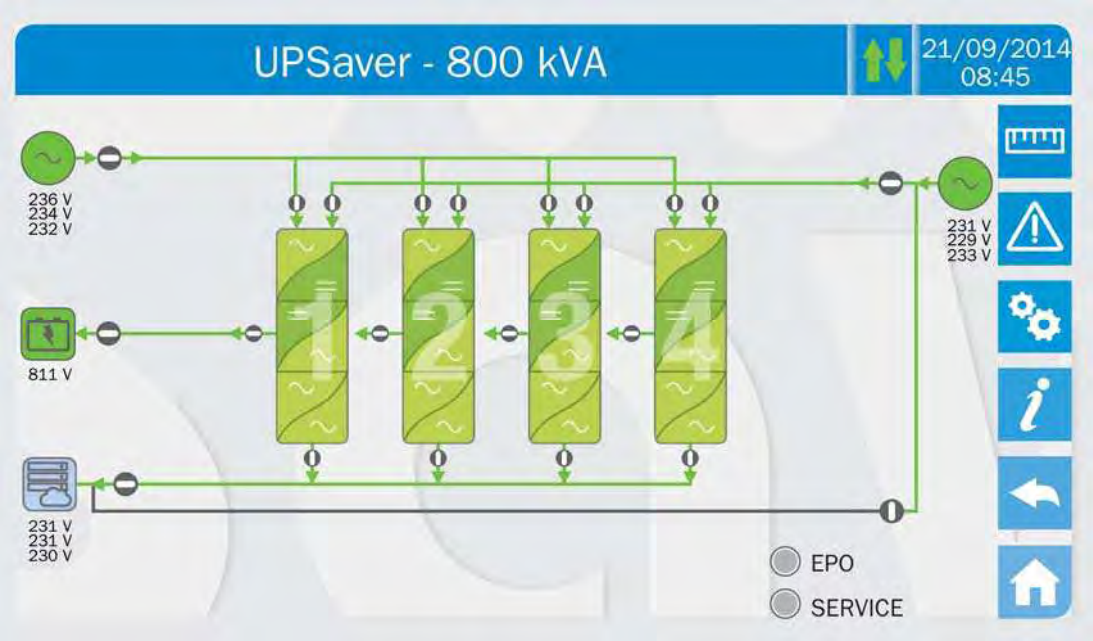
The UPS control panel is used for:

- Verifying the device operating parameters
- Accessing the events log
- Displaying the device information
- Modifying the operating parameters

The section through which the parameters can be modified is password-protected in order to avoid the access by non-authorized personnel.

4 CONTROL PANEL

The UPS control panel is a 10.1" *touch screen* which dialogues with the I/O module control logic via ModBus protocol. The main page (***Home***) shows the system flow diagram, from which all the *UPSaver* UPS operating variables, as well as those of each single power module (BPU) that compose the system, can be displayed.



Picture 19 – 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

The panel also contains touch-sensitive areas in correspondence to the diagrams of the power modules. The pages related to the module can be opened by pressing the module itself.

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 *UPSaver* UPS, therefore it will show the system data.
- Dark blue → The keys ***Measures***, ***Alarms***, ***Settings*** and ***Info*** turn dark blue when the module data display is entered, by pressing one of the modules.
- Grey → The keys turn grey (disabled) when the key specific section is entered.
- Red → The ***Home*** and ***Alarms*** keys will turn red in case an alarm occurs.

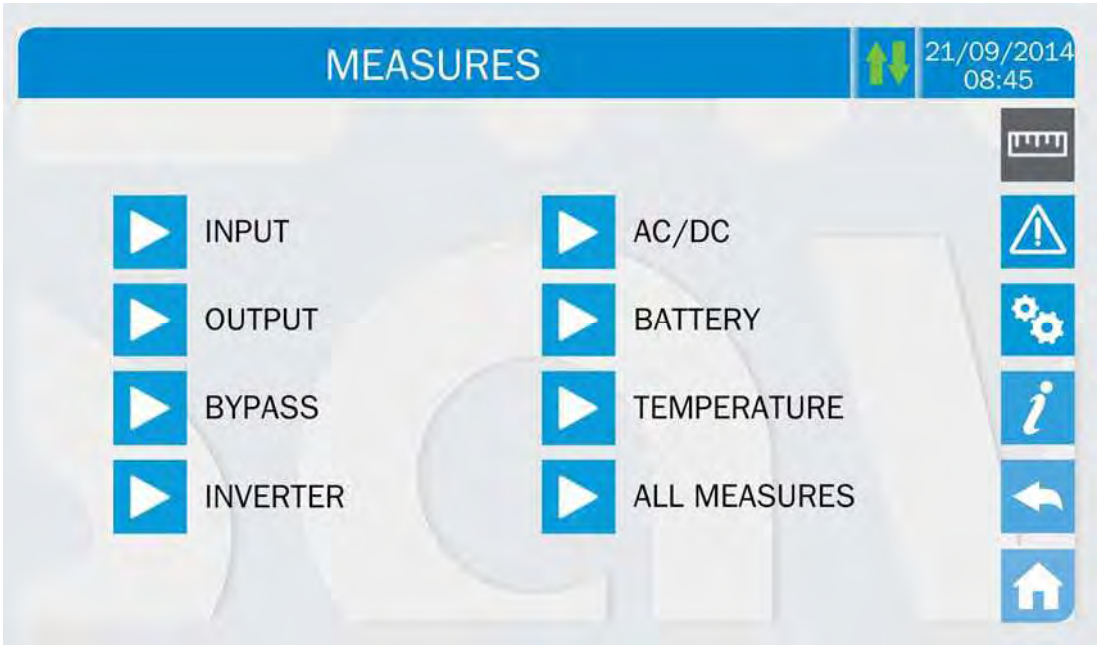
For what concern the *Communication* icon, it turns red in case of communication error between the *touch screen* and the I/O module control logic.

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.

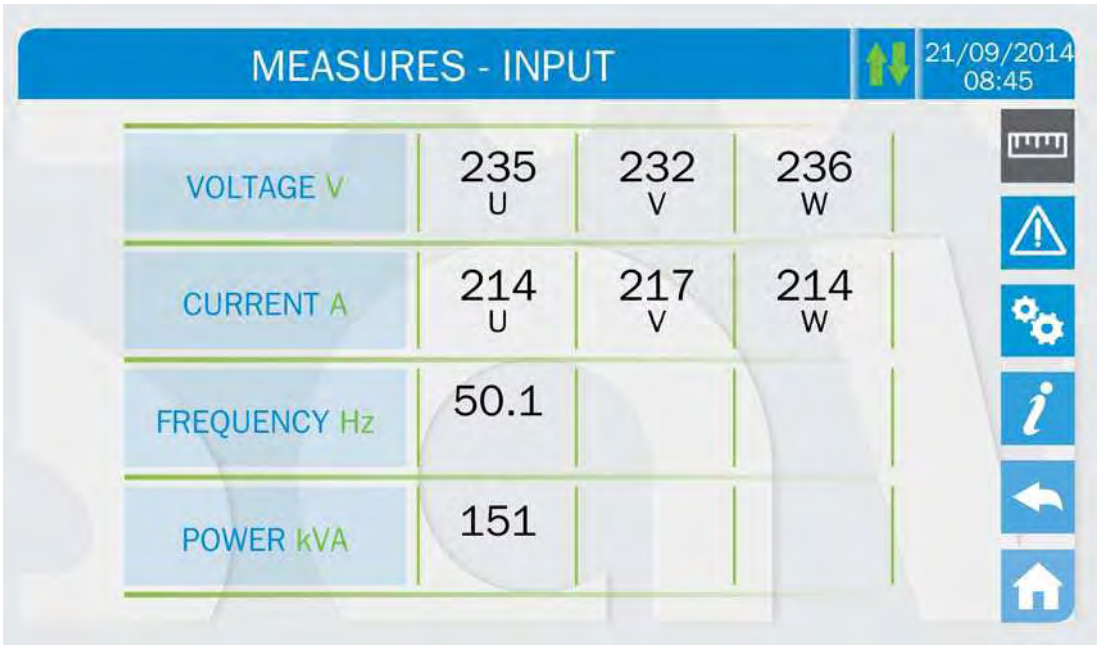
5.1 DISPLAYING THE MEASURES

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



Picture 20 – 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 21 – Input measures page

The list of all the available measures is given below.

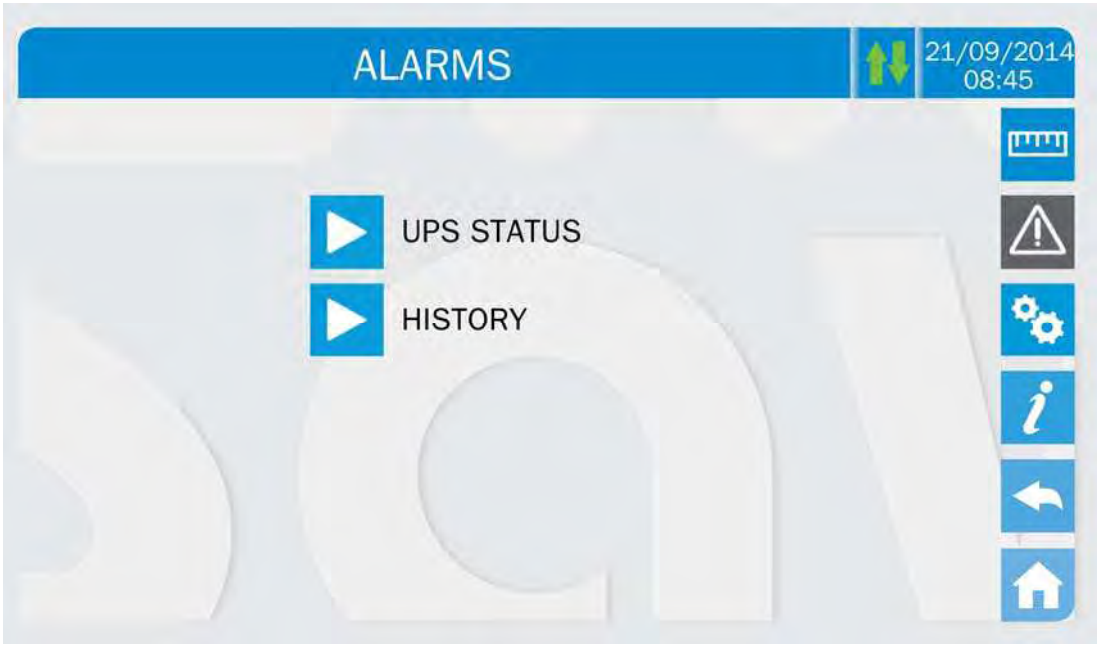
Sub-page	Displayed data	Accuracy
INPUT	Rectifier input voltage (1)	1 V
	Rectifier input current	1 A
	Frequency	0,1 Hz
	Input power	1 kVA
OUTPUT	Voltage (1)	1 V
	Current	1 A
	Load percentage	1 %
	Active power	1 kW
	Apparente power	1 kVA
	Frequency	0,1 Hz
BYPASS	Voltage (1)	1 V
	Frequency	0,1 Hz
INVERTER	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

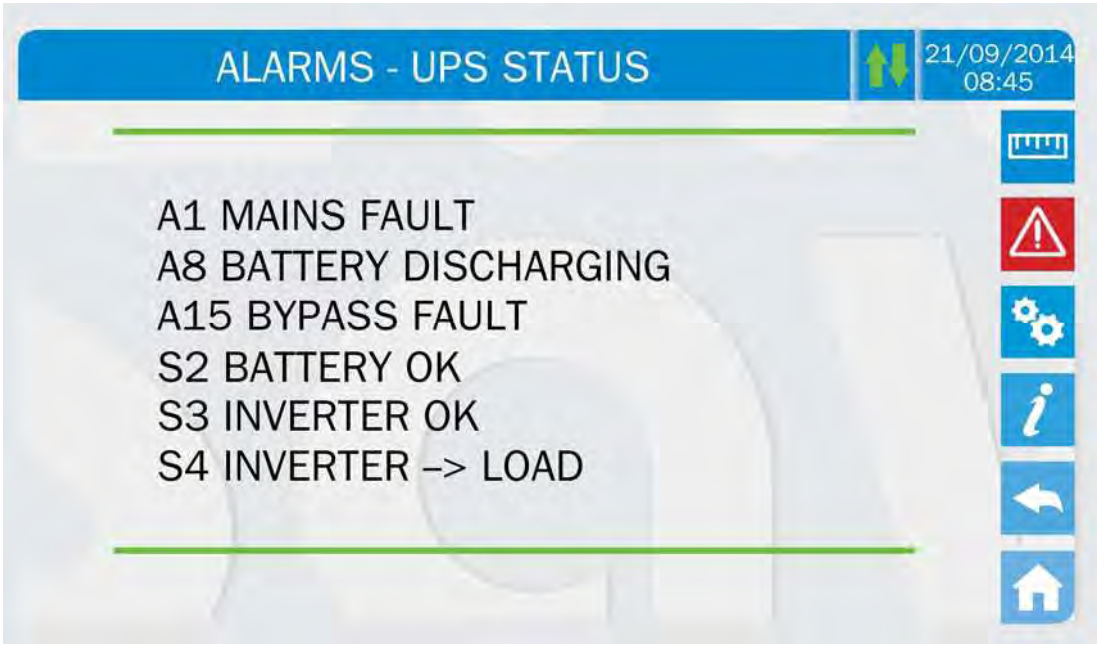
Pressing the *Alarms* icon will open the page where either the UPS operating status or the history log can be selected.



Picture 22 – ALARMS section

5.2.1 Displaying the operating status

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



Picture 23 – 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.

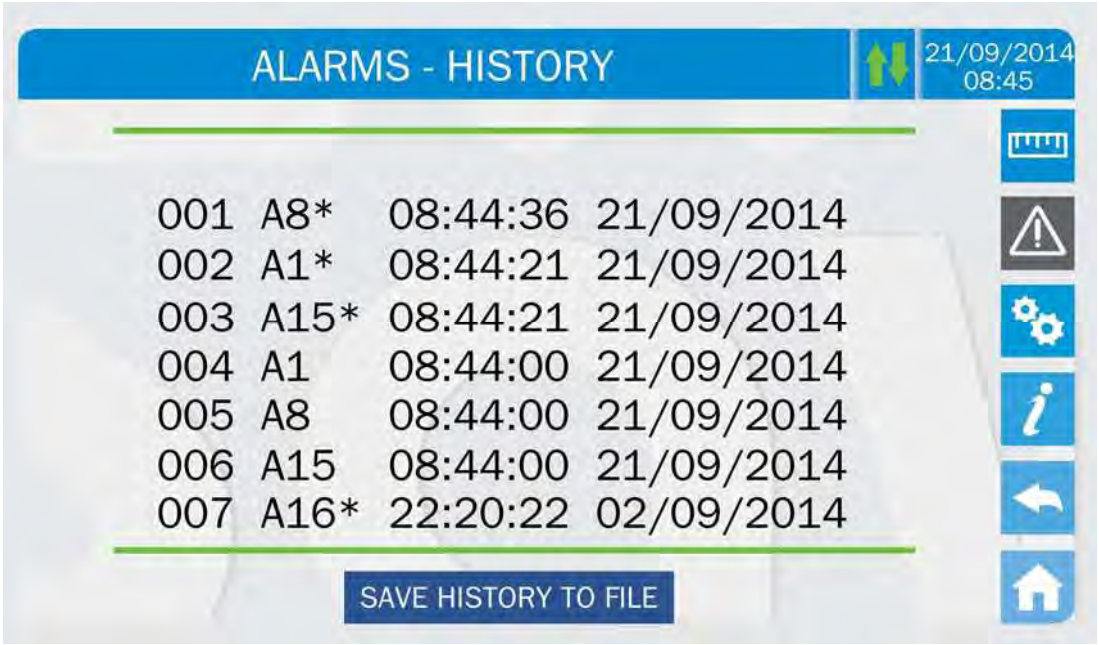
Icon	Colour	Meaning
	*Light blue* *Dark blue*	No active alarms
	*Grey*	No active alarms A page of the *Alarms* section is currently displayed
	*Red*	Active alarm; if the alarm is affecting one of the modules the relevant icon in the *Home* page will turn *Orange* or *Red*
	*Light blue*	No active alarms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



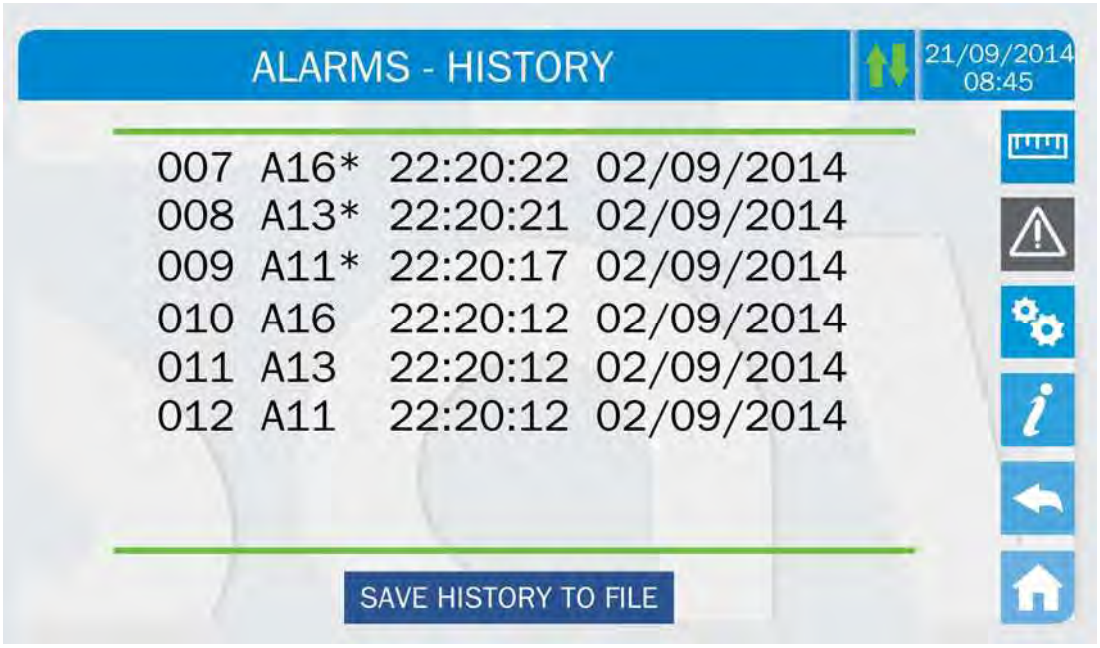
Picture 24 – History log, page 1

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.

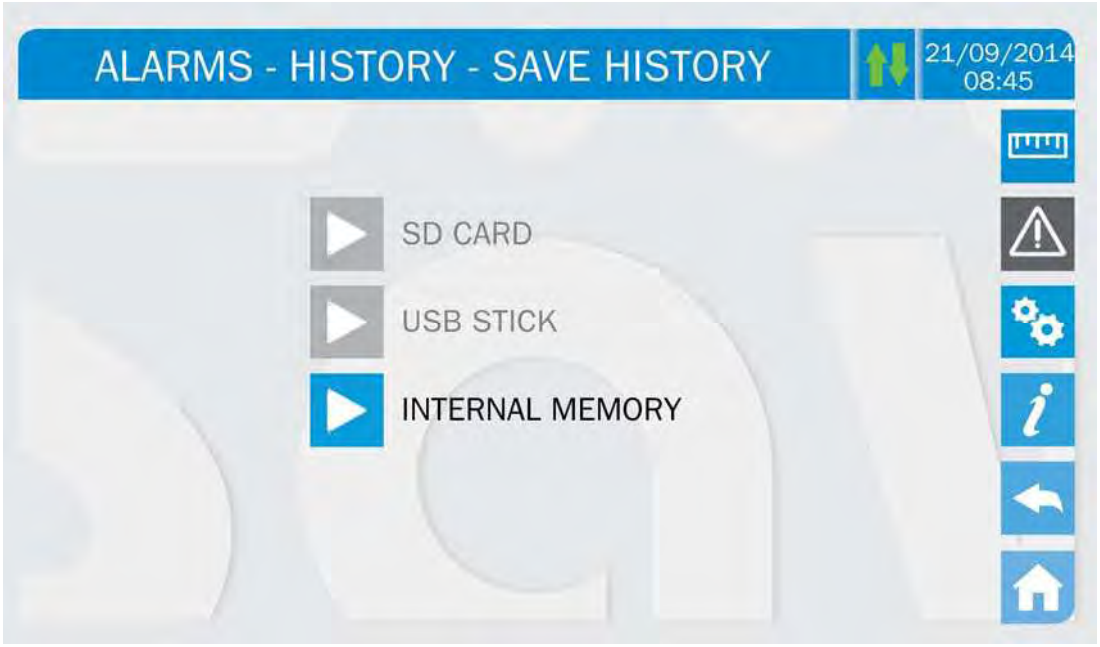
The maximum number of events which can be shown is equal to 250.

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



Picture 25 – History log, page 2

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



Picture 26 – 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

ALLARMI

A1 MAINS FAULT
A2 INPUT WRONG SEQUENCE
A3 BOOSTER STOPPED
A4 BOOSTER FAULT
A5 DC VOLTAGE FAULT
A6 BATTERY IN TEST
A7 BCB MODULE OPEN
A8 BATTERY DISCHARGE
A9 BATTERY AUTONOMY END
A10 BATTERY FAULT
A11 SHORT CIRCUIT
A12 STOP TIMEOUT SHORT CIRCUIT
A13 INVERTER OUT OF TOLERANCE
A14 BYPASS WRONG SEQUENCE
A15 BYPASS FAULT
A16 BYPASS → LOAD
A17 RETRANSFER BLOCKED
A18 MBCB CLOSED
A19 OCB MODULE OPEN
A20 OVERLOAD
A21 THERMAL IMAGE
A22 BYPASS SWITCH
A23 EPO PRESSED
A24 HIGH TEMPERATURE
A25 INVERTER OFF
A26 COMMUNICATION ERROR
A27 EEPROM ERROR
A28 CRITICAL FAULT
A29 MAINTENANCE REQUIRED
A30 COMMON ALARM
A31 MBCB CLOSE BUS
A32 EPO BUS CLOSED
A33 ASYMMETRIC LOAD
A34 SERVICE REQUIRED
A35 DIESEL MODE
A36 DC FAST SHUTDOWN
A37 BCBb OPEN
A38 INVERTER → LOAD
A39 INVERTER LOOP ERROR
A40 SSI MODULE FAILURE
A41 RECTIFIER VOLTAGE LOOP ERROR
A42 BCB OPEN
A43 OCB OPEN
A44 MODULE CONFIGURATION ERROR
A45 HIGH TEMPERATURE SSW
A46 REDUNDANCY LOSS
A47 SEND PARAMETERS ERROR
A48 FAILED RECEPTION OF EEPROM PAR.
A49 TEST MODE ERROR
A50 1 PARALLEL CABLE DISCONNECTED
A51 BATTERY TEMPERATURE
A52 UNDERVOLTAGE LOCKOUT
A53 FIRMWARE ERROR
A54 CAN ERROR
A55 2 PARALLEL CABLES DISCONNECTED
A56 MAINS UNBALANCED
A57 INPUT CURRENT UNBALANCED
A58 INVERTER CURRENT UNBALANCED
A59 RL BACKFEED ON
A60 UHE BLOCKED
A61 POWER SUPPLY RED. LOST
A62 INTERNAL RS485 ERROR
A63 STARTING SEQUENCE BLOCKED
A64

STATUS

S1	BOOSTER OK	**S10**	RECTIFIER STANDBY
S2	BATTERY OK	**S11**	INVERTER STANDBY
S3	INVERTER OK	**S12**	BATTERY STANDBY
S4	INVERTER → LOAD	**S13**	BATTERY DISCHARGING
S5	INVERTER BYPASS SYNCHRONIZED	**S14**	BATTERY IN CHARGE (I)
S6	BYPASS OK	**S15**	BATTERY IN CHARGE (I)
S7	BYPASS → LOAD	**S16**	GREEN CONVERSION
S8	INVERTER MASTER GROUPS SYNC.	**S17**	LINE INTERACTIVE
S9	INVERTER MODULES SYNCHRONIZED		

Display and recording mode of alarms

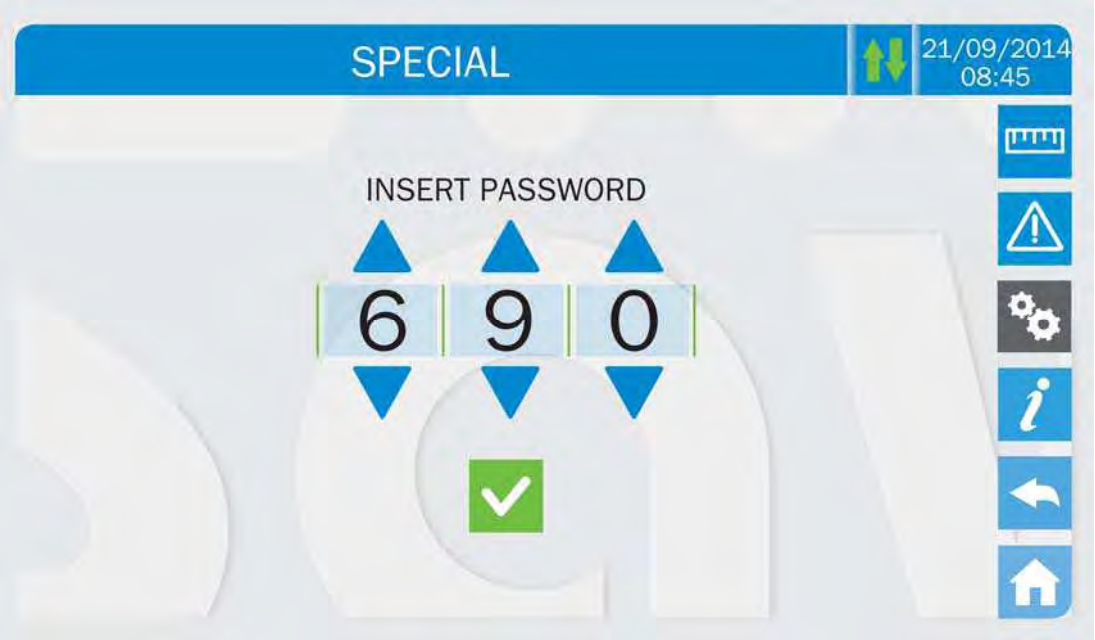
- The statuses are always displayed in ascending order when the ALARMS – STATUS menu is entered.
- The alarms are shown when they are present and must be silenced with the buzzer.
- The alarms remain displayed whilst they are present and they are automatically stored in the event log with date and time.

Description of alarms and statuses

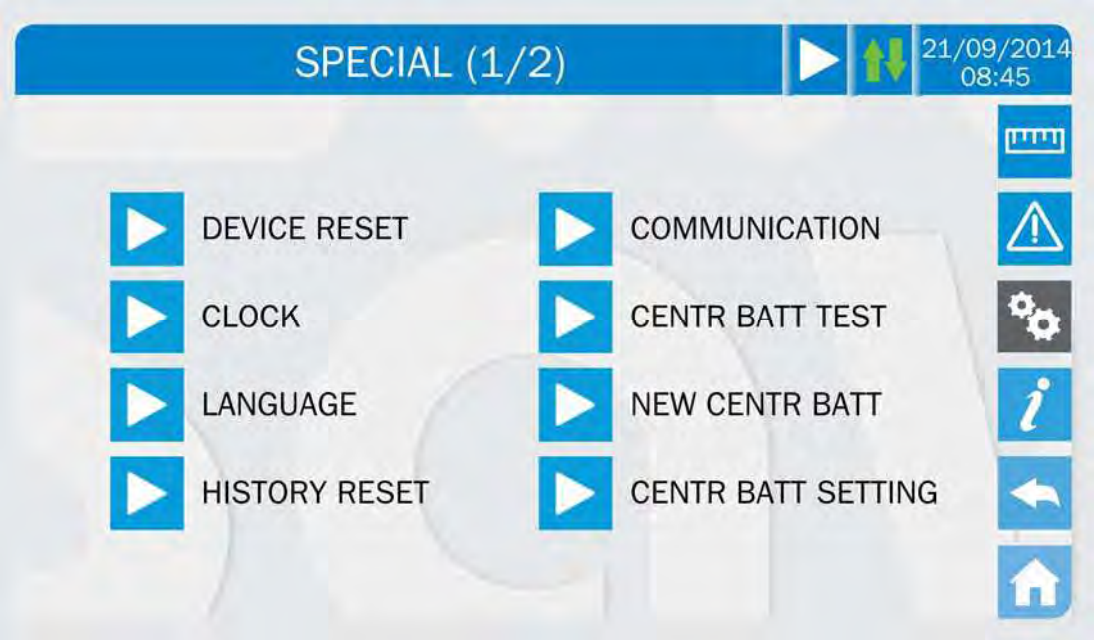
For a more detailed description of the alarms and statuses, see the “Faults and alarms” section of the present manual.

5.3 SETTINGS AND ADVANCED OPERATIONS

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

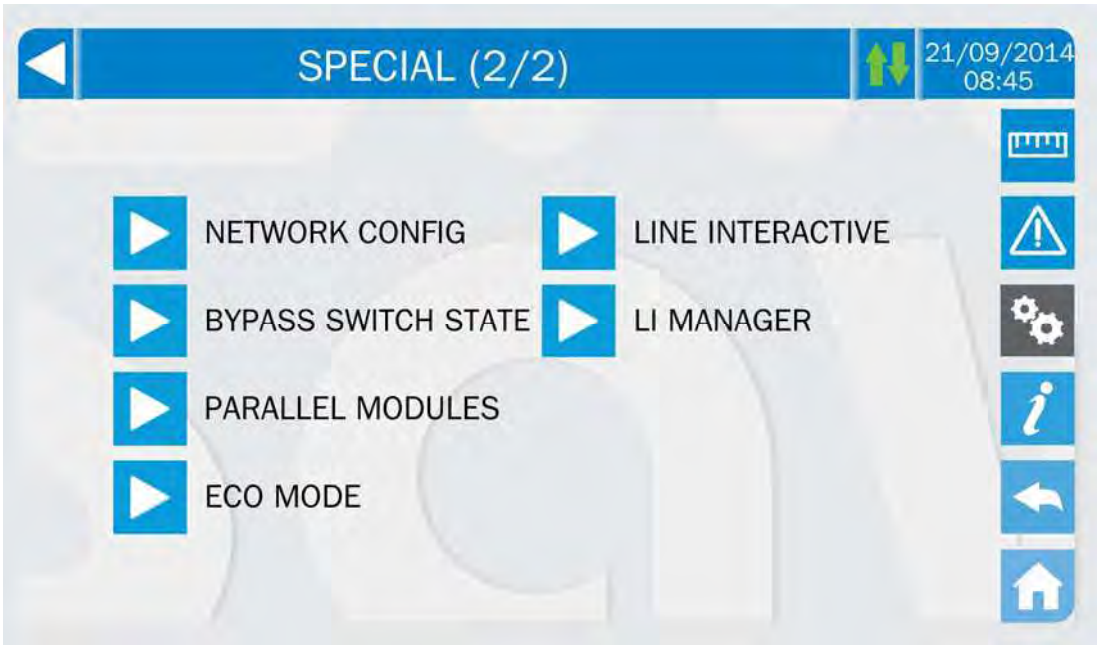


Picture 27 – Access password to the Settings section



Picture 28 – SETTINGS section, page 1

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



Picture 29 – 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 of the single modules booster section (alarm A57)
- Block due to the disconnection of one parallel cable (alarm A50)
- Block due to the disconnection of two parallel cables (alarm A55)

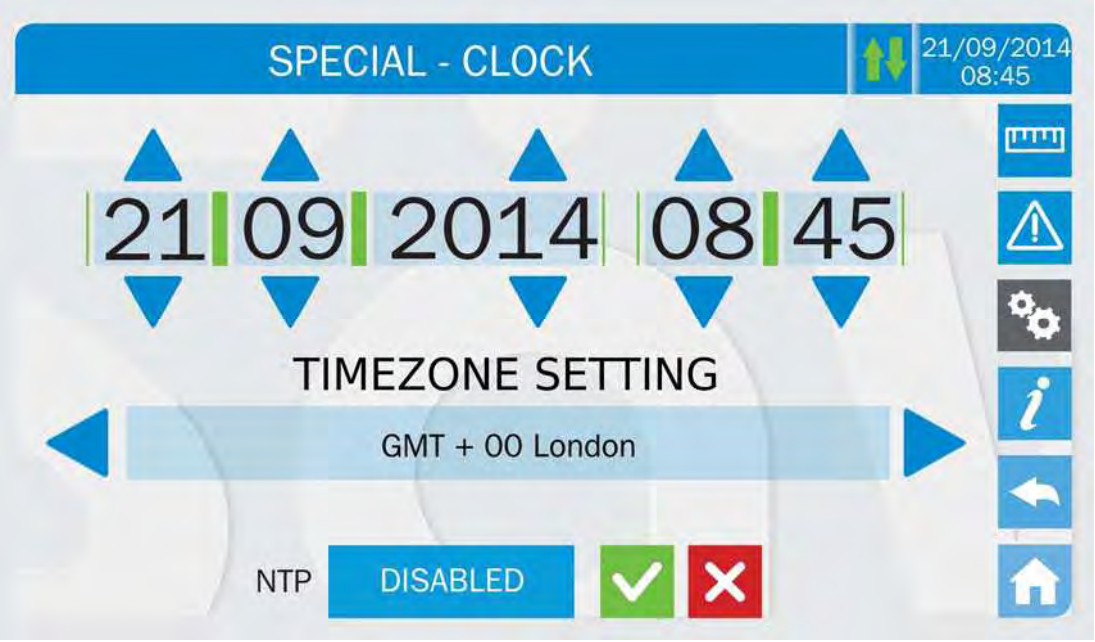
- System restart after a shutdown due to EPO activation

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.

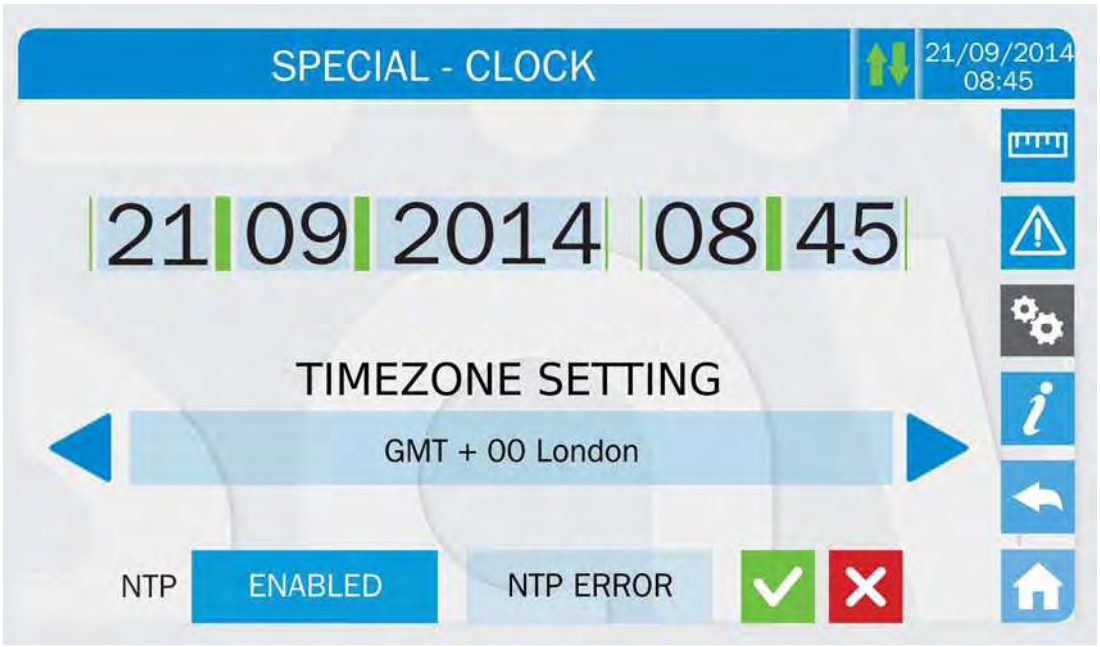


Picture 30 – Clock manual setting

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 31 – 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 32 – 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 *COMMUNICATION* section.

Picture 33 – Communication main page

The three sections are almost identical, and allows, for each one of the available communication ports, to set the typical parameters, that is the ModBus address, the communication mode and the data transmission speed.

The *Teleservice* port is reserved to the interface with a dedicated converter for the integration within the BORRI teleservice system; the other two ports are available for the user.

5.3.6 New centralized battery

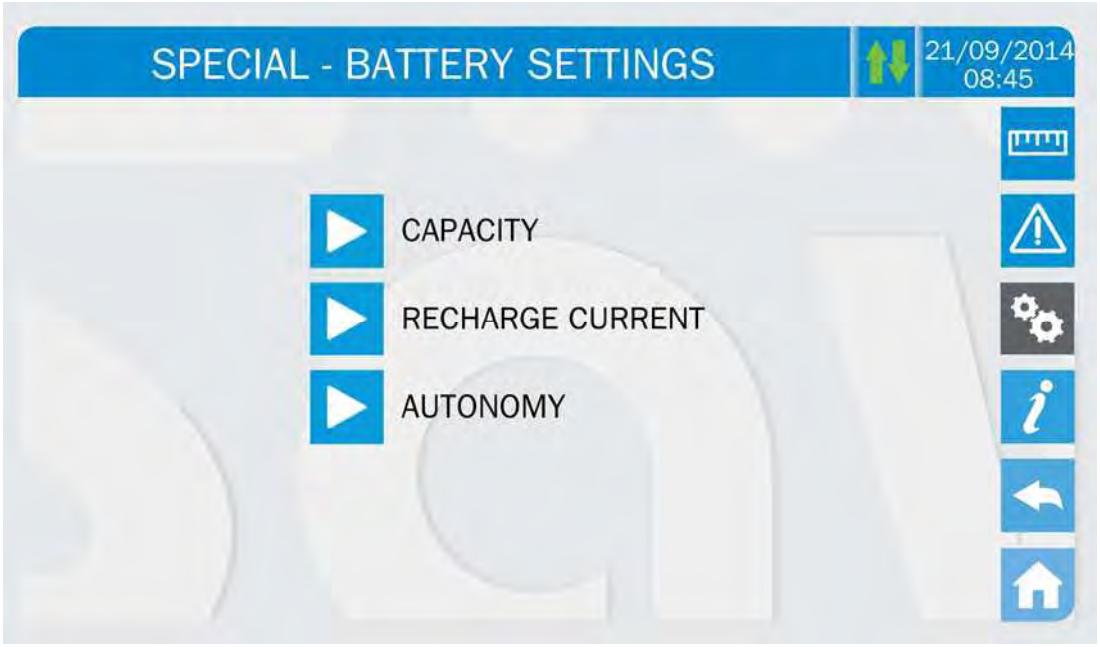
The page *NEW CENTR BATT* is used in case battery circuit breaker BCB is not closed, when requested, in the start-up phase. In this case the system will start considering the battery completely discharged and activating the alarm “A10 – BATTERY FAULT”.

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.

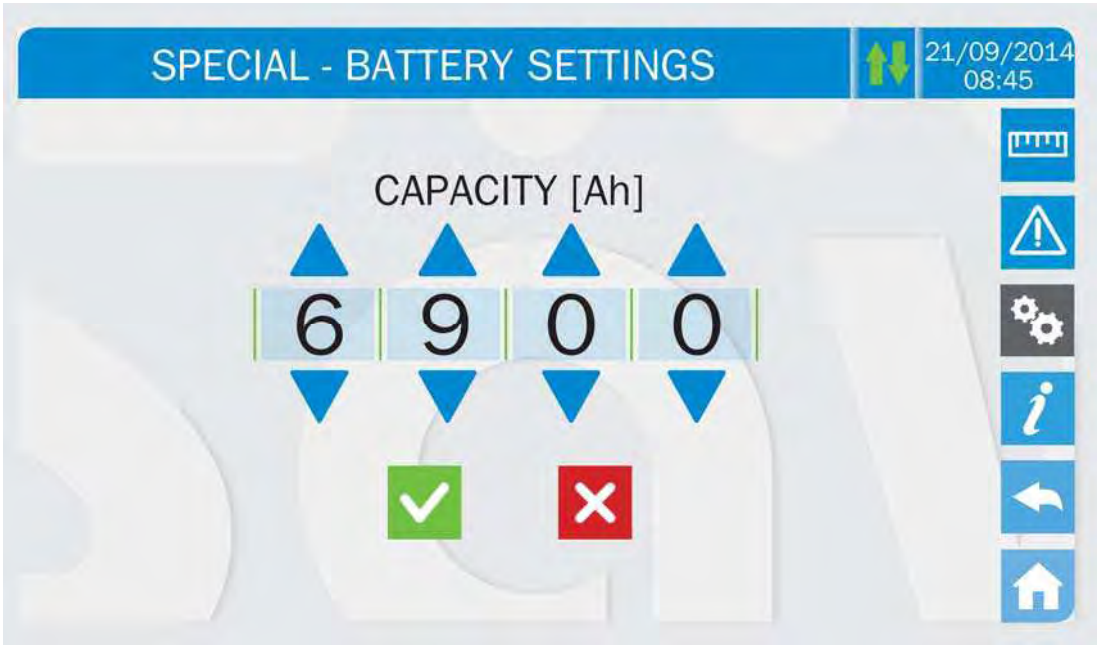
5.3.7 Setting the centralized battery

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



Picture 34 – Centralized 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 35 – Centralized battery parameters setting

5.3.8 Centralized battery test

The *CENTR BATT 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.

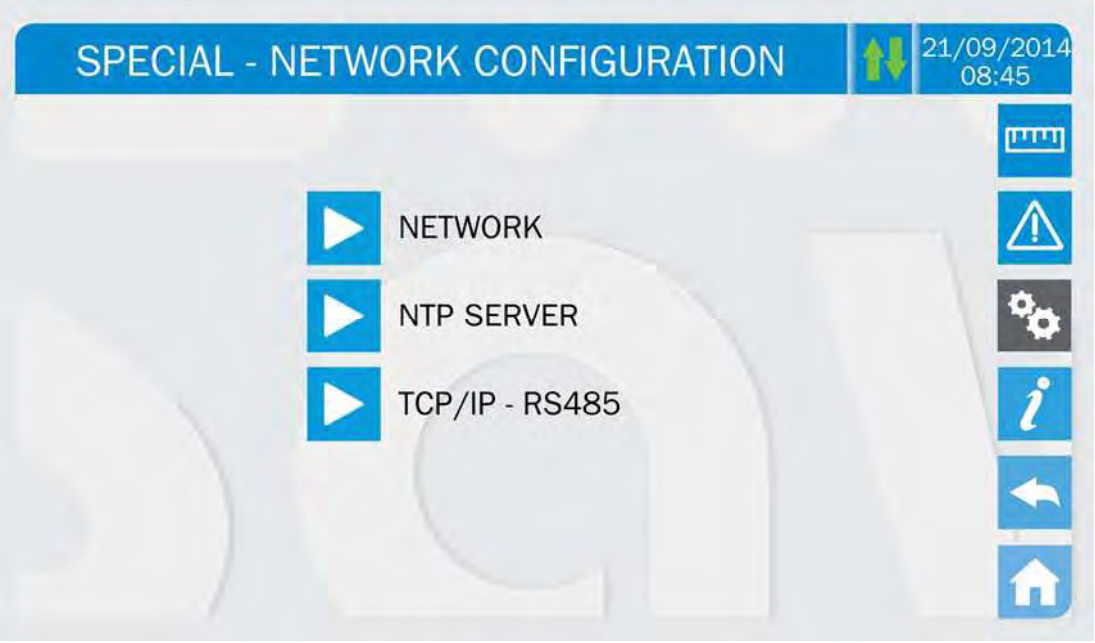
Possible loss of supply

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 CONFIGUR* 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*.

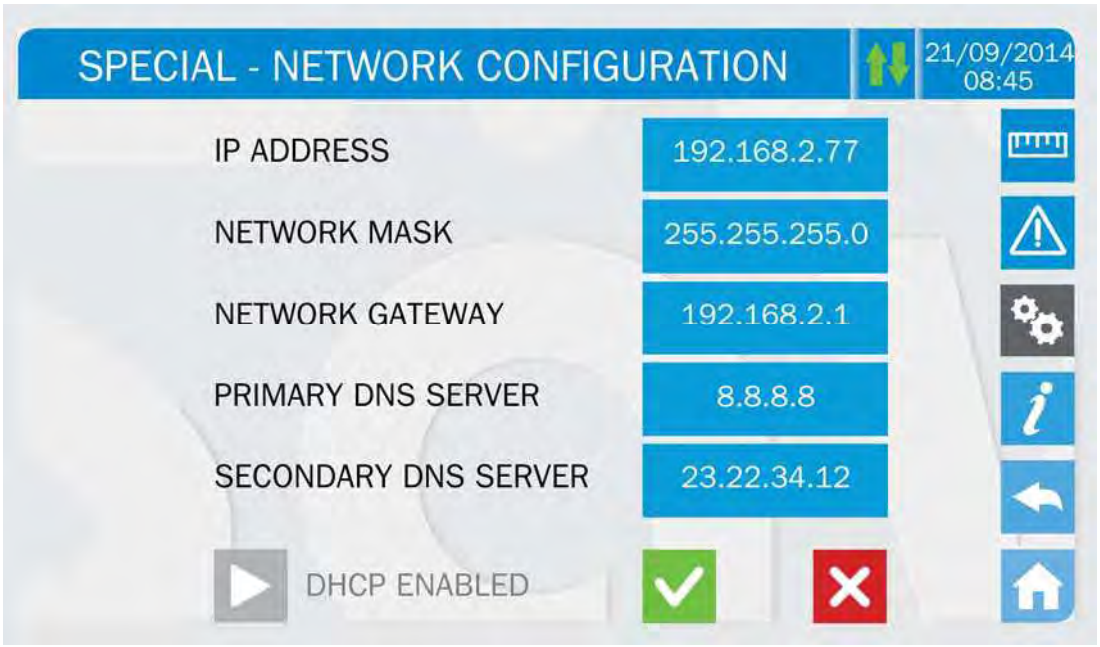


Picture 36 – Touch screen network parameters setting

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

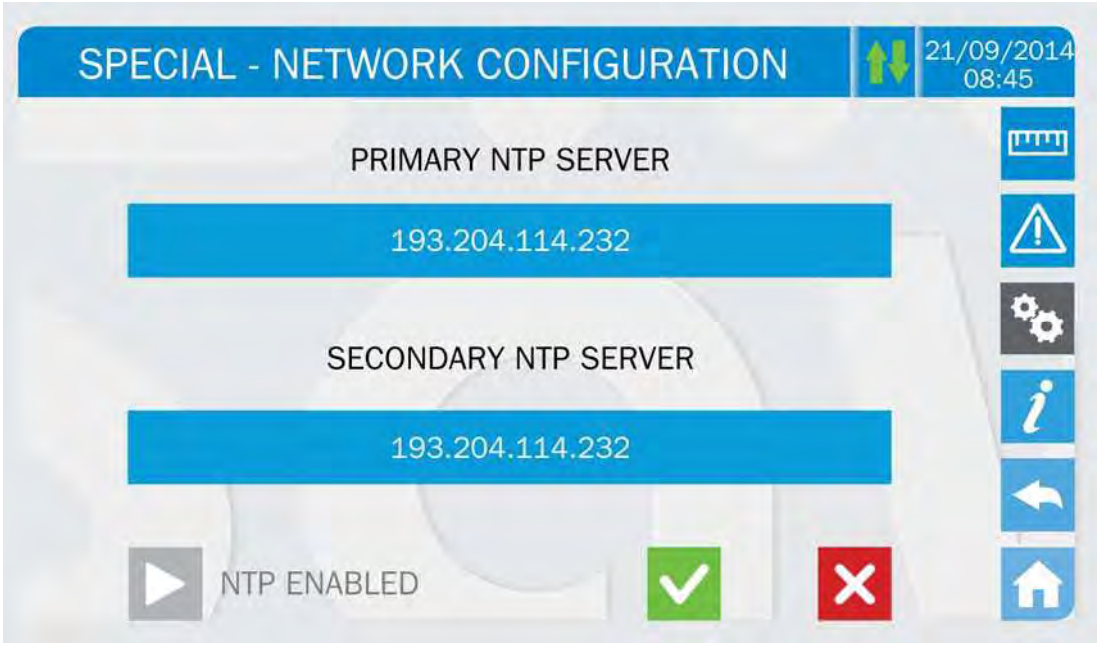


Picture 37 – LAN parameters setting

5.3.9.2 Setting the NTP parameters

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

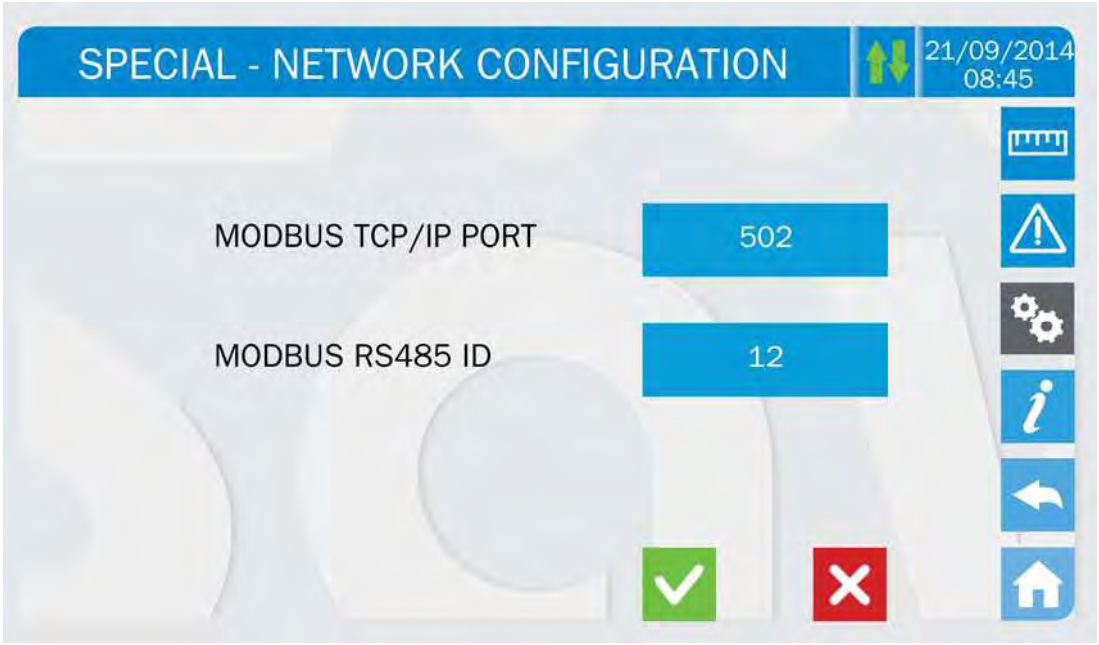
- Primary NTP server address
- Primary NTP server address
- NTP Enabling / Disabling



Picture 38 – NTP parameters setting

5.3.9.3 Setting the ModBus TCP/IP and RS485 parameters

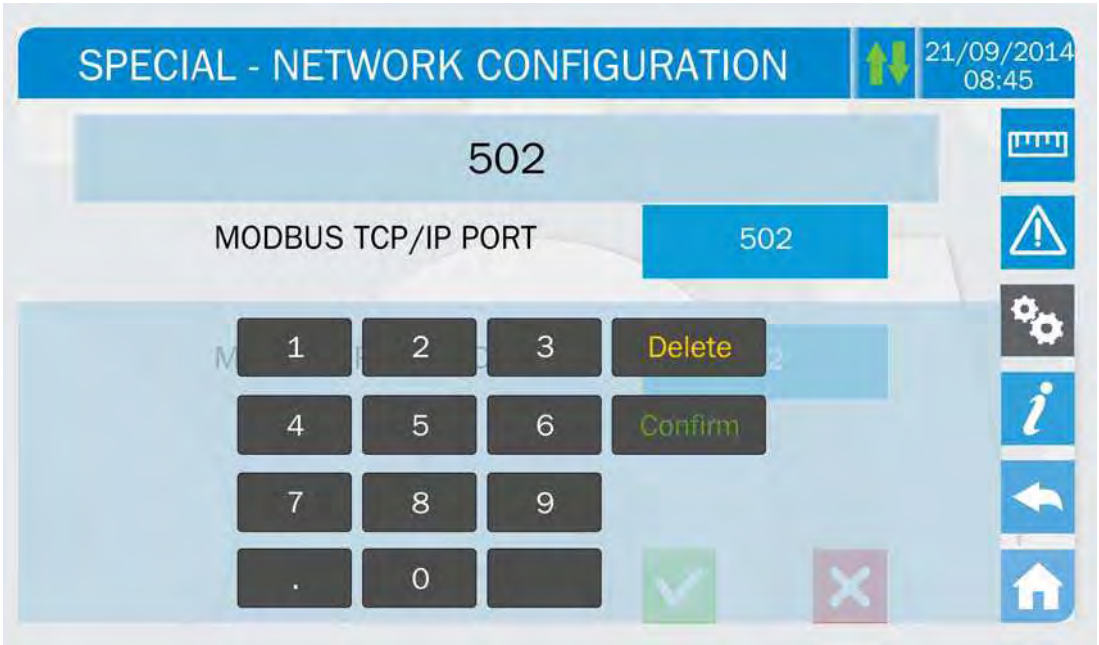
This screen allows the setting of the TCP/IP port on which the display answers via ModBus TCP/IP protocol. The address of the ModBus RS485 port can also be set.



Picture 39 – TCP/IP ports setting

5.3.9.4 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.



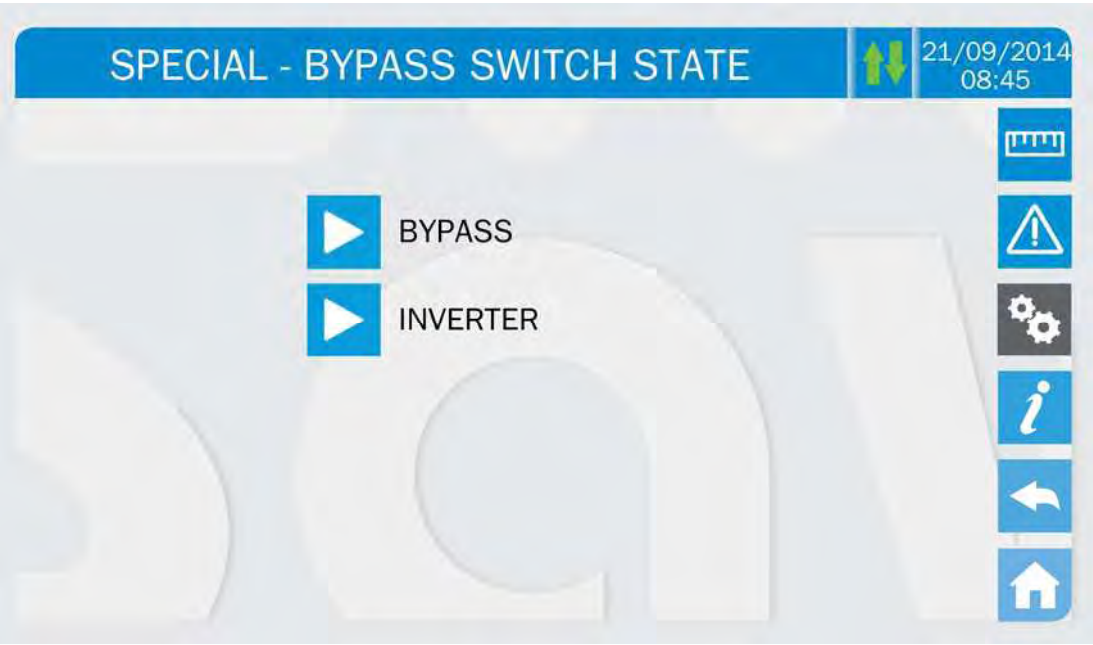
Picture 40 – Modification of numerical parameters

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 41 – Modification of NTP address parameters

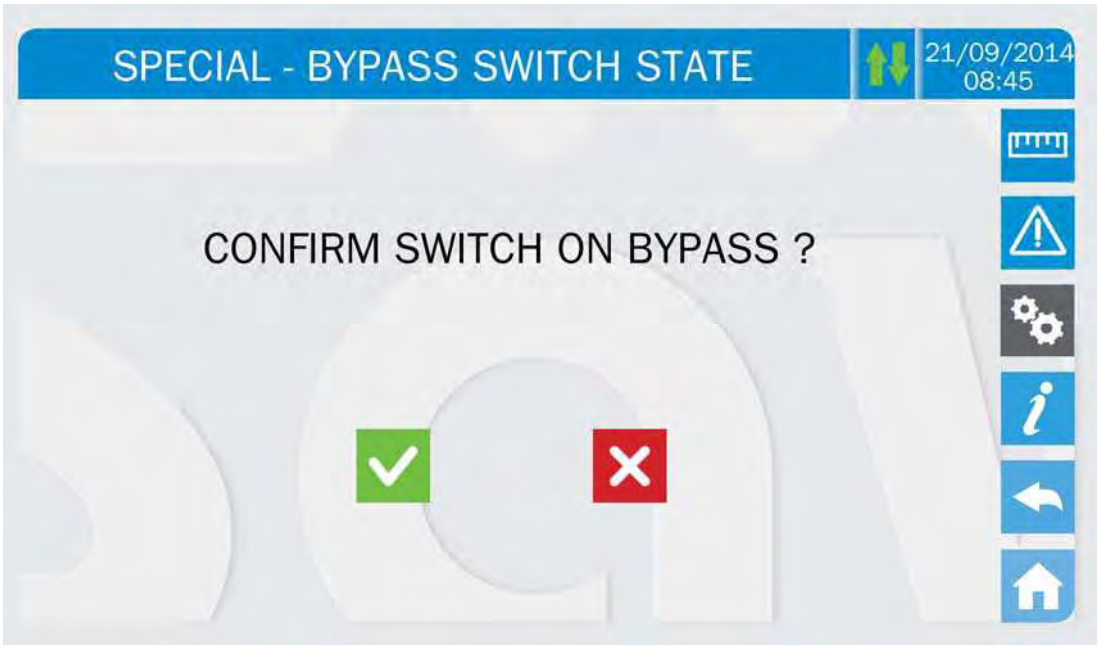
5.3.10 Bypass Switch status

The section *BYPASS SWITCH STATUS* replies the operation of the *Bypass_SW* selector, which allows the system commutation from inverter to the bypass mains and vice-versa.



Picture 42 – Bypass switch status

One of the sources to which the load is to be transferred can be selected from the main page; the page that follows requires a confirmation of the operation.



Picture 43 – Confirmation of load transfer

Load transfer operation

The load transfer operation is reserved to skilled personnel.

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.

5.3.11 Modifying the operating mode – LINE INTERACTIVE

The section *LINE INTERACTIVE* allows the modification of the UPS operating mode, from the VFI – Voltage Frequency Independent operation (on-line double conversion) to VI – Voltage Independent. In such mode the inverter works as a "compensator", supplying reactive power to the load, so that the the power supplied by the mains is almost purely resistive and at unity power factor.

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 – Line Interactive

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

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.

5.3.12 Modifying the modules redundancy logic

The section *PARALLEL MODULES* allows the modification of the redundancy logic of the power modules. Such operation is reserved to personnel who have had a specific training on the product.

Modifying the power modules redundancy logic

The modification of the modules redundancy logic is reserved to skilled personnel.

Before modifying the redundancy logic verify that the load is stable and such to allow the modification.

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.

5.3.13 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.

5.3.14 Setting the LINE INTERACTIVE mode

The *LINE INTERACTIVE* section allows to enable the system operation in such mode. the different settings are possible:

- DISABLED;
- MANUAL;
- AUTOMATIC.

The activation of the *LINE INTERACTIVE* mode depends on an algorithm which controls the stability of the bypass line and the conditions of the load supplied by the system. When all the

conditions are fulfilled (see *LINE INTERACTIVE* section of the *INFO* menu) the activation of such operating mode depends on how the parameter is set.

In the **AUTOMATIC** mode the system manages independently the activation and de-activation of the *LINE INTERACTIVE* mode. In case of alarms, or parameters out of tolerance, the system restores the on-line double conversion mode and the *LINE INTERACTIVE* mode is resumed when the activation conditions are fulfilled again.

In the **MANUAL** mode the *LINE INTERACTIVE* mode can only be started through the section *LI MANAGEMENT* (see following paragraph). In case of stop owing to alarms or parameters out of tolerance, the system stays in the on-line double conversion mode unless the *LINE INTERACTIVE* mode is manually re-started.

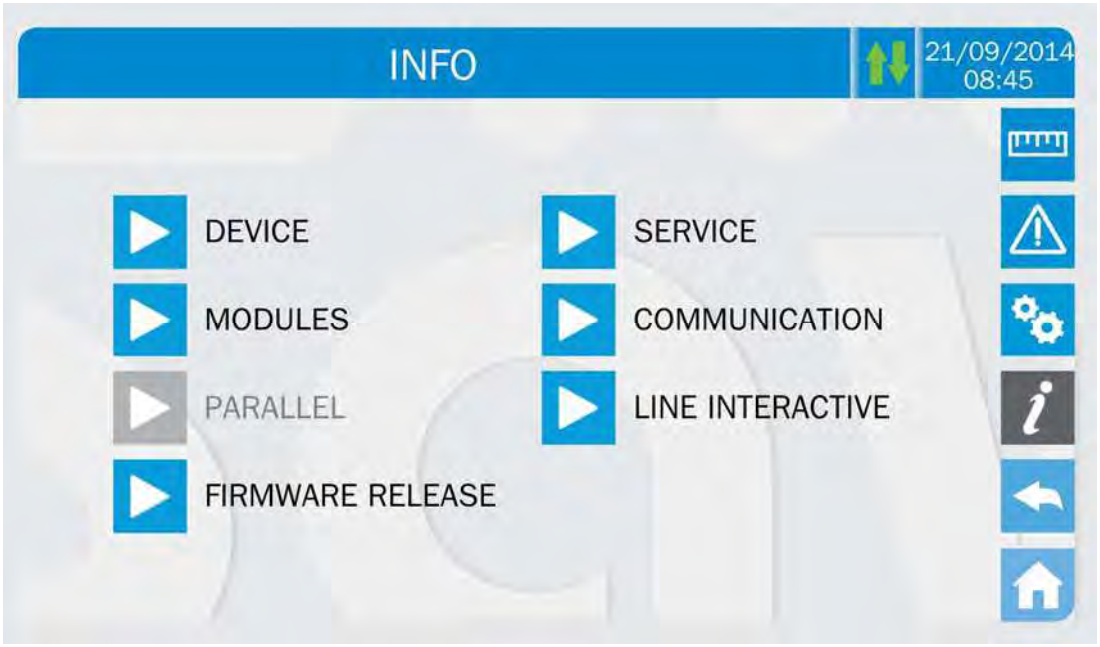
5.3.15 Starting and stopping the LINE INTERACTIVE mode

This section includes two buttons, *START* and *STOP*, which allows to start and stop the *LINE INTERACTIVE* mode.

In case of AUTOMATIC management, a stop of the operating mode switches the system to the on-line double conversion mode, with the automatic re-start of the *LINE INTERACTIVE* mode on the basis of the activation algorithm.

5.4 SYSTEM INFORMATION

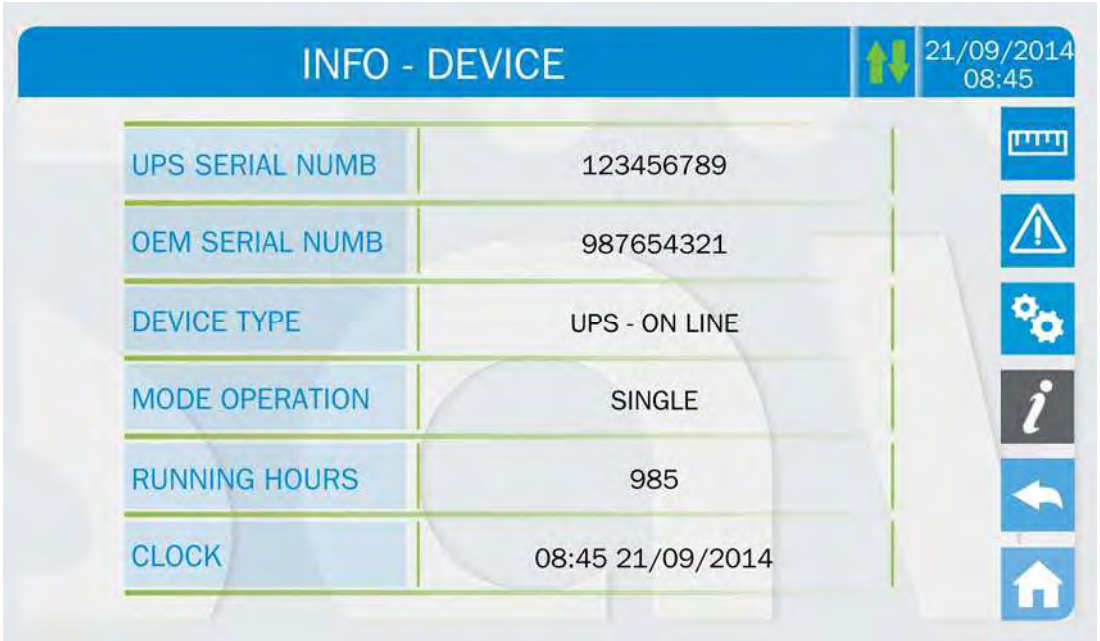
The *INFO* section provides general information about the UPS; press the related icon to open the main page.



Picture 44 – 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 45 – 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 Modules information

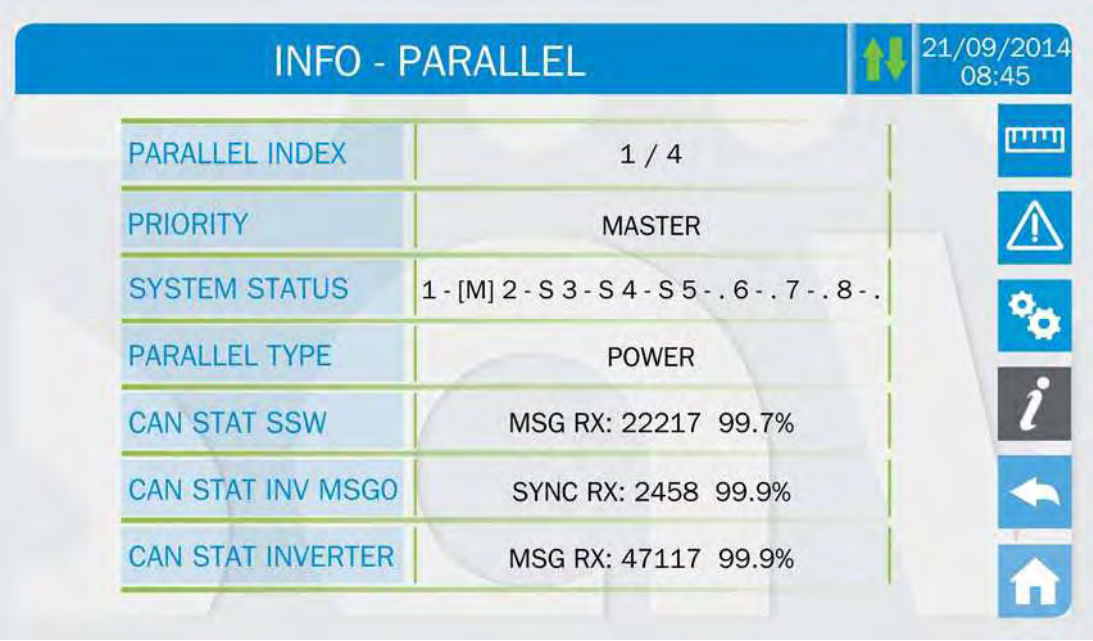
Picture 46 – Modules information

The page provides information about both the system arrangement and the power modules (BPU) operating mode. In the example given in the above picture the system is composed of #6 BPU's (1200 kVA) which operates in "redundant + 1" mode, thus on a total load of maximum 1000 kVA.

The lines related to the statistics gives information about the quality of the communication between the power modules and the control unit located in the I/O module.

5.4.3 Parallel information

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



Picture 47 – Parallel information

5.4.3.1 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.

5.4.3.2 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.

5.4.3.3 System status (communication bus monitoring)

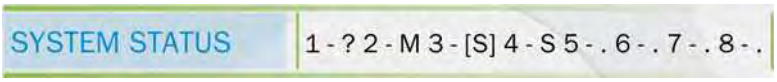
This field gives a general indication regarding the communication between the UPS units composing the system.

- 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 48 – Parallel bus communication status

5.4.3.4 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.

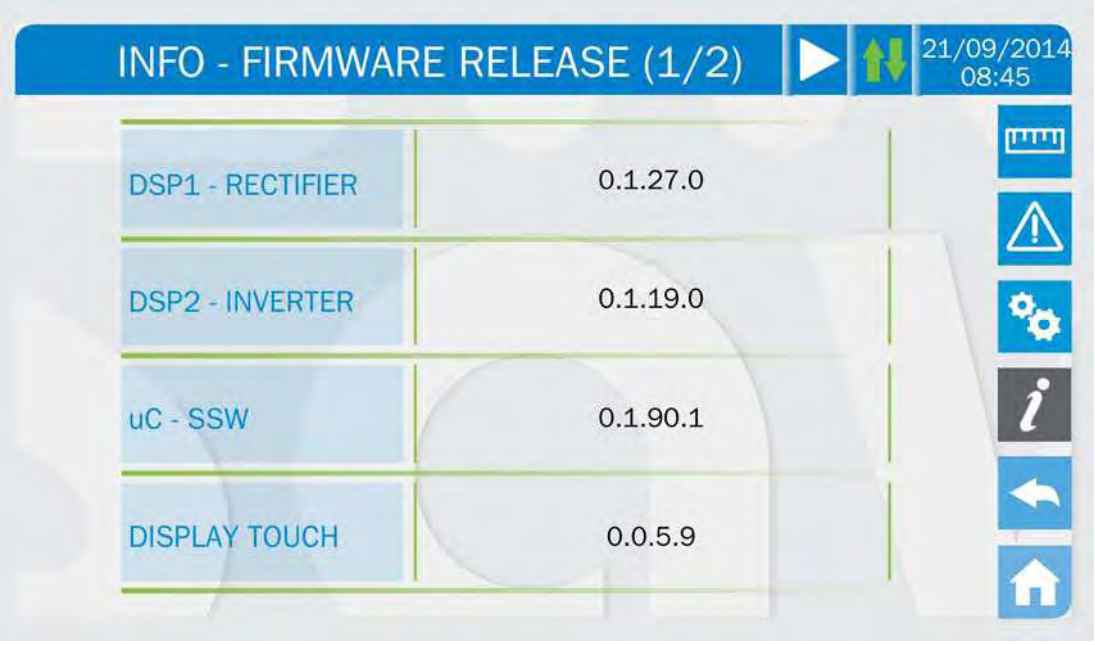
5.4.3.5 Message statistics

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.

5.4.4 Firmware release



Picture 49 – Firmware release

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

5.4.5 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.

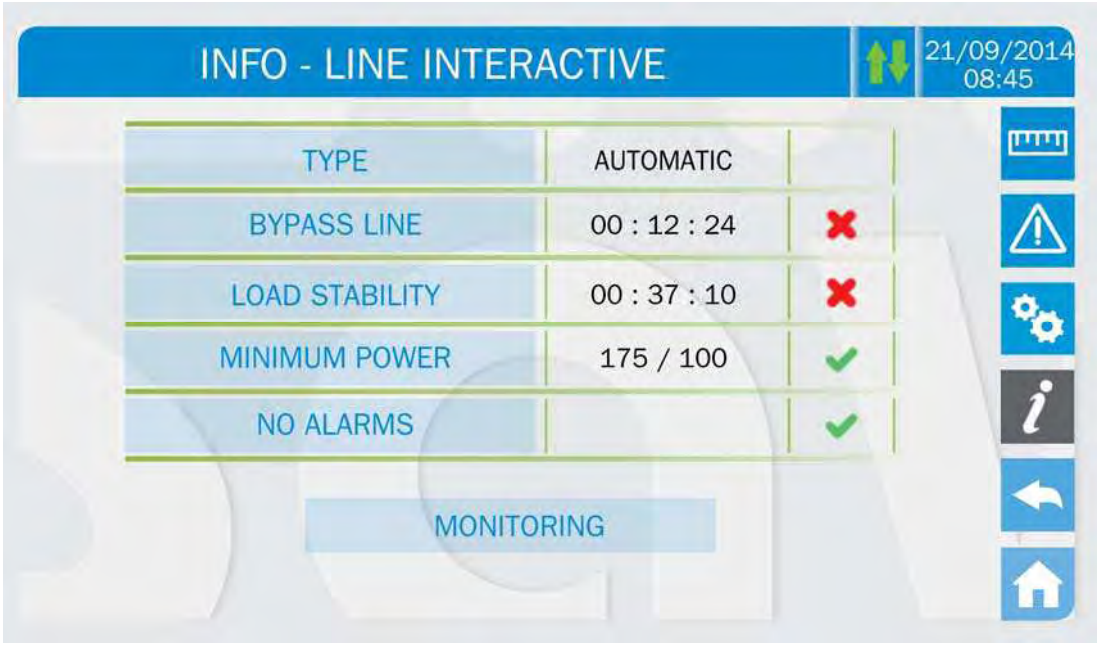
However, please also see the addresses and contact numbers indicated in the present manual

5.4.6 Communication information

The *COMMUNICATION* section provides information about the settings of the three communication ports, as regards the assigned ModBus address, the communication mode and the data transmission speed.

5.4.7 LINE INTERACTIVE mode information

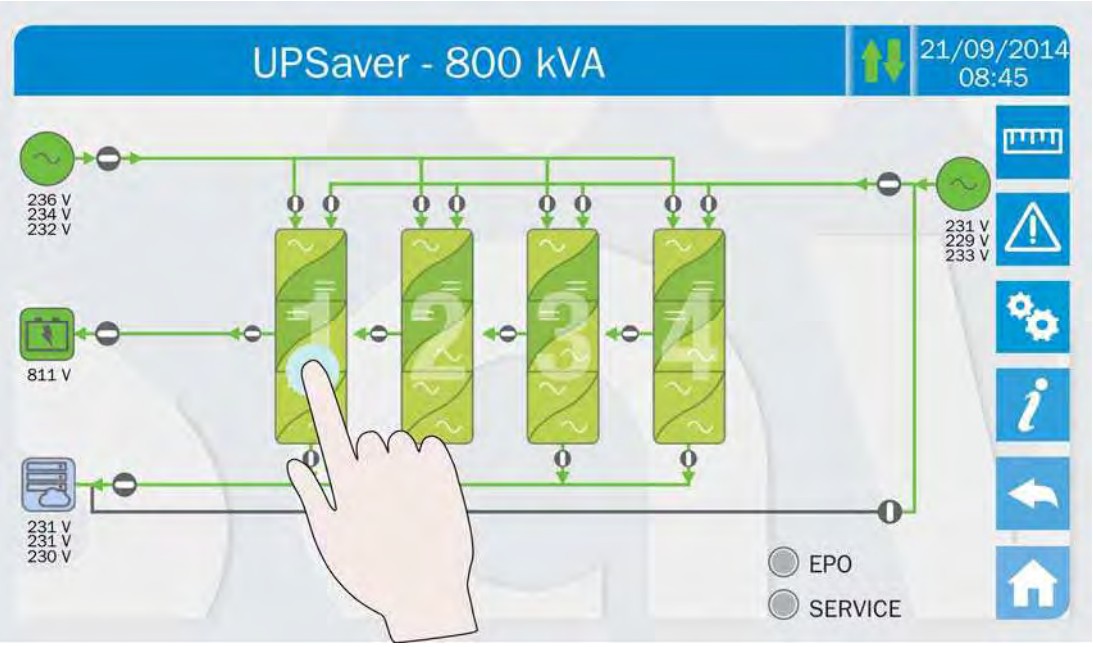
This section provides information about the parameters of the *LINE INTERACTIVE* mode activation algorithm. When all the parameters are within the tolerance range (green tick) the mode is active, unless the MANUAL control is set, in which case it can only be activated by the *SPECIAL* menu.



Picture 50 – LINE INTERACTIVE parameters

6 *TOUCH SCREEN* – MANAGING THE POWER MODULES

The power modules operating parameters can be managed by entering the various sections of the control panel by pressing the picture of the module from the *Home* page flow diagram.

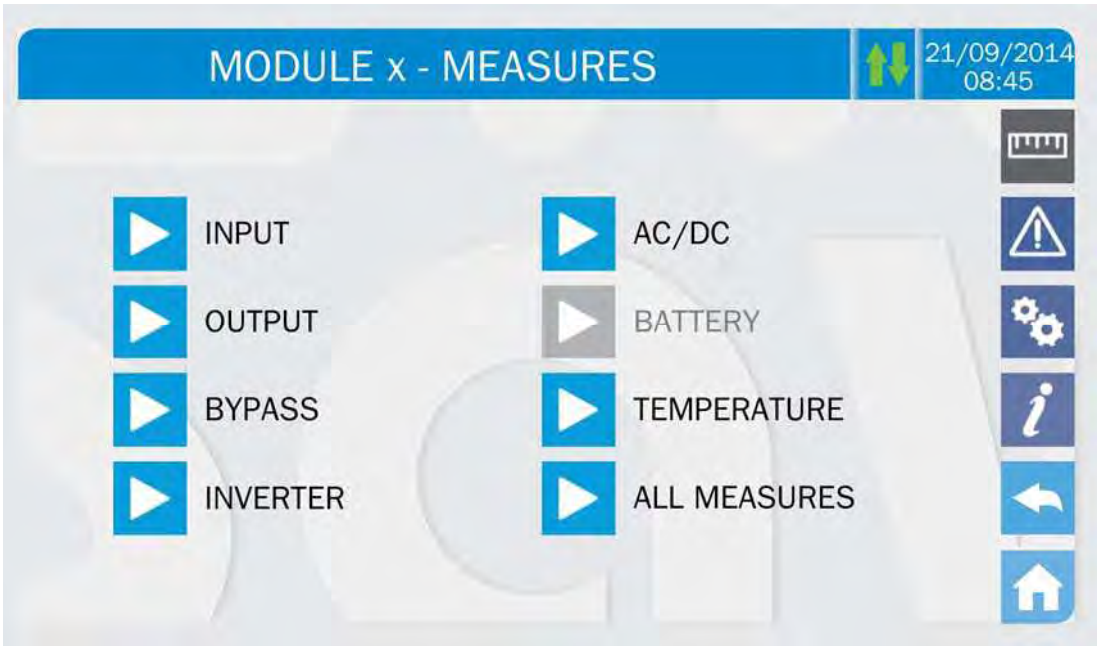


Picture 51 – Accessing the power module sections

The page containing the power module flow diagram will be displayed, from which it is possible to open the *Measures*, *Alarms*, *Settings* and *Info* sections related to the module itself.

6.1 DISPLAYING THE MEASURES

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



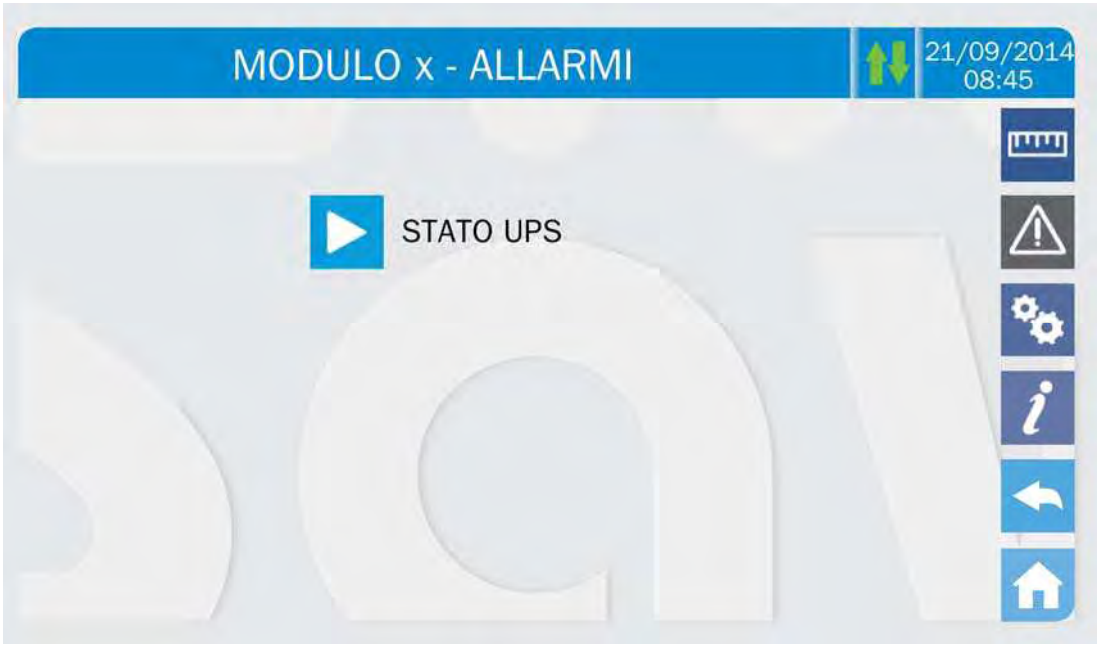
Picture 52 – MEASURES section, power module

The measures page of a specific section of the module is entered pressing one of the arrows. The available measures are the same as those related to the *UPSaver* system that can be displayed from the *Home* page.

The module battery measures are only available if the system is configured with distributed battery (DB). The same concepts applies to the bypass measures, which are only available if the bypass static switch is distributed.

6.2 DIAGNOSTICA DI BASE

Pressing the *Alarms* icon will open the page where either the module operating status can be selected.



Picture 53 – ALARMS section, power modules

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

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.

6.2.1 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
	*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.

6.2.2 Lista degli allarmi e degli stati

ALLARMI

A1	MAINS FAULT	**A33**	ASYMMETRIC LOAD
A2	INPUT WRONG SEQUENCE	**A34**	
A3	BOOSTER STOPPED	**A35**	
A4	BOOSTER FAULT	**A36**	DC FAST SHUTDOWN
A5	DC VOLTAGE FAULT	**A37**	
A6		**A38**	INVERTER → LOAD
A7	BCB OPEN	**A39**	INVERTER LOOP ERROR
A8		**A40**	SSI FAULT
A9		**A41**	RECTIFIER VOLTAGE LOOP ERROR
A10		**A42**	
A11	SHORT CIRCUIT	**A43**	
A12	STOP TIMEOUT SHORT CIRCUIT	**A44**	FAILED RECEPTION OF IOBM PARAM.
A13	INVERTER OUT OF TOLERANCE	**A45**	HIGH TEMPERATURE SSW
A14	BYPASS WRONG SEQUENCE	**A46**	
A15	BYPASS FAULT	**A47**	SEND PARAMETERS ERROR
A16	BYPASS → LOAD	**A48**	FAILED RECEPTION OF EEPROM PAR.
A17	RETRANSFER BLOCKED	**A49**	TEST MODE ERROR
A18	MBCB CLOSED	**A50**	PARALLEL CABLE DISCONNECTED
A19	OCB OPEN	**A51**	
A20	OVERLOAD	**A52**	UNDERVOLTAGE LOCKOUT
A21	THERMAL IMAGE	**A53**	FIRMWARE ERROR
A22	BYPASS SWITCH	**A54**	CAN / SPI-A ERROR
A23	EPO PRESSED	**A55**	
A24	HIGH TEMPERATURE	**A56**	MAINS UNBALANCED
A25	INVERTER OFF	**A57**	INPUT CURRENT UNBALANCED
A26	COMMUNICATION ERROR	**A58**	INVERTER CURRENT UNBALANCED
A27	EEPROM ERROR	**A59**	RL BACKFEED ON
A28	CRITICAL FAULT	**A60**	UHE BLOCKED
A29		**A61**	
A30	COMMON ALARM	**A62**	
A31	MBCB BUS CHIUSO	**A63**	STARTING SEQUENCE BLOCKED
A32		**A64**	

STATI

S1	BOOSTER OK	**S10**	
S2		**S11**	
S3	INVERTER OK	**S12**	
S4	INVERTER → LOAD	**S13**	BATTERY DISCHARGING
S5	INVERTER BYPASS SYNCHRONIZED	**S14**	BATTERY IN CHARGE (I)
S6	BYPASS OK	**S15**	BATTERY IN CHARGE (U)
S7	BYPASS → LOAD	**S16**	
S8		**S17**	
S9	INVERTER MASTER SYNCHRONIZED		

Display and recording mode of alarms

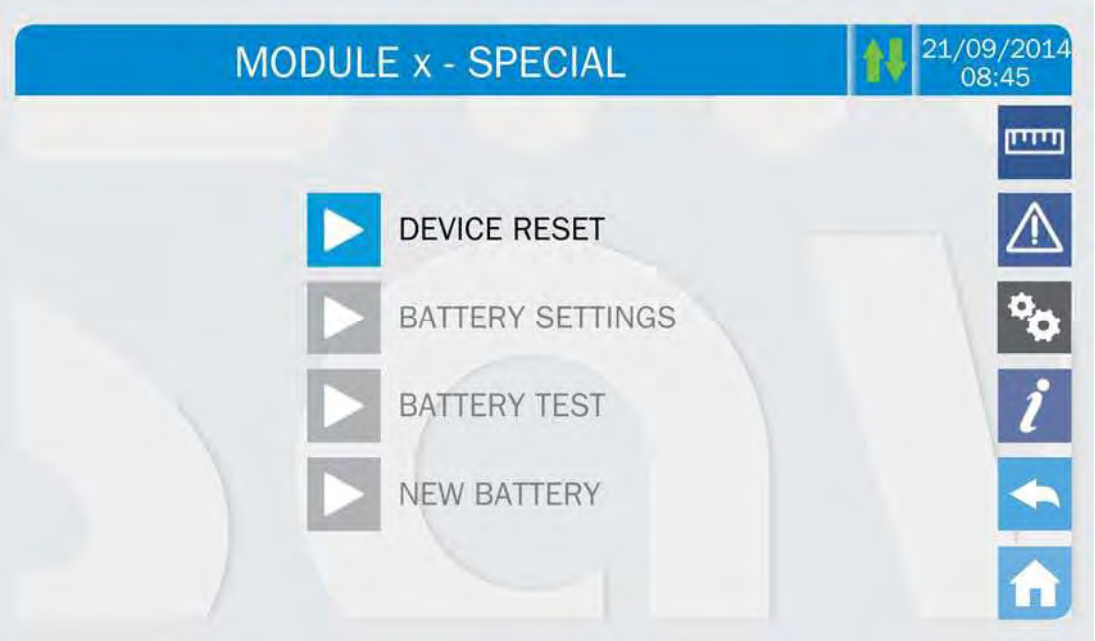
- The statuses are always displayed in ascending order when the ALARMS – STATUS menu is entered.
- The alarms are shown when they are present and must be silenced with the buzzer.
- The alarms remain displayed whilst they are present and they are automatically stored in the event log with date and time.

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.

6.3 SETTINGS AND ADVANCED OPERATIONS

Pressing the *Settings* icon will show the setting section access page, protected by password. The password access page is the same as the one described in the paragraph related to the *Settings* section of the whole UPS.



Picture 54 – SETTINGS section, power module

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.

The settings related to the battey are disabled in case the system is configured with centralized battery (CB).

6.3.1 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* 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 failure conditions which impose a manual reset are:

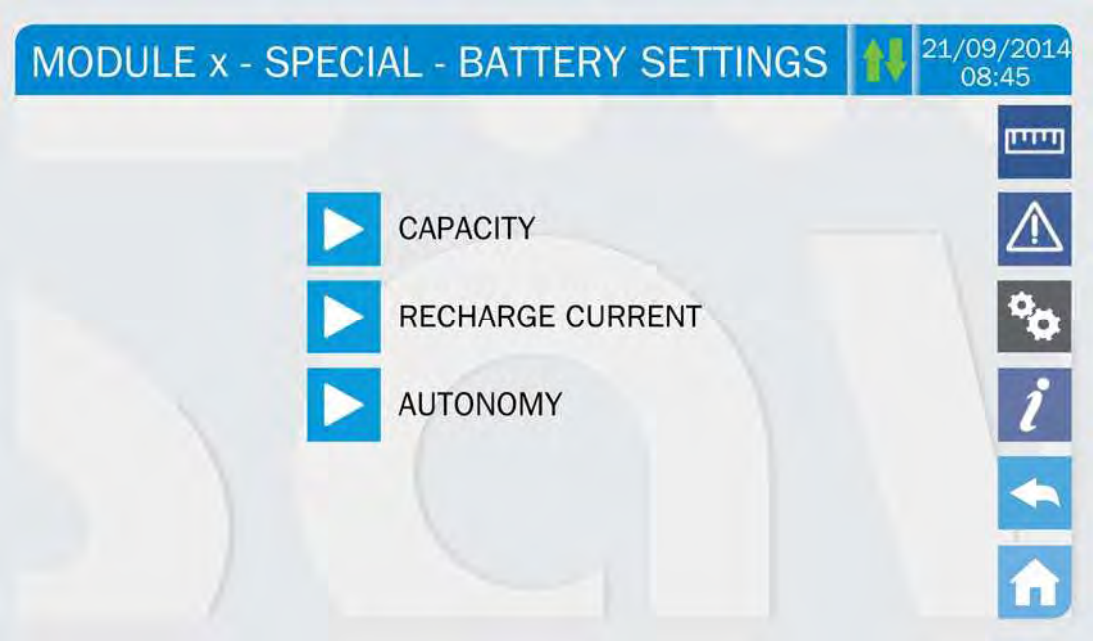
- Activation of the battery fault alarm (alarm A10)
- Inverter shutdown due to short-circuit timeout (alarm A12)
- Inverter shutdown due to thermal image protection (alarm A21)
- Inverter shutdown due to the operation of the quick disconnect sensor (alarm A36)
- Scheduled maintenance request (alarm A29)

- 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)
- Blocco per disconnessione di un cavo parallelo (alarm A50)
- Blocco sistema per errore cablaggio ingresso (alarm A37)

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

6.3.2 Setting the battery

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



Picture 55 – Power module battery parameters setting

The various parameters setting pages are similar to each other and requires the operator to enter and confirm the value.

6.3.3 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.

6.3.4 New battery

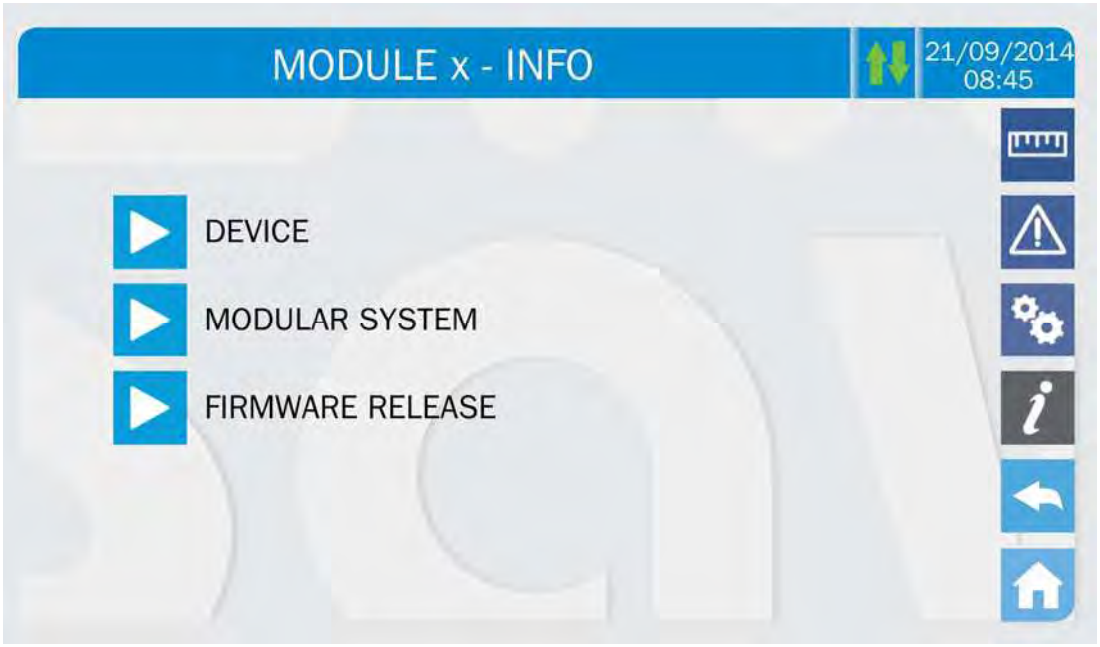
The page *NEW BATTERY* is used in case battery circuit breaker BCB is not closed, when requested, in the start-up phase. In this case the system will start considering the battery completely discharged and activating the alarm “A10 – BATTERY FAULT”.

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 centralized battery configuration such section is disabled and can be found in the *Settings* section of the whole UPS.

6.4 POWER MODULE INFORMATION

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



Picture 56 – INFO section, power module

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.

6.4.1 Device information

The D*EVICE* section provides the following information:

- Power module factory serial number
- Power module OEM serial number
- Power module running hours

6.4.2 Modular system information

The *MODULAR SYSTEM* section provides the following information:

- Index (position) of the module in the *UPSaver* system and total number of modules
- Monitoring of the communication bus with both the control unit and the other modules, including the statistics related to the various CAN channels.

6.4.3 Firmware release

The *FIRMWARE RELEASE* section provides information related to the firmware installed on board the power module control logic.

- Rectifier microcontroller firmware (*DSP1 – RADD*)
- Rectifier microcontroller firmware (*DSP1 – INVERTER*)
- SSW microcontroller firmware (*uC – SSW*)

7 FAULTS AND ALARMS

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

L'icona *Allarmi* diventa rossa e viene attivato il segnalatore acustico (se abilitato). Nella pagina *Stato UPS* vengono visualizzati il codice alfanumerico dell'allarme e una breve descrizione dello stesso.

Normalmente un allarme su un modulo di potenza genera anche un allarme nell'unità di controllo dell'UPS; alcune condizioni invece vengono elaborate in logica "n/N", sulla base della ridondanza di potenza impostata,

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.

As previously mentioned, different diagnostics for the UPS system and the single power module exist. The power module and central unit (I/O module) alarm codes are very similar; the differences are highlighted anyway.

7.1 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	INVERTER BYPASS SYNCHRONIZED
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, active status only in the ECO / VHE / UHE modes.	

Status	S8	INVERTER MASTER GROUPS SYNCHRONIZED
Description	The *UPSaver* system is synchronized with the *UPSaver* MASTER system with which it is in parallel.	
Operating condition	This status is only present on the SLAVE *UPS*aver units, and shows that the inverter is sync with the signal sent by the MASTER *UPSaver*.	

Status	S9	INVERTER MODULES SYNCHRONIZED
Description	The inverter power modules are synchronized to each other.	
Operating condition	The single modules are synchronized with the reference signal sent by the I/O module.	

Status	S10	RECTIFIER STANDBY
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	INVERTER STANDBY
Description	The inverter is in standby mode.	
Operating condition	Active status in *UHE* mode. The inverter is off and ready to be started in case of anomaly of the bypass mains.	

Status	S12	BATTERY 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	BATTERY DISCHARGING
Description	The battery is discharging.	
Operating condition	The battery is connected to the DC bus and feeding current to the inverter.	

Status	S14	BATTERY IN 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	BATTERY IN 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.	

Status	S16	GREEN CONVERSION
Description	The system is operating in *GREEN CONVERSION* mode.	
Operating condition	The battery static switch is open and the system is working at reduced DC voltage (700 Vdc).	

Status	S17	LINE INTERACTIVE
Description	The system is operating in *LINE INTERACTIVE* mode.	
Operating condition	The inverter is in parallel with the bypass line.	

7.2 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 SEQUENCE
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 MODULE OPEN
Description	The battery isolator in the I/O module distribution column is open.	
Possible causes	➢ Module battery isolator open.	
Solutions	1. Check the status of the battery isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. 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 AUTONOMY 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 SHORT CIRCUIT
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	INVERTER OUT OF TOLERANCE
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 WRONG SEQUENCE
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 BLOCKED
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 of a BPU module is open.
Possible causes	➢ BPU Module 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 THERMA 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.
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	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 COMMUNICATION 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 REQUIRED
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 modules acquire the closing signal from the manual bypass isolator.
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. ➢ Output load with DC current component
Solutions	1. Reset the system. 2. Verify the output load. 3. 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	A37 BCBb OPEN
Description	The battery isolator in the external battery cabinet is open (distributed battery)..
Possible causes	➢ External cabinet battery isolator open.
Solutions	1. Check the status of the battery isolator. 2. Check the functionality of the auxiliary contact of the isolator. 3. If the alarm persists, contact our Technical Support Service.

Alarm	A38	INVERTER → LOAD
Description	The load is fed by the inverter. This alarm is active for UPS systems in ECO / VHE / UHE 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	INVERTER 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 inverter static 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	RECTIFIER VOLTAGE 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	A42	BCB IOBM OPEN	→ *Only on IOBM* ←
Description	The battery general isolator (centralized battery) 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	A43	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	A44	MODULE CONFIGURATION ERROR	→ *Only on IOBM* ←
Description	During the startup the control logic detects a communication problem with the power modules..		
Possible causes	➢ Power module wrong configuration. ➢ Wiring error between the I/O module and the power modules		
Solutions	1. Verify the power connections 2. If the alarm persists, contact our Technical Support Service.		

Alarm	A44	FAILED RECEPTION OF IOBM PARAM.	→ *Only on BPU* ←
Description	Internal error.		
Possible causes	➢ Communication error between the I/O module and the power modules.		
Solutions	1. 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	REDUNDANCY LOSS	*→ Only on IOBM ←*
Description	Continuity is not ensured in the event of a fault on one of the power modules.		
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 PARAMETERS ERROR
Description	Internal error.	
Possible causes	➢ Microcontroller communication problems.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A48	FAILED RECEPTION OF IOBM PARAMETERS
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	1 PARALLEL CABLE DISCONNECTED
Description	The systems has detected the disconnection in one point of the parallel bus cable.	
Possible causes	➢ Parallel cable disconnected or damaged.	
Solutions	1. Verify the connection of the bus cables. 2. Reset and re-start the system. 3. If the alarm persists, contact our Technical Support Service.	

Alarm	A51	BATTERY 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	A52	UNDERVOLTAGE LOCKOUT
Description	The inverter is blocked because of an anomaly on the control power supply.	
Possible causes	➢ Internal error	
Solutions	1. 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 / SPI-A ERROR
Description	Internal error.	
Possible causes	➢ Microcontroller communication problems.	
Solutions	1. Contact our Technical Support Service.	

Alarm	**A55** **2 PARALLEL CABLES DISCONNECTED** *→ Only on IOBM ←*
Description	The systems has detected the disconnection in two points of the parallel bus cable.
Possible causes	➢ DIsconnection of the parallel cable in two separate points.
Solutions	1. Verify the connection of the bus cables. 2. If the alarm persists, contact our Technical Support Service.

Alarm	**A56** **MAINS UNBALANCED**
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	**A57** **INPUT CURRENT UNBALANCED** *→ Only on IOBM ←*
Description	The power modules input currents are not balanced.
Possible causes	➢ Possible problems in the module input stage. ➢ Anomaly of the system control.
Solutions	1. Contact our Technical Support Service.

Alarm	**A58** **INVERTER CURRENT UNBALANCED** *→ Only on IOBM ←*
Description	The power modules inverter currents are not balanced.
Possible causes	➢ Possible problems in the module inverter stage. ➢ Anomaly of the system control.
Solutions	1. Contact our Technical Support Service.

Alarm	**A59** **RL BACKFEED ON**
Description	The relay for the external backfeed protection device has activated.
Possible causes	➢ Failure of the bypass static switch. ➢ Anomaly of the system control.
Solutions	1. Contact our Technical Support Service.

Alarm	A60	UHE BLOCKED
Description	*The UHE* mode is blocked.	
Possible causes	➢ Anomaly of the system control.	
Solutions	1. Contact our Technical Support Service.	

Alarm	A61	POWER SUPPLY REDUNDANCY LOST	→ *Only on IOBM* ←
Description	One of the power supply cards is defective.		
Possible causes	➢ Possible problems in the power supply card.		
Solutions	1. Contact our Technical Support Service.		

Alarm	A62	INTERNAL RS485 ERROR	→ *Only on IOBM* ←
Description	Internal error.		
Possible causes	➢ Microcontroller communication problems.		
Solutions	1. Contact our Technical Support Service.		

Alarm	A63	STARTING SEQUENCE BLOCKED
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.	