

# Technical Specification

## **SAFEPOWER MODULAR**



**100-1200 kVA SPM THREE-PHASE/THREE-PHASE**  
**On-Line Double Conversion Technology (VFI)**  
**Modular (50-60kVA)**

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## PURPOSE

These specifications define the technical characteristics of the **Safepower Modular – SPM (50–60k)** series of 3 phase Uninterruptible Power Systems (UPS), a device that supplies clean energy to the connected load, without interruptions, regardless of the conditions of the power supply.

To view the other products available, refer to the website [www.sielups.com](http://www.sielups.com).

## DESCRIPTION OF THE SYSTEM

The **SPM** series is available in 100(50+50)-1200 kVA models with On-Line Double Conversion topology, compliant with VFI-SS-111 classification, in accordance with IEC EN 62040-3, and with expandable modular design.

**SPM** is compliant with the most demanding industrial and Information Technology (IT) installations, thanks to its performance level:

- a) True modular architecture, based on 50 kVA and 60 kVA power modules, with vertical and horizontal expandable scalability;
- b) Plug-in UPS modules and monitoring units with hot-swap capability;
- c) Possibility of configuring the system with internal N+X redundancy;
- d) Possibility of connecting several SPM units in parallel to enhance the capacity/redundancy;
- e) Fully compatible with diesel generator and network
  - low input current distortion up to 2.5% and power factor > 0.99;
  - *Power walk-in* and sequential start-up of modules to reduce the need for generator oversizing and ensure the compatibility with any power supply, even with limited power installed.
- f) Accurate Battery Care
  - adjustable for batteries with 30 / 32 / 34 / 36 / 38 / 40 / 42 / 44 / 46 / 48 / 50 x 12V monoblocs per string;
  - two voltage level recharge according to the IU characteristic, as an alternative;
  - temperature compensated battery recharge;
  - suitable to charge extended back-up battery sets;
  - immediate detection of battery disconnection;
  - Battery test function to detect potential battery deterioration
  - Configurable to operate with lithium batteries.
- g) Unity nominal output power factor (PF=1), with possibility to power distorted, step, inductive and capacitive loads and to deliver the necessary active power (kW) for the load with a proper configuration of the number of modules;
- h) Latest generation technological high-performance project and component solutions, based on a transformer-free architecture and the IGBT 3-Level technology and that guarantees an overall efficiency OVER 96% (On-Line Double Conversion Mode) and >99% for the ECO-MODE operation, with possibility of setting the most suitable mode for the load;

- i) Automatic high-efficiency parallel module system which places the excess modules in "SLEEP MODE", allowing a maximum performance operation;
- j) Backfeed Protection;
- k) Flexible structure, which allows:
  - Wide choice of external battery solutions, even for extended run time
  - Easy separation of the emergency bypass input supply from the rectifier power input supply (dual input)
  - Wide choice of communication options
  - Possibility of electrical isolation through the optional transformer.

The **Safepower Modular – SPM** series, with a compact architecture based on high-density technology, where the height of the single modules is 3U and where they are arranged in a rack, as specified, includes the following models:

MODEL	DESCRIPTION
<b>SPM 150 kVA</b>	150 kVA cabinet: can house up to 3 modules
<b>SPM 300 kVA</b>	300 kVA cabinet: can house up to 6 modules
<b>SPM 400 kVA</b>	400 kVA cabinet: can house up to 8 modules
<b>SPM 500 kVA</b>	500 kVA cabinet: can house up to 10 modules
<b>SPM 600 kVA</b>	600 kVA cabinet: can house up to 10 modules
<b>SPM 800 kVA</b>	800 kVA cabinet: can house up to 16 modules
<b>SPM 1000 kVA</b>	1000 kVA cabinet: can house up to 20 modules
<b>SPM 1200 kVA</b>	1200 kVA cabinet: can house up to 20 modules

## REFERENCE STANDARDS

The company's Integrated Quality Management System is certified according to:  
 ISO 9001/2015 Standard, covering all company functions, from design and manufacture to sales and services;  
 EN ISO 14001: 20015 Standard, Environmental management systems;  
 ISO 45001:2018 Standard, Occupational health and safety management systems.

This certification gives a greater reliability to the client, for the following reasons:

- use of high quality materials;
- strictness during production and testing phases;
- constant support to the client.

Apart from the company's certification, the product is classified as VFI-SS-111, pursuant to Standard EN 62040-3, and complies to the following UPS Standards:

- **IEC EN62040-1**: Uninterruptible power systems (UPS): General and safety requirements;

- **IEC EN 62040-2:** Electromagnetic compatibility requirements (EMC), C3 category;
- **IEC EN 62040-3:** Method of specifying the performance and test requirements;

The **SPM** range complies also to the following general standards, where applicable and indicated in the previous standards:

- **RoHS EN 50581:2012:** Assessment of electrical and electronic products with respect to the restriction of hazardous substances;
- **IEC 60529:** Degrees of protection provided by enclosures;
- **IEC 60664:** Insulation for equipment within low-voltage systems;
- **IEC 60755:** General requirements for residual current operated protective devices;
- **IEC 60950:** General requirements for Information Technology Equipment;
- **IEC 61000-2-2:** Electromagnetic compatibility immunity standards;
- **IEC 61000-4-2:** Electrostatic discharges immunity test;
- **IEC 61000-4-3:** Radio frequency, magnetic field Immunity test;
- **IEC 61000-4-4:** Transient overvoltage immunity test;
- **IEC 61000-4-5:** Overvoltage immunity test;
- **IEC 61000-4-11:** Voltage dips, short interruptions and voltage variations immunity test.
- **IEC 61000-3-12:** Limits for harmonic current emissions (equipment input current  $> 16\text{ A} \leq 75$ )

#### European Directives and CE marking:

##### LV 2014/35/EU

Low Voltage Directive: regulates the safety risks of the equipment and imposes the **CE marking** obligation since January 1st 1997.

##### EMC 2014/30/EU

Electromagnetic Compatibility Directive: regulates the UPS immunity and emissions in its installation environment and imposes the **CE marking** obligation since January 1st 1996.

##### 2011/65/UE

Directive on the restriction of the use of certain hazardous substances in AEE

## APPLICATIONS

The **Safepower Modular – SPM** series of UPS are compatible for a wide variety of applications where protection of the critical load is required, from simple installations to the most demanding ones, with higher reliability and low maintenance requirements.

**LAN, Server and Data Center:** the 0.9 output power factor allows a higher active power availability for the powered units, guaranteeing several sizing options for the UPS in relation to the load to be powered.

**e-business and Telecommunications:** the continuity system can be expanded along with the company business, thanks to the possibility of adding up to four units in parallel, without compromising the initial investment.

**Industrial Processes and Medical Systems:** the uninterruptible power supply is perfectly suitable to ensure the quality of the supply for any type of load, from industrial processes to medical applications. This is possible thanks to the carefully designed technical features, which guarantee the following properties:

- Optimum technical input features, with zero impact on the power supply source
- high short-circuit and overload capacity
- high battery recharge capacity with the option to use a variety of battery types (sealed valve regulated and open-vented) even for long back-up times.

**Emergency Systems:** the UPS can be set-up according to the Standard EN 50171 (Centralized Supply Systems), by selecting the correct battery type, back-up and recharge times.

## ARCHITECTURE AND CONFIGURATIONS

**True Modular Design. Safepower Modular SPM** is based on true modular architecture. Each 50 or 60 kVA UPS module is housed in a single 19" plug-and-play drawer with hot-swap capability, each module contains all the associated hardware and software necessary for the full operation of the system. The modules do not share any component: each module is virtually a complete UPS, including individual diagnostics with related display. Single points of failure are thus eliminated (de-centralised architecture). In the event a module needs to be replaced, it can be hot-swapped without affecting the operation of the other active modules, with a temporary power reduction of maximum 50 or 60 kVA.

This allows a Mean Time to Repair (MTTR) of practically zero for the maintenance (no downtime and no transfer to the emergency by-pass).

The self-diagnostic features installed on each module facilitate the rapid identification of any failed module and of the specific fault.

**N+X Multiple Redundancy.** The UPS of this series, comprising several modules in parallel with N+X redundancy within the UPS, allows to choose different levels of redundancy depending on the load priority, in order to enhance the availability and the reliability of the power supplied to the load. Through the settings on the LCD display, you are able to set the quantity of redundant modules. When the load connected is too high compared to the redundancy level set, the UPS will immediately initiate a redundancy loss alarm. All active modules operate simultaneously equally sharing the connected load.

The UPS can operate with faulty modules, up to a maximum of X, corresponding to a maximum load power of

$$P_{out} = P_{nom} \frac{(N - X)}{N}$$

$P_{nom}$  is the UPS rated power

$P_{out}$  is the maximum power supplies to the load with X faulty modules

$N$  is the number of modules installed on the UPS

$X$  is the maximum number of faulty modules which are allowed, which corresponds to the set redundancy level.

All the UPS modules within a unit share the same *common battery*: the deactivation of one or more modules does not result in a reduction of the run time in battery mode (mains failure).

**Scalability (Hot Expansion).** Since the operating modularity coincides with the assembly modularity (each module is virtually a complete UPS by itself), it's easy to add power: the 3U-high plug-n-power drawers can be *hot-swapped* allowing a vast *vertical expansion* (by populating the cabinet vertically) and *horizontal expansion* (by populating several columns). In order to do this, it is not necessary to implement changes to the structure or to use any special tools: the UPS continues to supply the load without changing its status. A further expansion can be achieved by placing several units (cabinets) in parallel, as shown below.

**Sleep mode:** is a function which can be activated from the front user panel, that allows a high-efficient system operation by placing the excess modules in "SLEEP MODE ", allowing the remaining active modules to operate at the maximum efficiency point.

- The active modules are placed in sleeping mode when the load connected is lower than 30% of the rated power; this operation is executed when the condition endures for at least one hour, to avoid status variations due to excessive load fluctuations;
- The modules involved are placed in sleep mode one at a time, at one minute intervals, and remain in stand-by mode without powering the load;
- When the load powered by the remaining active modules increases above 70% of the rated power, the modules in sleep mode are immediately reactivated to power the load;
- Each month, every module in sleeping mode are alternated with an active one, facilitating a rotation in module use;

The available configurations are the following:

### **Single UPS**

The UPS can be installed as a single modular unit, with a minimum number of two power modules and up to a maximum number of modules depending on the system frame capability, keeping in mind also the internal redundancy level required (N+X). The models described above indicate how many modules can be added in the cabinet, according to the system design.

The unit can be configured with a common input for both the rectifier input and by-pass input, or with two *separate inputs*, one for the rectifier and the other for the emergency by-pass (through the removal of the provided internal power links).

A further expansion can be obtained by placing a maximum of 4 units in parallel, to meet the load power increase requirements or to introduce an additional redundancy level, as indicated below.

### **Parallel Configuration**

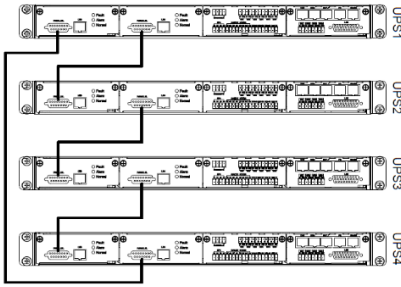
The UPS units can be connected in parallel, up to a maximum of 4 units, to increase the system's power (capacity parallel) or to increase its reliability (redundancy parallel).

The system is defined as "redundant parallel" when the interruption of one or more UPS does not affect the load protection.

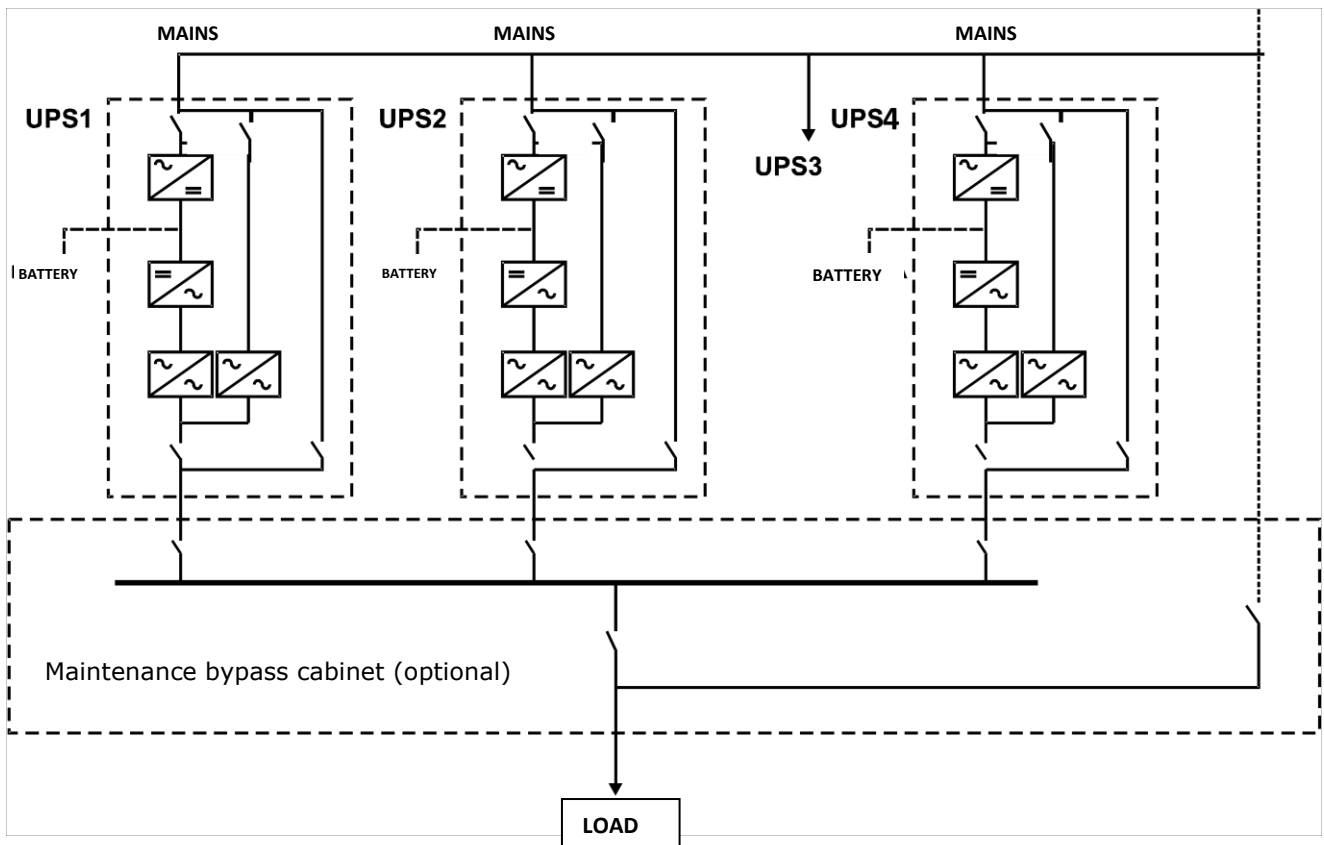
All the UPS power the connected load simultaneously, with automatic current sharing.

The units share information on the operational status and the sync signals through the connections in a loop with dual redundancy. These are connected through double-insulation shielded control cables, as shown below, with the parallel control boards, installed on each UPS (on board the control unit), visible. The connection loop guarantees a highly reliable control configuration, even in the event of accidental interruption of both the connections, only the UPS subject to such interruption is automatically excluded, while the others continue to function without any perturbation.





Thanks to the **"Hot Expansion"**, it is possible to expand the system with the addition of a further UPS System (up to a max of 4), while the remaining units are still on-line and powering the load from the inverter. The additional UPS will automatically configure itself with the other units, without affecting the load in any way.



Each parallel UPS unit can be configured with its own battery (see table above) or, as an alternative, with a **common battery**.

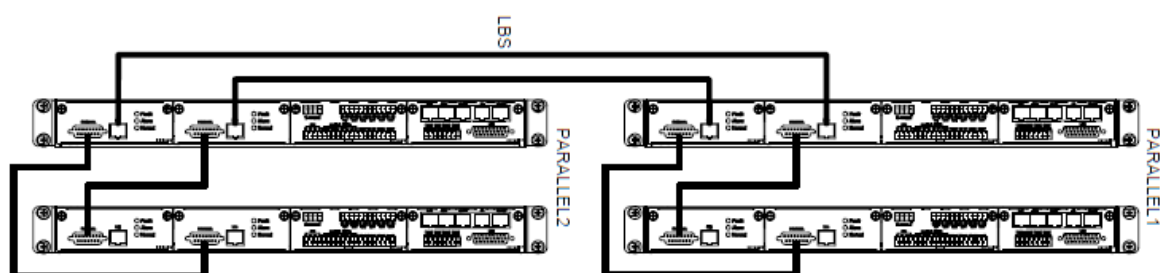
#### **DLBS (Dual Load Bus Synchronization)**

The bus synchronization function is used to maintain the outputs of two independent UPS systems (single units or parallel systems of multiple units) in sync even when the two systems are not equipped with a common power supply source (i.e., in case of battery operation).

This function is usually employed to power the two inputs of Static Transfer Switches (STS), in order to power the "dual bus" critical loads, ensuring sync switching between the two sources in zero time.

**Safepower Modular SPM** does not require any additional hardware to operate in DLBS mode: the UPS units are equipped with signal cables to ensure a correct operation.





## UPS DESCRIPTION

### 6.1 Operating principles

The uninterruptible power supply can be set based on three main operating modes: ON-LINE, Smart Energy Saving - ECO MODE or Frequency converter, in their different variants, as described below.

#### Mode: ON-LINE

**Normal Operation:** the PCF rectifier, drawing power from the mains power supply, supports the Inverter and charges the batteries; the load is powered by the Inverter which provides a clean and secure supply, synchronised to the bypass supply. In this way, a **double conversion** is achieved, with the maximum separation between the UPS input voltage and output voltage.

**Battery Operation:** when the mains power supply exceeds the pre-set limits, the rectifier is shut down and the Inverter is powered by the battery for the remaining back-up time, without disruption to the load. When the mains power supply is reactivated, the rectifier gradually starts working again, charging the batteries and powering the Inverter.

**Automatic By-Pass Operation:** if an Inverter overload exceeds permitted limits (or is manually shut down), the load automatically transfers to the emergency bypass via the static switch and without disruption to the load.

#### Mode: Smart Energy Saving – ECO MODE

**Normal Operation:** The load is normally powered from the mains power supply (direct power supply) through the power interfaces, while the rectifier charges the batteries. When the mains power supply exits the restricted voltage and frequency ranges, the system switches automatically to the **double conversion mode**, with the load powered by the Inverter.

**Battery Operation:** When the mains power supply exits the voltage and frequency ranges allowed by the rectifier, the unit switches to the battery-operated mode.

When the mains power supply is suitable again, the system switches to the direct power supply. The decision is made based on statistical calculations performed based on the quality of the mains power supply: if it remains suitable for a certain period, the unit selects ECO mode, otherwise it remains in double conversion mode.

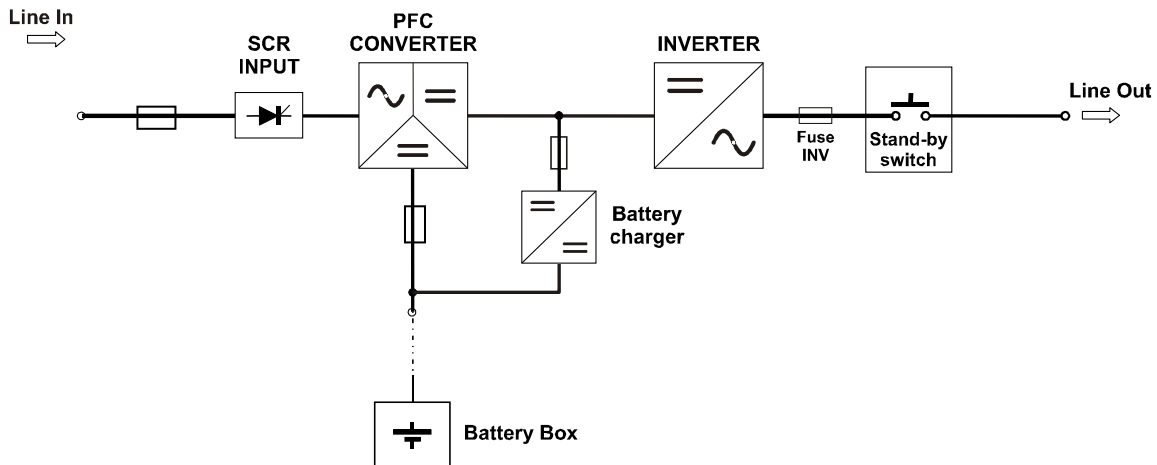
*Note:* for maintenance needs, under each of the modes described above, it's possible to switch manually to the **maintenance by-pass** mode. The load will be powered by input mains power supply through the maintenance section (internal or external to the UPS cabinet), as described below.

#### Mode: FREQUENCY CONVERTER

The UPS can be configured as a frequency converter (through front panel) with input frequency at 50Hz and output frequency at 60Hz and vice versa (the automatic by-pass is deactivated in this mode). The "frequency converter" configuration can be operated with or without batteries.

## 6.2 Power module: operation

50-60 kVA UPS power module block diagram is as follows:



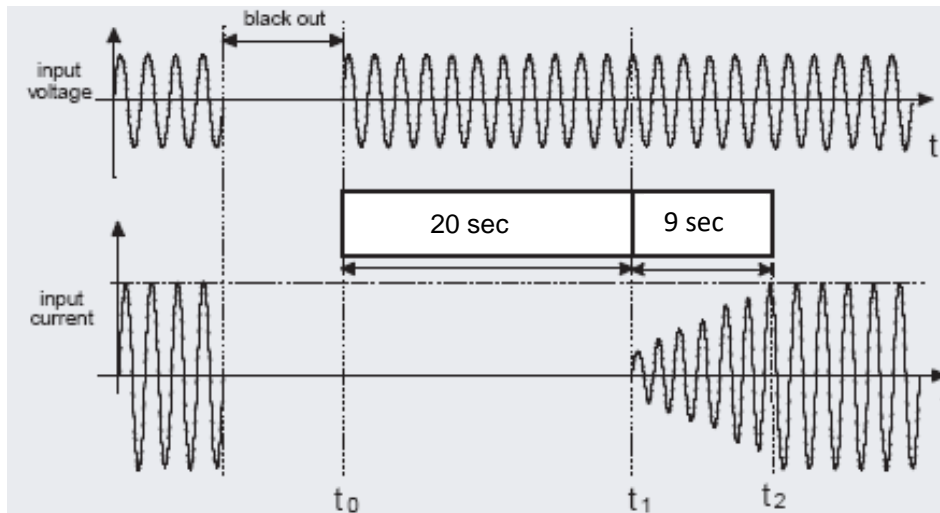
It comprises the following operational blocks:

- PFC converter (rectifier) and booster
- Battery charger
- Inverter

### 6.2.1 PFC Converter (rectifier) and booster

The PFC Converter converts the AC voltage into a DC supply to power the Inverter; if the mains or alternative power supply fails, the Converter will raise the battery voltage (booster) to a value suitable to power the Inverter. The PFC control technology, using Digital Signal Processing (DSP) microprocessors and IGBT power semiconductors, achieves a low impact on the power supply source, low harmonic distortion and high input power factor. The converter/rectifier achieves a zero impact on the supply source thanks to the following characteristics:

- **Input Harmonics:** rating of upstream generators and transformers (including distribution) can be reduced due to the negligible input harmonic distortion of 2.5% and high input power factor > 0.99;
- **Progressive rectifier start-up (Walk-in):** when the mains power supply returns, power absorption from the mains power supply progressively reaches the rated value (walk-in) within approximately 9 seconds, after an initial hold-off of about 20 seconds. The start-up of the single power modules within the unit occurs in succession, with the start-up of a module each second.



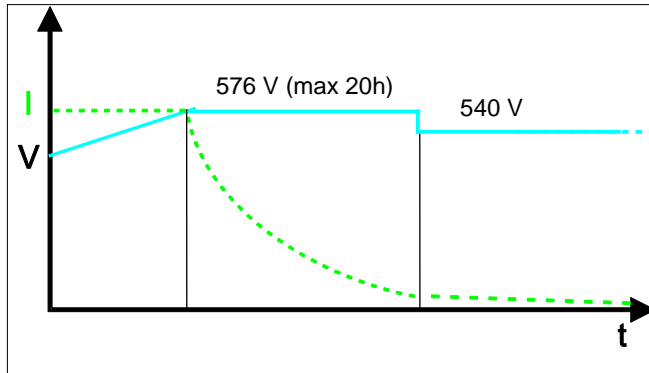
The **booster** maintains the bus voltage stable within the modules, regardless of the battery voltage variations. On the other hand, the bus voltage variations due to rapid dynamic changes of the load do not affect the battery voltage directly.

## 6.2.2 Battery Charger (Accurate Battery Care)

"Accurate Battery Care" is a set of functions designed to help extend the working life the battery set and optimise its performance.

- Battery Rated Voltage:** The SPM can be used with a different number of sealed lead batteries (2Vpc) per string, depending on the back-up needs desired:  $\pm 180 \text{ V}^* / \pm 192 \text{ V}^* / \pm 204 \text{ V}^* / \pm 216 \text{ V} / \pm 228 \text{ V} / \pm 240 / \pm 252 \text{ V} / \pm 264 / \pm 276 \text{ V} / \pm 288 / \pm 300 \text{ Vdc}$  (equal to 30 \* / 32 \* / 34 \* / 36 / 38 / 40 / 42 / 44 / 46 / 48 / 50 12V monoblocs); in case of faulty monobloc, the battery voltage can be temporary reduced until the monobloc is replaces, without interruptions to the line. NOTE (\*): with active power derating (30: output PF = 0.8; 32 and 34 output PF = 0.9)
- Battery recharging:** the SPM can be used with sealed lead batteries (VRLA), and, after proper forming charge, even with open-vented and NiCd batteries. After appropriate settings, lithium batteries complete with BMS management can also be used. Dependant to the type of battery used, several recharge methods are available:

Recharging modes	SPM Configurations
	<p><b>One-level recharge:</b> the charge state of the battery is continuously monitored; when the mains power supply is present, the batteries are charged at a preset constant current (if the discharge has been deep) and then the batteries are kept at a preset voltage level (floating).</p> <p>The constant current is adjustable and is generally set at <math>0.1C_{10}</math> up to a maximum of 20A of recharge for each UPS module.</p> <p>The floating voltage has a range of 2.20-2.29 Vpc (<math>2.25 \times 6 \times 40^* = 540 \text{ V}</math>).</p> <p>Note (*): example with 40 monoblocs 12V</p>



**Two-level recharge:** this recharge is at limited current with two levels of voltage. After an initial constant current phase (if the discharge has been deep), a fast recharge voltage phase begins (boost), followed by a floating recharge phase. This type of charging is mainly used with open-vented batteries or other types when an accelerated recharge time is required. The boost voltage is comprised between 2.30-2.4 Vpc ( $2.4 \times 6 \times 40^* = 576V$ ).  
Note (\*): example with 40 monoblocs 12V  
The boost voltage phase starts as soon as the voltage raises to such level, at the end of the constant current phase, and lasts for the set time (up to 20 hours). The constant current level and the floating voltage level are indicated above.

It is possible to set the type of battery installed and the different recharge modes from the front touchscreen panel.

- c) It is possible to install an external **temperature sensor** which activates the temperature compensated recharge as a function of the battery temperature  $0.003V$  ( $0.001 \div 0.007V / \text{cell} / 1^\circ C$ ).
- d) **Connected battery:** the UPS detects whether the battery is connected or not. If the battery is not properly connected to the correct terminals on the UPS (i.e. reversed polarity), the UPS issues a warning and protects itself from any possible damage. The UPS must always operate with the batteries properly connected; if the same are missing, a warning is issued and the role of the UPS is affected.
- e) **Battery Test:** a battery operation test can be set and activated.  
Manual test: its duration can be set at 10 seconds, 10 minutes or complete discharge.  
Periodic automatic test: once a month, at 20% of battery capacity.  
If the test returns a negative result a warning is displayed on the UPS panel and remotely, if installed.
- f) **Protection against deep discharges:** in case of extended discharges until the limit of battery capacity, the battery is protected by stopping the discharge to an adjustable voltage level (1.6-1.9Vpc) as recommended by the battery manufacturers to avoid damages to the batteries. The end of discharge is preceded by a pre-warning (louder than the battery discharge warning) which activates at end-of-discharge+0.15Vpc.
- g) **Ripple current:** recharge ripple current (residual AC component) is one of the most important causes of poor battery reliability and reduced operating life. the SPM, thanks to its high-frequency battery charger, decreases this value to a negligible level, increasing the battery life and maintaining a high level of performance for a long time.
- h) **Cold Start:** This feature allows the Inverter to be switched on and the load to be powered by the battery, when the mains power supply is not present. It can be activated by manually pushing ON the button on the front.

### 6.2.3 Inverter

The DC/AC Converter (Inverter) converts the direct current into a stabilised sinusoidal alternating current to power the load. When the UPS is in ON-LINE mode, the load is always powered by the Inverter.

This Inverter is an IGBT (*Isolated Gate Bipolar Transistor*) based three-phase structure; the IGBT is a transistor that allows high switching frequencies ( $> 18\text{kHz}$ ) and, as a result, the Inverter provides a high quality output voltage, with low noise levels and high operating efficiency. In addition, the DSP microprocessor controls, guarantee static and dynamic performance and a high-quality output waveform, under any operating condition. The converter architecture is of the 3-level IGBT type, which provides maximum efficiency.

#### Voltage Adjustment

The output voltage can be adjusted using the independent phase control and DSP microprocessor; this enables a better static and dynamic response. In detail:

- a) **static condition:** the inverter output voltage remains within  $\pm 1\%$  for all variations of the input voltage within the accepted limits;
- b) **dynamic condition:** for load variations from 0 to 100%, the output voltage remains within  $\pm 5\%$ , (within the values defined by class 1 of the EN 62040-3 standard).

#### Frequency Adjustment

The Inverter output frequency is independently generated by an internal oscillator, in synchronisation with the bypass supply. Frequency stability depends on operating conditions:

- a) **Frequency Stability**
  - a. With mains power present: the internal oscillator follows any frequency variations in the bypass supply, depending on the preset value, which is generally equal to  $\pm 1\%$  /  $\pm 2\%$  /  $\pm 4\%$  /  $\pm 5\%$  /  $\pm 10\%$  (adjustable).
  - b. With no mains power present: the inverter generates the frequency of the output voltage with a stability of  $\pm 0.1\text{Hz}$ .
- b) **Slew Rate**

The maximum Inverter output frequency variation (slew rate) to lock to that of the bypass supply is set to 1 Hz/s.

#### Distortion of the output voltage

The Inverter adjustment guarantees a distortion of the output voltage with a linear load within 2%. With a non-linear load, as defined by the EN 62040-3 standard, output voltage distortion does not exceed 5%.

#### Overload

The inverter is sized to provide a power overload for a limited length of time (see the limits indicated in the "**Technical Specification table**")

When the time period or power limits are exceeded, the load is transferred to the bypass supply.

## Short circuit capacity

If a short circuit occurs, the Inverter will carefully analyse the output voltage and current.

- the Inverter can supply a limited current for 200ms in case of both single phase L-N s.c. and phase-phase L-L s.c. (values indicated in “**Technical Specification table**”).
- When the mains power supply is present, after the above mentioned time the Inverter will switch to the automatic bypass.

The table below recommends the sizing of the various protection devices located downstream of the UPS in order to guarantee their selectivity even in the event of a power failure

Output protections (values recommended for selectivity)	
rapid fuses (GI)	$I_n \text{ (Nominal current)}/7$
regular switches	$I_n \text{ (Nominal current)}/7$
ultra-rapid fuses	$I_n \text{ (Nominal current)}/2$

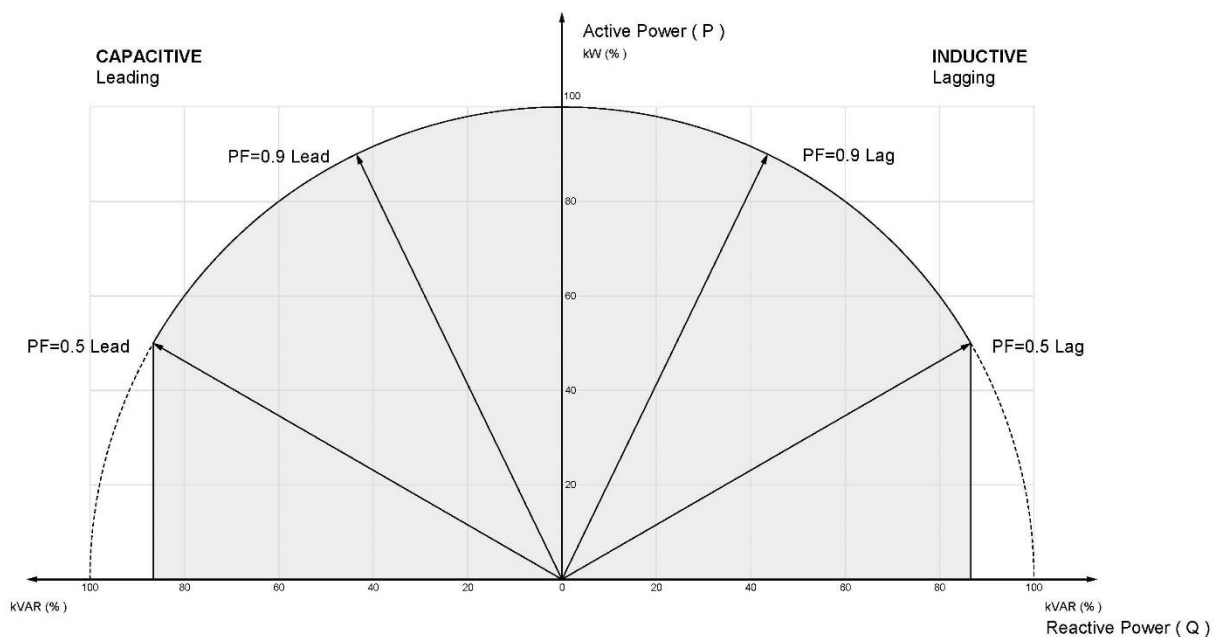
## Output voltage symmetry

Under all conditions, output voltage symmetry is maintained within  $\pm 1\%$  for balanced loads and  $\pm 2\%$  for 100% unbalanced loads (e.g. one phase with nominal load, the other two with no load).

## Phase shift angle

The three-phase Inverter output voltages have a guaranteed phase shift angle of  $120^\circ \pm 1^\circ$  for balanced loads and 100% unbalanced loads.

### Performance of 3-phase Inverter with reactive loads



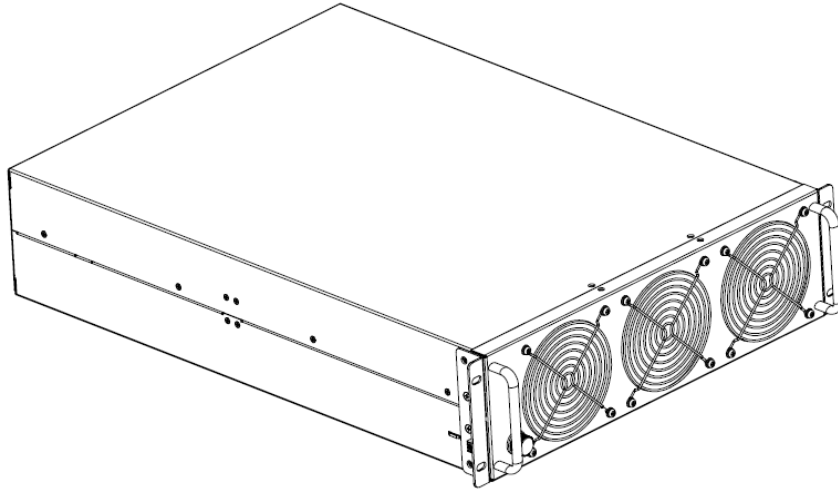


## 6.3 Power module: structure

Each UPS power module is contained in a 19" rack drawer.

It weighs 34 kg.

The module has a height of 3U, with dimensions 440x620x130 mm.



The module can be easily hot swapped (inserted or extracted) through plug-in connectors located on the back. The ventilation features variable speed fans which vary depending on the load and on the internal temperature of the components.

Each module is equipped with LEDs with basic status and alarms. The description of status, alarms and measures of each individual module can be seen on the equipment display.

The control pushbuttons include the ON key, also switching on from the battery, and the OFF key.

There are two displayed temperature monitoring points: module internal temperature and air inlet temperature to the module inlet.

## 6.4 Static switch module (Automatic Bypass)

A static switch is an electronic device that can automatically transfer the load to the bypass supply without any disruption under the following conditions:

- a) manual shut down of the Inverter;
- b) Inverter overload and short circuit limits are exceeded;
- c) internal over temperature limits are exceeded;
- d) the Inverter has an fault;
- e) DC voltage outside of the permitted range.

If at the time of switchover, the inverter voltage is not synchronised with bypass voltage, the transfer will take place with a delay of around 20ms; in consideration of the various types of loads, this delay can be set at 10ms or the switchover can be inhibited if there is no synchronism.

The static switch is made inside a specific hot-swappable drawer similar to that of the power modules.

### **Bypass supply voltage**

Transfer to the bypass supply only takes place if the voltage and the frequency are considered 'suitable' for the load. The limits for transfer can be set on-site by the user, depending on the load connected:

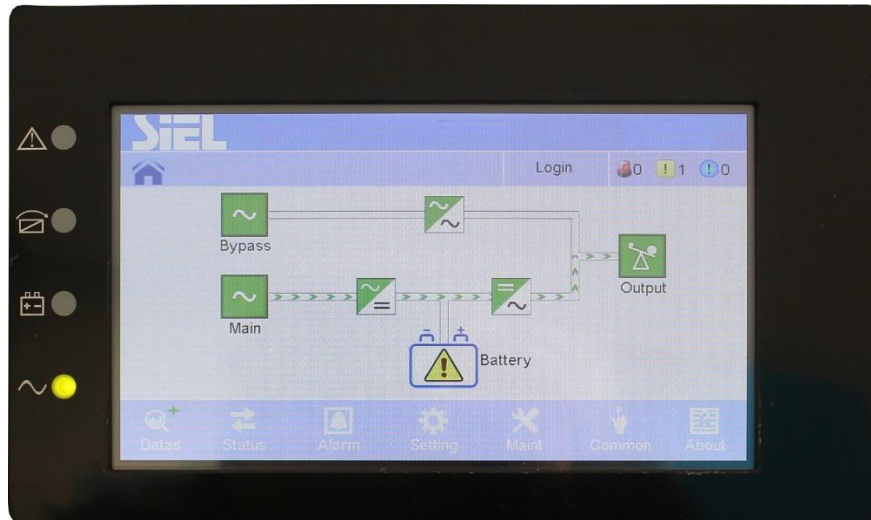
- Voltage range:  $\pm 10\%$  (settable from -10, -20, -30, -45% to +10, +15, +20%);
- Frequency range:  $\pm 10\%$  (settable as +1, 2, 3, 4, 5 %).

## **Overload**

The UPS static switch is sized to support the overload as per the following Technical Specification table.

## CONTROL PANEL

The general control panel, located in front of the main UPS cabinet, comprises a colour LCD touchscreen display and four LEDs.



- ① LCD touchscreen: monitoring of all the parameters measured, UPS and battery status, events, with mimic and alarms log, setting
- ② LEDs showing basic status and alarms

the LEDs shows respectively (from the top): alarm (red), load on bypass (yellow), battery mode (yellow), load on inverter (green).

Three temperature monitoring points are shown: internal temperature, air inlet temperature and battery temperature.

Messages are available in several languages selectable via display menu.

The control panel is made up of a colour wide touchscreen display providing a detailed real-time overview of the UPS operational status, starting from a mimic with block diagram. From the control panel the user can switch the UPS on/off, read electrical measurements - mains, output, battery, etc, monitor the status of each power module and set the main operational parameters.

The display has several screens, each one with a specific function.

### 1 GENERAL INFORMATION

A screen permanently showing the date and time and, according to the level of display, either the machine model or the title of the menu active at that time.

A colour animated *mimic* display represents the energy flow, the machine status, and the active, inactive or alarm status of components in real-time.

### 2 DATA DISPLAY/NAVIGATION MENU

The main screen of the display shows key UPS measurements (constantly updated in real-time), related to input, output and battery. The user can also select and view various menus using the appropriate touch icons. After selecting the required menu, this part of the display shows one or more pages containing all the data relevant to that menu.

### **3 UPS STATUS, ALARMS – FAILURES, CONTROLS**

A screen in which the UPS and single modules' operating status is constantly shown, also in a graphic form; it also shows any possible UPS warning/failure and the type of error/failure detected. It is also used to activate several functions, such as the battery test.

### **4 DATA LOG**

A menu screen provides access to all events recorded in chronological sequence, due to inadequate plant and environment conditions (supply voltage out of range, high temperature, overload, etc.) or internal failures.

The log records events in FIFO (First In First Out) mode and the string contains the following information: Event Code, Event Description, Date and Time.

Data is displayed through the graphical display.

The *data log* is downloadable through USB port on memory device.

### **5 VERSION AND SET-UP**

In addition to showing the UPS Firmware versions, several other menus allow access to set several measurements (i.e. battery data, bypass voltage acceptance range).

When an alarm appears, an audible warning will sound.

### **Measurements**

- Input voltage, current, power factor and frequency
- By-pass voltage, current and frequency
- Output voltage, current and frequency
- Output power (kVA, kW per phase and total) % load
- Output peak current
- Battery voltage
- Battery current (charge/discharge)
- Cabinet internal temperature
- External battery temperature (via optional probe located at the battery)
- Battery status and back-up time
- Output voltage, current and frequency and bus voltage for each module.

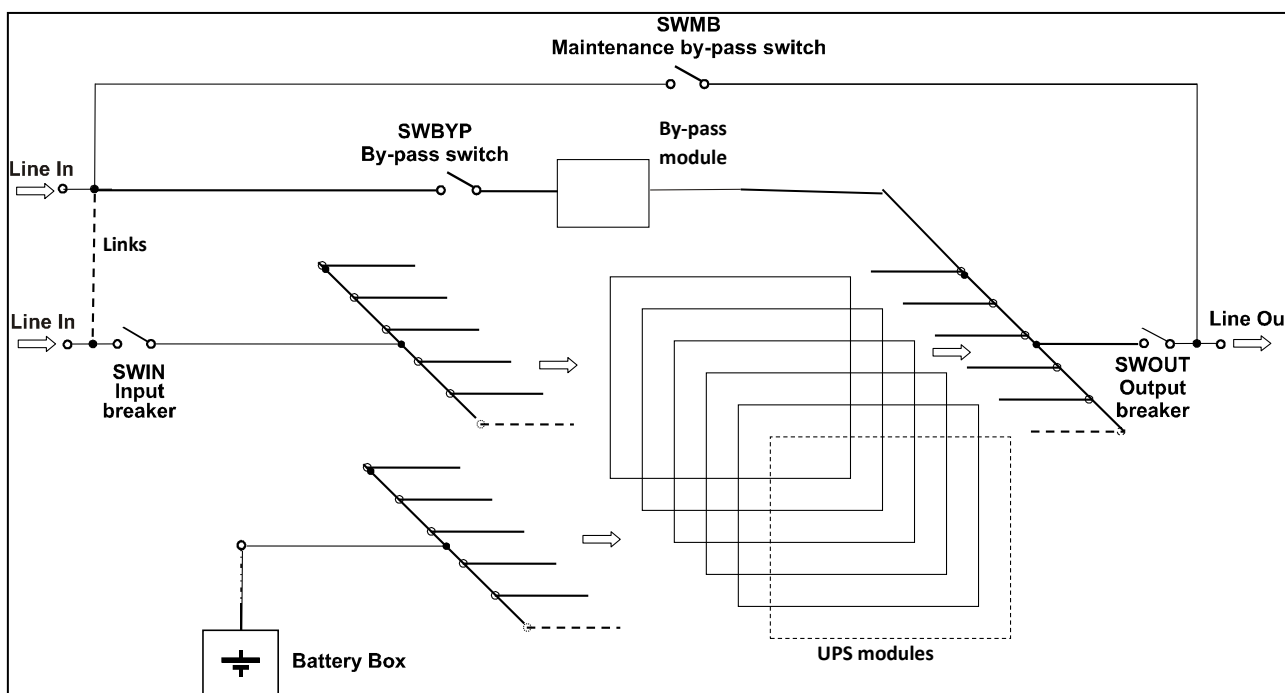
## UPS CABINET AND ISOLATING SWITCHES

The **Safepower Modular – SPM** UPS is housed in 19" rack cabinets with slots housing the power modules, arranged in one or more columns.

The cabinet is made of galvanized steel with IP20 protection, even with the open front door. The *forced ventilation* is located on-board of the single power modules: the air inlet is located in the front and the outlet on the back. The ventilation grids on the front doors are equipped with **anti-dust filters**.

Components with high heat dissipation, e.g. the power modules, are individually monitored by **double temperature sensors**.

The single line diagram highlights the main components.



The UPS is equipped with the following isolating switches located at front and/or rear of the cabinet and accessible opening the door:

- ① **SWMB**  
Manual bypass switch
- ② **SWOUT**  
Output switch (available on full version)
- ③ **SWIN**  
Input switch (available on full version)
- ④ **SWBYP**  
Bypass switch (available on full version)

In the 'standard' version, the switches 2), 3), 4) (output, input and bypass) are not present onboard the UPS cabinet: those of the electrical connection panel are used. The "full" version includes switches 2), 3), 4) onboard the UPS cabinet as well.

The power supply to and from these switches, as well as the DC power supply from the terminals of the (external) battery, is then internally distributed to the single power modules.

Main **terminations** are provided for the mains input, load and battery:

Rectifier input L1, L2, L3, N;

Output L1, L2, L3, N;

Positive, neutral, negative battery terminal;

Bypass input L1, L2, L3, N;

Ground terminal.

The input terminals can be arranged for a **single or dual input**: if the supply source is common, internal links are provided, if the rectifier input and bypass input are separate, the links are removed.

**Maintenance bypass** operation, by activating the related isolating switch: it is only possible to effect this operation after removal of the *protective cover*. By removing this cover, auxiliary contact forces the load to transfer to the static bypass line, if this has not already been executed manually. This prevents an erroneous operation with consequent direct connection of the power supply generated by the inverters to the mains upstream.

The input terminals are equipped with **surge protectors** for protection against potentially dangerous voltage surges. These are type 2 protectors, tested for Class II according to IEC EN 61643-11 (In 20 kA, I<sub>max</sub> 40 kA). They are plug-in modules which can be replaced in case of tripping.

For user interface purposes (communication ports, monitoring and control touchscreen display), the UPS is equipped with a **"Control Unit"**, made up of a **"Monitoring Unit"**, of a **"Dry contact Unit"** and of two parallel/synchronism units, which collects all the information, sends the commands to and from the power module communication bus, manages the output/user communication ports as described below.

The Monitoring Unit powers and communicates with the touchscreen **General control panel** located on the front door and previously described.

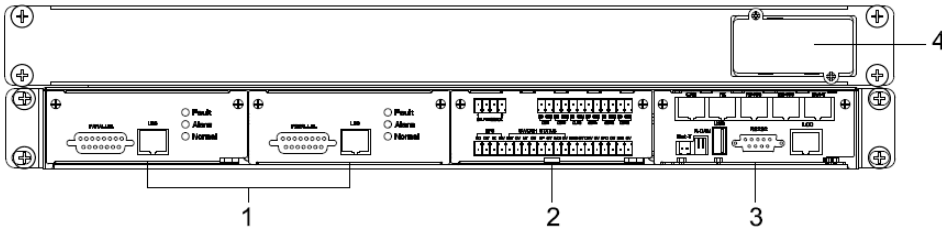
The two parallel/synchronism units allow communication with other UPS cabinets in order to create systems in parallel and/or synchronized as previously described.

The system is equipped with **"Backfeed Protection"**. In order to avoid any possible electric shock at the input terminals due to a failure of the electronic static switch, the internal device is capable of detecting such failure and generating a command to ensure that the faulty line is adequately disconnected, in accordance with Standard IEC/EN 62040-1. The command to an external device is made available through relay contact, both N.O. and N.C.

## MONITORING AND COMMUNICATION

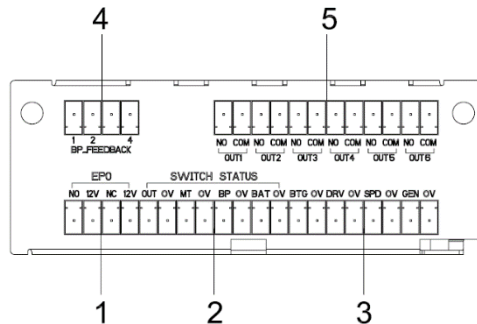
For user access purposes (communication ports, monitoring and control touchscreen display), the UPS is equipped with several units inside the Control Unit. This unit too, just as in the case with the power modules, can be hot swapped, without interruption to the services or status change in the UPS or switching to the bypass. The parameters and calibrations memorized in the monitoring module are stored as a copy on the UPS power modules and, in case of replacement, they are automatically copied in the new monitor unit.

### Control unit



- (1) parallel/synchronism units
- (2) Dry contact unit
- (3) Monitor unit
- (4) Intelligent slot: inset a SNMP board or a dry contact board

### Dry contact unit



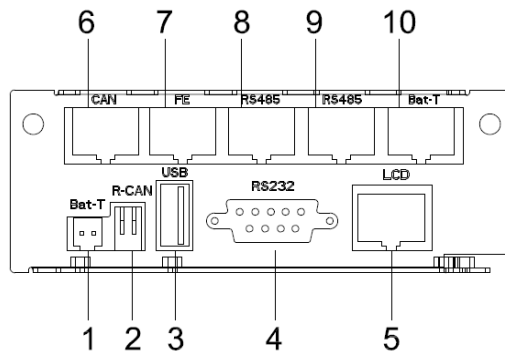
- (1) Remote EPO port: NO-12V: normally open port; NC-12V: normally close port
- (2) Switches status (including maintenance external switch)
- (3) Other ports
- (4) Port for Backfeed protection control
- (5) Dry contacts: 6 ports (125Vac/0.5A, 30Vdc/2A relays), N.A. or N.C., selectable via display.

N.	Selectable event	N.	Selectable event
1	URGENT_ALARM	8	BATTERY_SUPPLY
2	MINOR_ALARM	9	NO_SUPPLY
3	MAIN_ABNORMAL	10	ECO_MODE



4	BATTERY_LOW_VOLT	11	MAINT_CLOSE
5	BATTERY_SELFCHECK	12	OIL_MACHINE_CONTROL
6	MAIN_SUPPLY	13	SYS_MAINT_OPEN
7	BYPASS_SUPPLY	14	SYS_OUTPUT_OPEN

### Monitor unit



- (1) BAT\_T: NTC temperature sensor port
- (2) R-CAN: CAN communication adjustment
- (3) USB port: software upgrading and datalog download
- (4) RS232 port: communication
- (5) LCD port: connected to the general LCD panel
- (6) CAN port: BMS port
- (7) FE: network port (reserve)
- (8) RS485 port: communication
- (9) RS485 port: communication
- (10) BAT\_T: battery temperature sensor port (RS485)

Control unit, monitor unit and dry contacts unit can be accessed by opening the front door.

### COMMUNICATION PORTS

The following communication ports are present:

- Serial port with RS232 connector;
- One intelligent expansion slot for additional interface cards;
- Double RS485 RJ45 communication port with Modbus/RTU protocol to monitor the UPS by the BMS (Building Management System).

### COMMUNICATION SLOT

The UPS has one expansion slot for slot-in interface accessories that can be used for a variety of communications options.

Some examples:

- Second RS232 port
- Ethernet network agent with TCP/IP protocol, HTTP and SNMP
- Relay board with terminal block.

## ***9.1 EMERGENCY SHUTDOWN (E.P.O. and R.E.P.O.)***

In case of emergency, accessing the E.P.O. port ("Emergency Power Off") located on the control unit and adequately protected against accidental activation, the UPS goes in stand-by mode, shutting off the power supply to the load, in accordance with the requirements of Standard IEC/EN 62040-1.

The terminals of the isolated above mentioned port of N.C. (Normally Closed) or N.O. (Normally Open) type can be used to remotely shut down the UPS in case of emergency ("Remote Emergency Power Off" (R.E.P.O.)). At installation, the terminals have to be connected to the remote shutdown device, using a double-insulated cable. When activated remotely, the R.E.P.O connection opens and the UPS switches to stand-by mode. The UPS no longer powers the load.

The R.E.P.O circuit is supplied with SELV type circuits. No external supply voltage is required.

After an emergency shutdown, the UPS will return to on-line operating mode only after the UPS is completely without power supply.

## ***9.2 MONITORING AND CONTROL SOFTWARE***

The UPS is supplied with UPS monitoring and control software to provide the following:

- Chronological event recording;
- Event management;
- E-mail, modem, SNMP agent support;
- Sequential shutdown of all the PC/clients within a network environment, while saving the active work of the most common Network Management Systems:
  - Windows
  - Linux
  - HP Open View
  - SUN SunNet Mgr
  - IBM NetView
  - Novell NMS
  - Accton AccView
  - MegaTec SNMPView

## UPS RACK CABINETS AND SIZES

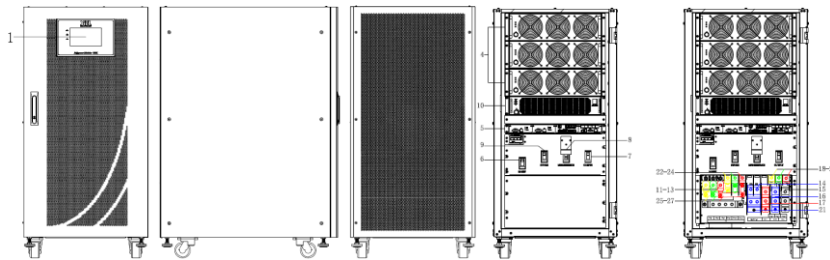
The cabinet is made of galvanized steel with IP20 protection, even with the open front door. The forced ventilation is guaranteed by fans positioned in the UPS modules; the air inlet is located on the front and the outlet on the back.

The components with a higher heat dissipation, e.g. the power modules, are individually monitored by temperature sensors and protection thermostats. Furthermore, the cabinet internal air temperature is monitored and shown on the user display.

### **Safepower Modular SPM. Cabinet 150 kVA** (max. 3 50kVA modules).

Dimensions (LxDxH = 600x850x1200 mm), weight 285 kg

Full version (bottom cable entry)



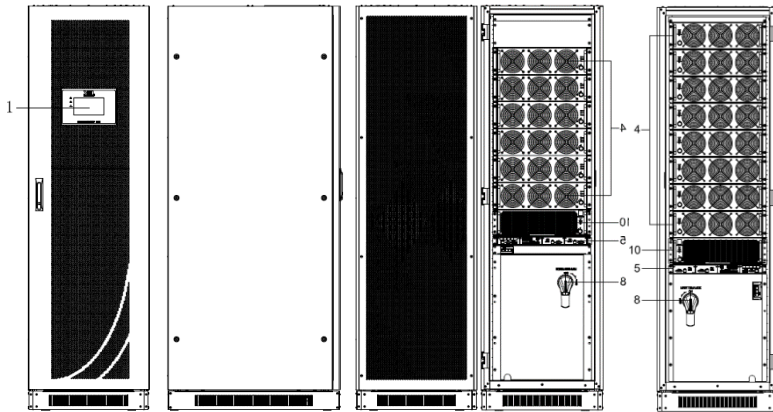
Closed (front, side, back)

Open (front, with and w/o protection panel)

### **Safepower Modular SPM. Cabinet 300 kVA / 400 kVA** (max 6/8 50kVA modules).

Dimensions (LxDxH = 600x850x2000 mm), weight 470/560 kg

Standardl version (bottom cable entry)



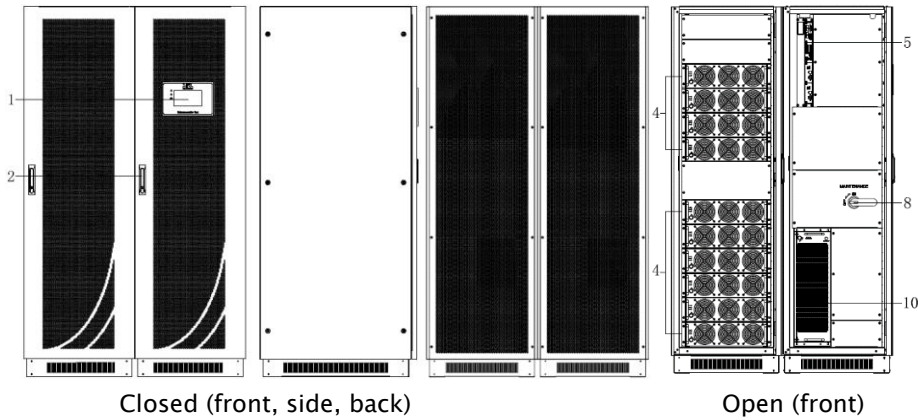
Closed (front, side, back)

Open (front, 300kVA e 400kVA)

**Safepower Modular SPM. Cabinet 500 kVA** (max 10 50kVA modules).

Dimensions (LxDxH = 1200x850x2000 mm), weight 800 kg

Standard version (bottom and top cable entry)



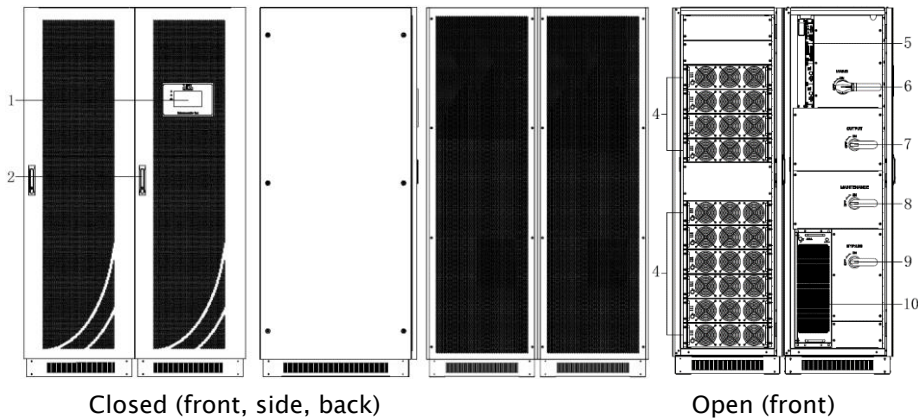
Closed (front, side, back)

Open (front)

**Safepower Madular SPM. Cabinet 600 kVA** (max 10 60kVA modules).

Dimensions (LxDxH = 1200x850x2000 mm), weight 900 kg

Full version (bottom and top cable entry)



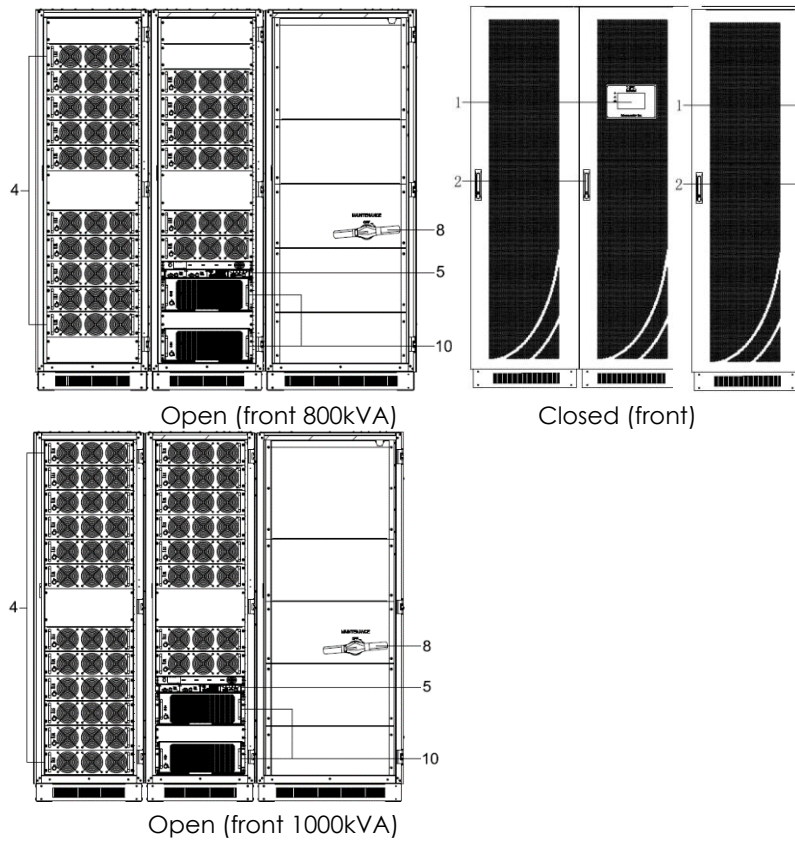
Closed (front, side, back)

Open (front)

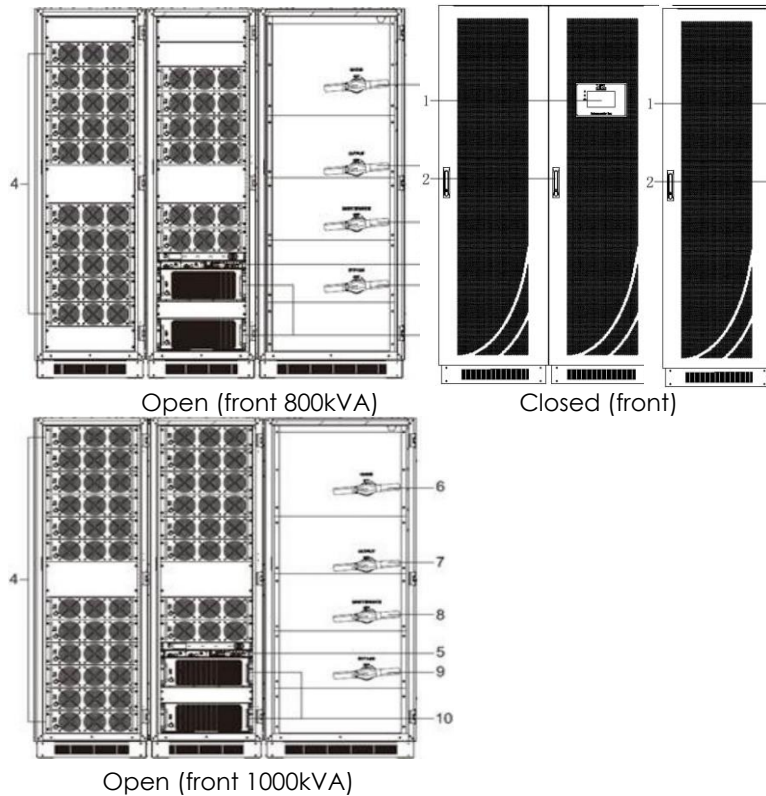
**Safepower Modular SPM. Cabinet 800 kVA / 1000 kVA** (max 16/20 50kVA modules).

Dimensioni (LxPxH = 2000x850x2000 mm).

Standard version, weight 1324 / 1384 kg (bottom and top cable entry)



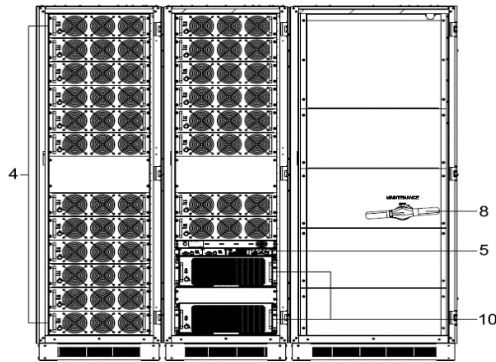
Full version, weight 1500 / 1580 kg (bottom and top cable entry)



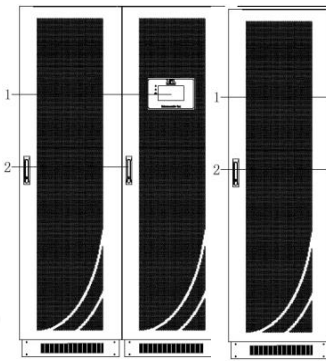
**Safepower Modular SPM. Cabinet 1200 kVA** (max 20 60kVA modules).

Dimensions (LxPxH = 2200x850x2000 mm)

Standard version, weight 1660 kg (bottom and top cable entry)

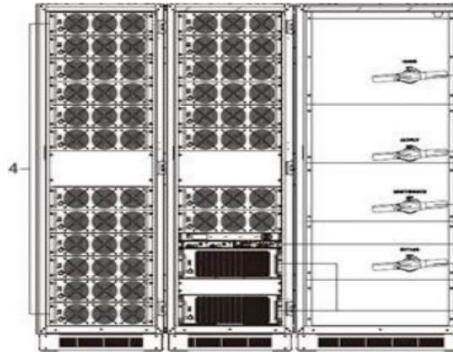


Open (front)

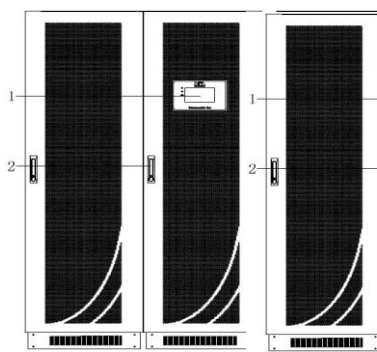


Closed (front)

Full versions, weight 1750 kg (bottom and top cable entry)



Open (front)



Closed (front)



## OPTIONS

### 11.1 COMMUNICATION

The expansion slot can house two of the following communication options:

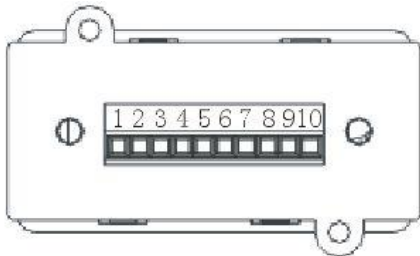
#### Network interface controller / SNMP adaptor (basic or advanced)

- a) network agent to manage the UPS directly connected to 10/100 Mbps LAN, using the main network communication protocols (TCP/IP, HTTP and SNMP). It is possible to connect also a modem to the same device.
- b) network agent to manage the UPS as indicated above with an additional environmental monitoring port (humidity, temperature, presence of smoke or gas) and modem/GSM port.

#### Relay board (terminal block)

In addition to the relay contacts already available as standard and mentioned above, it supports a 10 pin terminal block suitable for the following signals: bypass, mains failure, inverter ON, low battery power, UPS failure, UPS alarm and UPS stop.

The relay communication board includes six dry contact outlets and one dry contact inlet. The outlets and inlets are factory programmed based on the functions indicated in the table. The contacts are NO (normally open) or NC (normally closed) after selecting with jumpers.



Port		Function
1	Outlet	Mains failure
2		/
3		Low battery
4		Activated bypass
5		UPS failure
6		Inverter ON
7		UPS warning
8		COM
9	Inlet	Activation
10		Deactivation



## 11.2 EXTERNAL BATTERY TEMPERATURE SENSOR

The Monitoring unit is equipped with specific input ports for remote measurement of the battery temperature. The temperature is indicated via the UPS display.

Once installed, the battery external temperature measurement function has to be enabled from the panel.

The battery voltage recharge compensation level, adjustable from the panel, is indicated in the special section on the battery charger.

## 11.3 EXTERNAL MAINTENANCE BYPASS

An external manual maintenance bypass can be installed, which will provide complete isolation of the UPS and if required facilitate complete UPS replacement without power disruption to the load.

It is essential to connect the maintenance bypass auxiliary contacts port located inside the free contacts unit of the UPS to an auxiliary NO contact of the external maintenance bypass switch. Closure of the SERVICE BYPASS switch opens this auxiliary contact and informs the UPS of its closure. If such a connection is not made, operation of the remote maintenance bypass may disrupt the supply of power to the load and damage the UPS.

**Note:** Always check that the remote maintenance bypass installation is compatible with any transformer options selected for the UPS. (see paragraph 11.5 Optional Transformers)

## 11.4 BATTERY CABINETS

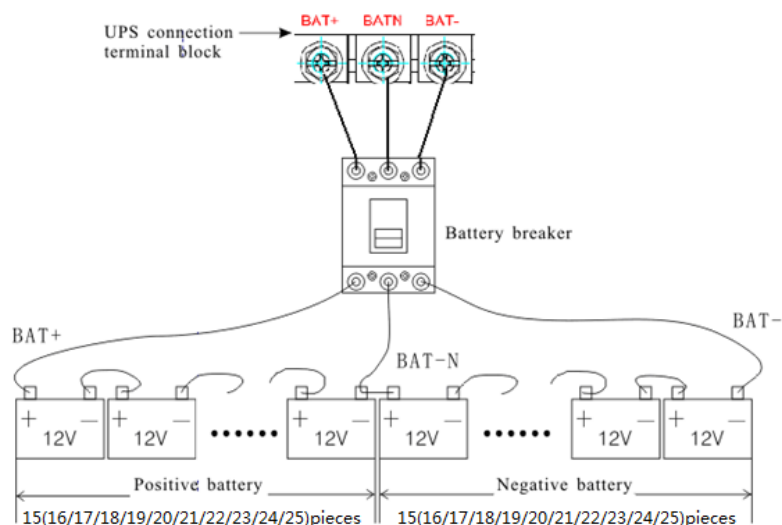
The battery cabinet contains the batteries necessary for the UPS operation in case of power outage. The number of batteries housed within the cabinet varies according to UPS size (and load) and run time desired, as well as the capacity of every single element.

In order to select exactly the requested run time or in the necessity to use a pre-existing battery, the total string, divided into two sub-strings, can comprise a number of blocks (12V rated lead batteries) from 30 to 50, as already specified in the battery recharge section.

For technical reasons, the battery comprises two internal sub-strings, one with positive voltage and the other with negative voltage with respect to the central neutral clamp (N).

The battery cabinet is equipped with an internal switch (isolating switch with fuses) or with a switch located in a special box.

The battery cabinet configuration for connection to the UPS is shown below.



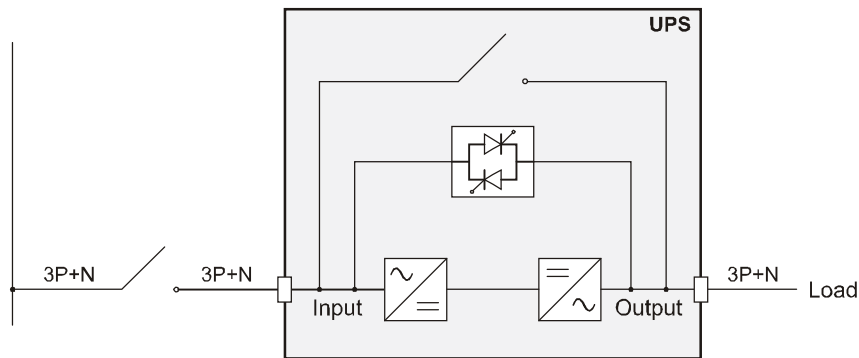
## 11.5 OPTIONAL TRANSFORMERS

The UPS can be equipped with external transformers used to recreate the power neutral where it is not available, to change its arrangement or to adapt the UPS output voltage.

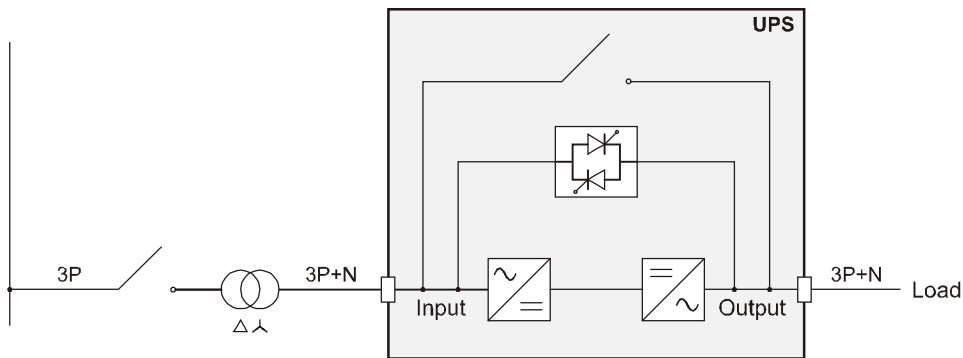
### ELECTRIC CONNECTIONS DIAGRAMS

**Note:** An external transformer will modify the neutral arrangements of the installation. Therefore, if a "remote maintenance bypass" is installed for UPS insulation, it must be sited downstream of the transformer (for an input-side transformer) or upstream (for an output-side transformer).

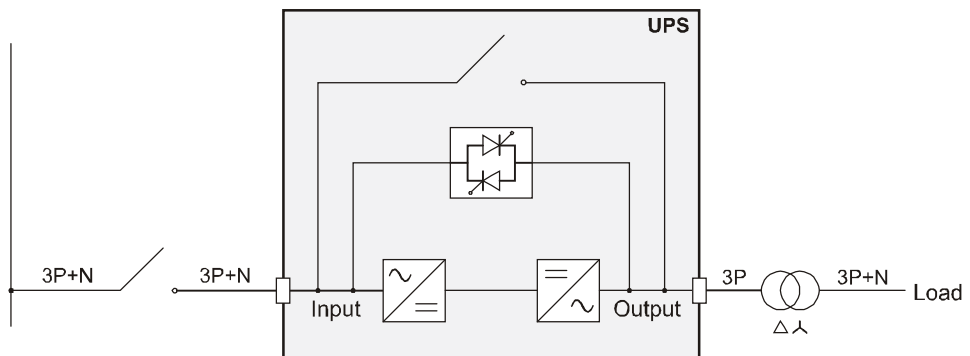
**UPS without variation of the neutral arrangement**



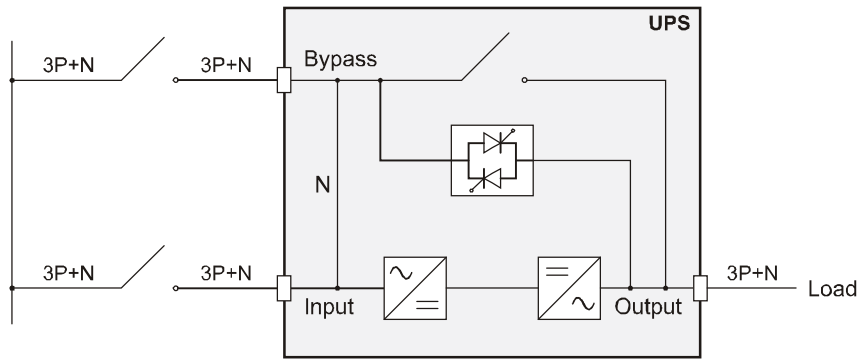
**UPS with galvanic isolation on the input**



**UPS with galvanic isolation on the output**

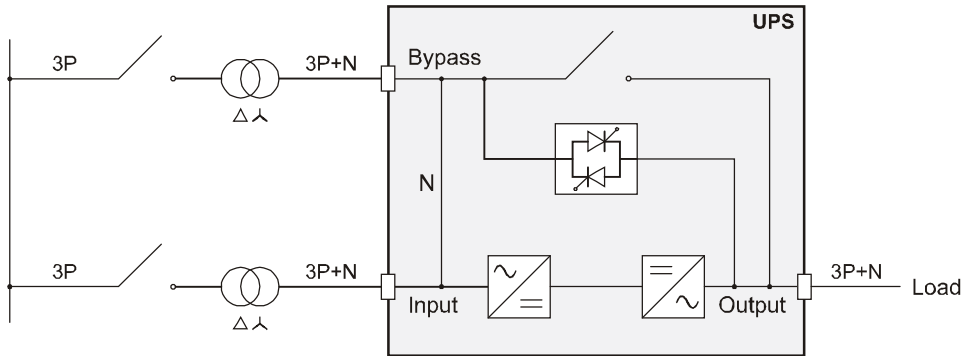


**UPS without variation of the neutral arrangements and with a separate bypass supply input**



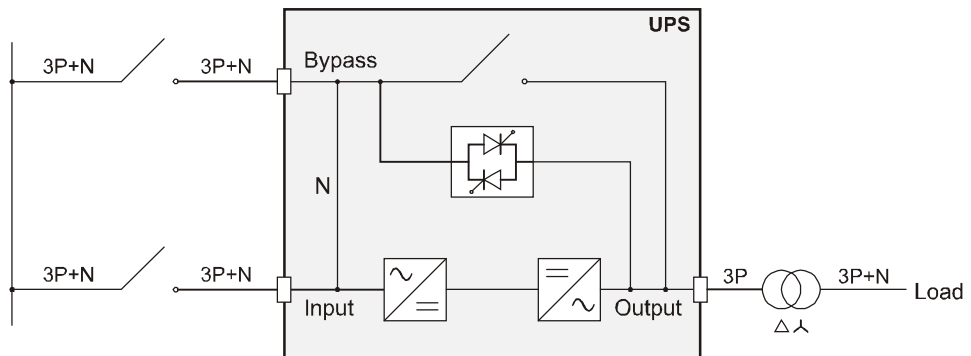
*After removal of the links for separate inputs (see 11.6)*

**UPS with galvanic isolation on the input and with a separate bypass supply input**



*After removal of the links for separate inputs (see 11.6)*

**UPS with galvanic isolation on the output and with a separate bypass supply input**



*After removal of the links for separate inputs (see 11.6)*

**Separate bypass on separated lines upstream:**

**Note:** the neutral of the input line and that of the bypass are joined inside the equipment, therefore they will refer to the same potential. If the two mains supplies are different, it is necessary to use an isolation transformer on one of the inputs.

## 11.6 SEPARATED LINE INPUT

All the UPS versions in the present range are configured for a common input. The simple removal of internal links facilitate the connection of separate Rectifier & Reserve inputs.

This facility provides means of individual isolation of the two power lines via the two switches which supply them (SWIN and SWBYP).

## ENVIRONMENTAL CONDITIONS

UPS room ambient temperature	0 ÷ 40° C
Recommended operating temperature for optimum battery performance	20 ÷ 25° C
Storage temperature	- 25° to +55 °C
Altitude-operating (Metres ASL)	<1500 m (with - 1% de-rating every 100m over 1500m)

## TECHNICAL DATA 150-500 kVA

Mechanical characteristics	UPS power (kVA)			
	150	300	400	500
Dimensions (mm)				
<ul style="list-style-type: none"> <li>Width</li> <li>Depth</li> <li>Height</li> </ul>	600 850 1200	600 850 2000	600 850 2000	1200 850 2000
Weight (kg) (with max. number of modules) (weight of each module 35 kg)	282	464	552	790
Ventilation	Forced through internal fans			
Cabinet IP rating	IP20			
Cable inlet	bottom / front			Bottom & top / front
Colour	RAL 9005			
Max. quantity of UPS modules	3 (50k) or 2+1 (60k)	6 (50k) or 5+1 (60k)	8 (50k) or 6+1 (60k)	10 (50k) or 8+1 (60k)

Electrical data	UPS power (kVA)			
	150	300	400	500
<b>INPUT</b>				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Input current (nom./max.)	228/344 A	456/687 A	608/917 A	761/1146 A
Voltage range (without switching to battery power)	323÷485 Vac at 100% of the load @ 40 °C 138÷323 Vac < 100% of the load @ 40 °C			
Nominal frequency	50 or 60Hz			
Input frequency tolerance (without switching to battery power)	40 to 70Hz			
Total Harmonic distortion (THDi) and power factor with full load	THDi 2.5 %, 0.99 Pf			
Rectifier progressive start-up ( <i>Power Walk-in duration</i> )	9 sec., with UPS modules start-up in progression			
Delayed start-up ( <i>Start-up delay</i> )	20 sec., with UPS modules start-up in progression			

Electrical data	UPS power (kVA)			
	150	300	400	500
<b>DC BUSBAR AND BATTERY SET</b>				
Number of battery cells	90+90 / 96+96 / 102+102 / 108+108 / 114+114 / 120+120 / 126+126 / 132+132 / 138+138 / 144+144 / 150+150			
Float voltage (2,25 V/el., adjustable)	270+270 Vdc (with 240 Pb cells)			
Boost voltage (2,4 V/el., adjustable)	288+288 Vdc (with 240 Pb cells)			
End of discharge voltage (1,65 V/el, adjustable 1,6-1,9V/el)	198+198 Vdc (with 240 Pb cells)			
Standard battery charger (max. 20 A per module)	60 A	120 A	160 A	200 A

Electrical data	UPS power (kVA)			
	150	300	400	500
<b>INVERTER</b>				
Nominal power (kVA)	150	300	400	500
Active power with p.f. 1 (kW)	150	300	400	500
Nominal voltage	380/400/415 Vac Three-Phase plus neutral			
Nominal frequency	50 / 60Hz			
Static stability	± 1%			
Dynamic variation	± 5%			
Recovery time within ± 2%	20ms In compliance with standard EN 62040-3, class 1			
Crest factor (I <sub>peak</sub> /I <sub>rms</sub> as per EN 62040-3)	3:1			
Voltage distortion with linear and distorting load (EN 62040-3)	≤ 2% with linear load ≤ 4% with distorting load			
Inverter frequency stability without by-pass supply synchronisation	± 0.1 Hz			
Slew rate	1Hz/sec			
Voltage phase dissymmetry with balanced and unbalanced loads	± 1% / ± 2%			
Voltage phase shift with balanced and unbalanced loads	120 ± 1 °			
Inverter overload	>105% ÷ ≤110% 60 min. >110% ÷ ≤125% 10 min. >125% ÷ ≤150% 1 min. >150% protection			
Short circuit current	280A peak per module			
Efficiency on battery operation (%)	≥96%			
Bus input voltage	370+370 Vdc			

Electrical data	UPS power (kVA)			
	150	300	400	500
<b>BY-PASS</b>				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Output nominal current (A) @400V	217	434	578	723
Bypass voltage range	Max. voltage: 380V: +25% (adjustable +10%, +15%, +20%); 400V: +20% (adjustable +10%, +15%); 415V: +15% (adjustable +10%); Min. voltage: -45% (adjustable -10%, -20%, -30%)			
Nominal frequency	50 ÷ 60Hz			
Bypass input frequency range	± 10% (adjustable ± 1% to ± 10%)			
Transfer time from By-pass to Inverter (UPS in "ECO mode")	2 ms typical			
Transfer delay to Inverter from By-pass	4 sec			
Overload capability on bypass line	≤125% continuous (≤135% continuous @ ≤40°C temp.) 1000% 100 ms			

Electrical data	UPS power (kVA)			
	150	300	400	500
<b>SYSTEM</b>				
AC/AC Efficiency (On line) %				
• Full load	96,0			
• 75% load	96,2			
• 50% load	96,5			
• 25% load	96,3			
Efficiency with UPS in ECO mode %	≥ 99			
Audible noise at 1mt (dBA)	50-68 dB (A) Depending on the load			
Max. dissipated power	7.1 kW 6079 kcal/h	14.4 kW 12157 kcal/h	18.9 kW 16209 kcal/h	23.6 kW 20262 kcal/h
UPS on-board fan capacity	2732 mc/h	5465 mc/h	7286 mc/h	9108 mc/h
Max current leaked to earth *	≤250mA			

\* The dispersion current of the load is added to that of the UPS on the ground protection conductor.



## TECHNICAL DATA 600-1200 kVA

Mechanical characteristics	UPS power (kVA)			
	600	800	1000	1200
Dimensions (mm)				
• Width	1200	2000	2000	2200
• Depth	850	850	850	850
• Height	2000	2000	2000	2000
Weight (kg) (with max. number of modules) (weight of each module 35 kg)	900	1324 s / 1384 f	1500 s / 1580 f	1660 s / 1750 f
Ventilation	Forced through internal fans			
Cabinet IP rating	IP20			
Cable inlet	From the bottom & top/ front			
Colour	RAL 9005			
Max. quantity of UPS modules	10	16 (50k) o 13+1 (60k)	20 (50k) o 16+1 (60k)	20

Electrical data	UPS power (kVA)			
	600	800	1000	1200
<b>INPUT</b>				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Input current (nom./max.)	913/1.336 A	1.217/1.833 A	1.521/2.292 A	1.825/2.672 A
Voltage range (without switching to battery power)	323÷485 Vac at 100% of the load @ 40 °C 138÷323 Vac < 100% of the load @ 40 °C			
Nominal frequency	50 or 60Hz			
Input frequency tolerance (without switching to battery power)	40 to 70Hz			
Total Harmonic distortion (THDi) and power factor with full load	THDi 2.5 %, 0.99 Pf			
Rectifier progressive start-up (Power Walk-in duration)	9 sec., with UPS modules start-up in progression			
Delayed start-up (Start-up delay)	20 sec., with UPS modules start-up in progression			

Electrical data	UPS power (kVA)			
	600	800	1000	1200
<b>DC BUSBAR AND BATTERY SET</b>				
Number of battery cells	90+90 / 96+96 / 102+102 / 108+108 / 114+114 / 120+120 / 126+126 / 132+132 / 138+138 / 144+144 / 150+150			
Float voltage (2,25 V/el., adjustable)	270+270 Vdc (with 240 Pb cells)			
Boost voltage (2,4 V/el., adjustable)	288+288 Vdc (with 240 Pb cells)			
End of discharge voltage (1,65 V/el, adjustable 1,6-1,9V/el)	198+198 Vdc (with 240 Pb cells)			
Standard battery charger (max. 20 A per module)	200 A	320 A	400 A	400 A

Electrical data	UPS power (kVA)			
	600	800	1000	1200
<b>INVERTER</b>				
Nominal power (kVA)	600	800	1000	1200
Active power with l.p.f. 1 (kW)	600	800	1000	1200
Nominal voltage	380/400/415 Vac Three-Phase plus neutral			
Nominal frequency	50 / 60Hz			
Static stability	± 1%			
Dynamic variation	± 5%			
Recovery time within ± 2%	20ms In compliance with standard EN 62040-3, class 1			
Crest factor (I <sub>peak</sub> /I <sub>rms</sub> as per EN 62040-3)	3:1			
Voltage distortion with linear and distorting load (EN 62040-3)	≤ 2% with linear load ≤ 4% with distorting load			
Inverter frequency stability without by-pass supply synchronisation	± 0.1 Hz			
Slew rate	1Hz/sec			
Voltage phase dissymmetry with balanced and unbalanced loads	± 1% / ± 2%			
Voltage phase shift with balanced and unbalanced loads	120 ± 1 °			
Inverter overload	>105% ÷ ≤110% 60 min. >110% ÷ ≤125% 10 min. >125% ÷ ≤150% 1 min. >150% protection.			
Short circuit current	280A peak per module			
Efficiency on battery operation (%)	≥96%			

Bus input voltage	370+370 Vdc			
Electrical data	UPS power (kVA)			
	800	1040	1280	1560
<b>BY-PASS</b>				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Output nominal current (A) @ 400V	867	1156	1445	1734
Bypass voltage range	Max. voltage: 380V: +25% (adjustable +10%, +15%, +20%); 400V: +20% (adjustable +10%, +15%); 415V: +15% (adjustable +10%); Min. voltage: -45% (adjustable -10%, -20%, -30%)			
Nominal frequency	50 ÷ 60Hz			
Bypass input frequency range	± 10% (adjustable ± 1% to ± 10%)			
Transfer time from By-pass to Inverter (UPS in "ECO mode")	2 ms typical			
Transfer delay to Inverter from By-pass	4 sec			
Overload capability on bypass line	≤125% continuous (≤135% continuous @ ≤40°C temp.) 1000% 100 ms			

Electrical data	UPS power (kVA)			
	600	800	1000	1200
<b>SYSTEM</b>				
AC/AC Efficiency (On line) %				
• Full load	96,0			
• 75% load	96,2			
• 50% load	96,5			
• 25% load	96,3			
Efficiency with UPS in ECO mode %	≥ 99			
Audible noise at 1mt (dBA)	50-68 dB (A) Depending on the load			
Max. dissipated power	28.3 kW 24314 kcal/h	37.7 kW 32419 kcal/h	47.1 kW 40524 kcal/h	56.5 kW 48628 kcal/h
UPS on-board fan capacity	10278 mc/h	14573 mc/h	18216 mc/h	20556 mc/h
Max current leaked to earth *	≤400mA			

\* The dispersion current of the load is added to that of the UPS on the ground protection conductor.

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