Technical Specification

SAFEPOWER S

60-200 kVA Safepower S Three-phase/ Three-phase PF1

On-Line Double Conversion Technology (VFI)

TABLE OF CONTENTS:

PURPOSE

These specifications define the technical characteristics of the **Safepower S** 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.

DESCRIPTION OF THE SYSTEM

The **Safepower S** series is available in 60-80-100-120-150-200 kVA models with On-Line Double Conversion topology, compliant with VFI-SS-111 classification, in accordance with IEC EN 62040-3, and with stand-alone design, parallel capable.

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

a) Possibility of connecting several units in parallel to enhance the capacity/redundancy;

b) Fully compatible with diesel generator and network
- low input current distortion up to 2.5% and power factor > 0.99;
- *Power walk-in* and delayed start-up to reduce the need for generator oversizing and ensure the compatibility with any power supply, even with limited power installed.

c) Accurate Battery Care
- adjustable for batteries with 30 /32 / 34 / 36 / 38 / 40 / 42 / 44 / 46 / 48 / 50 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.

d) Unity nominal output power factor (PF=1), with possibility to power distorted, step, inductive and capacitive loads;

e) 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;

f) Backfeed Protection;

g) Flexible structure, which allows:
  - Wide choice of external battery solutions, even for extended run time
  - Simple separation of the emergency bypass line from the rectifier power line (dual input)
  - Easy handling and positioning by means of the provided wheels
  - Wide choice of communication options
  - Possibility of electrical isolation through the optional transformer.

The **Safepower S** series, with a compact architecture based on high-density transformer-free technology, includes the following models:

MODEL	DESCRIPTION
Safepower S 60 kVA	60 kVA UPS: three-phase input / three-phase output
Safepower S 80 kVA	80 kVA UPS: three-phase input / three-phase output
Safepower S 100 kVA	100 kVA UPS: three-phase input / three-phase output
Safepower S 120 kVA	120 kVA UPS: three-phase input / three-phase output
Safepower S 150 kVA	150 kVA UPS: three-phase input / three-phase output
Safepower S 200 kVA	200 kVA UPS: three-phase input / three-phase output

REFERENCE STANDARDS

The company's Integrated System of Quality, Environment and Safety Assurance, is certified according to:
ISO 9001/2008 Standard, covering all company functions, from design and manufacture to sales and services;
EN ISO 14001 Standard, specifying requirements for an effective environmental management system;
ISO 45001:2018, specifying requirements for 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), C2 category;
- **EN 62040-3:** Method of specifying the performance and test requirements;

The **Safepower S** 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 A ≤ 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 S** 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

The available configurations are the following:

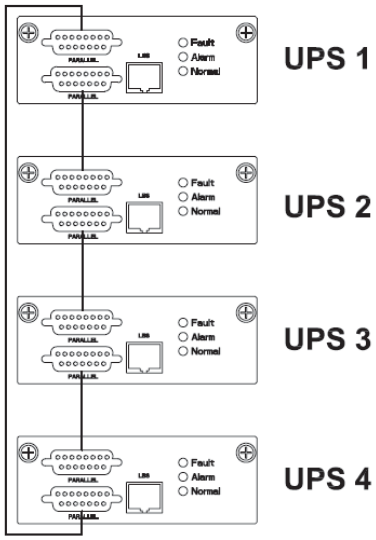
Single UPS

The UPS can be installed as a single stand-alone unit for simpler applications.
A further expansion can be obtained by placing a maximum of 6 units in parallel, to meet the load power increase requirements or to introduce a redundancy level, as indicated below.

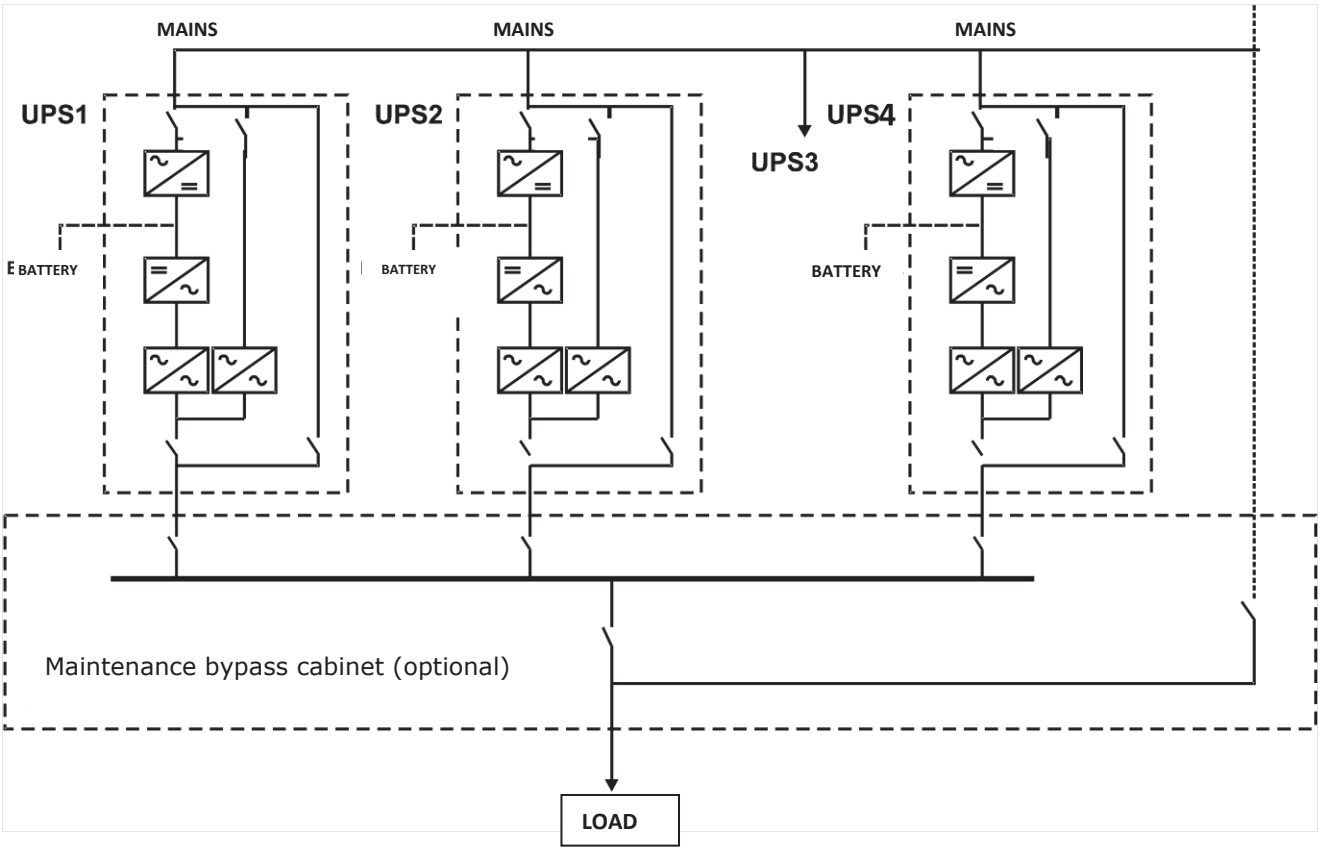
Parallel Configuration

The UPS units can be connected in parallel, up to a maximum of 6 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, 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 6), 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.



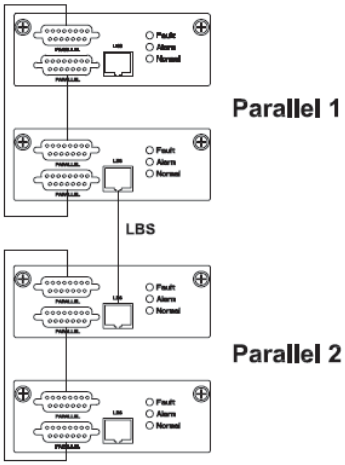
Each parallel UPS unit can be configured with its own battery (see table above) or, as an alternative, with a **common battery**.

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.

Modalità : Smart Energy Saving – ECO MODE

Normal Operation: The load is normally powered from the mains power supply (direct power supply), 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.

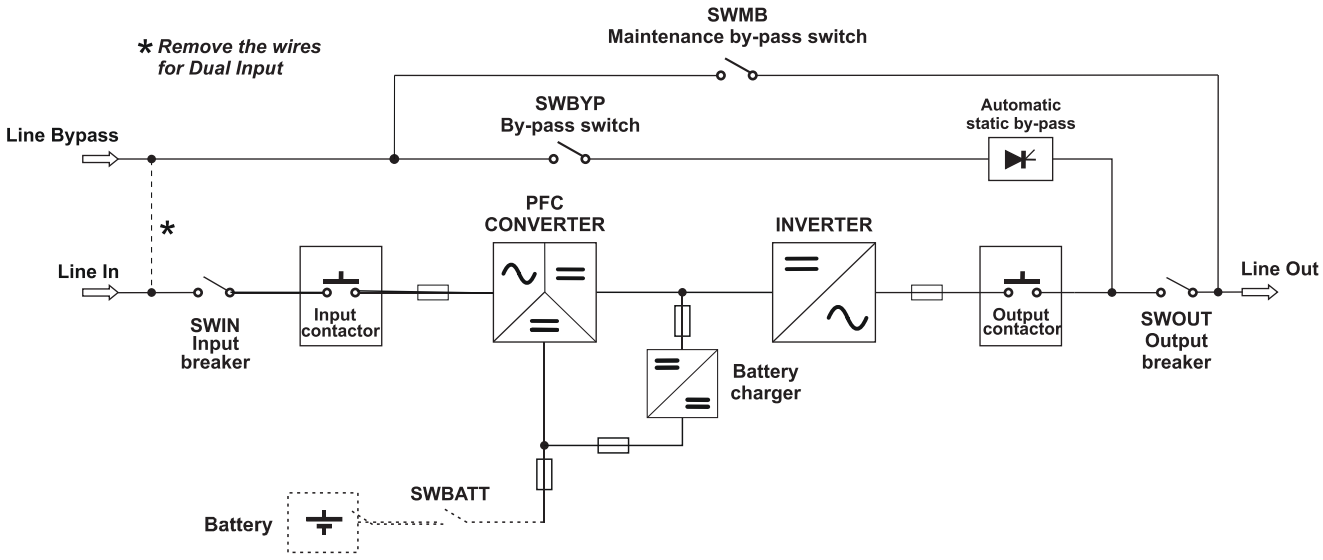
Note: for maintenance needs, under each of the modes described above, it's possible to switch manually to the **maintenance by-pass** mode. The load will be powered by input mains power supply through the maintenance section (internal or external to the UPS cabinet), as described below.

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 Functional blocks and their operation

Safepower S UPS block diagram is as follows:



It comprises the following operational blocks:

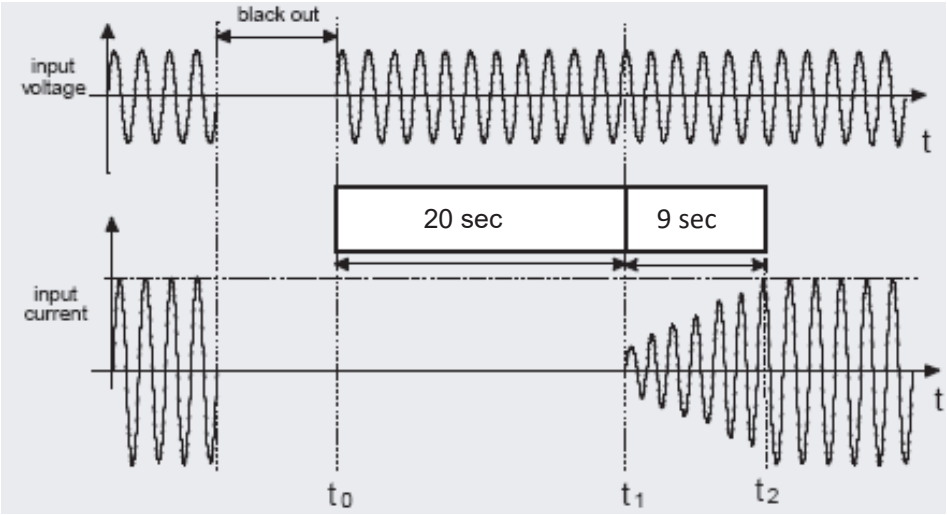
- PFC converter (rectifier) and booster
- Battery charger
- Inverter
- Static switch (automatic by-pass)

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.



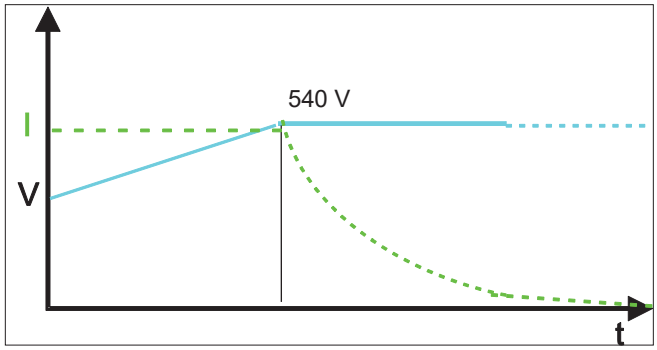
The **booster** maintains the internal bus voltage stable, regardless of the battery voltage variations. On the other hand, the bus voltage variations due to rapid dynamic changes of the load do not affect the battery voltage directly.

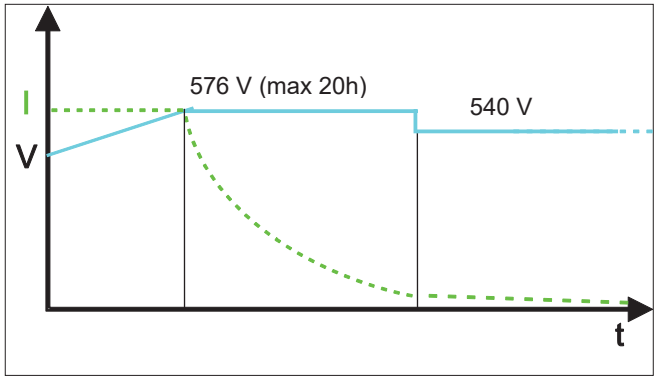
6.2.2 Battery Charger (Accurate Battery Care)

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

a) **Battery Rated Voltage**: The UPS can be used with a different number of sealed lead batteries (2Vpc) per string, depending on the back-up needs desired, ±180 V */ ±192 V * / ±204 V * / ±216 V / ±228 V / ±240 V / ±252 V / ±264 / ±276 V / ±288 / ±300 Vcc (equal to 30 * / 32 */ 34 * / 36 / 38 / 40 / 42 / 44 / 46 / 48 / 50 12V monoblocs) for a wide adaptability to any type of battery; 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).

b) **Battery recharging: the UPS** 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
	**<u>One-level recharge</u>**: 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). The constant current is adjustable and is generally set at $0.1C_{10}$ up to a maximum of 20A of recharge (60 kVA), 40A (up to 120 kVA) or 60A (up to 200 kVA). The floating voltage has a range of 2.20-2.29 Vpc (2.25x6x40* = 540V). Note (*): example with 40 monoblocs 12V

	**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 (2.4x6x40*=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 provided monitoring software via the serial port.

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÷0.007V / cell / 1°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 Safepower S, 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 "Cold Start" red button at rear.

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 (> 18kHz) 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 ±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 ± 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 ±1% / ±2% / ±4% / ±5% / ±10% (adjustable).
   b. With no mains power present: the Inverter generates the frequency of the output voltage with a stability of ±0.1Hz.
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 UPS will carefully analyse the output voltage and current.

- During battery operation (mains power supply failure) 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, 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)	In (Nominal current)/7
regular switches	In (Nominal current)/7
ultra-rapid fuses	In (Nominal current)/2

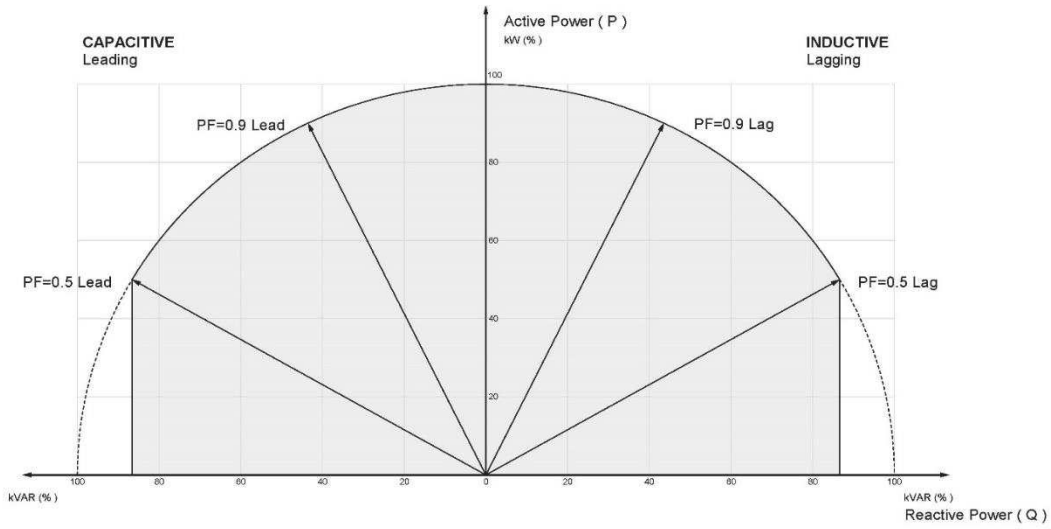
Output voltage symmetry

Under all conditions, output voltage symmetry is maintained within ± 1% for balanced loads and ± 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° ± 1° for balanced loads and 100% unbalanced loads.

Performance of 3-phase Inverter with reactive loads



6.2.4 Static Switch (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 limits are exceeded and short circuit;
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.

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:

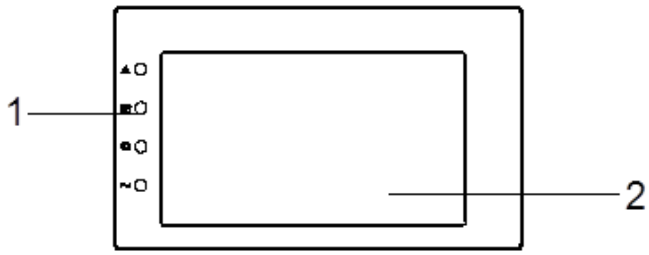
- Voltage range: ± 10% (settable from -10, -20, -30, -45% to +10, +15, +20, +25%);
- Frequency range: ± 10% (settable as +-1, 2, 3, 4, 5 %).

Overload

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

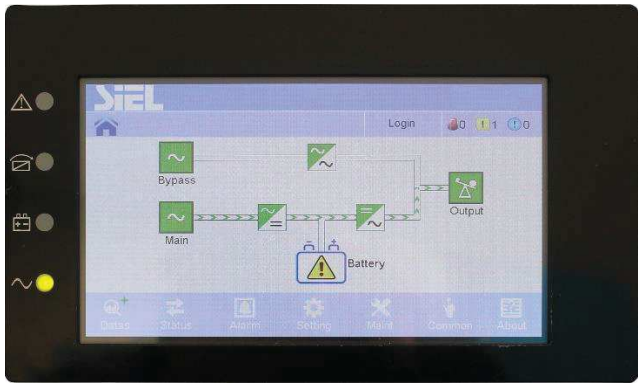
CONTROL PANEL

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



① status and alarms LEDs

② Colour touchscreen LCD display: monitoring of all the parameters measured, UPS and battery status with mimic, events and alarms, setting



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 various selectable languages.

The control panel is made up of a colour touchscreen graphic display, providing a detailed real-time overview of the UPS operational status, starting from a block diagram mimic. From the control panel the user can switch the UPS on/off, read electrical measurements - mains, output, battery, etc,

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, the machine model, the firmware version and title of the current menu.

2 DATA DISPLAY/NAVIGATION MENU

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, the display shows all the data relevant to that menu.

3 UPS STATUS, ALARMS – FAILURES, CONTROLS

A screen in which the UPS operating status is constantly shown; 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 or modes (e.g. output voltage, battery data, bypass voltage acceptance range, operating modes -parallel, Eco-).

When an alarm appears, an audible warning will sound.

Measurements

- Input voltage, current, power factor and frequency
- Bypass voltage, current and frequency
- Output voltage, current and frequency
- Output power (kVA, kW per phase and total) and load %
- Battery voltage
- Battery current (charge/discharge)
- Internal temperature and air inlet temperature
- battery temperature (via optional probe located at the battery)
- Battery status and back-up time

UPS CABINET AND ISOLATING SWITCHES

The **Safepower S** UPS is housed in a cabinet made of galvanized steel with IP20 protection. The *forced ventilation* features the air inlet 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 are individually monitored by **double temperature sensors**.
The ventilation features variable speed fans which vary depending on the load and on the internal temperature of the components.

The single line diagram at 6.2 section highlights the main components.
The UPS is equipped with the following swiches located at rear of the cabinet (SWMB 200kVA at rear):

① SWMB
Maintenance automatic breaker (switch on 200kVA)

② SWOUT
Output automatic breaker

③ SWIN
Input automatic breaker

④ SWBYP
Bypass automatic breaker

The power supply to and from these switches, as well as the DC power supply from the terminals of the 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 terminals;
Bypass input L1, L2, L3;
Ground terminal.

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.

Surge protectors are fitted inside the UPS for protection against potentially dangerous voltage surges. They are type 2, tested in class II according to IEC EN 61643-11 (In 20 kA, Imax 40 kA). They consist of replaceable plug-in modules in the event of intervention.

For user and other units interface purposes (communication ports, monitoring and control ports), the UPS is equipped at rear with the proper interfaces to the external environment as described below.

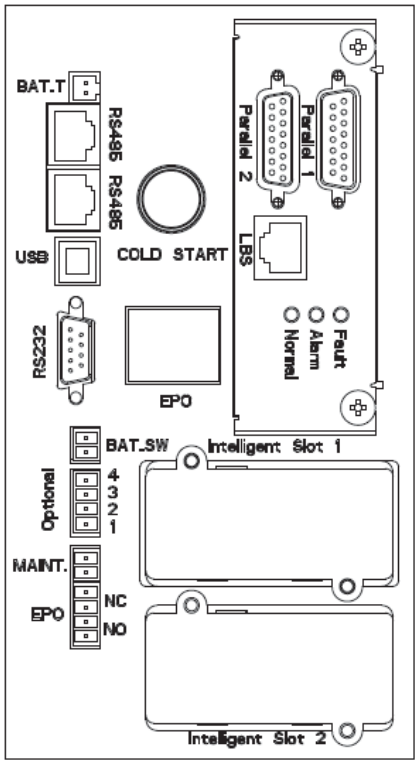
The system is equipped with "**Backfeed Protection**". In order to avoid any possible electric shock at the input terminals due to a failure of the electronic static switch, the internal device is capable of detecting such failure and generating a command to ensure that the faulty line is adequately disconnected, in accordance with

Standard IEC/EN 62040-1. A command is made available to an external device by means of a relay contact, both N.O. and N.C.

MONITORING AND COMMUNICATION

In order to communicate to the external environment and remotely to the user, a set of communication ports are located at the back of the unit.

Communication interfaces (example 60 kVA, back view)



COMMUNICATION PORTS

The following communication ports are present:

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

COMMUNICATION SLOTS

The UPS has two expansion slots 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, by pressing the EPO button ("Emergency Power Off", E.P.O.) suitably connected to the port located at rear, 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

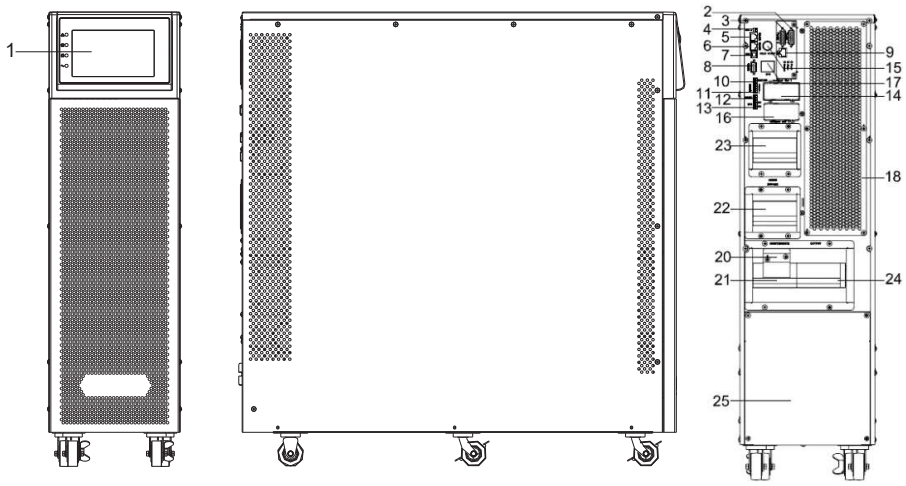
The UPS is supplied with UPS monitoring and control software to provide the following:

- 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 CABINETS AND SIZES

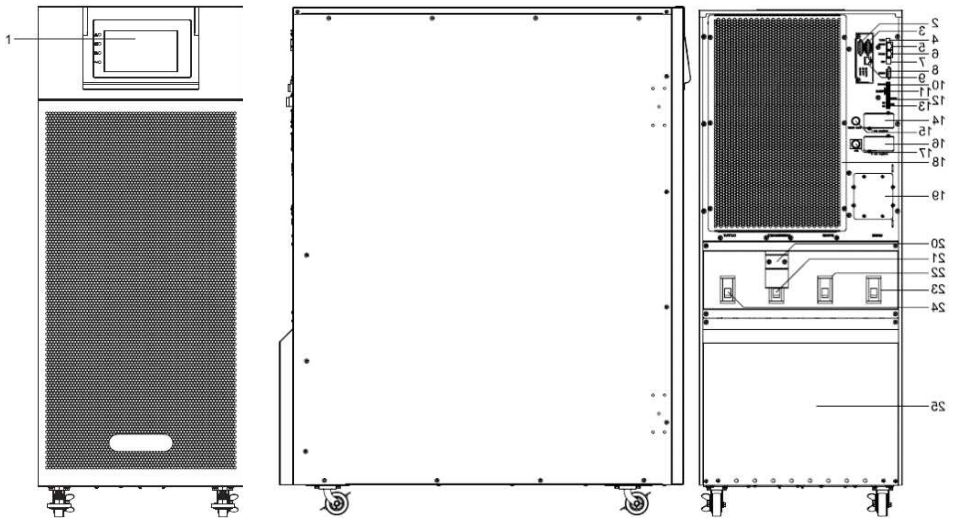
The cabinet is made of galvanized steel with IP20 protection.
The ventilation is forced; the air inlet is located on the front and the outlet on the back.
The components with an higher heat dissipation are individually monitored by temperature sensors and protection thermostats. Furthermore, the cabinet internal air temperature is monitored and shown on the user display.
The UPS is easily moveble as the cabinet is equipped with lockable wheels.

Safepower S. Cabinet **60 kVA**
Dimensions (LxDxH = 250x828x868 mm), weight (see table section)



Front view **Side view** **back view**

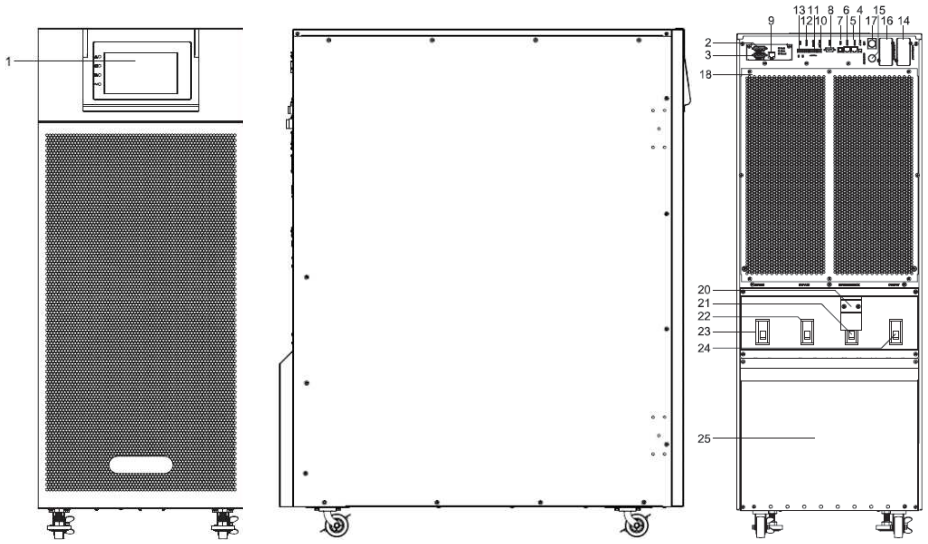
Safepower S. Cabinet **80-100-120 kVA**
Dimensions (LxDxH = 442x850x1100mm), weight (see table section)



Front view **Side view** **back view**

Safepower S. Cabinet **150 kVA**

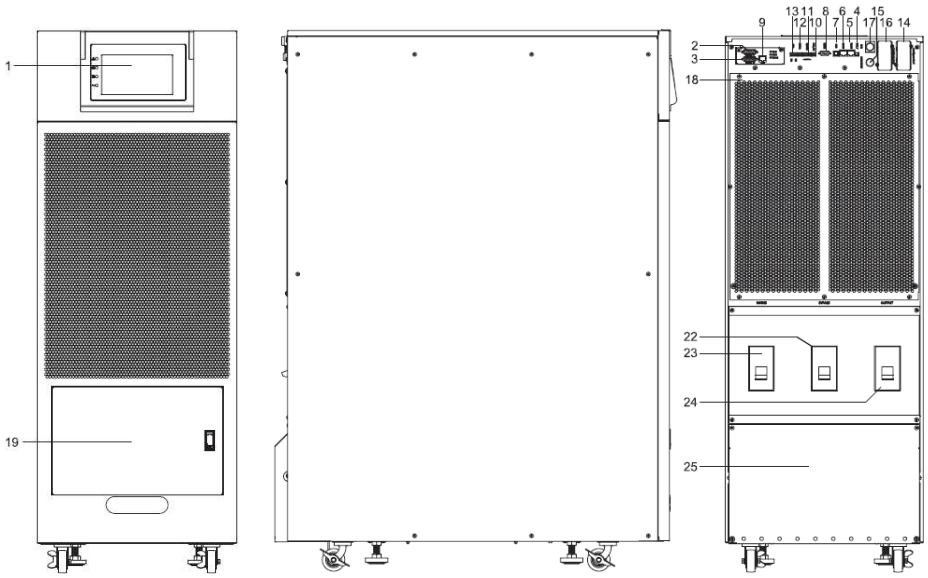
Dimensions (LxDxH = 442x850x1200mm), weight (see table section)



Front view **Side view** **back view**

Safepower S. Cabinet **200 kVA**

Dimensions (LxDxH = 442x850x1200mm), weight (see table section)



Front view **Side view** **back view**

OPTIONS

11.1 COMMUNICATION

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

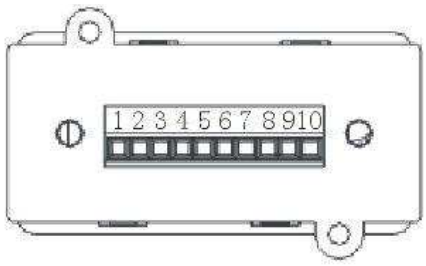
Network interface controller / SNMP adaptor (basic or advanced)

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)

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) o 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 UPS, via e a RJ45 input port or a specific connector, is equipped with a device 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.

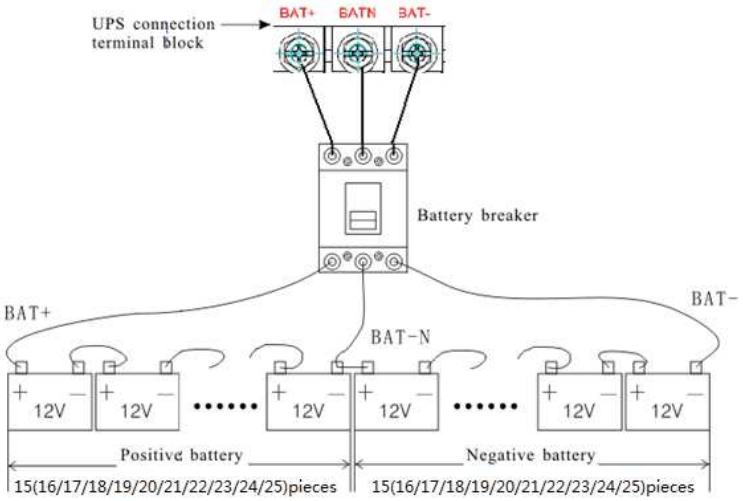
11.3 EXTERNAL MAINTENANCE BYPASS

An external manual maintenance bypass can be installed, which will provide complete isolation or 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 located inside the UPS in series to an auxiliary NO contact of the external maintenance bypass switch. The 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 60, 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.



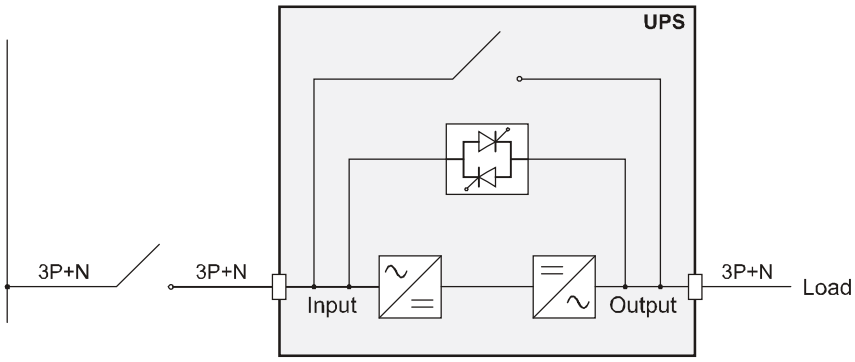
11.5 TRANSFORMERS

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.

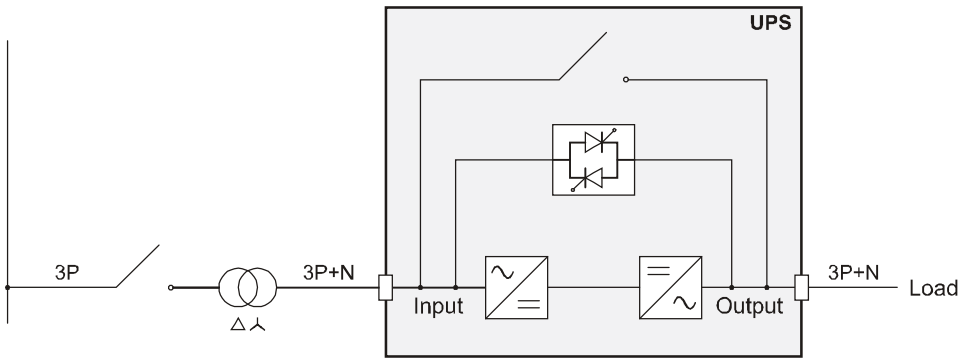
ELECTRIC CONNECTIONS DIAGRAMS

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).

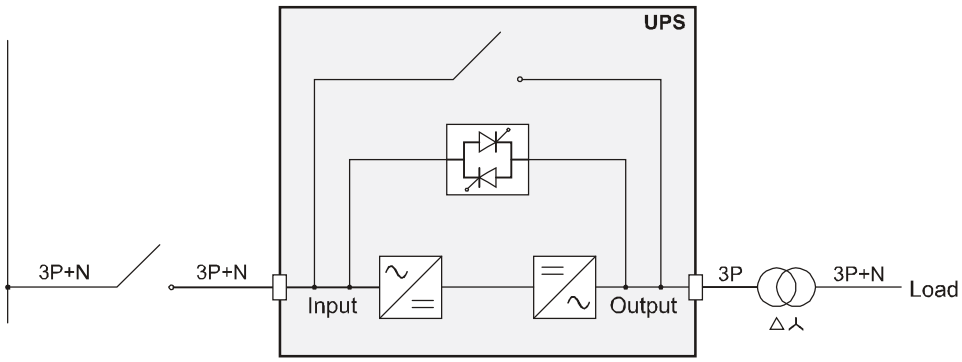
UPS without variation of the neutral arrangement



UPS with galvanic isolation on the input



UPS with galvanic isolation on the output



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 facilitates 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% of de-rating every 100m over 1500m)

TECHNICAL DATA 60-200 kVA

Mechanical characteristics	UPS power (kVA)					
	60	80	100	120	150	200
Dimensions (mm)						
• Width	250	442			442	
• Depth	828	850			850	
• Height	868	1100			1200	
Weight (Kg)	83	144	155	155	190	230
Ventilation	Forced through internal fans					
Cabinet IP rating	IP20					
Cable inlet	From the bottom/ at back					
Colour	RAL 9005					
Handling and positioning	By means of the provided lockable wheels					

Electrical data	UPS power (kVA)					
	60	80	100	120	150	200
INPUT						
Nominal voltage	380-400-415 Vac Three-Phase plus neutral					
Input current (nom./max.)	91/134 A	122/172 A	152/219 A	183/257 A	228/324 A	304/429 A
Voltage range (without switching to battery power)	323÷485 Vac at 100% load at 40 °C 138÷323 Vac < 100% load at 40 °C					
Nominal frequency	50 o 60Hz					
Input frequency tolerance (without switching to battery power)	45-55 Hz (50 Hz); 54-66 Hz (60Hz); autosensing					
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 secs					
Delayed start-up (*Start-up delay*)	20 secs					

Electrical data	UPS power (kVA)					
	60	80	100	120	150	200
DC BUSBAR AND BATTERY SET						
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	20 A	40 A	40 A	40 A	60 A	60 A

Electrical data	UPS power (kVA)					
	60	80	100	120	150	200
INVERTER						
Nominal power (kVA)	60	80	100	120	150	200
Active power with .p.f. 1 (kW)	60	80	100	120	150	200
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 (Ipeak/Irms 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					>105%÷≤110%60m >110%÷≤125% 1m >125%÷≤150% 1.2s >150% protection
Short circuit current (peak)	280 A	560 A	560 A	164 A	840A	960A
Efficiency on battery operation (%)	≥ 96					
Bus input voltage	370+370 Vdc					

Electrical data	UPS power (kVA)					
	60	80	100	120	150	200
BY–PASS						
Nominal voltage	380-400-415 Vac Three-Phase plus neutral					
Output nominal current (A)	87A	116 A	145 A	173 A	217 A	289 A
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% up to ± 10%)					
Transfer time from By-pass to Inverter (UPS in "ECO mode")	< 5-8 ms					
Transfer delay to Inverter from By-pass	4 sec					
Nominal voltage	≤125% continuous (≤135% continuous at temper. ≤40°C) 1000% 100 ms					

Electrical data	UPS power (kVA)					
	60	80	100	120	150	200
SYSTEM						
AC/AC Efficiency (On line) (%)						
• Full load	95,5	95,5	95.5	95.5	95,5	95,5
• 75% load	95,9	95,9	95.8	95.8	96,2	96,1
• 50% load	96,6	96,6	96.5	96.5	96,7	96,6
• 25% load	95,9	96,1	96,0	96,0	96,2	96,3
Efficiency with UPS in ECO mode (%)	≥ 99					
Audible noise at 1mt (dBA)(from 50 dB(A) to ... (depending on load)	62	64	64	64	65	66
Max. dissipated power	2,83 kW 2431 kcal/h	3,77kW 2242 kcal/h	4,71 kW 4052 kcal/h	5,65 kW 4863 kcal/h	7,07 kW 6079 kcal/h	9,42 kW 8105 kcal/h
UPS on-board fan capacity	1028 mc/h	1822 mc/h	2056 mc/h	2056 mc/h	2732 mc/h	3643 mc/h
Max current leaked to earth *	≤300mA					

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

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