

Technical Specifications

SAFEPOWER-EVO-HF



60/120 kVA three-phase input/three-phase output

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1. OBJECTIVE

These specifications define the technical characteristics of the **SAFEPOWER-EVO-HF** uninterruptible power supply (UPS). The UPS is designed to supply a clean and stable electrical supply, irrespective of the condition of the mains or an alternative power supply.

The **SAFEPOWER-EVO-HF** series of UPS is designed and manufactured by Siel UPS, a leader in this field with a range of products from 350VA to 800kVA, and over 25 years of experience in power protection.

For more information please visit our website at: www.sielups.com

2. SYSTEM DESCRIPTION

The **SAFEPOWER-EVO-HF** UPS is available in 10-120 kVA On Line double conversion technology. **SAFEPOWER-EVO-HF** meeting the VFI-SS-111 classification defined by IEC EN 62040-3.

SAFEPOWER-EVO-HF is designed to protect critical industrial and Information Technology (IT) systems with the following features:

- a) Zero Impact Source
 - low input current distortion - as low as 3% and with a 0.99 input power factor;
 - Power Walk-In and start-up delay to reduce generator oversizing; these features also help to guarantee supply compatibility where available mains power is limited.
- b) Battery Care System
 - two voltage level recharge according to the IU characteristic;
 - temperature compensating recharge voltage;
 - suitable for the charging of extended back-up battery sets with additional charger options;
 - Battery test function to detect potential battery deterioration
 - Cyclical recharge
 - Recharging the "commissioning charge".
- c) Inverter thermal oversizing in order to guarantee 115% overload (0.8pF) without time restrictions;
- d) Capability to power loads with $\cos \phi$ from 0.9 inductive to 0.9 capacitive, without active power (kW) reduction;
- e) High performance design achieving a system efficiency greater than 95% (on-line mode);
- f) Backfeed protection;
- g) Multi-function case design to allow:
 - Easy operations to separate the bypass line from the rectifier input line
 - Wide range of communication options

The **SAFEPOWER-EVO-HF** series consists of the following models:

MODEL	DESCRIPTION
Safepower-Evo60-HF	60kVA three-phase input/three-phase output UPS
Safepower-Evo80-HF	80kVA three-phase input/three-phase output UPS
Safepower-Evo100-HF	100kVA three-phase input/three-phase output UPS
Safepower-Evo120-HF	120kVA three-phase input/three-phase output UPS

3. REFERENCE STANDARDS

Siel UPS operates a Quality Management System certified to ISO 9001/2000 (Certification No. CERT-04116-99-AQ-MIL-SINCERT) covering all company functions from design and manufacture to after sales services.

In addition, the UPS meets the VFI-SS-111 classification (according to EN 62040-3) and complies with the following specific standards for UPS:

- **IEC EN62040-1**: Static uninterruptible power supplies (UPS): general and safety provisions;
- **IEC EN62040-1-1**: Static uninterruptible power supplies (UPS): general and safety provisions for operator-accessible areas;
- **IEC EN 62040-2**: Electromagnetic compatibility (EMC) requirements category C2
- **EN 62040-3**: Methods of specification of performances and test provisions;

The **SAFEPOWEREVO-HF** series also satisfies the following general standards, where applicable:

- **IEC 60529**: Degree of protection provided by enclosures;
- **IEC 60664**: Insulation for low-voltage equipment;
- **IEC 60755**: General Requirements for Residual Current Operated Protective Devices;
- **IEC 60950**: General safety provisions for "Information Technology" equipment;
- **IEC 61000-2-2**: Electromagnetic compatibility immunity;
- **IEC 61000-4-2**: Electrostatic discharge immunity test;
- **IEC 61000-4-3**: Radio frequencies, electromagnetic immunity test;
- **IEC 61000-4-4** : Transitory 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**: Harmonic current emissions (for equipment with rated current $> 16 \text{ A} \leq 75$)

European Directives:

LV 2006/95/EC

Low voltage Directive: contains provisions relating to equipment safety and imposes the EC marking obligation from 1/1/97.

EMC 2004/108/EC

Electromagnetic compatibility directive: contains provisions relating to UPS immunity and emissions in its installation environment and imposes the EC marking obligation from 1/1/96.

4. APPLICATIONS

SAFEPOWEREVO-HF UPS are suitable for applications requiring critical load protection including:

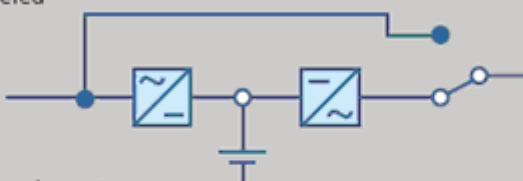
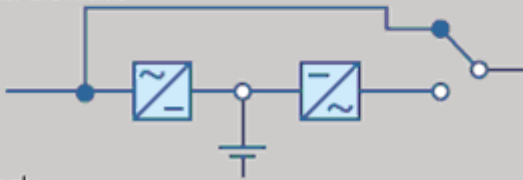
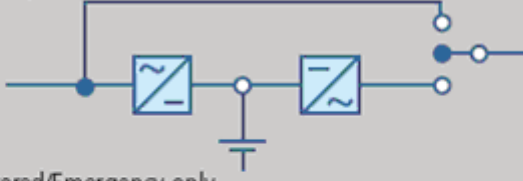
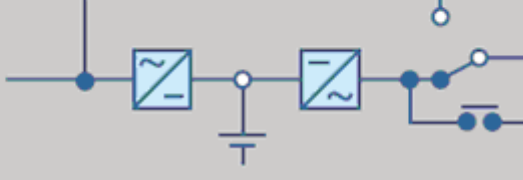
LAN, Server and Datacenters: the 0.9 output power factor ensures greater active power availability for efficient UPS loading.

e-business and Telecommunications: parallel operation means that the installed UPS size can be increased (up to 6 units) to keep pace with the growth of the organisation.

Industrial processes and electro-medical systems: the UPS is designed to protect a range of loads, from industrial processes to electro-medical applications. This has been achieved through careful load analysis at the design stage of the **SAFEPOWEREVO-HF** project, to ensure the following characteristics:

- optimum input technical characteristics 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) for long back-up times.

Emergency systems: the UPS can be configured to operate in any one of four operating modes to comply with EN 50171 (the Centralised Power Supply Systems) standard:

Operating modes (EN50171)	SAFEPOWER-EVO-HF Configurations
<p>1. Always powered</p>  <p>2. Powered from the mains</p>  <p>3. Emergency only</p>  <p>4. Always powered/Emergency only</p> 	<p>The UPS operates in the following mode: ON-LINE (See chapter 6 "Ups descriptions")</p> <p>The UPS operates in the following mode: ECO-MODE (See chapter 6 "Ups descriptions")</p> <p>The UPS operates in the following mode: STAND BY-OFF (See chapter 9.4 "Configuration Software")</p> <p>The UPS operates in the "ON LINE" MODE by using the POWERSHARE socket (see the operating manual)</p>

5. CONFIGURATIONS

The UPS can be installed as a single, stand-alone UPS and this format is most commonly used for relatively straight forward installations. This can be expanded up to 6 units in order to meet load power demands or to introduce a level of redundancy.

Parallel configuration

Up to 6 UPSs can be connected in parallel to increase the power of the uninterruptible power system (power parallel) or to enhance its reliability (redundant parallel).

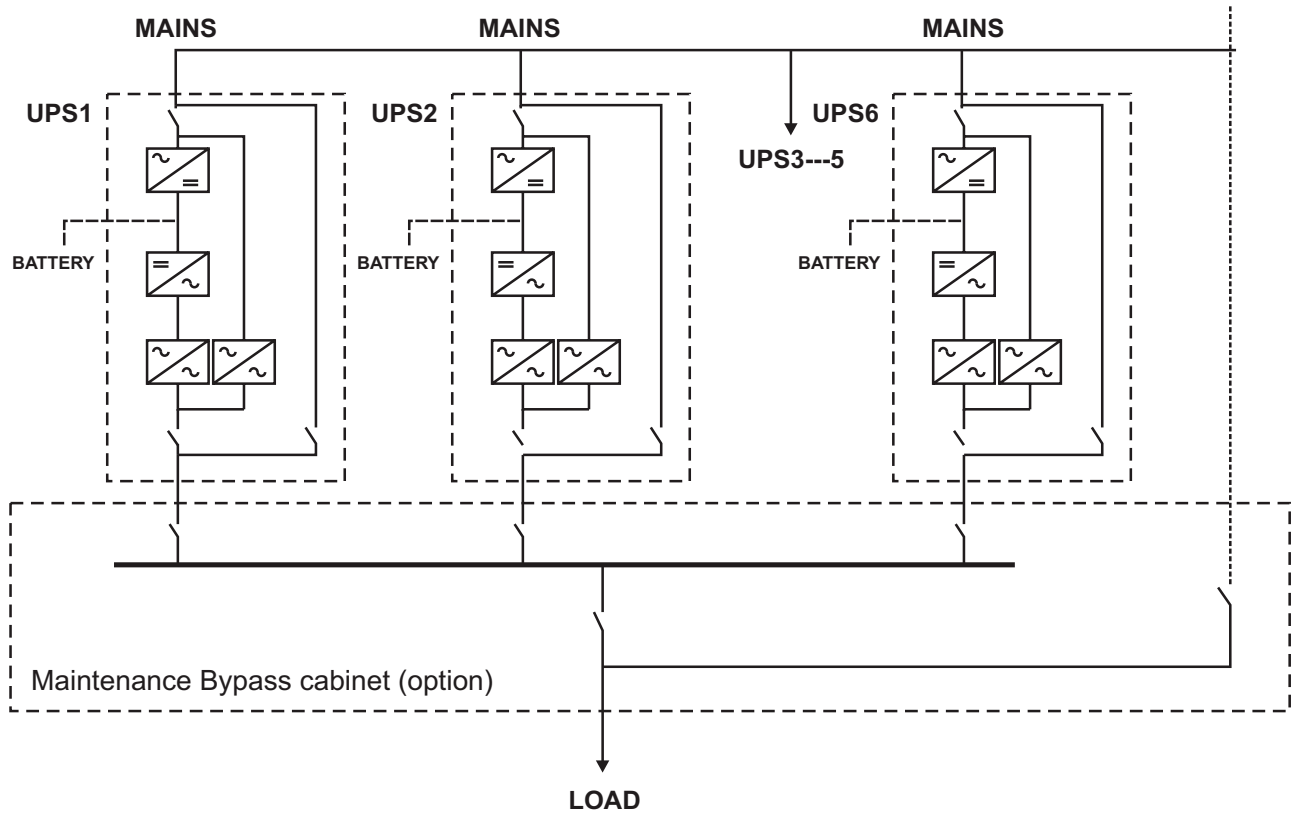
The system is defined as "redundant parallel" when the stoppage of one or several UPSs does not determine the loss of the power supply.

All the UPSs power the load simultaneously with automatic sharing of the current.

The units exchange information on the operating status and the sync signals by means of the RS485 connections in loop with dual redundancy. This means that even in the event of the accidental interruption of both connections, only the UPS affected by this interruption cuts itself off, while the other one continues to operate without any interference.

The “**Hot System Expansion**” feature means that a new UPS can be added to the system while the other units are on-line and powering the load from the inverter.

The integrated UPS will configure itself automatically with the system data without any disturbance to the load.



NOTE: for realizing a parallel configuration where is required a transformer connected downstream each single UPS please contact the manufacturer in advance

6. UPS DESCRIPTION

The UPS can be operated in four main operating modes: ON-LINE, FREQUENCY CONVERTER, ECO MODE and SMART ACTIVE and in their main variants described in following paragraph.

Mode: ON-LINE

Normal Operation: the 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.

Emergency Operation: if the mains power supply wanders outside the permitted input range (voltage and frequency), the rectifier is shut down and the Inverter is automatically powered by the battery set for the preset back-up time and without disruption to the load. When the mains power supply returns, the rectifier gradually starts up, charging the batteries and eventually powers the Inverter.

Operation from By-pass: if an Inverter overload exceeds permitted limits (or is manually shutdown), the load automatically transfers to the emergency bypass via the static switch and without disruption to the load.

Mode: FREQUENCY CONVERTER

The UPS can be configured as a frequency converter (with "UComGP"), therefore when the input frequency is 50Hz the output frequency can be 60Hz and vice versa. During this mode of operation the automatic by-pass is disable. The UPS can work in frequency converter mode with or without the batteries (must be set up with "UComGP").

Mode: ECO

The load is normally powered from the emergency bypass supply and the rectifier maintains battery charge. When the mains power supply wanders outside the permitted input range, the load is automatically transferred to the output of the Inverter until the mains power supply returns within range.

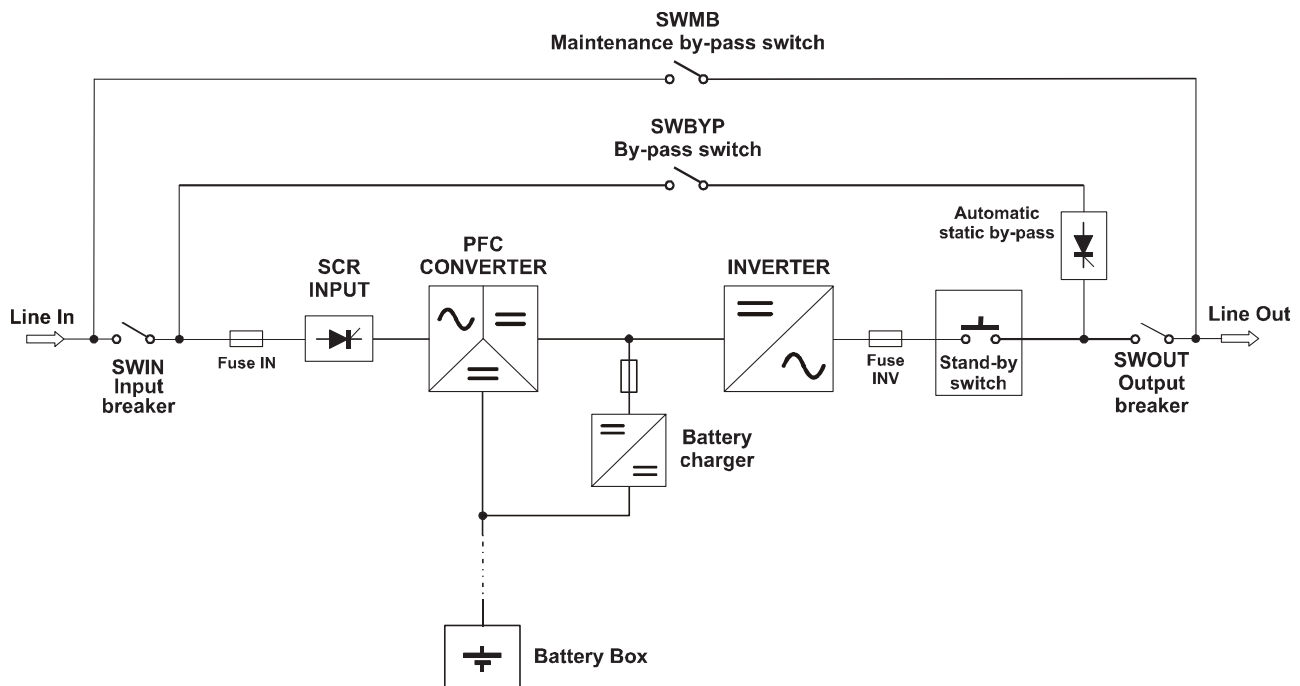
This mode is useful when powering loads that do not require the regulated no-break supply from the Inverter and allows the system to achieve an efficiency up to 99%.

Mode: SMART ACTIVE

When the UPS is configured to operate in SMART ACTIVE mode, it automatically selects whether to operate in ON-LINE or ECO mode.

The decision is made based on statistical calculations performed by the UPS and based on the quality of the mains and bypass supplies: if the latter remains suitable for a certain period, the unit selects ECO mode, otherwise it remains in ON-LINE mode.

The **SAFEPOWEREVO-HF** block diagram is as follows:

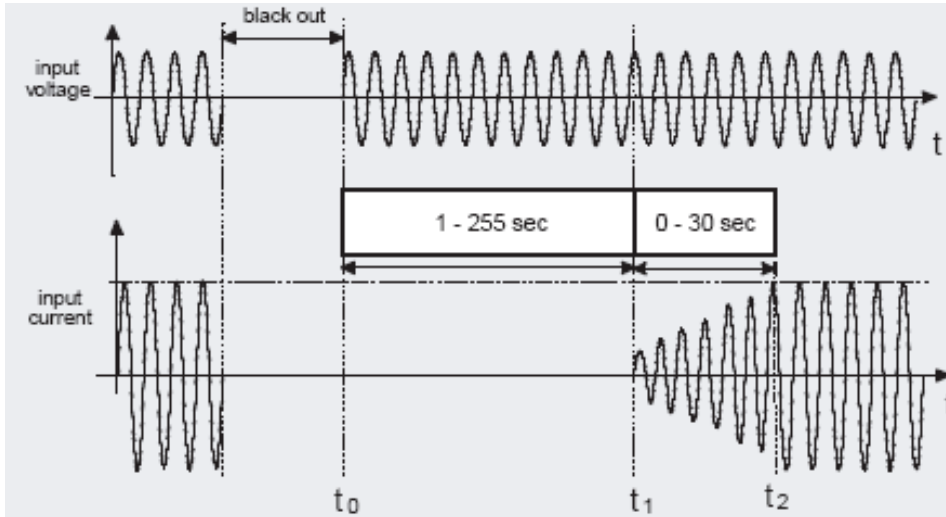


6.1 PFC CONVERTER (ZERO IMPACT SOURCE)

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 to a value suitable with which to power the Inverter. The PFC control technology using Digital Signal Processing (DSP) microprocessors and IENT power semiconductors to achieve a low impact on the power supply source, low harmonic distortion and high input power factor. A zero impact on the supply source is achieved due to the following characteristics:

- **Negligible Input Harmonics:** upstream generators and transformers (including distribution) can be reduced due to the negligible input harmonic distortion of 3% and high input power factor > 0.99.
- **Delayed switching of UPS -t0-T1 (Power Walk in-start Delay):** when the mains power supply returns, the UPS delays switching of the input stage for a period of time that can be set between 0 and 255 seconds (5 seconds standard). This function is particularly useful when the mains power supply returns after an interruption (or when the generator set is started) and the source must supply various UPS or, more typically, multiple users.

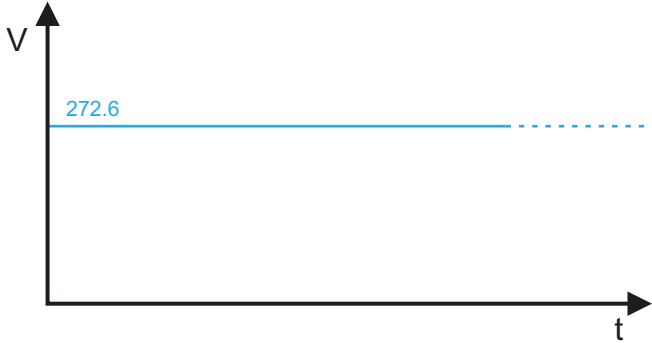
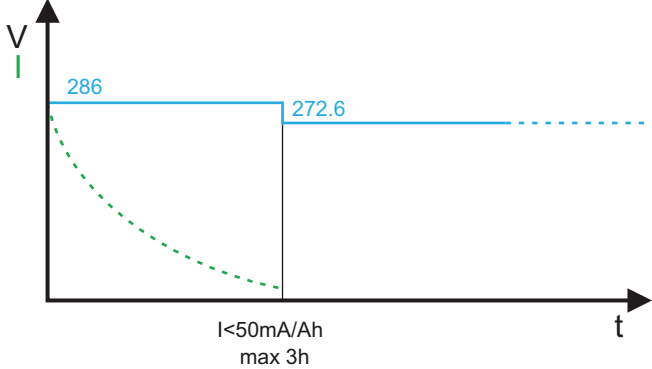
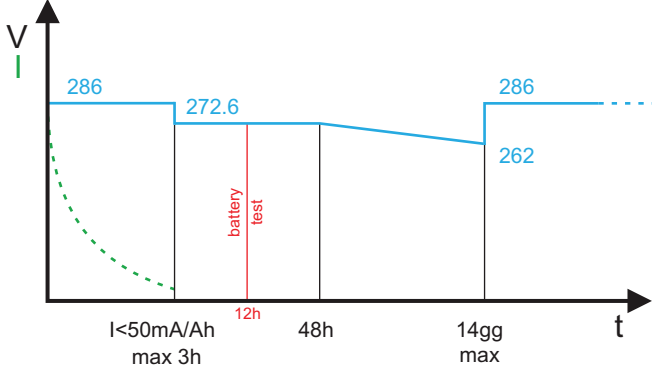
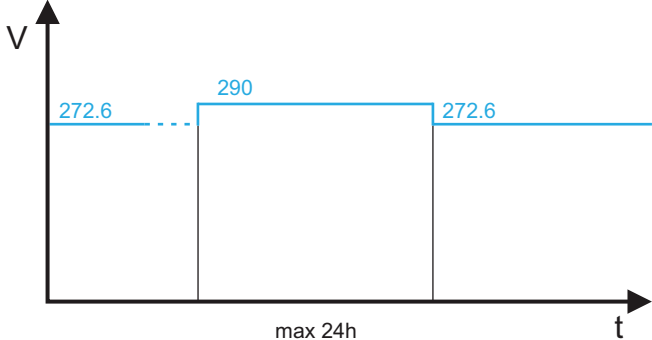
- **Progressive rectifier start-up – t_1 - t_2 (Power Walk-in duration):** when the mains power supply returns, absorption of the mains power supply progressively reaches the nominal value within a time period that can be set from 5 to 30 seconds. This function is normally disabled.



6.2 BATTERY CHARGER (Battery Care System)

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

- a) **Battery recharging:** the UPS can be used with sealed lead batteries (VRLA), AGM, open-vented and NiCd batteries. According to the type of battery used two recharge methods are available:

Recharging modes (selectable by "UComGP")	SAFEPOWEROVO-HF configurations
 <p>A graph showing Voltage (V) on the y-axis and time (t) on the x-axis. A horizontal blue line is drawn at 272.6V, extending across the time axis. A dashed line follows the blue line to the right.</p>	<p>Floating (standard configuration): the charge state of the battery is continuously monitored; when the mains power supply is present, the batteries are charged at a preset voltage level and limited current relative to the recharge time required and the capacity of the battery itself.</p>
 <p>A graph showing Voltage (V) on the y-axis and time (t) on the x-axis. The voltage starts at 286V, then drops to 272.6V. A dashed green line shows the battery voltage decreasing over time. Below the graph, it says "I < 50mA/Ah max 3h".</p>	<p>Two-level recharge (configurable): this recharge is at limited current with two levels of voltage. In the first instance, the process uses a quick charge voltage, whilst in the second stage a float charge. This type of charging is mainly used with open-vented batteries or other types when an accelerated recharge time is required.</p>
 <p>A graph showing Voltage (V) on the y-axis and time (t) on the x-axis. The voltage profile consists of several stages: a charge phase at 286V, a discharge phase at 272.6V, another charge phase at 286V, and a discharge phase at 262V. A dashed green line shows the battery voltage decreasing during discharge. Below the graph, it says "I < 50mA/Ah max 3h", "12h", "48h", and "14gg max".</p>	<p>Cyclical recharge: this recharge is sometimes recommended by battery manufacturers to prolong the battery life. It consists of battery charge and discharge cycles as indicated in the diagram.</p>
 <p>A graph showing Voltage (V) on the y-axis and time (t) on the x-axis. The voltage starts at 272.6V, rises to 290V, and then returns to 272.6V. A dashed blue line follows the solid blue line to the right. Below the graph, it says "max 24h".</p>	<p>"Commissioning charge": this charge method is useful every time new batteries are installed in the UPS. By increasing the voltage to 290 volts for a maximum of 24 hours, perfect equalisation of the battery charge is assured, thus guaranteeing a uniform discharge and wear of the battery monoblocks.</p>

The various recharge methods and the preset voltage values are defined using UComGP.

The presence of the external temperature sensor option will activate compensation of the voltage depending on the temperature with the battery backup voltage (272V for 20 battery blocks)

- b) **Battery test:** during normal operation the battery is automatically tested at regular intervals. The battery test can also be manually activated. The test is performed to ensure a limited battery discharge and impact on overall life expectancy. If the test returns a negative result a warning is displayed on the UPS panel (or remote panel, if installed).
- c) **Protection against slow discharges:** for long runtimes and low load discharges, the end of discharge voltage is raised to approximately 1.8V/eh as recommended by the battery manufacturers to avoid a deep discharge state.
- d) **Ripple current:** recharge ripple current (residual AC component) is one of the most important causes of poor battery reliability and reduced operating life. The UPS battery charger is a high-frequency design with a negligible level of ripple current,
- e) **Battery recharge limit current:** The battery recharge current is limited to a prefixed value of $C_{nom}/8$ (i.e. 12.5% C_{nom})
- f) **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.
- g) **UPS without batteries:** the UPS must always be operated with the batteries connected; if they are not connected alarms will be generated and the UPS will not be able to perform to specification.

6.3 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.

The Inverter is an IENT (Isolated Gate Bipolar Transistor) based three-phase design; the IENT is a transistor that allows high commutation 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 under any operating condition:

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 $\pm 3\%$, (within the values defined by class 1 of the EN 62040-3 standard).

Frequency adjustment

The Inverter output frequency is generated autonomously by an internal oscillator, in synchronisation with the bypass supply. Frequency stability is operating condition dependent:

- a) **Frequency stability**
 - a. With mains power present: the internal oscillator follows any frequency variations in the bypass supply and in relation to the preset value - normally $\pm 5\%$ (configurable from $\pm 0.25\%$ to $\pm 10\%$).
 - b. With no supply present: the Inverter autonomously generates the frequency of the output voltage with a stability of $\pm 0.01\%$.
- b) **Frequency variation speed**

The maximum Inverter output frequency variation (to lock to that of the bypass supply) is 1Hz/s (adjustable from 0.5 to 2Hz/s).

Distortion of the output voltage

Inverter output waveform distortion with a linear load is maintained within $\pm 1\%$. Within a non-linear load, as defined by the EN 62040-3 standard, output voltage distortion does not exceed $\pm 3\%$.

Overload

The inverter is sized to provide a power overload for a limited length of time (see the limits indicated in the **Technical specifications 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 whilst the UPS is operating from the batteries, the Inverter will carefully analyse the output voltage and current in order to distinguish if the short circuit is genuine or an overload.

- During battery operation (mains power supply failure) the Inverter can supply a current limited to 150% for 500ms.
- When the mains power supply is present, the Inverter will switch to bypass supplying a current limited to for 500ms.

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 (Nominal current)/7
Magneto-thermal switches (Curve C)	I_n (Nominal current)/7
Ultra-rapid fuses (GF)	I_n (Nominal current)/2

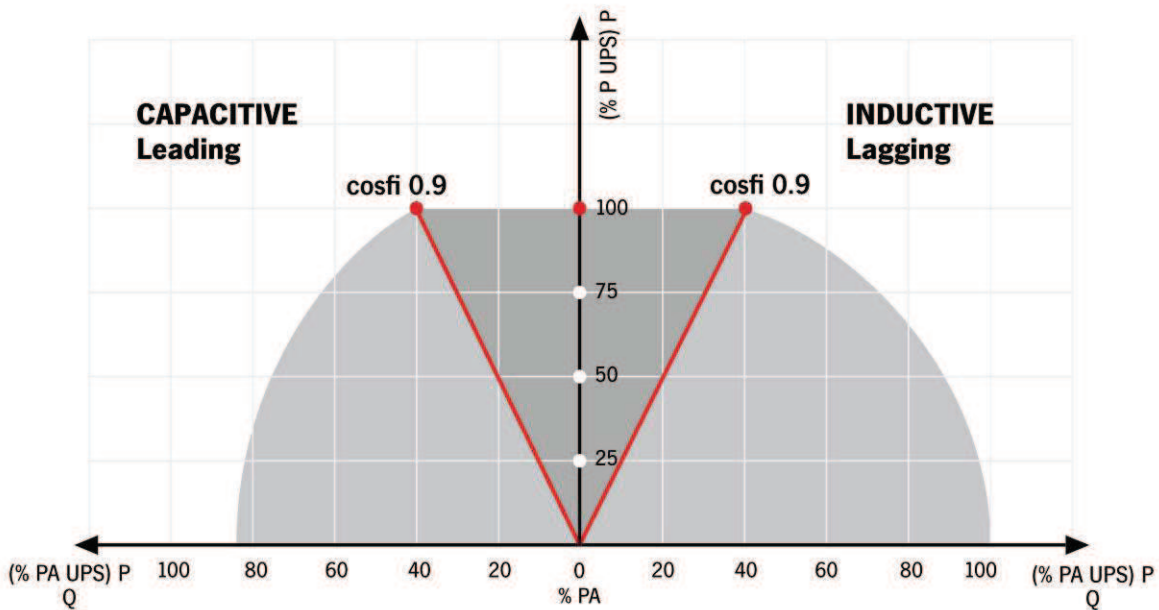
Output voltage symmetry

Under all conditions, output voltage symmetry is maintained within $\pm 1\%$, for balanced loads and $\pm 2\%$ for unbalanced loads of 100% (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 separation angle of $120^\circ \pm 1^\circ$ for balanced loads and 100% for unbalanced loads.

Performance of a 3-phase Inverter with reactive loads



6.4 STATIC SWITCH (*Automatic Bypass*)

A static switch is an electronic device that can automatically transfer the loads connected to the UPS to the bypass supply in an emergency for example when:

- a) the Inverter is shut down manually;
- b) Inverter overload limits are exceeded;
- c) internal over temperature limits are exceeded;
- d) the Inverter fails;
- e) DC voltage goes outside the permitted range.

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

Emergency Supply Voltage

Transfer to the emergency supply only takes place if the voltage and the frequency are considered 'suitable' for the load and the limits for transfer can be set on-site by the UPS user.

- Voltage range: $\pm 10\%$ (settable from -20% to $+15\%$);
- Frequency range: $\pm 5\%$ (settable from $\pm 0.25\%$ to $\pm 10\%$)

Overload

The static switch has no over current protection devices to guarantee maximum continuity. Overload protection is provided by protective devices within the overall installation to ensure UPS compatibility.

The UPS static switch is sized to support the following overload periods:

- 110% permanently
- 133% for 60 minutes
- 150% for 10 minute
- $>150\%$ for 2 seconds

Under short circuit conditions, the UPS will prevent transfer to bypass for 0.5 seconds; thyristors with I_{2t} ($T_j=125^\circ\text{C}$) = 80000A2s for 60-80kVA and 125000A2s for 100-120kVA.

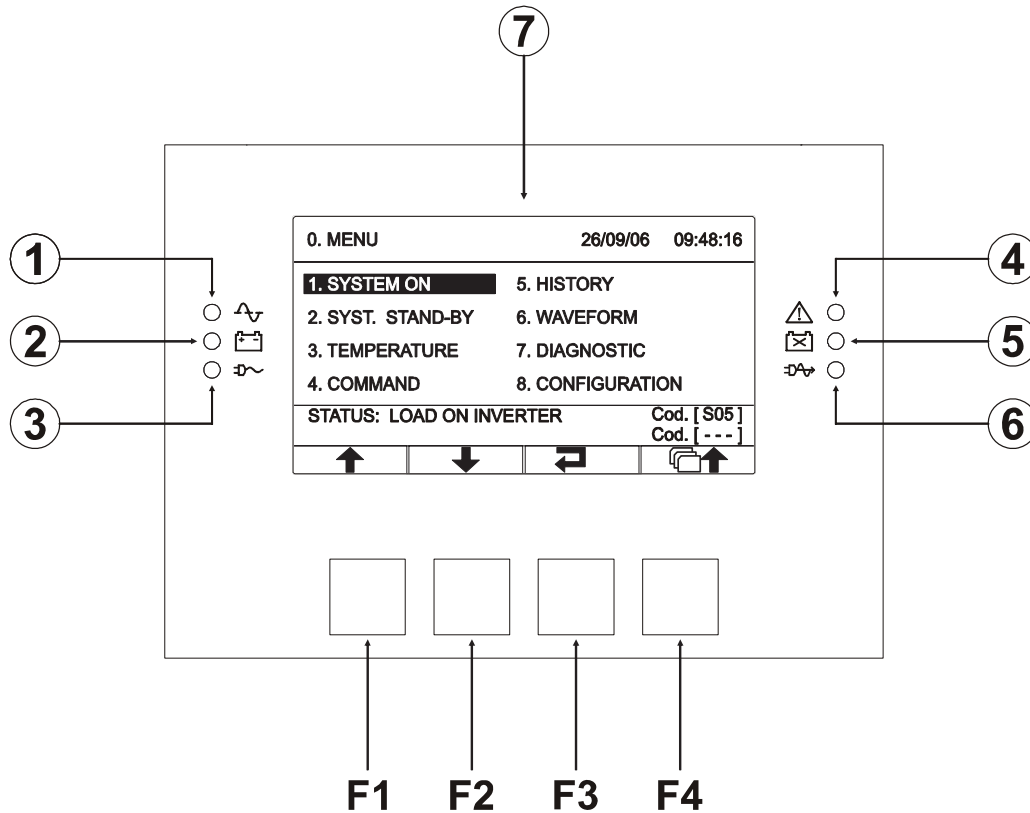
Redundant Auxiliary Power Supply for the Automatic Bypass

The UPS is equipped with a redundant auxiliary power supply to allow the automatic bypass to function even if the main power supply has failed.

If the UPS fails in addition to the main power supply, the load is powered through the automatic bypass. The multi processor card and control panel are not powered, and for this reason, all LEDs and the display are off.

7. CONTROL PANEL

The control panel consists of a graphical display, 6 visual warning LEDs and 4 function keys.



- | | |
|-----------------------------|-----------------------------|
| ① LED for mains operation | ⑤ LED for replace batteries |
| ② LED for battery operation | ⑥ LED for ECO mode |
| ③ LED for load on bypass | ⑦ Graphical Display |
| ④ LED for stand-by/alarm | |

F1, F2, F3, F4= FUNCTION KEYS. The function of each key is illustrated in the lower part of the display and varies according to the menu.

Messages are available in the following languages: Italian, English, French, German, Spanish, Polish, Chinese and russian.

At the centre of the control panel there is a wide-area graphical display providing a detailed real-time overview of the UPS operational state. From the control panel the user can switch the UPS on/off, read electrical measurements - mains, output, battery, etc, and set the main operational parameters.

The display is divided into four main areas, each with a specific function:

1 GENERAL INFORMATION

An area permanently showing the date and time and according to the level of display, either the UPS model or the title of the menu active at that time.

2 DATA DISPLAY/NAVIGATION MENU

The main area of the display showing key UPS measurements (constantly updated in real-time). The user can also select and view various menus using the appropriate function keys. 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 STATE / ERRORS – FAILURES

An area in which the UPS operating state is shown. The first line is always active and constantly displays the state of the UPS at any given time; the second line is active only if an error and/or failure of the UPS occurs and shows the type of error/failure found. Each line on the right shows the code corresponding to the current event.

4 EVENT LOG

An area showing chronological events recorded (supply voltage out of range, high temperature, overload, etc.) and alarms. The log records 960 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 using the scroll keys; the log can be downloaded in TXT format using the UPSTools configuration software.

5 KEY FUNCTIONS

An area divided into four sections, one for each of the function keys. According to the menu active at any time, the display will show the corresponding function key in the appropriate box.

When an alarm appears an audible warning will sound.

Measurements

- Input voltage and frequency
- By-pass voltage and frequency
- Output voltage, current and frequency
- Output power (VA, W and %)
- Output peak current
- Battery voltage
- Battery current (charge/discharge)
- Internal temperature (control logic, power modules, battery charger, internal batteries)
- External battery temperature
- Back-up time

8. ISOLATING SWITCHES

The UPS is supplied with the following isolating switches located and accessible from behind the case front door:

- ① SWMB
Manual by pass

- ② SWOUT
output

- ③ SWIN
input

- ④ SWBYP
by pass

9. COMMUNICATION

Communication ports

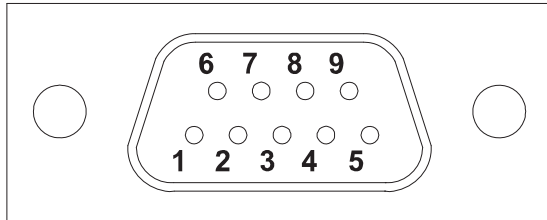
The rear panel (see UPS rear view) provides access to the following communication ports:

- Serial port, available with RS232 connector and USB connector.
NOTE: the use of one connector automatically excludes the other.
- Expansion slot for additional slot-in communications interface cards

Behind the front terminal panel, a further expansion slot is available for a volt-free signal card (optional 250Vac, 3A, 4 programmable contacts).

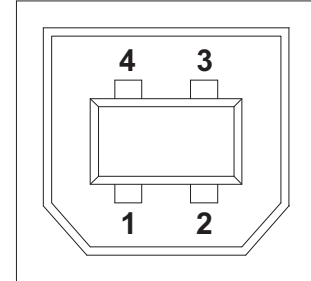
RS232 and USB Connectors

RS232 Connector



PIN #	NAME	TYPE	SIGNAL
1		IN	
2	TX	OUT	TX serial line
3	RX	IN	RX serial line
4			
5	GND	POWER	
6		OUT	
7			
8	+15V	POWER	Isolated power supply 15V±5% 80mA max
9	WKATX	OUT	ATX power supply wake-up

USB Connector



PIN #	SIGNAL
1	VBUS
2	D-
3	D+
4	GND

Communication Slots

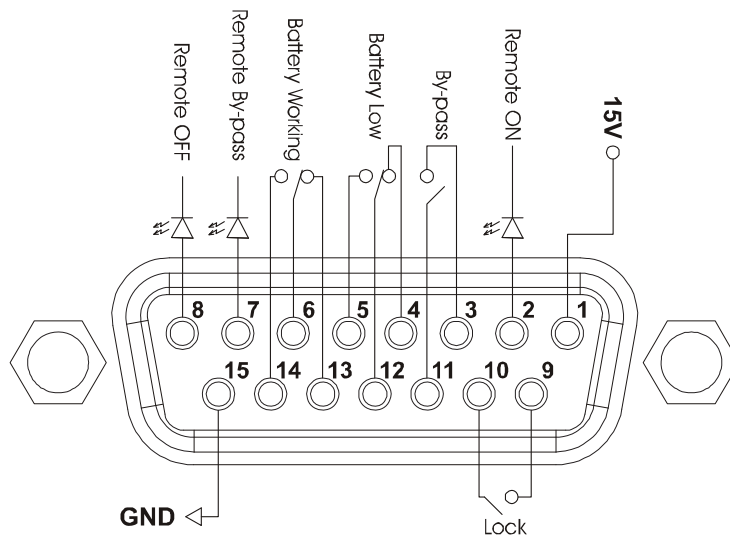
The UPS has two panel expansion slots for slot-in interface accessories that can be used for a variety of communications options including:

- Second RS232 port
- Serial port duplicator
- Ethernet network agent with TCP/IP protocol, HTTP and SNMP
- RS232 + RS485 port with JBUS/22#MODBUS protocol

For further accessory information please visit our website.

AS400 Port

AS400 PORT



PIN #	NOME	TIPO	FUNZIONE
1	15V	POWER	Isolated auxiliary power supply +15V± 5% 80mA max
15	GND	POWER	Ground for the isolated auxiliary power supply (15V) and remote controls (Remote ON, Remote BYPASS, Remote OFF)
2	REMOTE ON	INPUT #1	By connecting pin 2 with pin 15 for at least 3 seconds the UPS switches on
8	REMOTE OFF	INPUT #2	By connecting pin 8 to pin 15 the UPS is shut down immediately
7	REMOTE BYPASS	INPUT #3	By connecting pin 7 to pin 15 the load power supply switches from inverter to bypass. For as long as the connection is made, the UPS continues to operate on bypass even if the input mains supply fails. If the jumper is removed with the mains power supply present, the UPS will resume operation and the load will be powered by the inverter. If the jumper is removed with the mains power supply fails, the UPS will resume operation on battery power.
4,5,12	BATTERY LOW	OUTPUT #1	Reports that the batteries are at the end of discharge when contact 5/12 is closed ⁽¹⁾
6,13,14	BATTERY WORKING	OUTPUT #2	Reports that the UPS is operating on battery power when contact 6/14 is closed
9,10	LOCK	OUTPUT #3	When the contact is closed, reports that the UPS is blocked ⁽¹⁾
3,11	BYPASS	OUTPUT #4	When the contact is closed, reports that the bypass supply is powering the load

NOTE: The diagram shows the contacts present inside the UPS that can provide a maximum current of 0.5A at 42Vdc. The position of the contacts in the diagram is shown without alarms or warnings.

⁽¹⁾ The output can be programmed through the appropriate configuration software. The function shown is the default (configured by the manufacturer).

9.1 EMERGENCY SHUTDOWN (R.E.P.O.)

This isolated input is used to switch off the UPS in an emergency. The UPS is supplied with the "Remote Emergency Power Off" (R.E.P.O.) terminals short circuited. At installation, remove the short-circuit and connect to the normally closed contact of the shutdown device , using a double-insulating cable.

When activated from a remote push-button or other device in an emergency, 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. When it is closed (normal condition), a maximum current of 15mA flows.

After an emergency shutdown, the UPS will return to on-line operating mode only when it receives a startup command from the mimic panel (provided that the Remote Emergency Power Off device is not still active).

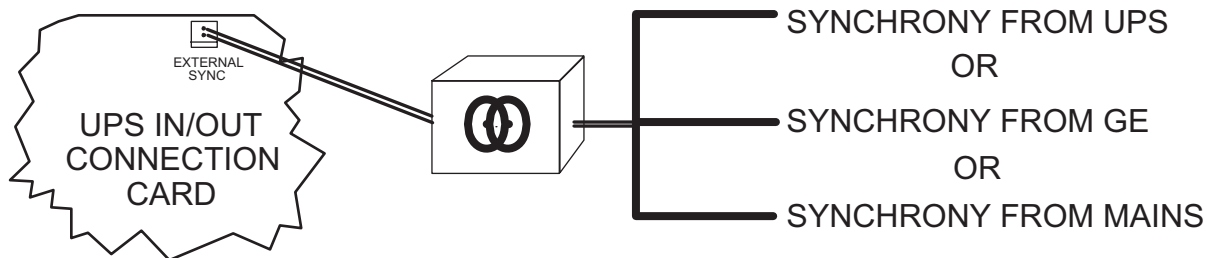
9.2 EXTERNAL SYNCHRONISATION

This non-isolated input can be used to synchronise inverter output with a suitable signal from an external source. It is essential when the **SAFEPOWEREVO-HF** is used in combination with Static Switch Transfer Systems.

At installation, it is important to:

- use an isolation transformer with isolated single-phase output (SELV), 12-24ac and power = 0.5VA
- connect the transformer secondary to the "EXTERNAL SYNC" terminal through a double-insulation cable with cross-sectional area of 1 sq.mm.

The external synchronization must be enabled through the advanced configuration software (UComGP) assigned to authorized personnel.



9.3 MONITORING AND CONTROL SOFTWARE

The UPS is supplied with Powershield³ UPS monitoring and control software to provide the following:

- Chronological event recording
- UPS operating status management
- E-mail, modem, SNMP agent support
- Sequential shutdown and load-shedding within a network environment

9.4 CONFIGURATION SOFTWARE

User can modify some of the UPS configurations from the operating mimic panel; here below the list of adjustable functions:

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
Language*	Selects mimic panel language	English	<ul style="list-style-type: none"> • English • Italian • German • French • Spanish • Polish • Turkish • Chinese
Output voltage	Selects the rated output voltage (Phase - Neutral)	230V	<ul style="list-style-type: none"> • 220V • 230V • 240V
Buzzer	Selects the audible alarm operating mode	Reduced	<ul style="list-style-type: none"> • Normal • Reduced: does not sound due to the momentary intervention of the bypass
Operating mode**	Selects one of five different operating modes	ON LINE	<ul style="list-style-type: none"> • ON LINE • ECO • SMART ACTIVE • STAND-BY OFF
Battery low **	Estimated autonomy time remaining for "battery low" warning	3 min.	1 ÷ 7 @1 min step
Date and time**	UPS internal watch setup		

* Pressing the F1 and F4 keys at the same time for $t > 2$ sec will automatically reset English as default language.

** This function might be locked by configuration software.

Authorized service centers can modify all UPS configurations through configuration software ("configurator" of UCom GP program) as below defined:

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
BASIC			
Operating mode	Selects one of five different operating modes	ON LINE	<ul style="list-style-type: none"> • ON LINE • ECO • SMART ACTIVE • STAND-BY OFF • Frequency converter
Output voltage	Selects the rated output voltage (Phase - Neutral)	230V	<ul style="list-style-type: none"> • 220 ÷ 240 1 V step • 200V with power downgrading • 208V with power downgrading
Output nominal frequency	Selects the rated output frequency	50Hz	<ul style="list-style-type: none"> • 50Hz • 60Hz
Autorestart	Waiting time for automatic power-on after the return of mains voltage	5 sec.	<ul style="list-style-type: none"> • Disabled • Delay: 1 - 255 @1 sec step
Auto power off	Automatic UPS power-off in battery operation mode if the charge is lower than 5%	Disabled	<ul style="list-style-type: none"> • Enabled • Disabled
Buzzer Reduced	Selects the audible alarm operating mode	Reduced	<ul style="list-style-type: none"> • Normal • Reduced: does not sound due to the momentary intervention of the bypass
Power share off	Selects the auxiliary socket operating mode	Always connected	<ul style="list-style-type: none"> • Always connected • Disconnection after n seconds of battery operation • Disconnection after n seconds from the battery low pre-alarm signal • ... (see UPSTools manual)
FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
ADVANCED			
Autonomy limitation	Maximum battery operation time	Disabled	<ul style="list-style-type: none"> • Disabled (complete battery discharge) • 1 - 65534 @1 sec step
Maximum load	Selects the user overload limit	Disabled	<ul style="list-style-type: none"> • Disabled • 0 - 103 @1 % step

Power walk-in duration	Activates the gradual return to mains voltage mode	Disable	<ul style="list-style-type: none"> • Disable (0 sec set up) • Enable 1 ÷ 125 @1 sec step
Auto system on	Automatic UPS power-on	Disable	<ul style="list-style-type: none"> • Disable • Enable
Bypass Synchronization speed	Selects the synchronisation speed of the inverter to the bypass line	1 Hz/sec	<ul style="list-style-type: none"> • 0.5 Hz/sec • 1 Hz/sec • 1.5 Hz/sec • 2 Hz/sec
Panel lock - Enable config change	Disables UPS settings from the Display Panel	Settings enabled	<ul style="list-style-type: none"> • Settings enabled • Settings disabled
Panel lock - Enable command	Disables command from the Display Panel	Commands enabled	<ul style="list-style-type: none"> • Commands enabled • Commands disabled
External synchronization	Selects the source of synchronisation for the inverter output	From bypass line	<ul style="list-style-type: none"> • From bypass line • From external input • From bypass line if within the limits; from external input otherwise
External temperature	Activates reading of the external temperature probe	Disable	<ul style="list-style-type: none"> • Disable • Enable
Communication speed Slot 1	Communication speed for serial port (Slot 1)	1200bps	<ul style="list-style-type: none"> • 1200bps (PRTK GPSER11201..) • 9600bps (PRTK GPSER19601..)
Communication speed Slot 2	Communication speed for serial port (Slot 2)	1200bps	<ul style="list-style-type: none"> • 1200bps (PRTK GPSER11201..) • 9600bps (PRTK GPSER19601..)

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
BYPASS			
Separated bypass line	UPS bypass line separated from rectifier line	Separated bypass line	<ul style="list-style-type: none"> • Common bypass line • Separated bypass line
Bypass mode	Selects the mode of use of the bypass line	Enabled / High sensitivity	<ul style="list-style-type: none"> • Enabled / High sensitivity • Enabled / Low sensitivity • Disabled with input/output synchronisation • Disabled without input/output synchronisation
Bypass active in stand-by	Load supply from bypass with UPS in stand-by	Disable (load NOT supplied)	<ul style="list-style-type: none"> • Disable (load not supplied) • Enable (load supplied)
Bypass frequency tolerance	Selects the accepted range for the input frequency for switching to the bypass and for the synchronisation of the output	± 5%	<ul style="list-style-type: none"> • ± 0.25% • ± 0.5% • ± 0.75% • ± 1 - ±10 @n 1% step
Bypass min.-max. threshold	Selects the accepted voltage range for switching to the bypass	Low: 180V High: 264V	<ul style="list-style-type: none"> • Low: 180 ÷ 220 @ 1V step • High: 240 ÷ 264 @ 1V step
Eco mode sensibility	Selects the intervention sensitivity during operation in ECO mode	Normal	<ul style="list-style-type: none"> • Low • Normal • High
Eco mode min.-max. threshold	Selects the accepted voltage range for operation in ECO mode	Low: 200V High: 253V	<ul style="list-style-type: none"> • Low: 180 ÷ 220 @ 1V step • High: 240 ÷ 264 @ 1V step

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
BATTERY			
UPS without battery	Operating mode without batteries (for converters or voltage stabilizers)	Operating with Batteries	<ul style="list-style-type: none"> • With Batteries • Without Batteries
Battery low time	Estimated autonomy time remaining for “battery low” warning	3 min.	<ul style="list-style-type: none"> • 1 - 255 @1 min step
Autorestart voltage	Minimum Battery voltage for automatic restart	236V	<ul style="list-style-type: none"> • 200 ÷ 260 @ 1V step
Automatic battery test	Interval of time for the automatic battery test	40 ore	<ul style="list-style-type: none"> • Disabled • 1 - 1093 @n 1 hour step
Parallel common battery	Common Battery for parallel UPS systems	Disable	<ul style="list-style-type: none"> • Disable • Enable
Internal battery capacity	Nominal Battery capacity for internal batteries	Change according with UPS model	<ul style="list-style-type: none"> • 0 – 18 Ah @1 Ah step
External battery capacity	Nominal Battery capacity for external batteries	7Ah for UPS without internal batteries; 0Ah all other cases	<ul style="list-style-type: none"> • 0 ÷ 999 @ 1Ah step
Battery charging algorithm	Algorithm and Battery recharging threshold (#)	Two levels	<ul style="list-style-type: none"> • Floating • Two levels • Cycling recharge • Customised

Battery recharging current	Recharging current compare to battery nominal capacity (%)	12%	<ul style="list-style-type: none"> • 3 ÷ 50 @ 1% step
Internal charger	Nominal recharging current for internal battery charger	Change according with UPS model	<ul style="list-style-type: none"> • 6 Amps • 10 Amps • 20 Amps • 25 Amps
Additional charger (external)	Nominal recharging current for external battery charger (not inside UPS)	0A	<ul style="list-style-type: none"> • 0 ÷ 100 @ 1Amp step

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS
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EXTERNAL I-O			
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Input contact #3 mode	Input contact port setting (AS400 port or MultiCOM 382)		see software configuration manual
Output contact #1-#2-#3-#4 mode	Output contact port setting (AS400 port or MultiCOM 382)		see software configuration manual

(#) Batteries voltage configuration			
Battery custom thresholds	Recharging voltage	±286 V	<ul style="list-style-type: none"> • ±260 ÷ ±300 V
	Floating voltage	±273 V	<ul style="list-style-type: none"> • ±260 ÷ ±300 V
	Battery low voltage	±220 V	<ul style="list-style-type: none"> • ±210 ÷ ±240 V
	End discharge voltage	±204 V	<ul style="list-style-type: none"> • ±190 ÷ ±230 V
	Recharging current	12 %	<ul style="list-style-type: none"> • 3 ÷ 50 %

10. UPS CABINET

The cabinet is made of galvanised steel with an IP20 rating (degree of Ingress Protection), even with the front door open.

Ventilation via the rear panel; air intake is front to rear.

The main assemblies (including the power module and magnetics) are temperature monitored.

11. OPTIONS

11.1 COMMUNICATION

PowerNETGuard is a centralised UPS management and control software package using the SNMP communications protocol. It is the ideal UPS management tool for IT/EDP managers running datacenters and medium-to-large-sized networks.

The main features of the software include:

- Various display levels by geographical areas, building plans, maps.
- Multi-user accesses with various security levels.
- Compatible with RFC 1628 standard SNMP agents.
- Graphical representation and file backup of operating measurements
- Notification of alarms via email and SMS.
- Integrated Wap Server for display of alarms.
- Suitable for operation with Windows operating systems: (98, ME, NT, 2000, 2003, and Xp) Linux, Mac OS X, Solaris 8 and 9.

Hardware

Two slots are available in which to house one or two of the following options:

- a) **NetMan 102 Plus:** the NetMan Plus network agent allows UPS management across a LAN using any of the main network communication protocols - TCP/IP, HTTP and network interface (SNMP). NetMan Plus enabled UPS integrate easily into medium and large sized networks and provide reliable communications between the UPS and management systems employed.
- b) **MultiCom 302:** a Modbus/Jbus protocol converter through an RS232 or RS485 output for monitoring the UPS, for example, from a BMS (Building Management System). It also provides a second independent RS232 serial line that can be used by other devices such as a NetMan Plus or PC.
- c) **Multicom 382:** it provides a set of relay contacts to provide UPS alarm and status indication. The contacts are connected through terminal connections. Signal contacts include Emergency Power Off (EPO), Remote Shut Down (RSD), On Battery, On Bypass, Alarm and Low battery. The contacts are change over or normally open.
- d) **Multicom 372:** MultiCOM 372 provides a UPS with an additional RS232 serial interface port. The card has Emergency Power Off (EPO) and Remote Shut Down (RSD) inputs with terminal connections.

- e) **Multi Panel:** MultiPanel is a remote monitoring device that can provide a detailed UPS status overview in real time. It is compatible with all SIEL UPS and can display values for UPS specific input and output supplies, and battery set measurements. MultiPanel has a high-definition graphical display and can report in 7 languages: English, Italian, German, French, Spanish, Russian and Chinese. It has 3 independent serial ports, one of which allows for UPS monitoring via the MODBUS/JBUS protocol (on either an RS485 or RS232 serial line). The others can be used with devices such as the Netman 101 Plus or a PC running PowerShield³ software.

11.2 EXTERNAL BATTERY TEMPERATURE SENSOR

The UPS has a special entry point for measuring the temperature inside a remote Battery Box and indicating the temperature on the UPS display.

The specific kit supplied by the manufacturer includes a bipolar double isolated cable measuring 6 meters. The use of a bipolar cable without isolation exposes the UPS and the user to risks resulting from a lack of isolation as the reading refers directly to the UPS neutral earthing.

Once installed, the device is configured using the UPSTools software package assigned to authorized personnel.

11.3 EXTERNAL MAINTENANCE BYPASS

An external remote maintenance bypass can be installed with the UPS, to allow, for example, UPS replacement without disruption to the load.

If this option is chosen, it is essential to connect the "SERVICE BYPASS" terminal located inside the UPS to the auxiliary "Normally Open "(NO) contact of the SERVICE BYPASS switch. Operation of the SERVICE BYPASS switch closes this auxiliary contact and informs the UPS. 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.

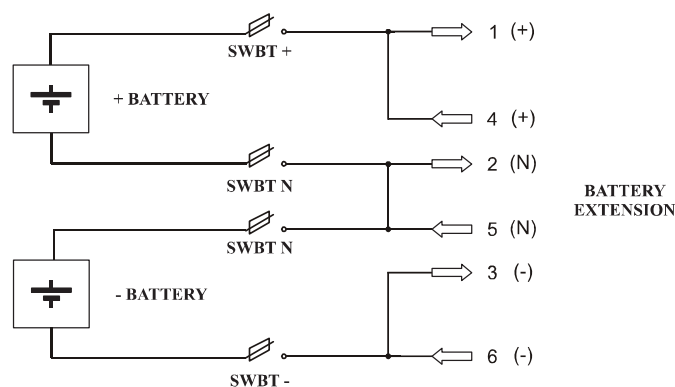
Note: Always check that the remote maintenance bypass installation (if selected) is compatible with any transformer options selected for the UPS - see paragraph 11.6 Optional Transformer.

11.4 BATTERY CABINETS

The battery cabinet can be used to provide an external battery set when.

The number of batteries housed within the cabinet varies according to UPS rating. It is therefore necessary to carefully match that Battery Cabinet DC rating to that of the UPS.

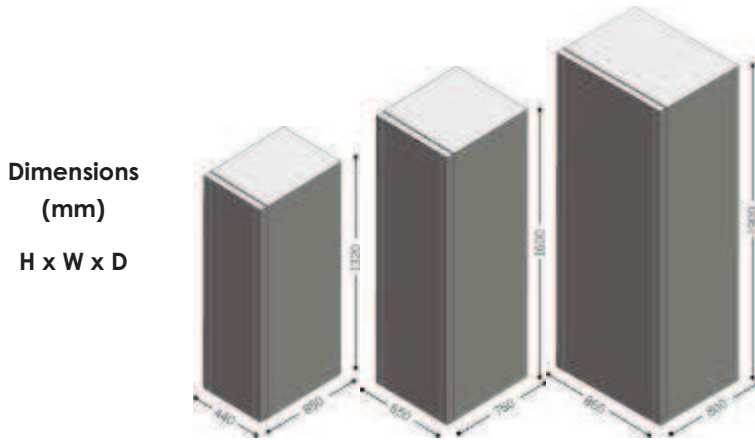
The Battery Cabinet configuration is shown below.



Other solutions may be developed on site, bearing in mind that:

- the structure of the battery enclosure must respect that described above.
- the number of batteries must remain constant (20+20 12 volt monoblocks)
- the battery capacity (expressed in AH) must fall within the range of 4 and 20 times the available recharging current (see the "**technical specifications table**")

BATTERY BOX MODELS	AB 1320-120B	AB 1600-40B	AB 1900
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AB 1320-120B	AB 1600-40B	AB 1900
(90 empty) 400Kg	(150 empty)) 730Kg	200 empty)

11.5 BATTERY CHARGER

The UPS can be furnished from the factory with a more powerful battery charger mounted in place of the standard one.

Model	SAFEPOWER-EVO-HF 60KVA	SAFEPOWER-EVO-HF 80KVA
Standard battery charger	10 Amperes	20 Amperes

Model	SAFEPOWER-EVO-HF 100KVA	SAFEPOWER-EVO-HF 120KVA
Standard battery charger	25 Amperes	25 Amperes

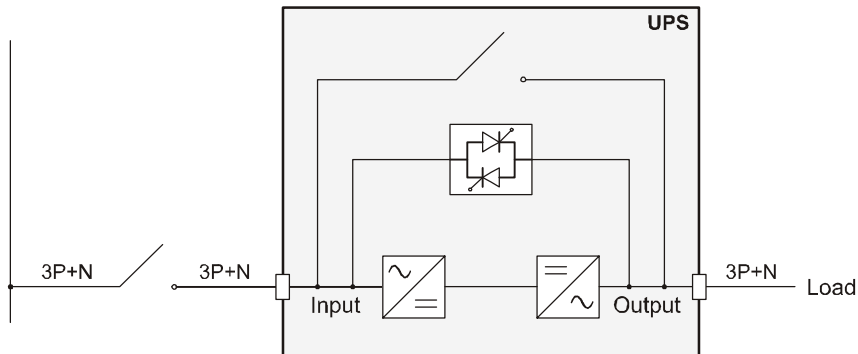
11.6 OPTIONAL TRANSFORMERS

An external transformer can be installed. Transformer options include: supply neutral reference, Galvanic isolation and output voltage (step-up or down).

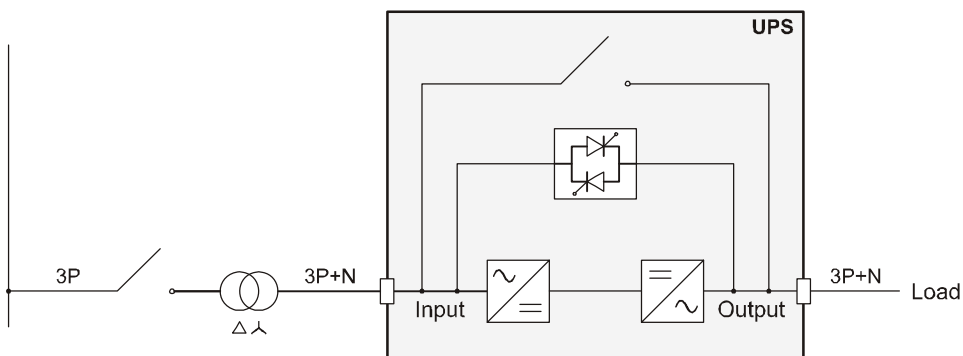
Electric connections diagrams

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

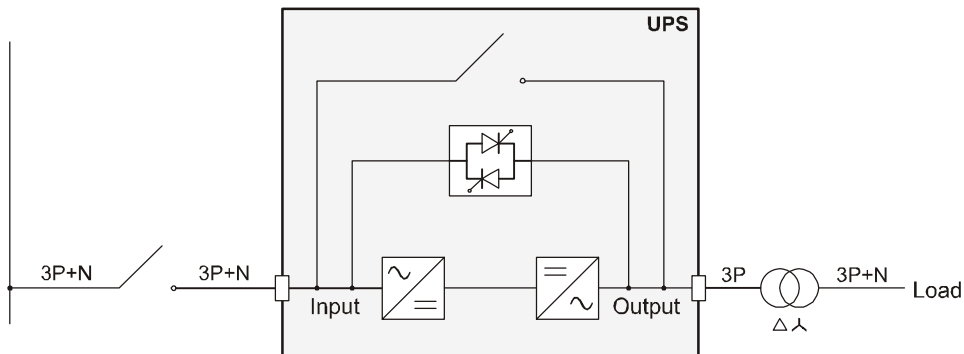
UPS without variation of the neutral arrangements



UPS with Galvanic isolation on the input

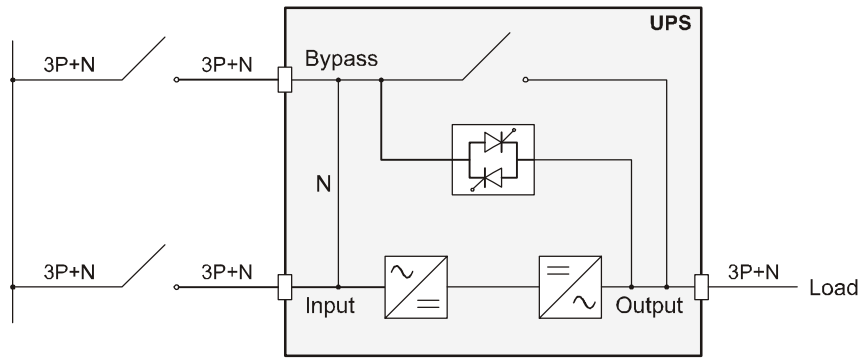


UPS with Galvanic isolation on the output



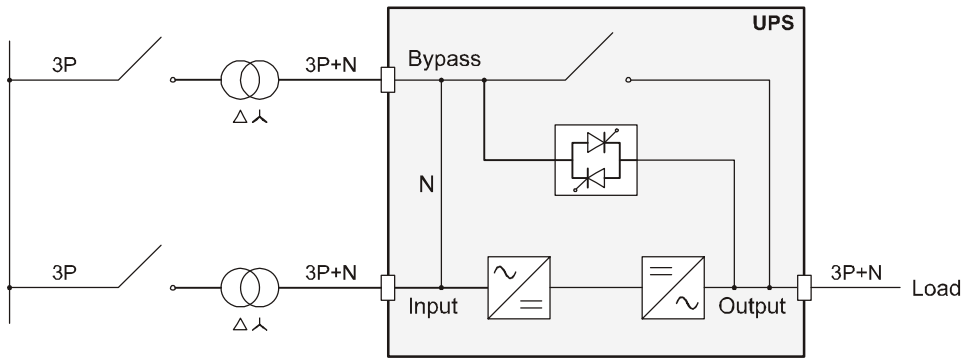
UPS without variation of the neutral arrangements and with a separate bypass supply input (standard for

120kVA, option for others)



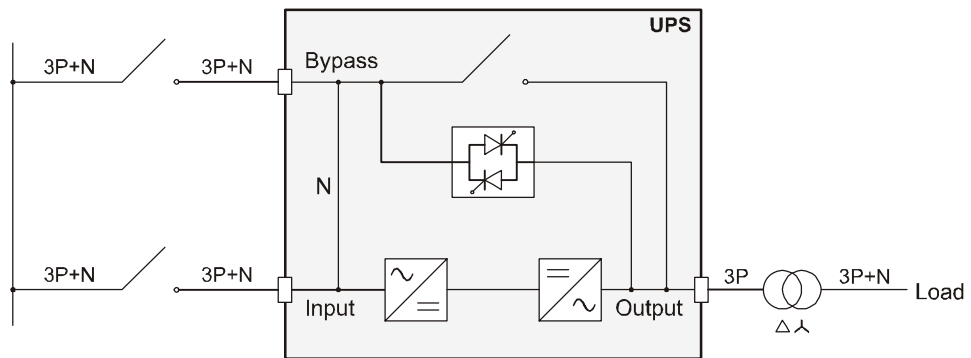
Remove the jumpers present between the SWIN and SWBY isolating switches (120 kVA)

UPS with Galvanic isolation on the input-side and separate bypass supply input (standard for 120kVA, option for others)



Remove the jumpers present between the SWIN and SWBY isolating switches (120 kVA)

UPS with Galvanic isolation on the output-side and separate bypass supply input (standard for 120kVA, option for others)



Remove the jumpers present between the SWIN and SWBY isolating switches (120 kVA)

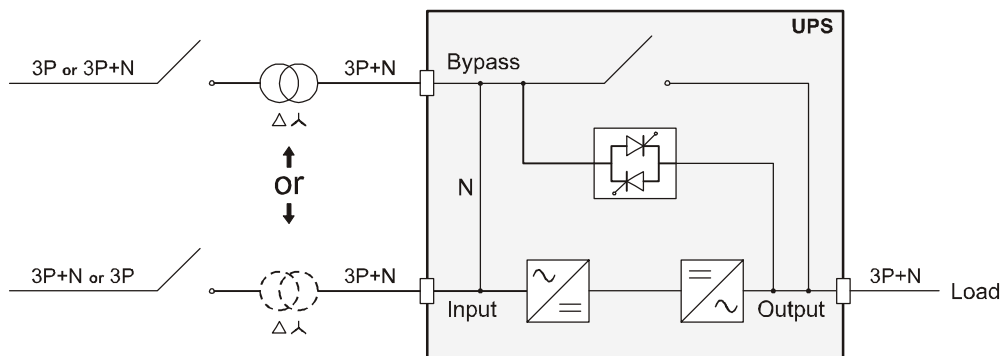
Separate bypass on separated lines upstream:

If the separate bypass option is present, the protection devices will be installed both on the mains supply line and on the separate bypass line.

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

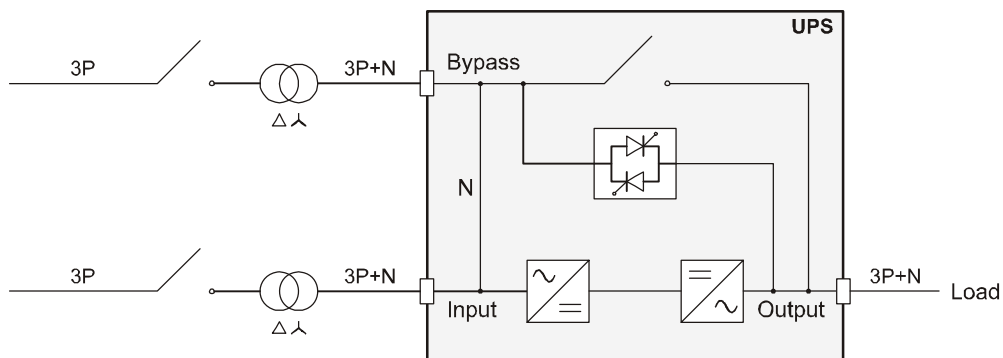
inputs.

UPS without variation of the neutral arrangement and with a separate bypass supply (standard for 120kVA, option for others) connected on the independent mains line



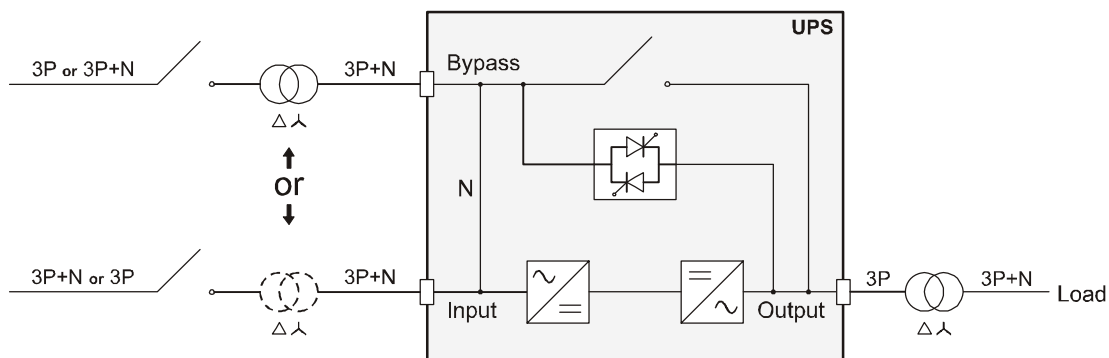
Remove the jumpers present between the SWIN and SWBY isolating switches (120kVA)

UPS with a separate bypass supply connected to an independent supply (standard for 120kVA, option for others) and with galvanic isolation on the input



Remove the jumpers present between the SWIN and SWBY isolating switches (120kVA)

UPS with a separate bypass supply (standard for 120kVA, option for others) connected to an independent mains supply and with galvanic isolation on the output



Remove the jumpers present between the SWIN and SWBY isolating switches (120kVA)

11.7 SEPARATE LINE INPUT

All the UPS versions in the range of 60-120 KVA are provided with a single feeding input. Simply removing the parallel input jumpers it is possible to separate the bypass line from the rectifier input line directly on site. Anyway, this operation guarantee the dissection of both the feeding lines through the two switches present on the UPS (SWIN-SWBYP).

12. ENVIRONMENTAL CONDITIONS

Room ambient temperature	0 to 40° C
Maximum temperature for 8 hours a day	40° C
Average temperature over 24 hours	35° C
Recommended working temperature for optimum battery performance	20 to 25° C
Storage temperature	- 25° up to +55 °C (UPS) - 15° up to +40 °C (UPS with battery)

13. TECHNICAL DATA 60-120 KVA

Mechanical Characteristics	UPS Power (kVA)			
	60	80	100	120
Dimensions (mm)				
<ul style="list-style-type: none"> • Width • Depth • Height 	500		750	
		850		855
		1600		1900
Weight (Kg)	190	200	370	380
Ventilation	Forced through internal fans			
Cabinet IP rating	IP20			
Cable input	From the bottom/On the rear			
Colour	RAL 7035			

Electrical data	UPS Power (kVA)			
	60	80	100	120
INPUT				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Input Current ⁽¹⁾	104	138	182	215
Voltage range (without switching to battery power)	320 to 480 V at 100% of the load 240 to 480 V at 50% of the load			
Nominal frequency	50 or 60Hz			
Input frequency tolerance	40 to 72Hz			
Total Harmonic distortion (THDi) and power factor with full load	THDi 2,5 % , 0,99 Pf		THDi 3 % , 0,99 Pf	
Rectifier progressive start-up (Power Walk-in duration)	Programmable from 5 to 125 seconds in steps of 1 second (this function is disabled by default)			
Delayed switching	Programmable from 1 to 255 seconds in steps of 1second. (5 seconds by default)			

(1) The input current is stated for the following general conditions:

- Output load at 0,9pF
- Input voltage at 346 Volts
- Battery charging current of 25 Ampere (10 Ampere 60/80 kVA)

Electrical data	UPS Power (kVA)			
	60	80	100	120
DC BUSBAR AND BATTERY SET				
Number of battery cells	120+120			
Float voltage (2,27 V/el. adjustable)	273+273 Vdc			
Boost voltage (2,4 V/el. adjustable)	288+288 Vdc			
End of discharge voltage – load dependent (1,6 V/el. adjustable)	192+192 Vdc			
Standard battery charger ⁽³⁾	Nominal 10 Amps		Nominal 25 Amps	
• 0-100 %	10 A		25A	
• Enhanced battery charger ⁽³⁾ (See note 11.5)	Substitutive 20 A			
• Full load	10 A			
• 95% load	15A			
• 90% load	18 A			
• 88% load	20 A			

⁽³⁾ The currents refer to input voltages ≥ 200 Volt

Electrical data	UPS Power (kVA)			
	60	80	100	120
INVERTER				
Nominal power (kVA)	60	80	100	120
Active power pF 1 (kW)	54	72	90	108
Active power with load power factor from 0,9 inductive to 0,9 capacitive (kW).	54	72	90	108
Nominal voltage	380/400/415 Vac Three-Phase plus neutral			
Derating for output voltage (Phase – Neutral) set to:				
• 208 V	- 5 %			
• 200 V	- 10 %			
Nominal frequency	50 / 60Hz			
Static stability	± 0,5%			
Dynamic stability	± 3% (1) (resistive load) EN62040-3 class performance 1 distorting load			
Recovery Time within ± 1%	20ms In compliance with standard EN 62040-3, class 1			
Crest factor (I _{peak} /I _{rms} as per EN 62040-3)	3:1			
Voltage distortion with linear and distorting load (EN 62040-3)	≤ 1% with linear load ≤ 3% with distorting load		≤ 2% with linear load ≤ 4% with distorting load	
Inverter frequency stability without by-pass supply synchronisation	0,01%			
R _{rate} of Frequency variation	1Hz/sec (adjustable from 0,5 to 2)			
Voltage phase Dissymmetry with balanced and unbalanced loads	± 1% / ± 2%			
Voltage phase shift with balanced and unbalanced loads	120 ± 1 °			
Inverter Overload	>103% ÷ ≤110% 10 min. >110% ÷ ≤133% ÷ 1 min. >133% ÷ ≤150% 5 sec. >150% 0,5 sec.			
Short circuit current	1,5 x I _n for t≥500 ms			
Efficiency on battery-operation	≥95 %		≥93 %	

(1) @ Mains / battery / mains @ resistive load 0% / 100% / 0%

Electrical data	UPS Power (kVA)			
	60	80	100	120
BY-PASS				
Nominal voltage	380-400-415 Vac Three-Phase plus neutral			
Output nominal current (A)	87	116	145	174
Bypass voltage range	from 180V (adjustable 180-200) to 264 V (adjustable 250-264V)			
Nominal frequency	50 to 60Hz			
Bypass input frequency range	± 5% (adjustable from 0,25 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			
Max current in short circuit for 20 ms (Tj 25°C)	4000 A		4600 A	
Overload capability on bypass line	<ul style="list-style-type: none"> • ≤ 110% infinite • > 110% ÷ ≤133% 60 min. • > 133% ÷ ≤150% 10 min. • > 150% 2 sec. 			

Electrical data	UPS Power (kVA)			
	60	80	100	120
SYSTEM				
AC/AC Efficiency (On line)				
Full load	95,4	95,2	93,6	93,5
75% Load	95,5	95,6	94,0	94,0
50% Load	95,5	95,6	93,7	93,8
25% Load	94,6	94,9	92,3	92,5
Auto-consumption (W)	455	455	1160	1280
Efficiency with UPS in STAND BY mode	≥ 99,1 %		≥ 98,6 %	
Audible noise at 1mt (from 0 to full load) - (dBA)	≤ 56 dB (A)		≤ 70 dB (A)	
Operating temperature	0 ± 40 °C			
Max. relative humidity during operation	90% (without condensation)			
Max. installation altitude	1000 m at nominal power (- 1% reduction in power for every 100m over 1000m) Max 4000m			
Power dissipated with resistive nominal load (pf=0,8) and backup battery*	2,61 kW 2245 kcal/h 8910 B.T.U./h	3,65 kW 3140 kcal/h 12460 B.T.U./h	6,9 kW 5933 kcal/h 23550 B.T.U./h	7,2 kW 6191 kcal/h 24578 B.T.U./h
UPS fan capacity	2100 mc/h	2100 mc/h	2600 mc/h	2600 mc/h
Max current leaked to earth **	≤ 100 mA			

* 3,97 B.T.U. = 1 kcal

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



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