manuale d'installazione ed uso • installation and use manual • installations- und bedienungsanleitung
manuel d'installation et d'utilisation • manual de instalación y uso

MULTI SENTRY

MST 30 - 40

INTRODUCTION

Thank you for choosing our product.

Our company is specialised in designing, developing and manufacturing uninterruptible power supplies (UPS).

The UPS described in this manual is a high quality product which has been carefully designed and built in order to guarantee the highest levels of performance.

This manual contains detailed instructions for using and installing the product.
For information about using and getting the most out of your appliance, this manual must be stored with care in the vicinity of the UPS and CONSULTED BEFORE OPERATING ON IT.

NOTE: Some images contained within this document are for indication purposes only and therefore may not identically match the products in use.

ENVIRONMENTAL PROTECTION

During the development of its products, the company uses extensive resources with regards to all environmental aspects.
All our products pursue the objective defined in the environmental management system developed by the company in compliance with standards in force.

No hazardous materials such as CFC, HCFC or asbestos are used in this product.

When evaluating packaging, the choice of material has been made favouring recyclable materials.
For correct disposal, please separate and identify the type of material of which the packaging is made in the table below. Dispose of all material in compliance with standards in force in the country in which the product is used.

DESCRIPTION	MATERIAL
Pallet	Heat-treated pine
Packaging corner	Stratocell/cardboard
Box	Cardboard
Adhesive pad	Stratocell
Protective bag	HD Polyethylene

DISPOSING OF THE PRODUCT

The UPS contains internal material that (in case of dismiss / disposal) are considered TOXIC and HAZARDOUS WASTE, such as electronic circuit boards and batteries. Treat these materials according to the laws applicable referring to qualified service personnel. Their proper disposal contributes to respect the environment and human health.

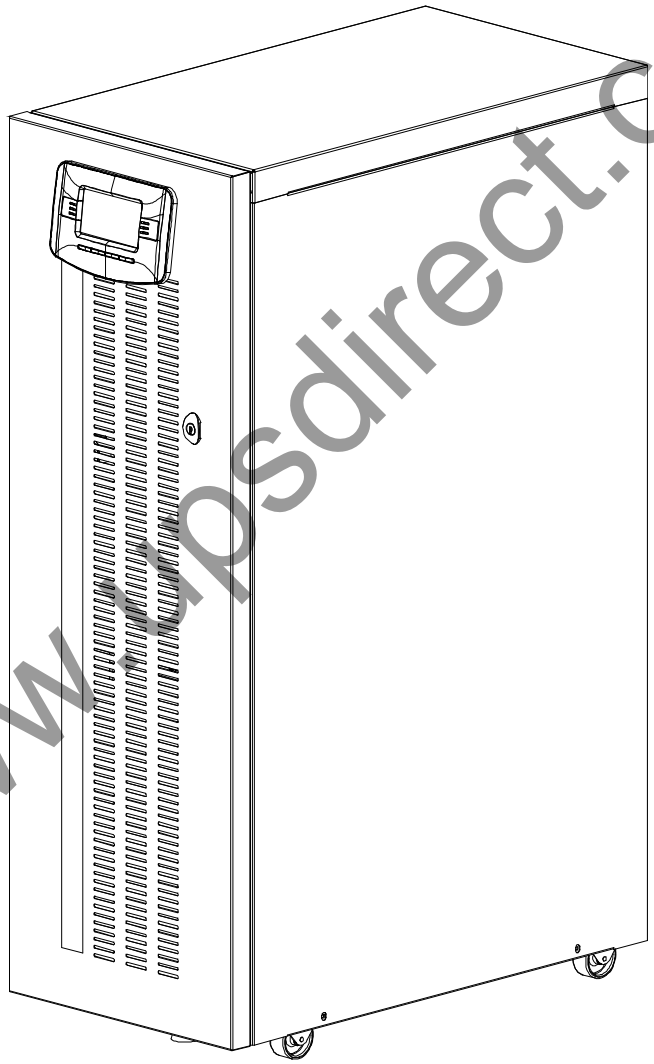
CONTENTS

OVERVIEW

MULTI SENTRY

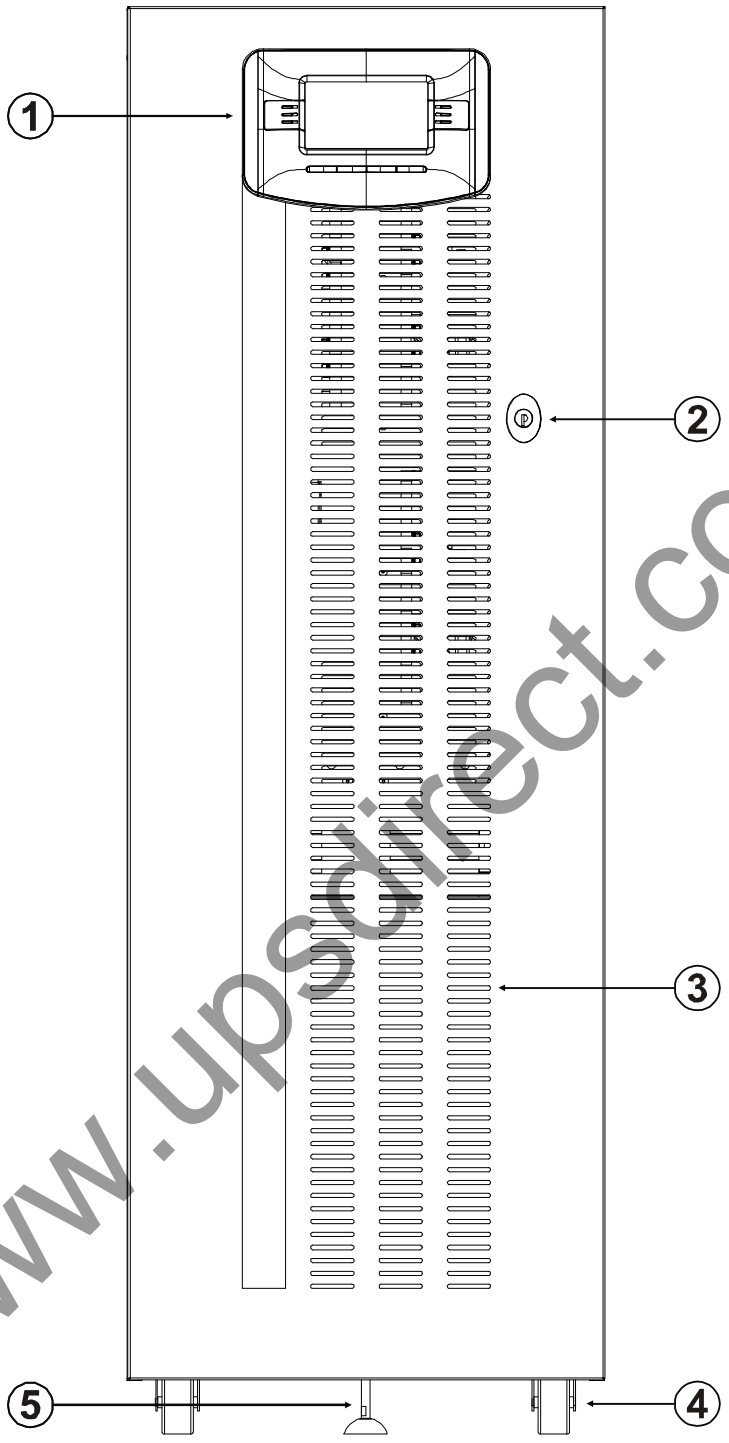
The UPSs in the ***MST*** series have been designed using state-of-the-art technology, in order to ensure the best performance for the user. The use of the new control boards based on microprocessor architecture (DSP + µP inside), together with the adoption of specific circuit solutions that use last-generation components, have allowed to reach high performances such as:

- ZERO IMPACT SOURCE: ensures low input distortion, a power factor close to 1, and maximum generator set compatibility.
- BATTERY CARE SYSTEM: allows a customised management for different battery types and their continuous monitoring, therefore enhancing battery efficiency and durability.
- SMART INVERTER: guarantees an extraordinary efficiency even at a low-load percentage. Moreover, it ensures a stable low-distortion output tension even in extreme operating conditions.

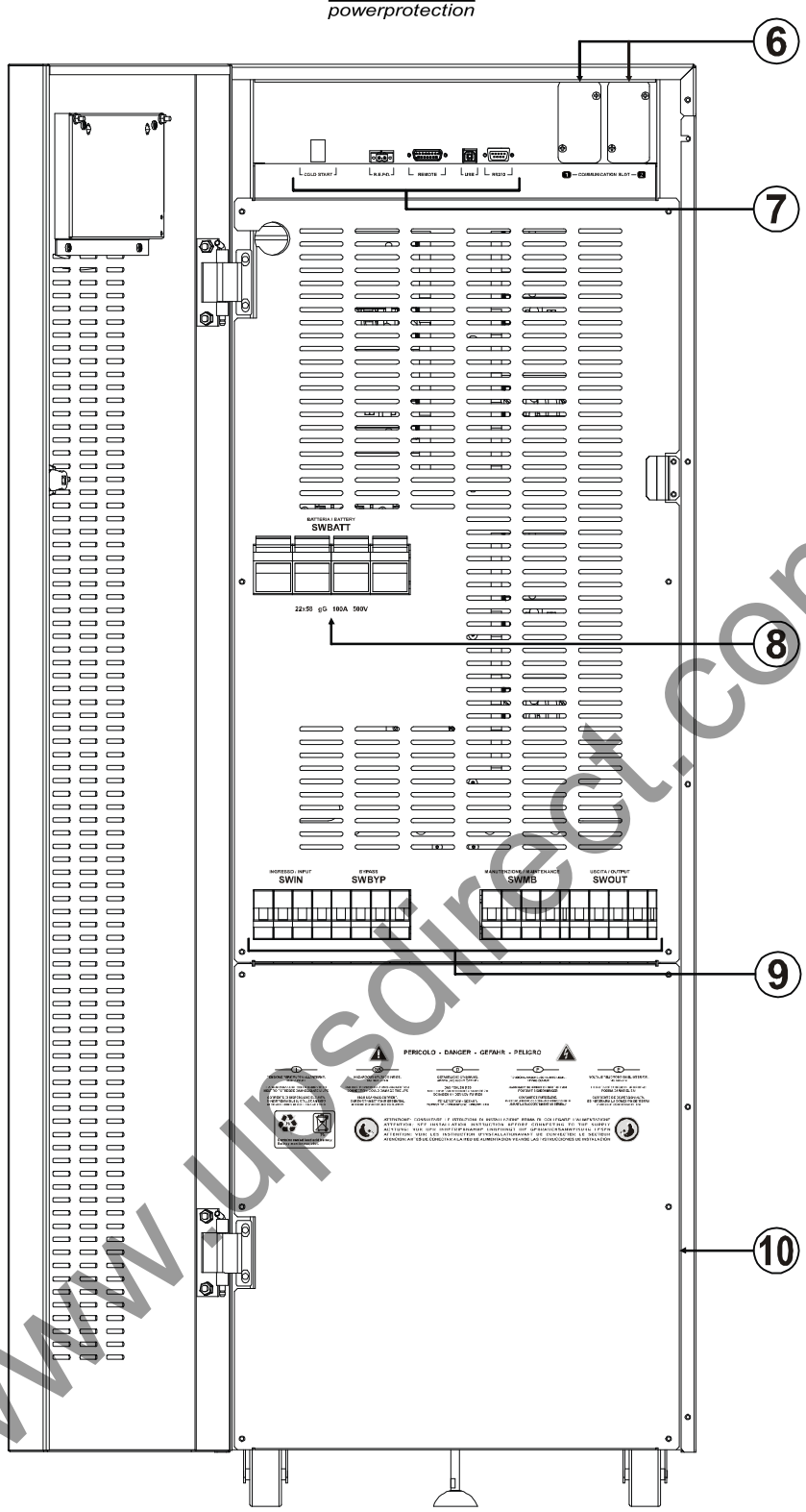


Thanks to these and other features, and thanks to its ease of use, the ***MST*** series presents itself as a reference point among three-phase UPSs.

FRONT VIEWS OF THE UPS



1. Control panel with graphic display
2. Front door with lock
3. Ventilation grid
4. Wheels for moving the UPS
5. Brake rod



⑥ Slot for auxiliary communication board

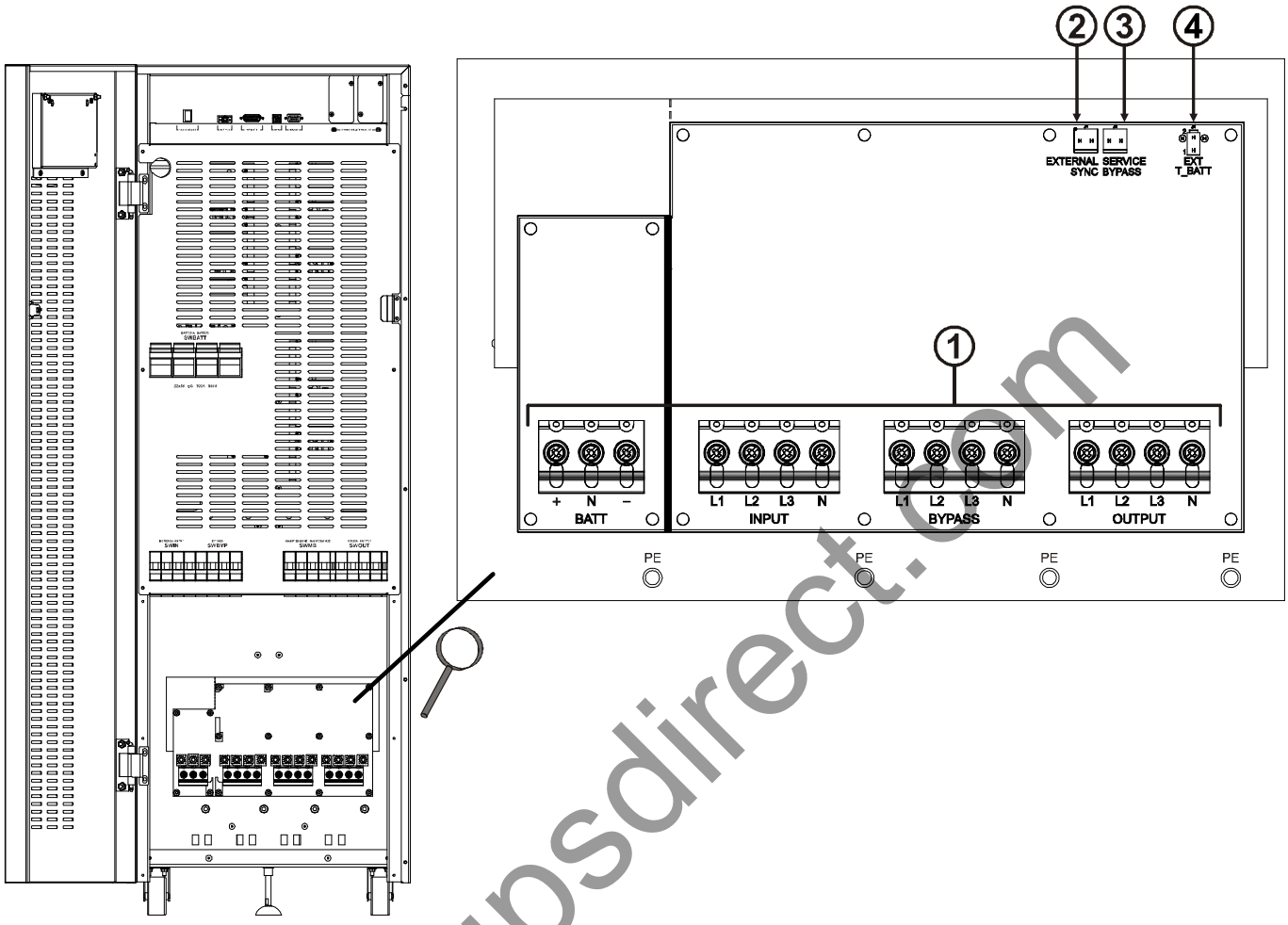
⑦ *From the left:*
Battery start button (COLD START) / R.E.P.O. (Remote Emergency Power Off) connector / Contact holder for AS400 / USB communication port / RS232 communication port

⑧ Battery fuse holder isolator

⑨ *From the left*:
Input isolator / Separate bypass isolator (optional) / Manual bypass isolator / Output isolator

⑩ Terminal cover

VIEWS OF THE UPS CONNECTIONS



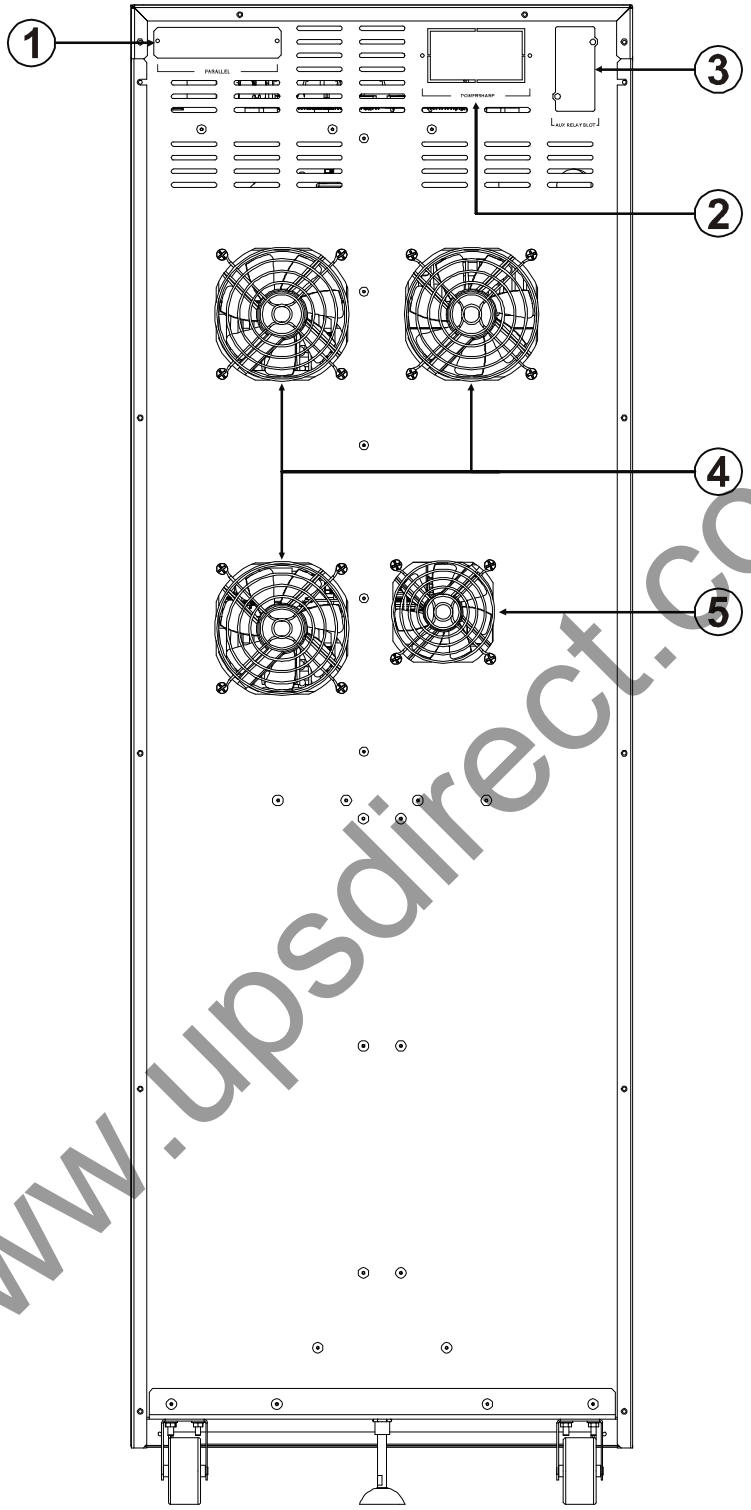
(1) Power connections: EXTERNAL BATTERY, INPUT, SEPARATE BYPASS (optional), OUTPUT

(2) Connection for external synchronization signal

(3) Connection for remote maintenance bypass command

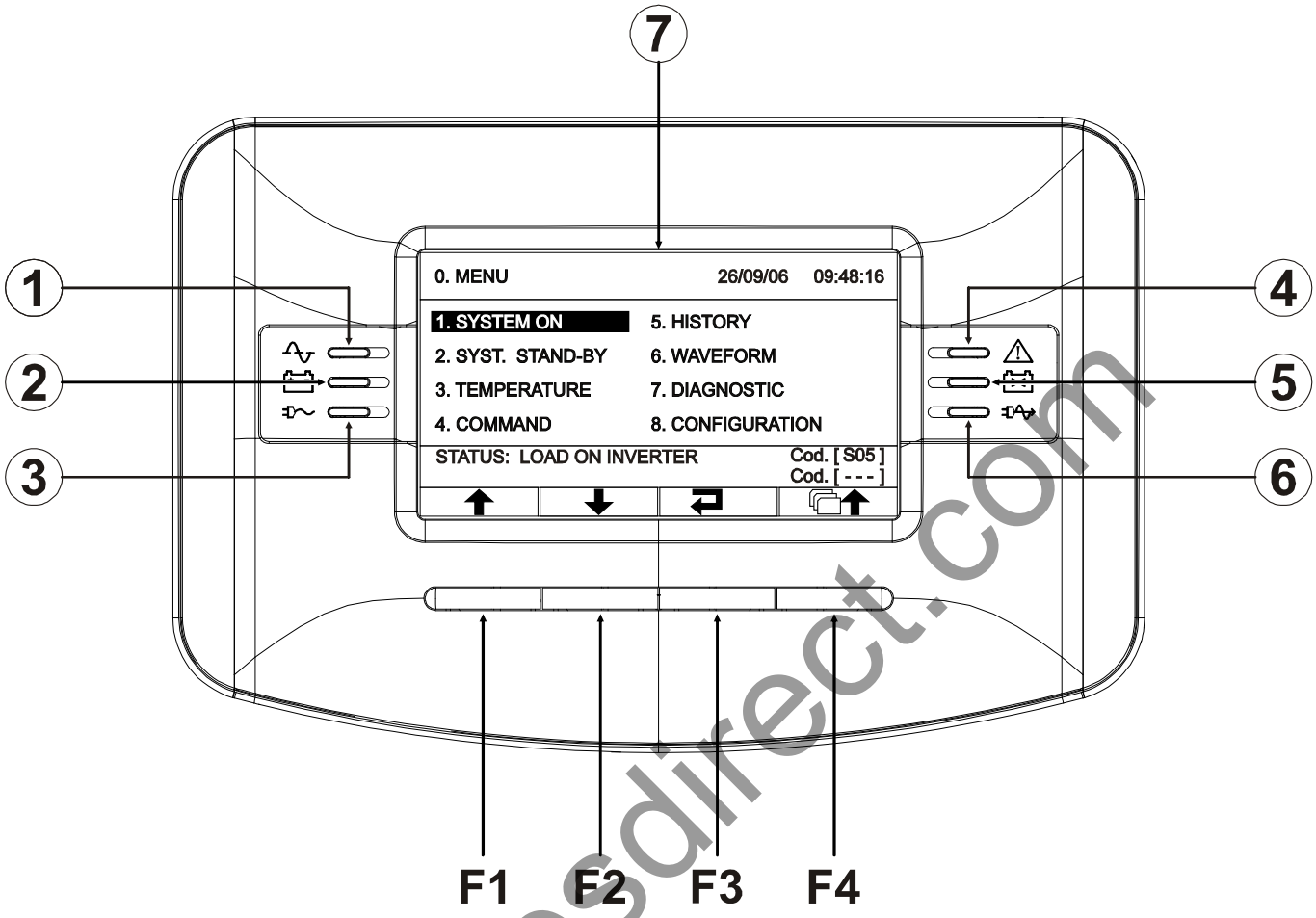
(4) Connection for external Battery Box temperature probe

REAR VIEW OF THE UPS



1. Parallel board slot (optional)
2. Powershare socket / Power out socket (optional)
3. Power relay board slot (optional)
4. Power board fans
5. Battery charger fan

VIEW OF THE CONTROL PANEL



1. Mains power LED
2. Battery power LED
3. Load on bypass LED
4. Stand-by / alarm LED
5. Low battery LED
6. ECO mode LED
7. Graphic display

F1, F2, F3, F4 = FUNCTION KEYS. The function of each key is indicated at the bottom of the display and it varies according to the menu.

SEPARATE BYPASS INPUT (OPTIONAL)

THE OPTIONAL DI VERSION OF THE UPS SERIES HAS SEPARATE BYPASS AND INPUT LINES.
The UPS series with Separate Bypass allows a separate connection between the input and the bypass lines.
The UPS output is synchronised with the bypass line, in order to avoid incorrect voltage changeovers during the alternate phases, in case an automatic bypass or a maintenance isolator closure occurs.

INTERNAL TRANSFORMER

THE OT (OPTIONAL) VERSION OF THE UPS SERIES DIFFERS FROM THE STANDARD VERSION IN THAT IT USES AN ISOLATION TRANSFORMER INSTEAD OF THE BATTERIES.

This series of UPS uses an isolation transformer connected to the UPS output terminals.
NOTE: A separate bypass line is supplied on this UPS version.

The transformer is connected to the UPS output terminals, so the values displayed are those of the quantities measured upstream of the transformer.

The presence of the transformer inside the UPS modifies the system neutral arrangements.

The installation of a remote maintenance bypass parallel to the UPS is incompatible with inclusion of the transformer. In any event, if the remote maintenance bypass is inserted, make sure, at the time the remote bypass switch is closed, that the UPS is isolated from the system by opening the input and/or output switches.

INSTALLATION

ALL OPERATIONS DESCRIBED IN THIS SECTION MUST BE CARRIED OUT BY QUALIFIED PERSONNEL ONLY.
The company assumes no responsibility for any damage caused by flawed connections or by operations that are not described in this manual.

STORAGE OF THE UPS

The storage area must respect the following characteristics:

Temperature: 0°÷40°C (32°÷104°F)

Relative humidity degree: 95% max

PREPARATION FOR INSTALLATION

PRELIMINARY INFORMATION

UPS Models	MST 30	MST 40
Nominal power	30kVA	40kVA
Operating temperature	0 ÷ 40 °C	
Max. relative humidity during operation	90 % (no condensation)	
Max. installation height	1000 m at nominal power rating (-1% power for every 100 m over 1000 m) max 4000 m	
Dimensions W x D x H	440 x 850 X 1320 mm	
Weight with no batteries	135kg	145kg
Weight with batteries	340kg	350kg
Dissipated power with nominal resistive load (pf=0.9) and buffer battery (1)	1.4 kW 1205 kcal/h 4780 B.T.U./h	1.5 kW 1290 kcal/h 5120 B.T.U./h
Dissipated power with nominal distorting load (pf=0.7) and charged battery (1)	1.34 kW 1150 kcal/h 4565 B.T.U./h	1.35 kW 1160 kcal/h 4605 B.T.U./h
Flow rate of the fans to remove heat from the installation area (2)	750mc/h	800 mc/h
Current dispersion to earth (3)	< 50 mA	
Protection level	IP20	
Cable input	On the rear from the bottom	

(1) 3,97 B.T.U./h = 1 kcal/h

(2) The following formula can be used to calculate the air flow rate: $Q\ [mc/h] = 3{,}1 \times P_{diss}\ [kcal/h] / (t_a - t_e)\ [°C]$
P_{diss} is the power expressed in kcal/h dissipated by all the devices installed in the installation environment.
ta= ambient temperature, te=external temperature. In order to take leaks into account, it is necessary to increase the value obtained by 10%.
The table shows an example of a flow rate with $(t_a - t_e) = 5°C$ and a rated resistive load (pf=0.9).
(Note: This formula is applicable only if ta>te. If not, the UPS installation requires an air-conditioning system).

(3) The dispersion current of the load is added to that of the UPS on earth wire.

ELECTROMAGNETIC COMPATIBILITY

This UPS product conforms to the current electromagnetic compatibility (EMC) regulations (C2 class). It may cause radio interference in the home environment. The user may have to adopt supplementary measures.
This product is for professional use in industrial and commercial environments. Connections to USB and RS232 connectors must be made with the cables provided, or at least with shielded cables less than 3 metres long.

INSTALLATION ENVIRONMENT

As for the installation area of the UPS, and, if necessary, of the Battery Box, follow carefully the following instructions:

- Avoid dusty environments
- Make sure that the floor is level and that it is able to withstand the weight of the UPS (and of the Battery Box)
- Avoid environments which are too narrow, as they could impede normal maintenance operations
- The relative humidity should not exceed 90% with no condensation
- Make sure that the ambient temperature remains between 0 and 40°C while the UPS is operating

  This UPS can operate with an ambient temperature between 0 and 40°C. The recommended working temperature for the UPS and the batteries is between 20 and 25°C. In fact, with a working temperature of 20°C, a battery has an average operating life of 5 years, whilst with a working temperature of 30°C the operating life is halved.

- Avoid positioning the UPS in places exposed to direct sunlight or hot air

To maintain the temperature in the installation area within the above mentioned range, there must be a system to dispose of the dissipated heat (the kW / kcal/h / B.T.U./h values dissipated by the UPS are shown in the table in the previous page). The methods that can be used are the following:

- *Natural ventilation*
- *Forced ventilation*, recommended when the external temperature is lower (e.g. 20°C) than the temperature at which the UPS or the Battery Box has to be operated (e.g. 25°C)
- *Air-conditioning system*, recommended when the external temperature is higher (e.g. 30°C) than the temperature at which the UPS or the Battery Box has to be operated (e.g. 25°C)

INTERNAL BATTERIES

CAUTION: If the UPS has INTERNAL BATTERIES, follow all the *PRECAUTIONS AND SAFETY RULES* listed below.

- The UPS has HAZARDOUS electrical voltages inside it, even when the input and/or battery switches are off. The inside of the UPS is protected by safety panels which should not be removed by untrained personnel. All installation and maintenance or operations involving access inside the UPS require the use of tools and may ONLY be performed by trained personnel.

- The UPS contains an internal source of energy: batteries. All terminals and sockets may be live even without connecting the UPS to the mains.

- The total battery voltage may be potentially dangerous: it may generate an electric shock. The battery compartment is protected by safety panels which should not be removed by untrained personnel. All installation and maintenance of the batteries involve access inside the UPS and require the use of tools: such operations may ONLY be performed by trained personnel.

- Replaced batteries must be considered TOXIC WASTE and treated accordingly. Do not dispose of batteries in a fire: they may explode. Do not attempt to open the batteries: they are maintenance-free. In addition, the electrolyte is harmful to the skin and eyes and can be toxic.

- Do not turn on the UPS if it is leaking fluid or if you see a residual white powder.

- Do not allow water, liquids in general and/or other foreign objects to get inside the UPS.

- Do not open the battery fuse holder while the UPS is powering the load in battery operation mode. The interruption of the battery DC may cause an electrical arc resulting in broken equipment and/or fire. In addition, if there is no mains power, the energy to power the load is provided by the batteries, therefore opening the battery caps would lead to the shutdown of the load.

- Follow these recommendations when working on the batteries:

  - Remove wristwatches, rings and other metal objects
  - Use tools with insulated handles
  - Wear rubber shoes and gloves
  - Do not lay tools or metal objects on top of the batteries
  - Disconnect the charging source before connecting or disconnecting the battery terminals
  - Check whether the battery has been inadvertently earthed. If this is the case, disconnect the source from earth. Contact with any part of the earthed battery may cause an electric shock. The likelihood can be reduced if the earthing connections are interrupted during installation and maintenance (applicable to remote battery-powering and equipment, without earthing circuits).

- Risk of explosion if the battery is replaced by another of the incorrect type. Refer to the following table to identify the correct quantities and models:

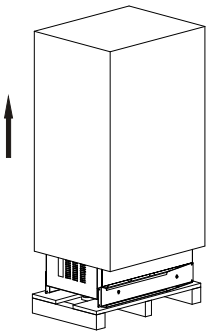
Battery Type	*12V* *Valve regulated sealed lead-acid rechargeable*
Number of batteries positive branch	*20+20*
Number of batteries negative branch	*20+20*
Total rated battery voltage Positive branch	*240 VDC*
Total rated battery voltage Positive branch	*240 VDC*

For correct interconnection of the batteries, refer to the wiring diagrams available to service personnel only or to the battery kit installation manual.

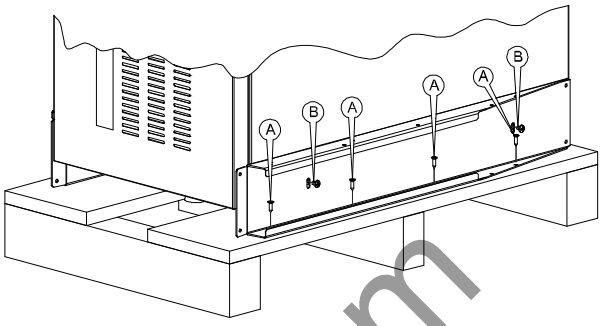
REMOVING THE UPS FROM THE PALLET

CAUTION! TO AVOID HARMING PEOPLE AND/OR DAMAGING THE EQUIPMENT, FOLLOW CAREFULLY THE FOLLOWING INSTRUCTIONS.

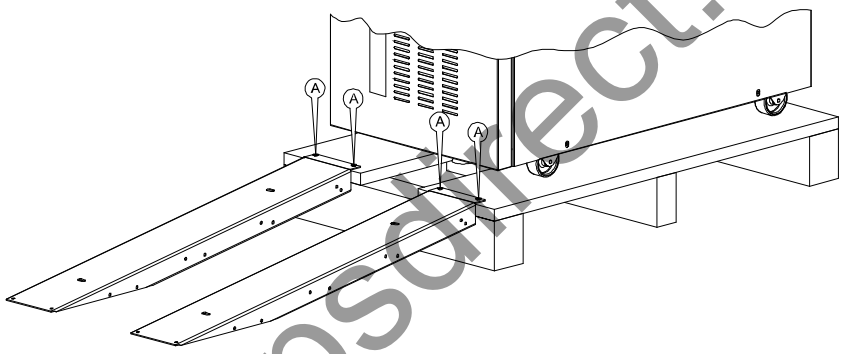
SOME OF THESE INSTRUCTIONS NEED TO BE CARRIED OUT BY TWO PEOPLE.



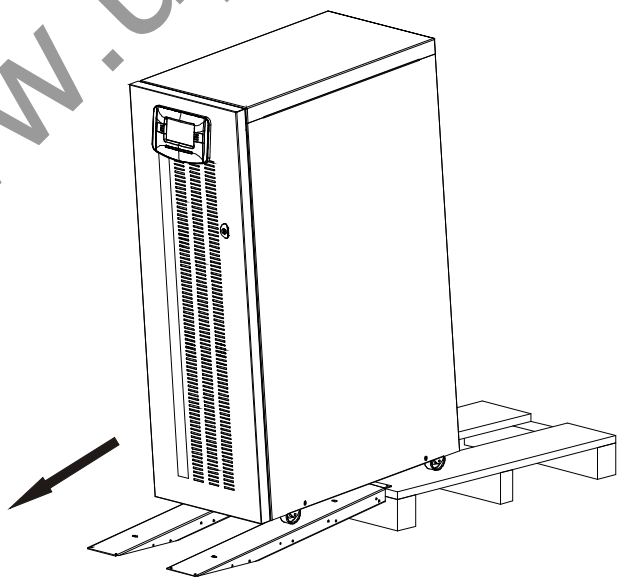
- Cut the straps and remove the cardboard box by sliding it upwards. Remove the packaging material.
- Remove the accessory box.
  NOTE: the accessory box can be either inside the packaging, or behind the USP door.



- Remove the 2 brackets securing the UPS to the pallet by unscrewing the screws marked A and B in the figure.



- The previously removed brackets can also be used as slides. Secure the slides to the pallet by using the type A screws, making sure they are aligned with the wheels.



- **Screw the brake rod completely, so to separate it from the pallet**
- **Make sure that the door is firmly closed.**
- **<u>CAUTION!</u> Push the UPS from the rear with great care. Given the weight of the equipment, this operation needs to be carried out by two people.**

NOTE : It is recommended to keep all parts of the packaging for further use

PRELIMINARY CONTENT CHECK

After opening the package, first check the content:

metal chutes, warranty card, user manual, safety manual, inspection certificate, serial connection cable, 4 x battery fuses (to be inserted in the “SWBATT” fuse holders), door key.

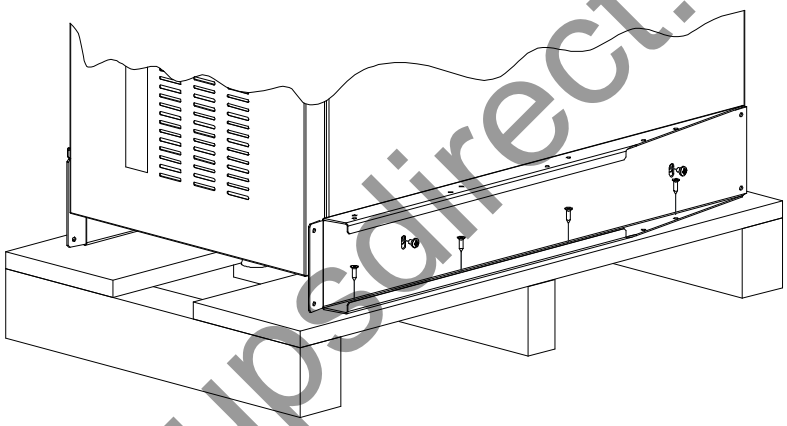
POSITIONING THE UPS

When positioning the equipment, the following points should be taken into account:

- The wheels are intended for accurate positioning, therefore for small movements only.
- The plastic parts and the door are not suitable for pushing or gripping the UPS.
- Sufficient space should be left in front of the equipment, for it to be switched on and off and in order to allow carrying out maintenance operations on it (≥ 1,5 metres).
- The rear part of the UPS should be placed at least at 30 cm from the wall, to allow the air blown by the ventilation fans to outflow correctly.
- No objects should be placed on its upper surface.

Once the equipment has been positioned, secure it with the apposite brake rod (see *"Front views of the UPS "*).

In earthquake-prone zones or in mobile systems it is possible to use the brackets securing the UPS to the pallet to anchor the machine to the ground (see figure below). In normal conditions the brackets are not necessary.



OPERATIONS TO ACCESS THE TERMINALS OF THE UPS

To carry out the following operations, the UPS must be disconnected from the mains power supply, switched off, and with all the equipment switches and fuse holders open.

Follow the instructions provided below to open the UPS:

- Open the door using, if necessary, the key provided
- Remove the terminal cover in correspondence with the switches (see *"Front views of the UPS"*)

Once the installation operations inside the equipment have been completed, replace the terminal cover and close the door.

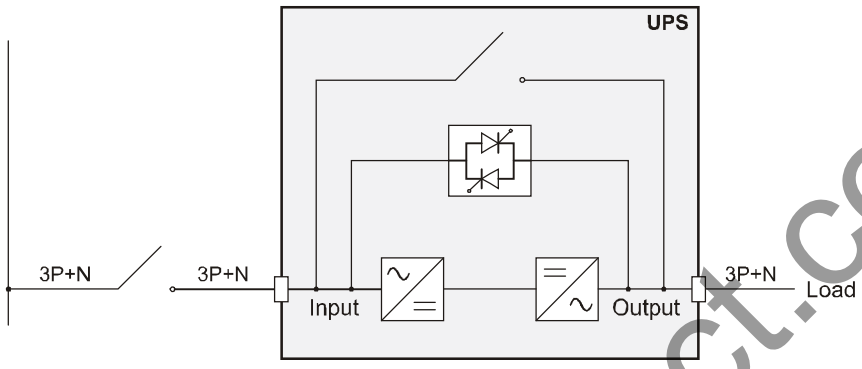
ELECTRICAL CONNECTIONS

WARNING: a 4-wire three-phase distribution system is required.

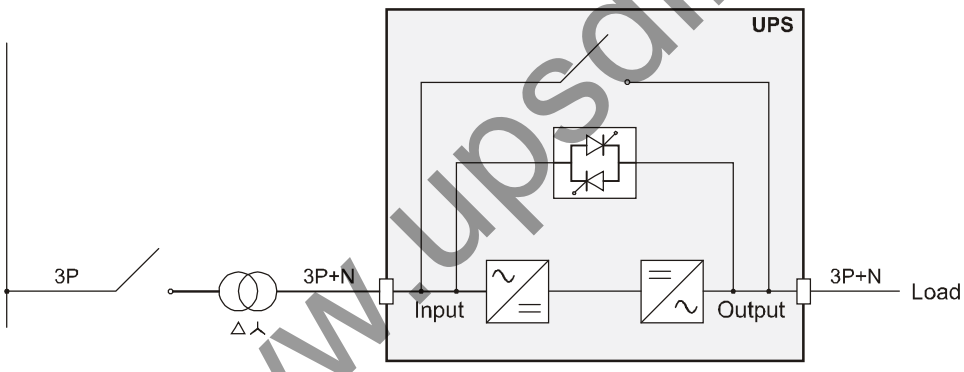
The UPS must be connected to a power supply line made up of 3 phases + neutral + PE (protective earth) of TT, TN or IT type. Therefore, the phase rotation must be respected.
Optional TRANSFORMER BOXES to convert the distribution systems from 3 wires to 4 wires are available.

DIAGRAMS OF CONNECTIONS TO THE ELECTRICAL SYSTEM

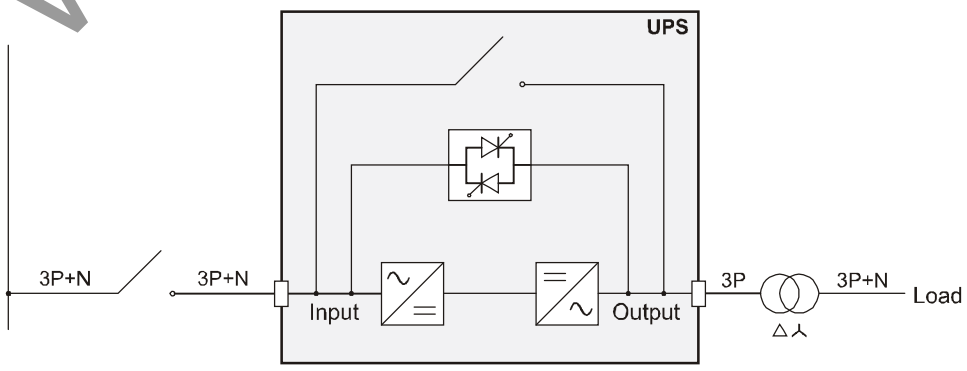
UPS with no modification of the neutral regime



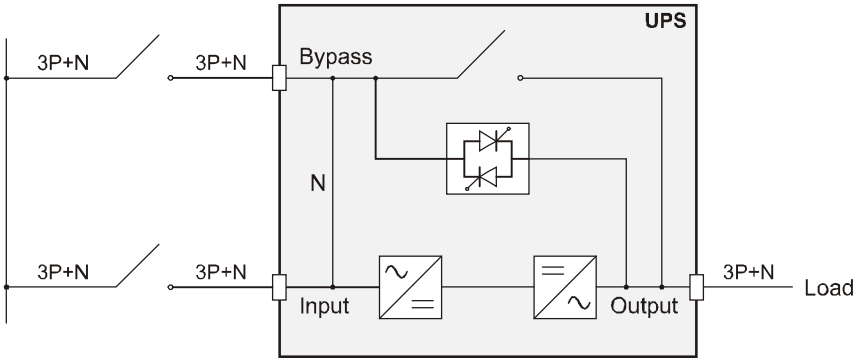
UPS with input galvanic isolation



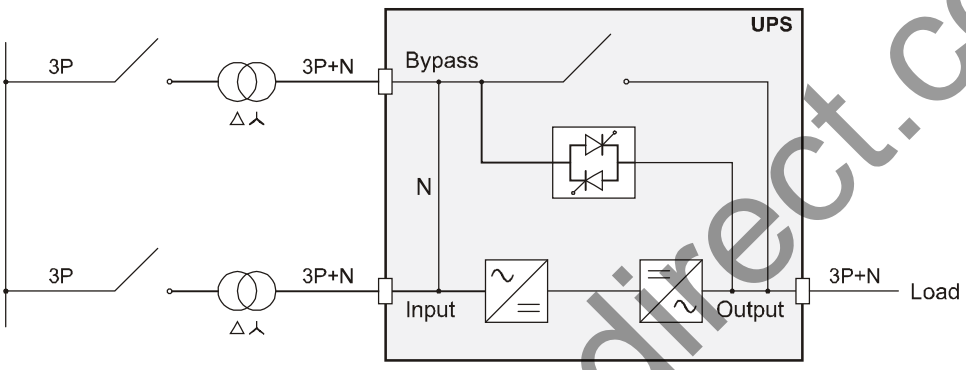
UPS with output galvanic isolation



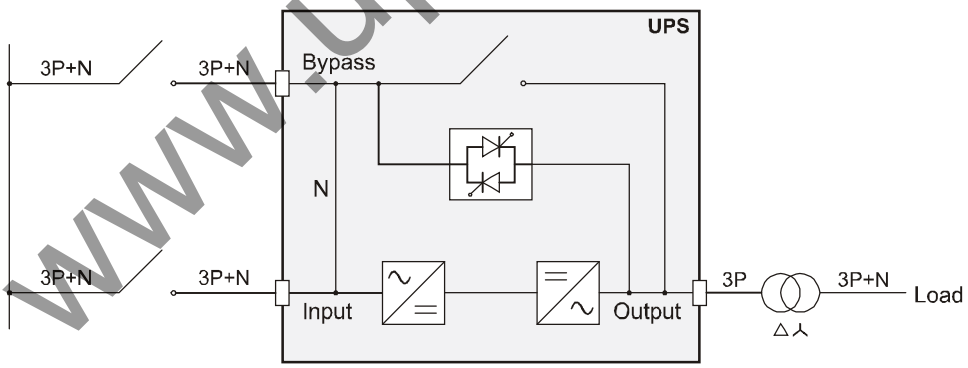
UPS with no modification of the neutral regime and with separate bypass input



UPS with input galvanic isolation and with separate bypass input



UPS with output galvanic isolation and separate bypass input

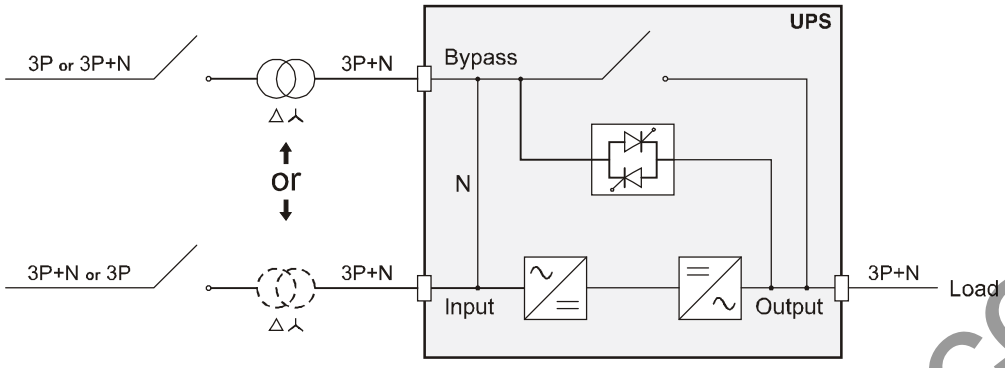


Separate bypass on separate lines:

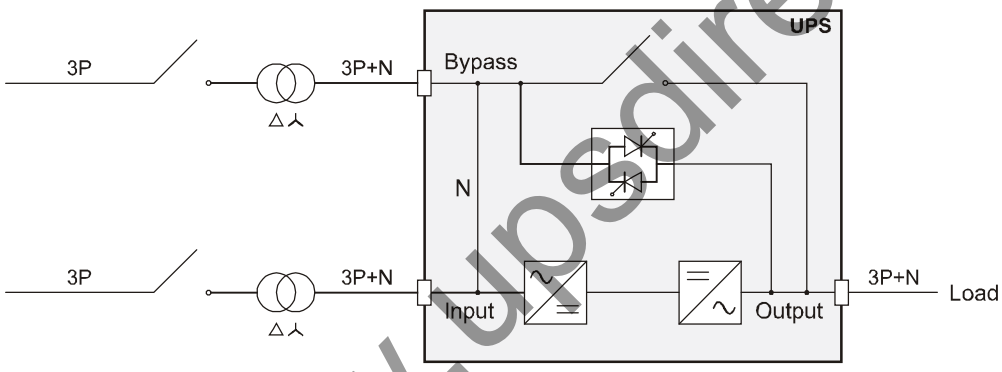
When the separate bypass option is present, protective devices should be placed on both the main power supply line and the bypass line.

Note: The neutral of the input line and that of the bypass are commoned inside the equipment, therefore they must refer to the same potential. In case the two power supplies were different, an isolation transformer would be necessary on one of the inputs.

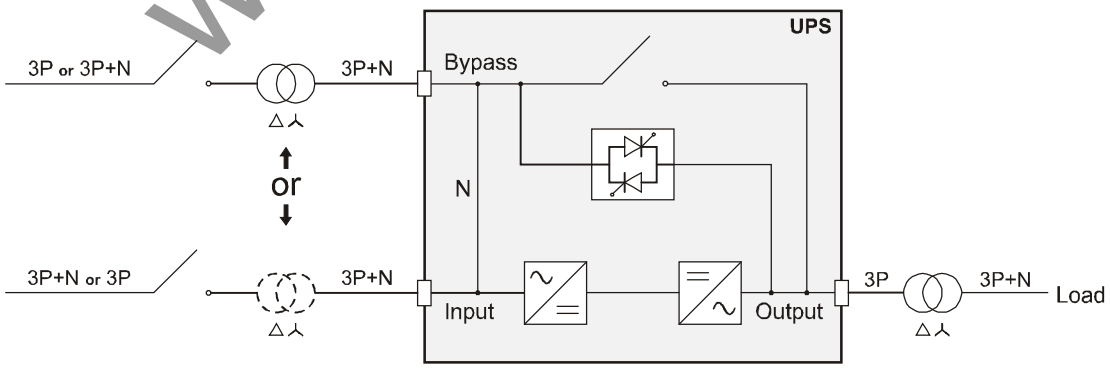
UPS with no modification of the neutral regime and with separate bypass input connected to an independent power supply line



UPS with separate bypass input connected to an independent power supply line and with input galvanic isolation



UPS with separate bypass input connected to an independent power supply line and with output galvanic isolation



UPS INTERNAL PROTECTIONS

The table below shows the sizes of the UPS isolators and the battery fuses (SWBATT) which are all accessible from the front of the UPS. Moreover, the table shows the maximum input and the nominal output currents.
Fuses must be replaced with ones of the same type and of the same rating, as shown in the table.

	Isolators and currents				
UPS Mod.	Non-automatic switches		Battery isolator	Currents	
[kVA]	UPS input / Separate bypass	UPS output / Maintenance	Battery fuse	Input current [A]	Output current [A]
	SWIN / SWBYP (optional)	SWOUT / SWMB	SWBATT	Max *	Nominal
30	63A(4P)	63A(4P)	80A gG 400V (22x58)	54A	46A
40	100A(4P)	100A(4P)	100A gG 400V (22x58)	70A	61A

* *The maximum input current refers to a nominal load (PF = 0,9), to a 346V+ input voltage, and battery charger under a 7A charge.*

SHORT CIRCUIT

If a fault occurs on the load, the UPS protects itself by limiting the value and the duration of the current supplied (short circuit current). These values also depend on the UPS operating status at the time of the fault, which can be either:

- UPS in NORMAL OPERATION: the load is instantly commutated to the bypass line (UPS 30kVA $I^2t=20000A^2s$; UPS 40kVA $I^2t=25000A^2s$): the input line is connected to the output with no internal protection (locked after t>0.5s)
- UPS in BATTERY OPERATION: the UPS protects itself by supplying an output current which is about 1.5 the nominal current for 0.5s, after which it shuts down.

BACKFEED

This UPS is also equipped with an internal protection against backfeed through metal separation devices.
An optional output on the relay board is available for activating a release device to be installed upstream from the UPS.

This UPS has an internal device (redundant bypass power supply) which, in case a fault occurs, activates the bypass automatically, thus maintaining the load powered with no internal protection and with no limit on the power supplied to the load.
Under such emergency conditions, any disturbance on the input line will affect the load.
Please see the paragraph "Redundant auxiliary power supply for automatic bypass", in the "USE" section.

EXTERNAL PROTECTION DEVICES

CIRCUIT BREAKER

When setting up the power supply line, install a circuit breaker with trip curve C (or D depending on the type of load) upstream from the UPS, as indicated in the following table:

	Automatic external protection devices*	
UPS model	Mains input	Separate bypass input (optional)
30kVA	63A	63A
40kVA	80A	80A

* In the case of a non-linear load, oversize the neutral line N correctly after site assessment.

If the protection device upstream of the UPS interrupts the neutral conductor, it must also interrupt all the phase conductors at the same time (quadripolar switch).

Output protections (recommended selectivity values)	
Normal fuses (gL-gG)	In (Nominal current)/7
Magnetothermal switches (C curve)	In (Nominal current)/7
Ultrarapid fuses (GF)	In (Nominal current)/3

DIFFERENTIAL

In the absence of an input separating transformer, the neutral from the mains power supply is connected to the neutral of the UPS output. This way the neutral regime of the equipment is not modified.

THE INPUT NEUTRAL IS CONNECTED TO THE OUTPUT NEUTRAL
THE DISTRIBUTION SYSTEM THAT POWERS THE UPS IS NOT MODIFIED BY THE UPS

WARNING: make sure that the equipment is connected correctly to the input neutral, or else damages to the UPS may be caused.
The neutral regime is modified only in presence of an isolation transformer or when the UPS operates with a neutral isolated upstream.

When operating from mains power, a differential switch located at the input can intervene as the output circuit is not isolated from the input circuit. Anyhow, other differential switches can be inserted at the output, possibly coordinated with the switches at the input.
The differential switch located upstream must have the following features:

- Differential current adjusted to the sum of the UPS load. It is strongly recommended to keep an adequate margin in order to avoid delayed interventions (100mA min. - 300mA recommended)
- type B or type A
- delay greater than or equal to 0,1s

CROSS SECTION OF THE CABLES

We recommend that the INPUT/OUTPUT and the BATTERY cables pass under the UPS.
As for the dimensioning of the cross section of the input and output cables, please refer to the following table:

	Cross section of cables (mm^2)*								
	INPUT mains / separate bypass (optional)			OUTPUT			EXTERNAL BATTERY ** (optional)		
kVA	PE	L1/L2/L3	N	PE	L1/L2/L3	N	PE	+/-	N
30	16	16	16	16	16	16	16	16	16
40	16	25	25	16	25	25	16	25	25

* *The cross sections shown in this table refer to a maximum length of 10 metres*

** *The maximum length of the cables for connection to the optional Battery Box is 3 metres*

Note: the maximum cross section of the cables that can be inserted in the terminal board is:

- 25 mm^2 for trailing cables
- 35 mm^2 per rigid cables

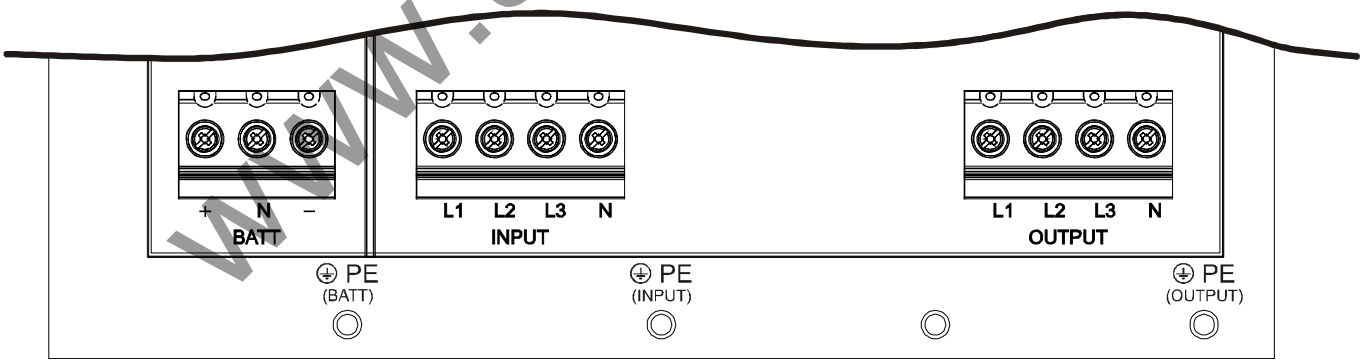
CONNECTIONS

As for UPSs with separate bypass, please see the subsequent paragraph.

The very first connection to be carried out is that of the protection conductor (earth cable), which must be connected to the terminal marked PE. The UPS must not operate without being connected to an earthing system

THE INPUT NEUTRAL MUST ALWAYS BE CONNECTED
DO NOT CONNECT THE OUTPUT NEUTRAL TO THE INPUT NEUTRAL

Connect the input and output cables to the terminal board as shown in the figure below:



Note 1: The protection conductor (earth cable) connection must be carried out through eyelet terminal stud M6

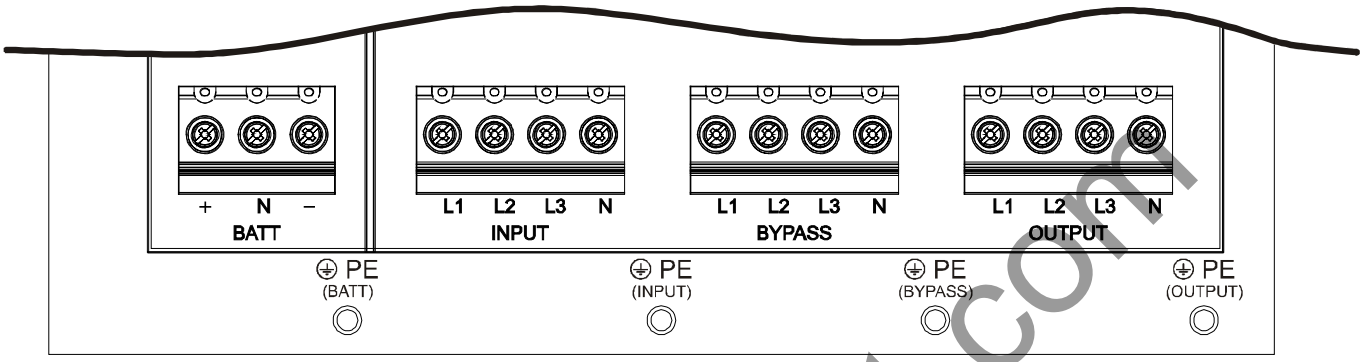
Note 2: Connections to the BATTERY module are required only when the Battery Box is present
(see paragraph "*Connecting the UPS to the Battery Box (optional)*")

CONNECTIONS OF THE MODEL WITH SEPARATE BYPASS

The very first connection to be carried out is that of the protection conductor (earth cable), which must be connected to the terminal marked PE. The UPS must not operate without being connected to an earthing system

THE INPUT AND THE BYPASS NEUTRALS MUST ALWAYS BE CONNECTED.
THE INPUT AND BYPASS LINES MUST REFER TO THE SAME NEUTRAL POTENTIAL.
DO NOT CONNECT THE OUTPUT NEUTRAL TO THE INPUT OR BYPASS NEUTRAL.

Connect the input and output cables to the terminal board as shown in the figure below:

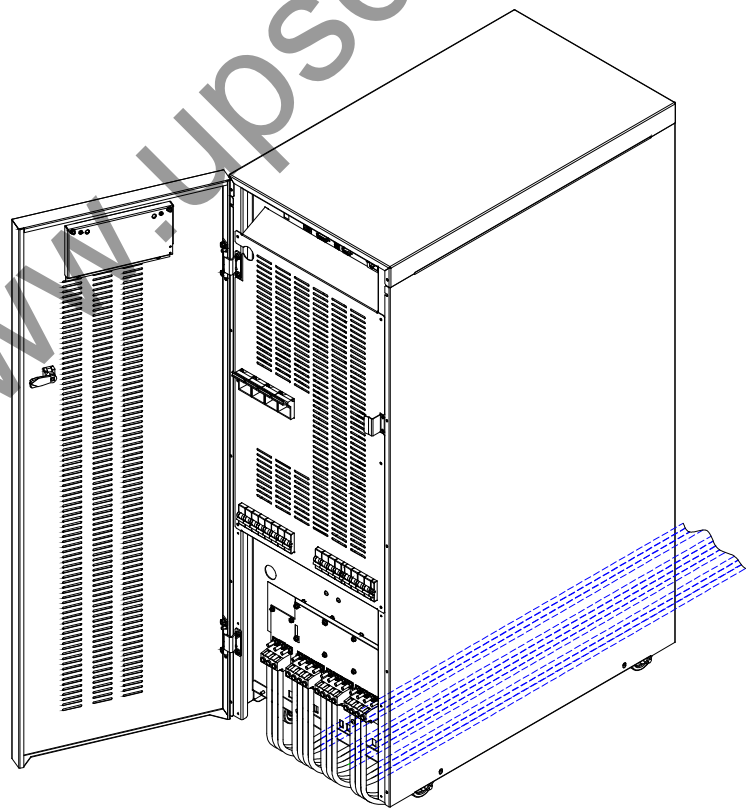


Note 1: The protection conductor (earth cable) connection must be carried out through eyelet terminal stud M6

Note 2: Connections to the BATTERY module are required only when the optional Battery Box is present

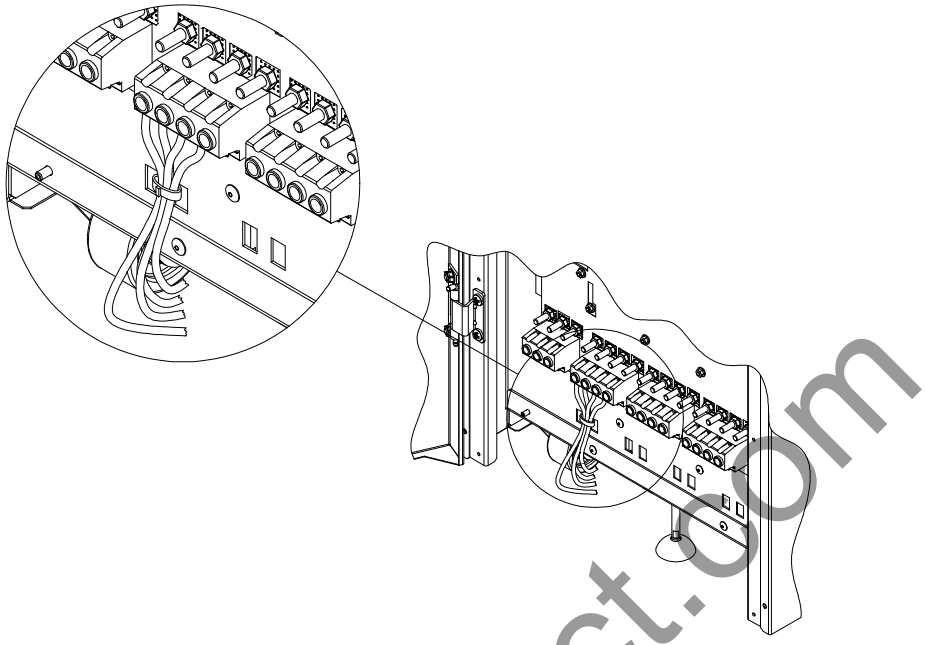
CABLE ROUTING

It is recommended to wire the power cables routing them from the back, under the UPS, to the front of the machine, ensuring they come up in the terminal area as shown:



The lower part of the structure also has slots that can be used to secure the cables using suitably sized clamps.

N.B.
- Tighten the clamps only after tightening the cables in their power terminals.
- Perform the cables so that when the clamp is tightened, they do not strain the power terminals.



R.E.P.O.

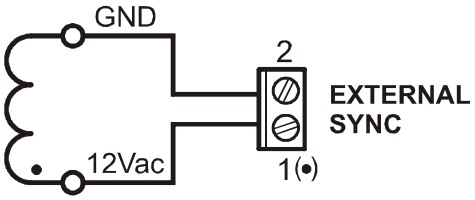
This isolated input is used to turn off the UPS remotely in case of emergency.
This UPS is provided from the factory with “Remote Emergency Power Off” (R.E.P.O.) terminals short-circuited (**see "Views of the UPS connections"**). If it is to be installed, remove the short-circuit and connect to the normally closed contact of the stopping device by using a cable that ensures a double isolation connection.
In case of emergency, the R.E.P.O.control is opened by activating the stopping device; the UPS enters stand-by mode (see "USE" section) and powers off the load completely.

The R.E.P.O circuit is self-powered with SELV type circuits. Therefore, no external power supply voltage is required. When closed (normal condition) a maximum current is present.

EXTERNAL SYNC

This non-isolated input can be used to synchronise the inverter output with an opportune signal coming from an external source. If it is to be installed it is necessary to:

- Use an isolation transformer with an isolated single-phase output (SELV) within the range 12÷24Vac with a power ≥ 0.5VA
- Connect the transformer secondary to the "EXTERNAL SYNC" terminal (see *"Views of the UPS connections")* using a double isolation cable with a 1mm2 cross section. Warning: always respect the polarisation as in the figure below:



After installation, enable the control using the configuration software.

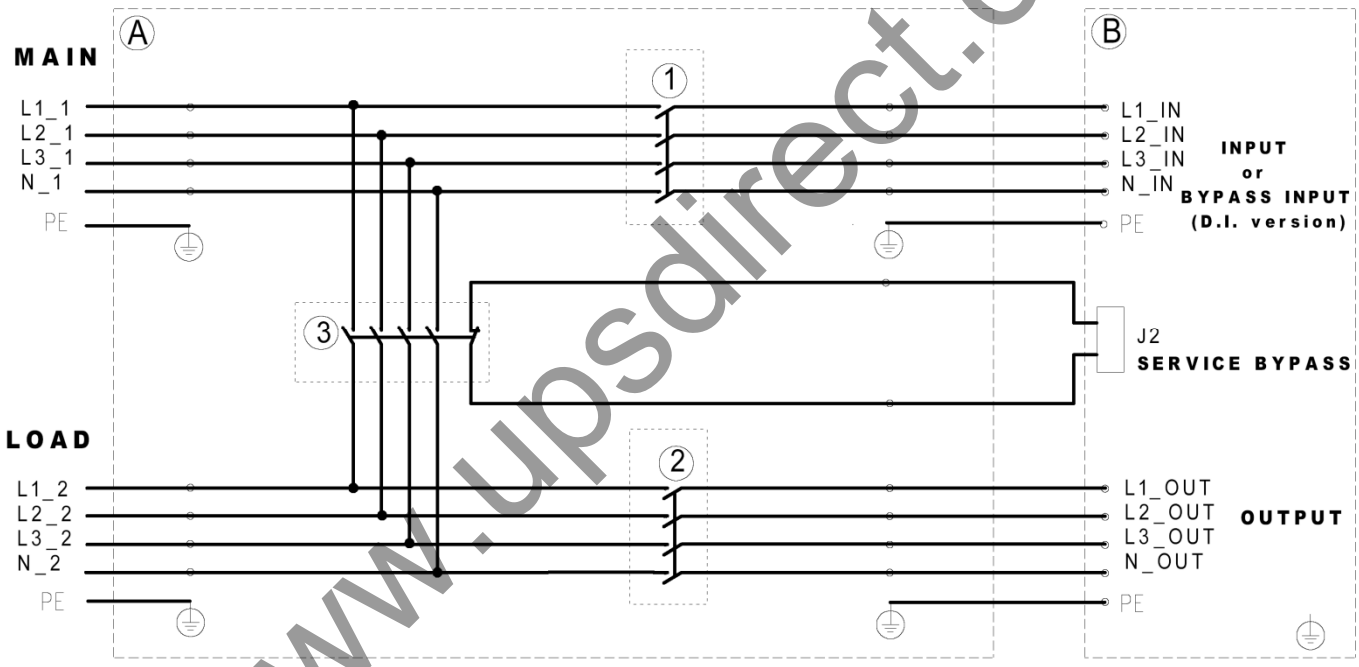
REMOTE MAINTENANCE BYPASS CONNECTION

An additional maintenance bypass may be installed on a peripheral switchboard (see diagram below), for example, o allow replacing the UPS without interrupting the power supply to the load.
Note: The Company provides this accessory already pre-assembled in an IP65 plastic box.

It is essential to connect the "SERVICE BYPASS" terminal (see "Views of the UPS connections") to the auxiliary contact of the SERVICE BYPASS switch. The closure of the SERVICE BYPASS switch will open this auxiliary contact which informs the UPS that the maintenance bypass has been inserted. The absence of this connection may interrupt the power supply to the load and damage the UPS.

- Use cables with cross sections in compliance with the indications given in the "Cross section of the cables" paragraph.
- In order to connect the "SERVICE BYPASS" terminal to the auxiliary contact of the remote maintenance bypass isolator, use 1mm2 double isolation cables.
- If the UPS is connected to an isolation transformer, check the compatibility between the *"remote maintenance bypass"* and the neutral regime of the installation.

REMOTE MAINTENANCE BYPASS INSTALLATION DIAGRAM



(A) Peripheral switchboard

(B) UPS internal connections

(1) INPUT switch: isolator compliant with the indications given in the "UPS internal protections" section

(2) OUTPUT switch: isolator compliant with the indications given in the "UPS internal protections" section

(3) SERVICE BYPASS switch: isolator compliant with the indications given in the "UPS internal protections" section, equipped with a normally closed auxiliary contact

CONNECTING THE UPS TO THE BATTERY BOX (OPTIONAL)

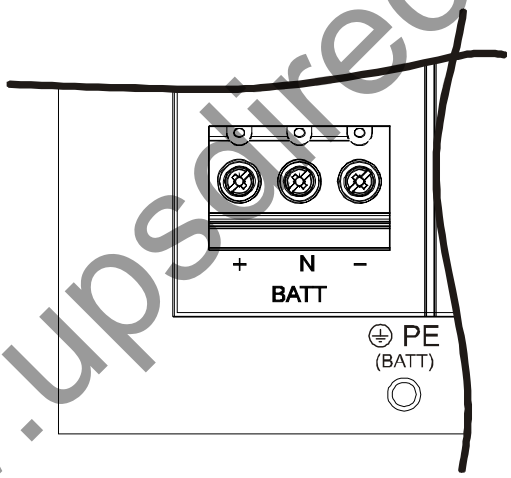
THE CONNECTION BETWEEN THE UPS AND THE BATTERY BOX MUST BE MADE WITH THE DEVICES SWITCHED OFF AND UNPLUGGED FROM THE MAINS

UPS SHUTDOWN PROCEDURE:

- Turn off all the devices connected to the USP, or use (if installed) the remote bypass option.
- Turn off the UPS following the correct procedure (see “Switching off the UPS”, in the “USE” section).
- Open all isolators and fuse holders in the UPS.
- Isolate the UPS completely from the mains power supply, by opening all the external protection devices located on the input and output lines.
- Wait a few minutes before working on the UPS.
- Remove the UPS terminal cover (see “Operations to access the terminals of the UPS").

CONNECTING THE BATTERY BOX:

- Make sure that the battery voltage of the Battery Box corresponds to that allowed by the UPS (check the data plate on the Battery Box and the UPS manual)
- **IMPORTANT:** make sure that SWBATT fuse holders of the UPS and Battery Box are open.
- Before making any connection read carefully the instructions in the Battery Box manual.
- Connect the cables coming from the Battery Box to the UPS terminal board (see figure below), making sure to respect the polarisation. The first connection to be made is that of the yellow-green protection cable.



- Once all these operations have been carried out, replace the previously removed terminal covers on the UPS and on the Battery Box

CHECKING INSTALLATION:

- Insert the fuses in the SWBATT fuse holders of the Battery Box.
- Close the SWBATT fuse holders of the Battery Box and the UPS.
- Carry out the UPS start-up procedure indicated in this manual.
- After about 30 seconds, check that the UPS is operating correctly: simulate a black-out by opening the SWIN input isolator of the UPS. The load should continue to be powered, and the “battery power” LED should light up on the UPS control panel. The latter should beep at regular intervals. Once the SWIN input isolator has been closed again, the UPS should resume operating on mains power.

SETTING THE NOMINAL BATTERY CAPACITY – SOFTWARE CONFIGURATION

Once the BATTERY BOX has been installed, it is necessary to configure the UPS to update the nominal capacity value (total Ah of batteries inside the UPS + external batteries).
To perform this operation, use the dedicated configuration software.

EXTERNAL TEMPERATURE PROBE

This **NON-ISOLATED** input can be used to measure the temperature inside a remote Battery Box.

It is essential that only the kit provided by the manufacturer is used. Any uses not conforming to the specifications may cause faults or breakdowns of the equipment.

As for installation, connect the cable included in the special kit (optional) to the "EXT T_BATT" connector (see "Views of the UPS connections") following the instructions in the manual.
After installation, enable the outdoor temperature measuring function using the configuration software.

REMOTE SYNOPTIC PANEL (OPTIONAL)

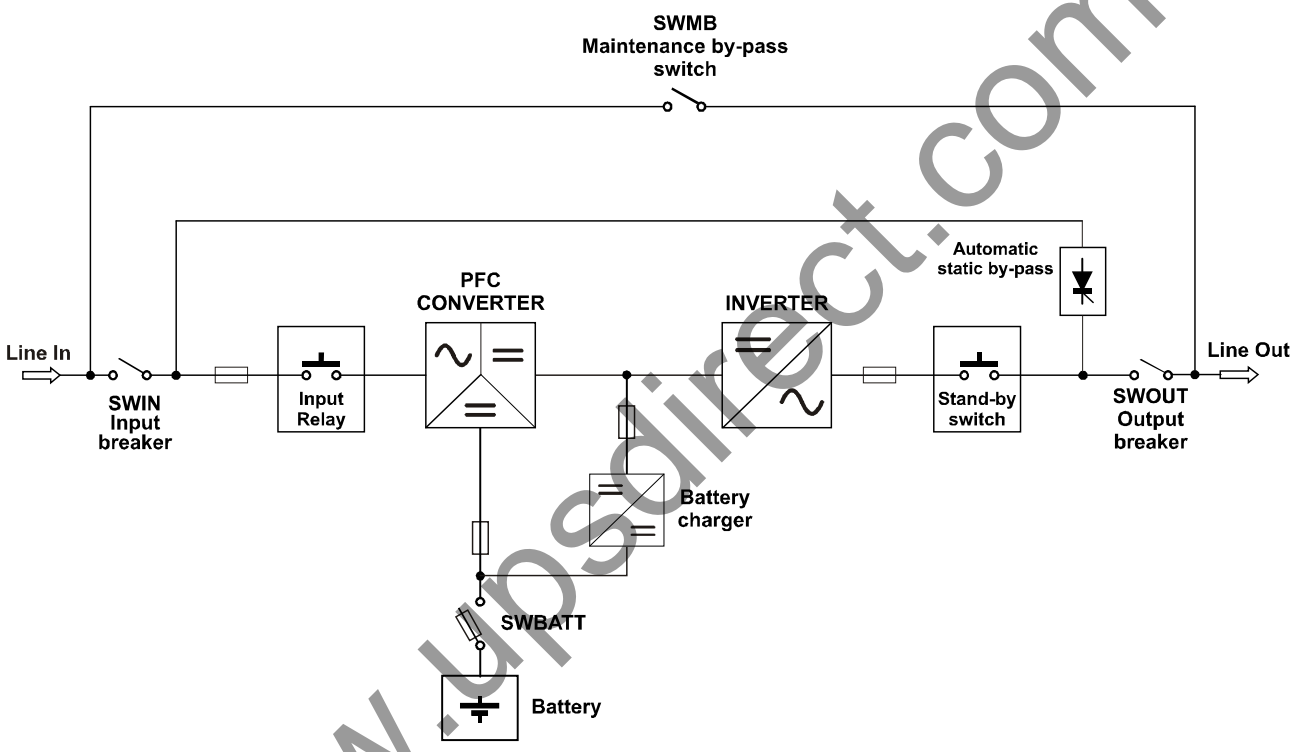
The remote synoptic panel allows remote monitoring of the UPS and therefore, ensures a detailed real-time overview of the machine status. With this device, it is possible to keep the mains, the output and the battery measurements under control, and detect any alarm. .

For further information regarding the connection and use of this device, please refer to its apposite manual.

DESCRIPTION

The purpose of this UPS is to ensure a perfect power supply voltage for the devices connected to it, whether mains power is present, or not. Once it has been connected and powered, the UPS generates a sinusoidal alternating voltage with stable amplitude and frequency, regardless of any sudden change or variation in the mains supply. While the UPS draws energy from the mains, the batteries are kept under charge, controlled by the multiprocessor board. This board also monitors continuously the amplitude and frequency of the mains voltage, the amplitude and frequency of the voltage generated by the inverter, the load applied, the internal temperature and the state of battery efficiency.

The UPS block diagram is shown below with a description of its individual components.



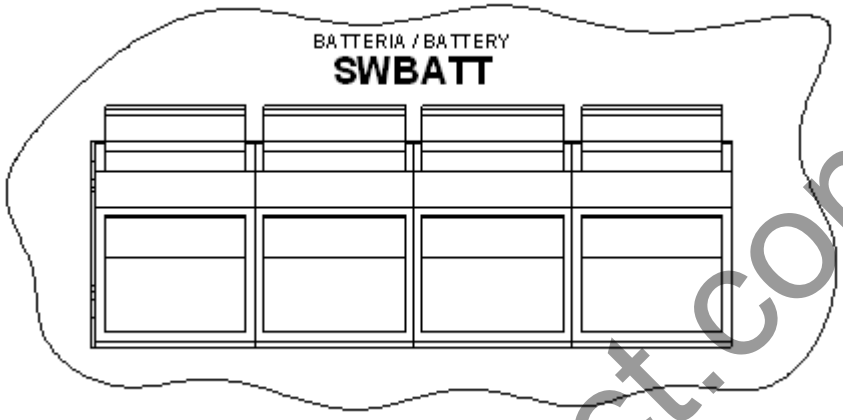
UPS block diagram

IMPORTANT: Our UPSs are designed and built for long durability, even under the most stringent operating conditions. However, it is important to remember that they are electrical power equipments and therefore, need regular checks. Moreover, some components inevitably have a life cycle of their own, so, for this reason, they need to be checked regularly and, if necessary, be replaced. This is referred in particular to the batteries, the fans and, in some cases, to the electrolytic condensers.
Therefore, a preventive maintenance programme is strongly recommended. This preventive maintenance programme must be entrusted to specialised personnel authorised by the manufacturer.
Our Technical Servicing department is at your disposal for customised preventive maintenance options.

PRELIMINARY OPERATIONS AND FIRST START-UP

- **Visual check of the connection**
  Make sure that all the connections have been made by following carefully the instructions given in the "Connections" paragraph.
  Check that all the isolators are open.

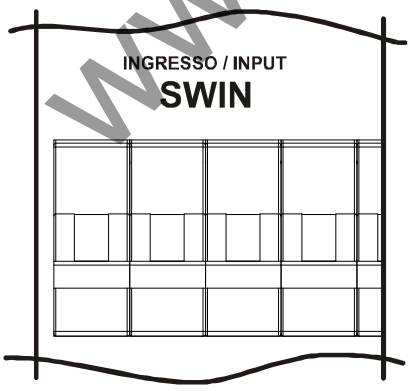
- **Closure of the battery fuse holders**
  Close the 4 battery fuse holders (SWBATT) as shown in the figure below.

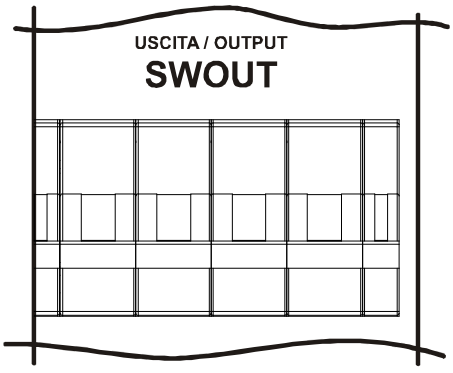


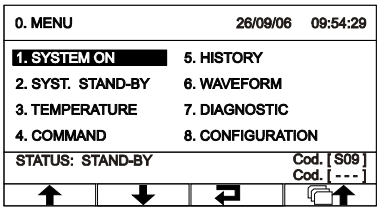
WARNING: if an external Battery Box is present and the connection does not comply with the instructions given in "Connecting the UPS to the Battery Box (optional)" paragraph, the battery fuses and other protections may result damaged. In that case, please contact the Customer Service department, in order to prevent further damages to the UPS.
When the fuses are closed, a small arc may occur due to charge of the condensers inside the UPS. This is normal, and does not cause faults and/or damages.

- **UPS powering**
  Close the protections upstream the UPS.

- **Closure of the input and output isolators**
  Close the SWIN and SWBYP (if present) input isolators. Close the SWOUT output isolator but leave the SWMB maintenance isolator open.



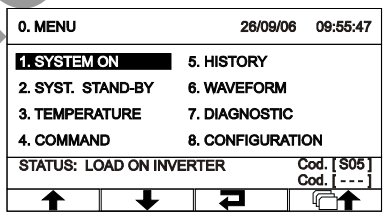




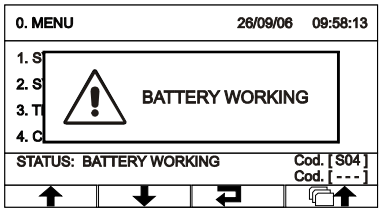
- After a few seconds, check that the display is turned on and that the UPS enters STAND-BY mode.

If an error message appears on display indicating a wrong cyclic sense of the input phases, perform the following operations:

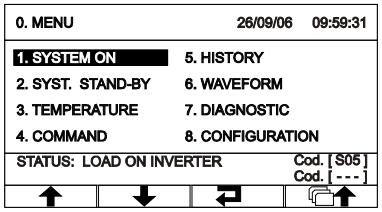
- Open all the input and output isolators
- Wait for the display to turn off
- Open the battery fuse holders
- Open all the protections upstream the UPS
- Remove the protective panel covering the input terminal board
- Correct the position of the input wires so that the cyclic sense of the phases is respected.
  Only if the separate bypass option is present: check which terminal board (input and/or bypass) the code error shown on display corresponds to (see the "Alarm codes" paragraph); correct the position of the wires following the indications on the terminal board.
- Close the protective panel again
- Repeat the preliminary operations given in the previous page.



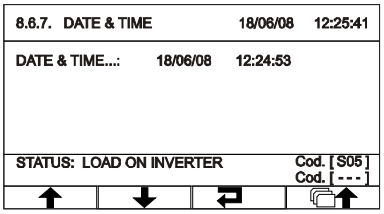
- Press the ↵ button to access the start-up menu. Press "YES" when requested to confirm. press ↵ to confirm and wait for a few seconds. Make sure that the UPS enters ON-LINE mode and that the load is on the inverter.



- Open the input isolator (SWIN) and wait for a few seconds. Check that the UPS enters "battery working" mode and that the load is still powered correctly. You should hear a beep about once every 7 seconds.



- Close the input isolator (SWIN) and wait for a few seconds. Make sure that the UPS is not on "battery working" mode anymore and that the load is still powered correctly by the inverter.



- To set up Date and Time, access menu 8.6.7 (see "Menu display"). Use direction buttons (↑↓) to set up the desired value, and the confirm button (↵) to proceed to the next menu. To save the new set up, return to the previous menu by pressing the ⧉↑ button.

MAINS START-UP

- Close the SWIN and SWBYP (if present) and leave the SWMB maintenance isolator open.
  After a few moments the UPS will be activated. The condensers are pre-charged and the "Lock / stand-by" led will start to flash: The UPS is in stand-by mode.
- Press the ↵ button to access the start-up menu. When requested to confirm, press “YES” and then press the ↵ button again to confirm. All LEDs on display will turn on for about a second and you should hear a beep. The start-up sequence ends when the UPS enters the “load on inverter” status.

BATTERY START-UP

- Keep the “Cold Start” button (located behind the door) pressed for about 5 seconds. The UPS will be activated and the display will turn on.
- Press the ↵ button to access the start-up menu. When requested to confirm, press “YES” and then press the ↵ button again to confirm. All LEDs on display will turn on for about a second, and the buzzer will beep once every 7 seconds. The start-up sequence ends when the UPS enters “battery working” mode.

Note: if the sequence described above is not carried out within 1 minute, the UPS will turn off automatically so not to discharge the batteries unnecessarily.

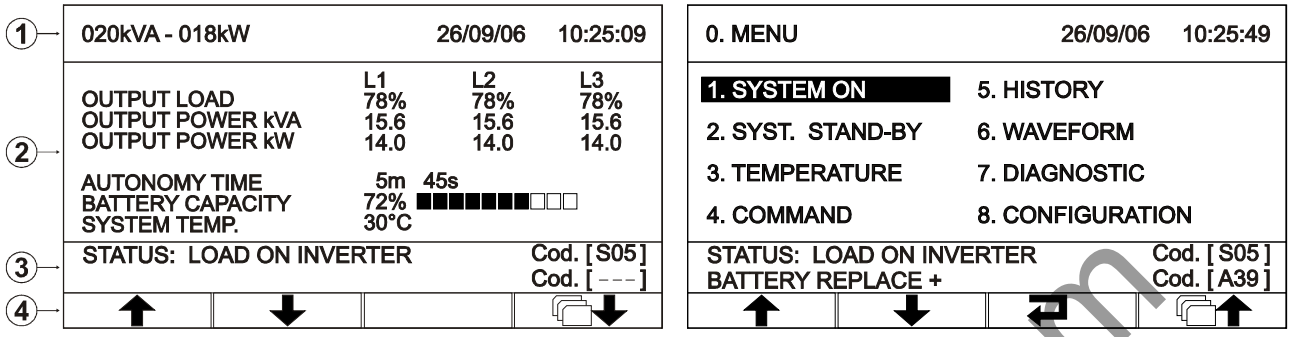
SWITCHING OFF THE UPS

From the main menu, select “OFF” and press ↵ the submenu. Then select the option “YES – CONFIRM” and press ↵. The UPS will enter “stand-by” mode. To switch off the UPS completely, open the SWIN and SWBYP (if present) input isolators.

***Note**: During long idle periods, it is recommended to switch off the UPS and then, while the display is off, open the battery fuse holders.*

GRAPHIC DISPLAY

Located at the centre of the control panel there is a large graphic display, which provides, in the foreground and in real-time, a detailed overview of the UPS status. The user can switch on and off the UPS, consult the electrical measurements of the mains, output, battery etc. [1], and make the main machine settings directly from the control panel.
The display is divided into four main areas, each with its own specific function.



Sample screens of the graphic display
(these screens are for indicative purpose only, and may not reflect the actual situation)

1 GENERAL INFORMATION

Area of the display that shows the date and time permanently, and, depending on the screen, the page number or the title of the menu currently active.

2 DISPLAY DATA / BROWSE MENU

Main area of the display used to view the UPS measurements (updated constantly in real-time), and to consult the various menus that the user can select by pressing the apposite function button. Once the desired menu has been selected, this part of the display will show one or more pages containing all the data referred to the menu chosen.

3 UPS STATUS / ERRORS - FAULTS

This area of the display shows the UPS operating status.
The first line is always active and constantly shows the current status of the UPS. The second line is active only in presence of an error and/or fault on the UPS, and shows what kind of error/fault has occurred.
On the right, each line shows the code corresponding to the ongoing event.

4 BUTTON FUNCTIONS

This area is divided into four boxes, each referring to the function button below it. According to the menu active in that moment, the display will show the function of the corresponding button in the relevant box.

Button Symbols


To access the main menu


To return to the previous menu or screen

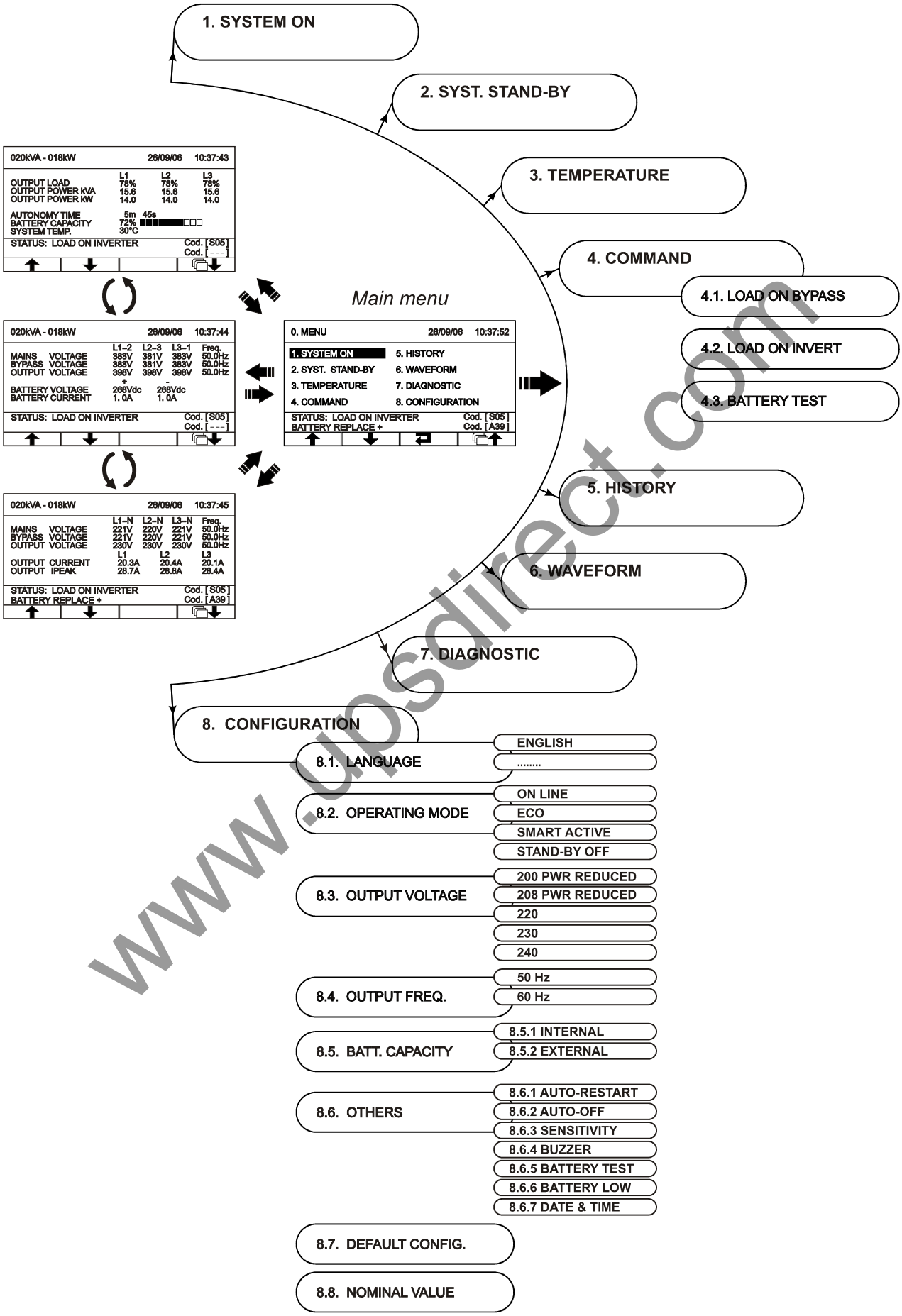

To scroll through the various items on a menu or to move from one page to another while viewing data


To confirm a selection


To temporarily silence the buzzer (press for more than 0.5 seconds).
To cancel a programmed switch-on/off (press for more than 2 seconds)

[1] *The precision of these measurements is: 1% for voltage measurements, 3% for current measurements, 0.1% for frequency measurements. The indication of the autonomy time left is a mere ESTIMATE; therefore, it is not to be considered a perfectly accurate tool.*

MENU DISPLAY



OPERATING MODE

The mode that guarantees the maximum protection for the load is the ON LINE mode, in which the Energy for the load undergoes a double conversion and is reconstructed at the output in a perfectly sinusoidal manner, with the frequency and the voltage set by a precise digital control of the DSP regardless of the input (V.F.I.). *
In addition to the traditional ON LINE double-conversion mode, it is possible to select the following modes:

- ECO (LINE INTERACTIVE)
- SMART (SMART ACTIVE)
- STBYOFF (STAND-BY OFF)

In order to optimise the efficiency, in ECO mode the load is normally powered from the bypass (any interference on the mains can affect the load). In absence of the mains, or when the mains voltage exceeds its tolerance limit, the UPS commutates to the normal ON LINE double-conversion mode. About five minutes after having returned within its tolerance limits, the load is commutated back to bypass.

If the user cannot decide which is the most suitable operating mode (between ON LINE and ECO) the choice can be left to the SMART ACTIVE mode, in which, according to statistical data on the quality of the mains power supply, the UPS autonomously decides in which mode to configure itself.

Finally, in STAND-BY OFF mode, the UPS is set to operate as a back-up device:
In presence of the mains power, the load is not powered, whilst in the event of a black-out, the load is powered by the inverter via the batteries. When the mains power is restored, the load is powered off again. The activation time is less than 0.5 seconds.

MAINTENANCE BYPASS (SWMB)

WARNING: Maintenance inside the UPS must be carried out by qualified personnel trained by the manufacturer only. In fact, inside the equipment there may be a voltage even when the input, output and battery switches are open. Removal of the UPS panels by non-qualified personnel may cause harm to the operator and damage to the equipment.

Listed below are the operations to be performed in order to carry out the maintenance on the equipment with no interruption of the power supply to the load:

- With the mains voltage present, the UPS must power the load through the inverter or the automatic bypass.
  N.B.: If the UPS is in battery power mode, activating the maintenance bypass may imply an interruption of the power supply to the load.
- Close the maintenance bypass isolator (SWMB) located behind the door. This way, the input is short-circuited with the output.
- Open the input switches (SWIN), the output switches (SWOUT), and the battery fuse holders (SWBATT) located behind the door. The signal panel is turned off. Wait for the electrolytic condensers on the power board to discharge (about 20 minutes) and then proceed with the maintenance operations.
  N.B.: During this phase, with the load powered via the maintenance bypass, any disturbance on the UPS power supply line would affect the equipment powered (the load is connected directly to the mains. The UPS is no longer active). **Moreover, the auxiliary *"Power share"* and *"Power out" sockets*, are no longer powered (see "*Auxiliary (power share)sockets"* in the *"USE" section*).**

Once these maintenance operations have been completed, perform the following operations to restart the UPS:

- Close the input and output isolators and the battery fuse holders. The signal panel is reactivated. Turn the UPS on again from the “SYSTEM ON” menu. Wait for the sequence to be completed.
- Open the maintenance bypass: The UPS resumes normal operation.

* The rms value of the output voltage is set by the precise control of the DSP, regardless of the input voltage, while the output voltage frequency is synchronised (within a tolerance range which can be set by the user) with the input voltage, in order to allow use of the bypass. Outside this tolerance range, the UPS desynchronises adopting the nominal frequency and the bypass can no longer be used (free running mode).

REDUNDANT AUXILIARY POWER SUPPLY FOR AUTOMATIC BYPASS

This UPS is provided with a redundant auxiliary power supply which allows the UPS to run on an automatic bypass, even in the event of faults on the main auxiliary power supply. If a fault occurs in the UPS, shutting off the main auxiliary power supply, the load will be powered anyway by the automatic bypass. The multiprocessor board and the control panel are not powered; therefore the LEDs and the display are off.

AUXILIARY "POWER SHARE" AND "POWER OUT" SOCKETS (OPTIONALS)

The "Power share" socket is a programmable output socket which enables, under certain operating circumstances, the automatic disconnection of the load applied to it. The events that determine this automatic disconnection of the "power share" socket can be selected by the user through the configuration software (see *"Configuration software"* and *"Configuring the UPS"* paragraphs). For example, the disconnection could be selected after a given time of battery operation, or when the end-of-battery-charging pre-alarm threshold is reached, or when an overload occurs.
The "Power out" socket is connected directly to the UPS output and it is useful to power accessories such as modems, for example
.

Safety notes: *when the UPS is switched on, if the output isolator (SWOUT) is opened, the sockets will remain powered.*

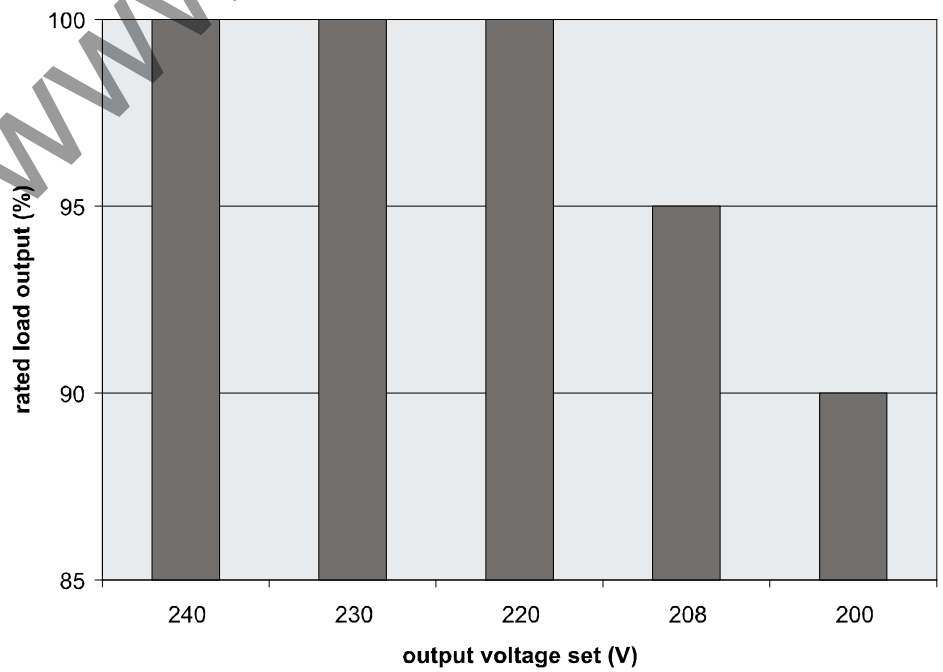
If the manual bypass isolator (SWMB) is inserted, the output isolator (SWOUT) is opened and once the UPS is turned off, the sockets are no longer powered.

POWER WALK-IN

This UPS is equipped in series with a Power Walk-In mode, which can be activated and configured through the configuration software. When the mode is active, and mains power is restored (after an autonomy period) the UPS resumes absorbing progressively from it, in order to prevent stress (due to the peak) on any generator set installed upstream. The transient time can be set from 1 to 125 seconds. The default value is 10 seconds. During the transient, the necessary power is drawn partially from the batteries and partially from the mains, maintaining a sinusoidal absorption. Once the transient is over, the battery charger is turned on again.

POWER REDUCTION FOR 200/208V PHASE-NEUTRAL LOADS

In case the output voltage is set to 200V or 208V PHASE-NEUTRAL (see the "Configuring the UPS" paragraph), the maximum power output of the UPS is reduced compared to its nominal value, as shown in the diagram below:



CONFIGURING THE UPS

The following table shows all possible configurations available to tailor the UPS to your needs in the best way possible.

CP (Control Panel) = Indicates that the configuration can be edited not only by the configuration software but also using the control panel (if function editing is enabled on the panel).

SW (Software) = Indicates that the configuration can be changed from the configuration software only.

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS	MOD.
Output frequency	Selecting the rated output frequency (for the setting to be active, turn the UPS off then back on)	50 Hz	• 50 Hz • 60 Hz	***CP***
Output Voltage	Selects nominal Output voltage (Phase / Neutral)	230V	• 200V * • 208V * • 220V • 230V • 240V	***CP***
			• 220 ÷ 240 in steps of 1V	***SW***
Operating Mode	Selects one of the 5 operating modes	ON LINE	• ON LINE • ECO • SMART ACTIVE • STAND-BY OFF	***CP***
			• FREQUENCY CONVERTER	***SW***
Power off due to minimum load	Automatically switches off the UPS in battery operation when the load is less than 5%	Disabled	• Enabled • Disabled	***CP***
Autonomy limitation	Sets the maximum time of battery operation	Disabled	• Disabled (complete battery discharge) • 1 ÷ 65000 in steps of 1 sec.	***SW***
Low battery pre-alarm	Sets the estimated autonomy time left for low battery warning	3 min.	1 ÷ 255 in steps of 1 min. (1 to 7 min from the panel)	***SW***
Battery test	Sets the interval of time for the automatic battery test	40 hours	• Disabled/Enabled (from the panel) • 1 ÷ 1000 in steps of 1 hour	***SW***
Maximum load alarm threshold	Selects the user overload limit	Disabled	• Disabled • 0 ÷ 103 in steps of 1%	***SW***
Sound alarm	Selects the operating mode of the sound alarm	Reduced	• Normal • Reduced: does not sound because of momentary intervention of the bypass	***CP***
Auxiliary socket (power share)	Selects the operating mode of the auxiliary socket	Always connected	• Always connected • Disconnected after *n* seconds of battery operation • Disconnected after *n* seconds from the end-of-discharge alarm signal • ... (see configuration software manual)	***SW***
Battery expansion	Sets the Ah installed (external battery extension)	0 Ah	Min.: 0 - Max.: 999 (in steps of 1 Ah)	***CP***
Language**	Selects the display language	English	• English • Spanish • Italian • Polish • German • Russian • French • Chinese	***CP***
Date and time	Sets the date and time	--	--	***CP***

FUNCTION	DESCRIPTION	DEFAULT	POSSIBLE CONFIGURATIONS	MOD.
Advanced Functions				
Input frequency tolerance	Selects the allowed input frequency range for switching to bypass and for output synchronisation	± 5%	• ± 0.25% • ± 0.5% • ± 0.75% • ± 1 ÷ ±10 in steps of 1%	***SW***
Bypass voltage thresholds	Selects the voltage range allowed for switching to bypass	Low: 180V High: 264V	Low: 180 ÷ 220 in steps of 1V High: 240 ÷ 264 in steps of 1V	***SW***
Bypass voltage thresholds for ECO	Selects the voltage range allowed for ECO mode operation	Low: 200V High: 253V	Low: 180 ÷ 220 in steps of 1V High: 240 ÷ 264 in steps of 1V	***SW***
Activation sensitivity for ECO	Selects activation sensitivity during ECO mode operation	Normal	• Low • Normal • High	***CP***
Power supply of load in stand-by	Load on bypass power supply with UPS off (stand-by status)	Disabled (load NOT powered)	• Disabled (not powered) • Enabled (**powered**)	***SW***
Bypass operation	Selects the bypass line operating mode	Enabled / High sensitivity	• Enabled / High sensitivity • Enabled / Low sensitivity • Disabled with input / output synchronisation • Disabled without input / output synchronisation	***SW***
Inverter synchronization (External Sync)	Selects the synchronisation source for the inverter output	From bypass line	• From bypass line • From external input	***SW***
Start-up delay	Waiting time for automatic restart after the mains power supply has been restored	5 sec.	• Disabled/Enabled (from the panel) • 1 ÷ 255 in steps of 1 sec.	***SW***
Power Walk-In	Enables the mode for gradual return to mains power	Disabled	• Enabled • Disabled	***SW***
Duration of Power Walk-In	Sets the duration of the gradual return to mains power (only if Power Walk-in is enabled)	10 sec.	Min.: 1 sec. - Max.: 125 sec.	***SW***
Speed of synchronisation between inverter and bypass line	Selects the synchronisation speed between the inverter and the bypass line	1 Hz/sec	• 0.5 Hz/sec • 1 Hz/sec • 1.5 Hz/sec • 2 Hz/sec	***SW***
External temperature probe (*optional*)	Enables reading of the external temperature probe	Not enabled	• Not enabled • Enabled	***SW***
UPS settings from the display	Disable UPS settings from the display panel	Settings enabled	• Settings enabled • Settings disabled	***SW***
UPS controls from the display	Disable UPS controls from the display panel	Controls enabled	• Controls enabled • Controls disabled	***SW***

** Once these output voltage values are set, the UPS output power is reduced (see the "Power reduction for 200V and 208V phase-neutral loads" paragraph)*

*** Pressing the F1 and F4 keys at the same time for t > 2 sec. automatically resets the language to English.*

COMMUNICATION PORTS

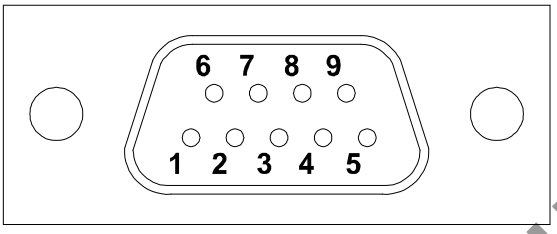
In the upper part of the UPS, behind the door (see "*Views of the UPS*") there are the following communication ports:

- Serial port, available with RS232 connector and USB connector.
  NOTE: the choice of one connector automatically excludes the other.
- Expansion slots for additional COMMUNICATION SLOT interface boards
- AS400 port

Moreover, on the rear of the UPS it is possible to install as an option the power relay board (4 programmable contacts, 250Vac, 3A)

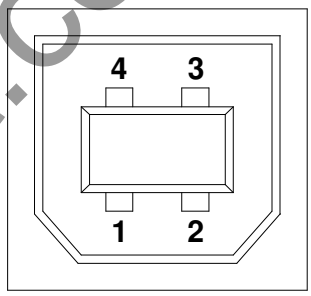
RS232 AND USB CONNECTORS

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

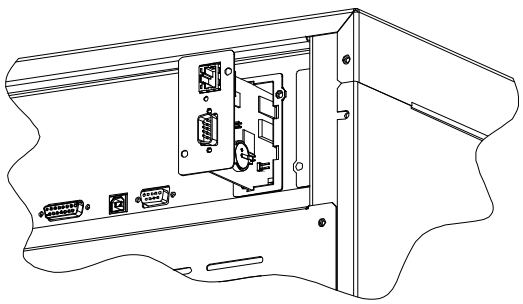


PIN #	SIGNAL
1	VBUS
2	D-
3	D+
4	GND

COMMUNICATION SLOT

This UPS is equipped with two expansion slots for accessory communication boards, which allow the device to communicate using the main communication standards (see the "*Front views of the UPS*" paragraph).
Here are some examples:

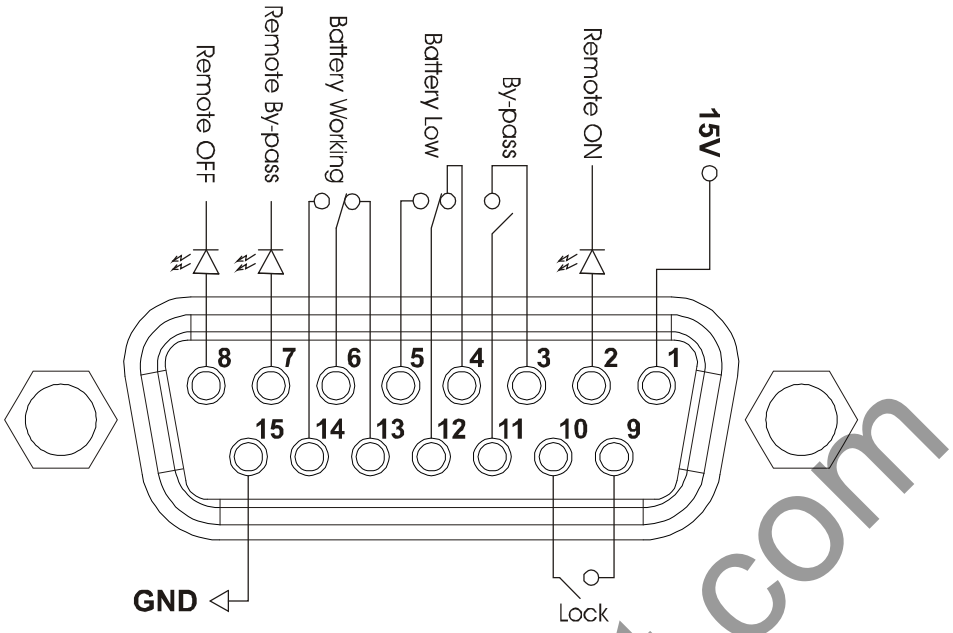
- Second RS232 port
- Serial duplicator
- Ethernet agent with TCP/IP, HTTP and SNMP protocol
- RS232 + RS485 port with JBUS / MODBUS protocol



For further information on the accessories available, please visit the website.

AS400 PORT

AS400 PORT



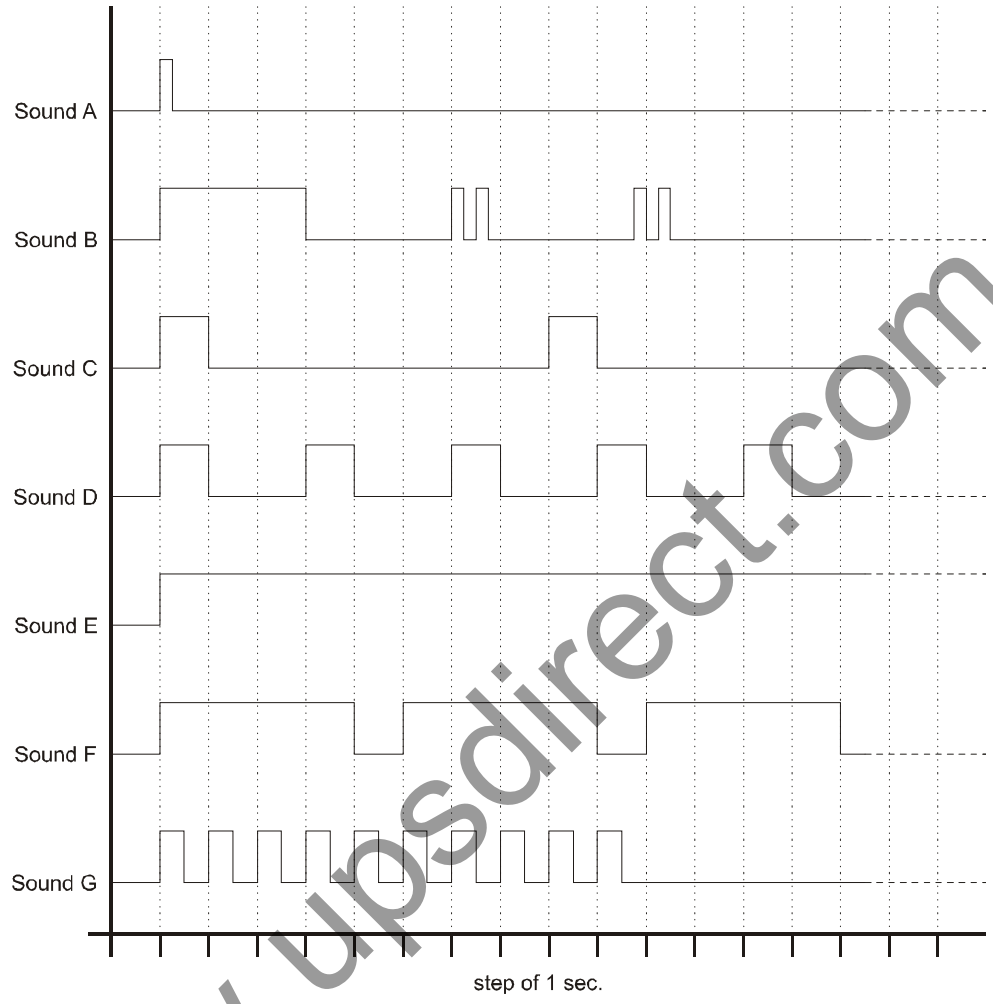
PIN #	NAME	TYPE	FUNCTION
1	15V	POWER	Isolated auxiliary power supply +15V±5% 80mA max
15	GND	POWER	Ground to which the isolated auxiliary power supply (15V) and the remote commands (Remote ON, Remote BYPASS, Remote OFF) refer
2	REMOTE ON	INPUT #1	By connecting pin 2 to pin 15 for at least 3 seconds the UPS is turned on
8	REMOTE OFF	INPUT #2	By connecting pin 8 to pin 15 the UPS switches off instantly
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 remains, the UPS keeps operating from the bypass, even if the input mains voltage is absent. If the jumper is removed in presence of the mains voltage, the UPS resumes operating from the inverter. If the jumper is removed in absence of the mains voltage, the UPS resumes operating from the battery
4,5,12	BATTERY LOW	OUTPUT #1	Indicates that the batteries are about to run out when contact 5/12 is closed [1]
6,13,14	BATTERY WORKING	OUTPUT #2	Indicates that the UPS is running on battery power when contact 6/14 is closed [1]
9,10	LOCK	OUTPUT #3	When the contact is closed, indicates that the UPS is locked [1]
3,11	BYPASS	OUTPUT #4	When the contact is closed, indicates that the load is powered via the bypass [1]

N.B.: The figure shows the contacts present inside the UPS, which are capable of carrying a max. current of 0.5A to 42Vdc. The position of the contact indicated in the figure is with no alarm or signal present.

[1] *The output may be programmed using the configuration software.*
The function indicated is selected by default (factory setting)

BUZZER

The status and the faults of the UPS are signalled by the buzzer, which will emit a sound according to the various operating conditions of the UPS.
The various kinds of sounds are described below:



Sound A: This signal is emitted when the UPS is turned on or off using the apposite buttons. A single beep confirms the start-up, the activation of the battery test, and the cancellation of the programmed switch-off. By keeping the power-off button pressed, the buzzer will emit in rapid succession sound A four times, before confirming the switch-off with a fifth beep.

Sound B: This signal is made when the UPS commutates to bypass in order to compensate the surge current due to the insertion of a distorting load.

Sound C: This signal is emitted when the UPS switches to battery operation, before the low battery signal (sound D). It is possible to silence the signal (see the “Graphic display” paragraph).

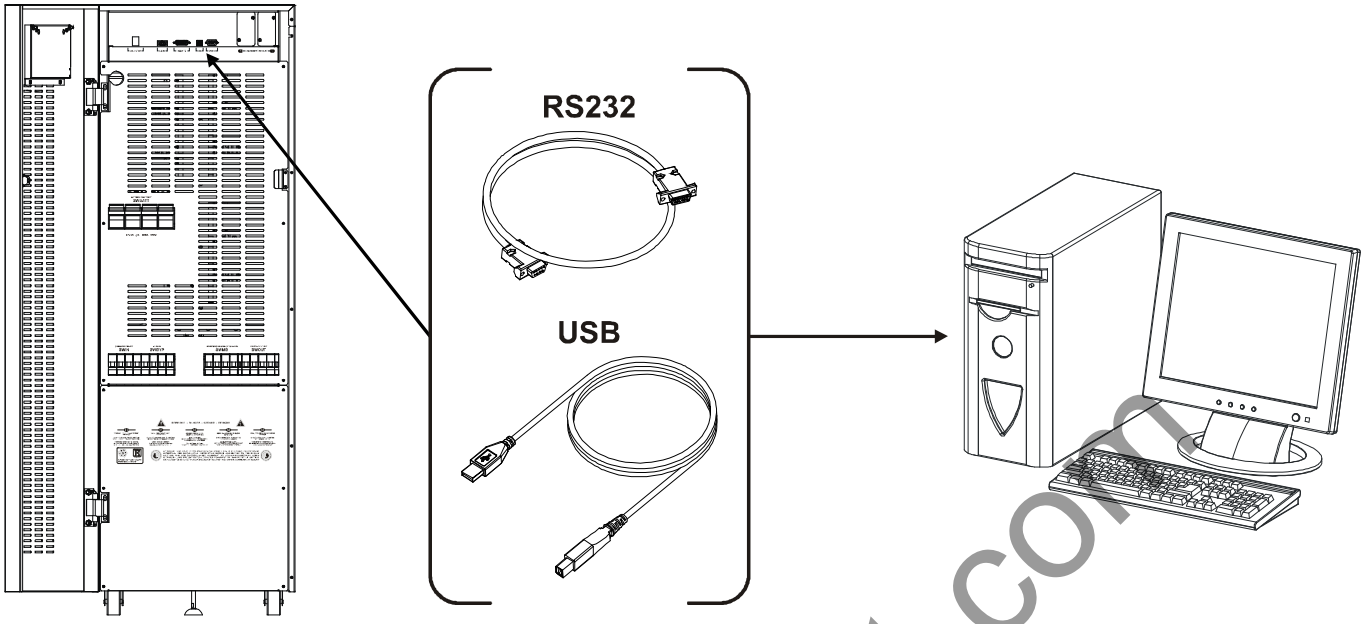
Sound D: This signal is made during battery operation, when the low battery threshold is reached. It is possible to silence the signal (see the “Graphic display” paragraph).

Sound E: This signal is emitted in the presence of an alarm or lock.

Sound F: This signal is emitted if a battery overvoltage fault occurs

Sound G: This signal is made when the battery test fails. The buzzer beeps ten times. The alarm signal is maintained with the “replace batteries” LEDs on.

SOFTWARE



MONITORING AND CONTROL SOFTWARE

The **PowerShield**[3] software guarantees an effective and user-friendly management of the UPS, by displaying all the most important information such as input voltage, load applied, and battery capacity.
It can also perform automatically shutdown operations, send e-mails, sms and network messages when specific user-selected events occur.

Installation operations:

- Connect the RS232 communication port of the UPS to a COM communication port of the PC via the serial cable provided* or connect the USB port of the UPS to a USB port of the PC using a standard USB cable*.
- Download the software from **www.riello-ups.com**, selecting the desired operating system.
- Follow the installation program instructions.
- For more detailed information about installation and use, refer to the software manual which can be downloaded from our website **www.riello-ups.com**.

CONFIGURATION SOFTWARE

Using special software, it is possible to configure the most important UPS parameters.
For a list of possible configurations, refer to the ***UPS configuration*** paragraph.

* *We recommend the use of a cable not more than 3 metres long.*

TROUBLESHOOTING

An irregular operation of the UPS is frequently not due to malfunctions, but to simple problems, inconveniences or distractions. Therefore, the user is advised to consult the table below providing useful information on how to solve the most common problems.

WARNING: *the table below often refers to the use of the maintenance BYPASS. Before restoring the correct operation of the UPS, make sure that it is switched on and* ***not in STAND-BY****.*
In case it is in stand-by, turn the UPS on by accessing the "SYSTEM ON" menu, and wait for the start-up sequence to be completed before removing the maintenance BYPASS.
For further information ***read carefully the sequence described in the "maintenance BYPASS (SWMB)"*** *paragraph*

NOTE: For the exact meaning of the codes mentioned in the table, please read the "ALARM CODES" section.

PROBLEM	POSSIBLE CAUSE	SOLUTION
THE UPS CONNECTED TO THE MAINS, DOES NOT SWITCH TO STAND BY MODE (THE RED BLOCK/STAND-BY LED DOES NOT FLASH, NO BEEP SOUNDS AND THE DISPLAY DOES NOT LIGHT UP)	CONNECTION TO THE INPUT TERMINAL MISSING	Connect the mains to the terminals following the indications in the paragraph on Installation
	NEUTRAL CONNECTION MISSING	The UPS cannot operate without the neutral connection. WARNING: The absence of this connection could damage the UPS and the load. Connect the mains to the terminals following the indications in the paragraph on Installation.
	THE ISOLATOR BEHIND THE DOOR (SWIN) IS OPEN	Close the isolator
	MAINS POWER MISSING (BLACKOUT)	Make sure the mains power is present. If necessary, perform battery start-up to power the load.
	INTERVENTION OF THE UPSTREAM PROTECTION DEVICE	Restore the protection. Warning: make sure there is no overload or short circuit on the UPS output.
NO POWER REACHES THE LOAD	CONNECTION TO THE OUTPUT TERMINAL MISSING	Connect the load to the terminals
	THE ISOLATOR BEHIND THE DOOR (SWOUT) IS OPEN	Close the isolator
	THE UPS IS IN STAND-BY MODE	Run the start-up sequence
	THE STAND-BY OFF MODE HAS BEEN SELECTED	The operating mode must be changed. In fact the STAND-BY OFF (emergency) mode only powers the loads when a black out occurs.
	MALFUNCTION OF THE UPS AND AUTOMATIC BYPASS OUT OF USE	Insert the maintenance bypass (SWMB) and contact the nearest service centre
THE UPS OPERATES OFF THE BATTERIES EVEN THOUGH MAINS POWER IS PRESENT	INTERVENTION OF THE UPSTREAM PROTECTION DEVICE	Restore the protection. WARNING: make sure there is no overload or short circuit on the UPS output.
	THE INPUT VOLTAGE IS OUT OF THE ALLOWED OPERATING VALUES FOR MAINS POWER	Problem caused by the mains power. Wait for the input mains voltage to return within the tolerance limits. The UPS will return automatically to mains operation.

PROBLEM	POSSIBLE CAUSE	SOLUTION
THE DISPLAY SHOWS C01	THE JUMPER IS MISSING FROM THE R.E.P.O. CONNECTOR (see "FRONT VIEWS OF THE UPS") OR IT IS NOT INSERTED CORRECTLY	Assemble the jumper or make sure that it is inserted correctly.
THE DISPLAY SHOWS C02	MAINTENANCE BYPASS ISOLATOR (SWMB) CLOSED	Open the isolator (SWMB) located behind the door.
	THE JUMPER IS MISSING FROM THE TERMINALS FOR THE REMOTE MAINTENANCE BYPASS (J2, "VIEWS OF THE UPS CONNECTIONS")	Insert the jumper
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: A30, A32, A33, A34 AND THE UPS DOES NOT START UP	AMBIENT TEMPERATURE < 0°C	Heat the environment, wait for the heat sink temperature to rise above 0°C and then start up the UPS
	FAULT IN HEAT SINK TEMPERATURE PROBE	Activate the maintenance bypass (SWMB), turn the UPS off and back on again and exclude the maintenance bypass. If the problem persists, contact the nearest service centre
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F09, F10	FAULT IN THE INPUT STAGE OF THE UPS	Activate the maintenance bypass (SWMB), turn the UPS off and back on again and exclude the maintenance bypass. If the problem persists, contact the nearest service centre
	PHASE 1 HAS A MUCH LOWER VOLTAGE THAN THE OTHER TWO PHASES.	Open the SWIN, switch on the UPS from the battery. Wait for the sequence to be completed and close the SWIN
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F11, F14, F15, F16, F17, L06, L07, L08, L09, L14, L15, L16, L17, L18, L19, L20, L21, L22	ANOMALOUS LOADS APPLIED	Remove the load. Insert the maintenance bypass (SWMB), turn the UPS off and back on again. Exclude the maintenance bypass. If the problem persists, contact the nearest service centre
	FAULT IN THE INPUT OR OUTPUT STAGE OF THE UPS	Activate the maintenance bypass (SWMB), turn the UPS off and back on again. Exclude the maintenance bypass. If the problem persists, contact the nearest service centre
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F03, F04, F05, A08, A09, A10	NO CONNECTION ON ONE OR MORE PHASES	Check the connections to the terminals
	INTERNAL PROTECTION FUSES ON THE PHASES OR ON THE INPUT RELAY BROKEN	Contact the nearest service centre
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F42, F43, F44, L42, L43, L44	INTERNAL PROTECTION FUSES ON THE BATTERIES BROKEN	Contact the nearest service centre

PROBLEM	POSSIBLE CAUSE	SOLUTION
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: A13, A14, A15	PROTECTION DEVICE UPSTREAM FROM THE BYPASS LINE OPEN (ONLY IF BYPASS IS SEPARATE)	Restore the protection device upstream. WARNING: check that there is no overload or short circuit at the output of the UPS
	BYPASS ISOLATOR OPEN (SWBYP ONLY IF BYPASS IS SEPARATE)	Close the isolator located behind the door
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F19, F20	BATTERY CHARGER FAULT	Open the battery fuse holders (SWBATT) and insert the maintenance bypass (SWMB), turn the UPS off completely. Turn the UPS back on and if the problem persists, contact the nearest service centre
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: A26, A27	BATTERY FUSES BLOWN OR FUSE HOLDER ISOLATORS OPEN	Replace the fuses or close the isolators (SWBATT). WARNING: if necessary, we recommend fuses be replaced with others of the same type (see UPS internal protections)
THE DISPLAY SHOWS THE CODE S06	THE BATTERIES ARE DISCHARGED; THE UPS WAITS FOR THE BATTERY VOLTAGE TO EXCEED THE SET THRESHOLD	Wait for the batteries to recharge or force startup from the “SYSTEM ON” menu
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F06, F07, F08	INPUT RELAY LOCKED	Activate the maintenance bypass (SWMB), switch off the UPS, open the SWIN and contact the nearest service centre.
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: L01, L10, L38, L39, L40, L41	FAULT IN: ▪ TEMPERATURE PROBE OR UPS COOLING SYSTEM ▪ MAIN AUXILIARY POWER SUPPLY ▪ STATIC BYPASS SWITCH	Activate the maintenance bypass (SWMB), turn the UPS off and back on again. Exclude the maintenance bypass. If the problem persists, contact the nearest service centre
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: A22, A23, A24, F23, L23, L24, L25	THE LOAD APPLIED TO THE UPS IS TOO HIGH	Reduce the load to below the 100% threshold (or user threshold for the code A22, A23 or A24)
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: L26, L27, L28	SHORT CIRCUIT AT OUTPUT	Switch off the UPS. Disconnect all the devices connected to the phase concerned by the short circuit. Turn the UPS back on. Reconnect the devices one by one until the fault is identified.

PROBLEM	POSSIBLE CAUSE	SOLUTION
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: A39, A40 AND THE RED "REPLACE BATTERIES" LED IS ON	THE BATTERIES HAVE FAILED THE PERIODIC EFFICIENCY TEST	It is recommended to replace the batteries of the UPS, since they ate no longer able to maintain the charge for a sufficient autonomy. **Warning: The replacement of the batteries must be carried out by qualified personnel.**
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F34, F35, F36, L34, L35, L36	▪ AMBIENT TEMPERATURE HIGHER THAN 40°C ▪ HEAT SOURCES CLOSE TO THE UPS ▪ VENTILATION SLITS OBSTRUCTED OR TOO CLOSE TO THE WALLS	Activate the maintenance bypass (SWMB) without switching off the UPS. This way, the fans will cool the heat sink more rapidly. Eliminate the cause of the overtemperature and wait for the temperature of the heat sink to drop. Exclude the maintenance bypass.
	FAULT IN TEMPERATURE PROBE OR UPS COOLING SYSTEM	Insert the maintenance bypass (SWMB) without switching off the UPS, so that the fans, while keeping running, cool the heat sink more rapidly and wait for the temperature of the heat sink to drop. Turn the UPS off and back on again. Exclude the maintenance bypass and if the problem persists, contact the nearest service centre.
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: F37, L37	▪ AMBIENT TEMPERATURE HIGHER THAN 40°C ▪ HEAT SOURCES CLOSE TO THE UPS ▪ VENTILATION SLITS OBSTRUCTED OR TOO CLOSE TO THE WALLS ▪ FAULT IN THE TEMPERATURE PROBE OR IN THE BATTERY CHARGER COOLING SYSTEM	Eliminate the cause of the overtemperature. Open the battery fuse holder isolators (SWBATT) and wait for the temperature of the battery charger heat sink to drop. Close the battery fuse holders. If the problem persists, contact the nearest service centre. WARNING: never open the SWBATT fuse holders during battery operation.
THE DISPLAY SHOWS ONE OR MORE OF THE FOLLOWING CODES: L11, L12, L13	STATIC BYPASS RUPTURE OR FAULT	Activate the maintenance bypass (SWMB). Switch off the UPS, wait for a minute and turn the UPS back on. Exclude the maintenance bypass and if the problem persists, contact the nearest service centre.
THE DISPLAY SHOWS NOTHING OR PROVIDES INCORRECT INFORMATION	THE DISPLAY HAS POWER SUPPLY PROBLEMS	Activate the maintenance bypass (SWMB) without opening the INPUT/OUTPUT isolators. Switch off the UPS, wait for a minute and turn the UPS back on. Exclude the maintenance bypass and if the problem persists, contact the nearest service centre.
THE DISPLAY IS OFF, THE FANS ARE OFF BUT THE LOAD IS POWERED	FAULT IN THE AUXILIARY POWER SUPPLIES. THE UPS IS IN BYPASS SUPPORTED BY THE REDUNANT POWER SUPPLY.	Activate the maintenance bypass (SWMB). Switch off the UPS, wait for a minute and turn the UPS back on. If the display does not turn on or if the sequence fails, contact the nearest service centre, leaving the UPS in manual bypass mode.

STATUS / ALARM CODES

By using a sophisticated self-diagnostic system, this UPS can check and indicate on the display panel its status and any error and/or fault occurred during operation. Whenever a problem arises, the UPS signals the event by showing the code and the corresponding alarm on the display.

- **Status:** these codes indicate the current status of the UPS.

CODE	DESCRIPTION
S01	Precharging
S02	Load not powered (stand-by status)
S03	Start-up phase
S04	Load powered by bypass line
S05	Load powered by inverter
S06	Battery operation
S07	Waiting for batteries to recharge
S08	Economy mode enabled
S09	Ready for start-up
S10	UPS locked – load not powered
S11	UPS locked – load on bypass
S12	BOOST stage or battery-charger locked – load not powered
S13	Frequency converter - load powered by inverter

- **Commands:** these codes indicate that a command has been activated.

CODE	DESCRIPTION
C01	Remote switch-off command
C02	Remote load on bypass command
C03	Remote start-up command
C04	Battery test running
C05	Manual bypass command
C06	Emergency switch-off command
C07	Remote battery charger switch-off command
C08	Load on bypass command

- **Warnings:** these messages refer to a specific configuration or operation of the UPS.

CODE	DESCRIPTION
W01	Low battery warning
W02	Programmed switch-off enabled
W03	Programmed switch-off imminent
W04	Bypass disabled
W05	Synchronisation disabled (UPS in Free running mode)

- **Anomalies:** these are “minor” problems, which do not bring the UPS to a halt, but can reduce its performance or inhibit the use of some of its functions.

CODE	DESCRIPTION
A03	Inverter not synchronised
A04	External synchronism failed
A05	Overvoltage on input line of Phase1
A06	Overvoltage on input line of Phase2
A07	Overvoltage on input line of Phase3
A08	Undervoltage on input line of Phase1
A09	Undervoltage on input line of Phase2
A10	Undervoltage on input line of Phase3
A11	Input frequency outside tolerance limits
A13	Voltage on bypass line of Phase1 out of tolerance limits
A14	Voltage on bypass line of Phase2 out of tolerance limits
A15	Voltage on bypass line of Phase3 out of tolerance limits
A16	Bypass frequency out of tolerance limits
A18	Voltage on bypass line out of tolerance limits
A19	High current peak on phase 1 output
A20	High current peak on phase 2 output
A21	High current peak on phase 3 output
A22	Load on Phase1 > user-defined threshold
A23	Load on Phase2 > user-defined threshold
A24	Load on Phase3 > user-defined threshold
A25	Output isolator open
A26	Positive branch batteries missing or battery fuses open
A27	Negative branch batteries missing or battery fuses open
A29	System temperature probe damaged
A30	System temperature < 0°C
A31	System temperature too high
A32	Temperature of heat sink 1 < 0°C
A33	Temperature of heat sink 2 < 0°C
A34	Temperature of heat sink 3 < 0°C
A35	Internal battery temperature probe damaged
A36	Internal battery overtemperature
A37	External battery temperature probe damaged
A38	External battery overtemperature
A39	Positive branch batteries must be replaced
A40	Negative branch batteries must be replaced

- **Faults:** These are more critical problems compared to the “Anomalies”, as if they persist they may bring the UPS to a halt even in a very short time.

CODE	DESCRIPTION
F01	Internal communication error
F02	Wrong cyclic sense of the input phases
F03	Phase1 input fuse broken or input relay locked (will not close)
F04	Phase 2 input fuse broken or input relay locked (will not close)
F05	Phase3 input fuse broken or input relay locked (will not close)
F06	Phase 1 input relay locked (will not open)
F07	Phase 2 input relay locked (will not open)
F08	Phase 3 input relay locked (will not open)
F09	Precharge of positive branch condensers failed
F10	Precharge of negative branch condensers failed
F11	BOOST stage anomaly
F12	Wrong cyclic sense of the bypass phases
F14	Inverter phase 1 sine curve distorted
F15	Inverter phase 2 sine curve distorted
F16	Inverter phase 3 sine curve distorted
F17	Inverter stage anomaly
F19	Positive battery overvoltage
F20	Negative battery overvoltage
F21	Positive battery undervoltage
F22	Negative battery undervoltage
F23	Output overload
F26	Phase 1 output relay locked (will not open)
F27	Phase 2 output relay locked (will not open)
F28	Phase 3 output relay locked (will not open)
F29	Phase 1 output fuse broken or output relay locked (will not close)
F30	Phase 2 output fuse broken or output relay locked (will not close)
F31	Phase 3 output fuse broken or output relay locked (will not close)
F32	Battery charger stage anomaly
F33	Battery charger output fuse broken
F34	Heat sink overtemperature
F37	Battery charger overtemperature
F42	BOOST 1 battery fuse broken
F43	BOOST 2 battery fuse broken
F44	BOOST 3 battery fuse broken

- **Locks:** these codes indicate that the UPS, or one of its parts, is locked. Usually, they are preceded by an alarm signal. In case of faults and consequent locking of the inverter, the latter will be turned off and the load will be powered via the bypass line (this procedure is excluded for locks caused by serious and persistent overloads and for those caused by a short circuit).

CODE	DESCRIPTION
L01	Incorrect auxiliary power supply
L02	One or more internal cables disconnected
L03	Phase 1 input fuse broken or input relay locked (will not close)
L04	Phase 2 input fuse broken or input relay locked (will not close))
L05	Phase 3 input fuse broken or input relay locked (will not close))
L06	BOOST stage overvoltage positive
L07	BOOST stage overvoltage negative
L08	BOOST stage undervoltage positive
L09	BOOST stage undervoltage negative
L10	Static bypass switch fault
L11	L1 bypass output locked
L12	L2 bypass output locked
L13	L3 bypass output locked
L14	Phase 1 inverter overvoltage
L15	Phase 2 inverter overvoltage
L16	Phase 3 inverter overvoltage
L17	Phase 1 inverter undervoltage
L18	Phase 2 inverter undervoltage
L19	Phase 3 inverter undervoltage
L20	Continuous voltage at inverter output or Sine curve of Phase 1 inverter distorted
L21	Continuous voltage at inverter output or Sine curve of Phase 2 inverter distorted
L22	Continuous voltage at inverter output or Sine curve of Phase 3 inverter distorted
L23	Phase 1 output overload
L24	Phase 2 output overload
L25	Phase 3 output overload
L26	Short circuit at Phase 1 output
L27	Short circuit at Phase 2 output
L28	Short circuit at Phase 3 output
L29	Phase 1 output fuse broken or output relay locked (will not close)
L30	Phase 2 output fuse broken or output relay locked (will not close)
L31	Phase 3 output fuse broken or output relay locked (will not close)
L34	Phase 1 heat sink overtemperature
L35	Phase 2 heat sink overtemperature
L36	Phase 3 heat sink overtemperature
L37	Battery charger overtermperature
L38	Phase 1 heat sink temperature probe damaged
L39	Phase 2 heat sink temperature probe damaged
L40	Phase 3 heat sink temperature probe damaged
L41	Battery charger temperature probe damaged
L42	BOOST 1 battery fuse broken
L43	BOOST 2 battery fuse broken
L44	BOOST 3 battery fuse broken

UPS DIRECT powerprotection

TECHNICAL DATA

UPS Models	MST 30	MST 40
INPUT STAGE		
Nominal voltage	380-400-415 Vac 3-phase with neutral (4 wire)	
Nominal frequency	50-60Hz	
Accepted input voltage tolerance due to no intervention of the battery (referred to 400Vac)	± 20% @ 100% load -40% +20% @50% load	
Accepted input frequency tolerance due to no intervention of the battery (referred to 50/60Hz)	± 20% 40-72Hz	
Technology	High frequency IGBT or CoolMos with an independent digital PFC average current mode control on each phase	
Input current harmonic distortion	THDi ≤ 3 % (1)	
Input power factor	≥ 0.99	
Power Walk In mode	Programmable from 5 to 30 sec. in 1 second steps	
OUTPUT STAGE		
Nominal voltage (2)	380/400/415 Vac 3-phase with neutral (4wire)	
Nominal frequency (3)	50/60Hz	
Nominal apparent output power	30kVA	40kVA
Nominal active output power	27kW	36kW
Output power factor	0,9	
Short circuit current	1,5 x In for t ≥ 500ms	
Precision of output voltage (referred to a 400Vac output voltage)	± 1%	
Static stability (4)	± 0.5%	
Dynamic stability	± 3% resistive load (5)	
Voltage harmonic distortion with linear and normalised distorting load	≤ 1% with linear load ≤ 3% with distorting load	
Crest factor allowed with nominal load	3:1	
Frequency precision in free running mode	0,01%	
Inverter overloads @ PFout = 0,8 (Resistive load)	115% Infinite 125% 10 min. 133% 1 min 150% 1 min. 168% 5 sec. > 168% 0,5 sec.	
Inverter overloads @ PFout = 0,9 (Resistive load)	110% 10 min. 125% 1 min 133% 1 min. 150% 5 sec. > 150% 0,5 sec.	
Bypass overload	110% Infinite 125% 60 min 133% 60 minutes 150% 10 minutes >150% 2 seconds	
Technology	High efficiency inverter with digital multiprocessor (DSP+µP) voltage/current control, based on signal processing techniques with feedforward	

UPS Models	MST 30	MST 40
BATTERY CHARGER STAGE		
Nominal voltage	±240Vdc	
Maximum recharge current [6]	10A	
Battery charger algorithm	Two levels with temperature compensation	
Technology	Analogue switching current under µP control (PWM voltage and charge current adjustment)	
Input voltage tolerance for recharging at maximum current	345-480Vac	
MODES AND EFFICIENCY		
Operating modes	True on line double conversion ECO mode Smart Active mode Stand By Off (Emergency) Frequency Converter (with batteries)	
AC/AC performance in on line mode	Up to 96.5%	
AC/AC performance in Eco mode	≥ 99%	
OTHER FEATURES		
Noise	≤ 48dB(A)	
Colour	RAL 7016	
Ambient temperature [7]	0 – 40 °C	

(1) *@ 100% load & THDv ≤ 1%*

(2) *In order to keep the output voltage within the indicated precision range, a recalibration may be necessary, following a long period of use.*

(3) *If the mains frequency is within ± 5% of the selected value, the UPS is synchronised with the mains. If the frequency is out of the tolerance range, or in battery operation, the frequency will be the selected +0.01%*

(4) *Mains/Battery @ 0% -100% load*

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

(6) *The recharge current is adjusted automatically, depending on the capacity of the battery installed.*

(7) *20 – 25 °C for a longer battery life*