INFOSEC™
UPS SYSTEM

User Manual

M4T

10 - 80 kVA

GENERAL INDEX

1 INTRODUCTION

The equipment described hereafter can cause considerable physical damage if incorrectly handled. This is why, the installation, maintenance and/or repair of this equipment must be done by our staff or specifically authorised technicians.
According to our policy of continuous improvement, we reserve the right to modify the specifications, in part or in whole, without prior warning.
All reproduction or third party concession of this manual is prohibited without prior written authorization from our firm.

1.1 Using this manual

The purpose of this manual is to explain the installation and operating procedures. This manual must be read carefully before installing and operating the equipment. Keep this manual for future reference.
This equipment must be **installed by qualified staff** and, with the simple advice in this manual, **can be used by personnel without any specific training**.

1.2 Symbols and conventions

"Warning" symbol.
Carefully read the indicated paragraph and take the stated preventive measures.

"Danger of electrical discharge" symbol. Pay special attention to it, in terms of both the indication on the equipment and the paragraph referred to in this user manual.

"Main protective earthing terminal" symbol. Connect the earth cable from the installation to this terminal.

"Earth bonding terminal". Connect the earth cable from the installation to this terminal.

"Information" symbol. Additional topics that complement the basic procedures.

1.3 For further information and/or help

For further information and/or help of the version of your specific unit, refer to our Service and Technical Support Department.

1.4 Safety and first aid

Together with the equipment and this "User and installation manual" information regarding "Safety instructions" is provided (see section 8.3). Before installation or commissioning, check that both sets of information are available; otherwise please request them. As the user you are legally obliged to comply with the "Safety instructions". Once read, keep them for future reference.

2 QUALITY AND STANDARD GUARANTEE

2.1 Standard

The M4T UPS series product is designed, manufactured and commercialised in accordance with standard EN ISO 9001 of Quality Management Systems.
The EC marking is proof of conformity with the EEC Directive (in brackets) in application of the following standards

- **2006/95/EC** Low voltage directive.
- **2004/108/EC** Electromagnetic Compatibility directive (EMC)

In accordance with the specifications of harmonised standards:
- **EN-IEC 62040-1**. Uninterruptible power supply (UPS).
  Part 1-1: General and safety requirements for UPS devices in use in accessible areas by end users.
- **EN-IEC 60950-1**. IT equipment. Safety.
  Part 1: General requirements.
- **EN-IEC 62040-2**. Uninterruptible power supply (UPS).
  Part 2: Requirements for Electromagnetic compatibility (EMC).
- **EN-IEC 62040-3**. Uninterruptible power supply (UPS).
  Part 3: Methods of operation specification and test requirements.

The manufacturer may not be held responsible for any modification of or repair to the product by the customer.

2.2 Environment

UPS devices belong to the electronic and electrical equipment category. At the end of their useful life they must be disposed of separately and in an appropriate manner.
This symbol is also affixed to the batteries supplied with this device, which means they too have to be taken to the appropriate place at the end of their useful life.

Contact your local recycling or hazardous waste centre for information on proper disposal of the used battery.

3.1 Views.

3.1.1 Equipment.

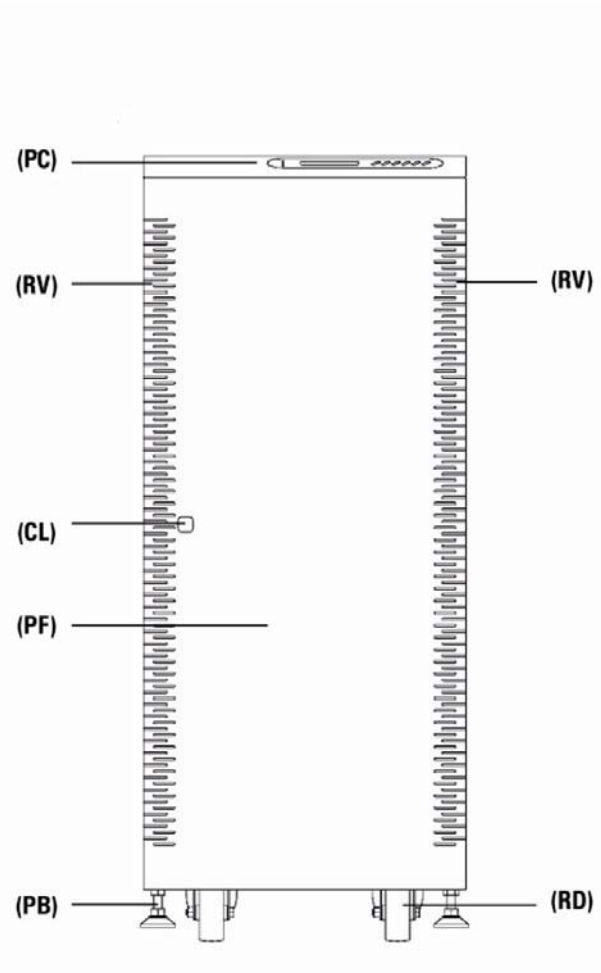

Fig.1.
Cabinet front view for UPS devices up to 20kVA.

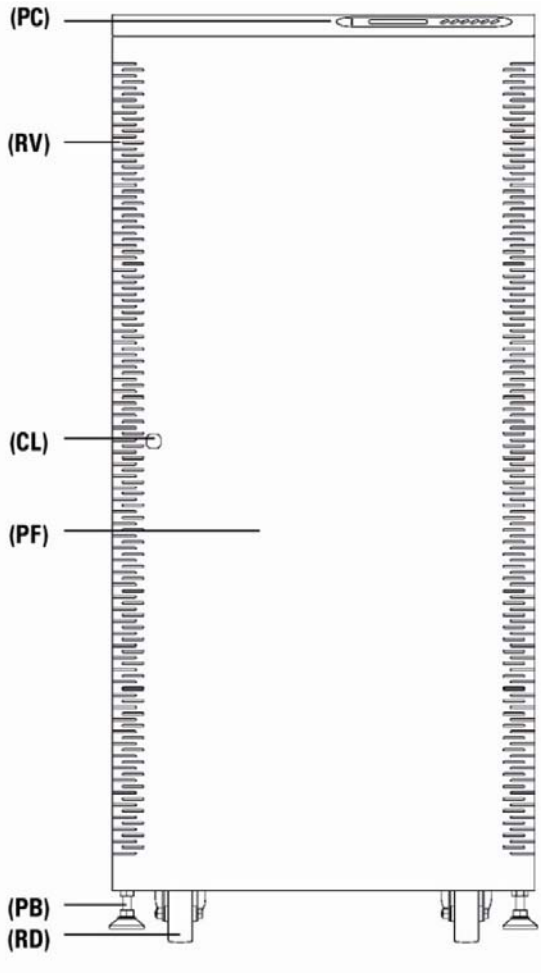

Fig.2.
Cabinet front view for UPS devices from 30 to 80kVA.

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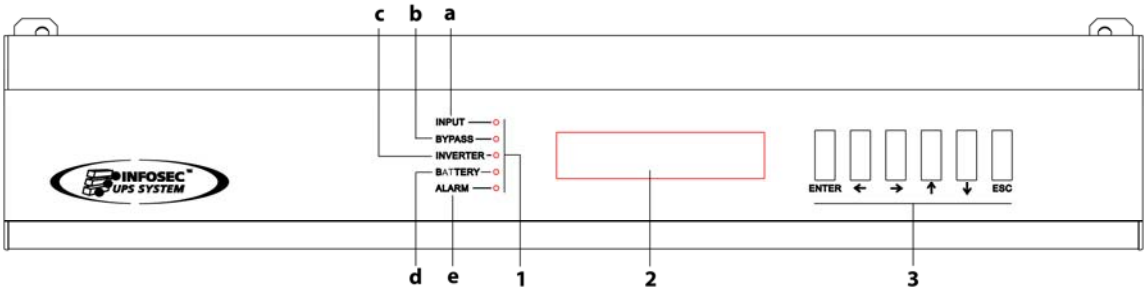

Fig.3. Control panel view (PC).

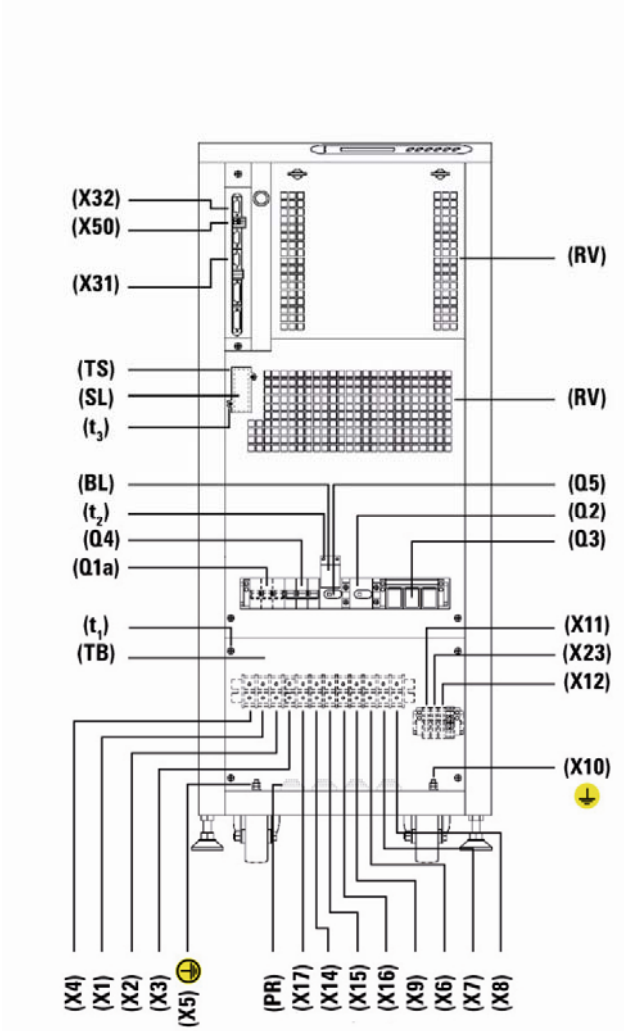

Fig.4.
Cabinet front view for UPS devices up to 20kVA.

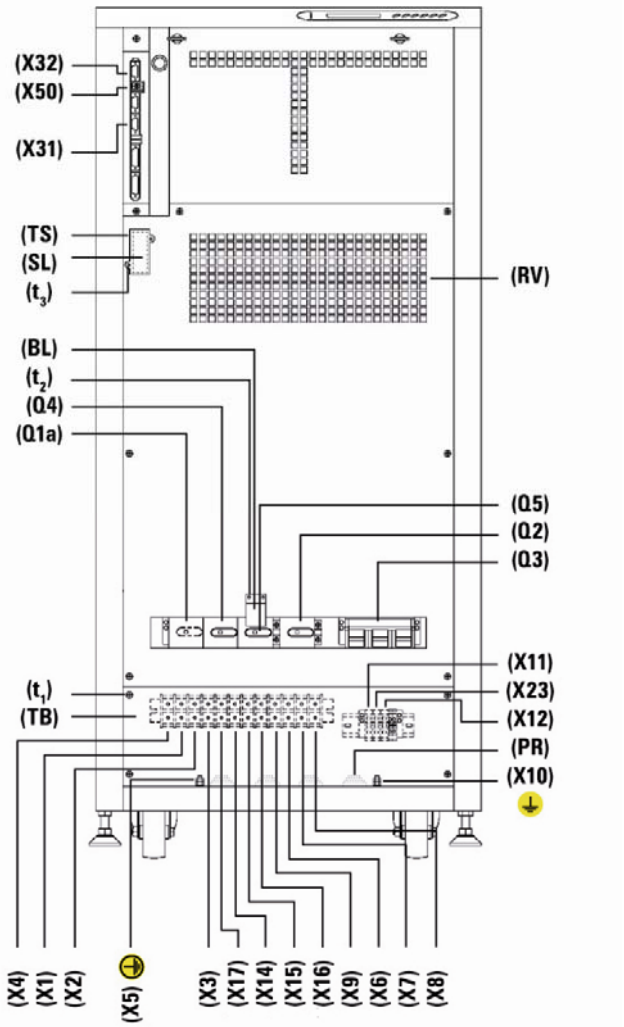

Fig.5.
Cabinet front view for UPS devices from 30 to 80kVA.

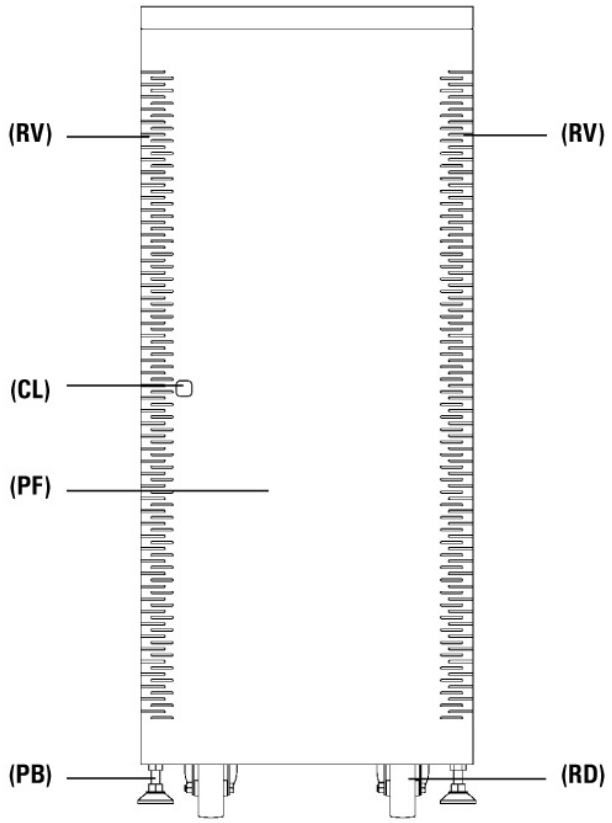

Fig.6. No 1 battery cabinet front view with front door closed.

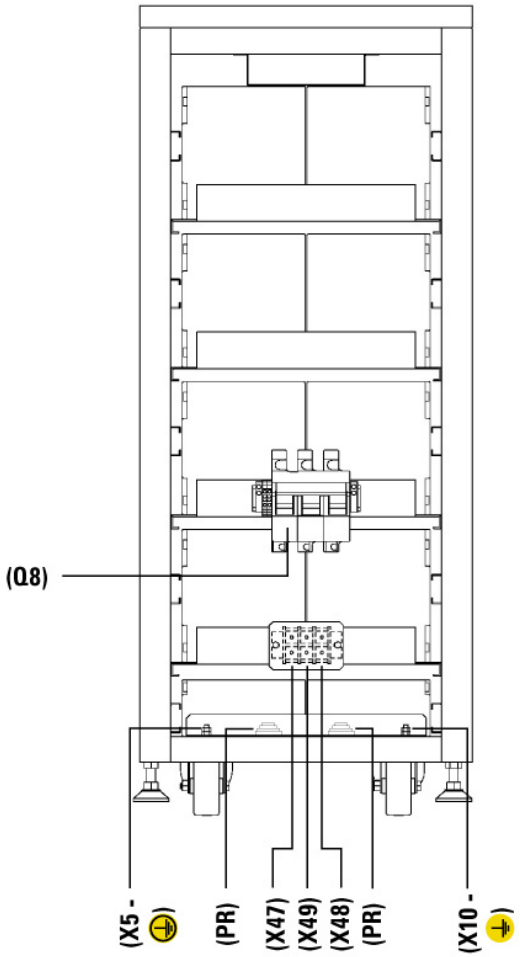

Fig.7. No 1 battery cabinet front view with front door opened.

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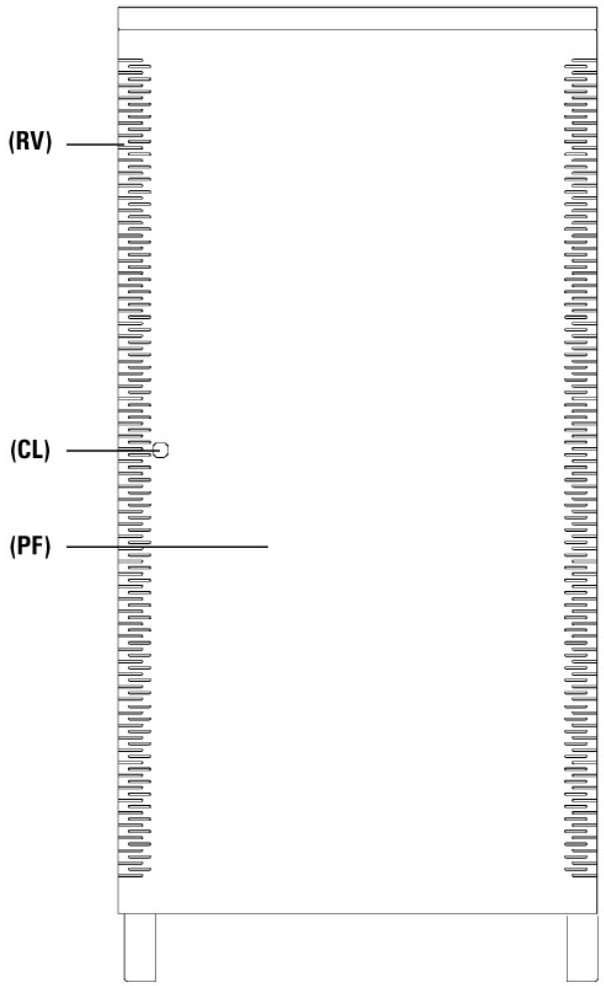

Fig.8. No 2 battery cabinet front view with front door closed.

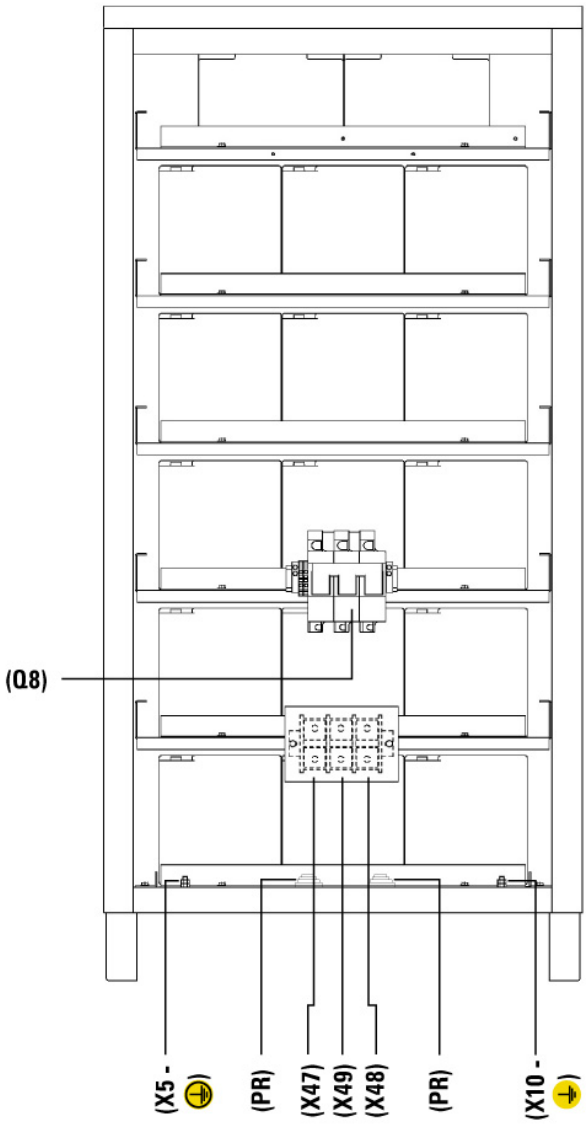

Fig.9. No 2 battery cabinet front view with front door opened

3.1.2 Diagram keys.

Protection and handling components (Q*):

(Q1a) Input circuit breaker or switch according to power of the equipment.
(Q2) Output switch.
(Q3) Battery fuse holder switch with 3 fuses (models up to 40 kVA) or switch (for higher models).
(Q4) Static bypass (Only in optional version -B).
(Q5) Maintenance bypass switch.
(Q8) Battery fuse holder switch 3 fuses, located in the battery cabinet.

Connecting elements (X*):

(X1) Phase input terminal R.
(X2) Phase input terminal S.
(X3) Phase input terminal T.
(X4) Neutral input terminal N.
(X5) Main protection earthing terminal ( ).
(X6) Phase output terminal U.
(X7) Phase output terminal V.
(X8) Phase output terminal W.
(X9) Neutral output terminal N.
(X10) Earth bonding terminal for load(s) and/or battery cabinet ( ).
(X11) Batteries terminal +(Only for external battery model).
(X12) Batteries terminal –(Only for external battery model).
(X14) Phase static bypass terminal R (Dual Input).
(X15) Phase static bypass terminal S (Dual Input).
(X16) Phase static bypass terminal T (Dual Input).
(X17) Neutral static bypass terminal N (Dual Input).
(X23) Batteries terminal N (middle connector, Only for external battery model).
(X31) DB9 connector COM RS-232 and RS-485 ports.
(X32) DB9 connector relay interface.
(X47) Batteries terminal + of external batteries cabinet.
(X48) Batteries terminal – of external batteries cabinet.
(X49) Batteries terminal N (middle tap) of external batteries cabinet.
(X50) Terminals for external EPO.

Keyboard and optical indications control panel (PC):

(LCD) LCD screen.
(ENT) "ENTER" key.
(ESC) "ESC" key.
( ) Move up key.
( ) Move down key.
( ) Move to the right key.
( ) Move to the left key.
(a) Rectifier Input Voltage OK LED (green).
(b) Output voltage unit from the Bypass LED (orange).
(c) Inverter is working LED (green).
(d) Unit working from batteries -mains failure- LED (red).
(e) General alarm LED (red).

Other abbreviations:

(BL) Mechanical block for manual bypass switch (Q5).
(CL) Lock for cabinet front door.
(PB) Levellers and immobilising components.
(PC) Control panel.
(PF) Cabinet front door.
(PR) Cables passage.
(RD) Scroll wheel.
(RV) Ventilation grate.
(SL) Slot for optional SICRES card.
(TB) Terminal cover.
(TS) Slot cover (SL).
(t1) Attachment screws for terminals cover (TB).
(t2) Attachment screws for mechanical block (BL) and switch (Q5).
(t3) Attachment screws for slot cover SICRES (TS).

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3.2 Definition and structure.

3.2.1 Structural diagram.

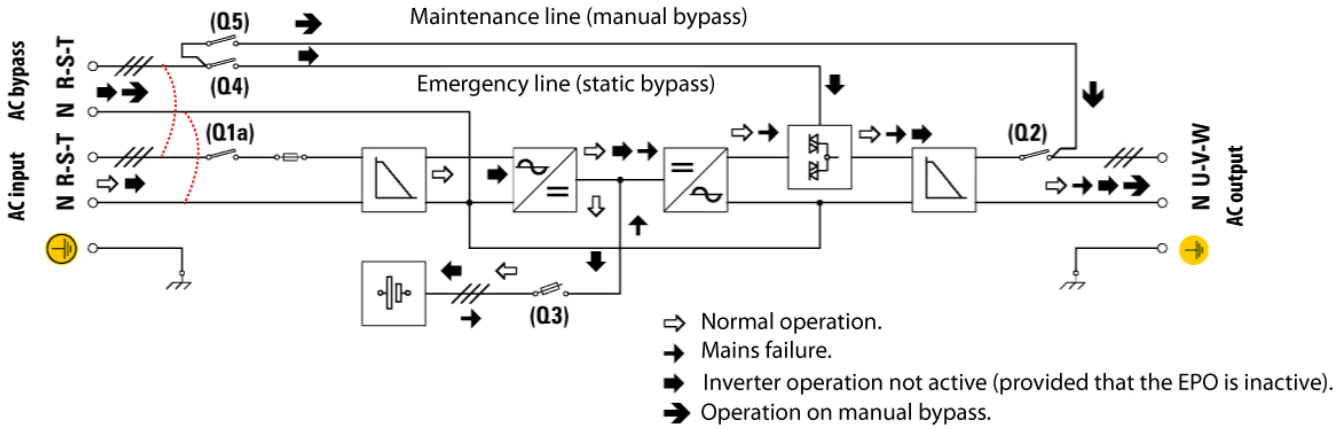
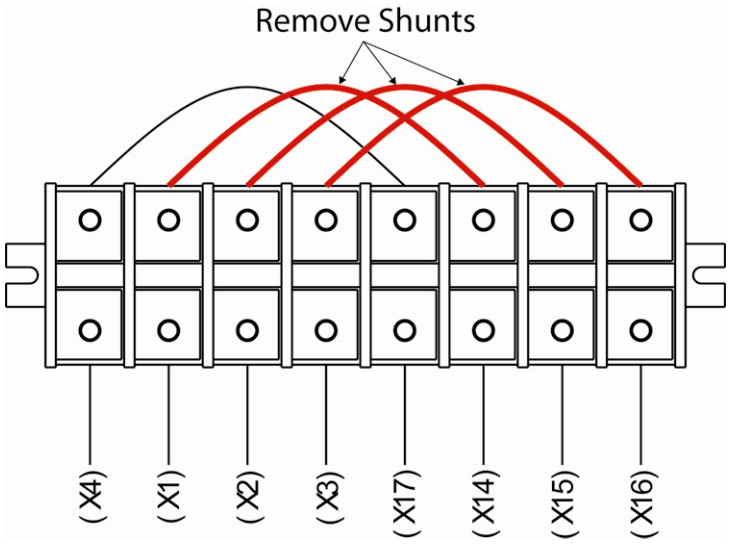


Fig.10. M4T block diagram with operating flow.

M4T UPS may be used with main input and separate bypass line.
The most common required connection is the one with common main input and bypass. So both input terminals are short-circuited by shunt.
If final configuration is set with dual input please remove shunts between main input terminal and bypass line terminal (see figure below).



Input terminals

In equipment with separate bypass line, an isolation transformer must be placed at either or both of the UPS mains power supply inputs (rectifier input or static bypass), in order to avoid the direct connection of the neutral terminal with both mains through the internal wiring of the equipment. This is only applicable if the power supply comes from two different electrical mains, for example:
- Two different electricity companies.
- An electricity company and a generator set, etc.

3.3 Operating principle.

The M4T UPS series is a double conversion system AC/DC, DC/AC with a sine wave output that gives safe protection in extreme power supply conditions (variations in voltage, frequency, electrical noises, blackout and micro cuts, etc…). Regardless of the type of load to be protected, these devices are designed to ensure a quality and continuous power supply.

The operation is as follows:

- An IGBT three phase rectifier converts the AC voltage into DC by absorbing a pure sine wave current (THD <2%) and charging batteries at constant current / voltage.
- The batteries supply the power needed by the inverter in the event of mains failure.
- The basic double conversion structure is complemented by two new functional blocks, the static bypass commuter switch and the manual bypass commuter switch.
- The static bypass commuter switch connects the output load directly to the bypass network in special circumstances such as overloading or overheating and reconnects it to the Inverter when normal conditions are restored.
- The standard version has separate lines for the Inverter and bypass blocks, thus increasing the safety of the installation as it allows the use of a second power supply (generator unit, other electricity company, etc.).
- The manual bypass commuter switch isolates the UPS from the mains and from the loads connected to the output, so that maintenance operations may be performed on the UPS without any need to interrupt the supply to the loads.

3.3.1 Normal operation, (⇨).

When there is a mains power supply, the rectifier transforms the AC input voltage into DC raising the DC voltage to a suitable level to supply the inverter and to charge the batteries.
The inverter transforms the voltage of the DC bus into AC, providing a sine wave alternating output, stabilized in voltage and frequency to supply the loads connected to the output (figure 10).

3.3.2 Operation with mains failure, (➔).

In the event of mains failure or should a micro cut occur, the group of batteries supplies the power needed to supply the inverter.
The inverter continues working normally without being affected by the lack of mains and the back-up time of the device depends only on the capacity of the group of batteries (figure 10).
When the battery voltage reaches the end of back-up time, the control blocks the output to protect against deep battery discharge.
When mains is restored and after the first seconds of analysis, the UPS again operates as described in the "Normal operation" section.

3.3.3 Operation with inverter not active, (➡).

The inverter is inactive due to the existence of alarm conditions such as overloads, overheating, end of back-up time, etc. In this case the rectifier continues charging the batteries to maintain the optimal charge.
The inverter is also inactive if the unit has not been started up with the keyboard. In that case, the rectifier will be inactive.

In all these cases the output voltage of the UPS is supplied by the emergency bypass line through the static bypass commuter switch (figure 10), provided that the EPO is inactive

3.3.4 Operation in manual bypass, (➔).

When maintenance checks are to be performed on the device, it may be disconnected from the mains without any need to cut the power supply to the system and affect the critical load. The UPS may only be worked on by technical or maintenance personnel, by means of the maintenance bypass (as per specific instructions for that purpose).

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4 INSTALLATION

Check the Safety Instructions.
Make sure that the data on the characteristics plate are those required for the installation.
Any incorrect connection or handling may cause damage to the UPS and/or the loads connected to it. Read these instructions carefully and follow the steps in the order indicated.
This UPS must be installed by qualified staff but can be used by personal with without any specific preparation aside from this "User Guide".

4.1 Important Safety Instructions.

⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection ( )). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

All connections to the device, including those for control (interface, remote control, etc.), will be performed with the switches in the off position and without any mains present (UPS power line cut off "Off").

It should always be remembered that the UPS is a generator of electrical power, so users must take all necessary precautions against direct or indirect contact.

Warning labels should be placed on all primary power switches installed in places that are not in the vicinity of the device to alert the electrical maintenance personnel of the presence of a UPS in the circuit.
The label will bear the following or an equivalent text:

Before working on this circuit. - Isolate the Uninterruptible Power Supply (UPS). -Then check for Hazardous Voltage between all terminals including the protective earth. ⚠ Risk of Voltage Back feed

When the power supply reaches the UPS input with static bypass included, although the inverter is "Off" (shut-down), it does not mean there is no output voltage at the output terminals.
To do this, (Q1a), (Q4) and (Q2) must be switched to the "Off" position.
The UPS may be supplying output voltage from the manual bypass which must be taken into account for safety purposes. If the output power supply of the UPS has to be interrupted in this situation, deactivate the switch (Q5).

Precautions must be taken for devices with battery terminals, as they are not isolated from the alternating input line, and there could be dangerous voltage between the battery terminals and the ground.

4.1.1 Batteries.

Batteries should be handled and connected or supervised by qualified personnel with battery knowledge.

For units supplied without batteries, the batteries will always acquire, installed and connected by the customer and under his responsibility. The battery details (number, capacity and voltage) are indicated on the battery label pasted beside the nameplate of the equipment. These requirements should be strictly adhered to as well as the battery polarity connection and the circuit diagram provided with this documentation.
The battery supply may involve the risk of electric shock and may produce high short circuit current. Please observe the following preventive measures before manipulating any terminal block identified on the label as "Battery":

- ❒ Disconnect the corresponding protection components.
- ❒ When connecting a battery cabinet to the equipment, the cable's polarity and color (red-positive; black-negative) indicated in the manual and in the corresponding labeling must be adhered to.
- ❒ Wear rubber gloves and shoes.
- ❒ Use tools with insulated handles.
- ❒ Remove watches, rings or other metal objects.
- ❒ Do not place metal tools or objects on the batteries.
- ❒ Never handle with your bare hands or through conducting objects as this may short-circuit the battery terminal block or the battery enclosure.

- Never short-circuit the battery terminals as it involves high risk and will be detrimental to the equipment and batteries.
- Avoid mechanical stress and impacts.
- Do not open or mutilate the battery. Released electrolyte is harmful to the skin and eyes.
- Do not dispose of batteries in a fire. The batteries may explode.
- In the event parts of the body come into contact with battery acid, wash immediately with plenty of water and call the nearest medical service as soon as possible.
- Batteries involve a serious risk for health and the environment.
- They should be disposed of according to current laws.

4.1.2 Account access.

All the UPS devices in the M4T series and battery packs have terminals as power connection parts, and DB9 connectors for the communication channel, located inside the equipment. Follow the steps described below to access them:

- ❒ Open the door (PF) by unlocking the lock (CL) -use special key provided.
- ❒ The DB9 connectors from communication ports, terminals for remote EPO button and breakers are now accessible.
- ❒ Remove the screws (t1), which fastening the terminal cover (TB) inside the cabinet and move it away; the power terminals will now be accessible.

	Model.	Equipment power (kVA)	Maximum input and bypass current, and nominal output current (A)								
			3x380 V			3x400 V			3x415 V		
			Input	Output	Bypass	Input	Output	Bypass	Input	Output	Bypass
1 common supply	M4T-10	10	15	15	-	14	14	-	13	13	-
	M4T-15	15	22	23	-	21	22	-	20	21	-
	M4T-20	20	30	30	-	28	29	-	28	28	-
	M4T-30	30	44	45	-	43	43	-	40	41	-
	M4T-40	40	59	61	-	57	58	-	53	55	-
	M4T-50	50	74	76	-	71	72	-	67	68	-
	M4T-60	60	89	91	-	85	87	-	80	82	-
	M4T-80	80	118	122	-	113	116	-	107	110	-
Dual input	M4T-10-B	10	15	15	15	14	14	14	13	13	13
	M4T-15-B	15	22	23	23	21	22	22	20	21	21
	M4T-20-B	20	30	30	30	28	29	29	28	28	28
	M4T-30-B	30	44	45	45	43	43	43	40	41	41
	M4T-40-B	40	59	61	61	57	58	58	53	55	55
	M4T-50-B	50	74	76	76	71	72	72	67	68	68
	M4T-60-B	60	89	91	91	85	87	87	80	82	82
	M4T-80-B	80	118	122	122	113	116	116	107	110	110

Table 1. Input, output and bypass currents for a standard three phase voltage UPS.

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- ❒ Once the UPS is connected, replace the cover (TB) and close the door (PF) with the lock (CL).

- The cable cross section of the bypass, input and output lines shall be determined from the maximum currents for the first two and from nominal ones for the output, by respecting the local and/or country Low Voltage Electro-technical standards.
  To calculate the cross cable sections, take the figures of the current given in tables 1 or depending on the model, single or three phase configuration and nominal voltage value of the UPS.
  The equipment nameplate only gives the nominal currents as stated in safety standard EN-IEC 62040-1.

- The protections in the distribution board will have the following characteristics:
  - ❒ For the input and bypass lines, type B earth leakage breakers and curve C circuit breakers.
  - ❒ For the output (supply loads), curve C circuit breaker.

- If input, output or bypass peripherals such as transformers or autotransformers are added to the UPS, currents stated on the nameplates of those components have to be taken into account, in order to use the suitable cross sections, by complying with the Local and/or National Low Voltage Electro-technical Regulations.

- When a piece of equipment has a galvanic isolation transformer, as standard, as an option or installed by the end user, at the UPS input, bypass, output line or in all locations, they have to be fitted with protections against indirect contacts (earth leakage breaker) at the output of each transformer, because its own isolation feature will impede the tripping of protections installed at the primary winding of the transformer in case there is an electric shock in the secondary winding (isolation transformer output).

- May we remind you that all isolation transformers supplied or installed from factory have the neutral cable connected to the ground through a cable bridge between the neutral and ground terminals. If you require an isolated output neutral, please remove this bridge, taking the stated precautions to comply with local and/or national low voltage standards.

- The supplied cable passages fitted to the metal structure are those recommended to correctly attach the input, output and bypass wires with the sections determined by the National Low Voltage Electro-technical Regulation in accordance with the currents of the device.

If these sections have to be changed for any reason, it should be done from a separate distribution box and the sections indicated should be maintained from the device to the distribution box.

- In standard equipment up to 40 kVA, batteries are supplied inside the UPS enclosure and for higher power rates; they are supplied in a separate cabinet. By default, the UPS has a battery fuse-holder switch (Q3) with 3 fuses for models up to 40 kVA or battery switch (Q3) for models with higher power rate. The battery cabinet has a fuse holder switch (Q8) with 3 fuses, for both models with a higher power rate of 40 kVA and for extended back up times. fuse holder switch (Q3) or (Q8), install the 3 fuses and **WAIT until it is indicated before CLOSING IT**.

⚠ **IMPORTANT FOR YOUR SAFETY**: Do not turn the battery fuse holder switch (Q3) or (Q8) located in the battery cabinet to "On" (Close), until the equipment is switched on completely because it may cause irreversible damage to the equipment or accidents.

4.2 Equipment Reception.

4.2.1 Unpacking and content checking.

- On receiving the device, make sure that it has not suffered any damage during transportation. Otherwise, make all pertinent claims to your supplier or to our company. Also check that the data on the nameplate, which is affixed inside the front door (PF), corresponds to those specified in the purchase order, to do this, you will need to unpack it. In the event of non-conformity please give notification as soon as possible quoting the device serial number and references of the delivery remittance.

- When the device has been accepted, it is best to repack the UPS until it is commissioned in order to protect it from any knocks, dust, dirt, etc....

- The packaging of the device consists of a wooden pallet, a cardboard or wooden surround depending on the case, expanded polystyrene corner pieces, polyethylene sleeve and band, all recyclable materials; they should therefore be disposed of according to current regulations. We recommend that the packaging is kept for future use.

- To unpack, cut the bands on the cardboard surround and remove it from above as if it is an cover or remove it with the necessary tools if the surround is made of wood; remove the corner pieces and the plastic sleeve. The UPS will be unpacked on the pallet, to lower it suitable equipment must be used with the required safety equipment (use plank to remove UPS from pallet). The approximate weights of table 7 and 8 must be considered.

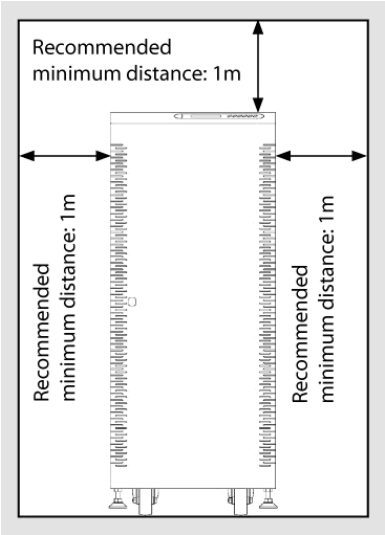

Fig.11. Front view UPS location

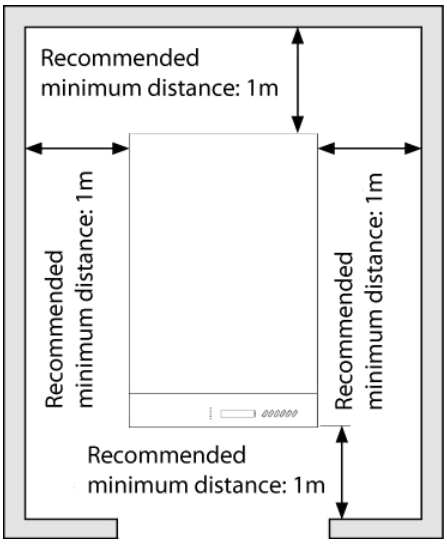

Fig.12. Top view UPS location.

4.2.2 Storage.

- The UPS will be stored in a dry, well-ventilated place and protected against rain, water jets or chemical agents. It is advisable to keep the equipment and the battery pack(s) in their original package which has been designed to assure maximum protection during transport and storage.

⚠

- Except special cases the UPS has sealed airtight, lead batteries and should not be stored for more than 12 months (see the date the batteries were last charged on the label affixed to the device packaging or on the battery cabinet).

- After this time, connect the device to the mains along with the battery pack(s), as the case may be. Start it up as per the instructions given in this manual and charge the batteries for 12 hours from float level.

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- Then shut down the device, disconnect it and keep the UPS and the battery cabinet(s) in their original packaging, noting the new battery charge date on the respective labels.

- Do not store the unit where the ambient temperature exceeds 40ºC or falls below -20ºC, as this may deteriorate the electrical characteristics of the batteries.

4.2.3 Transport to location.

- All UPS devices have castors to facilitate their transport to their final location. It is important to abide by the approximate weight requirements indicated in tables 5 and 6 both with respect to the site itself and the installation means (floor, hoist, lift, stairs, etc.).

4.2.4 Location.

- The Safety Instructions indicate that a minimum of 25cm clearance should be left around the equipment for ventilation purposes. However an additional 75 cm is recommended to facilitate maintenance operations or technical assistance in the event of breakdown (see figures 11 and 12).

- The UPS may be put in any place as long as the Safety Instruction requirements are fulfilled and the weight requirements indicated in table 7 and 8 are complied with.

- The UPS includes 2 leveling components (PB) located near the front castors, which immobilize the unit once in place.

  ❒ Open the front door (PF) of the cabinet and proceed as follows:

  - Lower the feet (PB) by hand by turning them anticlockwise until they touch the floor, and then, using a spanner, continue loosening until the castors are raised off the floor by a maximum of 0.5 cm, ensuring that it is level.

  -Close the door (PF).

4.3 Connections.

4.3.1 Mains terminals (X1 to X4).

- ⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection (⏚)). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

- In accordance with safety standard EN-IEC 62040-1, the installation has to be provided with a "Backfeed protection" system.

For example a contactor, which will prevent the appearance of voltage or dangerous energy in the input mains during a mains fault (see figure 13)

⚠ There can be no bypass in the line that goes from the "Backfeed protection" to the UPS, as this would infringe on standard safety requirements.

Warning labels should be placed on all primary power switches installed in places that are not in the vicinity of the device to alert the electrical maintenance personnel of the presence of a UPS in the circuit.
The label will bear the following or an equivalent text:

Before working on this circuit : - Isolate the Uninterruptible Power Supply (UPS). - Then check for Hazardous Voltage between all terminals including the protective earth. ⚠ Risk of Voltage Backfeed.

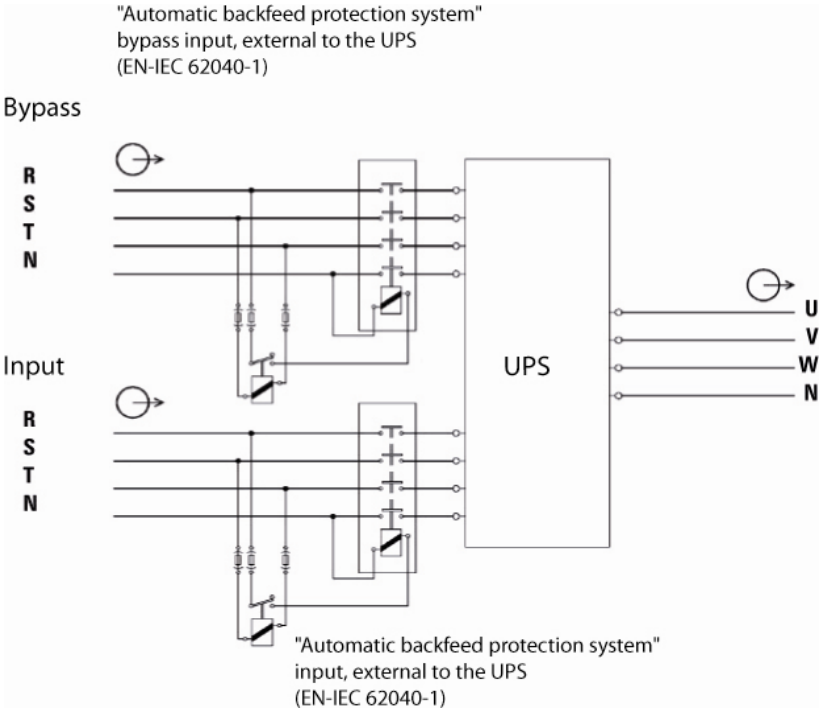


Fig.13. Block diagram for the "Backfeed protection" application, for three phase input / three phase output configuration.

Mains three phase:
Connect the power supply cables N-R-S-T to the input terminals **(X4), (X1), (X2) and (X3), adhering to the order of neutral and phases** indicated on the label of the device and in this manual. If the order of the phases is not adhered to, the device will not operate.
When there are discrepancies between the labelling and the instructions of this manual, the label will always prevail.

4.3.2 Independent static bypass line connection, terminals (X14 to X17). With dual input.

- ⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection (⏚)). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

- In accordance with safety standard EN-IEC 62040-1, the installation has to be provided with a "Backfeed protection" system, such as a contactor, which will prevent the appearance of voltage or dangerous energy in the input mains during a mains fault (see figure 13).

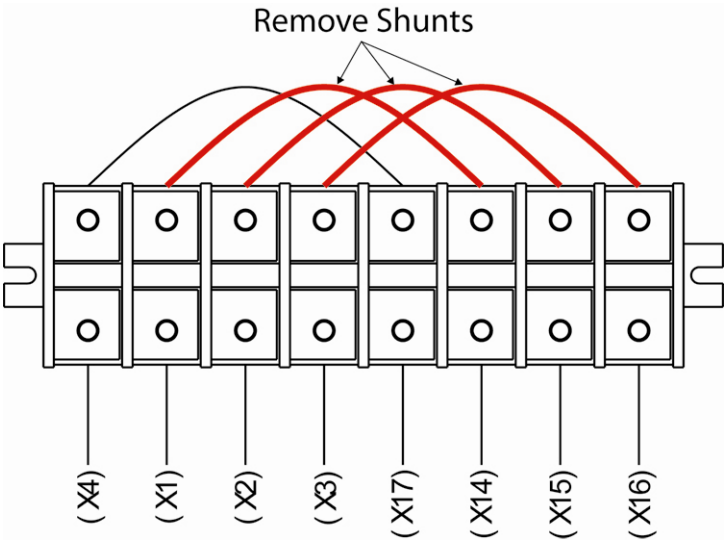
- ⚠ There can be no bypass in the line that goes from the "Backfeed protection" to the UPS, as this would infringe on standard safety requirements.

- Warning labels should be placed on all primary power switches installed in places that are not in the vicinity of the device to alert the electrical maintenance personnel of the presence of a UPS in the circuit.
  The label will bear the following or an equivalent text:

  Before working on this circuit.
  - Isolate the Uninterruptible Power Supply (UPS).
  - Then check for Hazardous Voltage between all terminals including the protective earth.
  ⚠ Risk of Voltage Backfeed.

- Connect the static bypass line cables to the respective terminals according to the configuration of the available equipment.

Three phase static bypass line:



Remove shunts between terminals X4 and X17, X1 and X14, X2 and X15, X3 and X16.

Connect the power supply cables N-R-S-T to the static bypass line terminals **(X17), (X14), (X15) and (X16), adhering to the order of neutral** and phases indicated on the label of the device and in this manual. If the order of the phases is not adhered to, the device will not operate.
When there are discrepancies between the labelling and the instructions of this manual, the label will always prevail.

⚠ In equipment with a separate bypass line, an isolation transformer must be placed at either or both of the UPS mains power supply inputs (rectifier input or static bypass), in order to avoid the direct connection of the neutral terminal with both mains through the internal wiring of the equipment.
This is only applicable if the power supply comes from two different electrical mains, for example:
- Two different electricity companies.
- An electricity company and a generator set, etc.

4.3.3 Output, terminals (X6 to X9).

- ⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection (⏚)). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

- Connect the output cables to the respective terminals according to configuration of the available equipment.

Three phase output:
Connect the load cables N-U-V-W to the output terminals (X9), (X6), (X7) and (X8), adhering to the order of neutral and phases indicated on the label of the device and in this manual. When there are discrepancies between the labelling and the instructions of this manual, the label will always prevail.

- With respect to the compulsory protection on the UPS output, we recommend that the output power should be distributed in at least four lines. Each has a magnetic thermal protection switch with a value equivalent to a quarter of the nominal power. This type of power distribution means that only the faulty line will be affected in the event of a breakdown in any of the machines connected to the device resulting in a short circuit. The rest of the connected loads will have their continuity ensured due to the triggering of the protection, only the line affected by the short circuit will remain.

4.3.4 UPS connection to each in-cabinet battery pack, terminals (X11, X12, X23) & (X47, X48, X49).

- ⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection (⏚)). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

- ⚠ IMPORTANT FOR YOUR SAFETY: Do not turn the battery fuse holder switch (Q3) or (Q8) located in the battery cabinet to "On" (Close), until the equipment is switched on completely, it may cause irreversible damage to the equipment or accidents because the fitter is exposed to ELECTRICAL DISCHARGE DANGERS when connecting the UPS with the battery cabinet.

- The UPS with battery pack will be connected, by connecting one side to terminals (X11), (X23) and (X12) of the UPS and the other to terminals (X47), (X49) and (X48) of the battery pack, while adhering to the stated polarity on the labelling of each part and in this manual, and the color of the cables (red for positive, black for negative, blue for middle tap (N) and green-yellow for earth bonding), see figure 14.

- Keep in mind that if more than one battery pack is supplied, the connection will always be in parallel with the equipment. For instance, the black cable from the UPS negative terminal to the negative of the first battery pack and from this one to the negative of the second battery pack, and so on. Please, proceed in the same way for red cable for positive, blue for half tap (N) and green-yellow for earthing.

- ⚠ **Electrical discharge danger**. If after starting up the UPS, the battery cabinet needs to be disconnected, the equipment has to be completely shut down (see section 5.2). Turn off the battery fuse holder switch (Q8) located in the battery cabinet and/or fuse holder switch or switch (Q3) located in the UPS. Wait at least 5 min. until the filter capacitors have been discharged.

4.3.5 Main protective earthing terminal (⏚) & protective earth bonding terminal (⏚).

- ⚠ As this is a device with class I protection against electric shocks, it is essential to install a protective earth conductor (earth connection (⏚)). Connect the conductor to the terminal (X5), before connecting the power supply to the UPS input.

- Make sure that all the loads connected to the UPS are only connected to the protective earth bonding terminal (⏚). The fact that the earthing of the load(s) and/or the battery case(s) or cabinet(s) is not restricted to this single point will create return loops to earth which will affect the quality of the power supplied.

- All of the terminals identified as protective earth bonding (⏚), are joined together and to the main protective earthing terminal (⏚) and to the frame of the device.

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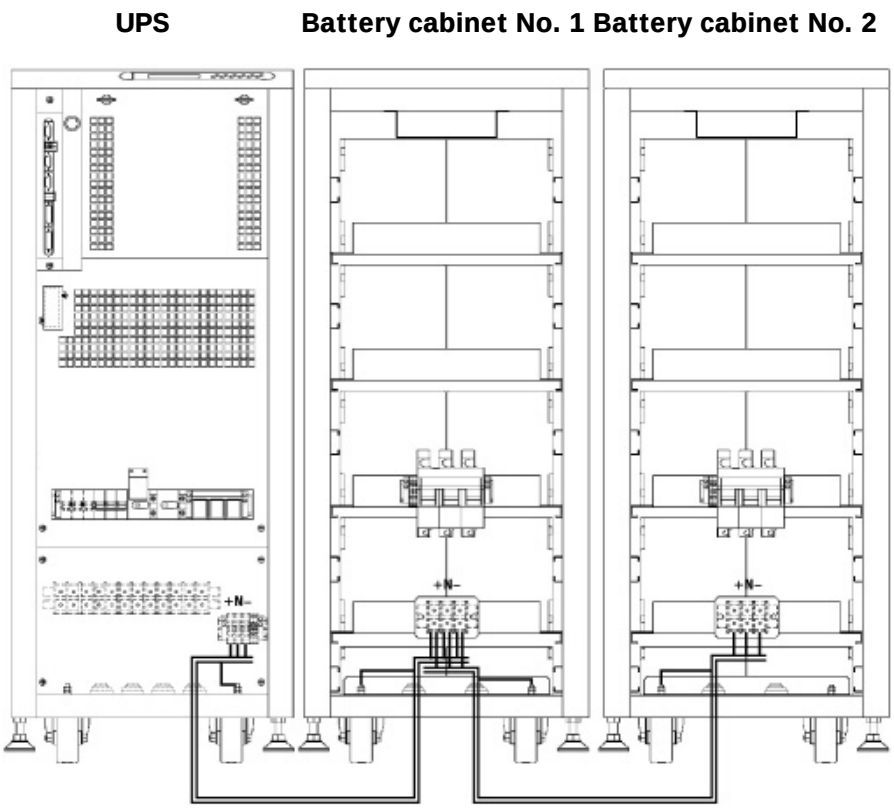

Fig.14. Connection example between a UPS and two battery cabinets.

4.3.6 COM port to relay. Connector (X32).

- ⚠ The communications line (COM) represents a very low safety voltage circuit. To maintain the quality, it must be installed away from other lines that have dangerous voltages (power distribution line).

- The communication port to relays provides digital signals in the form of potential free contacts with a maximum applicable voltage and current of 6 A 30 V DC or 6 A 100 V AC. Both channels are used to connect the UPS to any machine or device that has this standard bus (connector DB9 (X32)).

- In standard units, there are 5 output signalling relays (one of which can be configured), whose common point is connected to pin 5. Also an input signal can be externally supplied to perform Shutdown (5V~12V).

- The most common use of these kinds of port is to supply the necessary information to the file closing software.

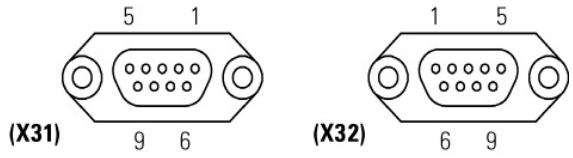

Fig.15. DB9 Connector (X31) & (X32).

Pin-out No.	Description	N.C.-N.O. Position
1	Shutdown signal +	-
2	Shutdown signal –	-
3	Configurable	Not connected
4	Discharge - Mains failure	N.C.
5	Common	-
6	Equipment in Bypass	N.O.
7	Low battery	N.O.
8	General alarm	N.O.
9	Discharge - Mains failure	N.O.

- N.C.: Normally closed contact.
- N.O.: Normally open contact.

Table 2. Alarm interface to relay connector DB9 **(X32).**

4.3.7 Port COM RS-232 & RS-485. Connector (X32).

- ⚠The communications line (COM) represents a very low safety voltage circuit. To maintain the quality, it must be installed away from other lines that have dangerous voltages (power distribution line).

- Both of the equipment's communication ports, RS-232 and RS-485, are in the same connector DB9. It is not possible to use them simultaneously.

- Both channels are in use to connect the UPS with any machine or device that has this standard bus. The RS-232 transmits serial data, so it is possible to send a large amount of information through a communication cable with just 3 wires.

- **Physical structure of the RS-232.**

- Pin-out
  - Pin 2. RXD. Serial data reception.
  - Pin 3. TXD. Serial data transmission.
  - Pin 5. GND. Signal mass.

- Communication protocol of the RS-232.

The communication protocol used is a "MASTER/SLAVE" type. The computer or computer system ("MASTER") asks for certain data, and the UPS ("SLAVE") answers immediately with the required data.
Firstly, the computer communication channel will be programmed with the same parameters as the UPS communication channel.
Then the communication can begin and the UPS is sent the first question.
If a problem occurs during the communication, it is advisable to repeat the channel initialization sequence.

- **Physical structure of the RS-485.**

Unlike other serial communication links, this uses only 2 wires (pins 4 and 9 of the female DB9 connector) to perform the dialogue between the systems connected to the network. The communication will be established by sending and receiving signals in differential mode, which gives the system great immunity to noise and a long reach (approx. 800 m).

- Pin-out
  - Pin 4. RS-485 output signal A (+).
  - Pin 9. RS-485 output signal B (–)[22].

- Communication protocol of the RS-485.

The communication protocol of the RS-485 channel is developed to enable the UPS to dialogue with other computer systems that have this kind of channel.

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- **The RS-232 and RS-485 communication parameters are as follows:**

  - Communication speed: 1200, 2400, 4800, 9600 or 19200 Bauds.
  - No. information bits: 8 Bits.
  - No. stop bits: 1 or 2 stop bits.
  - Parity: - Even, Odd or None.

4.3.8 EPO terminals (X50).

The equipment has two terminals ready for external (remote) Emergency Power Off (EPO).
If a switch or button (EPO) has to be installed, the cable bridge that closes the circuit has to be removed from terminal strip (X50).
The switch or button (EPO) has to open the circuit between the terminal strip (X50) to activate the emergency shutdown. To restore the UPS to normal mode, invert the position of the switch or button (EPO), and close the circuit in terminal strip (X50).
For information on EPO operation, see section 5.3 of this manual.

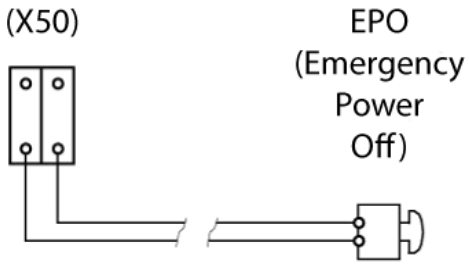

Fig.16. Terminals for connecting an external push-button (EPO), property of the user.

5.1 Start up

5.1.1 Control before start-up.

- Carefully check that all the connections have been made correctly and are sufficiently tight, complying with the labelling on the device and the instructions of chapter "4. Installation and wiring of the unit".
- Check that the UPS switches and the batteries cabinet(s) are turned off (position "Off").
- Be sure that all the loads are turned "Off".

5.1.2 Start-up procedure.

It is very important to operate in the given order, considering the following instructions.

- If the power supply you use to supply the UPS has a header board general switch, set it to "On".
- Turn the input switch (Q1a) to the "On" position. The Control Panel (PC) display will come on automatically.
- If the following alarm message appears on the Control Panel Display ...

MAINS PHASE ROT.
UPS START INH.

Screen 4.*

… and also an audible alarm comes on, the UPS cannot be started, because of an incorrect input phase sequence. Disconnect the input switch (Q1a) and the general cut-off on the header board, swap the phases on the UPS input terminals according to the labelling and repeat the start-up process described up to now.

- Also turn the Bypass switch (Q4) to the "On" position.
- If the following alarm message appears on the Control Panel Display ...

BYPASS PHASE ROT.
UPS START INH.

Screen 4.*

... and also an audible alarm comes on, the UPS cannot be started, because of an incorrect input phase sequence. Disconnect the Bypass switch (Q4) and the general cut-off on the header board, swap the phases on the UPS input bypass terminals according to the labelling and repeat the start-up process described up to now.

At this point, with no alarm active, green LED indications of Input Voltage OK, and Unit on Bypass orange LED indicator light comes on ((a), (b) from figure 18).
Following message appears on the Control Panel Display:

DO NOT CLOSE THE
BATTERY SWITCH

Écran 4.*

Turn the output switch (Q2) to "On", the UPS output terminals will supply voltage through the bypass line.

Start up the inverter. The start-up operation will be done through the keypad of the control panel ((3) from Fig. 18). Go down to "CONTROL & STATUS OF THE UNIT" submenu (screen 1.0), and then right only once. Screen 1.1 will appear asking you to start the unit by pressing (ENT). Do so, and then confirm the operation by pressing (ENT) again. See following screen diagram (figure 17).

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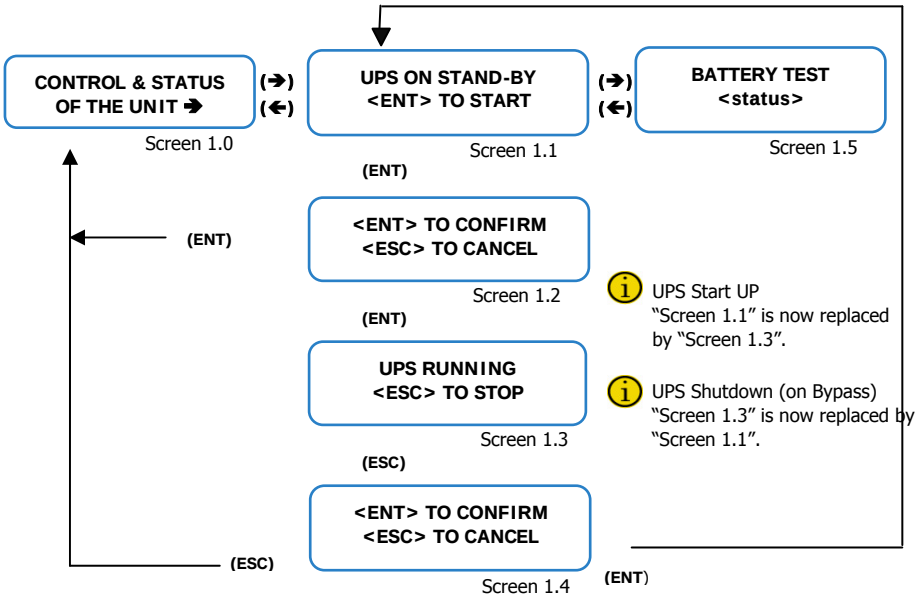

Fig.17. Procedure start-up / shutdown.

After a few seconds, the UPS will be running (rectifier working, inverter working), and the output will be supplied from the inverter.

- Before continuing, make sure the LED indicator light (c) "INVERTER" is lit (green), and (b) "BYPASS" is turned OFF (see Fig. 18). Otherwise please contact the Service and Technical Support.

- Once the rectifier is fully working, it starts a process of equalization (DC bus voltage starts to equalize with battery voltage). After a few seconds an alarm message like this ...

BATT. SWITCH OPEN
SWITCH IT ON

Screen 4.*

…indicates that the equalising process is complete, and NOW AND ONLY NOW can the battery cabinet (Q8) fuse holder switch and/or battery fuse holder switch or UPS switch (Q3) be turned on.

DO NOT TRY to close any battery fuse holder switch at any other moment, because this operation could damage the equipment and/or potentially cause an accident. They can only be turned on by following the aforementioned steps.

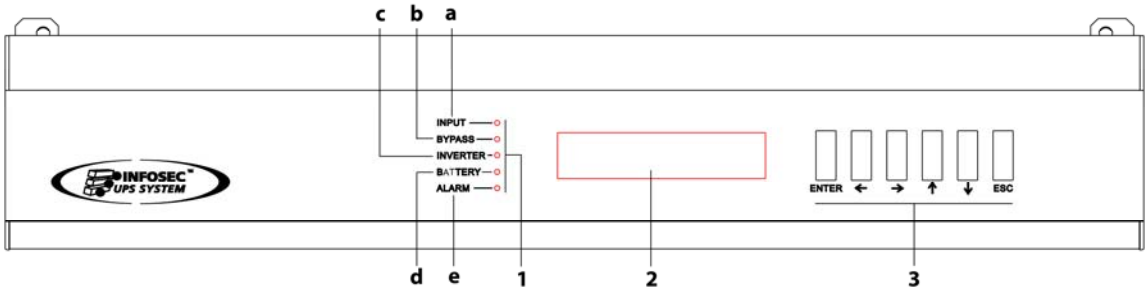

Fig.18. Control panel (PC) LED indications

- Wait 30 seconds for the UPS to be fully started.
- If the system has outgoing distribution protections, switch them "On".
- Start up the loads to be supplied in a progressive way.
- The system is fully started, and the loads are protected by the UPS.

5.2 Complete UPS shutdown.

- Shut down the loads.
- If the system has outgoing distribution protections, switch them "Off".
- Shut down the inverter. Go down to the "CONTROL & STATUS OF THE UNIT" submenu (screen 1.0) using the control panel keypad ((3) from figure 18), and then right once only. Screen 1.3 will appear asking you to shut down the unit by pressing (ESC). Do so, and then confirm the operation by pressing (ENT), see figure 17.
- Turn the output switch (Q2) to the "Off" position.
- Turn fuse holder switch from battery cabinet (Q8) and/or battery fuse holder switch or UPS switch (Q3) to "Off".
- Set the input switch (Q1a) and static bypass switch (Q4) to the "Off" position.
- Cut the UPS power supply and the bypass with the header board cut-off or general switch. The system will be fully deactivated.
- ⚠ **Electrical discharge hazard**. If after equipment shutdown, the separate battery pack(s) have to be disconnected, wait several minutes (5 min. approx.), until the electrolytic capacitors have discharged.
- The equipment is fully shut down.

5.3 Emergency power off (EPO) operation.

Emergency Power Off (EPO) is equivalent to a complete unit system halt:

- All UPS converters are turned off (rectifier and inverter).
- No output voltage is supplied to the loads.
  This function can be commanded through 2-way connector (X50).

See table below for the operation:

E.P.O. function	**Activation (perform System Halt)**	**Return to normal mode.**
Terminals **(X50)**. Normally closed circuit by means of the cable bridge provided (it allows an external switch (EPO)).	Contact normally closed. Remote button or switch has to be opened **(X50)**.	The equipment has to be shut down and fully de-energized (turn off all switches), wait until the DC bus is discharged (all LEDs and LCD have to be turned off). The equipment has to be started up according to section "5.1.2. Start-up procedure".

Table 3. Emergency Power Off (EPO) operation.

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5.4 Bypass manual switch (MAINTENANCE).

5.4.1 Operating principle.

The UPS integrated manual bypass is a very useful feature, but undue use can have irreversible consequences both for the UPS and for the loads connected to its output. It is therefore important to handle it as described in the following paragraphs.

5.4.2 Transfer to manual maintenance bypass.

Procedure for passing from normal operation to maintenance bypass:

- Shut down the inverter. Go down to the "CONTROL & STATUS OF THE UNIT" submenu (screen 1.0) using the control panel keypad ((3) from figure 19), and then right once only. Screen 1.3 will appear asking you to shut down the unit by pressing (ESC). Do so, and then confirm the operation by pressing (**ESC**). Do so, and then confirm operation by pressing (**ENT**), see figure 18.
- Remove the screws fastening the mechanical block (**BL**).
- Remove the mechanical block (BL) of the manual bypass switch (Q5) and set it to the "On" position.
- Set the output switch (**Q2**) to the "Off" position.
- Set the Battery Fuse Holder or battery switch (**Q3**) to "Off". In addition, in models with independent battery pack(s) also turns Battery Fuse Holder (**Q8**) of each pack to "Off".
- Set the input switch (**Q1a**) and static bypass switch (**Q4**) to the "Off" position.

The UPS supplies output voltage through the manual bypass. The UPS is fully shut down and inactive.

5.4.3 Transfer to normal operation

Procedure for passing from maintenance bypass to normal operation:

- Set the input switch (**Q1a**) and static bypass switch (**Q4**) to the "On" position.
- Set the output switch (**Q2**) to the "On" position.
- Set the manual bypass switch (**Q5**) to the "Off" position and refit the mechanical block (BL) and the screws (**t2**).

⚠ It is an essential safety requirement, for the life of the UPS and the loads connected to it, to refit the mechanical block (**BL**) as this avoids dangerous handling.

- Start up the inverter. Go down to the "CONTROL & STATUS OF THE UNIT" submenu (screen 1.0) using the control panel keypad ((3) from figure 19), and then right once only. Screen 1.1, asking you to start the unit up by pressing (**ENT**). Do so, and then confirm operation by pressing (**ENT**) again. See following screen diagram (figure 18).

The UPS supplies output voltage entirely protected against voltage variations, electric noise, etc.

- Wait for alarm message to appear:

BATT. SWITCH OPEN SWITCH IT ON

Screen 4.*

- The fuse holder switch from battery cabinet (**Q8**) and/or battery fuse holder switch or switch from UPS (**Q3**) will be turned "On" only if the alarm message above displays.

DO NOT TRY to close any battery fuse holder switch at any other moment, because this operation could damage the equipment and/or potentially cause an accident. They can only be turned on by following the aforementioned steps.

- The UPS supplies output voltage entirely protected against cuts, micro cuts, voltage variations, electric noise, etc.

6 CONTROL PANEL AND DISPLAY DESCRIPTION

6.1 Control panel parts.

(LEDs) LED indications:
(a) Rectifier Input Voltage OK (green).
(b) Unit on Bypass (orange).
(c) Inverter is working (green).
(d) Unit working from batteries -mains failure- (red).
(e) In the event of a unit alarm (red).
(2) Character Display
(3) Keyboard
ENT "Enter" key. Confirmation of orders, program values (or other specified functions)

🡐 "Left" key for submenu navigation, or cursor displacement.
🡒 "Right" key for submenu navigation, or cursor displacement.
🡕 "Up" key for menu navigation, or digit modification.
🡗 "Down" key menu navigation, or digit modification.

ESC "Escape" key. Return to main screen, cancel/finish programming (or other specified functions).
ENT, 🡐 When pressed simultaneously at least during 3 seconds, equivalent to an Emergency Power Off (EPO), turn-off any voltage at the output (see section 5.3).

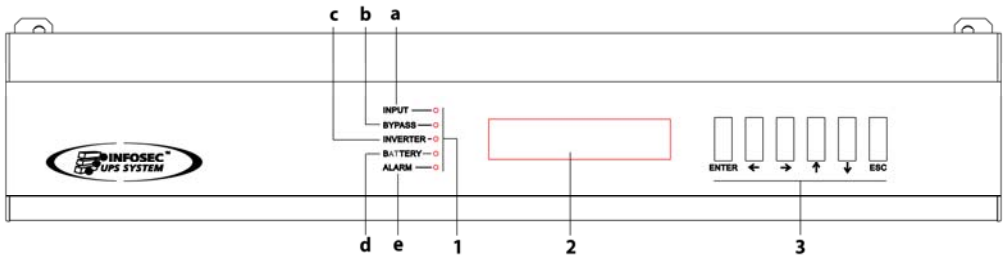

Fig.19. Control panel parts.

6.2 Basic functions of keyboard from overview.

- Advance (🡗) and return (🡕) keys give access to all the LCD panel menus and allow movement from one to another.

- Right (🡒) or left (🡐) keys give access to the screens of all the LCD panel submenus, and allow movement from one to another.

- Key (ENT), has different purposes depending on the menu:

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- ❒ Setting values. Press key (ENT) to activate the function setting, the figures in the screen flash. With keys (➔)-(🡐) the character to set is selected and with keys (🡙)-(🡕) the value is selected. To confirm press (ENT). The next field will flash. To continue with the settings proceed in the same way or press (ESC) to return to no-setting situation.
- ❒ Validation of orders or commands.

- Press key (**ESC**) on any screen of any submenu, to return to main screen (**Screen 0.0**), unless on a screen of a "**Parameters**" menu and setting any of them. If so, the first pulsation of key (**ESC**) will stop the flashing value, and a second time to return to main screen.

- Notes related to the screen map (see figure 20):

  - ❒ Some screens have a certain number of "–" characters. Each one represents a character so the maximum length of the field will be determined by their number.
  - ❒ Each screen is numbered with a number located to the right bottom corner. It is only included as a simple reference for the next description and explanation.
  - ❒ Note (*1): means the hidden programming screens through the password (*****) in "**screen 1**...". This safety level prevents unauthorized staff from altering or modifying setting.

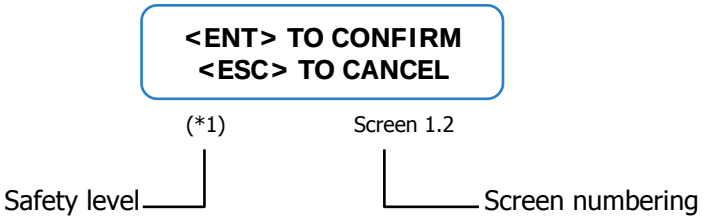

Fig.20. Notes related to the screens.

6.2.1 Message menus and classification in submenus.

- Use (🡙) and (🡕) keys to choose between different menus (0.0, 1.0,...7.0).

- Use (➔) and (🡐) keys to move inside submenu screens.

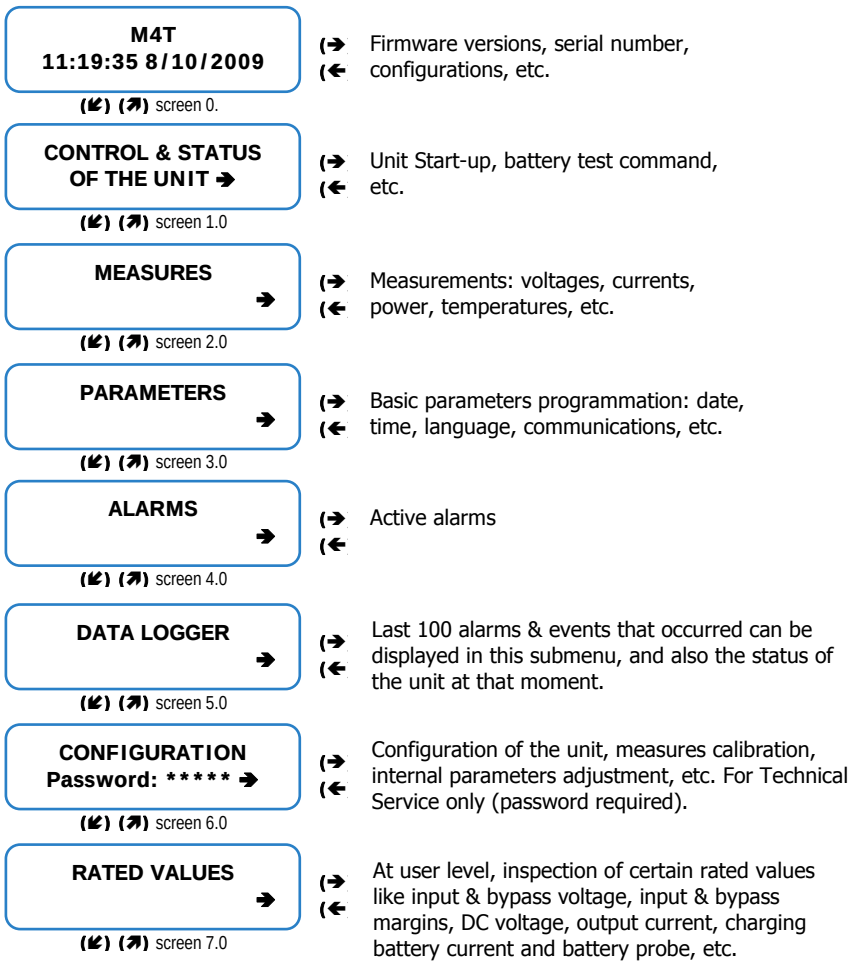

Fig.21. Display message menus and classification in submenus.

6.3 Screen description.

6.3.1 Main level (screen menu 0.0).

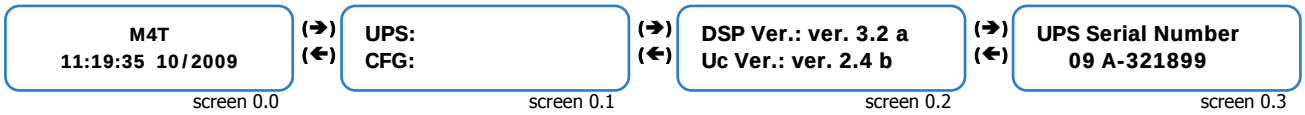

Fig.22. Screen 0.0 "Initial" and its submenus.

- **Screen 0.0**: Main presentation screen, with time and date indication.

Press key (**ESC**) on any screen of any submenu, to return to main screen (Screen 0.0),

- **Screen 0.1:** UPS Status ("UPS:", 1st row) and configuration ("CFG:", 2nd row). In the first row, there are two fields, first to show the general status of the converters, and second to show the origin of the output voltage. These two fields are separated by a " , ":

  ❒ Possible state of the converters:
  - "Shutdown" Rectifier and Inverter stopped or blocked.
  - "Start" UPS converters (rectifier and inverter) are starting, but still not ready.
  - "Normal" UPS is running in normal mode: mains present, rectifier running, and output on inverter. Loads are protected.
  - "Dischar." Mains failure. UPS running in back-up mode (rectifier stopped, inverter running).

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❒ Origin of the output:
- "OFF" No voltage supplied at the output (either EPO pressed, or severe problem on the unit).
- "Invert" Inverter voltage is supplied at the output. Loads are protected.
- "Bypass" Bypass voltage is supplied at the output. Either the unit is manually stopped, or overloaded, or other possible problems on the inverter.

Information about the unit's configuration (single or parallel) is shown in the second row:

❒ Configuration and status of the unit:
- "Single:" "Single" connection.
- "Parallel-Single" Parallel connection. Unit is in "single" status.
- "Parallel-Master" Parallel connection. Unit is in "master" status.
- "Parallel-Slave" Parallel connection. Unit is on "slave" status.

Examples:

a)

UPS: Normal, Invert.
CFG: Single

b)

UPS: Shutdown, Bypass
CFG: Parallel-Master

- **Screen 0.2:** Internal firmware versions of both Digital Signal Processor ("DSP Ver:") and microcontroller ("uC Ver:"). On the sample screen, "ver. 3.2 a" and "ver. 2.4 b" respectively.

- **Screen 0.3:** UPS Serial Number, expressed with 10 characters. Possible characters ranges are "0"-"9", "A"-"Z" and also " " (blank space), "-". See sample screen.

6.3.2 "UNIT CONTROL & STATUS" Level (screen menu 1.0).

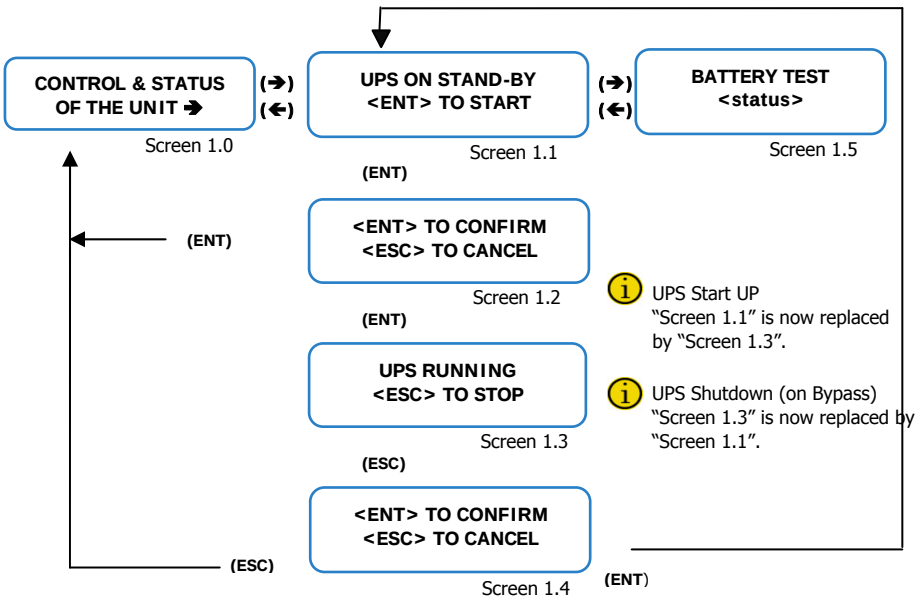

Fig.23. Procedure start-up / shutdown.

- **Screens 1.1, 1.3 and confirmation screen (1.2 / 1.4):** to start and stop the unit through the control panel.
  See chapters 5.1.2 and 5.2 for the starting and stopping procedure.

- **Screen 1.5 and confirmation screen (1.2 / 1.4):** to order a battery test. Information about the battery test is given on the second row. Possible messages:
  "NOT AVAILABLE": The battery test is not available.
  "PRESS <ENTER>": Press <ENTER> to run the battery test.
  "EXECUTING": The battery test is running.
  "SUCCESSFUL": The battery test was successful.
  "NOT SUCCESSFUL": The battery test was not successful.

6.3.3 "MEASURES" level (screen menu 2.0).

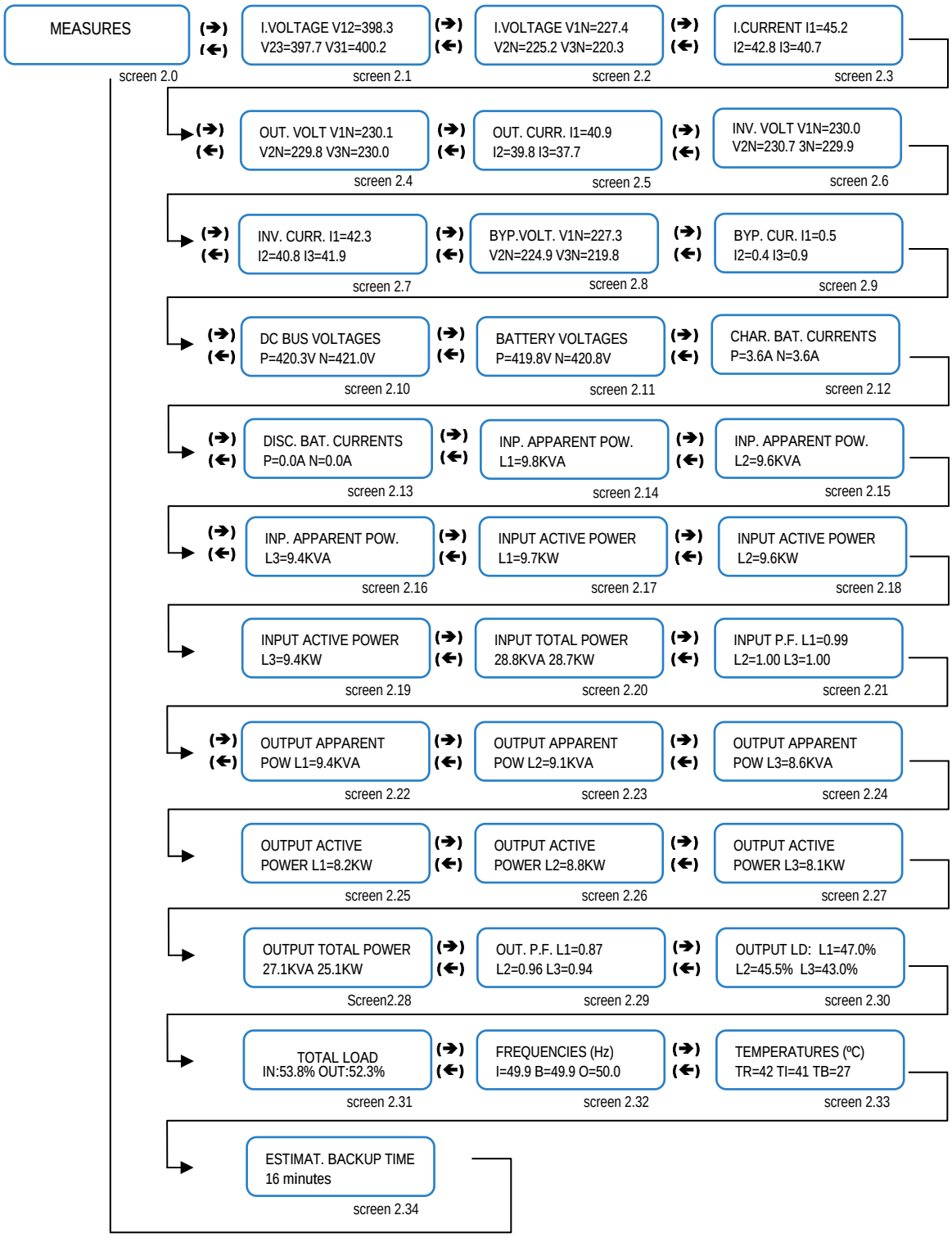

Fig.24. Screen 2.0 "Measures" and its submenus.

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Press key (**ESC**) on any screen of any submenu, to return to main screen (**Screen 0.0**),

Screen 2.1: Input voltages phase to phase (units 0.1V).

Screen 2.2: Three phase input voltages phases to neutral (units 0.1V).

Screen 2.3: Input current for each phase in three phase equipment (units 0.1A).

Screen 2.4: Three phase output voltages phases to neutral (units 0.1V).

Screen 2.5: Output current for each phase in three phase equipment (units 0.1A).

Screen 2.6: Three phase inverter output voltages phases to neutral (units 0.1V).

Screen 2.7: Inverter output current for each phase in three phase equipment (units 0.1A).

Screen 2.8: Three phase bypass voltages phases to neutral (units 0.1V).

Screen 2.9: Bypass current for each phase in three phase equipment (units 0.1A).

Screen 2.10: DC bus voltages positive and negative (units 0.1V).

Screen 2.11: Battery voltages positive and negative (units 0.1V).

Screen 2.12: Charge battery currents positive and negative (units 0.1A).

Screen 2.13: Discharge battery currents positive and negative (units 0.A).

Screen 2.14: Input apparent power of L1 (units 0.1kVA).

Screen 2.15: Input apparent power of L2 (units 0.1kVA).

Screen 2.16: Input apparent power of L3 (units 0.1kVA).

Screen 2.17: Input active power of L1 (units 0.1kW).

Screen 2.18: Input active power of L2 (units 0.1kW).

Screen 2.19: Input active power of L3 (units 0.1kW).

Screen 2.20: Total input apparent power and active power (units 0.1kVA & 0,1kW).

Screen 2.21: Input power factor for each phase in three phase equipment (units 0.01).

Screen 2.22: Apparent output power L1 (units 0.1kVA).

Screen 2.23: Apparent output power L2 (units 0.1kVA).

Screen 2.24: Apparent output power L3 (units 0.1kVA).

Screen 2.25: Active output power L1 (units 0.1kW).

Screen 2.26: Active output power L2 (units 0.1kW).

Screen 2.27: Active output power L3 (units 0.1kW).

Screen 2.28: Total apparent and active powers (units 0.1kVA and 0,1kW).

Screen 2.29: Output power factor of each phase for three phase equipment (units 0.01).

Screen 2.30: Output load of three phases (units 0.1%).

Screen 2.31: Total input load and total output load (units 0.1%).

Screen 2.32: Input, bypass and output frequencies (units 0.1Hz).

Screen 2.33: Rectifier, inverter and battery temperatures (units 1ºC).

Screen 2.34: Estimated backup time (units 1 minute).

6.3.4 "PARAMETERS" level (screen menu 3.0). See Fig. 33.

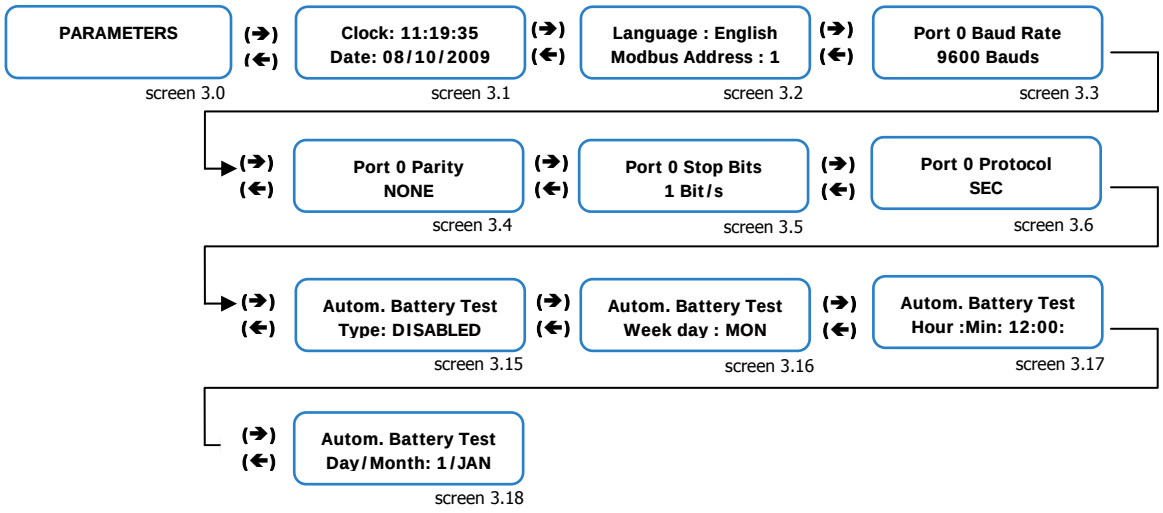

Fig.25. Screen 3.0 "Parameters" and its submenus.

Screen 3.1: You can program the time "hh:mm:ss" (hours/minutes/seconds) in the first row and the date "dd/mm/yy" (day/month/year) in the second row.

Screen 3.2: You can select the display language from the following options in the first row:
- "English"
- "Francais"
- "Español"

You can program the Modbus Address in the second row. The address range is from 1 to 247 characters.

Screen 3.3: You can program the BAUD RATE of communication port #0 on this screen. The options are as follows:
- "1200"
- "2400"
- "4800"
- "9600"
- "19200"

Screen 3.4: You can program the PARITY type of communication port #0 on this screen. The options are as follows:
- "NONE"
- "ODD"
- "EVEN"

Screen 3.5: You can program the number of STOP BITS of communication port #0 on this screen. The options are as follows:
- "1"
- "12"

Screen 3.6: You can program the protocol type of communication port #0 on this screen. The options are as follows:
- "SEC"
- "MODBUS"

Screen 3.15: This is the screen for programming the frequency of the automatic battery test. The options to be programmed are as follows:
- "DISABLED": The automatic battery test is disabled.
- "WEEKLY": The automatic battery test runs once a week.
- "MONTHLY": The automatic battery test runs once a month.
- "YEARLY": The automatic battery test runs once a year.

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Screen 3.16: This screen appears independently on the last screen, but it only makes sense to be programmed if the automatic battery test runs once per week. The options to be programmed are as follows:

- "MON": the day selected to run the weekly battery test is Monday.
- "TUE": the day selected to run the weekly battery test is Tuesday.
- "WED": the day selected to run the weekly battery test is Wednesday.
- "THU": the day selected to run the weekly battery test is Thursday.
- "FRI": the day selected to run the weekly battery test is Friday.
- "SAT": the day selected to run the weekly battery test is Saturday.
- "SUN": the day selected to run the weekly battery test is Sunday.

Screen 3.17: This screen appears independently on the last screen, but it only makes sense to be programmed if the automatic battery test is enabled. You can program the time "hh:mm" (hours/minutes) in 24h format on this screen.

Screen 3.18: This screen appears independently on the last screen, but it only makes sense to be programmed if the automatic battery test runs monthly or yearly. You can program the day from 1 to 31 on this screen and the month selecting one of the following options:

- "JAN": the month selected to run the yearly battery test is January.
- "FEB": the month selected to run the yearly battery test is February.
- "MAR": the month selected to run the yearly battery test is March.
- "APR": the month selected to run the yearly battery test is April.
- "MAY": the month selected to run the yearly battery test is May.
- "JUN": the month selected to run the yearly battery test is June.
- "JUL": the month selected to run the yearly battery test is July.
- "AUG": the month selected to run the yearly battery test is August.
- "SEP": the month selected to run the yearly battery test is September.
- "OCT": the month selected to run the yearly battery test is October.
- "NOV": the month selected to run the yearly battery test is November.
- "DEC": the month selected to run the yearly battery test is December.

6.3.5 "ALARMS" level (screen menu 4.0).

Active alarms are displayed using key (➔). You can move from one to another within the alarm list using keys (➔) or (🡐).
If there is no alarm, it will not be possible to go forward with key (➔).
Figure 26 shows only one alarm as an example, but there could be other active alarms.
Table 6 shows all the possible alarms displayed on the LCD screen.
In addition, alarm message screens may appear flashing and replacing any other screen (even in different menus or submenus) currently displayed.
The flashing alarm message is acknowledged by pressing (ENT), and the previous screen is displayed again.

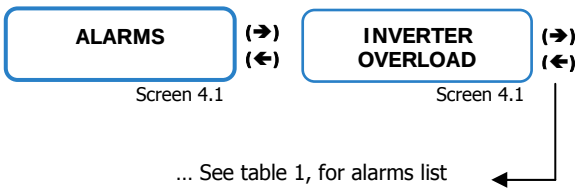

Fig.26. Screen 4.0 "Alarms" and its submenus.

LCD screen display	Alarms	Ref.
RECTIFIER OVERLOAD	RECTIFIER	4.1
INVERTER OVERLOAD	INVERTER	4.2
MAINS FAILURE LOW BATTERY LEVEL		4.3
INVERTER VOLTAGE OUTSIDE MARGINS		4.4
DC VOLT. DETECTED AT THE OUTPUT		4.5
DC VOLT. DETECTED AT THE OUTPUT		4.6
MAINS FAILURE BATTERY DISCHARGIG	UPS	4.7
HIGH TEMPERATURE REDUCE OUTPUT LOAD		4.8
BATT. SWITCH OPEN SWITCH IT ON		4.9
BYPASS FAILURE NOT SYNCHRONISED INV		4.10
UPS ON BYPASS INITIALISE THE UPS		4.11
SOME UNIT BLOCKED DUE TO MAINT. BYPASS		4.12
CAN BUS 1 COMMUNICATION FAIL.		4.13
CAN BUS 2 COMMUNICATION FAIL.		4.14
END OF BATTERY LIFE ALARM		4.15
BATT. TEMPERATURE TOO HIGH		4.16
BATTERY TEST NOT SUCCEEDED		4.17
BAT.DISCONNECTION SHUTDOWN & RESTART		4.18
MAINS PHASE ROT. UPS START INH.		4.19
BYPASS PHASE ROT. UPS START INH.		4.20
INP. VOLTA. WRONG RECTIFIER STOP	RECTIFIER STOPS	4.21
RECTIFIER DESATS. RECTIFIER STOP		4.22
DSP INTERN. ERROR RECTIFIER STOP		4.23
INPUT PHASE ROT. RECTIFIER STOP		4.24

LCD screen display	Alarms	Ref.
INVERTER DESATS. INVERTER STOP	INVERTER STOPS	4.25
INVERTER OVERLOAD INVERTER STOP		4.26
SHUTDOWN COMMAND INVERTER STOP		4.27
MAINTENANCE BYP. INVERTER STOP		4.28
PARAL. SYS. DISC. INVERTER STOP		4.29
HIGH OVERLOAD INVERTER STOP		4.30
OVERTEMPERATURE INVERTER STOP		4.31
RECTIFIER OVERLO. INVERTER STOP		4.32
DSP INTERN. ERROR INVERTER STOP		4.33
OUT SHORT-CIRCUIT INVERTER STOP		4.34
BYPASS PHASE ROT. INVERTER STOP		4.35
DSP INTERN. ERROR UPS STOP	UPS STOPS	4.36
LOW BATTERY UPS STOP		4.37
EMERGE. POWER OFF NO OUTPUT VOLTAGE	BYP STOPS	4.38
OUT SHORT-CIRCUIT NO OUTPUT VOLTAGE		4.39
DSP INTERN. ERROR UPS BLOCK ALL		4.40
DC BUS VOLT WRONG RECTIFIER BLOCKED	RECTIFIER STOPS	4.41
RECTIFIER BLOCKED BLK.UPS -> BLK.REC		4.42
RECTIFIER DESATS. RECTIFIER BLOCKED		4.43
VOLTAGE RAMP ERR. RECTIFIER BLOCKED		4.44
INTERN.EXE. ERROR RECTIFIER BLOCKED		4.45
DSP INTERN. ERROR RECTIFIER BLOCKED		4.46
CONTACTOR T. FAIL RECTIFIER BLOCKED		4.47

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LCD screen display	Alarms	Ref.
VOLTAGE RAMP ERR. INVERTER BLOCKED	INVERTER BLOCKS	4.48
OUTPUT DC VOLTAGE INVERTER BLOCKED		4.49
INVERTER BLOCKED BLK.UPS -> BLK.INV		4.50
INVERTER DESATS. INVERTER BLOCKED		4.51
INTERN.EXE. ERROR INVERTER BLOCKED		4.52
DSP INTERN. ERROR INVERTER BLOCKED		4.53
UPS BLOCKED BLK.REC -> BLK.UPS	UPS BLOCKS	4.54
INTERN.INI. ERROR UPS BLOCKED (DSP)		4.55
INTERN.EXE. ERROR UPS BLOCKED (DSP)		4.56
UPS BLOCKED BLK.INV -> BLK.UPS		4.57
INTERN.COM. ERROR UPS BLOCKED (DSP)		4.58
PARAL. SYS. DISC. UPS BLOCKED		4.59
UPS OVERTEMPERAT. UPS BLOCKED		4.60
RECTIFIER OVERLO. UPS BLOCKED		4.61
INVERTER DESATS. UPS BLOCKED		4.62
DSP INTERN. ERROR UPS BLOCKED		4.63
PFC & INV BLOCK. UPS BLOCKED		4.64

Table .4 Alarm list displayed in the LCD panel.

Screen 4.1: This alarm indicates that the rectifier is overloaded. The rectifier overload appears when the input current of any phase is greater than the following ratio:

$$I_{in\text{-}ovl} = 0{,}326 \times P_{out} / V_{out\_p\text{-}n}$$

Where:
- Iin-ovl is Overload Input Current (A)
- Pout is Rated Output Apparent Power (VA)
- Vout_p-n is Rated Output Voltage phase-to-neutral (V)

Screen 4.2: This alarm indicates that the inverter is overloaded. The inverter overload appears when the output current of any phase is greater than the rated output current.

$$I_{out\text{-}ovl} = P_{out} / (V_{out\_p\text{-}n} * 3)$$

Where:
- Iout is rated Output Current (A)
- Pout is Rated Output Apparent Power (VA)
- Vout_p-n is Rated Output Voltage phase-to-neutral (V) or when the total output active power is greater than the following formula:

Pact_out-ovl = Pout x 0,8

Where:
- Pact_out-ovl is the Overload Output Active Power (W)
- Pout is Rated Output Apparent Power (VA)

Screen 4.3: This alarm appears when the unit input is in mains failure condition and the battery level is lower than 11,5V/bat.

Screen 4.4: This alarm appears when the inverter output voltage phase to neutral in any phase is outside range of +/-6%.

Screen 4.5: This alarm appears when there is an offset voltage higher than 5V, in any phase of the inverter output voltage phase to neutral.

Screen 4.6: When the maintenance bypass switch is ON the UPS inverter will not be available.

Screen 4.7: The mains failure occurs when in any phase, the input voltage phase to neutral is outside the set margins (+15%/–20% by default) or the input frequency is outside the set margins (± 0,5Hz by default).

Screen 4.8: When the inverter or PFC temperature sensors measure temperatures over the programmed values (70ºC by default).

Screen 4.9: This message appears when the battery switch is OFF and the DC bus is charged to the battery voltage level, to inform the user to switch ON the battery switch.

Screen 4.10: This screen indicates that the bypass input voltage or the bypass input frequency are outside the margins. These margins are programmable but the default bypass voltage range is +12%/–17% and the bypass frequency range is ±0.5Hz.

Screen 4.11: The UPS is on bypass for whatever reason. It must be restarted via the display keypad.

Screen 4.12: This is an alarm for parallel systems. It appears when UPS devices in the parallel system are blocked because the maintenance bypass switch of a unit is switched ON.

Screen 4.13: This alarm indicates that the CAN BUS #1 fails. This communication channel is used for remote control.

Screen 4.14: This alarm indicates that the CAN BUS #2 fails. This channel is used for data communication between UPS devices, in a parallel system.

Screen 4.15: This alarm appears at the estimated end of life of the battery bank. The revision and replacement of some batteries will be required by calling the S.T.S. (Service and Technical Support) department.

Screen 4.16: The temperature of the battery cabinet (in the case of a separate battery cabinet) or battery lace (if batteries located inside the UPS) is higher than 40ºC.

Screen 4.17: If battery test (automatic or manual) is completed unsuccessfully, this alarm will appear.

Screen 4.18: Two possible reasons:
- ❒ During the unit start up, a message appears indicating that the battery switch can be switched ON. After a period of time without switching ON, this alarm appears.
- ❒ When the unit is running under normal conditions and the battery switch is switched OFF.

Screen 4.19: When mains is connected during the startup, a phase rotation error is detected and the startup procedure is inhibited.

Screen 4.20: When the bypass is connected during the startup, a bypass phase rotation error is detected and the startup procedure is inhibited.

Screen 4.21: This alarm appears when in any phase, the rectifier input voltage phase to neutral is outside the set margins (+15%/–20% by default) or the rectifier input frequency is outside the set margins (± 0,5Hz by default). Then the rectifier is shut down.

Screen 4.22: This alarm appears when any IGBT in the rectifier side modifies the number of times programmed by display (50 by default).

Screen 4.23: This alarm appears when there is a (*) DSP Internal Error in the rectifier module, shutting down the rectifier immediately. There will be 3 more retries before the rectifier is blocked.

Screen 4.24: If when attempting to turn ON the rectifier a mains phase rotation error is detected and under these conditions an input phase rotation alarm appears shutting down the rectifier.

Screen 4.25: This alarm appears when any IGBT in the inverter side modifies the number of times programmed by display (200 by default).

Screen 4.26: When the inverter output is overloaded, depending on the level of this overload, the inverter will be shut down after a period of time according to the UPS overload curve and this alarm will appear.

Screen 4.27: When an external shutdown signal is enabled, the inverter will shut down displaying this message.

Screen 4.28: When the inverter is running and the maintenance bypass switch is turned ON the inverter shuts down immediately.

Screen 4.29: This alarm appears when, in a parallel system, a UPS goes into battery mode. The inverter will shut down.

Screen 4.30: This message indicates that a UPS is running over 160% of load in a parallel system.

Screen 4.31: When an over temperature is detected by the PFC or inverter temperature sensors, after 1 minute the inverter will be turned off automatically. If the over temperature condition remains after another minute with the rectifier working, the rectifier is also blocked (alarm 4.60).

Screen 4.32: When the rectifier is overloaded, depending on the level of this overload, the inverter will be shut down after a period of time according to the rectifier overload curve and this alarm will appear. If this overload is still present with the inverter is switched off, the rectifier will be blocked after 30" and a blocking alarm 4.61 will appear.

Screen 4.33: This alarm appears when there is a (*) DSP Internal Error in the inverter module, shutting down the inverter immediately. There will be 4 retries before the inverter is blocked.

Screen 4.34: This alarm appears when an output short circuit is detected limiting the output RMS current up to the set value (150% of nominal current by default). The short circuit is detected when the output voltage phase to neutral is lower than 8% of nominal voltage. The system will retry twice to restart.

Screen 4.35: If there is a bypass phase rotation error when the inverter is running, the inverter will shut down.

Screen 4.36: This alarm appears when there is a (*) DSP Internal Error in the UPS module, shutting down the UPS immediately. There will be 2 retries before the UPS is blocked.

Screen 4.37: This alarm announces that in battery mode, the battery bank reaches 10.5V/bat. This is the end of backup time and the UPS is shut down.

Screen 4.38: The EPO (Emergency Power Off) switch is ON. The UPS and the static bypass are switched off and there is no AC voltage present at the output anymore.

Screen 4.39: This alarm appears after 3 times detecting output short-circuit. The UPS and the static bypass are then switched off and there is no AC voltage present at the output anymore.

Screen 4.40: This alarm appears when there is a (*) DSP Internal Error in the UPS module three times, shutting down the UPS. The UPS including the bypass is blocked, so no AC voltage is present at the output anymore.

Screen 4.41: This alarm appears when there is one of the following conditions:

- Positive DC bus voltage over 450V.

- Positive DC bus voltage less than 325V.
- Negative DC bus voltage over – 450V (absolute value).
- Negative DC bus voltage less than – 325V (absolute value).

Screen 4.42: This alarm appears when the UPS is blocked for any reason. This condition also blocks the rectifier.

Screen 4.43: After 3 times shutdowns of the rectifier for failure and retry, this alarm will appear indicating that the rectifier is blocked.

Screen 4.44: If an error in the initial rectifier ramp is detected during the PFC start up, this alarm will appear also blocking the rectifier.

Screen 4.45: If there is a command from the microprocessor to the DSP, with no response from the rectifier module of the DSP, the rectifier will be blocked.

Screen 4.46: After 4 shutdowns of the rectifier because of (*) DSP Internal Error in the rectifier module, this alarm will appear indicating that the rectifier is blocked.

Screen 4.47: During the startup there is an input contactor test. If this test ends unsuccessfully the rectifier will be blocked.

Screen 4.48: If the output voltage ramp does not work properly during the inverter start up the inverter will be blocked.

Screen 4.49: This alarm appears when there is an offset voltage higher than 8V, in any phase of the inverter output voltage phase to neutral. The inverter will be blocked.

Screen 4.50: This alarm appears when the UPS is blocked for any reason. This condition also blocks the inverter.

Screen 4.51: After 3 shutdowns of the inverter for failure and retry, this alarm will appear indicating that the inverter is blocked.

Screen 4.52: If there is a command from the microprocessor to the DSP, with no response from the inverter module of the DSP, the inverter will be blocked.

Screen 4.53: After 5 shutdowns of the inverter because of (*) DSP Internal Error in the inverter module, this alarm will appear indicating that the inverter is blocked.

Screen 4.54: This alarm appears when the rectifier is blocked for a reason that may also block the UPS.

Screen 4.55: The alarm appears when the DSP does not respond to the microprocessor during the initial procedure before the start up.

Screen 4.56: If there is a command from the microprocessor to the DSP, with no response from the UPS module of the DSP, the UPS will be blocked.

Screen 4.57: This alarm appears when the inverter is blocked for a reason that may also block the UPS.

Screen 4.58: If there is an internal error in the communication channel between microprocessor and DSP, this condition blocks the UPS.

Screen 4.59: This alarm appears when, in a parallel system, one UPS goes into battery mode. After a period of time, the UPS will shut down.

Screen 4.60: When an over temperature is detected by the PFC or inverter temperature sensors, first the inverter will be turned off automatically after 1 minute (alarm 4.31). If one minute later the over temperature is still detected, the UPS will be fully blocked (rectifier also shut down) and the alarm appears.

Screen 4.61: When the rectifier is overloaded, depending on the level of this overload, the inverter will be shut down after a certain time according to the rectifier overload curve (alarm 4.32). If this overload is still present with the inverter switched off, the UPS will be fully blocked (rectifier also shut down) after 30" and an alarm message appears.

Screen 4.62: When any IGBT on the inverter side, modifies the number of display times programmed (200 by default) the inverter blocks. After two more retries this alarm appears indicating that the UPS is blocked.

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Screen 4.63: After 3 shutdowns of the UPS because of (*) DSP Internal Error in the UPS module, this alarm will appear indicating that the UPS is blocked.

Screen 4.64: If there is a blocking condition for the inverter and also a blocking condition for the PFC, this alarm appears also blocking the UPS.

(*) DSP Internal Error may occur for the following reasons:

- Watch Dog failure.
- Wrong ADC measures.
- Communication errors between DSP and processor.

6.3.6 "DATA LOGGER" level (screen menu 5.0).

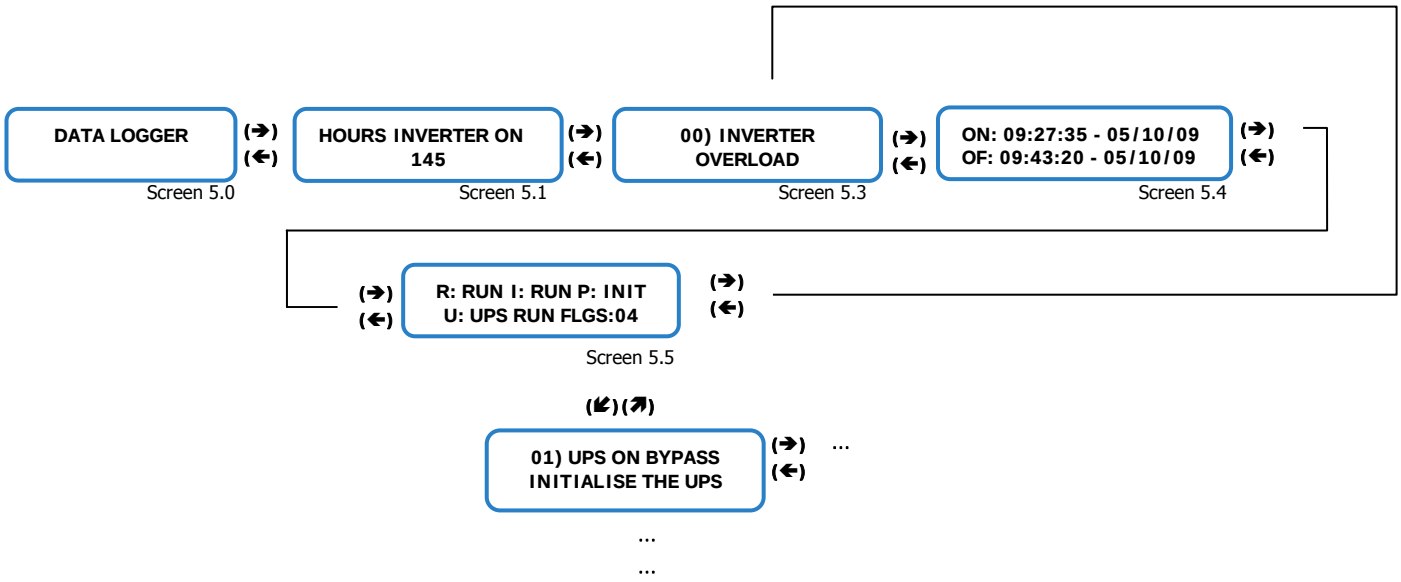

Fig.27. Screen 5.0 "Data logger" and its submenus.

Press key (**ESC**) on any screen of any submenu to return to main screen (**Screen 0.0**).

Screen 5.1: Indicates the inverter runtime from the first unit start-up. This counter accumulates the total inverter running time from the beginning and it is not possible to reset it.

Screen 5.2: This screen indicates that the data logger is empty. This only happens if authorized personnel reset this file. If the buffer is not empty, the following screen will inform of the data logger registers.

You can move through the different registers of this log file using the (↙) (↗) keys. The data logger file can save up to 100 log registers.
You can see the three different screens per register, using the (→) (←) keys, with the information described below.

Screen 5.3: The same information appears in this screen as described above in the alarm screens except the first three characters where there is a register counter from 00) to 99).

Screen 5.4: This screen is divided into two rows.

In the first row there is information about alarm activation time and date:

- hh: hour of alarm activation
- mm: minutes of alarm activation
- ss: seconds of alarm activation
- dd: day of deleted alarm
- mm: month of alarm activation dd: day of alarm activation
- yy: year of alarm activation

In the second row there is information about deleted alarm time and date.

- hh: hour of deleted alarm
- mm: minutes of deleted alarm
- ss: seconds of deleted alarm
- dd: day of deleted alarm
- mm: month of deleted alarm
- yy: year of deleted alarm

Screen 5.5: This is a screen for technical service, to know the state of the different parts of the UPS at the moment the registered alarm was activated.

6.3.7 "CONFIGURATION" level (screen menu 6.0).

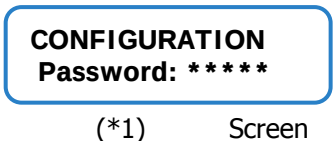

Fig.28. Screen 6.0 "Configuration".

At this level an authorized password will be required to modify some advanced parameters.

6.3.8 Rated values screens (screen menu 7.0).

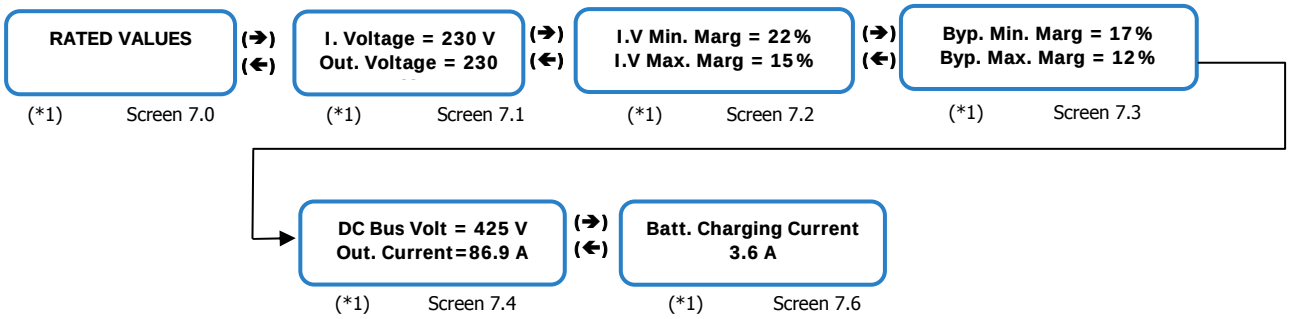

Fig.29. Screen 7.0 "Rated values" and its submenus.

To modify the rated values on the screens of this submenu, the "Password" has to be entered on the previous screen 6.0, otherwise they will be "view only".

Screen 7.1: This screen shows the Rated Input and Output Rectifier Voltage.

Screen 7.2: This screen shows the Input Rectifier Voltage Upper and Lower Margins.

Screen 7.3: This screen shows the Input Bypass Voltage Upper and Lower Margin.

Screen 7.4: This screen shows the Rated DC Bus Voltage and the Rated Output Current.

Screen 7.5: This screen shows the Rated Inverter Voltage and Rated Output Voltage.

Screen 7.6: This screen shows the Rated Battery Charging Current.

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7.1 Basic maintenance guide.

Batteries, fans and capacitors must be replaced at the end of their useful lifetime.

- ⚠ Inside the UPS there are dangerous voltages and metallic parts at very high temperatures, even after the UPS is shut down. Direct contact can cause electrocutions and burns. All operations, except battery fuse replacement, must be done by authorized technical staff.
- ⚠ Some internal parts of the UPS (terminals, EMC filters and measurement circuits) are still under voltage during the maintenance bypass operation. To cancel all voltages, the mains and bypass circuit breakers on the panel supplying the UPS and the external battery cabinet fuse holders have to be turned ”OFF“ / ”0“. The internal batteries must also be isolated from the system.

7.1.1 Battery fuses.

Turning on the battery switch or fuse holder according to power of the equipment (“ON” or “I” position) before alarm message “BATT. SWITCH OPEN, SWITCH IT ON” is displayed on the LCD panel can blow the battery fuses or switch.

- ⚠ The battery fuses can only be replaced by ultrafast models type Gould aR 660V (14x51 or 22x58 mm, depending on the unit model) of the same dimensions and rating.

7.1.2 Batteries.

The useful lifetime of the batteries depends on the ambient temperature and other factors such as the quantity of charging and discharging cycles and full discharges.

The average lifetime is between 3 and 5 years if the ambient temperature is between 10 and 20ºC. For more information of its status, activate the battery test.

- ⚠ There is a risk of fire and/or explosion if the wrong quantity or type of batteries is used. Do not dispose of the batteries in a fire: they can explode. Do not open or mutilate the batteries: the dumped electrolyte is dangerous for the skin and eyes. It can be toxic.

7.1.3 Fans.

The useful lifetime of the fans used to cool the power circuits depends on the use and surrounding conditions. Their preventive replacement by authorized technical staff is recommended at the same time as batteries replacement.

7.1.4 Capacitors.

The useful lifetime of the DC bus capacitors and those used in input and output filtering depends on the use and the surrounding conditions. Their preventive replacement by authorized technical staff is recommended.

7.2 Warranty conditions.

The limited warranty only applies to those products that you acquire for commercial or industrial use in the normal development of your business.

7.2.1 Product covered.

M4T series.

7.2.2 Not included in the scope of supply.

Our company is not bound by the warranty if it considers that there is no defect in the product or it was caused by improper use, negligence, installation and/or inadequate testing, attempt to repair or unauthorized modification, or any other cause beyond the foreseen use, or by accident, fire, lightning or other dangers. It will not be bound, in all of these cases, to compensation for damages or injuries.

8.1 GENERAL TECHNICAL SPECIFICATIONS.

Nominal power (kVA)	10	15	20	30	40	60	80
INPUT							
Nominal voltage	Three phase 3x380 V, 3x400 V or 3x415 V (4 wires: 3 phases + N).						
Input voltage margin	+ 15% / –20%.						
Frequency	50 / 60 Hz ±5 %.						
Input current total harmonic distortion	100 % load: THDi < 1.5 %. 50 % load: THDi < 2.5 %. 10 % load: THDi < 6.0 %.			100 % load: THDi < 1.0 %. 50 % load: THDi < 2.0 %. 10 % load: THDi < 5.0 %.			
Current limit	High overload: PFC Limit (discharging batteries).						
Power factor	1.0 (at any load condition).						
INVERTER							
Nominal voltage	Three phase 3x380 V, 3x400 V or 3x415 V (4 wires: 3 phases + N).						
Precision	Static variation: ±1 %. Dynamic variation: ±2 % (load variations 100%-0%-100 %).						
Frequency	Synchronized: 50/60 Hz ±4 % / Battery mode 50/60 Hz ±0.05 %.						
Max. synchronization speed	±1 Hz/s.						
Wave form	Sine-wave.						
Output voltage total harmonic distortion	Linear load: THD-v < 0.5 %. Ref. non-linear load (EN-62040-3): THD-v < 1.5 %.						
Phase displacement	120 ±1 % (balanced load). 120 ±2 % (imbalances 50 % of the load).						
Dynamic recovery time	10 ms. at 98 % of the static value.						
Admissible overload	125 % for 10 min., 150 % for 60 s.						
Admissible crest factor	3.4 to 1.			3.2 to 1.			2.8 to 1.
Admissible power factor	0.1 inductive to 0.1 capacitive.						
Imbalance output voltage with load 100 % unbalanced	< 1 %.						
Current limit	High overload, short-circuit: RMS voltage Limit. High Crest-Factor current: Peak Voltage Limit.						
STATIC BYPASS							
Type	Microprocessor-controlled static system						
Voltage	Three phase 3x380 V, 3x400 V or 3x415 V (4 wires: 3 phases + N).						
Frequency	50 / 60 Hz						
Transfer time	Zero						
Admissible overload	400 % for 10 sec.						
Transfer to bypass	Immediate, for overloads above 150 %.						
Retransfer	Automatic after alarm clear.						
MANUAL BYPASS (maintenance)							
Type	Without interruption.						
Voltage	Three phases 3x380 V, 3x400 V or 3x415 V (4 wires: 3 phases + N).						
Frequency	50 / 60 Hz.						
GENERAL							
Overall efficiency	90.5 %	90.5 %	91.0 %	92.0 %	92.5 %	93.05 %	94.0 %
DIMENSIONS & WEIGHT (cabinet ups)							
Depth x Width x Height (mm) / equipped with castors	700 x 450 x 1100 / YES.			805 x 590 x 1320 / YES.			
Weight (no batteries) (kg)	120			190		200	300
Built-in 2x31 batteries 12 V (Ah)	7	7	9	12	18	-	-
Weight (with built-in batteries) (kg)	250			530		-	-
Batteries terminal torque	Depending on battery manufacture.						

Table 5. Technical specifications

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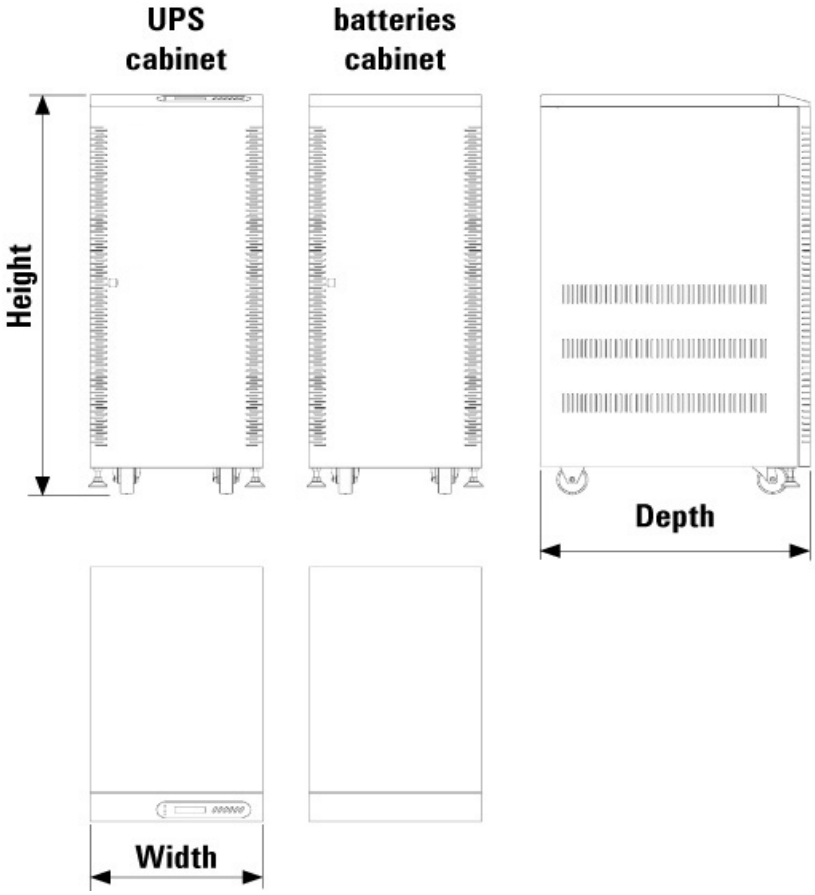
EXTERNAL BATTERIES CABINET DIMENSIONS & WEIGHT.				
CABINET SIZE	**No 1**		**No 2**	
Depth x Width x Height (mm) / equipped with castors	700 x 450 x 1100 / YES		805 x 590 x 1320 / NO	980 x 650 x 1320 / NO
Capacity batteries - 2x31 batteries 12 V (Ah)	12	18	26	40
Weight (kg)	250	410	710	1020
Batteries terminal torque	Depending on battery manufacture.			

Table 6. External batteries cabinet.



⚠ Some cabinets do not have wheels

Fig.30. General technical specifications.

8.2 Glossary.

AC - It is nominated as alternating current to the electrical current in which the magnitude and direction varies in a cyclic way. The most common wave shape of the alternating current is sine wave, because the energy transmission is better. Nevertheless, some applications could need other period wave shapes, like triangular or square.

Bypass - Manual or automatic, it is the physical junction between the input and the output electric device.

DC and AC - The direct current is the continuous electron flow through a cable between two points with different potential. Unlike the alternating current, in direct current the electrical loads always flow in the same direction from the highest potential point to the lowest one. Although, usually the direct current is identified with the constant current (for example that supplied by the battery), any current that always maintains the polarity is said to be continuous.

DSP - It is the acronym for Digital Signal Processor. A DSP is a system based on a processor or microprocessor that has instructions in it, hardware and optimized software to develop applications where very fast numerical operations are needed. It is very useful to process analogical signals in real time: in a system that runs in this way (real time) samples are received, usually from an analogical/digital converter (ADC).

Power factor - The power factor, p.f., of an alternating current circuit, is defined as the ratio between the active power, P, and the apparent power, S, or as the cosine of the angles that make the current and voltage vectors, designating as Cos φ, being the value of that angle.

GND - The term ground, as its name states, refers to the potential of the earth's surface.

IGBT - The Insulated Gate Bipolar Transistor is a semiconductor used as a controlled switch in powered electronic circuits. This device has the feature of the gate signal of the effect field transistors with the capacity of high current and low voltage saturation of the bipolar transistor, combining an isolated FET gate for the input and a bipolar transistor as the switch in a single device. The triggering circuit of the IGBT is the same as MOSFET one, while the driving features are like the BJT.

Interface - In electronics, telecommunications and hardware, an interface (electronic) is the port (physical circuit) through which signals are sent or received from a system or subsystems toward others.

kVA - The volt-ampere is the unit of the apparent power in electrical current. In direct current it is almost equal to the real power but in alternating current it can differ depending on the power factor.

LCD - Acronym of Liquid Crystal Display. It is an electric system of data presentation based on 2 transparent conductor layers and in the middle a special crystal liquid that have the capacity to direct light passing through.

LED - Acronym of Light Emitting Diode, the LED is a semiconductor (diode) that emits almost monochrome light with a very narrow spectrum, i.e. when it is direct polarized and it is crossed by an electric current. The color, (wave longitude), depends on the semiconductor material used in its construction, being able to vary from ultraviolet going through the visible spectrum of light to infrared. The latter type is called IRED (Infra-Red Emitting Diode).

Circuit breaker - A circuit breaker or switch, is a device ready to break the electrical current of a circuit when it exceeds the maximum set values.

On-Line mode - A piece of equipment is on line when it is connected to the system, and it is in operation, and usually has its power supply turned on.

Inverter - An inverter is a circuit used to convert direct current into alternating current. The function of an inverter is to change an input voltage of direct current into a symmetrical output voltage of alternating current, with the magnitude and frequency required by the user or the designer.

Rectifier - In electronics, a rectifier is the component or circuit that allows the alternating current to be converted into direct current. This is done by rectifier diodes, which can be solid state semiconductors, vacuum or gassy valves such as the mercury vapour. Depending on the features of the alternating current power supply used, it is classified as single phase when supplied by a single phase electrical mains, or three phase when supplied by the three phase power. Depending on the rectification type, a rectifier can be half wave, when only one of the current semi-cycles is used, or full wave, where both semi-cycles are used.

Relay - The relay (in French "relais") is an electromechanical device that works like a switch controlled by an electric circuit where, through an electromagnet, a set of contacts is moved.

8.3 Safety Instructions

8.3.1 TO PROVIDE FOR.

• These "Safety Instructions" are associated with the "Operating Manual" regarding the equipment you have purchased. Before proceeding with the installation or start-up, check that you have both sets of information, if not, ask for them. Compliance with the "Safety Instructions" is compulsory and is the user's legal responsibility. Read them carefully, follow the steps in the given order and keep them for future reference. The local electrical standards and different restrictions of the end user's city may invalidate some of the recommendations given in the manuals. In case of discrepancies, the user must comply with the pertinent local standards. The situation may arise where the equipment's distribution of connecting terminals and/or commands do not line up with the manual's illustrations. However, the simplicity of the operation together with the correct labelling provides for easy understanding in an intuitive way.

• It is strictly forbidden to reproduce or to release this information without written permission from our company.

• Do not install the machine in a corrosive or dusty atmosphere, and never outdoors.

• Do not obstruct the ventilation grates nor introduce objects through these or other orifices. Leave a minimum free space of 25 cm around the machine for ventilation and air circulation.

• The location must be spacious, airy, away from heat sources and easily accessible. In addition to the ventilation space indicated above, there must be an area of 75 cm clearance all-round the device for possible action by the After Sales Service (A.S.S.), so that if this involves moving the machine the connecting cables will have the required space.

• Do not place materials on top of the machine or objects which would obstruct a proper view of readings.

8.3.2 GENERAL SAFETY INSTRUCTIONS.

• All equipment connections including those of the control should be done without the presence of the mains supply and with the switches turned off, position "On", "Off", or respectively.

• Special attention should be paid to the labelling on the equipment warning about the "Risk of electric shock" and indicators like ( ). Hazardous live parts inside the equipment, do not remove the cover. Servicing is reserved for qualified service personnel. For maintenance or repair services, contact your nearest After Sales Service (A.S.S.) in our company.

• It is compulsory to connect the earth protection. Make sure that this is done before powering up the input to the equipment.

For small equipment (input power cord provided with plug), the user should make sure that the wall outlet's voltage corresponds to the type delivered, properly grounded and connected to the local protection earth. For equipment fitted with terminals, the licensed wirer should connect the earth wire to the terminal identified as ( ).

• The installation of hard wired equipment should be done by personnel qualified in electrical low voltage installations.

• The cross section of the power supply and output cables to the loads should be determined according to the rated current given on the equipment's specifications plate and comply with the Local Low Voltage Electro technical Regulations.

• The power supply cables to the equipment as well as to the loads, interfaces, etc. should be fastened to non-movable parts to prevent pulling.

• Please keep in mind that if the equipment incorporates a Bypass with mains power available it will supply output voltage even if the equipment is not turned on. Place warning notices and /or emergency switches as requested by the safety Regulations of your specific installation.

• The voltage stabilizers and line conditioners should be considered as transformers or distribution lines from the point of view of the installation and of the electrical safety. This equipment is "transparent" to the input voltage.

• The Neutral input of the three phase equipment should be necessarily connected to the terminal intended for this purpose.

• The phase to phase voltage at the output may not be the same on the three phase voltage stabilizer and line conditioners with independent phase regulation with unbalanced voltage from the three phase input supply on the loads, however the phase to neutral regulation will be kept.

• The line conditioners (voltage stabilizers fitted with galvanic isolation transformer) can be connected with the desired neutral condition. The wire bridge going from one output terminal (neutral) to the ground terminal can be deleted for the isolated neutral condition.

• The servo-motor voltage stabilizers and line conditioner incorporate mechanical components (gearing, dented belts, etc.) Do not service inside the equipment as the motion during the regulation may cause personal injuries.

• Devises mounted on CHASSIS or RACKS for the installation on pre-determined assembly units is intended to be done by professionals.

- Your installation should be planned and carried out by qualified personnel, who will be responsible for applying the safety and EMC legislation as well as standards regulating the specific installation where the product is to be used.
- CHASSIS mounted equipment has neither enveloping protection nor connecting terminals.
- RACK mounted equipment has no connecting terminal protection.

8.3.3 ⚠ SAFETY INTERACTIONS FOR BATTERY EQUIPPED PRODUCTS.

• The UPS are continuous supply equipments. If the mains supply fails while the equipment is operating, the output lines will continue supplying output voltage depending on the autonomy provided by the battery.

• Generally batteries are already fitted in a single cabinet except in specific situations where, for various reasons, they are delivered inside a separate enclosure.

• For proper operation the battery cabinet must be located beside the machine.

• The battery supply can involve the risk of electric shock and can produce high short circuit current. Observe the following preventive measures before handling any terminal block identified in the labelling as "Battery".

- Disconnect the corresponding protection components.
- When connecting a battery cabinet to the equipment abide by the cable polarity and color (red-positive; black-negative) indicated in the manual and by the corresponding labelling.
- Wear rubber gloves and shoes.
- Use tools with insulted handles.
- Remove watches, rings or other metal objects.
- Do not place metal tools or objects on the batteries.
- Never touch with your hands or through conducting objects, do not short the battery terminal block or the battery enclosure.

• To prevent full battery discharge and as a safety measure after an extended power failure, as well as at the end of the daily work, you should turn off the loads and later the equipment according to the operation given in the "Operating Manual".

• For extended periods of disconnection connect the equipment every month for at least 12 hours to charge the battery, to prevent any irreversible deterioration. When storing the equipment, place it in a cool and dry location, never outdoors.

• For installation with supplementary machines or an independent Bypass line, only a single differential of 300 - 500 mA will be placed in common for both lines, at the head of the installation.

8.3.4 ⚠ SAFETY INSTRUCTIONS REGARDING THE BATTERIES.

• Never short the battery terminals as this involves high risk. It will damage the equipment and the battery.

• Avoid mechanical stress and impacts.

• Do not open or mutilate the battery. Released electrolyte is harmful to the skin and eyes.

• Do not dispose of a battery in a fire. The battery may explode.

• In the event parts of the body come into contact with battery acid, wash immediately with plenty of water and call the nearest medical service as soon as possible.

• Batteries involve a serious risk for health and the environment. They should be disposed of according to current laws.