



Trimod HE[®]

EN

ENGLISH

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Contents

1	Introduction	6
1.1	Purpose of the manual	6
1.2	Symbols in the manual	6
1.3	Where and how to keep the manual	7
1.4	Update of the manual	7
1.5	Manufacturer's liability and guarantee	7
1.5.1	Guarantee terms	7
1.5.2	Extension of the guarantee and maintenance contracts	8
1.6	Copyright	8
2	Safety regulations	9
2.1	General notes	9
2.2	Definitions of "Skilled technician" and "Operator"	9
2.2.1	Skilled technician	9
2.2.2	Operator	9
2.3	Personal Protective Equipment	10
2.4	Hazard signs in the workplace	10
2.5	Signs on the equipment	10
2.6	General warnings	11
2.7	How to proceed in an emergency	13
2.7.1	First-aid procedures	13
2.7.2	Fire procedures	13
3	Technological description	14
3.1	Trimod HE technology	14
3.2	Features	16
3.3	Models	18
3.4	Block diagram of the power module	22
3.5	Block diagram of interconnections and distributions of the UPS cabinet	22
4	Unpacking and moving	23
4.1	Visual check	23
4.1.1	Equipment and supplied accessories check	23
4.2	Unpacking	23
4.3	Check of the content	23
4.4	Movement	24
4.5	Positioning constraints	24
4.6	Final operations	24

Contents

5	Installation	25
5.1	Safety regulations	25
5.2	Electric connections	25
5.2.1	Safety warnings	25
5.2.2	Preliminary operations	26
5.2.3	Wiring	26
5.2.4	Earthing	26
5.2.5	Protective devices	26
5.2.6	Backfeed protection	27
5.2.7	External battery unit installation (Trimod HE BATTERY)	28
5.2.8	Mains connection	31
5.2.9	Bypass input line connection (if separate)	32
5.2.10	Output line connection	32
5.3	Wiring diagrams	33
5.3.1	Factory configuration: input THREE PHASE – output THREE PHASE with shared bypass input line	33
5.3.2	THREE PHASE input - THREE PHASE output connection with separate bypass input line	35
5.3.3	THREE PHASE input – SINGLE PHASE output connection	36
5.3.4	SINGLE PHASE input - SINGLE PHASE output connection	38
5.3.5	SINGLE PHASE input - THREE PHASE 120° output connection	40
5.3.6	SINGLE PHASE input - THREE INDEPENDENT PHASE output connection	41
5.3.7	Installation of the connection jumpers	42
5.3.8	ARBC (Auxiliary Remote Bypass Contact)	44
5.4	Insertion of power modules and battery drawers	44
5.5	Communication devices	45
5.5.1	RS232 serial ports	45
5.5.2	Relay interface	46
5.5.3	Emergency Power Off (EPO)	46
5.5.4	Logic level interface	47
5.5.5	Network card (SNMP) slot	48
6	Configuration and Start-up	49
6.1	Introduction	49
6.2	Input configuration	49
6.3	Output configuration	49
6.4	Pre-start-up checks	49
6.5	Start-up procedure	50
6.6	ECO MODE setup	52
6.7	EMERGENCY POWER SYSTEM (EPS) MODE setup	52

7 Control panel	53
7.1 Description	53
7.2 Service Mode	54
7.3 Main screen	54
7.4 Main menu and submenu	56
7.4.1 UPS Status	57
7.4.2 UPS Setup	59
7.4.3 Power Modules	63
7.4.4 Events	65
7.4.5 Tools	65
7.4.6 Log Out	65
7.5 POWER ON/OFF menu	66
7.6 Switching off the UPS	66
7.7 Switching on the UPS	66
8 Diagnosis	67
8.1 Luminous and audible notifications	67
8.2 Messages	69
9 Maintenance	75
9.1 Introduction	75
9.2 Preventive maintenance	75
9.3 Periodical checks	75
9.4 Power module hot-swap replacement or inclusion of new modules	75
9.5 Maintenance procedure for the UPS in maintenance bypass mode	78
9.5.1 Accessing the manual maintenance bypass mode	78
9.5.2 Power module replacement or inclusion of new modules	79
9.5.3 Exiting from maintenance manual bypass	79
9.6 Maintenance procedure with UPS off	80
9.7 Battery drawer requirements	81
9.7.1 Installation/replacement of battery drawers with UPS on-line	81
9.7.2 Installation/replacement of battery drawers with UPS in maintenance manual bypass	81
10 Warehousing	82
10.1 UPS	82
10.2 Batteries	82
11 Dismantling	83
11.1 Battery disposal	83
11.2 UPS dismantling	83
11.3 Electronic component dismantling	83
12 Technical data	84
13 Tables	89

1. Introduction



CAUTION

The instructions in this manual are intended for a **SKILLED TECHNICIAN** (section 2.2.1).

Once the UPS continuity unit has been installed, the skilled technician must not leave this manual and the quick start sheet at the operator's disposal.

1.1 Purpose of the manual

The purpose of this manual is to provide the skilled technician (see section 2.2.1) with instructions for safely installing the TRIMOD HE unit, also called "UPS" or "equipment" in the rest of the manual, and carry out ordinary maintenance procedures.

Extraordinary maintenance operations are not dealt with in this manual because they are the sole preserve of LEGRAND's technical assistance service.

The reading of this manual is essential but does not substitute the skill of the technician who must have received adequate preliminary training.

The intended use and configurations envisaged for the equipment and shown in this manual are the only ones allowed by the Manufacturer. The equipment must not be installed differently from the instructions provided.

Any other use or configuration must be previously agreed with the Manufacturer in writing and, in this case, the written agreement will be attached to the installation and user manual.

This manual also makes reference to laws, directives and standards that the skilled technician is required to be aware of and consult.

The original text of this publication, drafted in Italian, is the only reference for the resolution of disputes of interpretation linked to translations into other languages.

1.2 Symbols in the manual

Some operations are shown in graphic symbols that draw the attention of the reader to the danger or the importance they imply:



DANGER

This indication shows a danger entailing a high degree of risk that, if not avoided, will lead to death or serious injury or considerable damage to the equipment and the things around it.



WARNING

This indication shows a danger entailing a medium degree of risk that, if not avoided, could lead to death or serious injury or considerable damage to the equipment and the things around it.



CAUTION

This indication shows a danger entailing a low level of risk that, if not avoided, could lead to minor or moderate injury or material damage to the equipment and the things around it.

INDICATION

This symbol indicates important information which should be read carefully.

1.3 Where and how to keep the manual

This manual must be kept in a safe, dry place and must always be available for consultation exclusively by the skilled technician and no one else.

It is recommended to make a copy of it and file it away.

If information is exchanged with the Manufacturer or the authorised assistance personnel, it is essential to refer to the equipment's rating plate data and serial number.

INDICATION

The installation and maintenance manual is an integral part of the equipment supplied and must therefore be kept for its entire lifetime. In case of need (for example in the case of damage that even partially compromise its consultation) the skilled technician is required to get a new copy from the Manufacturer, quoting the publication code on the cover.

1.4 Update of the manual

The manual reflects the state of the art when the equipment was put onto the market. The publication conforms with the standards current on that date; the manual cannot be considered inadequate when new standards come into force or modifications are made to the equipment.

Any addition to the manual the Manufacturer considers appropriate to send to the users, must be kept together with the manual of which they will become an integral part.

The version of the manual updated to its latest release is available on the Internet at <http://www.ups.legrand.com>

1.5 Manufacturer's liability and guarantee

To be able to take advantage of the Manufacturer's guarantee, the operator shall scrupulously comply with the precautions indicated in this manual, in particular:

- always work within the operating limits of the equipment;
- always carry out constant and careful maintenance through a skilled technician who complies with all the procedures indicated in this manual.

The Manufacturer declines all indirect or direct responsibility arising from:

- failure to observe the installation, maintenance instructions and use of the equipment which differs from the specifications in the user manual;
- use by personnel who have not read and thoroughly understood the content of the user manual;
- use that does not comply with the specific standards used in the country where the equipment is installed;
- modifications made to the equipment, software, functioning logic unless they have been authorised by the Manufacturer in writing;
- repairs that have not been authorised by the LEGRAND Technical Support Service;
- damage caused intentionally, through negligence, by acts of God, natural phenomena, fire or liquid infiltration.

Transfer of the equipment to others also requires the handing over of the installation manual and the user manual. Failure to hand over the manuals shall automatically nullify any right of the buyer, including the terms of the guarantee where applicable.

If the equipment is sold to another party in a country where a different language is spoken, the original owner shall be responsible for providing a faithful translation of this manual in the language of the country where the equipment will be used.

1.5.1 Guarantee terms

The terms of the guarantee may vary depending on the country where Trimod HE is sold. Check the validity and duration with LEGRAND's local sale representative.

If there should be a fault in the product, contact the LEGRAND Technical Support Service which will provide all the instructions on what to do.

Do not send anything back without LEGRAND's prior authorization.

1. Introduction

The guarantee becomes void if the UPS has not been brought into service by a properly trained skilled technician (see section 2.2.1).

If during the guarantee period the UPS does not conform with the characteristics and performance laid down in this manual, LEGRAND at its discretion will repair or replace the UPS and relative parts.
All the repaired or replaced parts will remain LEGRAND's property.

LEGRAND is not responsible for costs such as: loss of profits or earnings, losses of equipment, losses of data or software, claims by third parties or anything else, any damage to persons or things due to improper use, unauthorized technical alterations or modifications and installations where the full compliance with the standard regulating the specific usage applications have not been guaranteed.

1.5.2 Extension of the guarantee and maintenance contracts

The standard guarantee can be consolidated in a single extension contract (maintenance contract). Please contact the LEGRAND Technical Support Service for further information.

Once the guarantee period has passed, LEGRAND is available for giving a technical assistance service able to meet all requirements, maintenance agreements, 24/7 availability and monitoring. Please contact the LEGRAND Technical Assistance Centre for further information.

1.6 Copyright

The information contained in this manual cannot be disclosed to third parties. Any partial or total duplication of the manual which is not authorised in writing by the Manufacturer, by photocopying or other systems, including by electronic scanning, violates copyright conditions and may lead to prosecution.

LEGRAND reserves the copyright of this publication and prohibits its reproduction wholly or in part without previous written authorisation.

2. Safety Regulations



DANGER

Before carrying out any operation on the equipment, it is necessary to read the entire manual carefully, especially this chapter.

Look after this manual carefully and consult it repeatedly during installation and maintenance by a skilled technician.

2.1 General notes

The equipment has been made for the applications given in the installation and maintenance manual and the user manual. It may not be used for purposes other than those for which it has been designed, or differently from those specified in this manual.

The various operations must be carried out according to the criteria and the chronology described in this manual.

2.2 Definitions of "Skilled technician" and "Operator"

2.2.1 Skilled Technician

The figure who will carry out the installation, start up and ordinary maintenance is called "Skilled Technician".

This definition refers to people who have the specific technical qualification and are aware of the method of installing, assembling, repairing, bringing online and using the equipment safely.

In addition to the requirements listed in the section below for a general operator, the Skilled Technician has received instruction on the precautions to take around dangerous electrical voltage and uses the personal protective equipment listed in section 2.3 for all the operations indicated in this manual.



WARNING

The safety manager is responsible for protection and company risks prevention according to what is indicated in European directives 2007/30/EC and 89/391/EEC regarding safety in the workplace.

The safety manager must ensure that all the people working on the equipment have received all the instructions concerning them in the manual with particular reference to those contained in this chapter.

2.2.2 Operator

The figure assigned to the equipment for normal use is called "Operator".

This definition refers to people who know how to operate the equipment defined in the user manual and have the following requisites:

1. technical education, which enables them to operate according to safety standards in relation to the dangers linked to the presence of electric current;
2. training on the use of personal protective equipment and basic first aid interventions.

The company safety manager, in choosing the person (operator) who uses the equipment, must consider

- the person's work fitness according to the laws in force;
- the physical aspect (not disabled in any way);
- the psychological aspect (mental stability, sense of responsibility);
- the educational background, training and experience;
- the knowledge of the standards, regulations and measures for accident prevention.

He shall also provide training in such a way as to provide thorough knowledge of the equipment and its component parts.

The operator shall consult the user manual at any time. He shall also follow the requirements provided to achieve maximum safety for himself and others during all operating phases.

Some typical activities the operator is expected to carry out are:

- the use of the equipment in its normal functioning state and restoring it to working order after it shuts down;
- adoption of the necessary provisions for maintaining the quality performance of the UPS;
- cleaning the equipment;
- working with people responsible for ordinary maintenance activities (skilled technicians).

2. Safety Regulations

2.3 Personal Protective Equipment



DANGER

The UPS poses a considerable risk of electric shocks and a high short circuit current. During use and maintenance operations, the equipment mentioned in this section must be used.

People responsible for operating this equipment and/or passing close to it must not wear garments with flowing sleeves, nor may laces, belts, bracelets or other metal pieces that might cause a danger be worn.

The following sum up the Personal Protective Equipment to wear at all times:



Anti-accident and non-sparking shoes with rubber sole and reinforced toe



Waterproof rubber gloves



Protective garments



Protective glasses

2.4 Hazard signs in the workplace

The following signs must be exhibited at all points of access to the room where the equipment is installed.



Electric current

This sign indicates the electrical live parts.



How to proceed in an emergency

Do not use water to quench fires but just the extinguishers specially designed for putting out fires in electrical equipment.



No smoking

This sign indicates that smoking is not allowed.

2.5 Signs on the equipment

Displayed on the UPS are explanatory plates that can vary depending on the country the equipment is intended for and constructional standards applied.

Make sure the instructions are adhered to. Removing these plates and working in a way that differs from what written there, is strictly prohibited.

The plates must always be clearly read and they must be cleaned periodically.

If a plate deteriorates and/or it is no longer legible, even partially, the Manufacturer must be contacted for another one.



CAUTION

The plates must not be removed or covered. No other plates may be affixed to the equipment without the Manufacturer's prior written authorisation.

**WARNING**

Potential risks can be drastically reduced by wearing the Personal Protective Equipment listed in this chapter, that are considered to be indispensable. Always operate with due care around dangerous areas marked by the appropriate warning notices on the equipment.

2.6 General warnings**DANGER**

The UPS works with dangerous voltages. SKILLED TECHNICIANS shall perform the installation and ordinary maintenance operations. No part of the UPS can be repaired by the operator.

Extraordinary maintenance operations must be carried out by LEGRAND Technical Support Service personnel.

**DANGER**

Before beginning any installation and/or maintenance operation, make sure that all the DC and AC power sources are disconnected.

The UPS must be installed with an earth connection to avoid high leakage currents. First connect the earthing cable. Check during each installation and/or maintenance operation the continuity of the earthing system.

**DANGER**

The UPS is powered by its own direct current energy source (batteries). The output terminals may have a dangerous voltage even if the UPS is not connected to the power network in alternate current.

The DC power source could comprise multiple battery drawers in parallel and/or external battery units. Disconnect all battery drawers and external battery units before performing any installation and/or maintenance operation.

**WARNING**

A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed when working on batteries:

- a) remove watches, rings or other metal objects.
- b) use tools with insulated handles.
- c) wear rubber gloves and boots.
- d) do not lay tools or metal parts on top of batteries.
- e) disconnect the charging source prior to connecting or disconnecting battery terminals.
- f) determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

Do not dispose of batteries in a fire. The batteries may explode.

Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic. The batteries installed inside the cabinet must be disposed of correctly. For the disposal requirements refer to local laws and relevant standards.

**CAUTION**

The UPS functions with TT and TN systems. It has a pass-through neutral architecture: the status of the neutral on output is the same as the neutral on input.

When the output load needs a different neutral status from the input status, it is necessary to place downstream of the UPS a suitably scaled isolation transformer protected in compliance with the standards in force.

For electromedical applications which require the medical IT system, it is necessary to have an insulation board downstream the UPS that ensures compliance with the regulations in force for this type of application.

2. Safety Regulations



CAUTION

Do not open the battery fuse holders while the UPS is powering the loads in battery mode.



WARNING

To reduce the risk of fire or electric shock, the UPS must work in closed, clean environments with controlled temperature and humidity. It must be kept away from inflammable liquids and corrosive substances. The room temperature must not be above +40°C (+104°F) and the relative humidity must be a maximum of 95% not condensing.



CAUTION

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, it may cause harmful interference with radio communications.

The Trimod HE 10 is a category C2 product according to standard EN62040-2.

In the home environment it could cause radio interference; in this case appropriate countermeasures must be taken.

All other Trimod HE models are category C3 products according to standard EN62040-2.

They can therefore be used in commercial and industrial environments; nevertheless restrictions or adequate countermeasures might be necessary to avoid radio interference.

The possible countermeasures that can be implemented are the following:

- pass with a double turn, the cables connected to the backfeed terminals to a Fair-Rite toroid code 0431176451 made with T31 material, installed as close as possible to the clamps;
- pass the input cables through three EPCOS TDK toroids code B64290L699X35 made with T35 material;
- pass the output cables through two EPCOS TDK toroids code B64290L699X35 made with T35 material;



CAUTION

- The equipment must be maintained and used according to the instructions of this manual.
- The departmental manager must instruct the operating and maintenance personnel on the safe use and maintenance of the equipment.
- Only specifically-trained, highly skilled personnel are allowed access to the equipment in order to perform maintenance. While the maintenance operation is being carried out, signs saying "Maintenance work in progress" must be affixed in the department in such a way that they can be easily seen from any access area.
- The connection of the equipment (and of any accessory devices) must always be perfectly grounded to discharge short-circuit currents and electrostatic voltages. The input voltage must correspond with the value shown on the rating plate. Current adapters must not be used under any circumstances. Pay attention to polarity when connecting.
- Any intervention on the equipment must be done only after it has been disconnected from the power supply network by means of a switch disconnecter and must be locked with an appropriate padlock.
- The UPS must not be turned on if liquid is leaking from the batteries.
- The equipment used for any maintenance operations (pliers, screwdrivers etc.) must be electrically insulated.
- Depositing flammable material near the equipment is strictly forbidden. The equipment should always be locked, and only specifically trained personnel are allowed access to it.
- Do not disable any safety, notification or warning device and do not ignore any alarm, warning message or notice, no matter whether they are generated automatically or represented by plates fixed to the equipment.
- Do not run the equipment with fixed protections not installed (panels etc.).
- In case of breaking, buckling or malfunctioning of the equipment or parts of it, repair or replace immediately.
- For no reason can the structure of the equipment, the devices mounted on it, the operation sequence etc, be modified, manipulated or tampered with in any way, without prior consultation with the Manufacturer.
- When replacing fuses, only use ones of the same type.
- The replacement of the batteries is an operation intended to be carried out by a skilled technician.
- Keep a register in which to enter the date, time, type, performer's name and any other useful information about each and any routine and extraordinary maintenance operation.
- Do not use oils or chemical products for cleaning because they could scratch, corrode or damage certain parts of the equipment.
- The equipment and workplace must be kept completely clean.
- Upon completion of the maintenance operations, before connecting the power supply, carefully check that no tools and/or material of any kind have been left next to the equipment.

2.7 How to proceed in an emergency

The following information are general.

For the specific interventions consult the regulations in force in the country where the equipment is installed.

2.7.1 First-aid procedures

When administering first aid, adhere to the company rules and the usual procedures.

2.7.2 Fire procedures

Do not use water to quench fires but just the extinguishers specially designed for putting out fires on electrical equipments.

3. Technological description

3.1 Trimod HE technology

LEGRAND® has developed an innovative project that is the only one of its kind by producing Trimod HE, the uninterrupted power supply with powers of 10, 15, 20, 30, 40, 60 and 80 kVA able to adapt at any moment to changed demands of the protected loads.

The concepts underlying the Trimod HE project are modularity, expandability and redundancy in such a way as to offer maximum reliability and to be the guarantee of considerable savings.

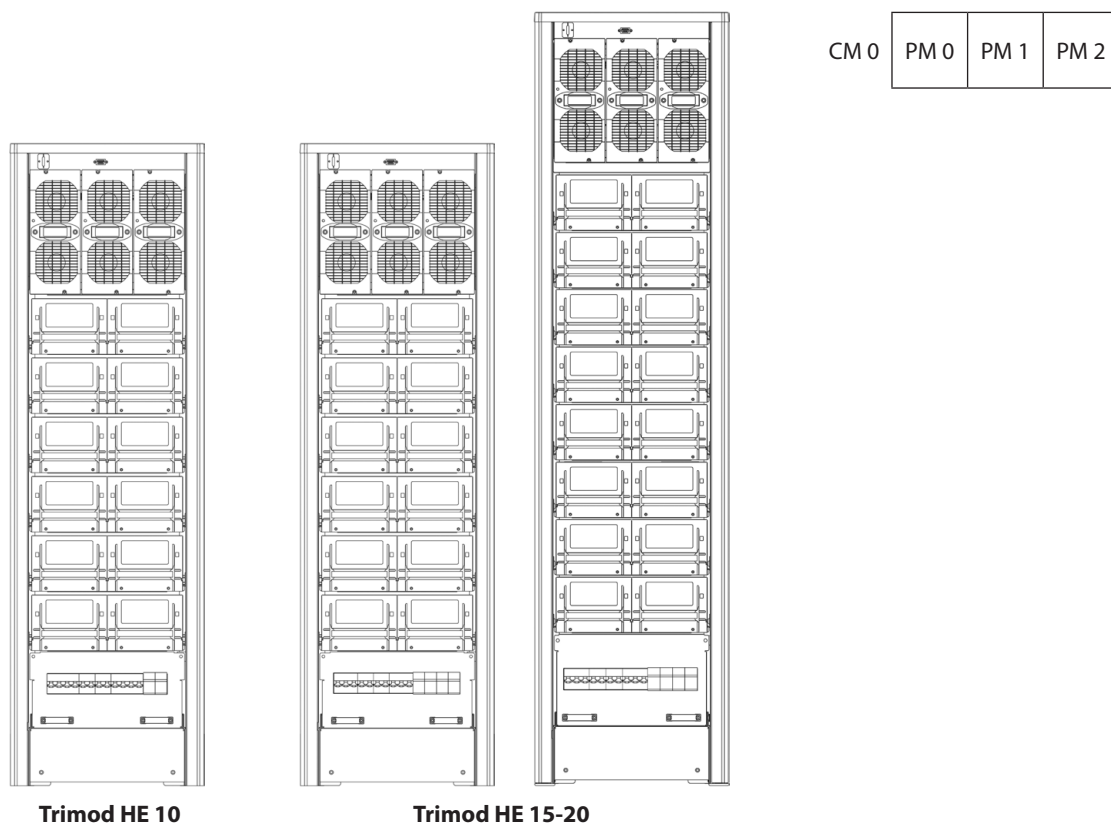
Trimod HE is a modular uninterrupted power supply whose base module is the single phase power type that can be programmed to obtain the desired input/output configuration. It is thus possible to manage three phase and single phase voltages on input and output to have a choice of the the traditional three phase/three phase, three phase/single phase, single phase/three phase and single phase/single phase. At the same time it is possible to obtain simultaneously single phase and three phase lines on output or two or more single phase lines even with different power.

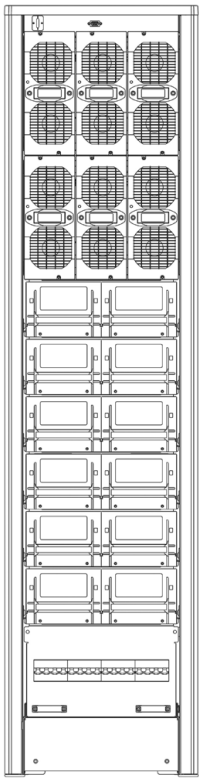
For every configuration it is possible to have redundancy that is both complete and partial; for example one normal three phase (or redundant) line can coexist with a redundant single phase (or normal) line on output. In each power module there is a microcontroller that can oversee the main functions of the individual unit, monitor its correct functioning and flag up any malfunctions.

The philosophy underlying modularity has also been applied to the batteries that have been supplied in individual drawers that can be extracted and make installation and maintenance easier.

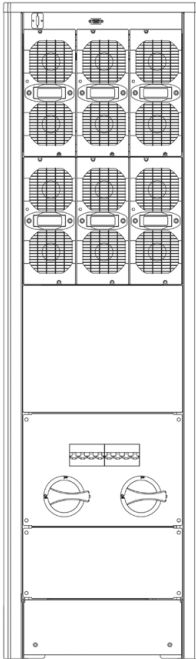
The UPS is controlled by one to four command boards depending on the model,

Both the command boards (CM) and the power modules (PM) are identified by a unique address inside the system, as shown below:



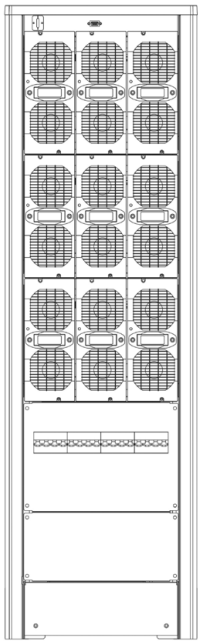


Trimod HE 30 TT/TM



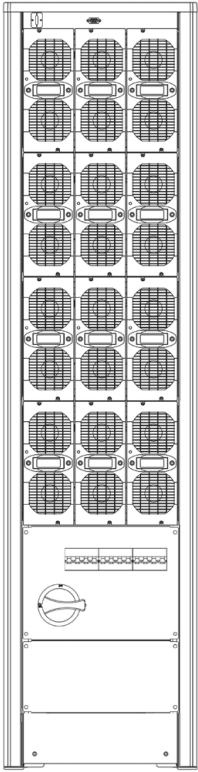
Trimod HE 40

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5



Trimod HE 60

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5
CM 2	PM 6	PM 7	PM 8



Trimod HE 80

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5
CM 2	PM 6	PM 7	PM 8
CM 3	PM 9	PM 10	PM 11

3. Technological description

Each command board can manage three power modules. If a command card becomes faulty, only the modules under its control are put into safe mode and turned off, while the UPS continues to function online, without any interruption in the load. It is therefore possible to have redundancy on both the individual phase (power module failure) and in the UPS (command board failure). The replacement of the hot-swap of the power modules is also possible by switching off the relative control and group of modules attached to it, without having to power the load from the bypass with the consequent temporary loss of protection.

The command boards are connected to a control panel with display from which it is possible to verify the status and setups of the UPS and to a communication interface with RS-232 and SNMP connection, dry contacts and logical contacts. It is possible to access all the UPS functions from the control panel and communicate through any one of the interfaces present thereby guaranteeing the redundancy of the peripherals as well. In installations of the UPS with three separate single phase line on output, it is possible to manage each line independently through the software; for example, it is possible to prioritise the autonomy of one of them during battery functioning. A bypass input line separated from that of the mains input makes it possible to supply the bypass with a second power source (the neutral wires of the two lines must be in common).

The technology used in the hardware and the firmware of the UPS represents the current state of the art.

A sophisticated microprocessor-type control optimises the performance of the UPS both the Booster/PFC side and on the output inverter. The recharge curve of the battery has been designed to get the maximum useful life out of the accumulators and have the greatest autonomy possible if the mains go down. The electronic boards are entirely assembled on LEGRAND automated lines and tested to the highest quality standards. Every device goes through an extended period of operation at full load before being sent to the customer.

3.2 Features

Modular-redundant architecture

The modular-redundant architecture is the best solution for protecting the nerve centres of a company and has the following advantages:

- there is one control of the devices supplied;
- modular expandability;
- module redundancy;
- easy maintenance;
- low running cost;
- compactness.

Efficiency

Trimod HE concentrates particularly on both the energy absorbed from the mains and the energy provided to the load. They are characterised by high efficiency (up to 96%), PF on input > 0,99, THDi 3%.

The advantages of a high efficiency are:

- reduction of the power section absorbed from the UPS but not supplied to the load and transmitted to the environment as heat;
- less heat loss to the environment means reducing the call for ventilation or air conditioning systems in the installation site;
- no power factor correction cost and so no increase in charges;
- no need increase the size of any generator upstream of the UPS.

Expandability

Most UPS systems on the market are of the non-modular and non-expandable type thus requiring an initial upscaling of the system to make future expansions possible.

The advantages of an expandable system are:

- optimisation of investments for UPSs, making them adequate for the current requirements without precluding future expansions and avoiding wastes of energy;
- increase in the efficiency of the system thanks to proper scaling.

Reliability

To obtain a level of redundancy with traditional UPSs it is necessary to put at least two in parallel thereby doubling the power acquired, the space occupied and the electricity consumed. Trimod HE's modular architecture makes it possible to have redundant configurations within a single cabinet.

The advantages are:

- a UPS with a redundant modular architecture can be configured as an N+X redundant in power. Even in the case of a fault in a module the equipment continues to function avoiding the activity from coming to a stop;
- clear indications and a large display make it possible to find the fault more quickly;
- the modular architecture makes it possible to speed up the solution to problems through the simple replacement of the faulty module without interrupting the service;
- high percentage of faults resolved at the first attempt.

Power module

The high-efficiency single phase module, available in three power sizes of 3400VA (PM4), 5000 VA (PM6) and 6700VA (PM7) respectively, is mainly made up of the following functional blocks: command and control logic (managed by a microprocessor), PFC rectifier/booster, inverter, battery charger, and automatic bypass.

The power module is Plug & Play to make the power expansion and any maintenance operations easier. Every module is put in parallel with other identical ones until reaching the power of the UPS.

The power modules are independent of each other and can function even if there is a fault in one of them. At the front of the module there is a multicoloured led with traffic-light code of green-yellow-red making it possible to identify the functioning status of the electronic unit quickly.

The power modules are housed on shelves also called tunnels that can house three modules.

Battery drawer

The battery modules are designed for easy insertion into the dedicated cabinet and they do not need any operation for their positioning: their lightness makes them simple to handle and therefore easy to maintain or replace. A drawer consists of five 12 V 7.2 Ah or 9 Ah batteries, connected in series and thanks to the Plug & Play connection it is easy to extract and insert in the cabinet.

The nominal battery voltage for the Trimod HE is 240Vdc, therefore a complete branch consists of 4 battery drawers (for a total of 20 12Vdc batteries) that form what is called KB (Battery Kit). Look at sections 5.2.7 and 6.5 for the meaning of KB. In order to ensure the maximum level of safety, especially during maintenance, the voltage of each drawer is properly isolated into two branches of 24 V and 36 V and it is only restored when the drawer is completely inserted into its housing. This allows conformity with standard EN 62040-1 on electrical safety that requires the use of adequate protection and particular care when handling dangerous voltages above 50 Vdc where direct contact is possible.

The autonomy can be further increased by adding more battery drawers in multiples of four, using both the seats for the purpose inside the UPS if they are there, and the seats in the additional modular cabinets.

Digital display and alarm display

Trimod HE is managed by between one and four microprocessor-type command cards (according to the version) and it has a backlit LCD alphanumeric display, with twenty characters on four lines.

The display is incorporated in the front of the UPS where there is also a high-brightness functioning status indicator that, through a traffic light type code of green-yellow-red, indicates the functioning status and any alarm conditions.

Four simple keys, situated near the display, enable the user to display the functioning data, set the functioning parameters, analyse the status of the individual power modules, select the language the messages are to be displayed in, start the hot-swap mode and carry out a guided set of functional tests and procedures.

BCM - Battery Charger Module

The additional battery charger module works in parallel and in synch with the battery chargers in the power modules managed by the same algorithm that governs the recharging cycle. Every additional battery charger module provides up to 15A of recharging current that are added to the current of the battery chargers in the power modules. Every power module can provide up to 2.5A of recharge current. This guarantees reducing the recharge times in installations of UPSs requiring long autonomies and increases the availability of the UPS after a black out. During functioning, the module takes current from the input phase (slot) it is installed in. It is possible to install any number of BCMs as long as there is at least one power unit and enough of empty slots in the UPS cabinet. All the information regarding the functioning status of the BCM is given by the LED on the front of the module and what is shown on the Trimod HE display. The module is managed by a microprocessor to optimize performance and reliability; its use in conjunction with batteries with capacities above 60Ah is recommended.

ECO MODE

The Trimod HE UPS has an "eco mode", making it possible to save energy while guaranteeing uninterruptability of the power supply with the load connected. During functioning in off-line mode, the load is supplied directly from the electrical mains through the automatic bypass circuit inside the power modules. This means that the output voltage and frequency are the same as the mains input and the Trimod HE UPS cannot control such parameters. The advantage obtained in the eco mode is a greater electrical efficiency and consequently a reduction in consumption. If the output voltage leaves the window of tolerance (-20% / +15% of the voltage set on output) or it is no longer available, the UPS actuates its inverter stage and supplies the load with energy stored in the batteries. Autonomy during battery functioning depends on the configuration of the UPS (nominal power, battery capacity) and on the percentage of load applied. When the input mains are back within the tolerance values, the UPS is automatically taken back to the eco mode. It is possible to change the functioning mode between on-line and off-line mode (and viceversa) both with UPS on and with the UPS off (in this case entering the Service Mode).

3. Technological description

EMERGENCY POWER SYSTEM (EPS) MODE

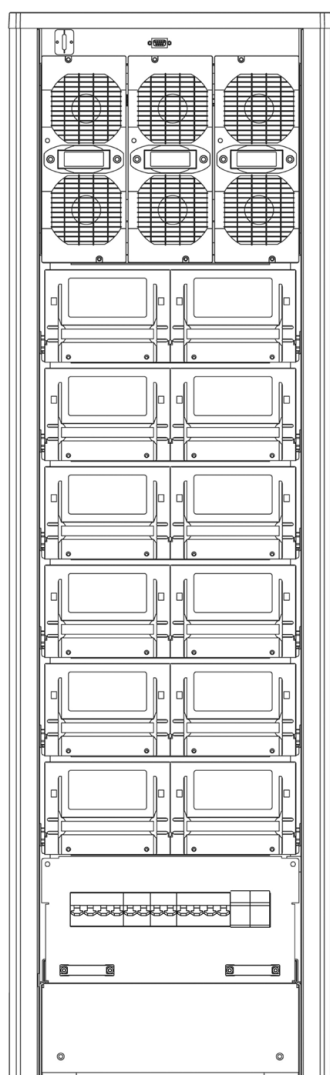
The Trimod HE UPS has an "emergency power system" functioning mode that is useful for example to power an emergency lighting system.

When there is input from the mains, the UPS output is disabled. If the mains input is missing, the output is supplied by the UPS functioning with batteries.

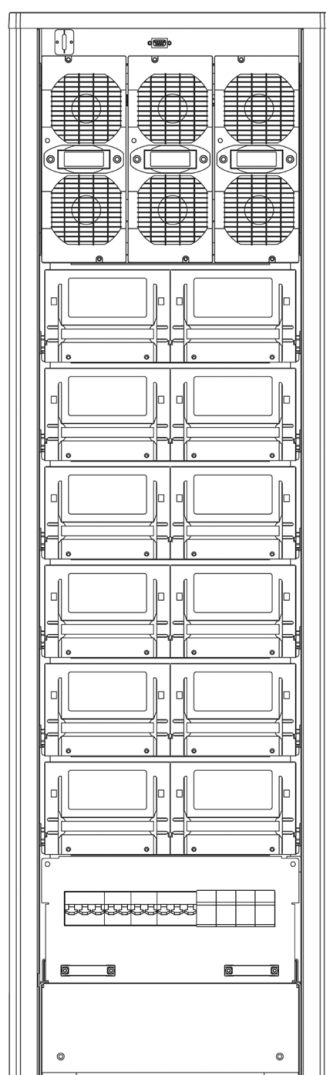
It is possible to enable or disable the "emergency power system" function only in "service mode" (therefore with the UPS off).

3.3 Models

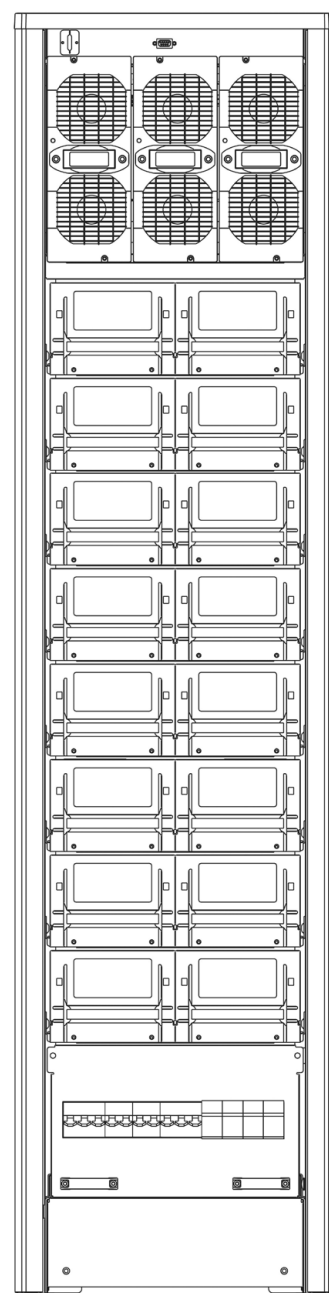
All the Trimod HE models are sold without power modules and without internal battery drawers (if they are required)).

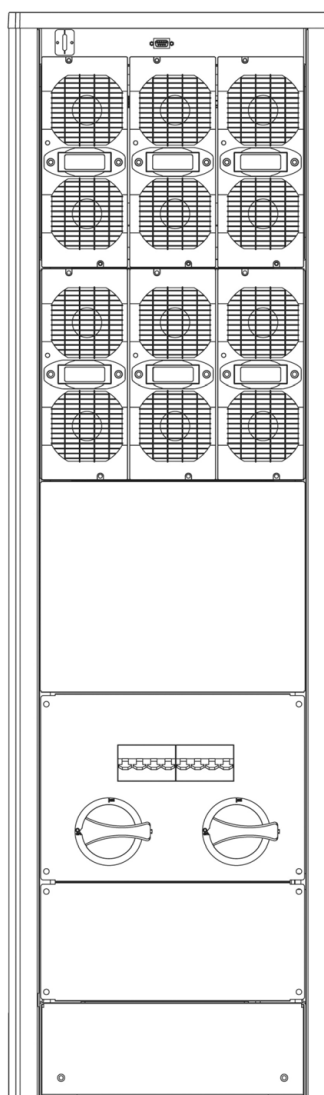


Trimod HE 10

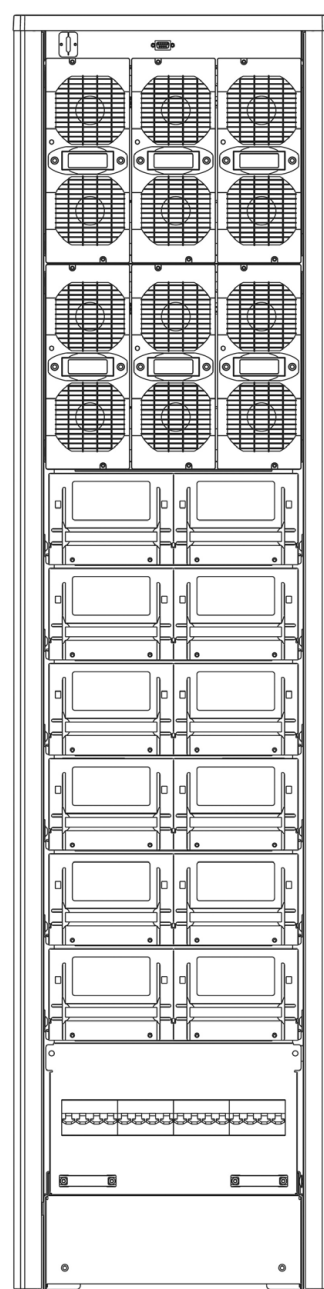


Trimod HE 15-20



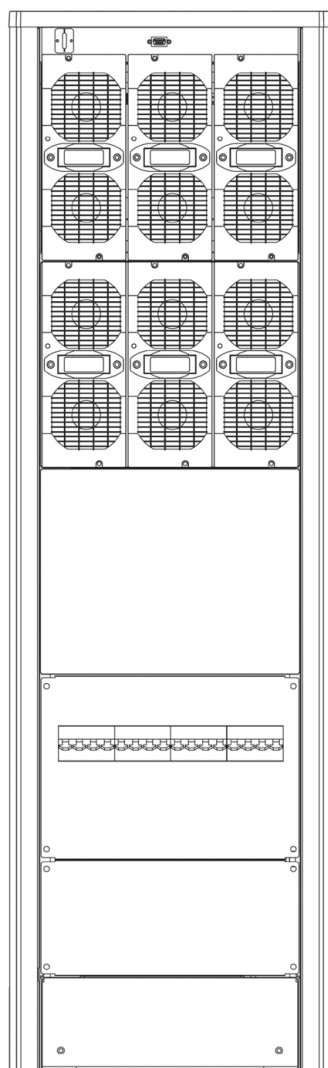


Trimod HE 30 TM

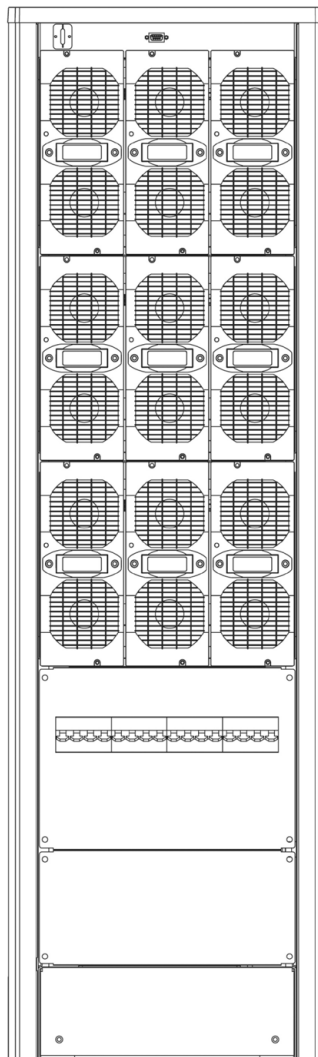


Trimod HE 30 TT

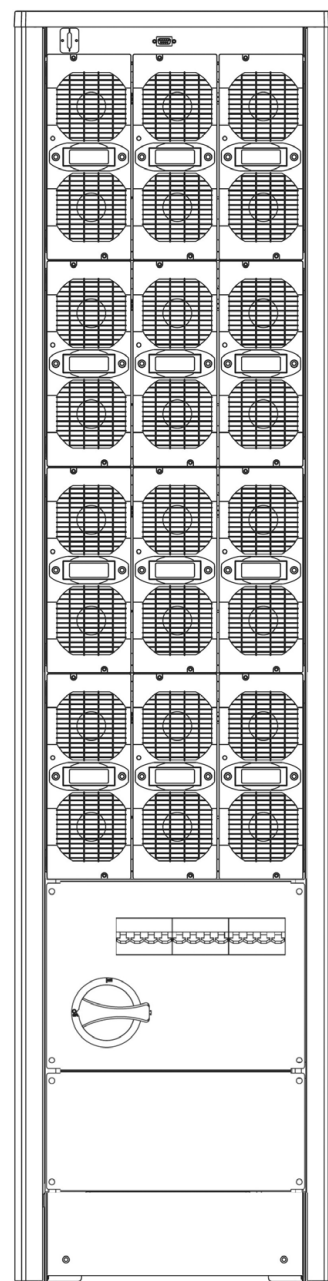
3. Technological description



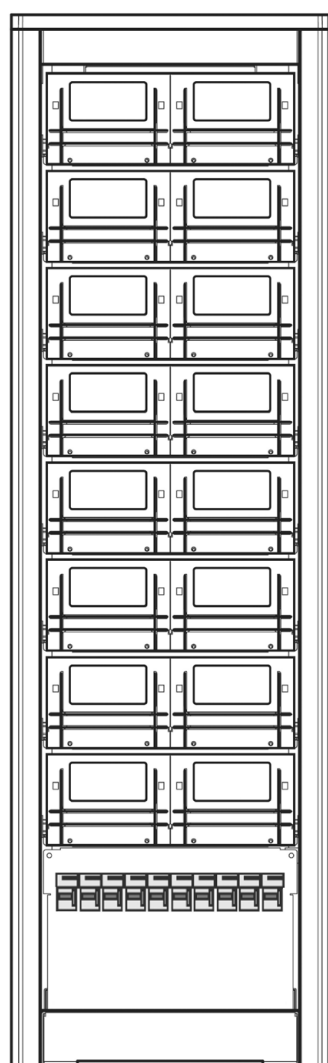
Trimod HE 40



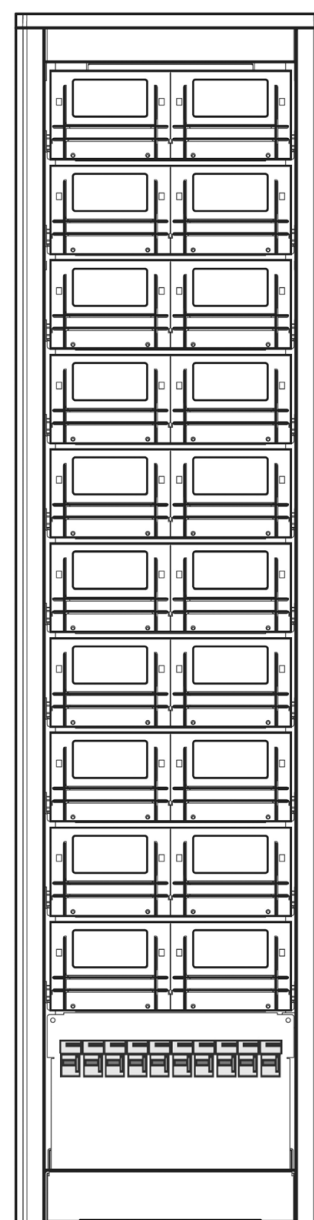
Trimod HE 60



Trimod HE 80



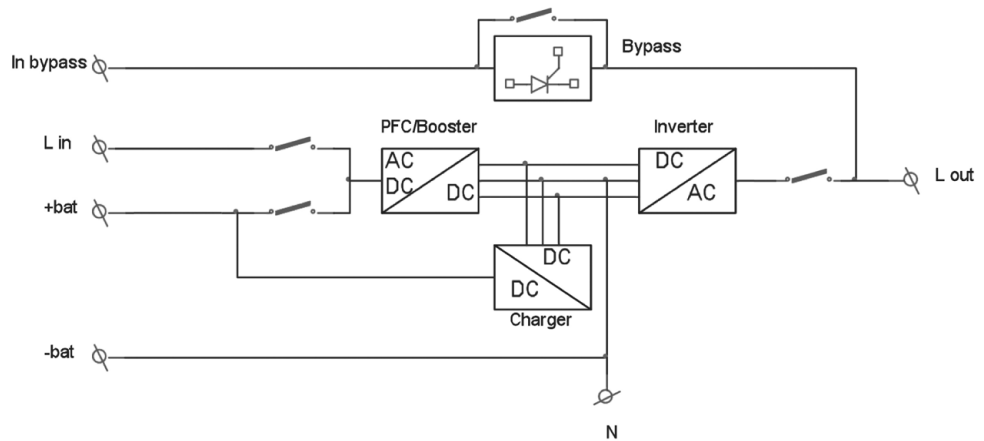
Trimod HE MODULAR BATTERY 4KB
(16 battery drawers)



Trimod HE MODULAR BATTERY 5KB
(20 battery drawers)

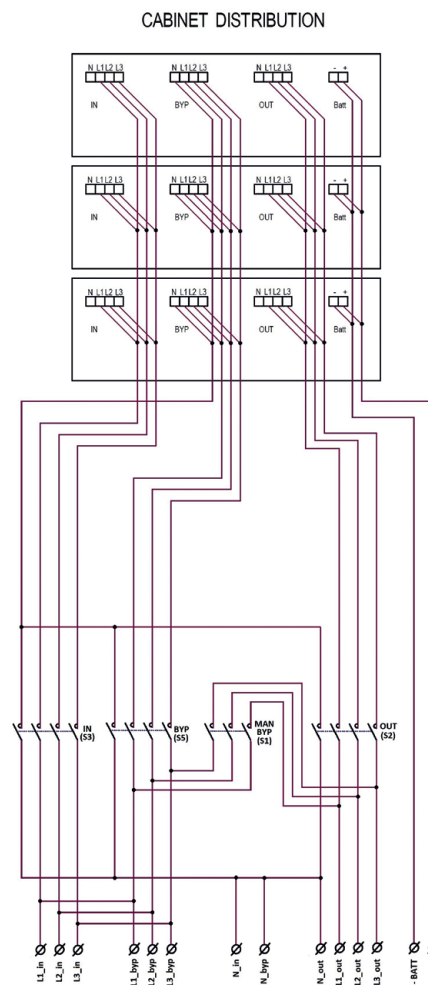
3. Technological description

3.4 Block diagram of the power module



3.5 Block diagram of interconnections and distributions of the UPS cabinet

The following figure shows the block diagram of a Trimod HE 60 distribution. The layout is similar for all the other models. The bypass input terminals are represented according to the factory configuration (bypass input line in common).



4. Unpacking and moving

4.1 Visual check

On delivery of the UPS, carefully inspect the packaging and the product for any damage that might have occurred during transport. Check there is no damage to the indicator on the outer label reading "Shock Watch".

If there is possible or ascertained damaged immediately inform:

- the transporter;
- the LEGRAND Technical Assistance Centre.

Check the equipment corresponds with the material indicated in the delivery documentation. The packaging protects the Trimod HE UPS from mechanical and environmental damage.

Follow the instructions in Chapter 10 when storing the UPS.

4.1.1 Equipment and supplied accessories check

The equipment and the relative supplied accessories must be a perfect state of repair.

Check that:

- the shipping data (address of the recipient, no. of packages, order no, etc.) correspond to what is contained in the delivery documentation;
- the Trimod HE technical rating plate data on the label applied to the UPS correspond with the material purchased, described in the delivery documentation;
- the documentation accompanying the equipment includes the installation manual and the user manual.

Should any of these be different from what they should be, immediately inform the LEGRAND Technical Assistance Centre before commissioning the equipment.

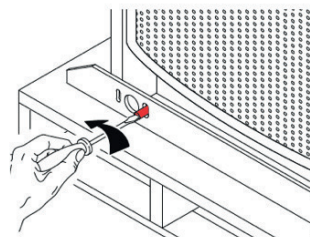
4.2 Unpacking

To remove the packaging material, comply with the icons on the outside of the box and observe the following procedure:

1. cut the wrapping material and open the plastic packaging safety holds;
2. open the top of the box;
3. remove the upper protection;
4. remove the four protective corners;
5. remove the packaging container pulling it upwards;
6. remove the pallet and the front/rear bracket from the UPS by undoing the four fixing screws present;
7. examine the UPS for any damage. Immediately inform the shipper and the supplier in the case of apparent damage.

Keep the packaging material for any future shipment of the UPS.

The package can be fully recycled: should you wish to dispose of it, comply with the legislation in force.



4.3 Check of the content

The content of the supply is subject to thorough checking before the shipment; nonetheless it is always advisable to check that it is complete and in order on receiving the material.

The following list is general:

- 1 Trimod HE UPS (empty cabinet);
- 1 envelope of accessories containing washers for the contact with the earthing, set of screws for fitting the panels, two eight-pole terminal strips, a serial cable and fuses (the latter are only included for models with internal batteries);
- 1 envelope of accessories containing one or more EC15 connectors according to the model and connecting jumpers for the terminal strip (ONLY for Trimod HE 10, 15, 20 and 30 TM);
- 1 front closing panel;
- 2 base strips for side closing;
- end user manual;
- acceptance report;
- quickstart and installation manual.

Should there be defects and/or missing material, immediately inform the LEGRAND Technical Assistance Centre before commissioning the equipment.



CAUTION

The quickstart and the installation manual are only to be used and consulted by SKILLED TECHNICIANS.

INDICATION

The power modules and any battery drawers to install must be bought separately.

4. Unpacking and moving

4.4 Movement



WARNING

Move the UPS very carefully, lifting it as little as possible and avoiding dangerous swings or falls. The equipment must always be handled by trained and instructed personnel equipped with the Personal Protective Equipment illustrated in chapter 2.

The Trimod HE UPS has wheels at the back of the cabinet so before installations, and while it is still empty, it can be moved by hand by at least two people.

For any lifting, use a forklift or a transpallet with an adequate carrying capacity, placing the forks in the wooden base and making sure they come out the other side by at least twenty centimetres.

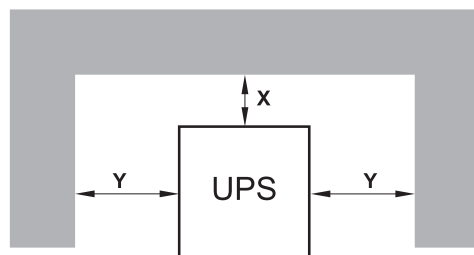


WARNING

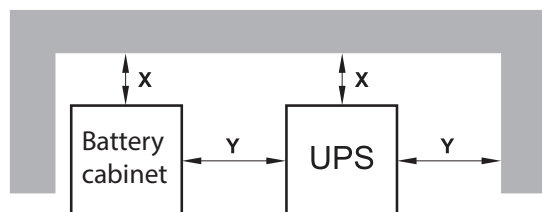
Do not move the UPS after installation or following the insertion of power modules and any battery drawers.

4.5 Positioning constraints

Minimum recommended distances for the UPS
X=100 mm / Y=200 mm



Recommended minimum distances
UPS Trimod HE®
+ Trimod HE®
BATTERY
X=100 mm / Y=200 mm



The UPS must be positioned respecting the following conditions:

- temperature and humidity must be within permitted limits;
- fire regulations must be respected;
- the wiring must be simply made;
- front and rear accessibility must be available for assistance or periodic servicing;
- the cooling flow of air must be guaranteed;
- the air conditioning system must be adequately scaled;
- dust or corrosive/explosive gasses must be absent;
- the premises must be free of vibration;
- the rear and side space must be enough to guarantee an adequate circulation of air for cooling;
- the support surface must be scaled in for the carrying capacity necessary to support the equipment.

To safeguard the batteries as well as possible it is necessary to bear in mind that their average lifetime is strongly influenced by the operating room temperature.

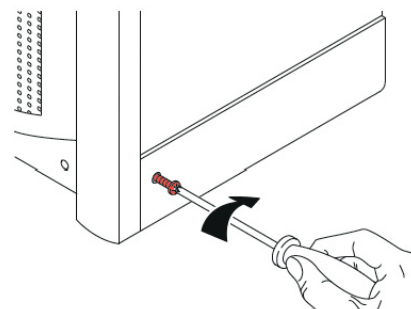
Position the UPS in an environment with a temperature range between +18°C (+64°F) and +23°C (+73°F) to guarantee the optimum life of the batteries.

Before proceeding with the installation operations, make sure that there is enough lighting to clearly see every detail. Provide artificial lighting if the natural lighting does not satisfy the requirements cited.

In the case of maintenance operations in places that are not sufficiently well lit, portable lighting systems must be used, avoiding shadows that prevent or reduce visibility on the point where you intend to work or on the surrounding areas.

4.6 Final operations

Once the UPS has been properly positioned, fit the two base strips and the front one provided in the accessory kit.



5. Installation



DANGER

All the UPS installation operations must be carried out exclusively by a **SKILLED TECHNICIAN**.

5.1 Safety regulations



CAUTION

Before carrying out any installation operation you must read and apply the following:

1. The UPS has a high leakage current. It is essential to make the earth connection before connecting the power supply. It is necessary to make sure that the switchgear has a safe connection with the earth circuit and adequate protection as required by the installation standards.
2. The UPS must only be installed in a fixed way with a thermal-magnetic circuit breaker placed upstream of it. Connection to the mains via traditional type plug is not allowed.
3. A protection circuit against backfeed made as in the diagrams shown in section 5.2.6 must be provided outside the UPS.
4. The switchgear or the disconnect switch must be installed near the equipment and must be easily accessible.
5. A warning label must be placed on all the mains disconnect switches installed away from the area of the UPS for the purpose of reminding the assistance personnel of the fact that the circuit is connected to a UPS. The label must bear the following text (or the equivalent):

Before working on this circuit

- Isolate the Uninterruptible Power System (UPS)
- Then check for the presence of Hazardous Voltage between all terminals including the protective earth.

Risk of Voltage Backfeed

5.2 Electrical connections

The electrical hookup of the UPS to the switchgear is part of the installation that is not normally performed by the UPS manufacturer; for this reason, the indications that follow are to be considered approximate and it is recommended that the electrical connections are made on the basis of local installation standards.

After removing the UPS from the packaging and positioning it in its definitive place, the skilled technician can begin to make the electrical connections.



ATTENTION

The choice of cable type and their cross sections depending on the current they carry and their installations must be made as indicated by the installation standards in force and it is a responsibility of the skilled technician. The input current and the output power of the UPS are indicated in chapter 12 and the battery current in table 8 of chapter 13.

INDICATION

Chapter 13 shows the instructions for scaling cables, fuses and automatic and differential switches.

5.2.1 Safety warnings



DANGER

Before proceeding with the operations it is necessary to read and apply what is reported below. Proceeding with the operations if one or more of the following conditions have not been met is prohibited.

- Do not carry out the installation if there is water or humidity around.
- Do not open or remove the UPS's panels.
- Check there is no mains voltage on the equipment.
- Check that the loads are off and disconnected from the UPS.
- Check the UPS is off and no voltage is present.
- Check that the battery breakers on the UPS (if present) and all external Trimod HE battery drawers, if there are any installed, are open.

5. Installation

- Non-occupied power module slots must be covered by installing in each of them the plastic mask with code 3 108 66 that must be fixed with two SHC M4x20mm screws.

All the electrical connection operations are carried out on the connection terminal strips inside the UPS. For the Trimod HE 10, 15, 20, 30 TT models, it is necessary to unscrew the distribution drawer locking screws and pull it outward to get at the distribution terminal strip. For the Trimod HE 30 TM, 40, 60 and 80 models, it is necessary to remove both the lower panels to get at the terminal distribution strip.

Outside the draw there are the fuse breakers (depending on the model), the output switch, the mains input switch, the bypass input switch and the manual maintenance bypass switch.

In the case of Trimod HE 30 TT, the fuse holders have been installed inside the terminal strip.

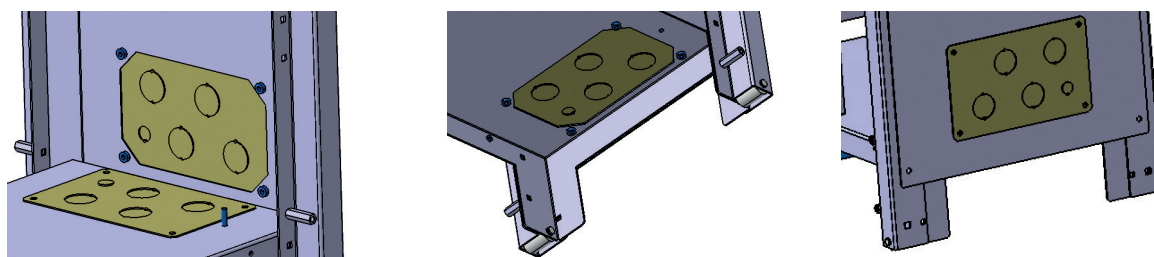
5.2.2 Preliminary operations

Before connecting the UPS, check that:

- the mains input voltage and frequency correspond with the values indicated in the technical data on the UPS rating plate;
- the earthing has been carried out in compliance with IEC (International Electrotechnical Commission) standards or local regulations;
- the electrical system has been fitted with the necessary residual-current and thermal-magnetic protections upline from the UPS input.

5.2.3 Wiring

The Trimod HE UPS has specific plates for with holes for the passage of the cables. It is possible to pass the cables either from underneath or from the rear panel, as can be seen in the following pictures:

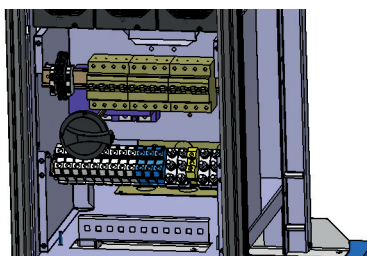


The metal plate at the rear is fixed to the rear panel by means of four screws.

It is necessary to lock the cables in place with appropriate cable glands, not supplied, to be inserted in the holes in the plates.

The plates have four holes 33 mm in diameter and one hole 16 mm in diameter.

In the case of the Trimod HE 80 kVA, the cables must be passed into the opening at the base and fixed on the bar which can be seen in the following picture:



5.2.4 Earthing

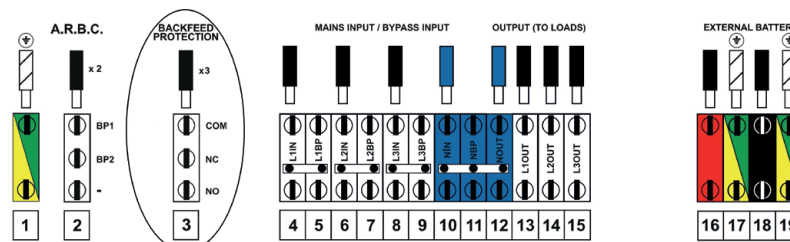
Before carrying out any other installation operation, connect the earthing wiring coming from the low voltage switchgear to the earthing terminal on the UPS terminal strip.

5.2.5 Protective devices

To ensure proper protection from overloads or shortcircuits on output, the UPS must be protected upstream with an automatic residual-current and thermal-magnetic switches both on the input line and on the bypass input line (if separate), selected according to the indications in the table shown in chapter 13.

5.2.6 Backfeed protection

The Trimod HE UPS is fitted with an auxiliary contact for the actuation of the external backfeed protection (protection against energy return). This auxiliary contact has been created with a C/NC/NO exchange relay and is available on the the relative tripolar "BACKFEED PROTECTION" terminal on the terminal strip.



If the UPS detects a voltage backfeed, the relay is energised and changes status, enabling the disconnection of the input lines. This must be done externally as indicated in the diagrams shown below.

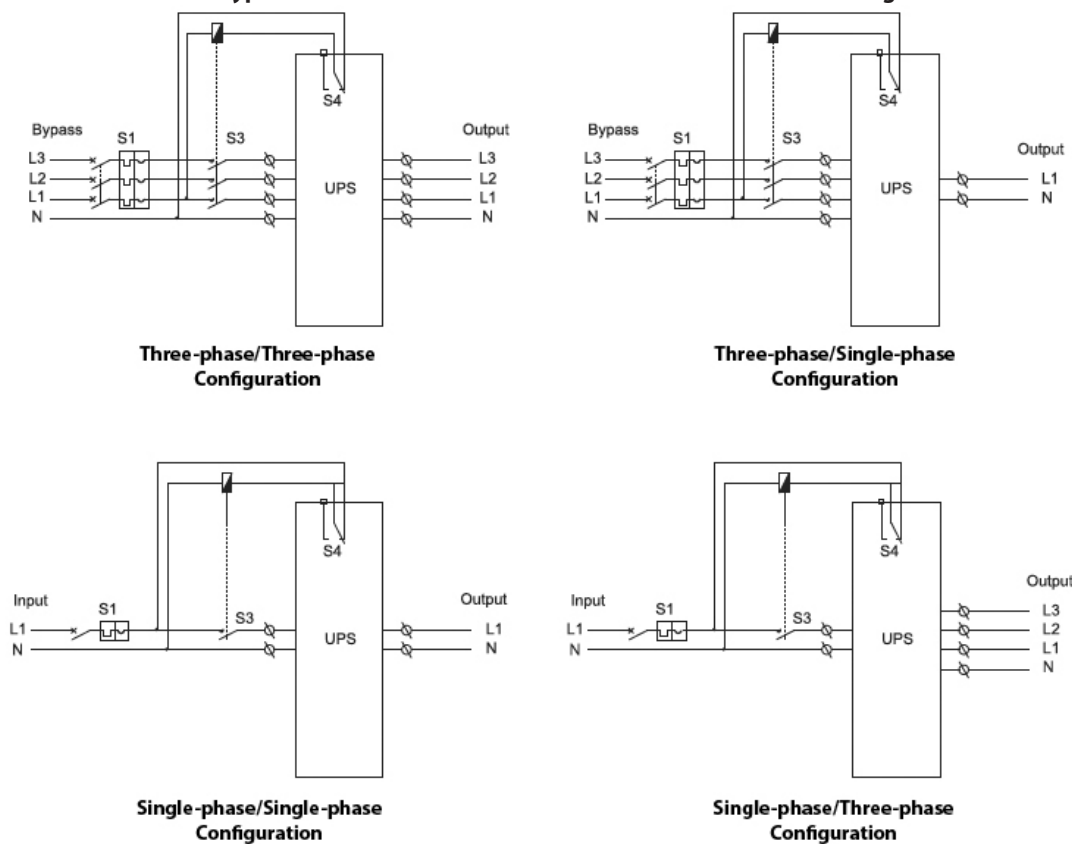
The relay contact characteristics are :

- Maximum applicable voltage: 250Vac.
- Maximum applicable current: 5A, $\cos\phi = 1$

INDICATION

If, during operation, the UPS signals that the backfeed protection has been actuated, contact the LEGRAND Technical Assistance Centre.

Connection to a TN-C type distribution network and backfeed circuit connection diagrams



In the diagrams:

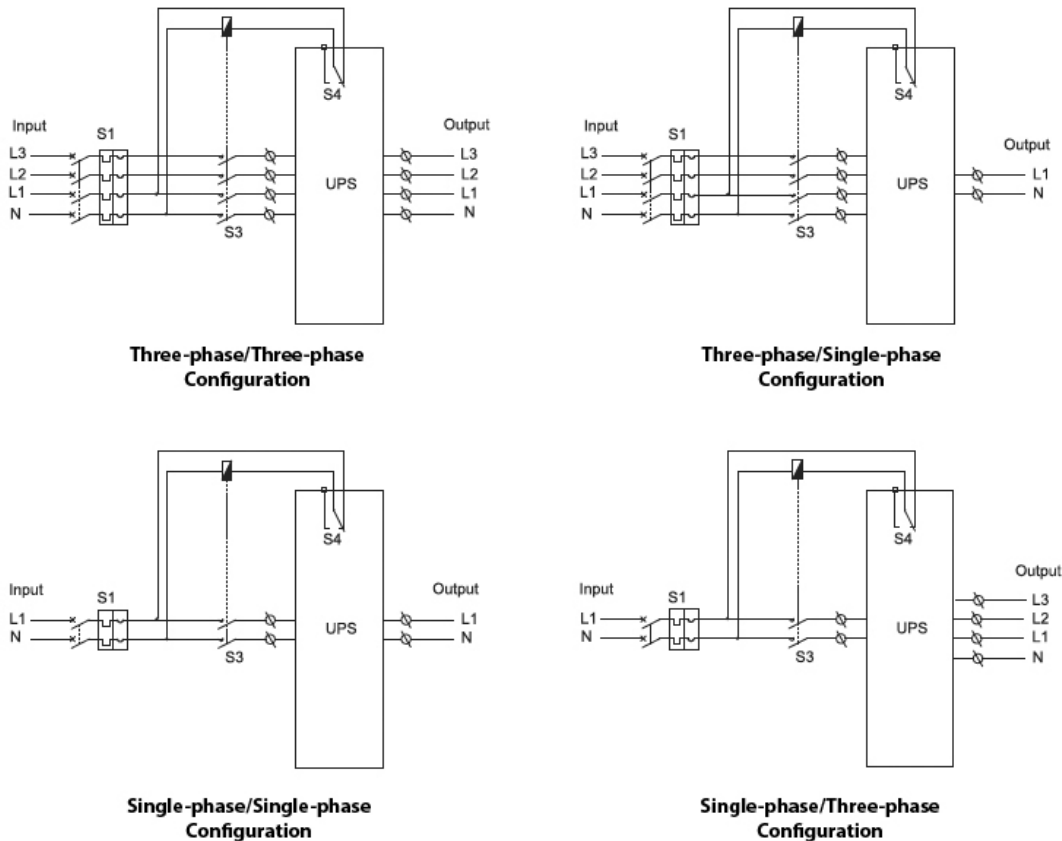
"S1" is the prescribed thermal magnetic circuit breaker

"S3" is the bypass line opening contactor

"S4" are the backfeed protection circuit contacts

5. Installation

Connection to a TT or TN-S type distribution network and the backfeed circuit connection diagrams



In the diagrams:

"S1" is the prescribed thermal magnetic circuit breaker

"S3" is the input line opening contactor

5.2.7 External battery unit installation (Trimod HE BATTERY)

In the case of Trimod HE UPS without internal batteries, it is necessary to connect one or more external battery units. The installation of external battery units makes it possible in addition to increase the autonomy of the UPS regardless of the model.

Three Trimod HE BATTERY models are available:

- a modular model, consisting of a cabinet with an internal structure using battery drawers for a maximum of eighty 12V-7.2 Ah or 12V-9Ah batteries (16 drawers);
- a modular model, consisting of a cabinet with an internal structure using battery drawers for a maximum of one hundred 12V-7.2 Ah or 12V-9Ah batteries (20 drawers);
- a compact, non-modular model that on the other hand uses a shelf architecture that can house twenty 12V-94 Ah batteries inside.



CAUTION

1 KB (Battery Kit) represents a string of 20 batteries in series.

In the case of models with internal battery drawers and external modular battery units, 1 KB comprises 4 battery drawers.

It is necessary to install 1 KB every 10 kVA of nominal UPS power in the case of modular units with battery drawers.

For example, for the Trimod HE 40 it is necessary to have at least one external modular battery unit with 4 KB (16 battery drawers).

In the case of non-modular 94h external battery units, each unit represents 1 KB.

In this case, 1 KB is sufficient for all the Trimod HE models.

**CAUTION**

The maximum length of the connection cable between the UPS and the first battery unit must not exceed 3 meters.

Connection of the external modular battery units to the Trimod HE 10-15-20-30TT/TM

The Trimod HE MODULAR BATTERY 4KB-5KB can be connected to the Trimod HE 10, 15, 20 and 30 TT-TM with one of the multipolar cables provided with each battery cabinet.

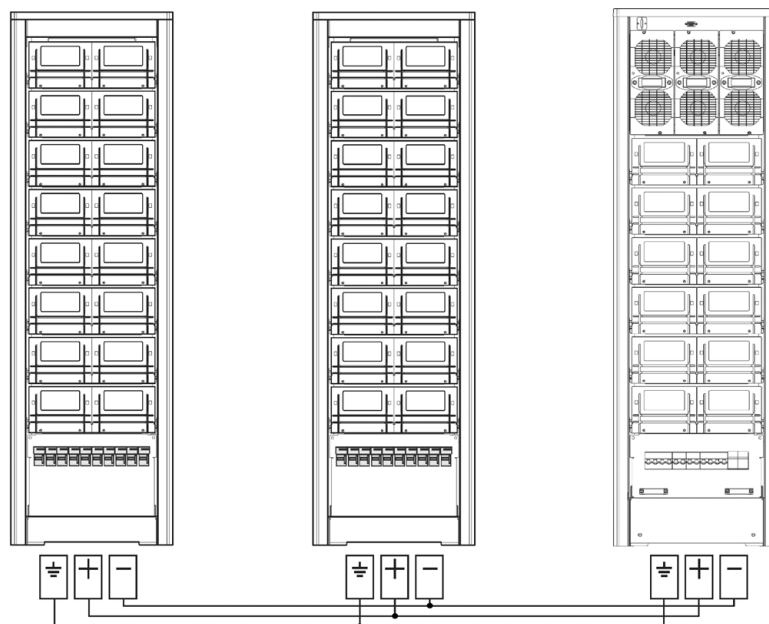
**CAUTION**

Table 8 of chapter 13 shows instructions for sizing the cables for connecting the UPS to the first external battery unit in the case the multipolar cable provided is not used.

The maximum length of the connection cable between the UPS and the first battery unit must not exceed 3 meters.

In the case of configurations where there are one or more external battery units, it is necessary to position all the Trimod HE BATTERIES on the same side as the UPS Trimod HE to realize a cascade connection by means of the multipolar cables provided with the external batteries.

The connection must be made according to the diagram and the passages indicated below:



1. Check that all the battery fuse isolation switches are open.
2. Loosen the screws that hold the external battery unit terminal strip access panel closed.
3. By using one of the multipolar cables provided with the external battery unit, connect the UPS to the first external battery unit installed using the earthing wire (yellow-green).
4. By means of the multipolar cable used in the preceding point, connect the positive and negative terminals of the UPS with those of the first external battery unit installed.
5. If there is more than one TRIMOD HE BATTERY, realize a cascade connection using one of the multipolar cables provided.
6. Refit the panel and tighten the screws.

Connection of the external modular battery units to the Trimod HE 40

A Trimod HE 40 can only be connected to the TRIMOD HE MODULAR BATTERY 5KB (20 battery drawers) using both of the multipolar cables provided with each battery unit.

5. Installation



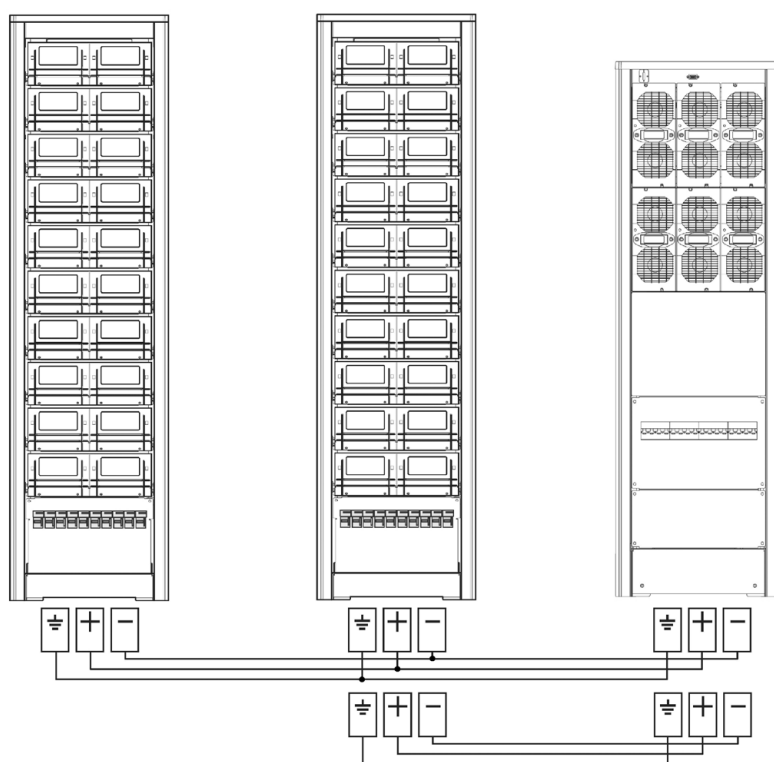
CAUTION

Table 8 of chapter 13 shows instructions for sizing the cables for connecting the UPS to the first external battery unit in the case the multipolar cable provided is not used.

The maximum length of the connection cable between the UPS and the first battery unit must not exceed 3 meters.

In the case of configurations where there are one or more external battery units, it is necessary to position all the Trimod HE BATTERIES on the same side as the UPS Trimod HE to realize a cascade connection by means of the multipolar cables provided with the external batteries.

The connection must be made according to the diagram and the passages indicated below:



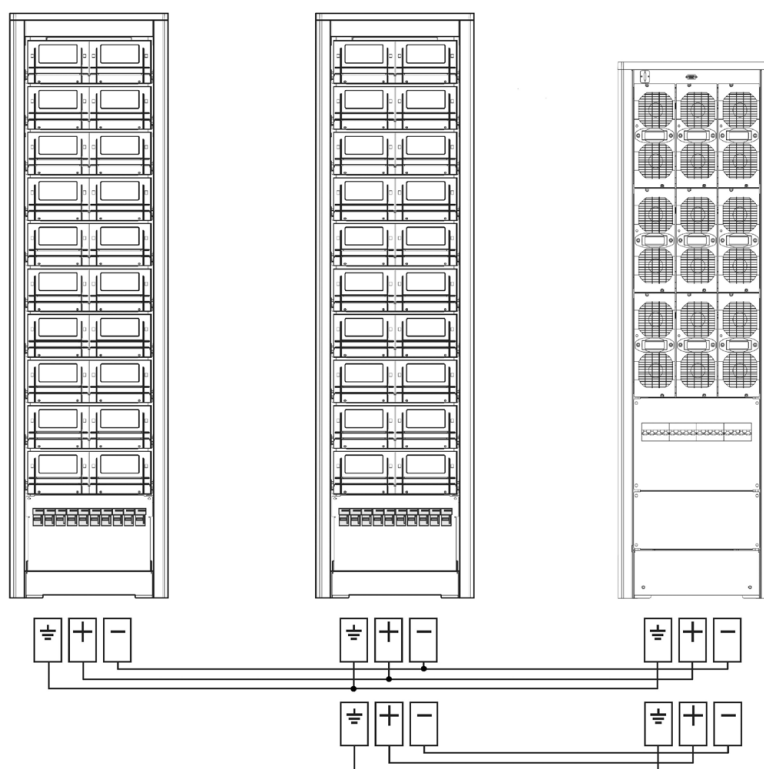
1. Check that all the battery fuse isolation switches are open.
2. Loose the screws that hold the external battery unit terminal strip access panel closed
3. By using both the multipolar cables provided with the external battery unit, connect the UPS to the first external battery unit installed using the earthing wires (yellow-green).
4. By means of the multipolar cables used in the preceding point , connect the positive and negative terminals of the UPS with those of the first external battery unit installed.
5. If there is more than one battery unit, realize a cascade connection using the two multipolar cables provided.
6. Close the panel and tighten the screws.

Connection of the external modular battery units to the Trimod HE 60

A Trimod HE 60 can only be connected to the TRIMOD HE MODULAR BATTERY 5 KB (20 battery drawers) using exclusively external cables as per the instructions provided in table 8 of chapter 13.

The multipolar cables provided with each battery cabinet must only be used for the cascade connection of the external battery units.

The connection must be made according to the diagram and the passages indicated below:



1. Check that all the battery fuse isolation switches are open.
2. Loosen the screws that hold the external battery unit terminal strip access panel closed.
3. Connect the UPS and the first external battery unit installed using an earthing (green/yellow) cable
4. By means of two cables with minimum cross-section indicated in table 8 of chapter 13, connect the positive and negative terminals of the UPS with those of the first external battery unit installed.
5. Interlink the first battery unit installed with the second using both the multipolar cables provided by connecting the earthing cable first and then the positive and negative terminals.
6. Should there be more than two battery units, realize a cascade connection using the two multipolar cables provided.
7. Close the panel and tighten the screws.

Connection of the external modular battery units to the Trimod HE 80

It is not possible to connect the external modular battery units to the Trimod HE 80 UPS.

It is only possible to connect the non modular model with a 12V 94Ah batteries. For the connection, it is necessary to use the external cables according to the instructions given in table 8 of chapter 13.

5.2.8 Mains connection

Before connecting the input power supply cables, check that all the UPS switches are open (in the OFF position) and arrange the connection jumpers on terminal strip depending on the requested input-output configuration.

INDICATION

Chapter 13 shows the instructions for sizing cables, fuses and automatic/residual current breakers.

The default configuration for the Trimod HE UPS is THREE PHASE INPUT and THREE PHASE 120° OUTPUT.

If this type of configuration is used, the connection jumpers are correctly sized and positioned. For different configurations, it is necessary to consult section 5.3 that includes the connection diagrams and chapter 6.

Perform the steps listed below:

- Before beginning to connect the mains, check that the available mains power is more than or the same as the nominal UPS input power.

5. Installation

- Check that the cables to connect to the UPS are isolated upstream and no voltage is present.
- Check that the earth wire from the low voltage switchgear is connected to the right terminal.
- Connect the mains input neutral cable to the respective N_{in} mains input terminal.
- Connect the cables L1, L2, L3 of the mains line to the respective L1_{in}, L2_{in} e L3_{in} terminals, being careful to observe the phase sequence (L1, L2, L3).



WARNING

The neutral input wire must ALWAYS be connected otherwise the UPS may be damaged irreparably once powered from the mains.

5.2.9 Bypass input line connection (if separate)

The connection of a separate bypass line is possible only if the bypass and mains neutral wires are in common (same potential). The UPS has the mains, bypass and output passing neutral and they are connected internally to each other.

INDICATION

Chapter 13 shows the instructions for sizing cables, fuses and automatic/residual current breakers.

The default configuration for the Trimod HE UPS provides the bypass line in common with the mains. For different configurations, it is necessary to consult section 5.3 that includes the connection diagrams and chapter 6 for the configuration with the separate bypass input line.

Perform the steps listed below:

- Before beginning to connect the bypass line, check that the available mains power is more than or the same as the nominal UPS input power.
- Check that the cables to connect to the UPS are isolated upstream and no voltage is present.
- Connect the earth wire of the bypass line to the correct terminal at the bottom of the equipment.
- Connect the bypass line neutral wire to the respective N_{byp} bypass input terminal.
- Remove the three jumpers linking terminals L1_{in}, L2_{in}, L3_{in} and L1_{byp}, L2_{byp}, L3_{byp}.
- Connect the cables L1, L2, L3 of the bypass input line to the respective L1_{byp}, L2_{byp} and L3_{byp} bypass input terminals, being careful to observe the phase sequence (L1, L2, L3).



WARNING

The separate bypass neutral wire must ALWAYS be connected, otherwise the UPS may be damaged irreparably once powered from the mains.

5.2.10 Output line connection

Before beginning to connect the loads, check that the nominal power of the UPS indicated on the rating plate is more than or the same as the total sum of the load powers. The choice of the type and section of the connecting wires depending on their design current and installation must be done as indicated in the current standards.

INDICATION

Chapter 13 shows the instructions for sizing the output cables.

Provide a separate switchgear for the load. It is advisable to use switches or automatic breakers in line with IEC standards to protect the output lines from the switchgear.

Indicate the values reported below on the system switchgear by means of stickers or similar:

- maximum nominal power of the total load;
- maximum nominal power of the load at the load outlets;
- if a common switchgear is used (mains and UPS power outlets), make sure that there is an indication of the relative power source on every power outlet ("Mains" or "UPS").

The default configuration for the Trimod HE UPS provides the THREE PHASE INPUT and THREE PHASE 120° OUTPUT.

If this configuration is used, the connection jumpers are correctly sized and positioned. For different configurations, it is necessary to consult section 5.3 that includes the connection diagrams and chapter 6.

Perform the steps listed below:

- Before beginning to connect the output, check that the UPS is off and that the output terminals are not live.
- Connect the earth wire of the output line to the correct terminal.
- Connect the output neutral wire to the respective N_{out} output terminal.
- Connect individually the cables L1, L2, L3 of the output line to the respective L1_{out}, L2_{out} and L3_{out} output terminals, being careful to observe the phase sequence (L1, L2, L3).

5.3 Wiring diagrams

The electrical configuration must be done on both the control panel and on the distribution terminal strip. For the explanation of the significance of the A.R.B.C terminal see section 5.3.8.

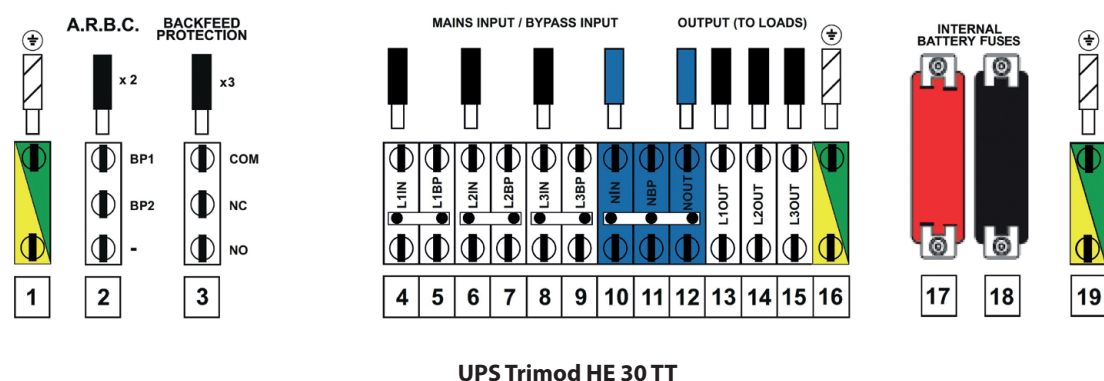
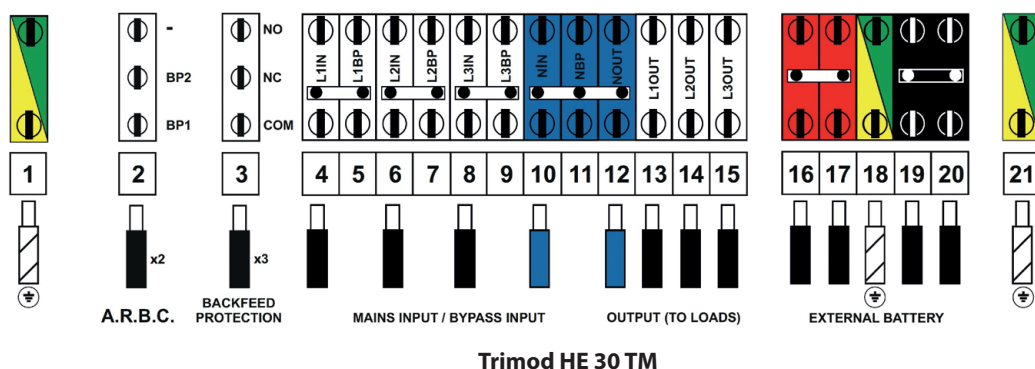
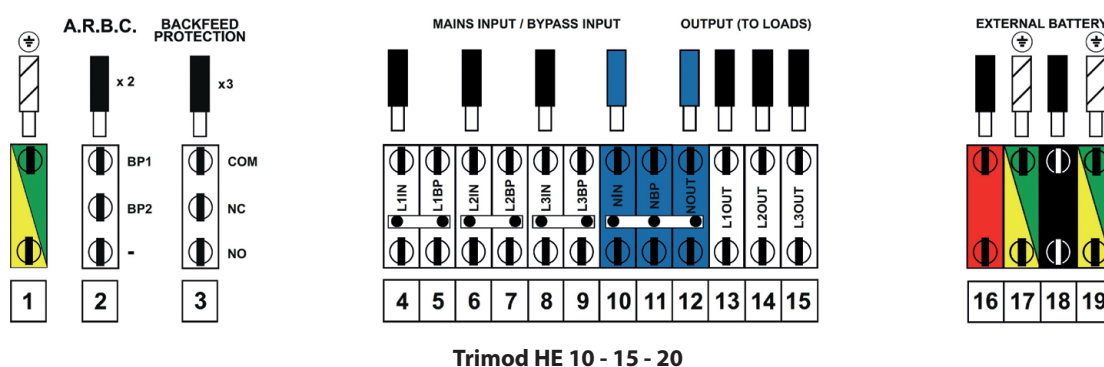


WARNING

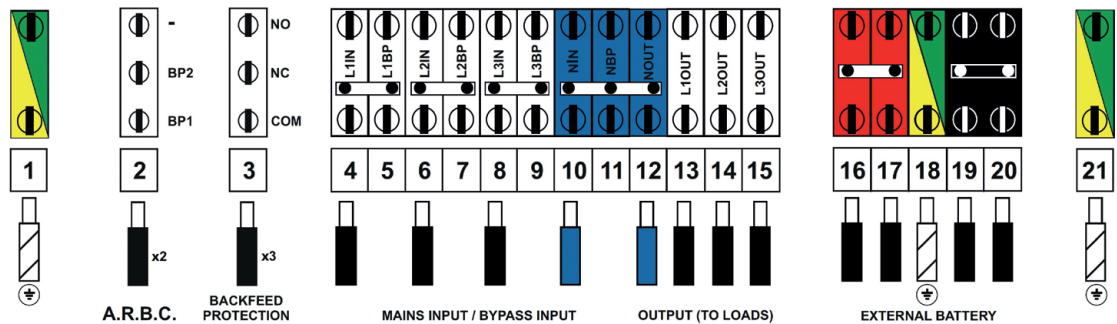
Always check that the connection jumper screws are tightened properly. If the configuration set in the factory is modified, it is necessary to configure the new functioning mode through the control panel as indicated in chapter 6.

5.3.1 Factory configuration: input THREE PHASE – output THREE PHASE with common bypass input line

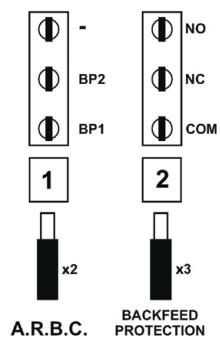
The UPS default configuration is set in the factory according to the following diagrams depending on the model. To use this configuration, no further action is necessary; it is however recommended that a check is made of the correct configuration of the connection jumper.



5. Installation

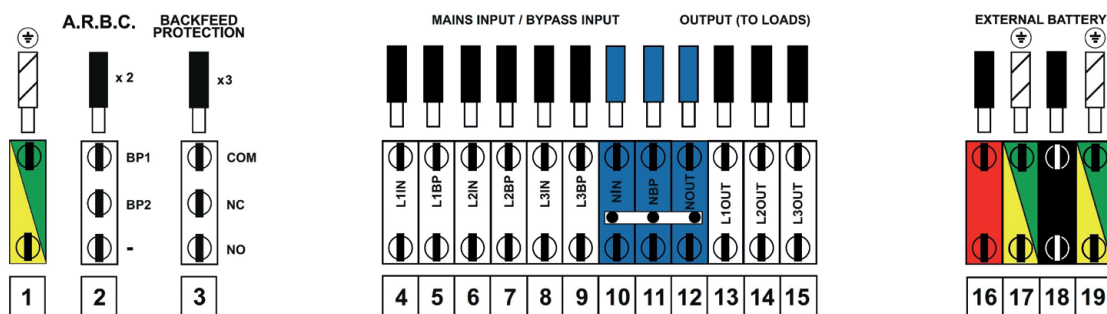


Trimod HE 40 - 60

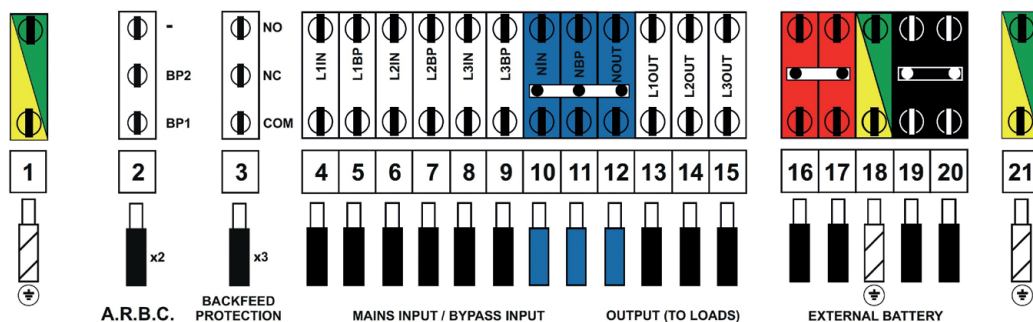


Trimod HE 80

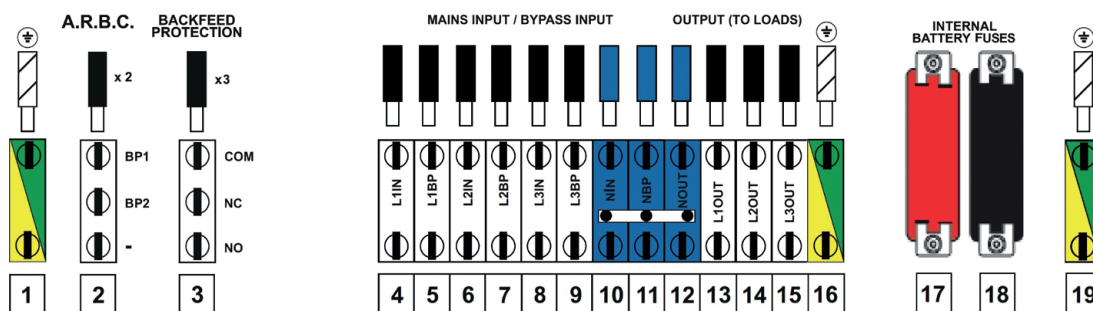
5.3.2 THREE PHASE input - THREE PHASE output connection with separate bypass input line



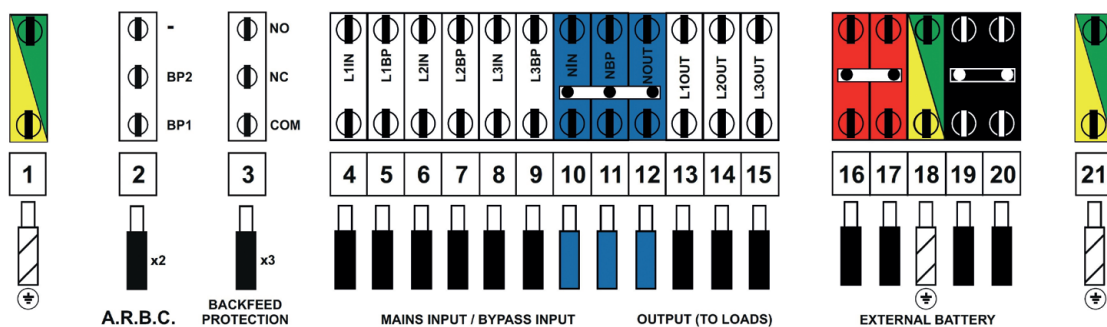
Trimod HE 10 - 15 - 20



Trimod HE 30 TM

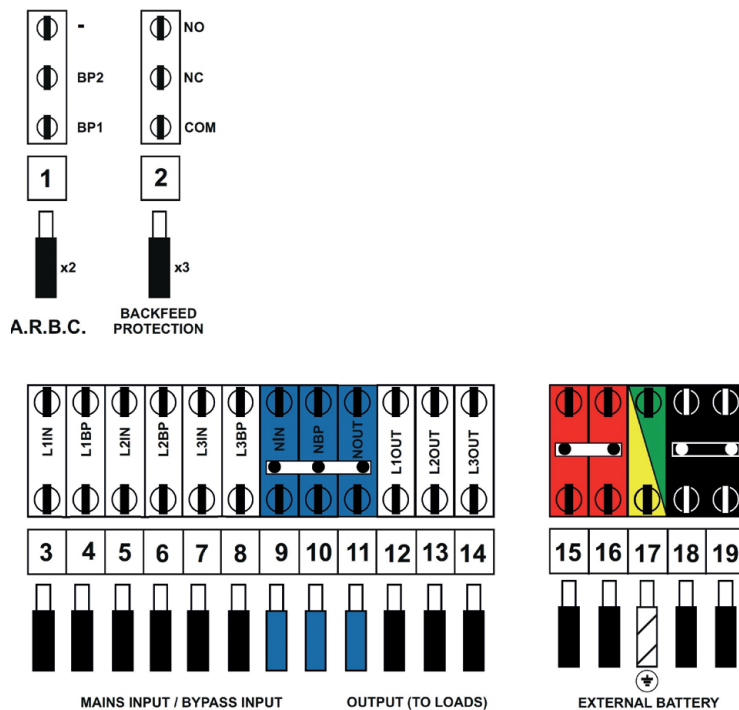


Trimod HE 30 TT



Trimod HE 40 - 60

5. Installation

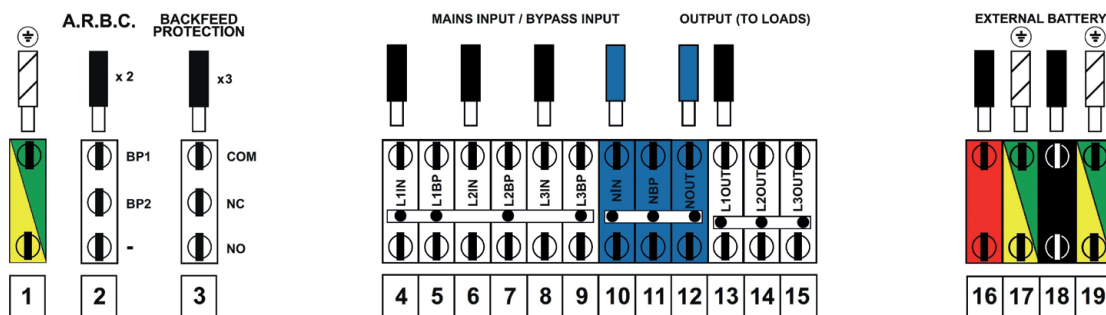


Trimod HE 80

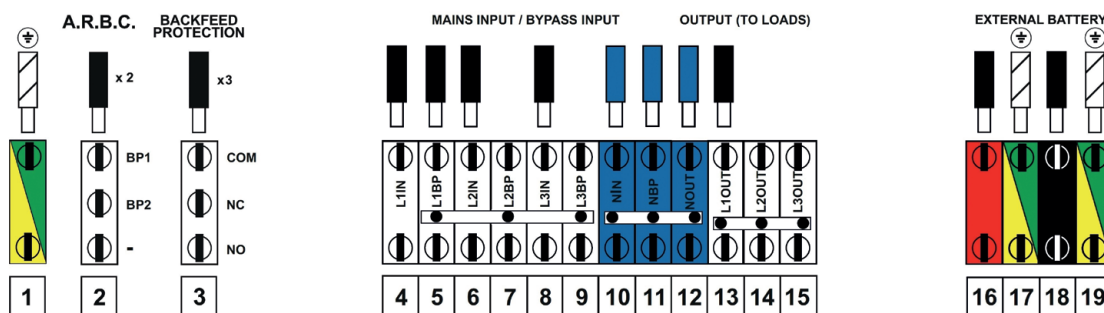
5.3.3 THREE PHASE input – SINGLE PHASE output connection

This connection is available only for Trimod HE 10, 15, 20 and 30 TM.

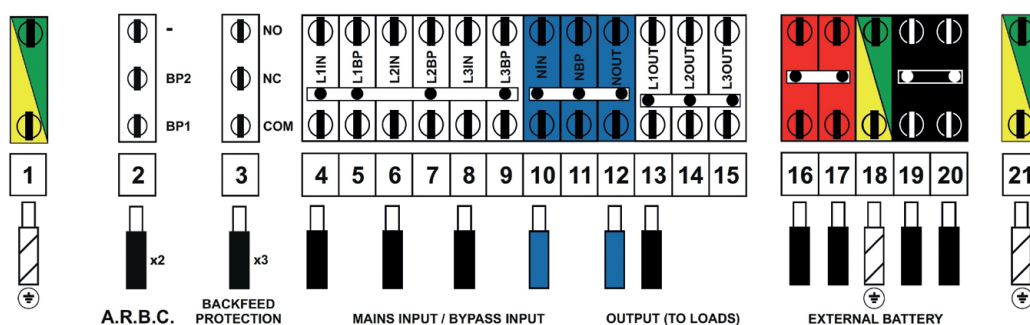
In addition to the wiring shown in the images that follow, it is necessary to configure the functioning mode as illustrated in chapter 6 "Configuration and Start-up".



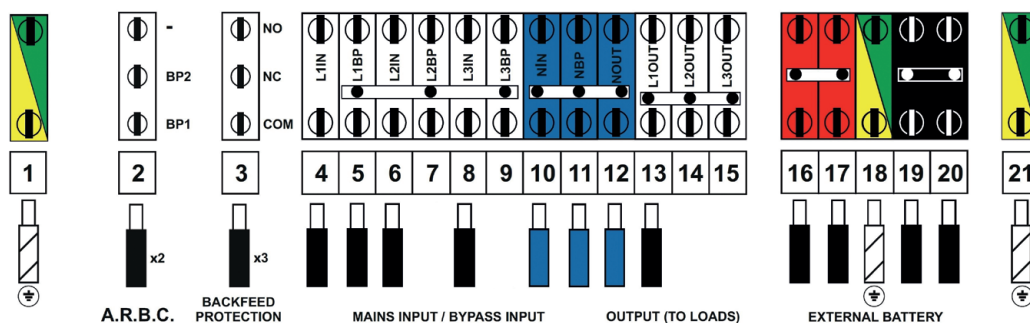
Trimod HE 10 - 15 - 20
with common bypass input line



Trimod HE 10 - 15 - 20
with separated bypass input line



Trimod HE 30 TM
with common bypass input line



Trimod HE 30 TM
with separated bypass input line

5. Installation

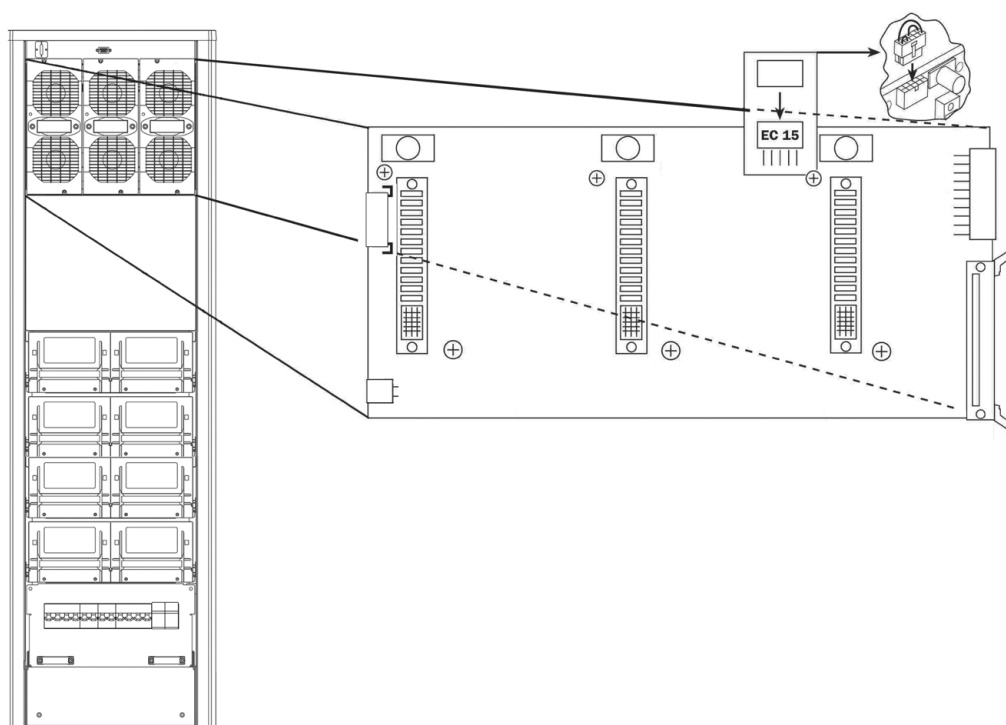


CAUTION

For the configuration with single phase output, it is necessary to insert a special connector provided in the accessory kit in all the back panel boards.

The back panel boards are located in the equipment behind the power modules. In the Trimod HE 10, 15 and 20 models there is just one back panel board. In the Trimod HE 30 kVA TM model there are two back panel boards.

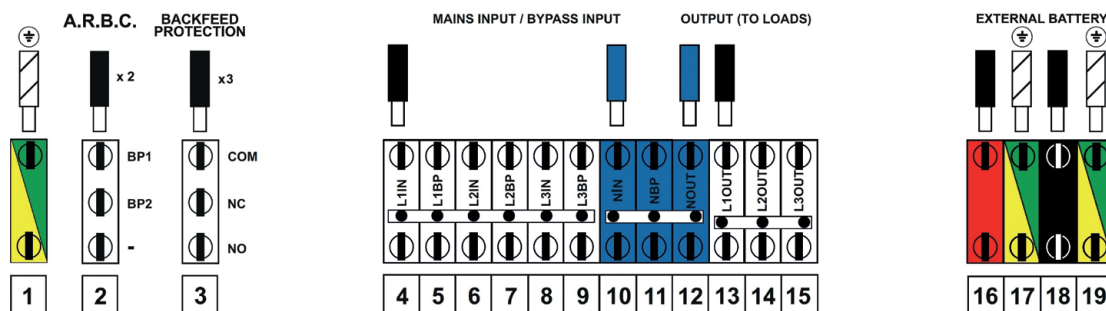
The connector must be inserted in the position indicated by EC 15 serigraphed onto the board as shown in the following figure.



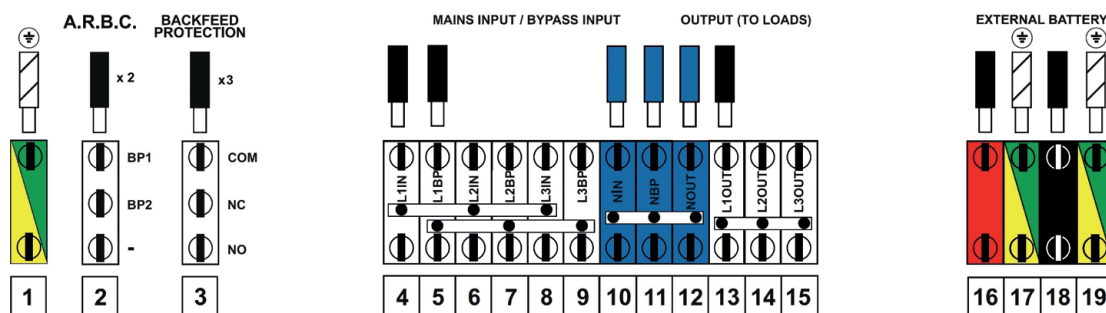
5.3.4 SINGLE PHASE input – SINGLE PHASE output connection

This connection is available only for Trimod HE 10, 15, 20 and 30 TM.

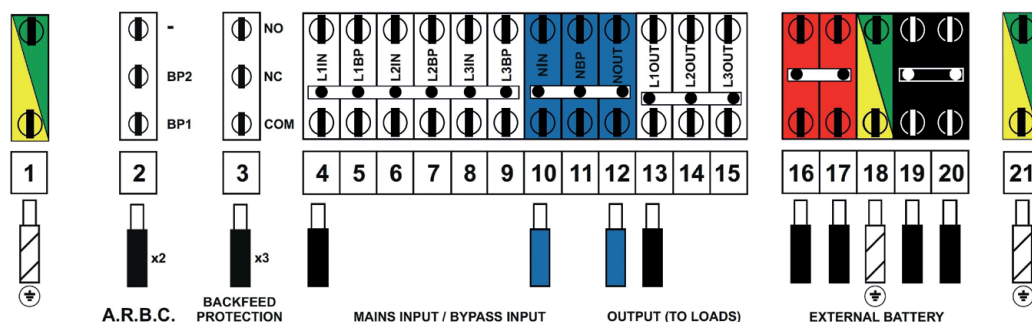
In addition to the wiring shown in the images that follow, it is necessary to configure the functioning mode as shown in chapter 6 "Configuration and Start-up".



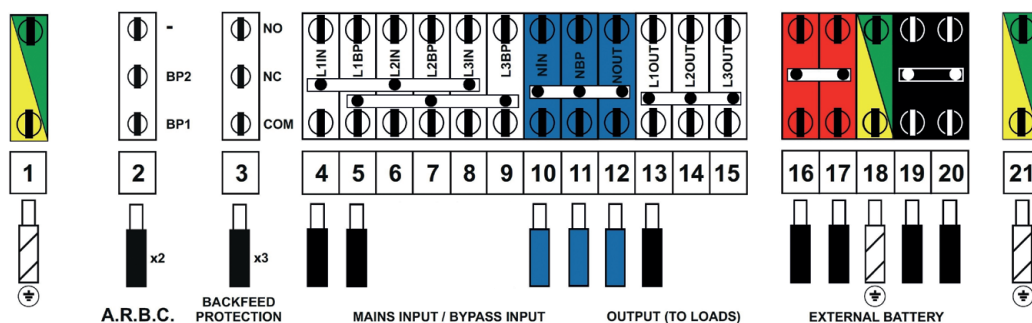
Trimod HE 10 - 15 - 20
with common bypass input line



Trimod HE 10 - 15 - 20
with separated bypass input line



Trimod HE 30 TM
with common bypass input line



Trimod HE 30 TM
with separated bypass input line

5. Installation

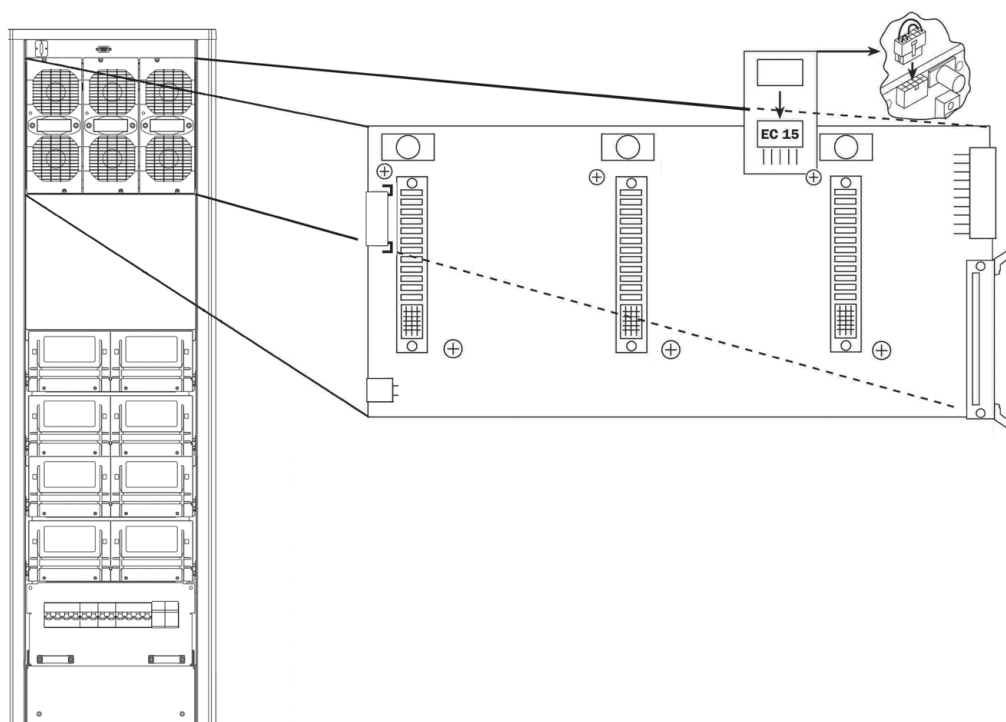


CAUTION

For the configuration with single phase output, it is necessary to insert a special connector provided in the accessory kit in all the back panel boards.

The back panel boards are located in the equipment behind the power modules. In the Trimod HE 10, 15 and 20 models there is just one back panel board. In the Trimod HE 30 TM there are two back panel boards.

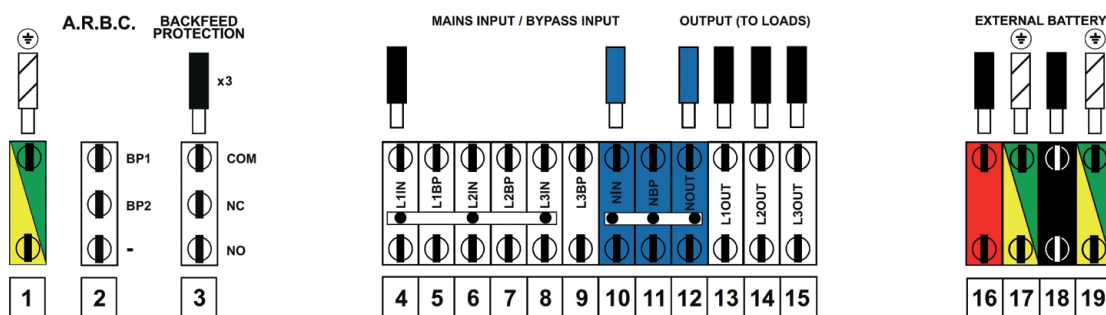
The connector must be inserted in the position indicated by EC 15 serigraphed onto the board as shown in the following figure.



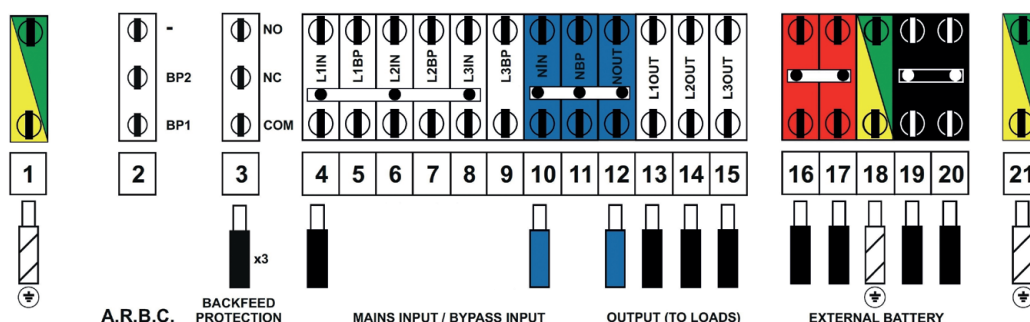
5.3.5 SINGLE PHASE input - THREE PHASE 120° output connection

This connection is available only for Trimod HE 10, 15, 20 and 30 TM.

In addition to the wiring shown in the images that follow, it is necessary to configure the control panel functioning mode as shown in chapter 6 "Configuration and Start-up".



Trimod HE 10 - 15 - 20
(with disabled bypass input line)



Trimod HE 30 TM
(with disabled bypass input line)



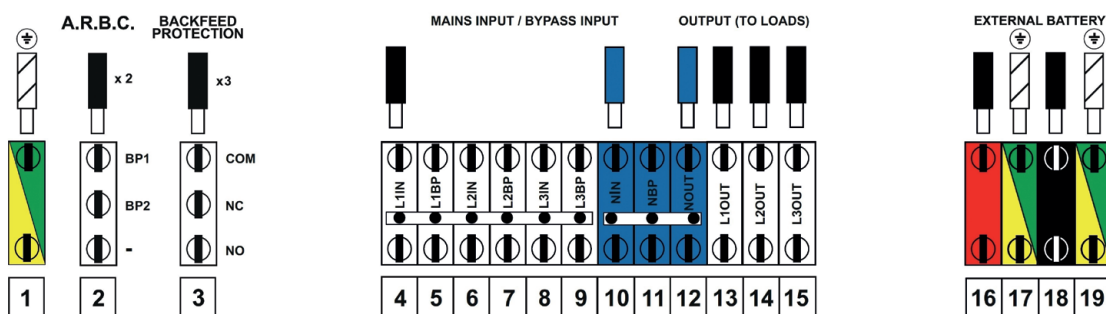
CAUTION

The bypass function is not available for the configuration with single phase input and three phase 120° output. The manual maintenance bypass switch S1 and bypass input line switch S5 must NEVER be activated. For greater safety, it is possible to completely eliminate the manual maintenance bypass by cutting the brown, black and grey cables that connect the relative S1 switch to the output S2 switch and being careful to isolate the wires adequately.

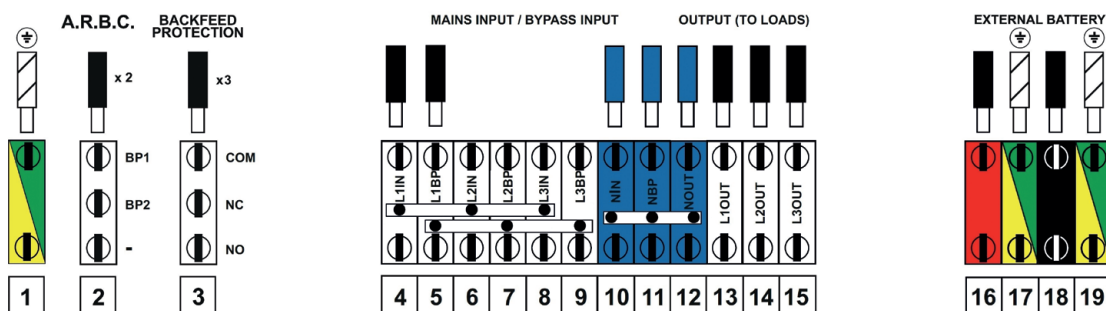
5.3.6 SINGLE PHASE input - THREE INDEPENDENT PHASE output connection

This connection is available only for Trimod HE 10, 15, 20 and 30 TM.

In addition to the wiring shown in the images that follow, it is necessary to configure the functioning mode as shown in chapter 6 "Configuration and Start-up".

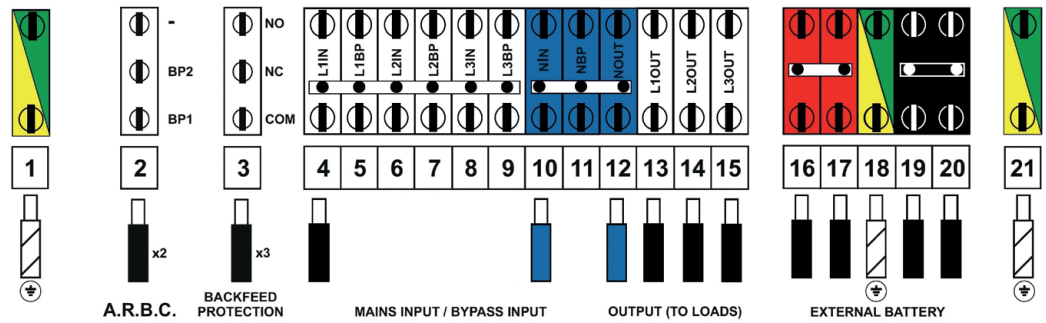


Trimod HE 10 - 15 - 20
with common bypass input line

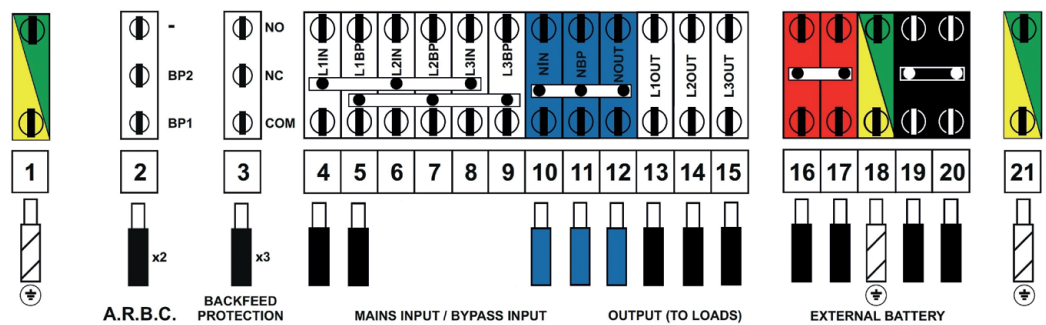


Trimod HE 10 - 15 - 20
with separated bypass input line

5. Installation



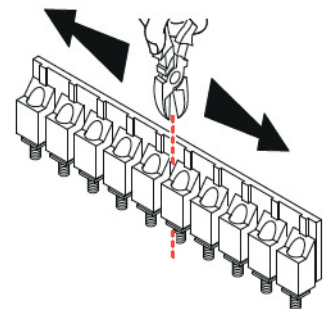
Trimod HE 30 TM
with common bypass input line



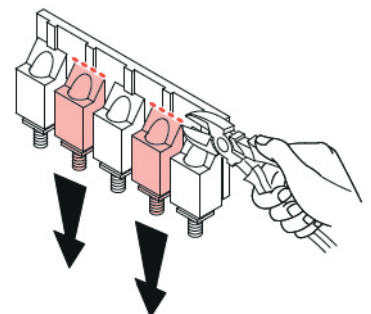
Trimod HE 30 TM
with separated bypass input line

5.3.7 Installation of the connection jumpers

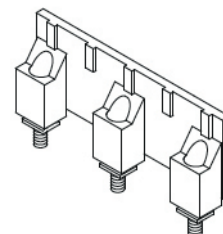
1. Take one of the connection jumpers out of the accessory envelope and cut it so as to make it the requisite length. Check that after the cut there are no burrs that could cause contact with adjacent jumpers.



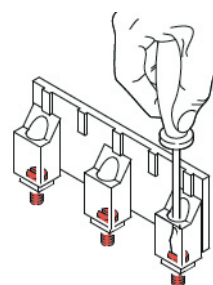
2. Eliminate the vertical connections that are not represented in the connection diagrams.



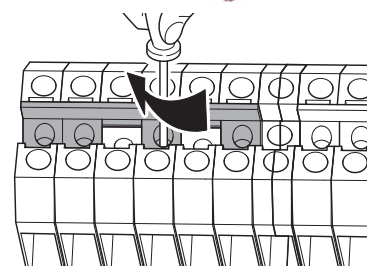
3. Insert the jumper into the terminal strip as shown in the connection diagrams.



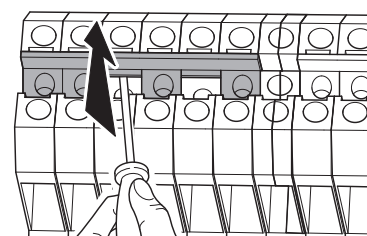
4. Carefully tighten all the screws to the terminal strip.



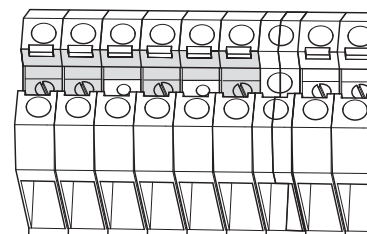
5. Tighten up the terminal strip.



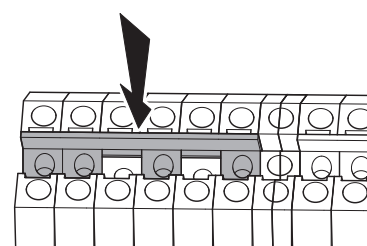
6. Use the screwdriver to extract the yellow plastic part.



7. Check that the screw head abuts properly on the terminals.



8. Reinsert the yellow plastic part.



5. Installation

5.3.8 ARBC (Auxiliary Remote Bypass Contact)

The Trimod HE UPS makes it possible to enable forced bypass mode through a normally open external contact. The external bypass contact terminal is found on the terminal strip and is marked by the letters "A.R.B.C.".

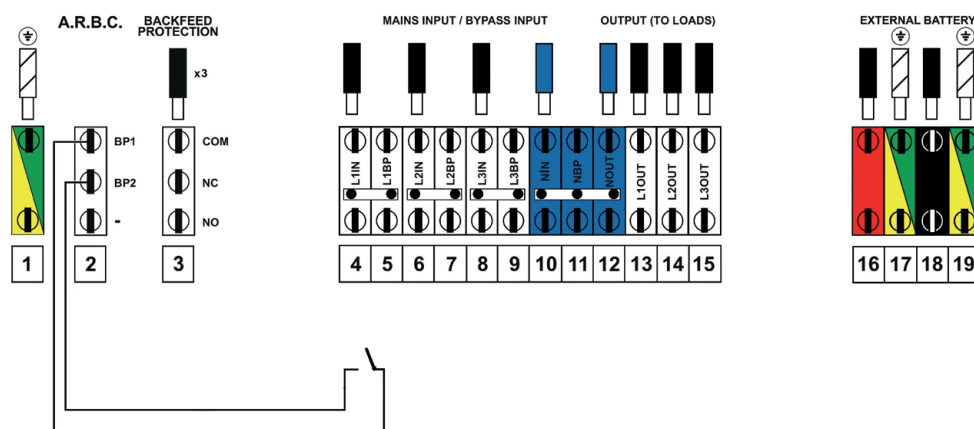
For the correct connection of the external contact, the following requirements must be adhered to:

- use a double-insulation cable of up to 10 meters in length;
- make sure that the switch used is galvanically isolated.

The electric characteristics of the auxiliary remote bypass contact are the following:

- voltage with open contacts: less than 100 V
- current with closed contacts: less than 100 mA

The figure below shows how the external bypass contact connection must be made:



CAUTION

It is not possible to use this contact if the UPS is configured as a single phase input three phase 120° output.

5.4 Insertion of power modules and battery drawers

Once all the electrical connections have been made, close the distribution drawer for the Trimod HE 10, 15, 20, 30 TT models or screw up the lower panels for the Trimod HE 30 TM, 40, 60 and 80 models.

It is then possible to move onto the insertion of the power modules and battery drawers into the UPS (depending on the model) and in the external modular battery units (if there are any).



WARNING

The Trimod HE UPSs have electrical distribution sized for the nominal power of the equipment and must be used exclusively with the power modules provided as shown in the "Mechanical characteristics" table in chapter 12 of this manual.

Do not use power modules that differ from those indicated and do not exchange the modules with each other and/or replace them to vary the power of the UPS.

The model, the nominal power and the type of power module to be installed in the Trimod HE UPS are indicated in the installation and user manuals and on the rating plate inside the door of the UPS.

The type and the nominal power of the power module are indicated on a rating plate at the back of the module.

Insert the power modules one at a time checking that they abut. Fix them to the frame with the two screws provided with each module. Use the SHC M4x20 screws (hex socket head). The two fixing screws also act as the module's earth connection and must both be fixed for safety purposes.

Insert the battery drawers one at a time checking that they abut. For each drawer, tighten all the fixing screws provided. Use SHC M4x20 screws (hex socket head).

In the case of the Trimod HE 30 TT do not insert abutted the drawers and do not screw them up.

5.5 Communication devices

The Trimod HE UPSs have two RS232 serial ports, one relay contacts card, one logic level interface on DB15 socket and one SNMP slot.

The communication interfaces are found in the rear of the UPS. The RS232 serial maintenance port is inside the UPS door, above the first row of power modules.

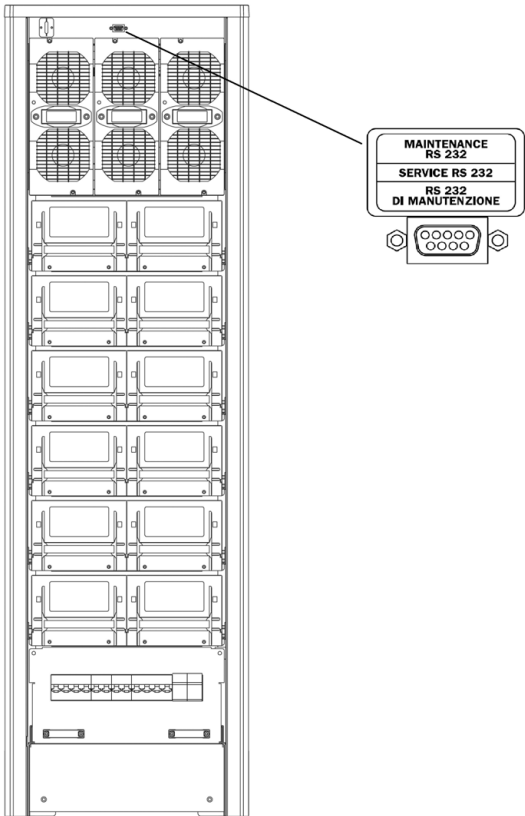


For the operator's safety it is essential the interfaces are connected in such a way that :

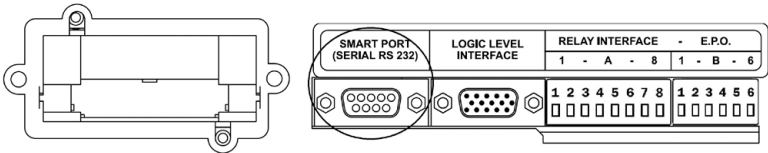
- the maximum voltage between any two wires connected to the interface and between any one of these wires and the earth is less than 42Vpk or less than 60Vdc;
- the isolation voltage between any wire connected to the interface and the earth is at least 1500Vac.

5.5.1 RS232 serial ports

The first of the two RS232 serial ports is called “maintenance RS232” and is found above the first row of power modules, so in a part accessible only to a skilled technician with a key to open the UPS door. The maintenance RS232 is dedicated exclusively to diagnostic functions and to update the equipment firmware.

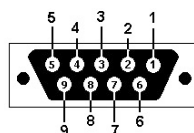


The second serial port called “user interface” is located at the back of the UPS. Through a computer or specific network card this port makes it possible to access a set of data relative to the functioning of the UPS as well as controlling the unmanned shutting down of the operating system.



5. Installation

The pinout of the RS232 interface is the following:



PIN	FUNCTION
2	RX
3	TX
5	GND
1 - 4 - 6	<i>connected together</i>
7 - 8	<i>connected together</i>

5.5.2 Relay interface

The contacts of the relay interface are programmed in default mode as normally open (NO) but can be configured as normally closed (NC) from the control panel.

The contacts are located on the back of the UPS and are available through 8 and 6 pole connectors.

The notifications available through this interface are:

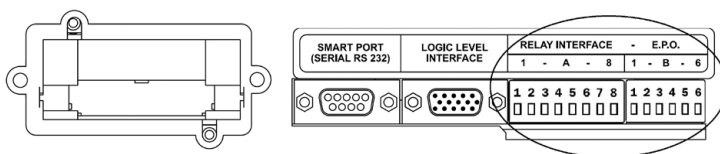
- battery mode functioning
- autonomy reserve
- generic alarm
- overload
- UPS in bypass mode

The electric characteristics of the relay interface are the following:

- $V_{MAX} = 250 \text{ Vac} / 30 \text{ Vdc}$.

- $I_{MAX} = 5 \text{ A}$.

The pinout of the contact interface is described below:



PIN	CONNECTOR A
	FUNCTION
1 - 2	Contact 1: default: battery mode functioning
3 - 4	Contact 2: default: autonomy reserve
5 - 6	Contact 3: default: generic alarm
7 - 8	Contact 4: default: overload

PIN	CONNECTOR B
	FUNCTION
1 - 2	Contact 5: default: UPS in bypass mode
3 - 4	EPO (see section 5.5.3)
5 - 6	-

5.5.3 Emergency Power Off (EPO)

The UPS has an external normally closed contact that can be opened to activate the immediate stop of the equipment. The EPO terminal is at the back of the UPS on pins 3 and 4 of the 6-pole connector on the relay interface:

For the correct connection of the EPO, the following requirements must be adhered to:

- use a double-insulation cable of up to 10 meters in length;
- check that the switch used is galvanically isolated.

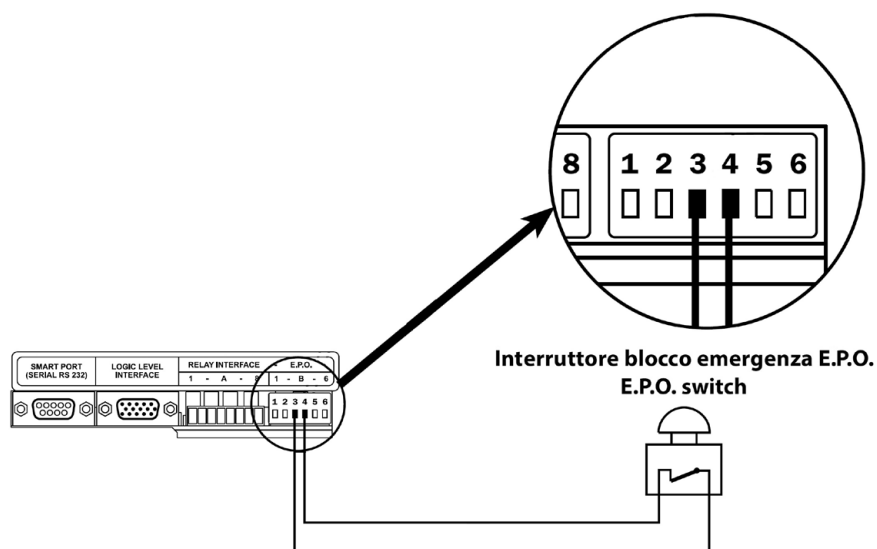
INDICATION

It is not possible to connect the EPO circuits of different UPSs in parallel. If necessary, use contacts on the EPO emergency pushbutton isolated from each other.

The electric characteristics of the EPO interface are:

- voltage between terminals 3 and 4 (6-pole connectors) with open circuit: 12Vdc.
- current between terminals 3 and 4 (6-pole connectors) with closed circuit: 5mA.

The figure below shows how the EPO connection must be made:

**5.5.4 Logic level interface**

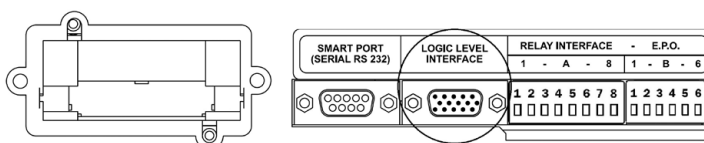
The logic level interface is available on connector DB15 at the back of the UPS and makes it possible to connect the UPS in remote control mode with the aim of monitoring its functioning status. The following control signals are available:

- mains/battery functioning
- autonomy reserve
- UPS Fault
- Overload
- UPS in bypass mode
- ON/OFF input

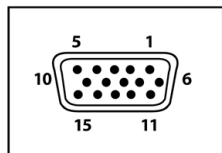
The electric characteristics of the logic level interface are the following

- Logical output: $V_{MAX} = 12 \text{ Vdc}$, impedance on output $2,2 \text{ k}\Omega$ in series
- Power supply: 12 Vdc , $I_{MAX} = 700 \text{ mA}$ - not regulated
- Open collector outputs: 30 Vdc , $I_{MAX} = 100 \text{ mA}$.

The pinout of the interface is described below:

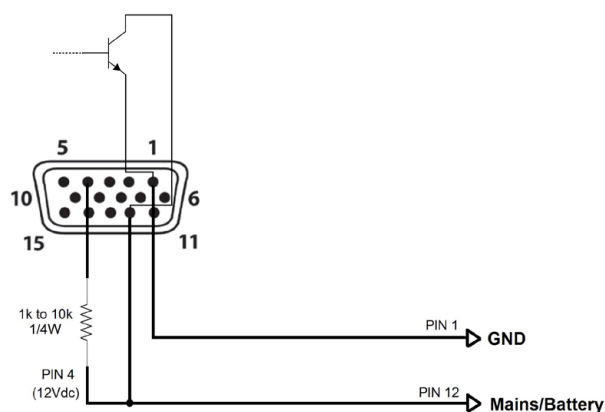


5. Installation

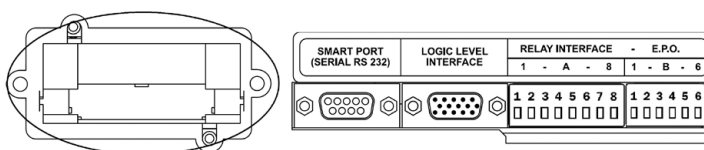


PIN	FUNCTION
1	GND
2	Mains / Battery (output, active high)
3	Autonomy reserve (output, active high)
4	Power supply
7	Overload (open collector, active low)
12	UPS in battery mode (open collector, active low)
13	UPS in bypass mode (open collector, active low)
14	Autonomy reserve (open collector, active low)
15	Overload (open collector, active low)
5 - 6 - 8 - 9 - 10 - 11	<i>do not connect</i>

An example of how the open collector outputs can be used is given below.



5.5.5 Network card (SNMP) slot



At the back of the UPS Trimod HE there is a slot for the SNMP card (optional).

The current taken from the SNMP slot for the functioning of the network card must be in total less than 700mA.

6. Configuration and Start-up



DANGER

All the configurations and start-up operations may only be done by a SKILLED TECHNICIAN (section 2.2.1)

6.1 Introduction

This chapter contains all the information necessary for a correct configuration of the Trimod HE UPS and for its subsequent startup.

The factory configuration provides for THREE PHASE INPUT and 120° THREE PHASE OUTPUT.

6.2 Input configuration

The Trimod HE UPS automatically recognises the voltage, frequency and number of phases on input if the electrical connection on the terminal strip is modified.



CAUTION

Make sure the neutral wire is always connected.

6.3 Output configuration

The Trimod HE UPS does not automatically recognise the electrical configuration on the output terminal strip. For this reason it is always necessary to select the type of voltage on output depending on the applied load from the control panel

The default configuration for the Trimod HE UPS is 120° three phase 400 Vac.

The UPS can also be configured to obtain a unique single phase 230 Vac output in the 10 kVA, 15 kVA, 20 kVA and 30 kVA TM models.

If the UPS is configured with three phase output, it is possible to select the management of the three phase as follows :

- THREE PHASES 120°: this is the default setup and is usually used if three phase loads are applied on the UPS output (e.g. three phase electrical motors) or if there are both three phase and single phase loads powered by the UPS. In this case the UPS manages the three output phases protecting the three phase load. For example, if an excessive load is applied to one of the three output lines, the automatic bypass switches all three lines on output.
- THREE SINGLE PHASE OUTPUTS: this setup is necessary if three single phase lines have been created with the common neutral on the UPS output. In this case, the UPS manages the three outputs completely independently of each other. For example, if an excessive load is applied to one of the three output lines, the bypass only cuts in on the overloaded line while the power supply continues to be guaranteed on the other two by the UPS. If the input is single phase, the three lines are not in phase but rather with a phase shift of 120° and therefore cannot be connected in parallel. If the input is three phase, the outputs are in phase and the possibility of using the bypass is guaranteed.

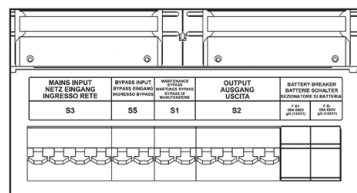
For the correct selection of the output configuration from the control panel, follow the instructions given in section 6.5.

6.4 Pre-start-up checks

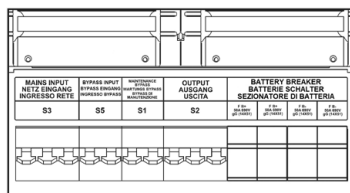
Before powering the equipment, carry out the following checks:

1. Check that the mains input switch S3 of the UPS is open (OFF position).
2. Check that the bypass input switch S5 of the UPS is open (OFF position).
3. Check that the battery fuse breakers of the UPS FB+ AND FB- (if the model includes them) and those inside the Trimod HE BATTERY (if present) are open (OFF position).
In the case of Trimod HE 30TT in which the fuse breakers are installed in the terminal strip, check that all the battery drawers are not installed abutting and thus the string of batteries is interrupted.
4. Check that the maintenance bypass switch S1 and the output switch S2 of the UPS are open (OFF position)
5. Check that the wiring on input and output has been done and that all the connections have been tightened up properly.
6. Check the correct phase sequence of the mains input and bypass line (if separate).
7. Check that the parameters (voltage and frequency) of the mains input are compatible with those shown on the UPS rating plate.
8. Check that all the power modules are inserted properly and that the fixing screws of the power modules are present and screwed up to abut the relative slots (use SHC M4x20 screws with hex socket head)
9. Check that all the battery drawers, if present, are inserted properly and that the fixing screws of the power modules are present and all the fixing screws are screwed up to abut (use SHC M4x20 screws with hex socket head)
In the case of the Trimod HE 30 TT, push the battery drawers one at a time to abut and screw them up with the fixing screws.

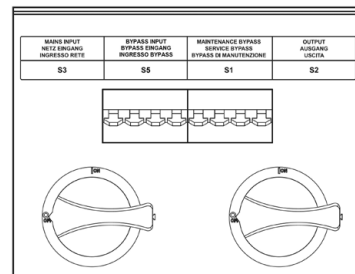
6. Configuration and Start-up



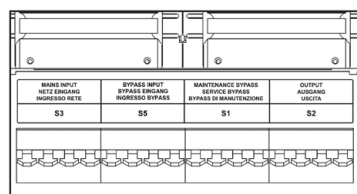
Trimod HE 10



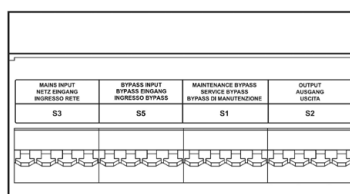
Trimod HE 15-20



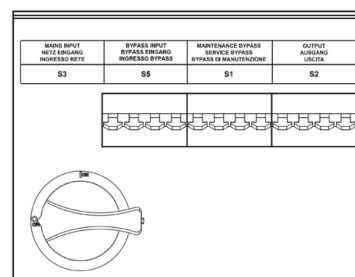
Trimod HE 30 TM



Trimod HE 30 TT



Trimod HE 40-60



Trimod HE 80

6.5 Start-up procedure

1. Insert the battery fuses into the appropriate fuse isolator switches of the Trimod HE UPS if the model includes them and inside the external Trimod HE BATTERY (if present).
2. Close the battery fuse isolator switches of the UPS and Trimod HE BATTERY FB+ e FB- (if present).



INDICATION

Before turning on the UPS it is necessary to select the right output configuration (Single phase/Three Phases 120° / Three independent phases). In order to do so, the rest of the procedure must be applied.

3. With the UPS off, press the ENTER key on the control panel and keep it held down until the text "Language" appears. Using the ARROW UP and ARROW DOWN keys, select the language you require and confirm your choice with ENTER.
4. Then press the ESC key to leave the Language page. The text "Service Mode" appears on the display. For further information about "service mode" and how the control panel works, consult chapter 7.



CAUTION

Trimod HE is able to recognise the presence of non aligned firmware among the power modules and therefore prevent the start-up.

In Service Mode the status indicator flashes orange rapidly and the texts "Service Mode" and "PM FW not updated!" alternate.

Follow the path **Power Modules → PM SW update** to update the power module firmware (see section 7.4.3) It is possible to choose **Update all PM** to check and if necessary update all the power modules, while with the option **Single PM SW update** you can select the specific power module to update.

5. Press the ENTER key to enter the menu. Using the ARROW UP and ARROW DOWN keys, it is possible to move the selection on the display; the ENTER key is used to confirm the choice and the ESC key is used to cancel the choice.

Follow this path: **UPS Setup → Output → Inverter**

Select "Three Phases 120°" / "Three Phases indep." / "Single Phase" in accordance with the type of load and distribution downline of the UPS.

**CAUTION**

The inverter output configuration must correspond with the configuration set on the output terminal strip during the installation.

Wrong connections or incorrect output configurations may cause injury and/or damage.

6. Follow the path **UPS Setup -> Output -> Voltage and UPS Setup -> Output -> Frequency** to check that the voltage and the frequency of the set outputs are the ones required.
7. Follow the path **UPS Setup -> Batteries -> Total KB** to select the correct number of KB (Battery Kits) installed.

INDICATION

1 KB (Battery Kit) represents a string of 20 batteries in series.

In the case of models with internal battery drawers and external modular battery units, 1 KB comprises 4 battery drawers. It is necessary to install 1 KB every 10 kVA of nominal UPS power in the case of modular units with battery drawers.

For example, for the Trimod HE 40 it is necessary to have at least one external modular battery unit with 4 KB (16 battery drawers).

In the case of non-modular 94h external battery units, each unit represents 1 KB.

In this case, 1 KB is sufficient for all the Trimod HE models.

8. Follow this path: **UPS Setup -> Batteries -> Capacity** to select the correct value of the capacity in Ah of the individual KB.

INDICATION

The UPS calculates the total battery capacity as produced by the total KB * Capacity.

9. Leave the Service Mode pressing the ON/OFF key.
10. Provide the power supply to the UPS and close the UPS mains input switch S3 and bypass input switch S5 (ON position).

INDICATION

If the "Standby Charge" is enabled, when the UPS is powered a battery charge cycle is started automatically. Press the ESC key to interrupt the standby charge and proceed with the power up of the UPS Trimod HE as described below.

11. Press the ON/OFF key to start up the UPS. When the display shows the text "<ENTER> to confirm UPS turn ON", press the ENTER key.

**CAUTION**

If the firmware of the power modules is out of alignment, the status indicator flashes red rapidly and the display shows the text "Invalid PM SW: ⏮ to execute update".

Press the ENTER key to update the modules and complete the start up phase. Press the ESC key to interrupt the update and start-up procedures.

If no operation is carried out within 30 seconds, the UPS turns off.

12. Wait for the backlit status indicator on the control panel to show a steady green light.
13. Check that the output voltage and frequency values set correspond with the requirements of the applied load. If this is not the case, insert the values necessary (Chapter 7)
14. Close the output disconnect switch S2 (position ON) of the UPS. At this point, the load is powered by the UPS.
15. Close the UPS door and remove the key.

INDICATION

If, during the installation phase, it is necessary to check the proper functioning of the UPS in stored energy mode, remove the mains voltage by means of the switch placed upstream of the UPS.

**CAUTION**

Do not remove the power modules during the functioning of the UPS without first having activated the proper hot-swap procedure (described in section 9.4). The removal of one or more power modules without the proper use of the hot-swap procedure could damage the equipment.

6. Configuration and Start-up



CAUTION

The keys for opening the UPS door must not be left at the operator's disposal.



WARNING

The installation and maintenance manual and the quickstart sheet must not be left at the disposal of the operator.

6.6 ECO MODE setup

The UPS Trimod HE has a functioning mode called "eco mode", in which the load is supplied directly from the electrical mains through the automatic bypass circuit inside the power modules.

If the output voltage leaves the window of tolerance (-20% / +15% of the voltage set on output) or it is no longer available, the UPS actuates its inverter stage and supplies the load with energy stored in the batteries.

When the input mains are back within the tolerance values, the UPS is automatically taken back to the "eco mode". It is possible to change the functioning mode between on-line and off-line mode (and vice versa) both with UPS on and with the UPS off (through the "Service Mode" function menu).

To activate the "eco mode", enter the main menu and follow this path:

UPS Setup → Bypass → Off-line Mode. Select "Enabled" and press ENTER to confirm the choice.

To return to the "on-line" mode, enter the main menu and follow this path:

UPS Setup → Bypass → Off-line Mode. Select "Disabled" and press ENTER to confirm the choice.

INDICATION

If the load needs to be supplied with a voltage without disturbances or with a voltage regulated in amplitude and/or frequency it is necessary to use the UPS Trimod HE in double conversion on-line mode.

6.7 EMERGENCY POWER SYSTEM (EPS) MODE setup

The Trimod HE UPS has an "emergency power system" functioning mode that is useful for example to power an emergency lighting system.

When there is input from the mains, the UPS output is disabled. If the mains input is missing, the output is supplied by the UPS functioning with batteries.

It is possible to enable or disable the "EPS" function only in "Service Mode" (therefore with the UPS off).

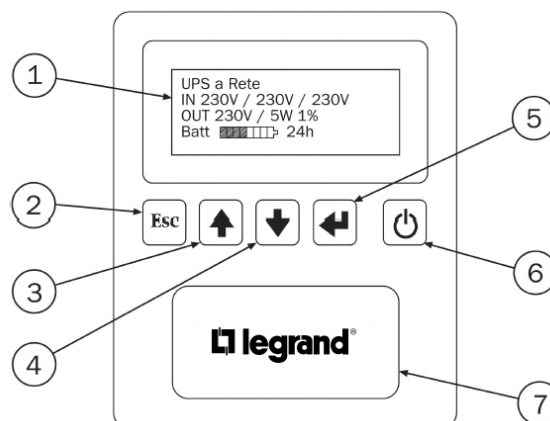
The path to follow is the following:

UPS Setup-> Options-> EPS mode. Select "Enabled" or "Disabled" and press ENTER to confirm the choice.

7. Control panel

7.1 Description

The control panel is in the front part of the UPS and consists of an LCD display with 4 x 20 character rows, a backlit multicolour status indicator and a five keys keyboard.



LEGEND

1 - 4 x 20 character row LCD display

2 - ESCAPE key

Main functions:

- leaving a function without changing it;
- passage from a lower to higher menu level;
- leaving the main menu and return to the status display;
- silencing of the beeper.

3 - ARROW UP key

Main functions:

- selecting a prior function;
- increasing the value within a function;
- selecting a new item within a function (e.g. from DISABLED to ENABLED);
- scrolling a menu with more than 4 lines;
- changing the page of the main screen.

4 - ARROW DOWN key

Main functions:

- selects a subsequent function;
- decreases the value within a function;
- selects a new item within a function (e.g. from ENABLED to DISABLED);
- scrolls through a menu with more than 4 lines;
- changes the page of the main screen.

5 - ENTER key

Main functions:

- confirms a value;
- accesses a menu item;
- passes from a higher to a lower menu level;
- allows access to the service mode.

6 - ON/OFF key

Main functions:

- it enables to turn the UPS on and off;
- it enables hot-swap operation of the power modules;
- it makes it possible to shut down the output phases individually (only with UPS set on the output with 3 independent phases).

7 - multicolour backlit status indicator

7. Control panel

7.2 Service Mode

This is the functioning mode necessary to make the setup during installation and to manage the software updating of command boards and power modules.

To access this mode, press the ENTER key with the the UPS off until the display shows the text "Service Mode..." At the end of the start up procedure, press the ENTER key to enter the navigation menu.

It is possible to choose one of the following languages for the text displayed: Italian, English, German, French, Russian, Spanish, Polish and Portuguese. Follow the path: **UPS Setup → Operator panel → Language** and press the ENTER key to confirm the choice.

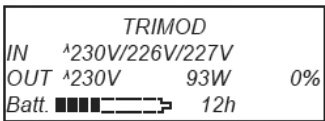
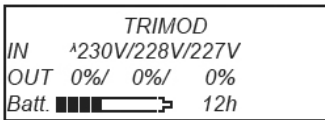
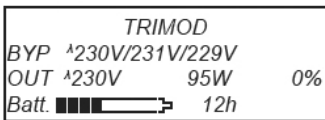
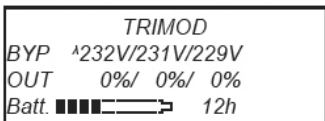
Press the ON/OFF key to leave this mode. Alternatively, the UPS turns off automatically after 20 minutes of not receiving manual or serial commands.

7.3 Main screen

The main screen is shown on the display during UPS operation.

Using the ARROW UP and ARROW DOWN keys it is possible to scroll through the different pages. Every page gives several information about the status of the UPS.

The pictures of the different pages of the main screen are shown below:

MAIN PAGE	DATA DISPLAYED
1 input - output - battery 	1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly 2nd line: Input voltages 3rd line: Voltage set on output, active power absorbed by the load and total percentage of the load applied. 4th line: Bar showing remaining battery capacity and the actual time of functioning in case of a power failure.
2 input - percentage output - battery 	1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly 2nd line: Input voltages 3rd line: Percentage of the loads on the output phases 4th line: Bar showing remaining battery capacity and the actual time of functioning in case of a power failure.
3 bypass - output - battery 	1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly 2nd line: Bypass voltages 3rd line: Voltage set on output, active power absorbed by the load and total percentage of the load applied. 4th line: Bar showing remaining battery capacity and the actual time of functioning in case of a power failure.
4 bypass - percentage output - battery 	1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly 2nd line: Bypass voltages 3rd line: Percentage of the loads on the output phases 4th line: Bar showing remaining battery capacity and the actual time of functioning in case of a power failure.

MAIN PAGE	DATA DISPLAYED																
<div>5 load availability on output</div> <div><table><tr><td colspan="4">TRIMOD</td></tr><tr><td>L1o</td><td>0.4/</td><td>40kVA</td><td>1%</td></tr><tr><td>L2o</td><td>0.5/</td><td>40kVA</td><td>1%</td></tr><tr><td>L3o</td><td>0.5/</td><td>40kVA</td><td>1%</td></tr></table></div>	TRIMOD				L1o	0.4/	40kVA	1%	L2o	0.5/	40kVA	1%	L3o	0.5/	40kVA	1%	<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: Phase L1 - power in kVA or in Watt compared with the nominal power or current compared with the nominal or relative percentage</div> <div>3rd line: Phase L2 - power in kVA or in Watt compared with the nominal power or current compared with the nominal or relative percentage</div> <div>4th line: Phase L3 - power in kVA or in Watt compared with the nominal power or current compared with the nominal or relative percentage</div>
TRIMOD																	
L1o	0.4/	40kVA	1%														
L2o	0.5/	40kVA	1%														
L3o	0.5/	40kVA	1%														
<div>6 measurements on output</div> <div><table><tr><td colspan="3">TRIMOD</td></tr><tr><td>L1o231V</td><td>1.7A</td><td>27W</td></tr><tr><td>L2o229V</td><td>1.6A</td><td>31W</td></tr><tr><td>L3o231V</td><td>1.9A</td><td>29W</td></tr></table></div>	TRIMOD			L1o231V	1.7A	27W	L2o229V	1.6A	31W	L3o231V	1.9A	29W	<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: Phase 1 on output - Voltage, current and active power</div> <div>3rd line: Phase 2 on output - Voltage, current and active power</div> <div>4th line: Phase 3 on output - Voltage, current and active power</div>				
TRIMOD																	
L1o231V	1.7A	27W															
L2o229V	1.6A	31W															
L3o231V	1.9A	29W															
<div>7 output line voltages</div> <div><table><tr><td colspan="2">TRIMOD</td></tr><tr><td>L1o-L2o</td><td>△ 400V</td></tr><tr><td>L2o-L3o</td><td>△ 399V</td></tr><tr><td>L3o-L1o</td><td>△ 396V</td></tr></table></div>	TRIMOD		L1o-L2o	△ 400V	L2o-L3o	△ 399V	L3o-L1o	△ 396V	<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: line voltage between phase L1 and L2 on output</div> <div>3rd line: line voltage between phase L2 and L3 on output</div> <div>4th line: line voltage between phase L3 and L1 on output</div>								
TRIMOD																	
L1o-L2o	△ 400V																
L2o-L3o	△ 399V																
L3o-L1o	△ 396V																
<div>8 measurement on input</div> <div><table><tr><td colspan="3">TRIMOD</td></tr><tr><td>L1i229V</td><td>3.4A</td><td>408W</td></tr><tr><td>L2i228V</td><td>2.9A</td><td>162W</td></tr><tr><td>L3i230V</td><td>2.6A</td><td>228W</td></tr></table></div>	TRIMOD			L1i229V	3.4A	408W	L2i228V	2.9A	162W	L3i230V	2.6A	228W	<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: Phase 1 on input - Voltage, current and active power</div> <div>3rd line: Phase 2 on input - Voltage, current and active power</div> <div>4th line: Phase 3 on input - Voltage, current and active power</div>				
TRIMOD																	
L1i229V	3.4A	408W															
L2i228V	2.9A	162W															
L3i230V	2.6A	228W															
<div>9 bypass line voltages</div> <div><table><tr><td colspan="2">TRIMOD</td></tr><tr><td>L1b-L2b</td><td>△ 401V</td></tr><tr><td>L2b-L3b</td><td>△ 402V</td></tr><tr><td>L3b-L1b</td><td>△ 400V</td></tr></table></div>	TRIMOD		L1b-L2b	△ 401V	L2b-L3b	△ 402V	L3b-L1b	△ 400V	<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: Line voltage between L1 and L2 of bypass line</div> <div>3rd line: Line voltage between L2 and L3 of bypass line</div> <div>4th line: Line voltage between L3 and L1 of bypass line</div>								
TRIMOD																	
L1b-L2b	△ 401V																
L2b-L3b	△ 402V																
L3b-L1b	△ 400V																
<div>10 battery status</div> <div><table><tr><td colspan="4">TRIMOD</td></tr><tr><td>Batt.</td><td>^288V</td><td>-0,3A</td><td></td></tr><tr><td>C 50%</td><td>R 12h</td><td>T 24h</td><td></td></tr><tr><td>Charging</td><td colspan="3">- maint.</td></tr></table></div>	TRIMOD				Batt.	^288V	-0,3A		C 50%	R 12h	T 24h		Charging	- maint.			<div>1st line: Functioning status of the UPS; if the text is "TRIMOD", the UPS is functioning properly</div> <div>2nd line: Voltage, charging current (negative value with charging in progress, positive value when the batteries are powering the equipment)</div> <div>3rd line: Battery capacity percentage compared with the nominal percentage, time remaining, total autonomy time</div> <div>4th line: Battery status<ul style="list-style-type: none">- Battery Stand-by: Batteries stand-by- Discharging: Batteries discharging- Reserve autonomy: Reserve autonomy- End autonomy: End autonomy, UPS Off- Charging - ph1 - battery recharging status (current limitation)- Charging - ph2 - battery recharging status (voltage limitation)- Charging - maint: Battery recharging in maintenance- Testing batteries: Testing batteries in progress- Equaliz. batteries: Batteries equalizing in progress- BATTERY FAULT: Battery fault- MaxTime on Battery: end of the maxium time in battery mode, UPS shutting down</div>
TRIMOD																	
Batt.	^288V	-0,3A															
C 50%	R 12h	T 24h															
Charging	- maint.																

7. Control panel

7.4 Main menu and submenu

Press the ENTER key on the main screen of the display to access the menu of the UPS.

The main screen has the following items:

- UPS STATUS: allows the UPS status to be checked in real time
- UPS SETUP: allows all the UPS functions to be set
- POWER MODULES: allows the status of the individual power modules to be analysed in real time
- EVENTS: allows the events memorized in the UPS history to be displayed
- TOOLS: allows a series of functional tests to be carried out on the UPS
- LOG OUT: allows the password-protected session to be terminated

Press the ENTER key to access the relative submenus.

The following table sums up all the menu and submenu pages:

UPS STATUS (section 7.4.1)	UPS SETUP (section 7.4.2)	POWER MODULES (section 7.4.3)	EVENTS (section 7.4.4)	TOOLS (section 7.4.5)	LOG OUT (o) (section 7.4.6)
UPS Info	Options	PM Status	Log View	Battery	-
UPS Cfg	Output	Diagnostics (*)		Signalling test (*)	
Measures	Input	PM SW Update (*)		LCD Display Test (*)	
Alarms	Bypass			Assistance	
History Data	Batteries			CM errors recovery	
	Operator Panel				
	Clock Setup				
	Dry contacts				

(*) Only available in "Service Mode"

(o) Available in password-protected session

The UPS has a menu and relative submenu tree structure the functions of which are explained in the sections below. On the right of the display, an arrow appears turned downwards or upwards when there are further items to display. Press the ARROW UP and ARROW DOWN keys to display.

7.4.1 UPS Status

UPS Info	Model	Equipment model (Trimod)
	SYNC. address	Synchronisation address of the command board
	Number of CM	Number of command boards recognised
	Max VA	Maximum apparent power[kVA]
	Max W	Maximum active power [kW]
	Max Ichg	Maximum current available to charge the batteries [A]
	SW Ver.	Firmware version of the command board
	PM SW Ver.	Firmware version of the power modules
	Boot Ver.	Bootloader version in the command board
	S/N	UPS serial number

UPS Cfg	OUT	Single Phase/ Three Phases 120° / Three Phases indep.
	IN	Single Phase / Three Phases / inv.3 phases / Undefined (_ _)
	BYP	Single Phase / Three Phases / inv.3 phases / Undefined (_ _)
	X/Y - X/Y - X/Y	X Power modules spread for phases managed by the command board Y Power modules spread for phases managed by the UPS
	Number BCM	Number of battery charger modules recognised
	Installed KB	Number of KB installed
	Batt. Cap.	Capacity of the batteries installed [Ah]
	Batt.N per KB	Number of batteries in series in one KB

Measures	Output X	Power	Output active power on phase X [W]
		Appar. Power	Output apparent power on phase X [VA]
		Vrms	Output effective voltage on phase X [V RMS]
		Vrms ph-ph	Output effective line voltage [VRMS]
		Irms	Output effective current on phase X [A RMS]
		Peak Current	Output peak current of phase X [A]
		Frequency	Pure sine output voltage frequency on phase X [Hz]
		I Crest factor	Crest factor for phase X
		Power fact.	Power factor of the load connected to the UPS on phase X
		Max W	Maximum active power on phase X [W]
		Power	Output active power on phase X, expressed as a percentage in relation to the maximum active power available on phase X [%]
		Max VA	Maximum apparent power on phase X [W]
		Appar. Power	Output apparent power on phase X, expressed as a percentage in relation to the maximum apparent power available on phase X [%]

INDICATION

To vary the value of X and therefore vary the phase from which the data is read, press the ENTER key after entering the submenu.

7. Control panel

Measurements	Input X	Power	Absorbed input active power on phase X [W]
		Appar. Power	Absorbed input apparent power on phase X [W]
		Vrms	Effective input voltage of phase X [V RMS]
		Vrms bypass	Effective input voltage of phase X of bypass line of the UPS [V RMS]
		Vrms ph-ph	Effective input line voltage [V RMS]
		Irms	Effective input current absorbed on phase X [A RMS]
		Peak Current	Input peak current of phase X [A]
		Frequency	Pure sine input voltage frequency on phase X [Hz]
		I Crest Factor	Crest factor for phase X
		Power Fact.	Power factor of the load connected to the UPS on phase X

INDICATION

To vary the value of X and therefore vary the phase from which the data is read, press the ENTER key after entering the submenu.

Measures	Batteries	Voltage	Batteries voltage [V]
		Current	Current supplied by the batteries (negative if the batteries are charging) [A]
		Residual Cap.	Battery charge status, expressed as percentage [0-100%]
		(Status)	Battery charge operating status: - Battery Stand-by: - Discharging - Reserve autonomy - End autonomy - Charging - ph1 - Charging - ph2 - Charging - maint. - Testing batteries - Equaliz. batteries - BATTERY FAULT - MaxTime on Battery
		Total Auton.	Total autonomy the UPS would have with batteries 100% charged
		Resid.Auton.	Residual autonomy of the UPS
		V Res.Th.	Threshold voltage of the string of batteries for autonomy end [V]
		Disch.Count	Total number of complete battery discharges
		Usage	Total number of hours in which the UPS has functioned in battery mode [h]
		Cal.	Day and time on which the last calibration was carried out. The text "Factory" is displayed if no calibration has yet been made.
		Calibr.count	Total number of calibrations made

Measures	Misc.	Int.Temp	Temperature inside the UPS [°C]
		Pos.H.V.Bus	Voltage on DC BUS, positive [V]
		Neg.H.V.Bus	Voltage on DC BUS, negative [V]

Alarms	Alarm Log. See chapter 8.
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INDICATION

To scroll through the list of alarms, press the ARROW UP and ARROW DOWN keys.

History Data	UPS RunTime	Total UPS runtime
	OnBatteryTime	Total UPS untime on battery mode
	This Batt.	Total UPS runtime with the batteries currently installed
	CHG Runtime	Total battery charger runtime
	DrainedOut N.	Total number of complete battery discharges
	Booster Int.	Total number of booster interventions
	BypassInterv.	Total number of bypass interventions
	Batt.calibr.	Total number of battery calibrations
	Chg.cycle N.	Total number of battery equalization calibrations
	Replace batt.N.	The total number of times the batteries have been replaced
	Load>80% N	The total number of times the load has exceeded 80% of the nominal load
	Load>80% T	The total time the load has exceeded 80% of the nominal load
	Load>100% N	The total number of times the load has exceeded 100% of the nominal load
	Load>100% T	The total time the load has exceeded 100% of the nominal load without the overload being signalled

7.4.2 UPS Setup

Options	Startup on Battery	If enabled, it allows the UPS to be started up in the absence of mains supply
	Auto Restart	If enabled, automatic restarts are permitted
	EPS mode (*)	If enabled, the UPS functions in EPS mode When the mains supply is present, the output is not powered. When the mains supply is absent, the output is powered.

(*) Only available in "Service Mode"

7. Control panel

Output	Voltage	This sets the output voltage value [V]	
	Frequency	Nominal Value (*)	This makes it possible to set the output frequency value (50 Hz or 60 Hz) independently of the input frequency.
		Auto Selection	If enabled, the UPS detects the frequency of the input voltage and synchronises the output to the same value. If disabled, the UPS uses the "Nominal Value".
	Inverter (*)	This sets the output configuration and the applied load: - Single Phase: a unique single phase output - Three Phases 120°: three phase output suited to the supply of three phase loads (e.g. a motor) - Three Phases indep.: three single phase output lines that are independent of each other	
	Phases in startup (**)	L1 phase	This makes it possible to program the UPS startup status for each output: - Always ON: phase always on on start up - Always OFF: phase always off on start up - Last state: phase restored to the status prior to the shut down
		L2 phase	
		L3 phase	

(*) Only available in "Service Mode"

(**) Only available with the inverter set up as three phases independent

INDICATION

For the correct setup of the **Inverter** parameter, refer to chapter 6.

Input	PLL Enable	If enabled, the UPS synchronises the output pure sine with that of the input. If disabled, the output voltage is not synchronised with the input and it is indicated with the status light (green) flashing.
	PLL Range *	This makes it possible to select the frequency range in which the UPS synchronises the output voltage with the input: - NORMAL: The UPS synchronises for frequency variations of $\pm 2\%$ of the nominal value - EXTENDED: The UPS synchronises for frequency variations of $\pm 14\%$ of the nominal value - CUSTOM: this can be set by the user (see the next menu item)
	Custom PLL Range	This makes it possible to set the customised frequency interval in which the UPS synchronises the output voltage with the input. The value can be selected from a minimum of 0.5 Hz to a maximum of 7.0 Hz with steps of 0.1 Hz.
	Input Dip Enable	This allows the input dip function to be enabled/disabled

* Available with PLL range set in CUSTOMISED mode

INDICATION

The PLL function ensures that the output frequency of the UPS is synchronised with that of the input, guaranteeing that passage through zero (zero-crossing) occurs at the same moment. Even in the case of bypass intervention (e.g. because of overload) the input-output synchronisation remains guaranteed.

INDICATION

By disabling the PLL function, the automatic bypass function is deactivated as well.
The UPS turns off in case of an extended overload.

Bypass	Bypass Enable	If enabled, the UPS manages the bypass intervention automatically. If disabled, the UPS never switches to bypass mode so in the case of an extended overload or in the case of failure and absence of redundancy, the UPS turns off.
	Forced Mode	If enabled, the UPS activates the bypass permanently.
	DIP Speed.	This makes it possible to vary the sensibility of the switching circuit: - SLOW: indicated for loads not sensitive to voltage variations and that cause peaks of current - STANDARD: normal mode - FAST: for all loads that are extremely sensible to voltage variations
	Off-line Mode	If enabled, the UPS functions in off-line MODE. During functioning in off-line mode, the load is powered directly by the automatic bypass circuit. If there is a power failure or the tolerance is exceeded, the UPS activates the inverter thereby powering the load through the batteries.
	Startup on Bypass	If enabled, on mains start up the first powering of the load occurs via bypass. If disabled, the inrush current is managed by the inverter as in a battery start up.

Batteries	Threshold values	Reserve Time	This sets the start time of the battery autonomy warning [min]
		MaxTime on Battery	This sets the maximum functioning time on battery mode. Once this time has elapsed, the UPS turns off. Set at OFF to disable the function
	Charger	Standby Charge	If enabled, it activates the battery charge with the UPS off
	Auto Restart	Restart Enable	This enables or disables the restart of the UPS when the mains return after the total discharge of the batteries
		Min. Autonomy	Minimum percentage of autonomy for restarting
	Total KB	This sets the total number of KB installed. The parameter is necessary so that the UPS provides proper values for autonomy based on the load applied and for a correct battery charge.	
	Capacity (*)	This sets the capacity value in Ah of the batteries in the UPS.	

(*) Only available in "Service Mode"



CAUTION

Set correctly the total KB value and the capacity for the installed batteries. If the settings are incorrect, the batteries might get damaged.

Look at sections 5.2.7 and 6.5 for the meaning of KB.

7. Control panel

Operator Panel	Language	This sets the language on the display
	Buzzer	This enables/disables all the sound signals
	Keyboard Beep	This enables/disables the sound made by the keys being pressed
	Locked turn off (*)	If enabled, the password is required to shutdown the UPS
	Display Backlight	This sets the backlighting of the display: - FIXED: always lit - TIMED: the backlighting goes off after one minute of keyboard inactivity - DISABLED: the lighting is always off
	Display Contrast	This sets the display contrast
	Password Change	This sets a password that blocks access to UPS settings
	Password level	It indicates the level of the password (the default value is "USER")

(*) Only available with the chosen password.

Clock Setup	DD/MM/YY – HH:mm:ss	<p>This sets the date/time of the UPS. By pressing the ENTER key, the value to modify is selected. By pressing the ARROWS UP/DOWN keys, the selected value is increased or decreased.</p> <p>DD: day MM: month YY: year HH: hour mm: minutes SS: seconds</p>
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Dry contacts	Contact 1	Function	This allows the signal to be associated with the contact: - Mains/Battery - Reserve autonomy - Alarm - Overload - Bypass
		Setup	This makes it possible to select: - NORMALLY CLOSED - NORMALLY OPEN
	Contact 2	Function	(see contact 1)
		Setup	
	Contact 3	Function	(see contact 1)
		Setup	
	Contact 4	Function	(see contact 1)
		Setup	
	Contact 5	Function	(see contact 1)
		Setup	
	All	Makes it possible to set all the contacts: - NORMALLY CLOSED - NORMALLY OPEN	

7.4.3 Power Modules

PM Status	PM Info X	Mod.	Model of power module X	
		SW Ver	Version of the firmware inside power module X	
		HW Ver	Hardware version of power module X	
		S/N	Serial number of power module X	
		Max VA	Maximum apparent power available from power module X [VA]	
		Max W	Maximum active power available from the power module X [W]	
		Max Ichg	Maximum current available from the battery charger of power module X [A]	
	PM Measures	Input X	Power	Absorbed active power by the power module X [W]
			Appar. Power	Absorbed apparent power by the power module X [VA]
			Vrms	Effective input voltage of the power module X [V RMS]
			Vrms bypass	Effective input voltage for the power module X of the bypass line [V RMS]
			Vrms ph-ph	Effective input line voltage of the power module X [V RMS]
			Irms	Effective current absorbed from the mains by the power module X [A RMS]
			Peak Current	Input peak current of the power module X [A]
			Frequency	Pure sine input frequency voltage of the power module X for the bypass line [Hz]
			I Crest factor	Crest factor applied by the power module X to the mains
			Power Fact.	Power factor applied by the power module X to the mains
		Output X	Power	Active power supplied by the power module X [W]
			Appar. Power	Apparent power supplied by the power module X [V]
			Vrms	Effective output voltage of the power module X [V RMS]
			Vrms ph-ph	Effective output line voltage of the power module X [V RMS]
			Irms	Effective output current supplied from the power module X [A RMS]
			Peak Current	Output peak current supplied of the power module X [A]
			Frequency	Pure sine output voltage frequency of power module X [Hz]
			I Crest factor	Crest factor of the output current of the power module X
			Power Fact.	Output power factor for the power module X
			Max W	Maximum active power available from the power module X [W]
			Power	Active power supplied from the power module X, expressed as a percentage in relation to the maximum active power available from the power module X [%]
			Max VA	Maximum apparent power available from power module X [W]
			Appar. Power	Apparent power supplied from the power module X, expressed as a percentage in relation to the maximum apparent power available from the power module X [%]

(continues)

7. Control panel

PM Status	PM Measures	Battery X	Voltage	Battery voltage detected by the power module X [V]
			Current	Current required to the batteries by the power module X (negative if the batteries are charging) [A]
			Charger	Status of the battery charger inside module X
		Misc. X	INV HSink Temp.	Temperature of the power module X Invertor heat sink [°C]
			BST HSink Temp.	Temperature of the power module X Booster/PFC heat sink [°C]
			Fan Speed	Fan speed of the power module X expressed as a percentage [%]
			Pos.H.V.Bus	Voltage on the positive BUS DC of power module X [V]
			Neg.H.V.Bus	Voltage on the negative BUS DC of power module X [V]
	PM History Data	Run Time	Total Runtime	
		Batt.Time	Total runtime on battery mode	
		Chg.Time	Total runtime of the battery charger	
		Bypass int.	Total number of bypass interventions	
		Battery int.	Total number of transfers to battery mode	
		Dumper int.	Total number of dumper interventions	
		Mains High	Total number of times when the tension of the input mains has exceeded the maximum value allowed by the power module	
		Overheat N.	Total number of overheating	
		Overload N.	Total number of overloads	
		HVBus Run.N.	Total number of overvoltages on the Bus	
		OutDCLevel N.	Total number of continuous output voltages of the power module	

INDICATION

Press the ENTER key to vary the value of X that represents the power module the data is read from. The value of X starts from 0 that represents the first power module installed in the first tunnel at the top left of the UPS.

Diagnostics (*)	PM errors recovery	It cancels the memory of errors detected in the power module. It works only with the errors that can be reset.
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PM SW Update (*)	Update all PM	This allows the sequential and automatic updating of the software in all the power modules present in the UPS. The procedure is initiated by pressing the ENTER key. If the updating is not necessary, a message saying "PM SW Versions updated!" appears on the display. By pressing the ESC key, the procedure ends.
	Single PM SW update	This allows the updating of the software in each individual power module. Using the ARROW UP/DOWN keys, it is possible to choose the module that has to be updated ('PM00' indicates the module installed in the first tunnel at the top left). By pressing the ENTER key a screen is displayed comparing the software currently present in the selected module and the new software. The updating procedure is initiated by pressing the ENTER key. When updating is complete, a message saying "PM SW Version updated!" appears on the display. By pressing the ESC key, the procedure ends

(*) Only available in "Service Mode"

7.4.4 Events

Events	Log View	All	This displays all the events
		Critical	This displays the events that have generated critical alarms
		Warning	This displays the events that have generated non-critical alarms
		Info	This displays the events that have generated simple warnings

7.4.5 Tools

Batteries	Battery Test	Automatic	This performs a test on the batteries to check their status and performance
	Batt. Calibration	This calibrates the batteries, finding the discharge curve. In order for the UPS to provide precise information regarding the charge status, it is necessary to perform the calibration in the following cases: - after installation and before the first start up; - in the case of battery change; - every six months after the first year of the UPS's life.	
	Battery cycle	This carries out a battery test and their equalization to check the status, the performance and to maximise the life of the batteries.	

Signalling Test (*)	This carries out the signalling test. When the ENTER key is pressed, the tests of the status indicator signal (green, orange and red) and the acoustic signal are performed..
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LCD Display Test (*)	This performs the test of the alphanumeric display. When the ENTER key is pressed, all the available characters are displayed.
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(*) Only available in "Service Mode"

Assistance	Display Identifier	This displays the code to communicate to the assistance service.
	Use code	Insert the code provided by the technical assistance service.

CM errors recovery	This cancels the memory of the errors detected by the control board. It works only with the errors that can be reset.
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7.4.6 Log Out

It is possible to set a password to prevent non-authorised personnel to modify the configuration of the UPS. By choosing a password, it is necessary to enter a private session to modify the UPS settings. At the end of the operations use the "Log Out" menu to leave the private session.

If the password has been forgotten, it is necessary to contact the LEGRAND Technical Assistance Centre.

7. Control panel

7.5 POWER ON/OFF menu

When the UPS is on, the operator can access a special menu called POWER ON/OFF, by pressing the ON/OFF button for less than 0,5 seconds.

The choices that can be made in this menu are the following:

L1 phase (**)	Press the ENTER key to access the submenu in which it is possible to choose whether to turn phase L1 on or off independently of the others. By pressing the ARROW UP/DOWN keys it is possible to choose the ON or the OFF value. By pressing the ENTER key the value is confirmed; pressing the ESC key you leave the submenu.
L2 phase (**)	Press the ENTER key to access the submenu in which it is possible to choose whether to turn phase L2 on or off independently of the others. By pressing the ARROW UP/DOWN keys it is possible to choose the ON or the OFF value. By pressing the ENTER key the value is confirmed; pressing the ESC key you leave the submenu.
L3 phase (**)	Press the ENTER key to access the submenu in which it is possible to choose whether to turn phase L3 on or off independently of the others. By pressing the ARROW UP/DOWN keys it is possible to choose the ON or the OFF value. By pressing the ENTER key the value is confirmed; pressing the ESC key you leave the submenu.
UPS	Press the ENTER key to access the submenu for shutting down the UPS. By pressing the ENTER key again, the UPS shuts down; by pressing the ESC key you leave the submenu.
Hot swap	Press the ENTER key to access a submenu to make the hot-swap substitution of the power modules (see section 9.4).

(**) Available only with the Inverter set up with three phases independent

7.6 Switching off the UPS



CAUTION

The shut down procedure must only be applied if the load is off or does not need powering by the UPS.

There are two possible ways to shut down the UPS.

It is possible to shut down the UPS from the **POWER ON/OFF** menu or it is possible to perform the following procedure:

1. keep the ON/OFF key pressed for at least 2 seconds;
2. the display shows the text "Turn off the UPS?". Press the ENTER key;
3. wait for the shut down operation to complete.

If shutdown of the UPS over a long period is envisaged, do as instructed in chapter 10.

7.7 Switching on the UPS

The operator can turn on the UPS by doing the following:

1. Press the ON/OFF key.
2. When the display shows the text "<ENTER> to confirm UPS turn ON", press the ENTER key. If no operation is carried out within 30 seconds, the UPS turns off.
If the display shows the message "WARNING: different UPS setup! <ENTER> to confirm UPS turn on", the UPS setup is different from the last power up. A skilled technician must check the UPS setup before confirming the power up.
3. Wait for the power up operations to complete. The load is only supplied when the bar with the text "UPS INITIALIZE" displayed reaches the end and the main screen appears.

8. Diagnosis

8.1 Luminous and audible notifications

The status indicator on the front panel of the UPS and the led on the front of every power module change their colour according to the actual functioning status of the UPS or of the individual power module in accordance with the table shown below.

INDICATION

Some luminous notifications can be accompanied by an audible signal. To turn off the audible notification, press the ESC key. On every subsequent press, the notification is silenced or enabled.

INDICATION

If it is not possible to solve the problem, contact the LEGRAND Technical Support Service.

STATUS INDICATOR	POWER MODULE LED	AUDIBLE NOTIFICATION	STATUS MESSAGE	UPS STATUS DESCRIPTION AND OPERATING ADVICE
GREEN Steady	GREEN Steady	-	Trimod	Normal functioning with mains present and load within the limits
GREEN Steady	GREEN Steady	-	3V Battery Fail	Contact the LEGRAND Technical Support Service.
GREEN Steady ORANGE Flashing	ORANGE Flashing	-	Out/phase turned OFF	Phase off in configuration of the 3 independent phases output. Check the output setup.
GREEN Steady ORANGE Flashing	OFF	-	Modules turned off	Control board in hot-swap
GREEN Steady	1 module: ORANGE Steady Remaining modules: GREEN Steady	-	Equalizing Battery	Battery Equalization in progress
GREEN Quick flashing	GREEN Quick flashing	-	-	Mains supply is absent on at least on one module and/or the frequency of the mains is not correct (>68Hz or <43Hz) and/or the input PLL is not synchronised. A skilled technician must check the mains.
GREEN Quick flashing	-	-	-	Bypass Absent, Input PLL not synchronised, bypass voltage outside the limits, bypass sequence not correct or reversed, bypass frequency out of tolerance. A skilled technician must check the mains.
GREEN Quick flashing	GREEN Quick flashing	-	Bypass line KO	The bypass cannot be used to power the load
ORANGE Steady	ORANGE Quick flashing	-	UPS on Bypass	Operation in automatic bypass mode
ORANGE Steady	ORANGE Steady	Access 500 ms and off 12 s	UPS on Battery	Battery functioning mode
ORANGE Steady	ORANGE Steady	-	Battery Cal...	Battery calibration in progress

continues...

8. Diagnosis

STATUS INDICATOR	POWER MODULE LED	AUDIBLE NOTIFICATION	STATUS MESSAGE	UPS STATUS DESCRIPTION AND OPERATING ADVICE
ORANGE Steady	-	-	Battery Test...	Battery test in progress
ORANGE Long intermittent	GREEN Steady	-	Make Maintenance	Contact the LEGRAND Technical Support Service
ORANGE Long intermittent	GREEN Steady	-	Check Batteries	A skilled technician must check the batteries status
ORANGE Flashing	ORANGE Quick flashing	-	Forced on Bypass	Forced bypass mode
ORANGE Flashing	ORANGE Quick flashing	-	Maintenance Bypass	Manual bypass mode
ORANGE Short and double intermittent with pause	ORANGE Steady	Intermittent short and double with pause	RUNTIME RESERVE!	Autonomy reserve. Few minutes left before the shutdown.
RED Steady	RED Steady only on the module with the fault	Quick intermittent	FAULT CHARGER	Battery charger faulty on at least one power module. A skilled technician must replace the faulty module.
RED Steady	RED Steady only on the module with the fault	Quick intermittent	FAULT MODULE	A skilled technician must replace the faulty power module.
RED Quick flashing	-	Quick intermittent	BATTERIES KO	Batteries faulty or not connected. A skilled technician must check the batteries.
RED Quick flashing	RED Short and double intermittent with pause	Quick intermittent	BATTERY RUNAWAY	Excessive voltage on the batteries. If the alarm persists over time a skilled technician must check the batteries.
RED Quick flashing	RED Short and double intermittent with pause	Quick intermittent	HVBUS RUNAWAY FAIL	Contact the LEGRAND Technical Support Service.
RED Quick flashing	RED Steady	Quick intermittent	OUT DC LEVEL FAIL	Reset the power module error from the control panel and turn on the UPS. If the error persists, one or more power modules are faulty and a skilled technician must replace them.
RED Quick flashing	RED Short and double intermittent with pause only on the module in alarm mode	Quick intermittent	OVERHEAT	Overheating of one or more power modules. Check the functioning of the module fans and clean the air intake grilles.
RED Quick flashing	RED Short and double intermittent with pause only on the overloaded module	Quick intermittent	OVERLOAD	Overload on one or more power modules. Check the applied load.
RED Quick flashing	-	Quick intermittent	CM FAILURE	Contact the LEGRAND Technical Support Service.
RED Quick flashing	-	Quick intermittent	Reference Error!	Contact the LEGRAND Technical Support Service.
RED Quick flashing	-	Quick intermittent	BACKFEED	Contact the LEGRAND Technical Support Service.

8.2 Messages

This section shows the messages that appear on the control panel display and the probable cause that could have generated them.

INDICATION

If it is not possible to solve the problem, contact the LEGRAND Technical Support Service.

FIRST ROW OF THE MAIN SCREEN

MESSAGE	MEANING AND OPERATING ADVICE
Abnormal batt.drain	Abnormal battery drain. Contact the LEGRAND Technical Support Service.
Buzzer Muted	The buzzer has been silenced
Service Mode	UPS in Service Mode. The parameters can be modified through the control panel and updates can be made.
Charging Battery	The UPS is charging the batteries. The mode is indicated next to the message.
Make Maintenance	Contact the LEGRAND Technical Support Service.
Check Batteries	Have a skilled technician check the status of the batteries
3V Battery Fail	The 3V battery of the command board is low. Contact the LEGRAND Technical Support Service.
Out/phase turned OFF	Phase or Output off. Configuration obtained via display or after a UPS malfunctioning
Bypass line KO	Bypass input KO; problems on the Bypass line have arisen. A skilled technician must check the bypass input line.
UPS on Bypass	UPS in bypass mode. In this operating mode, the load is not protected by the UPS.
Forced on Bypass	The UPS has entered the forced Bypass mode through a selection from the control panel. In this configuration, the load is not protected by the UPS.
Manual Bypass	The load is powered directly from the mains by means of manual bypass. In this configuration, the load is not protected by the UPS.
UPS in off-line	The charge is powered directly from the bypass line. The load is protected because a possible absence of the power line switches the load to battery.
UPS on Battery	UPS in battery mode. This configuration is due to a fault in the UPS power supply system or a loss of mains.
Battery Cal...	The UPS is performing the calibration of the batteries through a command from the control board.
Equalizing Battery	The UPS is performing battery equalization.
Battery Test...	The UPS is carrying out a test on the batteries in order to check their status and proper operation.
Reference Warning	Synchronisation error among the controls. Contact the LEGRAND Technical Support Service.
RUNTIME RESERVE!	The battery charge is at the minimum level. The UPS is about to shut down.
BATTERIES KO	Batteries faulty. A skilled technician must check their operation and replace them if necessary.

continues...

8. Diagnosis

MESSAGE	MEANING AND OPERATING ADVICE
BATTERY RUNAWAY	The voltage of the batteries is out of control. A skilled technician must check battery operation or the battery charger.
HVBUS RUNAWAY FAIL	Contact the LEGRAND Technical Support Service.
OUT DC LEVEL FAIL	Reset the power modules error from the control panel and turn on the UPS. If the error persists, one or more modules are faulty and a skilled technician must replace them.
OVERHEAT	The temperature inside the UPS is outside the nominal range. Check the functioning of the module fans and clean the air intake grilles.
OVERLOAD	The total load is more than the nominal power of the UPS. The UPS will switch to bypass if there is voltage on the bypass line, otherwise it will shut down.
STRONG OVERLOAD	The load on output has caused an excessive lowering of the output voltage.
BACKFEED	A backfeed error has been detected. Contact the LEGRAND Technical Support Service.
CM FAILURE	Error in communication among command boards. Contact the LEGRAND technical support service.
FAULT CHARGER	The battery charger circuit of one or more power modules is faulty. A skilled technician must replace them.
FAULT MODULE	One or more more modules are faulty. A skilled technician must replace them.
LOAD TURNED OFF!	An excessive load (e.g. a short circuit) has caused an excessive lowering of the output for an excessive period or the load has been shut down because of an extended overload in battery mode.
UPS EMERGENCY!	Contact the LEGRAND Technical Support Service.
UPS BLOCKED!	Contact the LEGRAND Technical Support Service.
Shutdown ongoing...	The UPS is shutting down because it is programmed to do so by the user.
Modules turned OFF	Command board in hot-swap The power modules are no longer powered and ready to be replaced.
PM FW not updated!	One or more power modules have the software not compatible with the command board. Update the modules before turning on the UPS.

SCREEN DISPLAYED ON START UP OR SHUT DOWN

MESSAGE	MEANING AND OPERATING ADVICE
First Turn ON: Supply Mains!	The UPS has never been turned on. No mains supply. Start up not permitted. Make sure the mains is present before turning on.
Mains not Present! Startup not Allowed	No mains supply. Start up not permitted. To start the UPS in battery mode select this configuration from the control panel.
Emergency Power Off!	The Emergency Power Off (EPO) has been activated. The EPO command has been sent by a push-button or a switch on the input line has been opened during the operation of the UPS. Check the emergency push-button.

continues...

MESSAGE	MEANING AND OPERATING ADVICE
Incomplete Setup for start-up!	The UPS requires a complete configuration for start up. Check that the output configuration, bypass enabling, number of KB, number of batteries per KB and output voltage have been inserted properly.
Three Phase Voltage Sequence Invalid!	The three phase sequence is not valid. A skilled technician must check that the input three phase system has been correctly connected.
Invalid PM HW Versions!	One or more power modules are not compatible with the command board. Contact the LEGRAND Technical Support Service.
START UP Error!	An error has occurred during the start up procedure. Contact the LEGRAND Technical Support Service.
Startup aborted	Start up only possible with confirmation. The start up has not been confirmed within 30 seconds.
UPS turned off by program!	UPS shut down as programmed via software in a remote controlled system.
Incorrect setup turn-off	An error has occurred during the configuration. UPS is shutting down. One or more of the parameters have not been set properly. Check the configuration from the control panel.
Incorrect KB setup turn-off	An error has occurred during the configuration of the number of KB. Set the right number of KB from the control panel.
Low Battery TurnOff	Shutdown of the UPS because the minimum voltage level of the batteries has been reached.
Battery Time Expired	Shutdown of the UPS because the maximum battery operating time set from the control panel has been reached.
Load turned OFF	Load power interrupted
Powered from Output	Start up error. Voltage present on the UPS output. A skilled technician must check the UPS connections.
Turned Off with charged H.V.bus	The UPS has not shutdown properly. Make sure the DC buses are discharged before performing any maintenance operation on the UPS.
Saving NVData error	Error saving some UPS parameters. If the problem persists, contact the LEGRAND Technical Support Service.
Invalid CM SW Versions: Execute update!	The command boards have been programmed with different software versions. The software versions must be aligned by carrying out an update of the command boards through the PC.

CRITICAL EVENTS

MESSAGE	MEANING AND OPERATING ADVICE
Inverter Fail	Fault detected in the Inverter circuit. One or more power modules are faulty. A skilled technician must replace them.
Booster Fail	Fault detected in the Booster/PFC circuit. One or more power modules are faulty. A skilled technician must replace them.
Battery Charger Fail	Fault detected in the Battery charger circuit. One or more power modules are faulty. A skilled technician must replace them.
Overheat	Overheating. Check the UPS ventilation system.

continues...

8. Diagnosis

MESSAGE	MEANING AND OPERATING ADVICE
Overload	Overload. Check the load level connected to the UPS.
H.V.Bus Runaway Failure	Contact the LEGRAND Technical Support Service.
Output DC Level	A skilled technician must check that there is not a faulty power module or a voltage backfeed from the load.
Battery voltage too high	Battery voltage too high. A skilled technician must check the batteries.
Power Module comm. failure	Contact the LEGRAND Technical Support Service.
Emergency	Contact the LEGRAND Technical Support Service.
Load turned OFF	The powering of the loads has been interrupted
Irregular TurnOff	UPS shutdown in an anomolous way. The skilled technician must make sure that there is no voltage inside the UPS before performing any maintenance operation.
Overload TurnOff	UPS shutdown because of extended overload.
Emergency Power Off turn-OFF	UPS shutdown because of Emergency Power Off.
Battery KO	Failure in the batteries. A skilled technician must check them.
Power Module battery wiring failure	There is a fault in the connection of the batteries to the power module. One or more power modules are faulty. A skilled technician must replace them.
Power Module mains wiring failure	There is a fault in the connection of the mains to the power module. One or more power modules are faulty. A skilled technician must replace them.
Power Module HVBus wiring failure	There is a fault in the connection of the HVBus to the power module. One or more power modules are faulty. A skilled technician must replace them.
Backfeed	A backfeed error has been detected. Contact the LEGRAND Technical Support Service.
Communication failure between CM	Communication error among the control boards. Contact the LEGRAND Technical Support Service.

NOTIFICATION EVENTS

MESSAGE	MEANING AND OPERATING ADVICE
Low Battery Turn Off	UPS shutdown because autonomy at an end
Invalid sequence turn-OFF	UPS shutdown because of incorrect three phase sequence on input. A skilled technician must check that the input three phase system has been correctly connected.
Battery calibration aborted	Battery calibration interrupted by the user.
Battery Time Expired	Shutdown of the UPS because the maximum battery operating time set from the control panel has been reached.
StartUp error	Start up error.
Start-up granted with alarms.	UPS start up authorised in the presence of alarms.
Start-up granted with new cfg	UPS startup authorised with new configuration. The number of power modules installed on the UPS has changed.

continues...

MESSAGE	MEANING AND OPERATING ADVICE
Incorrect setup turn-off	UPS shutdown because the configuration is wrong. The number of power modules detected by the UPS is not correct for the output configuration set.
PM firmware updated	Power module software updated.
Strong overload	Strong overload
Powered from Output	Voltage present on the UPS output. A skilled technician must check the connections.
Turned Off with charged H.V.bus	The UPS has not shutdown properly. The UPS has shut down without completely discharging the buses.
Make Maintenance	Contact the LEGRAND Technical Support Service.
Check Batteries	Have a skilled technician check the batteries
Replace Batteries	A skilled technician must check battery status and change them if necessary.

INFORMATIVE EVENTS

MESSAGE	MEANING
User start up	User start up of UPS
User shutdown	User shutdown of UPS
Automatic switch on	Automatic UPS start up.
Delayed shutdown.	The UPS has been shut down via the delayed shutdown programming.
Battery charger start in standby.	The battery charger has started in stand by.
UPS battery mode	UPS battery mode
UPS mains mode	UPS mains mode
Output shutdown	The output is not powered
Battery testing complete	Battery testing successfully completed
Battery calibration complete	Battery calibration successfully completed
Forced bypass ON	The forced bypass operation mode has been enabled. The load is powered in forced mode directly from the bypass. The load is not protected by the UPS.
Forced bypass OFF	The forced bypass operation mode has been disabled.
Bypass maintenance ON	The load is powered directly from the manual maintenance bypass switch. The load is not protected by the UPS.
Bypass maintenance OFF	The load is not powered directly from the manual maintenance bypass switch.

8. Diagnosis

ALARMS

MESSAGE	MEANING
ABNORMAL BATTERY DRAIN	Abnormal battery drain. Contact the LEGRAND Technical Support Service.
INVERTER FAIL	Fault detected in the Inverter circuit. One or more power modules are faulty. A skilled technician must replace them.
BOOSTER FAIL	Fault occurred in the Booster/PFC circuit. One or more power modules are faulty. A skilled technician must replace them.
CHARGER FAIL	Fault occurred in the Battery charger circuit. One or more power modules are faulty. A skilled technician must replace them.
OVERHEAT	Overheating. Check the UPS ventilation system.
OVERLOAD	Overload. Check the load level connected to the UPS.
HVBUS RUNAWAY	Contact the LEGRAND Technical Support Service.
OUTPUT DC LEVEL ERROR	A skilled technician must check that there is not a faulty module or a voltage backfeed from the load.
BATTERY VOLTAGE TOO HIGH	Battery voltage too high. A skilled technician must check the batteries.
MODULE COMMUNICATION FAIL PM -> CM	Fault in the communication with the power modules. Contact the LEGRAND Technical Support Service.
BATTERY WIRING FAIL	Error in the battery connection to the power module. One or more modules are faulty. A skilled technician must replace them.
MAINS WIRING FAIL	Error in the mains connection to the power module. One or more modules are faulty. A skilled technician must replace them.
H.V.BUS WIRING FAIL	Error in the D.C. bus connection to the power module. One or more modules are faulty. A skilled technician must replace them.
MODULE COMMUNICATION FAIL CM -> PM	Fault in the communication system with the power modules. Contact the LEGRAND Technical Support Service.
OVERLOAD	Overload
UNPROTECTED LOAD	Load not protected
MAKE MAINTENANCE	Have skilled personnel carry out the periodic check of the UPS.
CHECK BATTERIES	Have a skilled personnel check the batteries
REFERENCE ERROR OVER CAN NETWORK!	Synchronisation failure among the control boards. Contact the LEGRAND Technical Support Service.
CM FAILURE ON CAN NET	Synchronisation failure among the control boards. Contact the LEGRAND Technical Support Service.
BACKFEED	A backfeed error has been detected. Contact the LEGRAND Technical Support Service.

9. Maintenance



DANGER

All maintenance operations may only be done by a **SKILLED TECHNICIAN** (section 2.2.1)

9.1 Introduction

This chapter contains all the information necessary for a correct maintenance of the Trimod HE UPS.

LEGRAND declines all liability for any injury or damage caused by the activities carried out differently from the instructions in this manual.

9.2 Preventive maintenance

The UPS does not contain parts for preventative maintenance by the operator.

The operator must periodically perform:

- a general external cleaning;
- a check to verify the absence of alarms on the display;
- a check to verify the correct functioning of the fans on each power module.

During a preventive maintenance inspection the skilled technician must carry out the following checks:

- no alarm presence;
- list of the memorised events;
- correct function of the static and maintenance bypass;
- integrity of the electrical installation;
- flow of cold air;
- battery status;
- characteristics of the applied load;
- conditions of the installation location.

After the first year of UPS life, check the batteries every six months through the "battery calibration" function to check the optimal operation and continuous protection of the connected load. With this function, the UPS detects the discharge curve of the batteries to supply precise information on the status of the charge.

To activate the operation, enter the following menu:

Tools → Batteries → Batt. Calibration

Press the ENTER key to confirm the choice.

Contact the LEGRAND Technical Support Service in the case of problems.

9.3 Periodical checks

The correct functioning of the UPS unit must be guaranteed by periodical maintenance inspections. These are essential to safeguard the reliability of the UPS.



WARNING

The periodical checks involve operations inside the unit where there are dangerous voltages. Only people who are trained by LEGRAND are authorized to work.

9.4 Power module hot-swap replacement or inclusion of new modules

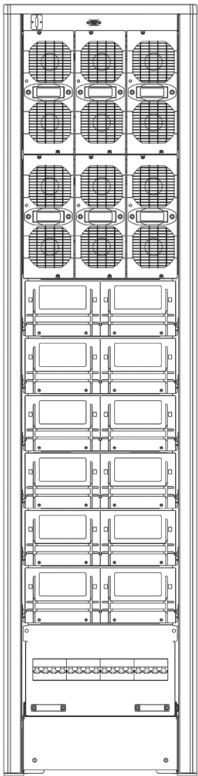
The 30 kVA to 80 kVA versions of the UPS Trimod HE allow the hot-swap of the power modules in case of failure. Thanks to this function the load is always powered by the UPS and not by the bypass line. The procedure requires the turning off of the modules that are managed by the same command board, therefore the load is powered by the remaining power modules.

INDICATION

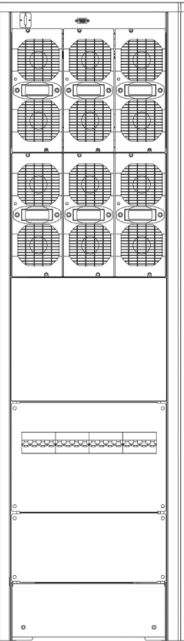
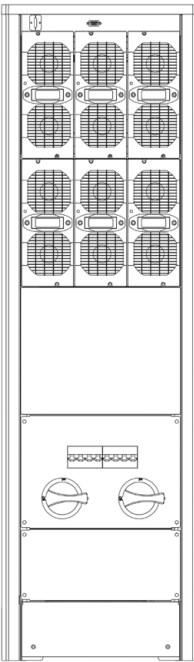
To use this function, it is necessary to have sized the UPS properly. If the percentage of the load does not allow the hot-swap without overload, perform the manual bypass mode maintenance procedure.

9. Maintenance

The command boards (CM) and the power modules (PM) are identified by a unique address inside the system, as shown below:

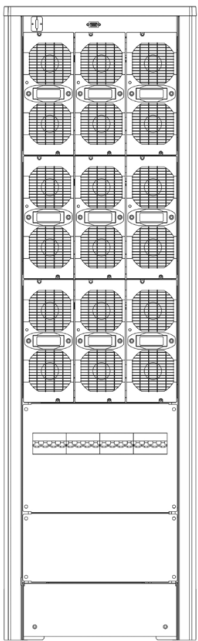


Trimod HE 30 TT/TM



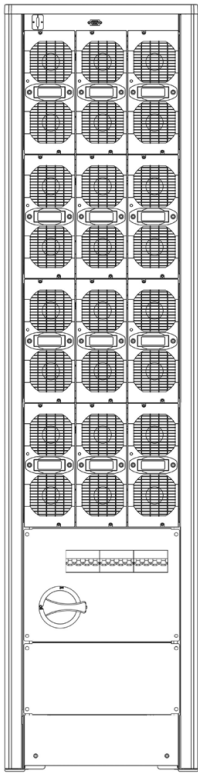
Trimod HE 40

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5



Trimod HE 60

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5
CM 2	PM 6	PM 7	PM 8



Trimod HE 80

CM 0	PM 0	PM 1	PM 2
CM 1	PM 3	PM 4	PM 5
CM 2	PM 6	PM 7	PM 8
CM 3	PM 9	PM 10	PM 11

In the Trimod HE 30 TT/TM and 40 there are two command boards. Each of them controls three power modules.
 In the Trimod HE 60 there are three command boards. Each of them controls three power modules.
 In the Trimod HE 80 there are four command boards. Each of them controls three power modules.

To change a power module, the three modules belonging to one command board are switched off. The maximum power available becomes 50% of the nominal power for Trimod HE 30 TT/TM and 40, 66% for Trimod HE 60 and 75% for Trimod HE 80.

Do the following to replace one or more faulty modules:

1. Check that the load percentage applied to the UPS allows the hot-swap replacement without overloading the UPS.
2. Open the door of the Trimod HE and identify the command board that controls the power module you want to replace.
3. Press the ON/OFF key briefly (less than 0.5 seconds)

INDICATION

One press of the ON/OFF key continuously for more than 2 seconds brings up the question "Turn off the UPS?" If this occurs, press the ESC key.

4. Press the ENTER key to access the **Hot swap** submenus. Using the ARROW UP/DOWN keys, choose the control (CM) on which to perform the hot-swap. The group of associate modules that are turned off are identified by the fast flashing of the front led in red.
5. Press the ENTER key. The command board selected turns off all the associated power modules and stays in standby mode.
6. Await the complete shutdown of the power modules (front led off and fans still).
7. Undo the fixing screws of the power modules that you intend to replace and conserve them.
8. Take the power modules you intend to replace out one at a time.
9. Check that the two leds visible through the two holes in the side cover are off on all the new power modules. If they are on, wait till they turn off.
10. Insert the new modules one at a time making sure that they are in abutment and fix them using the screws removed previously. The two fixing screws also allow the module's earthing and must both be fixed for safety purposes.
11. Press the ON/OFF key briefly (less than 0.5 seconds)

INDICATION


One press of the ON/OFF key continuously for more than 2 seconds brings up the question "Turn off the UPS?" If this occurs, press the ESC key.

12. Press the ENTER key to access the **Hot swap** submenus. Using the ARROW UP/DOWN keys, choose the control (CM) indicated as being OFF and press the ENTER key. The command board automatically restarts all the associated power modules.
13. The progress bar ("CM initialize ") makes it possible to monitor the completion of the operation. At the end of the operations, the UPS returns to operate with all the power modules. Close the UPS door (the keys must not be left at the operator's disposal).



CAUTION

Trimod HE is able to recognise the presence of non aligned firmware among the power modules and therefore prevent the start up.

If the firmware of the power modules is out of alignment, the status indicator flashes red rapidly and the display shows the text "Invalid PM SW Versions:  to execute update".

Press the ENTER key to update the power modules and complete the exit from the hot-swap.

Press the ESC key or do not carry out any operation for thirty seconds to interrupt the exit procedure from the hot-swap. In this case the "Modules turned OFF" and "PM FW not updated!" texts alternate on the display and the status indicator flashes intermittent orange. To update the power modules, go into the **Hot swap** menu and turn on the command board that is off.

INDICATION

If one or more screws are lost, only use M4x20 SHC screws (socket hex head screws) to fix the power modules.

9. Maintenance



WARNING

Do not touch the backplane of the tunnel left uncovered for the removal of the power modules because there are dangerous live parts.

On the cover of the power module there are two holes from which it is possible to see two leds that signal the presence of dangerous voltage on the rear connection. Before performing any operation on the power module, make sure that these leds are off. If they are on, wait for them to go off.

If one or more power modules are not installed, the free slots must be covered by installing a plastic mask in each of them with the code 3 108 66. This must be fixed with two SHC M4X20 screws.

9.5 Maintenance procedure for the UPS in maintenance bypass mode

If the power module hot-swap replacement procedure (section 9.4) is not applicable, it is possible to make the replacement with the UPS in maintenance bypass mode.

This mode is also necessary to perform maintenance or replace parts such as command boards, backplanes, update the UPS firmware etc.



CAUTION

During forced and maintenance bypass operations, the load is not protected because it is supplied from the bypass input line.



CAUTION

The power modules may not be replaced in this way without adhering scrupulously to the instructions below.

9.5.1 Accessing the manual maintenance bypass mode

1. Open the Trimod HE UPS door.
2. Enable the UPS in forced bypass mode by entering the following menu:
UPS Setup → Bypass → Forced Mode
Set the value of the parameter to "Enable" with the ARROW UP/DOWN keys directly. Press the ENTER key to confirm.
In this condition the power modules are excluded and the load is powered directly from the mains. The display shows the text "Forced on Bypass". When the equipment is in forced bypass mode, the status indicator on the front of the panel flashes quickly. The leds on the power modules flash quickly as well.
3. Close the maintenance manual bypass switch (S1) bringing it to the ON position. The load is powered directly from the mains. The display shows the text "Maintenance Bypass".
4. Open the output disconnect switch (S2) bringing it to the OFF position.
5. Shutdown the UPS by holding the ON/OFF key down for a few seconds. On the question "Turn off the UPS?" press the ENTER key.
6. Open the mains input switch (S3) and bypass input switch (S5) bringing them to the OFF position.
7. Open the battery breakers of the UPS and the Trimod HE BATTERY (if present).
8. Press the ON/OFF key to discharge any internal capacity. Then proceed with the maintenance operations.

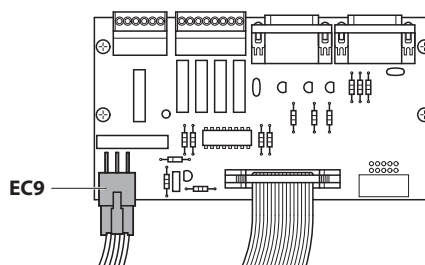


WARNING

In the case of models with internal batteries, some parts remain with dangerous voltage even all the battery fuse isolation switches are opened. Remove at least one battery drawer for every shelf present (in order to interrupt the battery string set).

**WARNING**

Inside the upper part of the UPS unit where the command boards and the relay contacts card are located there could be dangerous voltage due to the connection of the external backfeed control line. Be careful of connector EC9 of the relay contacts card to which the backfeed line is connected.



Note: by making the external backfeed protection as per the diagram in section 5.2, it is possible to isolate the line from the outside and make it safe.

9.5.2 Power module replacement or inclusion of new modules

1. Check that the procedure for placing in maintenance bypass mode described in the section above has been applied.
2. Extract the power module after undoing the two fixing screws.

**CAUTION**

On the cover of the power module there are two holes from which it is possible to see two leds that signal the presence of dangerous voltage on the rear connector. Before performing any operation on the power module, make sure that these leds are off. If they are on, wait for them to turn off.

3. Check that the two leds visible through the two holes in the side cover of the new power module are off. If they are on, wait for them to turn off.
4. Insert the new power module in the same slot where the previous one was located or, if you wish, increase the power of the UPS in one of the available slots.
5. Fix the new power module to the UPS frame with the two screws provided along with the power module, making sure they abut. Use SHC M4x20 screws (hex socket head). The two fixing screws also allow the power module's earthing and must both be fixed for safety purposes.

The procedure described does not need further manual setups from the control panel; the UPS automatically recognises the new power module and it is configured automatically.

9.5.3 Exiting from maintenance manual bypass

To transfer the UPS from the maintenance bypass status to the online bypass status, do the following:

1. Check that the output switch (S2) is open.
2. Close the battery breakers of the UPS and the Trimod HE BATTERY (if present).
3. Close the mains input switch (S3) and bypass input switch (S5) bringing them to the ON position.
4. Press the ON/OFF key to start up the UPS. When the display shows the text "<ENTER> to confirm UPS turn ON", press the ENTER key.

**CAUTION**

If the firmware of the power modules is out of alignment, the status indicator flashes red rapidly and the display shows the text "Invalid PM SW Versions: ⏮ to execute update".

Press the ENTER key to update the modules and complete the start up phase. Press the ESC key to interrupt the update and start-up procedures.

If no operation is carried out within 30 seconds, the UPS turns off.

9. Maintenance

5. Wait for the UPS to be completely on and the main screen is displayed. Under these conditions the UPS is on but the load is powered directly by the bypass line. The display shows the text "Manual Bypass" and "Forced on Bypass". Under these conditions the backlit indicator shines orange.
6. Open the output disconnect switch (S2) bringing it to the ON position.
7. Open the maintenance manual bypass switch (S1) bringing it to the OFF position.
8. Enable the UPS in inverter (on-line) mode by entering the following menu:

UPS Setup → Bypass → Forced Mode

Set the value of the parameter to "Disabled" with the ARROW UP/DOWN keys. Press the ENTER key to confirm.

9. At the end of the procedure the load is powered by the UPS. Under these conditions the backlit indicator shines green.
10. Close the Trimod HE UPS door (the keys must not be left at the operator's disposal).

9.6 Maintenance procedure with UPS off



CAUTION

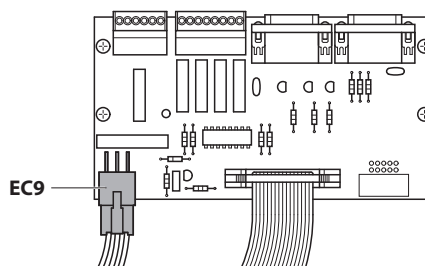
The shut down procedure shown below must only be applied if the load connected to the UPS unit is off or does not need powering by the UPS.

1. Keep the ON/OFF key on the control panel of the UPS unit pressed for at least two seconds.
2. When the display shows the text "Turn off the UPS?", press the ENTER key.
3. Wait for the shut down operation to complete.
4. Open the output disconnect switch (S2) bringing it to the OFF position.
5. Open the mains input switch (S3) and bypass input switch (S5) bringing them to the OFF position.
6. Open the battery breakers of the UPS and the Trimod HE BATTERY (if present).
7. Press the ON/OFF key, to discharge any internal capacity. Once these operations have been carried out properly, the UPS unit is without voltage. Then proceed with the maintenance operations.



WARNING

Inside the upper part of the UPS unit where the command boards and the contact interface card are located there could be dangerous voltage due to the connection of the external backfeed control line. Be careful of connector EC9 of the contact interface card to which the backfeed line is connected.



Note: by making the external backfeed protection as per the diagram in section 5.2, it is possible to isolate the line from the outside and make it safe.

9.7 Battery drawer requirements

The battery drawer of the UPS and modular Trimod HE BATTERY can be installed/replaced in two different ways. Read all the instructions carefully before working on the equipment.



A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed when working on batteries:

- a) remove watches, rings or other metal objects.
- b) use tools with insulated handles.
- c) wear rubber gloves and boots.
- d) do not lay tools or metal parts on top of batteries.
- e) disconnect the charging source prior to connecting or disconnecting battery terminals.
- f) determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

INDICATION

The battery drawers must always be added/removed in multiples of 4 (1 KB consists of four battery drawers for models with internal battery or external modular battery units)

If the installation/removal procedure changes the total number of KB installed in the UPS, it is necessary to update the KB setup from the control panel.

After concluding the installation/replacement operations, calibrate the batteries to get precise indications regarding the total autonomy of the UPS.

INDICATION

Always only replace 1 KB at a time

9.7.1 Installation/replacement of battery drawers with UPS on-line

If the UPS has more than 1 KB every 10kVA of power supplied on output, it is possible to replace 4 battery drawers (1 KB) a time with the UPS functioning on-line.

This operation can be carried out on models with internal batteries and on modular Trimod HE BATTERY.

The replacement procedure is the following:

1. Check that the UPS has installed more than 1KB every 10kVA of power supplied.
2. Check that the UPS is not functioning in battery mode and that the battery charger is in the "maintenance" or "standby" state.
To check the status of the battery charger, go into the menu:
UPS Status-> Measures -> Batteries
and check the fourth item shown on the screen.
3. Extract the four battery drawers relative to just one KB. To add another KB, do not remove any battery draw.
4. Insert the four new battery drawers and fix them with the screws provided with them.
5. Repeat steps 2, 3 and 4 for every KB to install/replace.

INDICATION

If the UPS switches to battery mode during the operation, do not extract nor insert battery drawers. It is possible to resume the operation when the UPS starts to function on-line again.

If during the operation the input mains power fails, the autonomy is reduced: it is therefore necessary to carefully assess this circumstance in relation to the application before beginning the procedure.

9.7.2 Installation/replacement of battery drawers with UPS in maintenance manual bypass

This procedure is valid for both models with internal batteries and for modular Trimod HE BATTERY

1. Check that the procedure for placing in maintenance bypass mode described in the section 9.5.1 has been applied.
2. Extract the four battery drawers relative to just one KB. To add another KB, do not remove any battery draw.
3. Insert the four new battery drawers and fix them with the screws provided with them.
4. Repeat steps 2 and 3 for every BK to install/replace.
5. To leave the manual maintenance status actuate the procedure described in section 9.5.3.

10. Warehousing



DANGER

All storage operations may only be done by a **SKILLED TECHNICIAN** (section 2.2.1)



DANGER

A **SKILLED TECHNICIAN** must check that there is no voltage present before disconnecting the cables. All the battery isolator switches on the UPS and on the external battery units must be open. The modular Trimod HE BATTERY battery drawers (if present) and the UPS battery drawers (according to the model) must be removed.

10.1 UPS

The UPS must be stored in an environment with a room temperature between -20°C (-4°F) and +50°C (+122°F) and humidity less than 90% (not condensing).

10.2 Batteries

The standard battery drawers installed inside the UPS Trimod HE models that require them are lead/acid sealed and do not require maintenance (VRLA).

It is possible to store batteries without recharging them in the following conditions:

- up to 6 months at +20°C (+68°F);
- up to 3 months at +30°C (+86°F);
- up to 2 months at +35°C (+95°F)..



CAUTION

The battery drawers of the external Trimod HE BATTERY battery units must never be stored if the batteries are partially or totally discharged.

LEGRAND is not liable for any damage or bad functioning caused to the UPS by wrong warehousing.

11. Dismantling



DANGER

Dismantling and disposal operations may only be done by a **SKILLED TECHNICIAN** (section 2.2.1)

The instructions in this chapter are to be considered indicative: in every country there are different regulations with regard to the disposal of electronic or hazardous waste such as batteries. It is necessary to strictly adhere to the standards in force in the country where the equipment is used.

Do not throw any component of the equipment in the ordinary rubbish.

11.1 Battery disposal

Batteries must be disposed of in a site intended for the recovery of toxic waste. Disposal in the traditional rubbish is not allowed.

Apply to the competent agencies in your countries for the proper procedure.



Pb



WARNING

A battery may constitute a risk of an electric shock and high short-circuit current.

When working on batteries, the prescriptions indicated in chapter 2 must be adhered to.

11.2 UPS dismantling

The dismantling of the UPS must occur after the dismantling of the various parts it consists of.

For the dismantling operations, it is necessary to wear the Personal Protective Equipment mentioned in section 2.3 and to consult the instructions and diagrams in this manual.

Sub-divide the components separating the metal from the plastic, from the copper and so on according to the type of selective waste disposal in the country where the machine is dismantled.

If the dismantled components must be stored waiting to be taken to the dump, be careful to keep them in a safe place protected from atmospheric agents to avoid soil and groundwater contamination.

11.3 Electronic component dismantling

For the disposal of electronic waste like the control panel or the command boards it is necessary to refer to the relevant standards.



12. Technical data

Main features

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Nominal power	10 kVA	15 KVA	20 kVA	30 kVA	30 kVA	40 kVA	60 kVA	80 kVA
Active Power	10 kW	15 kW	20 kW	30 kW	30 kW	40 kW	60 kW	80 kW
Technology	online, double conversion Classification according to EN62040-3: VFI-SS-111							
IN/OUT Configuration	Single-phase / Single-phase Single-phase / Three-phase Three-phase / Single-phase Three-phase / Three-phase (may be configured by a skilled technician)				Three-phase / Three-phase			
Dual Input	Available on all the models							
Command boards	1		1	1	2	2	3	4
UPS architecture	Modular with power modules PF=1 Expandable, redundant N+X							
Neutral system	Passing system							
Wave form in functioning in mains mode	Pure sine							
Wave form in functioning in battery mode	Pure sine							
Bypass	Automatic (static and electromechanical) Manual (for maintenance)							
Sswitching time	0 ms							

Input electrical characteristics

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Maximum three-phase/ three-phase current	19.2 A	28.8 A	38.4 A	57.6 A	57.6 A	76.8 A	115.2 A	153.6 A
Maximum three-phase/ single-phase current	19.2 A	28.8 A	38.4 A	57.6 A	-	-	-	-
Maximum single-phase/ three-phase current	57.6 A	86.4 A	115.2 A	172.8 A	-	-	-	-
Maximum single-phase/ single-phase current	57.6 A	86.4 A	115.2 A	172.8 A	-	-	-	-
Nominal input voltage	230 V + 15% - 20% (Single-phase) 400 V + 15% - 20% (Three-phase) (neutral line indispensable)				400 V + 15% - 20% (Three-phase) (neutral line indispensable)			
Input frequency	50 / 60 Hz ± 5 Hz							
Power factor on input	> 0.99							
Total harmonic distortion of the input current	THDi < 3%							

Electrical output characteristics (mains functioning)

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Maximum three-phase/ three-phase current	14.5 A	21.7 A	29 A	43.5 A	43.5 A	58 A	87 A	116 A
Maximum three-phase/ single-phase current	43.5 A	65.2 A	87 A	130.5 A	-	-	-	-
Maximum single-phase/ three-phase current	14.5 A	21.7 A	29 A	43.5 A	-	-	-	-
Maximum single-phase/ single-phase current	43.5 A	65.2 A	87 A	130.5 A	-	-	-	-
Nominal output voltage	230 V ± 1% (Single-phase) 400 V ± 1% (Three-phase)				400 V ± 1% (Three-phase)			
Nominal output frequency	50 / 60 Hz (autosensing and/or selectable by the user)							
Tolerance on the output frequency	synchronised to the input frequency with mains present and range from ± 0,5 Hz to ± 7 Hz adjustable from the control panel							
Crest factor admitted on the output current	3:1							
Mains performance (AC/AC online)	up to 96%							
Battery performance (AC/AC online)	99% max							
Overload admitted	115% for 10 minutes without automatic bypass intervention 135% for 60 seconds without automatic bypass intervention							

Electrical output characteristics (battery functioning)

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Nominal output voltage	230 V ± 1% (Single-phase) 400 V ± 1% (Three-phase)				400 V ± 1% (Three-phase)			
Output frequency	50 / 60 Hz ± 1%							
Total harmonic distortion of output voltage on non- linear nominal load	< 1%							
Overload admitted	115% for 2 minutes 135% for 30 seconds							

12. Technical data

Batteries and Battery Charger Characteristics

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Battery type	Lead-acid sealed without maintenance (VRLA)							
Unitary capacity	Battery drawers for UPS or external modular battery units: 12 Vdc 7.2Ah or 12 Vdc 9 Ah Non-modular external battery units 12 Vdc 94 Ah							
Nominal battery voltage UPS	240 Vdc (20 x 12 Vdc batteries in series)							
Type of battery charger	High performance PWM, one for each power module							
Recharge curve	Smart Charge, advanced three-stage cycle							
Nominal recharge current battery charger	2.5 A max for every power module installed							

Features

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Signals and alarms	Large four line alphanumeric screen, multicolour status indicator, acoustic notification							
Communications doors	2 x RS 232 ports, 1 relay interface, 1 contact port, 1 SMNP module slot							
Software	Free software for the Windows and Linux environments is available which expands the functions of: - displaying all the functioning and diagnostic data in case of problems; - setup of special functions; - automatic shutdown of all the computers supplied by the UPS (if connected to TCP/IP network) Visit us at http://www.ups.legrand.com to download a copy of the software free of charge.							
Protections	Electronics against overloads, short-circuit and excessive battery discharge Block of functions due to the end of autonomy In-rush limiter on start up E.P.O. contact Auxiliary contact for Backfeed protection							

Mechanical characteristics

	3 104 65 10 kVA	3 104 66 15 kVA	3 104 66 20 kVA	3 104 68 30 kVA TM	3 104 71 40 kVA	3 104 72 60 kVA
Net weight (without batteries)	110 Kg			130 kg		154 kg
Dimensions (mm): (w x h x d)	414 x 1367 x 628					
Power modules 3400VA (PM4) installed	3	-	-	-	-	-
Power modules 5000VA (PM6) installed	-	3	-	6	-	-
Power modules 6700VA (PM7) installed	-	-	3	-	6	9
Net power module weight	8.5 kg					
Net battery drawer weight	13 kg			-	-	-

	3 104 67 15 kVA	3 104 67 20 kVA	3 104 69 30 kVA TT	3 104 73 80 kVA
Net weight (without batteries)	130 kg			178 kg
Dimensions (mm): (w x h x d)	414 x 1650 x 628			
Power modules 3400VA installed	-	-	-	-
Power modules 5000VA installed	3	-	6	-
Power modules 6700VA installed	-	3	-	12
Net power module weight	8.5 kg			
Net battery drawer weight	13 kg			-

12. Technical data

Environmental conditions

	3 104 65 10 kVA	3 104 66 3 104 67 15 kVA	3 104 66 3 104 67 20 kVA	3 104 68 30 kVA TM	3 104 69 30 kVA TT	3 104 71 40 kVA	3 104 72 60 kVA	3 104 73 80 kVA
Operating temperature	0 ÷ 40 °C							
Relative humidity during operation	0% ÷ 95% non condensing							
Storage temperature	0 ÷ 50 °C (excluding batteries)							
Noise level at 1 metre	58 ÷ 62 dBA							
Ingress Protection Marking	IP 21							
Operating height	up to 1000 metres above sea level without derating							

Trimod HE 3 108 51 battery charger module (BCM) technical specifications

Nominal input voltage	230 Vac + 15% - 20%
Nominal input voltage	19.3 Arms
Input power factor	PF > 0.99
Total harmonic distortion of the input current	THDi < 3%
Nominal output voltage	240 Vdc
Output voltage in maintenance phase	13.75 Vdc per battery
Nominal input voltage	15 Adc max
AC/DC performance	>93% at max rated output current
Functioning status indications (signalled by multicoloured LED on module and indications on UPS display)	<p>Yellow LED, fast flashing: recharge phase f1</p> <p>Green LED, slow flashing: recharge phase and maintenance f2</p> <p>Green LED steady: standby</p> <p>Red LED: fault status</p>

Reference directive and standards

Safety	2014/35/EU Directive EN 62040-1:2008+A1:2013
EMC	2014/30/EU Directive EN 62040-2:2006
Performance and test requirements	EN 62040-3:2011

13. Tables



CAUTION

The choice of the type and section of the connecting wires depending on their voltage, usage current and installation must be done as indicated in the current standards in the country where the UPS is installed and it is the responsibility of the installation engineer.

The input current and the output power of the UPS are indicated in chapter 12 and the battery current in table 8 of this chapter.

The following tables give an indication of the wire cross sections to use if the wires are unipolar with simple PVC installation and installation in tube in the air.

TABLE 1

Minimum wire cross sections recommended for UPS Trimod HE

POWER	INPUT PHASES	OUTPUT PHASES	INPUT CABLE	BYPASS CABLE (in case of separate bypass line)	OUTPUT CABLE
10 kVA	3	3	5 x 4 mm ²	5 x 4 mm ²	5 x 4 mm ²
	1	1	3 x 10 mm ²	3 x 10 mm ²	3 x 10 mm ²
	1	3	3 x 10 mm ²	3 x 10 mm ²	5 x 4 mm ²
	3	1	5 x 10 mm ²	5 x 10 mm ²	3 x 10 mm ²
15/20 kVA	3	3	5 x 10 mm ²	5 x 10 mm ²	5 x 10 mm ²
	1	1	3 x 25 mm ²	3 x 25 mm ²	3 x 25 mm ²
	1	3	3 x 25 mm ²	3 x 25 mm ²	5 x 10 mm ²
	3	1	5 x 25 mm ²	5 x 25 mm ²	3 x 25 mm ²
30 kVA TM	3	3	5 x 16 mm ²	5 x 16 mm ²	5 x 16 mm ²
	1	1	3 x 50 mm ²	3 x 50 mm ²	3 x 50 mm ²
	1	3	3 x 50 mm ²	3 x 50 mm ²	5 x 16 mm ²
	3	1	5 x 50 mm ²	5 x 50 mm ²	3 x 50 mm ²
30 kVA TT	3	3	5 x 16 mm ²	5 x 16 mm ²	5 x 16 mm ²
40 kVA	3	3	5 x 25 mm ²	5 x 25 mm ²	5 x 25 mm ²
60 kVA	3	3	5 x 35 mm ²	5 x 35 mm ²	5 x 35 mm ²
80 kVA	3	3	5 x 50 mm ²	5 x 50 mm ²	5 x 50 mm ²

INDICATION

The maximum cable cross section that can be installed in the terminals is 50 mm².

TABLE 2

Battery fuse values recommended for UPS Trimod HE with internal batteries

POWER	BATTERY FUSES	
	UPS Trimod HE	
	F B+	F B-
10/15/20 kVA	50A 500V gG (14 x 51 mm)	50A 500V gG (14 x 51 mm)
30 kVA TT	160A 500V gG (SIZE 00)	160A 500V gG (SIZE 00)

13. Tables

TABLE 3

Battery fuse values recommended for MODULAR Trimod HE BATTERY 4KB

POWER	BATTERY FUSES	
	MODULAR Trimod HE BATTERY 4 BK (16 drawers)	
	F B+	F B-
10/15/20/30 kVA	n°4 – 50A 500V gG (14 x 51 mm)	n°4 – 50A 500V gG (14 x 51 mm)

TABLE 4

Battery fuse values recommended for MODULAR Trimod HE BATTERY 5KB (94Ah)

POWER	BATTERY FUSES	
	MODULAR Trimod HE BATTERY 5KB	
	F B+	F B-
10/15/20/30/40/60 kVA	n°4 – 50A 500V gG (14 x 51 mm)	n°4 – 50A 500V gG (14 x 51 mm)

TABLE 5

Battery fuse values recommended for NON MODULAR Trimod HE BATTERY 1KB (94Ah)

POWER	BATTERY FUSES	
	NON MODULAR Trimod HE BATTERY 1KB (94Ah)	
	F B+	F B-
10 kVA	No. 1 – 50A 500V gG (22 x 58 mm)	No. 1 – 50A 500V gG (22 x 58 mm)
15/20 kVA	No. 1 – 100A 500V gG (22 x 58 mm)	No. 1 – 100A 500V gG (22 x 58 mm)
30 kVA TT/TM	No. 2 – 80A 500V gG (22 x 58 mm)	No. 2 – 80A 500V gG (22 x 58 mm)
40 kVA	No. 2 – 125A 500V gG (22 x 58 mm)	No. 2 – 125A 500V gG (22 x 58 mm)
60 kVA	No. 3 – 100A 500V gG (22 x 58 mm)	No. 3 – 100A 500V gG (22 x 58 mm)
80 kVA	No. 4 – 100A 500V gG (22 x 58 mm)	No. 4 – 100A 500V gG (22 x 58 mm)

TABLE 6

Automatic breaker recommended for mains input and bypass line

POWER	INPUT PHASES	OUTPUT PHASES	AUTOMATIC CIRCUIT BREAKER RECOMMENDED
10 kVA	3	3	C curve 20A (3P+N)
	3	1	C curve 63A (3P+N)
	1	1-3	C curve 63A (1P+N)
15kVA	3	3	C curve 32A (3P+N)
	3	1	C curve 100A (3P+N)
	1	1-3	C curve 100A (1P+N)
20 kVA	3	3	C curve 40A (3P+N)
	3	1	C curve 100A (3P+N)
	1	1-3	C curve 100A (1P+N)
30 kVA TM	3	3	C curve 63A (3P+N)
	3	1	C curve 160A (3P+N)
	1	1-3	C curve 160A (1P+N)
30 kVA TT	3	3	C curve 63A (3P+N)
40 kVA	3	3	C curve 80A (3P+N)
60 kVA	3	3	C curve 100A (3P+N)
80 kVA	3	3	C curve 150A (3P+N)

TABLE 7

Residual current breaker recommended for mains input and bypass line

POWER	RESIDUAL CURRENT BREAKER RESIDUAL CURRENT (I _{Δn})
10 kVA	≥ 300 mA B type
15 kVA	
20 kVA	
30 kVA TT/TM	
40 kVA	
60 kVA	
80 kVA	

TABLE 8

Maximum current absorbed by the batteries at 100% of the load and minimum wire cross sections recommended for connection of the UPS to the external Trimod HE BATTERY units.

POWER	MAXIMUM BATTERY CURRENT	MINIMUM WIRE CROSS SECTION RECOMMENDED
10 kVA	50 A	1 x 10 mm ² for each pole
15 kVA	76 A	1 x 16 mm ² for each pole
20 kVA	100 A	1 x 25 mm ² for each pole
30 kVA TT/TM	152 A	2 x 25 mm ² for each pole
40 kVA	202 A	2 x 35 mm ² for each pole
60 kVA	304 A	2 x 50 mm ² for each pole
80 kVA	405 A	2 x 70 mm ² for each pole







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