Please read this manual before the installation and the start-up of equipment!

KEEP FOR FUTURE REFERENCE
For the entire life of the appliance

This manual should be considered an integral part of the UPS unit

INSTRUCTION MANUAL FOR SAFEPOWER-EVO SERIES

CONTENTS

IMPORTANT WARNINGS 5

INTRODUCTION 11

TAPPLICABLE REGULATIONS 11

DESCRIPTION OF SYSTEM 12

BLOCK DIAGRAM (FIGURE 1). 12
INTERACTIVE MODE OF OPERATION 15
DESCRIPTION OF PARALLEL OPERATION 15
DETAILED ANALYSIS OF PARALLEL OPERATION 16
1- POWER PARALLEL 16
2- REDUNDANCY PARALLEL 16
EQUIPMENT 17
CONTROL, MEASUREMENT AND SIGNALLING PANEL. 17
FUNCTIONAL DIAGRAM 20
DESCRIPTION OF THE BACK-FEED PROTECTION SENSOR 20
REMOTE SIGNALLING SYSTEMS. 21
DETAILED DESCRIPTION OF THE SIGNALS AVAILABLE ON THE CN1 CONNECTOR AND ON THE TERMINAL BOARDS. 21
DESCRIPTION OF COMMUNICATION FIBRE OPTICS 22
DETAILED DESCRIPTION OF FIBRE OPTICS CONNECTIONS. 22

INSTALLATION 23

CHOOSING THE INSTALLATION LOCATION 23
VISUAL INSPECTION 23
ENVIRONMENTAL CONSIDERATIONS 23
HANDLING 23
SAFETY CONSIDERATIONS 24
BATTERIES 24

ELECTRICAL CONNECTIONS 25

POWER CONNECTIONS 25
SIGNAL CONNECTIONS 25

MAINTENANCE 27

OPERATING INSTRUCTIONS 27

USING THE CONTROL PANEL PUSHBUTTONS 27
START-UP AND SUBSEQUENT ACTIONS 30
EMERGENCY DEVICE (EPO) OPERATION 33
FUSES 33

OPTIONS 33

OPTION 1: FILTRI RFI 34
OPTION 2: INPUT POWER FACTOR CORRECTION 34
OPTION 3: REDUCTION OF DISTORTION OF INPUT POWER FOR SIX-PHASE UPS 34

OPTION 4: REDUCTION OF INPUT CURRENT DISTORTION FOR 12-PULSE UPSS....34
OPTION 5: RESERVE MAINS ISOLATION TRANSFORMER....34
OPTION 6: RECTIFIER INPUT ISOLATION TRANSFORMER....34
OPTION 7: RECTIFIER AND RESERVE INPUT ISOLATION TRANSFORMER....34
OPTION 8: REMOTE SWITCH FOR DISCONNECTING THE RESERVE MAINS IN CASE OF A MAINS POWER BREAK AND UPS OUTPUT ISOLATION SENSOR....34
OPTION 9: BACK-FEED TO MAINS PROTECTION WITH SWITCH IN THE UPS....34
OPTION 10: BACK-FEED PROTECTION WITH REMOTE SWITCH....35
OPTION 11: UPS OUTPUT ISOLATION SENSOR FOR REGULAR OPERATION IN IT....35
OPTION 12: RESTRICTION OF THE INPUT CURRENT AND INHIBITION OF FAST LOADING FOR OPERATION WITH GENERATOR, SEQUENTIAL START OF RECTIFIERS.....35
OPTION 13: BATTERY TEMPERATURE READING KIT.....35
OPTION 14: BATTERY CABINET TEMPERATURE READING KIT, BY MEANS OF OPTIC FIBRES....35
OPTION 15: CUSTOMER INTERFACE BOARD WITH RS232 SERIAL PORT....35
OPTION 16: REMOTE MIMIC PANEL....35
OPTION 17: OCSYSTEM CONTROL SYSTEM....36
OPTION 18: SMS (SIEL MONITORING SOFTWARE) CONTROL SYSTEM....36
OPTION 19: CONNECTION TO SNMP NETWORK....36
OPTION 20: TELEGLOBALSERVICE....36
OPTION 21: POWER ADAPTER AUTOTRANSFORMERS....37
OPTION 22: UPS USED AS FREQUENCY CONVERTER....37
OPTION 23: SECOND CLIENT INTERFACE BOARD....37
OPTION 24: SECOND RS232 INTERFACE....37
OPTION 25: SINGLE BATTERY FOR PARALLEL OPERATION....37
OPTION 26: INCORPORATED BATTERIES....37
OPTION 27: 24-PULSE RECTIFIER BRIDGE....37
OPTION 28: REMOTE SENSING CIRCUIT....38
OPTION 29: VERSIONS WITHOUT DISCONNECTING SWITCHES....38

TECHNICAL SPECIFICATIONS....38

MAX POWER OF INPUT AND OUTPUT CABLES: TABLE 1
RECTIFIER INPUT SPECIFICATIONS TABLE 2
RECTIFIER OUTPUT SPECIFICATIONS TABLE 3
INVERTER INPUT SPECIFICATIONS TABLE 4
INVERTER OUTPUT SPECIFICATIONS TABLE 5
STATIC SWITCH SPECIFICATIONS: TABLE 6
COMPLETE UPS SPECIFICATIONS: TABLE 7
MECHANICAL SPECIFICATIONS TABLE 8
OTHER DETAILS: TABLE 9
PARALLEL: TABLE 10
AVAILABLE OPTIONS: TABLE 11
EMERGENCY NETWORK FUSES: TABLE 12

IMPORTANT WARNINGS

This section contains some of the most important warnings which must be read and understood before the installation and start-up of the equipment.
Read the following warnings very carefully.
Should you need any further information regarding this matter, please do not hesitate to contact SIEL S.p.A.
This manual shall be considered an integral part of the UPS and be stored for the entire product life. Keep it in an easily accessible location close to the device.
For any operation on the UPS carefully respect the instructions below.

The different paragraphs of the warnings and of the manual are signalled by the following symbols:

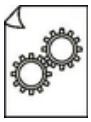
 Danger (situation which can cause severe injuries to people and/or damages to equipment)

 Risk of electrical shock (danger of death)

 Important notice

 Information regarding disposal

 Installation instructions

 Use instructions

 Unpacking instructions

Introduction

These warnings are meant to point out and, as far as possible, to eliminate the main dangerous conditions; they shall be completed with the information provided in each chapter of the manual (specifically in the chapters “Installation” and “Electrical connections”)

Dangerous voltage

The static switch contains potentially fatal voltages.
All dangerous voltages within the UPS equipment are segregated into special areas, which are only accessible using tools not provided with this equipment.

All maintenance or repair work which requires access to those areas can only be carried out by authorised SIEL S.p.A. personnel.

Introduction of objects

Do not insert any objects into the air vents, avoid contact with fluids and clean away with a dry cloth. These precautions must be observed even when the machine is switched off.

Equipment Top

The UPS top panels are not designed to withstand heavy weights. **Never** climb on the top of the UPS or place service platforms or other similar objects on it and **do not** use them as a support for further frameworks (cable grommets, brackets, etc...)

Batteries

These power supplies are connected to batteries which store electrical energy, often of a high capacity. They should therefore be operated with utmost care due to the high voltage which is present even when the loads are apparently not powered. It is important to remember that the residual voltage contained in seemingly flat batteries may still be potentially lethal. When working on batteries, be especially careful not to generate accidental electrical arcs.

Electrolyte

If the electrolyte leaks from the batteries, it is necessary to store them in sulphuric acid-resistant containers and dispose of them according to applicable laws.
If the electrolyte comes into contact with skin, rinse with plenty of water.
If it comes into contact with eyes, rinse immediately with plenty of water and contact a doctor as soon as possible.

Indirect contact

The input neutral is essential for the correct operation of the UPS.
If this connection is missing, the UPS will continue to power the load, but the neutral will be isolated, so that automatic differential circuit breakers downstream of the UPS, which should protect against indirect contact, will be disabled.

Cable cross-section

Check that the input and output cables have the correct cross-section. Also check plant cables.

Earth connections

Always connect the earth cable first. When disconnecting the equipment, remove the earth cable last.

Power feedback

If the backup mains cables for the equipment or the power supply board are not provided with a device against feedbacks from the UPS to the mains, place clearly visible warnings - near all the power switches installed on the plant to which the UPS is connected - with the following notice:

AN UNINTERRUPTIBLE POWER SUPPLY IS CONNECTED ON THIS LINE. BEFORE PERFORMING ANY OPERATION ON THIS CIRCUIT TURN OFF ALL THE INPUT/OUTPUT SWITCHES.

⚠⚡ Initial start-up
Never energise the equipment before a check has been carried out by trained personnel.

⚠⚡ Subsequent start-ups
Initiate the start-up procedure with all machine disconnect switches in open condition.

⚠ Handling 1
Power supply units are very heavy machines. Always make sure that handling operations are carried out by expert personnel and check the load-bearing capacity of raised floors.

⚠ Handling 2
Do not store the UPS in a tilted position or on one side.

⚠⚡ Installation environment 1
Appliance not suitable for bathrooms or similar damp environments (see: "Environmental consideration") and only suitable for use in closed environments.

⚠ Installation environment 2
The UPS is not suitable for installation in locations exposed to shocks and vibrations, e.g.: road vehicles, railway vehicles, cableway vehicles, airplanes, ships or similar (such as cranes, overhead travelling cranes, moving or vibrating parts of machine tools…)

⚠ Installation environment 3
Never install the UPS in locations with explosive, aggressive, corrosive or saline atmosphere.

⚠ⓘ Positioning
Always install the UPS well away from any sources of heat.
Position the UPS in rooms with sufficient ventilation.
Always install the UPS in closed areas: Never install the units outdoors.
Install the UPS in a dust-free environment: any dust entering the system may prevent it from cooling properly.
Place the UPS on the solid and even surface extending further than the machine base in all directions.
Please respect the values in figure 10 of this manual and the warnings in chapter "Installation".

⚠⚡ Tidiness of the installation location
The area where the UPS is installed must be kept clean and dry to prevent any solid or liquid material from being drawn into the UPS. Otherwise, malfunctioning and fire hazard can occur.

⚠⚡ⓘ Repair work
Never try to repair the machine on your own: refer to the manufacturer or to an authorized service centre. Any repair work made to the equipment not explicitly authorized or carried out by Siel, beside involving actual danger, implies the immediate cancellation of warranty. Siel shall not be liable for any consequent malfunctioning and for any arising loss or damages.

Service

Call for service in case of damages to the machine, for example after penetration of liquids, fall of objects into or on the machine, if it was exposed to rain or humidity (exceeding the allowed ranged), in the event of a malfunction, a major decrease in performance or a bump.

Accessories

Use only the accessories specified by the manufacturer. Using accessories of other kind can produce severe malfunctioning of the machine. The use of unauthorized accessories implies the immediate cancellation of warranty. Siel shall not be liable for any consequent malfunctioning and for any arising loss.

Personal safety 1

Siel UPS units are designed and manufactured in order to assure remarkably high MTBF values for the appliance and for the load supply. Please be aware that the MTBF is a statistical parameter and as such is subject to factual and conceptual limitations.
Please note that the MTBF refers to a correctly installed and maintained device: it does not consider conceptual neither factual errors made during plant creation, nor mistakes due to negligence or fraud.
Moreover, the reliability of load supply can be further enhanced by means of appropriate plant measures, even in presence of abnormal conditions (fraud or accident)
Considering the above, for plants involving hazards for people or featuring "mission critical" operations, we recommend to carry out an in-depth and validated risk analysis, in order to guarantee the maximum reliability of load supply and to prove that all possible state-of-the art methods were used at the time of plant erection (e.g. redundant parallel connection of UPS units, coupled with system external manual bypass and alternative power supply sources, etc.)
SIEL S.p.A. strongly recommends to contact the technical department for further details.

Personal safety 2

According to their specific function, Safepower-EVO UPS units, are only designed for professional users and shall not be used by untrained personnel.

Maintenance 1

In order to guarantee the expected life for which the product was designed, respect the maintenance plan mentioned in the relevant chapter.

Maintenance 2

Maintenance shall always be carried out by SIEL S.p.A, in order to be sure that only new and genuine spare parts are used and that the machine can be updated in line with any technical development (according to the respective service contract).
Specifically, any machine in which unauthorized, obsolete or outdated spare parts were used shall be considered as "modified", implying all the consequences pointed out in paragraph "Modifications to the equipment".

Limitation of use

The UPS is not designed to work as a the single equipment to be used to supply power to life saving devices. For such applications the integration of an additional UPS is mandatory, with further technical features designed to deliver a backup system to users in the event of the complete failure of the UPS, of the second equipment or of plant sections included in the same room of the UPS. (see also "Personal safety").

Residual risk

UPS from the Safepower-EVO series have been designed in order too minimize the risk of personal injuries both when the system is functioning properly and in error conditions. Nevertheless, since such devices involve the use of high voltages and currents, an actual residual risk exists. The user shall do anything in his power to minimize such a risk. In particular, he/she shall make sure the device is installed according to the instructions of this manual in chapters “Important warnings” “Installation” and “Electrical connections”.
Moreover, the user shall verify the device is installed according to the applicable regulations and to state-of-the-art procedures.
SIEL S.p.A. strongly recommends to contact the technical department for further details.

Product identification plate

The product identification plate showing technical details and the appliance code and serial number, is accessible by opening the front door of the UPS unit (near the disconnecting switches).
When calling about the appliance, always quote the serial number on the identification plate.

UPS connected to the electrical system 1

Only use the power supply source specified in the technical data and on the product identification plate.

UPS connected to the electrical system 2

All UPS units - in their standard configuration - are pieces of equipment that, if not correctly installed, can under certain conditions cause changes to the electric system of the supplied installation, thus making protection against indirect contacts ineffective. UPSs should, therefore, only be installed by skilled and trained personnel, duly authorised to issue state-of-the art Conformity Declarations for such equipment.

UPS connected to the electrical system 3

When the UPS is fitted with a power transformer connected to the backup line, the load is totally insulated from the mains; consequently:
- either the system is handled as IT (see option 20)
- or the output neutral wire must be connected to a reliable ground in order to restore the regular operation of the differential switches connected between the UPS and the loads (TN-S).

UPS connected to the electrical system 4

When two or more UPSs are connected in parallel, do not use automatic differential circuit breakers on each backup input. If a differential circuit breaker is required, only one circuit breaker must be used for all the backup inputs.

Protections and disconnecting devices

Ensure that the mains input is equipped with correctly sized switches and protections. Verify their correct operation.
If the protection against electric shock of the system where the UPS is installed is based on differential current devices, the devices must be type B

Ventilation

Never obstruct the air vents of the UPS. The type and the implementation of any air distribution line must be checked and approved by Siel S.p.A.

Modifications to the equipment

Any change made to the equipment not explicitly and formally authorized by Siel implies the immediate cancellation of warranty. Siel shall not be liable for any consequent malfunctioning and for any arising loss.

Electromagnetic compatibility

As to electromagnetic compatibility, SIEL UPS units comply with European standard EN62040 -2 (EN50091-2). In particular, these UPS units are "only produced for limited sale to people with appropriate technical skills. Limitations and other precautions regarding the installation may be required to prevent interference".

Batteries

The Batteries must be periodically recharged (at least every six months). SIEL S.p.A. shall not liable for any battery damage deriving from the infringement thereof.

Earth current

The equipment has anti-noise filters at high current to earth.

User Signals

All signals provided for the user by means of relay contacts are fully insulated from dangerous voltage levels.
Insulation between the various contacts is only effective for voltages below 48Vac (60Vdc); in no way can these contacts be used to switch the power line voltages.

Packaging

Always keep the UPS packaging.
When UPS units need to be transported they must be repacked in their original packaging.
In particular, if UPSs are returned for repair in unsuitable packaging or transported in a horizontal position, they will not be accepted nor will the warranty will be recognised.

Technical data

The addition of a number of options may significantly change the technical data shown. For more details contact Siel S.p.A..

Limitation of liability

SIEL S.p.A. shall not be liable for any direct or indirect damages (including loss of profits or revenues) deriving from the malfunction of the device, even if SIEL S.p.A. was warned in advance of the possibility of such damages.

Disposal 1

This product shall not be disposed of as domestic waste. It shall be taken to a pickup point of a recycling facility for electrical and electronic devices.

Disposal 2

Battery packs shall be disposed of separately according to current regulations.

Note about this manual

All pictures and tables quoted in the text are reproduced at the end of the manual.

INTRODUCTION

This instruction manual describes the Siel UPS "FLEXIPOWER-SAFEPOWER" series, manufactured by Siel SpA – Via I° Maggio 25 – Trezzano Rosa (Milan).
These UPS units are identified by codes, the first two letters of which are: UG……
Furthermore, this manual applies to non-standard products based on the "Flexipower-Safepower" series, as indicated in the machine documentation relating to the specific UPs unit.

This series comprises a range of technologically uniform appliances that extends from 20kVA up to 1MVA.
They are true double-conversion UPS units equipped with inverters with output transformers which fully separate the battery voltage from the power to the load, thus ensuring that it is absolutely impossible for the DC voltage from the battery to reach protected appliances, should a failure occur.
The input stage comprises two sturdy thyristor bridges which combine very high reliability with low emissions of high-frequency interference, thus avoiding all possibility of interference even with appliances which have a very low level of electromagnetic immunity.
All the units of this series have built in on-board disconnecting switches and are functionally complete, including all the rectifier, inverter and static switch sections.
(Only the 1MVA appliance does not feature the disconnecting switches on board the machine, but if necessary housed in a special outside cabinet).
Appliances up to 60kVA may be supplied with batteries incorporated.
Of the UPS to which this instruction manual refers, both the versions for single operation and the version for parallel operation exist; in any case, a parallel connection UPS is also able to operate correctly as a single apparatus; additionally, all sizes may be supplied both in twelve- and six-phase versions.

TAPPLICABLE REGULATIONS

The UPS units of the "Safepower EVO " series are CE marked and as such they comply with the relevant product regulations; more specifically:

Standard

EN62040-1-2:	Uninterruptible Power Supply (UPS) Part 1-2: General and safety requirements for UPS used in restricted access locations
IEC62040-1-2:	Uninterruptible Power Supply (UPS) Part 1-2: General and safety requirements for UPS used in restricted access locations

(EN50091-1-2:	Uninterruptible Power Supply systems (UPS) Part 1-2: General and safety requirements for UPS units used in restricted-access locations
EN50091-2:	Uninterruptible Power Systems (UPS) Part 2: Electromagnetic compatibility (EMC) requirements
IEC62040-2:	Uninterruptible Power Systems Part 2: Electromagnetic compatibility (EMC) requirements
EN62040-3:	Uninterruptible Power Supply systems (UPS) Part 3: Specific performance methods and test requirements
IEC62040-3:	Uninterruptible Power Systems Part 3: Protection requirements and test methods
(EN50091-3:	Uninterruptible Power Systems (UPS) Part 3: Protection requirements and test methods)

The appliances are designed and manufactured in conformity with UNI EN ISO 9001:2000 standard, as certified by Sincert certification N.005.

DESCRIPTION OF SYSTEM

The UPS described in this manual is a result of projects, technologies and advanced electronic components.
Its primary function is to guarantee the load is continuously supplied with or without the mains voltage. The supply output is of high quality voltage and frequency, suitable for supplying even the most sophisticated and delicate load.

Double-conversion UPS offer the following:
- Increased power quality
- Power blackout protection
- Full noise rejection
- Full compatibility with all types of loads
- To meet the needs of any installation, thanks to the huge number of options available
- To guarantee high efficiency in all load situations

Block diagram (Figure 1).
The equipment consists of the following units:
- A RECTIFIER SWITCH COMPONENT (S1) which enables the rectifier to be disconnected from the power supply.
- Rectifier fuses (1) which are used for quick disconnection of the rectifier from the mains, in case of a rectifier fault.
- One rectifier RF FILTER (2), which reduces the high frequency disturbances within the limits defined by European Standard EN 62040-2 (EN 50091-2).
- One RECTIFIER/BATTERY CHARGER (3) which converts the mains three-phase alternating voltage into direct voltage.

- One IGBT STATIC INVERTER (4) which converts direct voltage into high quality alternating voltage for feeding of important loads.
- A TRANSFORMER (5) that completely separates the load from battery D.C. voltage (10).
- A BATTERY (10) providing the energy required to operate the inverter in case of line voltage failure (the battery disconnecting switch (SB) must be included in the battery cabinet or premises).
- One STATIC SWITCH (6) which, when the inverter is overloaded or locked, transfers the load to the mains ensuring that the load is continuously supplied.
- One OUTPUT SWITCH S2 which can completely disconnect the UPS from the load.
- One S4 RESERVE LINE SWITCH COMPONENT enabling reserve line disconnection from the static switch.
- This switch also has FUSES (9) to protect the semiconductors of the static switch from output short-circuits.
- One S3 manual BY-PASS consisting of a disconnecting switch component which enables the load to be powered directly, excluding the UPS through the other disconnecting switches. The manual by-pass is not included in UPSs suited for in-parallel operation and must be envisaged externally as a general system bypass.
The rectifier/battery charger (3) changes the mains voltage into a regulated and filtered direct voltage, suitable to re-charge the battery and keep it charged. In the meantime the rectifier also supplies the necessary voltage for inverter operation. The inverter (4) (type IGBT with PWM modulation) takes voltage from the rectifier and supplies, through transformer (5), the loads with an alternating voltage featuring very low distortion and constant frequency and amplitude.
If the mains fails, the rectifier stops and the batteries (10) supply the necessary power to make the inverter work until the batteries are discharged or the mains is restored. This situation is maintained until batteries are low or until mains power is restored.
A special circuit stops inverter operation when the battery voltage reaches dangerously low levels.
The inverter stop voltage (end-of-discharge voltage) is changed according to the discharge current function so as to eliminate any chance of damaging the elements.
When the mains supply is restored, the rectifier starts working again, recharging the batteries and supplying the inverter.
The rectifier starts up gradually (soft-start circuit) to avoid any over current when the equipment starts.[1].
If the UPS has maintenance-free batteries, the recharge occurs with limited current until the floating voltage is reached (also called maintenance voltage).
the maintenance voltage is suitably changed according to battery temperature (if the UPS is supplied with inside battery or if the battery cabinet features a special heat probe).
If the UPS is connected to vented-type lead acid batteries, a higher voltage is reached (boost charge voltage) which is only maintained until the battery is completely recharged. Then the voltage returns to the floating value.
The charge criteria are defined in the I-U specification of Standard DIN 41773.

Thanks to the technology adopted, the efficiency of the apparatus remains very high, already starting with fairly low loads; this provides considerable energy saving (without sacrificing the specifications of double conversion operation) in normal operating conditions and with the in-parallel operation of several appliances.

The static switch permits supplying the load through the mains in case of strong overload of the inverter or of an inverter fault. Once the abnormal condition is over, the load is automatically supplied by the inverter.
If a reserve mains - separated from the rectifier mains - is not available, it is necessary to connect the terminals of both input mains in parallel.

1:In case of in-parallel operation, the appliances can be provided with a circuit for the sequential start of the UPS rectifiers

All the operating conditions are locally signalled both through a luminous (synoptic) functional diagram (Fig. 5) and messages on the control panel (Fig. 4).
The signals are sent through the “customer interface board” (Fig. 6) as described in paragraph «Description of the remote signalling systems».
The Bypass manual disconnection switch (S3 in figure 1) is used to carry out maintenance on the equipment without interrupting the supply of the load which keeps on being supplied by the reserve mains (IN2).
In this case, the UPS can be completely switched off and disconnected from the installation through the special S1, S2 and S4 disconnection switches, so that operations on the equipment can be carried out in complete safety.
Obviously, when the load is fed by the manual By-pass, it is not protected against any mains outages.
Since the manual bypass circuit must supply the load as if there were no UPS, this circuit is not protected and as such, suitable protection shall be provided in the plant. In the case of in-parallel apparatus, the manual bypass must be external to the UPS as shown in Fig. 11.

No battery disconnect switch is envisaged because this is fitted inside the battery cabinet; if such a cabinet cannot be fitted, a box must be installed near the batteries with disconnect switch and fuses or automatic switch.

The UPS is provided with an electronic device (E.P.O), which can simultaneously block the Rectifier, Inverter and Static switch operation, thus removing power from the load in case of emergency.
This device, though stopping operation of all UPS functions does not physically disconnect the apparatus from the public mains and battery, consequently the switch-off command must be provided by the system to the UPS together with other disconnections required by applicable regulations.

The integrity of the batteries is controlled periodically (normally every week) by provoking an intentional small battery discharge and making sure this occurs properly. It should be noted that the discharge is not determined by causing an intentional mains power break (which, in case of battery inefficiency could prove dangerous for correct load supply), but rather by varying the voltage at which the rectifier stabilises. This way, even in the case of totally faulty batteries, power continuity to the load is in any case assured. Moreover, after a battery discharge (intentional or due to a blackout), the time needed to recharge the battery is checked and if this is too long, an alarm is generated.

In the event of the UPS unit featuring a twelve-phase rectifier bridge, the current distortion reflected towards the mains is reduced by 29% (total-controlled six-phase rectifier), to 7 or 11% depending on the request.
This result can be obtained through specific magnetic components generating two triads of specially phased voltages (30°) feeding two six-phase rectifying bridges.
The result is that the current absorbed by the network is the sum of the currents absorbed by the two bridges; this way, the resulting current has a very low degree of distortion because its wave pattern successfully approximates the sinusoidal pattern.
In all other respects, a UPS fitted with a twelve-phase bridge functions in exactly the same way as a six-phase bridge.

When even lower input current distortions (≤5%) are required, the equipment may be fitted with a an extra filter to correct the input current phase.
Moreover, UPSs with capacities from 500kVA to 1MVA can also be supplied in a version with a 24-pulse rectifier bridge that, without the addition of extra filters, naturally guarantees a harmonic distortion of the current lower than 5% (the technical specifications of these UPSs are given in technical specification SP117 which integrates this document).

The version with the 24-pulse rectifier bridge may be supplied for UPSs with lower capacities on request (for further information, please contact Siel SpA).

Interactive mode of operation

The rectifier/battery charger (3) changes the mains voltage into a regulated and filtered direct voltage, suitable to re-charge the battery and keep it charged. Furthermore, the rectifier also supplies the necessary voltage for empty inverter operation.
In the meantime, the load is supplied by the mains through the static switch (6).
IGBT-type inverter (4), with Pulse-Width Modulation (PWM), is constantly synchronised at the mains voltage to minimise load disturbance in case of power outage.

In case of power outage, the static switch feeds the load from the inverter; power necessary for inverter operation is supplied by batteries (10), since the rectifier stopped when the power went off. This situation is maintained until batteries are low or until mains power is restored.
A special circuit stops the inverter when the battery voltage reaches very low levels (so low that the batteries could become damaged).
For this reason the end of discharge voltage is changed in function of the inverter current.

Before the inverter stops, a near low battery signal is produced.

When the mains power is restored, the rectifier restarts operating and recharges the batteries, while the load is again supplied by the mains.

Thanks to the technologies used, the efficiency of the apparatus remains very high during operation with mains; in fact the only leaks are determined by the static switch and by the empty operation of the inverter.

With regard to the description of battery recharging, signals, E.P.O. circuit and 12-phase bridge,, refer to the previous paragraph “Description of operation in ON-line mode".

The switch from ON-line mode to Interactive mode and vice-versa can be done (by trained personnel) directly in the field using a special command without replacing the electronic boards.

Description of Parallel operation

In the case of in-parallel operation, the units are interconnected so the outputs of all the machines are connected together (naturally, each UPS can be disconnected from parallel by means of the output disconnection switch S2).
This way it is possible to increase the output power and/or the reliability of power to the load. In fact, with n. machines in parallel, an output power of n. times the rated power of the single machine (Pn) can be achieved; furthermore, when the load absorbs a power equal to (n-1) Pn, if a machine breaks down, the system does not stop (increase of reliability of power to load).
In order to coordinate the operation of several units in parallel, the UPS units exchange a whole series of data by means of a network of optical fibres. This way, maximum immunity is achieved to electrical disturbances.
The Siel parallel does not require the exchange of any electrical type signal.
Without going into operating details (for more details, the Siel staff are at your disposal) suffice it to say that the inverters are kept carefully synchronised so as to prevent exchanges of current between the machines.
Even when the load is supplied through static switches (also connected in a parallel redundant configuration), power is correctly partitioned among the machines through suitable partition coils.
To sum up, in the event of an intentional or accidental stop of one of the UPS systems, the load is still supplied by the other units in parallel, provided this is allowed by the total load power. It is even possible, if the system is properly made (Figure 11), to disconnect one UPS completely and if necessary replace it without interrupting load supply.

In the parallel system, the UPS are each equipped with their own battery; on request the parallel system can be equipped with centralised battery (option 25).

No in-parallel operation is envisaged in interactive mode.

For more details about in-parallel operation, read the following paragraph (its omission does not prevent understanding the rest of the instruction manual).

Detailed analysis of parallel operation

The UPS units connected in parallel with ON-line operation can, by means of a setting made by means of a dip-switch, operate in two distinct ways:

1- Power parallel
2- Redundancy parallel

1- Power parallel

By power parallel is meant the situation whereby all the UPS units must operate at the same time in parallel in order to supply all the power needed for the load.
In this situation, in case of an inverter stop, the load has to be powered from the mains, in view of the fact that the power supplied by the remaining inverters is not sufficient.
Consequently, as soon as an inverter stops, the load is powered through the static switch from the emergency mains until all the inverters are working again.
In the event, due to maintenance, of an UPS unit being completely disconnected (disconnected from the mains, from the batteries and from parallel),or placed in test mode after disconnection from parallel (contact Siel) the remaining UPS units continue to power the load from inverter or mains as described previously.
For example: if in a 4-UPS parallel, a machine is completely disconnected (operation performed by trained personnel) it is imagined that the load has been reduced in order to be powered by the 3 inverters still working and consequently the system supplies power to the load through the inverters themselves (if all three of them are working properly).
In case of stoppage of another inverter, the load is powered from the mains.
The complete disconnection of two or more UPS units always results in the load being powered from the mains (See table 10)
If the buttons I<>R and Return (Figure 4) are pressed together, we have the manual switchover of the system from inverter to mains and vice versa.
If the inverters are not synchronised with the mains, manual switchover is prevented.
If the load is switched under mains, after 15 sec., conditions permitting (inverter OK, synchronism OK), the load is again supplied from the inverter.
In the event of the "Forced" switch of an operating machine being operated (forced powering of load from mains), the entire system switches to mains and remains there in all cases .
To prevent accidental operation, access to this command is only possible by opening the door of the UPS unit (featuring a key).
The forced button must only be pressed when the machine is synchronised with the mains (green light on and synchronism signal OK).
Optionally, an external device is available which, by means of a manual control, determines permanent load supply from mains or inverter.

2- Redundancy parallel

By redundancy parallel (commonly called n+1) is meant the situation whereby, if an inverter is stopped, the power supplied by the other inverters is in any case sufficient to power the load.
Consequently two or more inverters must stop together to cause the load to switch from inverter to mains; in fact, in this case, the power of the remaining inverters is no longer enough to power the load.
In the event, due to maintenance, of an UPS unit being completely disconnected (disconnected from the mains, from the batteries and from parallel),or placed in test mode after disconnection from parallel (contact Siel) the remaining UPS units continue to power the load from inverter or mains as described above.
For example if in a 4-UPS parallel, a machine is completely disconnected (operation performed by trained personnel) it is imagined that the load can be powered in redundant mode by the 3 machines that are still working.
The complete disconnection of two or more UPS units always results in the load being powered from the mains (See table 10b).
If the buttons I<>R and Return (Figure 4) are pressed together, we have the manual switchover of the system from inverter to mains and vice versa.
If the inverters are not synchronised with the mains, manual switchover is prevented.

If the load is switched under mains, after 15 sec., conditions permitting (inverter OK, synchronism OK), the load is again supplied from the inverter.
In the event of the "Forced" switch of an operating machine being operated (forced powering of load from mains), the entire system switches to mains and remains there in all cases .
To prevent accidental operation, access to this command is only possible by opening the door of the UPS unit (featuring a key).
The forced button must only be pressed when the machine is synchronised with the mains (green light on and synchronism signal OK).

What has been said above can be summed up in the following reports:
If:

Nrid	is the redundancy number, whose values can be 0 and 1 (0= power parallel)
Ni	is the number of units that can supply the load with the inverter
NUPS	is the number of UPSs making up the parallel

so the rule for defining load powering is the following:
if

$$Ni \geq NUPS - Nrid$$

so the parallel powers the load from inverter.
If instead

$$Ni < NUPS - Nrid$$

the parallel powers the load from mains.
It should be noted that if NUPS is less than Nrid, Nrid is set equal to NUPS.

Equipment

Figure 2 shows the view of the UPS units with the front doors closed.
The opening of the front door, featuring a lock, gives access only to the input, output and bypass disconnecting switches (if fitted); the UPS unit is supplied together with a key for accessing this compartment. Fig. 3 shows the disconnecting switch compartment for the various types of UPS units.

The switches (Figures 1 and 3) are:
S1 Rectifier input disconnection switch
S2 UPS output disconnection switch
S3 Manual bypass (Not envisaged in case of UPS set for parallel)
S4 Reserve mains disconnection switch

To access the power compartments, open the front doors and open the board support door: this operation can be performed using a simple screwdriver - not provided with the UPS unit.

The upper part of the equipment houses the control, measurement and signalling panel (shown in more detail in Figure 4) and a LED mimic diagram (shown in greater detail in Figure 5).
When the front doors are closed, these are the only accessible components which provide useful information and carry out all necessary checks.
Even with open doors with lock, the equipment still maintains an insulation standard of IP20, and no live part is accessible.

Control, measurement and signalling panel.

The control, measurement and signalling panel on the front of the equipment (Figure 2) is shown in detail in Figure 4 (referred to hereinafter as Signalling).
The signalling panel includes a liquid crystal display (LCD) with 80 characters, and control keys.
During normal UPS operation, signals appear showing the state of machine operation.
Some of these signals are repeated on the Functional diagram (Figure 5) where corresponding LEDs light up to provide a quick overview of the operation of the different equipment subassemblies.

The appearance of one or more alarms determines the tripping of the acoustic alarm; in these conditions, the alarms in progress are displayed.
The acoustic alarm can be muted by means of the specific key.
The messages concerning the alarms are organised as follows: the alarm appears in capital block letters on the top line of the display unit while the bottom line shows the operations to be carried out to reset the alarm.

A detailed description of the signalling panel functions is given below:

a) Loop view of the UPS status:

the signalling panel displays messages at about every 5 seconds related to the operating status of all main sections of the UPS.
If one or more alarms trip at the same time, the control logic gives a continuous beep and displays the alarms in progress.
If the operator mutes the acoustic signal using the key provided, the Signalling will again display all the UPS messages together with the alarms in progress.

The following are the alarms and signals displayed on the LCD.

Signals

RECTIFIER
1) Rectifier on

BATTERY
2) Battery on float charge
3) Battery on boost charge.
4) Battery voltage OK

INVERTER
5) Inverter on.
6) Inverter-reserve synchronised
7) UPS Master (only when in parallel)

STATIC SWITCH
8) Load on inverter
9) Rerserve OK
10) Load on reserve

Alarms

RECTIFIER
1) Rectifier off
2) Rectifier locked
3) Rectifier over temperature

BATTERY
4) Battery pre-alarm
5) Wrong battery voltage
6) Battery failure
7) Battery Overheating
8) Battery temperature probe fault

INVERTER
9) Inverter overload
10) Phase R over current

11) Phase S over current
12) Phase T over current
13) Inverter over temperature
14) Magnetic units overheating
15) Output filter fault
16) Inverter stopped
17) Inverter output over voltage
18) Inverter-Mains not synchronized

STATIC SWITCH
19) Switching blocked
20) Static switch failure
21) Stand-by not suitable

COMPLETE UPS
22) Emergency UPS activated
23) Back feed protection
24) Manual by-pass inserted (Not for parallel UPS)
25) No Parallel Data Exchange (Not envisaged for single UPS)
26) Ambient overheating
27) Strongly distorting load
28) Preventive maintenance is suggested
29) Preventive maintenance needed
30) Missing isolation (option)

In normal operating conditions (with no alarms) besides the various signals, when the display is switched on, the UPS Normal Operation message is displayed.

b) Manual display of the UPS status:

during its normal operation - described in item a) above - the signalling can be interrupted by the operator to see more quickly all messages related to the status and/or alarms. In particular, it is possible:
- to bring messages forward/back by pushing and releasing keys 2 or 3 together with key 1 as shown in Figure 4.
- to bring messages forward/back at one second intervals by holding down keys 2 or 3 whilst holding down key 1 as shown in Figure 4.

c) Display of voltage/current values:

there are three keys (2, 3, 4 in Figure 4) which enable the following information to be displayed in real time on the signalling panel:
Six UPS output voltages (Phase/Phase and Phase/Neutral)
Six rectifier input voltages (Phase/Phase and Phase/Neutral)
Six reserve mains voltages (Phase/Phase and Phase/Neutral)
Three UPS output currents
Three rectifier input currents

Apparent power, active power, power factor and crest factor of UPS output.

UPS output frequency
Reserve mains frequency

The voltage, the autonomy percentage (percentage of time left until the battery runs down), the battery current, the battery temperature and the max temperature reached by the batteries
Room temperature and max temperature reached in the room.

d) Communication with special software:

the panel firmware implements a communication protocol with programs that operate on computers equipped with a EIA-RS232C serial interface; this communication protocol envisages, at the request of the software with which it dialogues, the transmission of alarms/signals and measurements of the UPS; the partner software of this dialogue can also pilot all the functions envisaged by the front panel of the machine.
Siel offers two software programs, which take advantage of all opportunities given by the communication protocol. These programs, called EDMS and OCSystem3, cater for all possible control and signalling requirements. In particular, EDMS is compatible with virtually all existing hardware platforms, whilst the OCSystem3 software offers ample scope for customisation.
To function properly, computers must have a standard EIA-RS232C connection and a monitor with VGA or higher resolution.
Another option permits monitoring the state of the UPS and performing the shutdown of personal computer, server and workstation linked to a LAN network.
The option consists in additional hardware which on the one hand links up to the UPS through a serial interface RS232C and permits network linkup by means of an RJ45 connection.
The protocols implemented on this hardware are HTML and SNMP.
This implies that the status of the UPS can be configured and monitored through any web browser with Java and the shutdown can be managed of all the machines linked to this network node.

Functional diagram.

The functional diagram on the front of the appliance is shown in figure 5.

FUNCTIONAL DIAGRAM
The functional diagram includes the following signalling lamps (LEDs):
Led 1) - Rectifier on
Led 2) - Near low battery pre-alarm
Led 3) - Inverter on
Led 4) - Load on inverter
Led 5) - Reserve OK
Led 6) - Load on reserve
LED 7) By-pass on (Not functional in case of UPS in parallel)

Description of the back-feed protection sensor

Connection
This type of sensor must be fitted with a four-pole magnetothermal switch, to be supplied by the customer, and connected in series to the backup supply of the UPS.
When a failure on the static switch occurs, this device enables the release coil of the external switch (230 VAC with enabled alarm), thus protecting personnel working on the system from potential risks. The UPS must be connected to the external switch by means of two 4 sqm terminals installed next to the sectioning elements. If required, the UPS can also be fitted with three additional terminals to connect the signals of the back-feed protection board. Said terminals correspond to a normally closed contact (NC), a common contact (C) and a normally open contact (NO) (the tripping of the sensor causes the relay to be "attracted").

Operation
When the UPS is operated in ordinary mode, the green "R.E. POWER" LED lights on permanently. As soon as the sensor detects a return of power towards the mains, the red "R.E. ALARM" lights and an acoustic warning is enabled, while the relay on the back-feed protection board releases the external

switch upstream from the backup supply. To restart the UPS in ordinary mode, it is necessary to press "RESET R.E." and reset the switch.

WARNING
Pressing "TEST R.E." is equivalent to simulating a return of current towards the mains, which causes the external switch to be released.

Remote signalling systems.

All the signals exchanged with the UPS go through a customer interface board (Figure 6).
The customer interface board is equipped with terminals for the EPO circuit and for the battery temperature sensor (the latter on request).

UPS status can be monitored using potential-free relay contacts.
To monitor the conditions of these relays, there are two possibilities:
- one DB9 box-type connector which monitors 4 of them (CN1 in Figure 6)
- one terminal block which monitors all of them.

For more details on the signals available on the DB9 connector and on the terminal boards, read the following paragraph (its omission does not prevent understanding the rest of the instruction manual).

Detailed description of the signals available on the CN1 connector and on the terminal boards.

The DB9 drawer connector (CN1 in Figure 6) is used for connection to a personal computer, provided with special software, which can monitor the UPS status and control switch-off.
Terminal blocks M1, M2 and M3 (Figure 6) also supply further signals and alarms.

Description of connector CN1
- The CN1 connector is an isolated communication port showing clean contacts; these are normally used by various software applications dedicated to monitoring and controlling the UPS (for further details, contact SIEL S.p.A.).
The closing of a contact is equivalent to the occurrence of the event shown in figure 7. Figure 7 shows the standard connection. Upon request, it is possible to change connections to the various pins through J1 ... J6 jumpers. (In particular, you can order the connection kits to AS 400 and RISC 6000 computers.)
It is possible to switch off the UPS by injecting a 10mA DC current coming in from pin 4 and going out from pin 6.

Description of terminal boards M1, M2 and M3.
Terminal blocks M1, M2 and M3 are equipped with potential-free contacts (both normally open (NO) and normally closed (NC)) of the most important signals concerning the UPS.
Figure 8 shows relays in the idle position, while signal indications refer to an energised relay.

The signals coming from relays RL1, RL2, RL3 and RL4 (Figure 6) are fixed, while the ones handled by relays between RL5 and RL10 can be customised; implement this function by using DSW1 dipswitches (Fig. 6)

Description of DSW1 dipswitches (Figure 8).
This board houses four DSW1 dip-switches which control the microcontroller assembled on the customer interface board.
The four dip-switches have the following functions:
1. – In 1111 condition (all on) all relays are simultaneously and permanently energised.
2. – In 1110 condition (on, on, on, off) all data for the normal operation of relays are acquired (factory setting).
3. - in 1101 condition (on-on-off-on) the meaning of relay 9 becomes "Mains switchover ←→ Inverter blocked"
4. - in 1100 condition (on-on-off-off) the meaning of relay 9 becomes the OR logic of all the alarms (to remote trigger a cumulative alarm)
5. - All the other positions keep the relays released.

Therefore, to enable the operation of the terminal block and of CN1 connector, the dip-switches must be set to position 2. 3 or 4.

To verify operation of all the relays, and test the correctness of the connections made on the terminal board, place the dip-switches alternatively in positions 1 and 5 (for instance by alternatively operating dip-switch 1 while the others stay in on position).

Description of communication fibre optics

This board also includes three fibre optic connectors.
Fibre optics are an ideal data transmission media and ensure data can be carried safely, even over long distances in environments with a high level of electrical interference (Industrial applications, close proximity to radio transmitters, signal cables cannot be separated from power cables in system, etc.)

For more details about fibre optic transmission, read the following paragraph (its omission does not prevent understanding the rest of the instruction manual).

Detailed description of fibre optics connections.

If data must travel further than the maximum distance (approximately 100m), Siel S.p.A. can provide special repeaters/amplifiers.
The IC11 connector (central connector in Figure 6) is dedicated to interfacing with a remote dedicated mimic panel, which allows the display of the main parameters of the UPS on a small console, even without using a personal computer.
Connectors IC8 and IC9 are used for connection through fibre optics to a personal computer, which has specific software installed that can graphically display all signals and measurements sent by the UPS, keep an accurate history file of events, and control the UPS from the personal computer.
When ordering this software, it is also necessary to purchase its fibre optics and the fibre optics/RS232 converter (available from Siel S.p.A.), which must be installed in close proximity to the personal computer.
Through only one personal computer, where the OCSystem3 software is installed, it is possible to simultaneously monitor all UPSs connected in parallel.

Customers wishing to use their own software to capture the signals and measurements provided by the UPS should send a written request to Siel S.p.A., who will then authorise and issue detailed specifications on the communication protocol.
Also in this case, customers should remember to order the fibre optics/RS232 converter.
The remote mimic panel and the personal computer monitoring software program can also be used simultaneously.
The connection is made by simply inserting the optical fibre's mobile male connector in the female connectors on the board until they click together, which indicates that a proper connection has been made.
The IC9 connector receives commands from the personal computer, whilst the IC8 connector transmits data to the personal computer.

The following basic precautions must be taken when connecting and wiring the system:
1 – Always match the colours of the mobile and fixed connectors to avoid confusing the receiver and transmitter with consequent transmission failure.
2) Do not confuse the remote mimic panel connector (IC11) with the personal computer diagnosis connectors (IC8 and IC9).
3 – When laying the fibre optics, avoid creating bends with radii below 10 cm; in such cases the reflection of light inside the fibre no longer occurs properly and communication could break down.
If no mechanical damage was caused while bending the cable, the connection can be restored simply by making a "gentler" curve.
The customer interface board is placed at the bottom right area behind the front air grating.

Even though there are no dangerous potentials on the customer interface board, it is necessary to make all connections with the UPS switched off, and with the mains and the battery disconnected, because the compartment in which the board is located contains live conductors.

INSTALLATION

Choosing the installation location

For a successful UPS installation, the following rules must be observed:

- Although all routine maintenance can be carried out from the front side, it is advisable to leave a space as indicated in figure 10 between the rear side of the UPS and the wall to allow any special maintenance operations to be carried out and/or to provide an adequate circulation of cooling air (Figure 10).
- The area where the UPS is installed must be kept clean and dry to prevent any solid or liquid material from being drawn into the UPS.
- A free space of about 1 m must be kept in front of the UPS to allow all normal and maintenance operations to be carried out (Figure 10).
- The top of the UPS must have a minimum distance from the ceiling of about 1 m to provide adequate ventilation.
- In view of the fact that these appliances, especially in the in-parallel configurations, can reach considerable power ratings, it is a good engineering principal to equip the UPS compartment and/or batteries with an automatic smoke detection system featuring an alarm to stop UPS operation.

Visual inspection

Prior to delivery, every UPS is carefully checked both electrically and mechanically. Always visually check a UPS after delivery for any transit damage, and immediately inform Siel S.p.A. if such damage is evident.

Environmental considerations

There are various environmental aspects to take into consideration, the most important being:

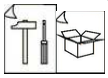
Floor capacity

The UPS occupies a small area and has a relatively heavy weight (see technical specifications). It is therefore necessary to position it on a floor having suitable capacity.
If the UPS is assembled on a raised floor, it is important to use a base with pedestals (this base can be provided by Siel upon request).
Cables must be connected from under the floor.

Temperature and humidity

The premises where the UPS is to be installed must be able to dispose of the kW dissipated by the machine during operation so as to keep the temperature at between 0°C ÷ 40°C; nevertheless, to achieve utmost reliability and life-span, the temperature of the environment should be around or below 25°C, with a humidity percentage between 0÷90% as shown on the technical specifications table.
More specifically, always remember that battery life is halved by a 10°C increase above 25°C.

Handling



The UPS is designed to be lifted from underneath using a fork-lift truck.

Safety Considerations


To reduce accidents, Health and Safety rules must be observed. Walls, ceilings and floors and everything surrounding the UPS are best not made of inflammable materials; furthermore, the area around the machine should be kept particularly clean so that metal dusts, iron filings or miscellaneous metals are not sucked up inside the UPS as these could cause short circuits.
It is advisable to keep a mobile powder fire extinguisher within easy reach.
For appliances with power above 100kVA, it is a good idea to fit an automatic smoke detection system.
Access to the UPS room should be restricted to machine service and maintenance personnel; the doors of the premises (equipped with handle and push opening from inside) and of the UPS must be kept closed and the keys properly looked after.
All service and maintenance personnel must be trained in emergency procedures.
Periodic tests are advisable to keep technicians trained.
New personnel must be trained before being authorised to operate the UPS.

Batteries


Siel build and supply reliable battery cabinets that do not require maintenance. The use of air-tight lead batteries rather than the "open-vented" batteries, which smell and need specific rooms, makes it possible to install them in cabinets adjacent to the UPS that are aesthetically matched.
If a battery room is used, the installer shall be responsible for following all applicable regulations.
Please remember that battery life is halved following an increase in temperature of 10°C above 25°C.
The batteries must be periodically recharged (at least every 6 months). SIEL S.p.A. declines any responsibility for damage to the batteries caused by failure to comply with the above warning.

ELECTRICAL CONNECTIONS

Power connections

See figure 9.

To access the power parts, remove the protection panels.
Unscrew the screws locking the panels in position to carry out this operation: this operation should only be carried out by trained personnel using special tools as high voltages are present in this area.

If, in order to remove the panels, the handles of the disconnecting switches have to be removed, this operation can only be performed with the disconnecting switches in OFF position. In the case of the mains and bypass disconnecting switches, the fact that these are in OFF position does not mean the power parts are de-energised. In fact the power supply is provided from the upstream network; safety condition is therefore only achieved by opening the switches of the upstream network.

The L1, L2 and L3 (R, S and T) rectifier input phases must be connected (following the correct phase sequence) to the specific bars located under disconnecting switch S1.
The reserve mains conductors must be connected to the bars of disconnecting switch S4.
The UPS output conductors must be connected to disconnecting switch S2.
In case a reserve mains is unavailable, connect the rectifier input in parallel with the reserve mains, carefully following the phase sequence;

Always connect the earth cable first (and disconnect it last).

Always connect the neutral cable!
If this connection is missing, the UPS will supply the load with the insulated neutral, and the differential automatic circuit-breakers supplied by the UPS will not protect against indirect contact.

Battery cables must be connected to the bars located on the right- or left-hand side of the power section bay, according to the polarity specified in Figure 9.

The UPS is not provided with a disconnecting switch on the battery cable: install a box which contains a disconnecting switch with fuses or with a magneto-thermal circuit-breaker (contact Siel S.p.A. for supply if necessary) near the battery.

Battery fuses are installed within the UPS. These fuses cannot protect against current coming from the battery in cases of cable short-circuiting.

ALL THESE OPERATIONS MUST BE CARRIED OUT WHEN THE UPS IS SWITCHED OFF AND THE SYSTEM IS NOT SUPPLIED BY POWER.

Cables of adequate cross section must be fitted for the UPS currents, in accordance with the details shown on table 1.

Signal connections

All signal connections are joined up to the client interface board.
The board is displayed in figure 6.

Insulation between the various contacts is only effective for voltages below 48Vac (60Vdc); in no way can these contacts be used to switch the line voltage.

Connection of the EPO circuit

The UPS is equipped with an electronic device able to stop at the same time operation of the Rectifier, the Inverter and the Static Switch, thereby interrupting power to the load in case of an emergency.
This device must be remotely activated by an emergency pushbutton; to restore normal operation, hold down the appropriate pushbutton on the customer interface board.

It is important to be very careful to prevent the EPO circuit leads from running close to the power cables.

The entire EPO circuit is without hazardous voltages and is metalically separated from the internal voltages of the UPS; care must nevertheless be taken because this circuit stops the entire UPS with consequent load supply loss!

Connection of the battery room temperature sensor (optional)

The connection leads of the temperature sensor must be connected as follows:
Sensor negative terminal: Terminal 1 of M4 (Figure 6)
Sensor positive terminal: Terminal 2 of M4 (Figure 6)
To carry out the connection it is necessary to push the white lever of the terminal block with a screwdriver, introduce the stripped cable, and then release the lever.
It is important to pay attention to the sensor polarity: if this is connected wrongly it could become damaged, and it would have no compensation effect on the recharge voltage.
This sensor can be used only if the battery cabinet is located close to the UPS.

In the event of the battery compartment being positioned a long way from the UPS or a separate battery room being used, ask Siel S.p.A. for the optional optic fibre temperature sensor; with this sensor a distance of over 50 m can be reached between battery room and UPS.

For other connections, refer to the "Remote signalling systems" section.

MAINTENANCE

UPS of the Safepower-EVO series are completely static devices and as such do not require any maintenance.

However, an annual check is recommended in order to carefully verify the batteries status, the correct functioning of the machine, the room conditions (specifically, the airing and conditioning system) and the efficiency of ventilation ports of the machine (i.e., make sure the air intakes of the UPS are free from dust or debris).
In order to ensure the expected device life, an extraordinary maintenance shall be carried out after five years of continuous operation, including the exchange of cooling fans and power capacitors.
Obviously, such maintenance may (according to the service contract) include a product "upgrade", in order to integrate any technical developments.

OPERATING INSTRUCTIONS

Using the control panel pushbuttons

The control panel (Figure 4) contains the keys that can be used by the operator to control the UPS.
Each pushbutton has a legend that indicates its function for quick identification.

Acoustic alarm muting button	1 in fig.5
Voltage reading selection button	2 in fig.5
Current and frequency reading selection button	3 in fig.5
Voltage, current, battery autonomy, power and temperature reading selection button	4 in fig.5
Inverter start button	6 in fig.5
Inverter start-stop confirmation button	7 in fig.5
– inverter stop button	8 in fig.5
Switching confirmation pushbutton (inverter <-> reserve)	9 in fig.5
Switchover button (Inverter <—> Reserve)	10 in figure 5

SPECIAL FUNCTION PUSHBUTTONS
The buttons below can be used to access/set the control panel menu:

To confirm a change	<SHIFT>+<MENU'> buttons 1&4	fig.4
To undo an action or go back to the previous section	<*> button 5	fig.4
To navigate through options	<SHIFT> + < ⇑ > < ⇓ > buttons 1,2&3	fig.4
To navigate through configurations	<MENU> button 4	fig.4
To change the parameters in configurations	< ⇑ > < ⇓ > buttons 2&3	fig.4

GENERAL EXPLANATIONS
SHIFT (key 1, Figure 4), UP (key 2, Figure 4), DN (key 3, Figure 4) and MENU (key 4, Figure 4) which are used during normal UPS operation (when the display cyclically shows signals and alarms), can be used to scroll messages at an interval chosen by the operator, and to select the various functions.
More specifically, to control forward movement, keeping the <SHIFT> key pressed, press the < ⇑ > key; to reverse, keeping the <SHIFT> key pressed, press the < ⇓ > key.
For message quick scrolling (at about 1 second intervals), keep the above keys pressed simultaneously.
To access the Signalling control menu, press the <SHIFT> and <MENU> keys simultaneously.

The display will show the following message:

** CHOICE OF OPERATING MODE **
(push UP/DN keys to see the menu)

The menu includes the following functions:

- DATA SET UP
- TIME SET UP
- ALARM HISTORICAL LOG
- BATTERY TEST
- BATTERY DISCHARGE TEST CONFIGURATION
- UPS CONFIGURATION DISPLAY
- LANGUAGE SELECTION
- CONFIGURATION OF SERIAL PORT
- TOTAL BATTERY CAPACITY DISPLAY
- SERVICE PARAMETERS

Below are described the panel keys used to run the menu:

Purpose	Action
- TO SCROLL QUICKLY THROUGH THE MENU ITEMS	: buttons SHIFT + ⇓ o ⇑
- TO SELECT AN ITEM OF THE MENU	: buttons SHIFT + MENU'
- TO SELECT A PARAMETER OF THE MENU ITEM	: button MENU
- SCROLL MENU PARAMETER CHANGES	: buttons ⇓ o ⇑
- TO STORE THE CONFIGURATION	: buttons SHIFT + MENU'
- RETURN TO PREVIOUS MENU ITEMS	: button *
- TO QUIT THE MENU	: button *

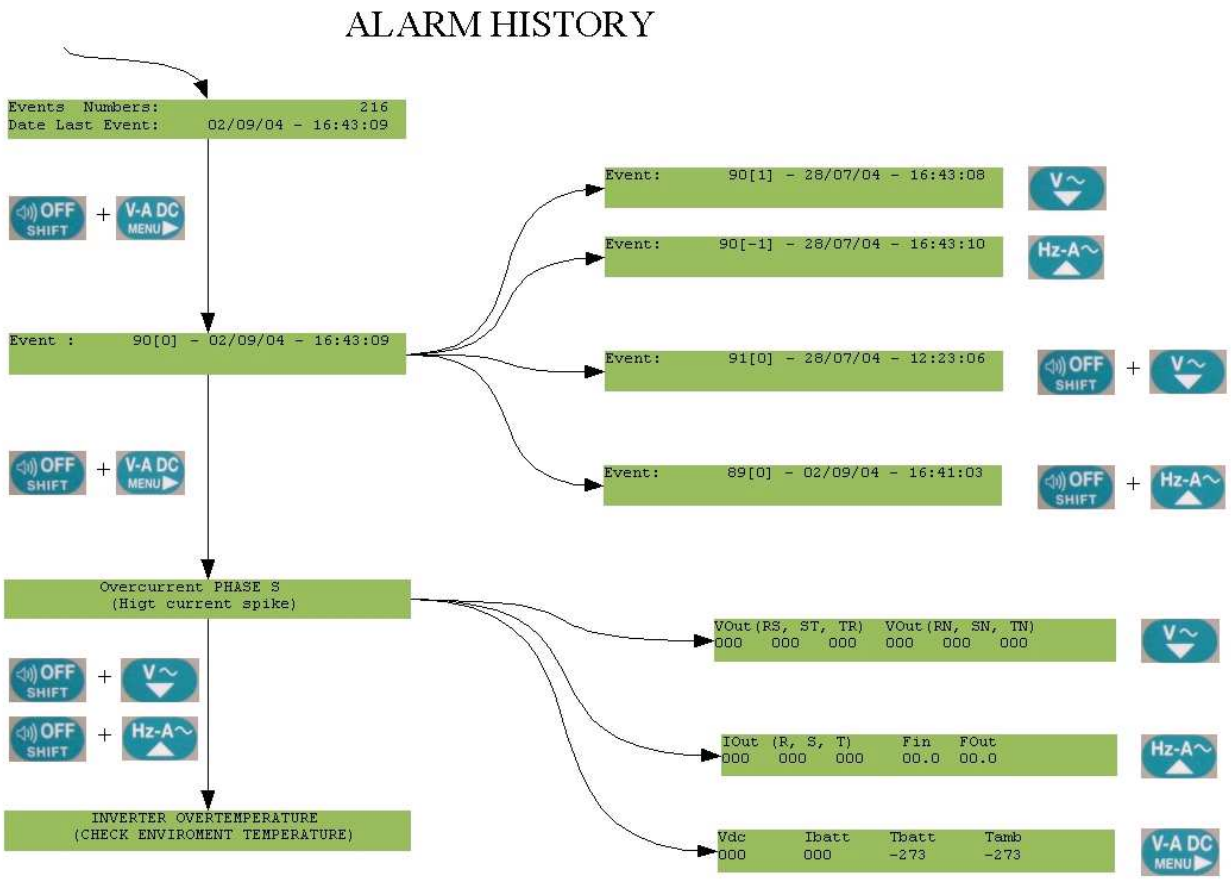

DATE AND TIME SETTING

To set the date and time of the system, it is necessary to select the corresponding items in the menu. After this, it is possible to use the < ⇑ >, < ⇓ > and <MENU'> keys to enter the various parameters and then store them with the <SHIFT> + <MENU'> key sequence. If the date (or time) entered is incorrect, the signalling panel will beep for about one second.
The date and time of the system are very important as they indicate the time of the events stored in the historical log of the panel.


ALARM HISTORICAL LOG

To view the remote alarms, select the <ALARM HISTORICAL LOG> menu item. As long as the history memory contains the alarms, the control panel will show the latest stored alarm, together with the date and time of occurrence.
Press the keys <SHIFT> + <MENU> to enter the single event to analyse
Keys <SHIFT> + < ⇓ > or < SHIFT > + < ⇑ > can be used for cyclic scrolling of the alarms recorded in the log.
You can also display the state prior to the stored event and the next state by pressing keys < ⇑ > < ⇓ > . Specifically [0] = Event [-1] = State prior to event [+1] = State of next event.
Once the event to be analysed has been defined, press keys < SHIFT > + < MENU' > to effect a detailed analysis of the selected event.
To highlight the states / alarms press < SHIFT > + < ⇑ > or < ⇓ > cyclically.

To highlight the electrical voltage and current measurements of the highlighted event, use keys < V >, <Hz-A> and V-A DC>.
See the example below.



MANUAL BATTERY TEST

To perform the battery test immediately, select the corresponding menu item.
Press the <SHIFT> + < ⇓ > keys together: the message 'BATTERY TEST IN PROGRESS' will appear on the display.
If after about 20 seconds the cyclical view of the UPS operating status is restored, the test has been successfully performed.
If there is a problem with the battery, "BATTERY FAILURE" appears on the display and an acoustic warning is heard.
The result of the test is stored until another battery test is carried out (manually or automatically).

BATTERY DISCHARGE TEST CONFIGURATION AT DUE TIME

To configure the battery discharge test it is necessary to select the corresponding item in the menu. After this operation, the display will show parameters called <activate>, <day/time> and <No. of weeks>. The first one, <activate>, can assume the value <YES>/<NO> and can be used to activate/de-activate the battery discharge test.
The second parameter, <day/time>, makes it possible to enter the day of the week expressed with <MON> ... <SUN> and the time when the discharge test is scheduled for. The third parameter, <n. weeks>, indicates the number of weeks between one test and another; for instance, by setting 1 for this item, the discharge test is performed every week. There are two more considerations:
a) If zero is set as a number of weeks, the discharge test will only occur during the first week.

b) If <NO> is set under the <activate> item, the signalling panel will not perform the test.
The keys used to modify this parameter are UP, DN and MENU. To store, use the SHIFT + MENU' key sequence.

UPS CONFIGURATION DISPLAY
Allows you to identify the UPS number, example in a system of 4 UPS in parallel UPS no. 1 , UPS no. 2, UPS no. 3 etc.
Allows you to configure the UPS model example model no. 29 UPS 40KVA 400Vac.

LANGUAGE SELECTION
Allows you to select the desired language.

CONFIGURATION OF SERIAL PORT
Allows you to configure the protocol type to be used for remote data transmission.

BATTERY CAPACITY DISPLAY
Allows you to set the number of monoblocks and total capacity of installed battery expressed in amperes/hour.

SERVICE PARAMETERS
By entering PASSWORDs you can:
- Delete the last stored value of the maximum
-Reset the alarm log
-Enable measuring of battery temperature (presence of battery thermal detector)
- Enable, disable or reset the scheduled maintenance alarm

Start-up and subsequent actions

This part of the manual contains the operating instructions for a correct UPS start-up and subsequent procedures such as stop or manual bypass.

Before start-up it is important to check that installation has been carried out correctly, verifying that the input phases are correctly connected in accordance with the right cyclic direction, and that the battery leads respect the polarity. Check all machine disconnect switches are open.

FIRST START-UP SEQUENCE WITH UPS COMPLETELY SWITCHED OFF
Refer to Figures 1, 2 and 3.

Note: the phrases *in italics* between [……] only apply to in parallel operation.

1) After opening the front doors, close switch S4 (reserve mains input). After a few seconds some messages will appear on the display (Fig. 4) and simultaneously the acoustic alarm will trip. This alarm shall be muted (by key 1) to ensure signal display.
[Repeat the operation on all the UPS units making up the system]

2) Close switch S1 (rectifier input) and switch S2 (output). During this phase it is necessary to verify that the display shows the following:
- Rectifier on
- Battery on float charge
- Battery voltage OK
- Load on reserve

LEDs on the Functional Diagram will illuminate to show the following indications:
- RECTIFIER ON (LED 1 Figure 5)
- RESERVE OK (LED 5)
- LOAD ON RESERVE (LED 6)

[Repeat the operation on all the UPS units making up the system]
From now on, the UPSs power the load on reserve.

3) Simultaneously press pushbutton 6 (INVERTER ON) and pushbutton 7 (START/STOP CONFIRMATION). LED 3 will illuminate on the Functional Diagram (INVERTER ON). After about 30 seconds LED 4 will illuminate (LOAD ON INVERTER) and LED 6 (LOAD ON RESERVE) will extinguish.
If the acoustic alarm has not been muted before, it will now be muted automatically as every alarm condition has disappeared.

4) Close the battery disconnect switch located in the battery cabinet (after checking that the battery OK signal is still ON).
Caution! If the battery is connected when the signal "Battery voltage OK" is not active, the protection fuse trips; this fuse can only be replaced by Siel personnel.
The following indications will appear on the display:
"Rectifier ON"
"Battery on float charge" or "Battery on boot charge"
"Battery voltage OK"
"Inverter ON"
"Inverter-Reserve Synchronized"
"Load on Inverter"
"Reserve OK"
"UPS Regular Operation"
[Repeat the operation on all the UPS units making up the system]
From now on, the UPSs operate smoothly and the load is fed on inverters.

SWITCHING THE SYSTEM OFF AND ON

1)To carry out the Inverter-Reserve switchover, it is necessary to simultaneously press the Switching and Switching Confirmation pushbuttons (pushbuttons 9 and 10 in Figure 4). [*on a UPS unit]*
On the Functional Diagram of the machine, the LED will go off corresponding to:
- Load on Inverter (LED 4)

Simultaneously the LED indicating the following will switch on:
- Load on reserve (LED 6)

The display will show the following message:
“Load on reserve”

2) Simultaneously press the Inverter OFF and Inverter stop confirmation pushbuttons (pushbuttons 7 and 8). *[of a machine]*
On the Functional Diagram, the LED will go off corresponding to:
- Inverted ON (LED 3)

The display unit will show the alarm:
"Inverter locked"
Mute the acoustic alarm by pressing key 1.
[2a) Repeat the operation on the other machines]

3) Open the front door of the UPS and switch off the following switches: S4 (Reserve mains)
S2 (UPS Output)

4) Open the battery disconnecting switch.

5) Open switch S1 (rectifier input).

6) In this way the UPS is switched off and the load is no longer supplied.
Wait for about 10 minutes before accessing the inside of the UPS for check and maintenance operations.

7) To switch the UPS on again, repeat the start-up operations as described above.


SWITCHING FROM UPS TO BYPASS *[External to the UPS]*

1. 1) During UPS operation, press key 9 shown in Figure 4 (changeover confirmation) and simultaneously press key 10 (changeover). Check the load is powered by reserve line (LED 6 in Figure 6 on, Load on mains LED 4 off).
2. Press pushbutton 7 (Run/stop confirmation) and simultaneously press pushbutton 8 (Inverter stop). Check LED 3 (Inverter ON) extinguishes.
3. 3) Close bypass disconnecting switch S3 (Figure 3). *[SW4 of Figure 11]*
4. From now on, the load is supplied on bypass.
5. 5) To completely switch the UPS off, open rectifier input disconnecting switch S1, reserve input disconnecting switch S4, and UPS and battery output disconnecting switch S2.


SWITCHING FROM BY-PASS TO UPS

1) Check that UPS output disconnecting switch S2 is open, and close reserve mains input and rectifier input disconnecting switches S4 and S1 (Figure 3). Check that LED 6 (load on mains) and LED 1 (rectifier on) are on. The UPS supplies the load through the manual bypass from the reserve mains and the rectifier is in operation.
2) Wait for the "Battery voltage OK". The red LED 2 (Battery voltage not OK) should have gone on and then off. Now the rectifiers have performed the soft-start operation and it is possible to connect the battery without any danger of compromising battery protections (fuses).
3) Close the external battery switch. From now on, the batteries are connected to the UPS.
4) Check that the "Load on reserve" message is displayed, and close UPS output disconnecting switch S2. In this situation, the load is powered both by the external bypass disconnecting switch and the UPS static switch.
5) Open the external bypass disconnecting switch. In this situation, the load is supplied by the mains through the static switch.
6) Press pushbutton 7 (inverter start/stop confirmation) and simultaneously press pushbutton 6 (inverter start).
7) Check that after about 30 seconds, LED 6 (load on mains) extinguishes and LED 4 (load on inverter) lights up. From now on, the load is supplied by the inverter. *[from inverters connected in parallel]*

Emergency device (EPO) operation

The UPS is equipped with an electronic emergency device (EPO) to simultaneously stop the operation of the rectifier, inverter and static switch, and thus stop the supply to the load in emergency conditions.
This emergency device can be remotely activated by pressing an emergency pushbutton (of the normally-closed type), located near to the load that is being protected.
Extreme care must be exercised, as this circuit stops the whole UPS, causing loss of supply to the load!
When in operation, this emergency device keeps the alarm condition stored so that the load remains completely insulated.
To restore normal operation, use a screwdriver (preferably an electrically-isolated one) on the appropriate pushbutton on the customer interface board.
Be extremely careful, because this panel can only be removed with a tool not provided with the equipment and, therefore, this operation should only be carried out by trained technical personnel (dangerous voltages are present in the vicinity of the board).
Consequently, when restoring the UPS to normal operation, observe the same safety measures adopted when carrying out servicing activities.
After a few seconds the UPS will feed the reserve load and will simultaneously activate the acoustic alarm, which can be muted by pressing the corresponding key.
Make sure the Battery voltage OK signal appears on the display, then press the Inverter ON pushbutton (pushbutton 6 in Figure 4) and at the same time press the Inverter Running Confirmation pushbutton (pushbutton 7 in Figure 4) on the control panel.
After about 15 seconds the UPS will switch the load to the inverter.
After this the UPS will operate regularly.

FUSES

Power and auxiliary fuses are not usually accessible (it is necessary to open the electronics bay with a tool not provided with the equipment).; the operation of one of these fuses always points to a fault in the appliance and they must never be reset by the user; they must only be replaced by persons trained by SIEL S.p.A., and only after finding and repairing the fault.

Only the fuses of the reserve network (FR1, FR2, FR3, positioned immediately above the reserve network disconnecting switch S4) can trip in case of a load overcurrent; in this case replace these with fuses of the type indicated on table 12.

Note that these fuses can only be accessed by removing the sheet steel panel placed over the disconnection switches. Caution: this panel can only be removed with a tool not provided with the equipment and, therefore, this procedure should only be carried out by trained technical personnel (dangerous voltages are present in the vicinity of the board).

OPTIONS

The various options are listed on table 11.
For each option, it is specified whether this can be housed in the existing structural work or whether an additional cabinet is required, whether this must be fitted in a container detached from the UPS, whether it is a software to be loaded on the computer or whether the possibility of fitting it on board the machine is only possible after ad hoc sizing.

Attention must be given to the fact that the table envisages fitting one option at a time in the machine; in the event of several options being adopted, it will be necessary to check from time to time whether these can be housed inside the same cabinet and whether additional containers are required.

Option 1: Filtri RFI

All the SIEL UPS units comply with European EN 62040-2 (EN50091-2) standard on electromagnetic compatibility.
Filters that comply with more stringent regulations are available on request.

Option 2: Input Power factor correction

A power factor correction circuit can be supplied for the current absorbed by the UPS rectifier at $\cos\varphi = 0.9$ for those applications where there is no centralised power factor correction.
A dedicated magneto-thermal breaker isolates the power factor correction circuit in the event of breakdown, thus ensuring the reliability of the system remains unaffected.

Option 3: Reduction of distortion of input power for six-phase UPS

As an alternative to the twelve-phase solution, the distortion of the current absorbed by the system from the six-phase bridge by 29 to 10% can be reduced by adding special filters. The use of such filters also permits input power factor correction.
A dedicated magneto-thermal breaker isolates the filter in the event of breakdown, thus ensuring the reliability of the system remains unaffected.

Option 4: Reduction of input current distortion for 12-pulse UPSs

This option makes it possible to lower distortion of the input current from the twelve-pulse bridge from 10% to 7%.
It is possible to achieve even lower levels of distortion by means of option 27 or customized solutions (in the latter case, please contact SIEL S.p.A.)

Option 5: Reserve mains isolation transformer

The UPS unit can be completed with a class H isolation transformer for the reserve mains with electrostatic screen. In this case the load remains totally isolated with respect to the input mains.

Option 6: Rectifier input isolation transformer

The UPS unit can be supplied with a class H isolation transformer for the rectifier input with electrostatic screen. In this case, the battery remains completely isolated with respect to the input mains.

Option 7: Rectifier and reserve input isolation transformer

If the input mains to the rectifier and the reserve mains are joined, the UPS unit can be supplied with a class H isolation transformer that completely separates the inputs from the UPS units. This way the load and battery remain completely isolated with respect to the input mains.
By means of this transformer, it is also possible to adapt the input voltage of the UPS units to non-standard values (also see option 21).

Option 8: Remote switch for disconnecting the reserve mains in case of a mains power break and UPS output isolation sensor

The UPS unit can be equipped with an input remote switch and isolation sensor for controlling the system in IT during a mains power failure.

Option 9: Back-Feed to Mains Protection with switch in the UPS

As a rule, in case of static switch fault, the “Back-Feed Protection” permits the activation of the release coil of an switch mounted in the UPS in order to avoid any danger for people working on the system.

Alternatively, by means of this option, the device may be used to stop UPS operation.

Option 10: Back-Feed Protection with remote switch

In case of a static switch fault, this device opens a remote switch so as to avoid any hazard for staff working on the plant.
In the case of options 8 and 10 being envisaged, the remote switch is the same.

Option 11: UPS output isolation sensor for regular operation in IT

In the event of an isolation transformer being fitted at the UPS input, the system can be controlled in IT by fitting a special earth phase sensor for signalling first fault.

Option 12: Restriction of the input current and inhibition of fast loading for operation with generator, sequential start of rectifiers.

In case of operation with a generator, an optional circuit can be supplied that restricts the power absorbed by the rectifier to such a value as not to overload the generator and at the same time inhibit fast battery charging.
It is also possible to set the sequential start (staggered over time) of several rectifiers in the case of UPS units connected in parallel.

Option 13: Battery temperature reading kit.

This Kit is necessary only if the UPS haven't battery inside or if you usen't Siel battery cabinet.
This Kit communicates battery temperature to the UPS in order to change the recharging voltage. This sensor can be used only if the battery cabinet is located close to the UPS.

Option 14: Battery cabinet temperature reading kit, by means of optic fibres.

By means of this kit, it is possible to communicate the temperature of the battery compartment to the UPS unit, even if this is not close to the UPS.
The transmitter located in the battery compartment must be powered with single-phase 230 V AC current. This voltage does not necessarily have to be continuous because in the case of a mains break, the batteries are not recharged and the recharge voltage correction signal is not used.
In case of interruption of the optic fibres or no power to the transmitter, the correction circuit automatically disengages and the batteries are correctly charged at fixed voltage.
NOTE: The length of the fibres must be indicated in the order: 25-50-75m.

Option 15: Customer interface board with RS232 serial port

Besides the features set out in the section entitled Remote Signalling Systems , this board (Figure 6) also includes an additional DB9 connector (female) for data transmission through an RS232 port;
The serial port is fully insulated from the UPS electronic circuitry and designed to interface with any computer with a RS232 port.
The interconnection cable must be of the Nullmodem type, i.e. Terminals 2 and 3 must be switched (this cable can be provided by Siel S.p.A. on request).
The baud rate equals 9600 Bit/sec; the baud rate can only be changed by contacting SIEL service.
Siel provides special software which can graphically display all signals and measurements sent by the UPS, keep an accurate history file of events, and control the UPS from the personal computer.
Customers wishing to use their own software to capture the signals and measurements provided by the UPS should send a written request to Siel S.p.A., who will then authorise and issue detailed specifications on the communication protocol.
All signals provided through RS232 can also be obtained through fibre optics as previously described.

Option 16: Remote mimic panel

The remote digital mimic panel is similar to the control panel provided on the SAFEPOWER series UPS.

A fibre optic cable is used to connect the digital mimic panel and the control panel; unlike conventional cables, it provides signals with electrical and magnetic insulation, which have considerable advantages in terms of transmission safety and reliability.
The digital mimic panel, like the control panel, includes an 80-character LCD display, a functional LED-diagram and special control keys allow the operator to:
- Silence the acoustic alarm
- Bring signals and alarms forward or backward.
- Read UPS output voltages
- Read UPS output currents and frequency
- Read the voltage and current

Unless otherwise controlled by the operator, the remote mimic panel cyclically displays messages related to the operational status of the main sections of the UPS.
In the event of one or more alarms, the remote mimic panel issues a continuous acoustic alarm to alert the operator of a system malfunction and, through the display, immediately identifies the fault cause.

Option 17: OCSystem control system

This software has been developed by Siel to permit the control and management of the UPS units by means of a personal computer. Thanks to this software, up to 4 UPS units can be monitored, including of different powers. The OCSystem processing system centralises the data from each single machine relating to operating status, running conditions and faults occurring over time.
The data from each UPS are conveyed via optic fibres directly to a computer (which need not necessarily be in the immediate vicinity of the UPS units). The computer processes and displays the status of each machine in real time and updates a historical file.
This system is suitable for operation on Windows platforms and can be easily customised as regards language.
The basic elements of the system are:
- A board inside or outside the PC that receives the signals from the various optic fibres from the UPS units and transforms these into signals suitable for a RS232.
- A software able to control the data of the controlled machines.

Option 18: SMS (Siel Monitoring Software) Control System

This software permits automatically switching off the computer in the event, due to a prolonged mains power break, of the batteries running low.
The software can be used in a variety of operating systems. The display pages are in English.
The basic elements of the system are:
- A board inside or outside the PC that receives the signals from the various optic fibres from the UPS units and transforms these into signals suitable for a RS232.
- A software able to control the data of the controlled machines.

Option 19: Connection to SNMP network

This option permits monitoring the status of the UPS unit and performing shutdown of PC, server and workstation linked to a LAN network.
The option consists in additional hardware which on the one hand links up to the UPS through a serial interface RS232C and permits network linkup by means of an RJ45 connection.
The protocols implemented on this hardware are HTML and SNMP.
This implies that the status of the UPS can be configured and monitored through any web browser with Java and the shutdown can be managed of all the machines linked to this network node.

Option 20: Teleglobalservice

By means of this option (remote-assistance apparatus) the UPS can be directly interlinked with the telephone line (specify whether ISDN), thus permitting the exchange of information between the Siel after-sales service and the machine under control.
In case of an alarm, the unit automatically contacts the after-sales service.

Furthermore, the UPS unit can be periodically interrogated by the after-sales service, at intervals to be defined when drawing up the contract, to unload the "historical" file of events.
A report can also be periodically sent on the operating status of the unit.

Option 21: Power adapter autotransformers

By means of this option, the input or output powers can be adapted to non-standard values.
Because the power of these components varies according to the difference between input and output voltage, sizing will have to be done from time to time.

Option 22: UPS used as frequency converter

By means of this option, the Siel UPS units can be used as frequency converters (input 50Hz-output 60Hz or vice versa). .

Option 23: Second client interface board

This option increases the number of signals from the UPS made available by means of “clean” contacts.
In particular:

- The connector CN1 in figure 6 is duplicated (see para. “Detailed description of the signals available on connector CN1 and on terminal boards”) with the same signals.
- The terminal boards M1, M2 and M3 are duplicated (by changing the position of the DipSwitch the set of signals can be changed on the additional board; e.g., the "OR" of the alarms can be added).
- The optic fibre connector for the remote mimic panel is duplicated (this way two remote mimic panels can be connected).

Option 24: Second RS232 interface

By means of this option, the UPS unit can be equipped with a second serial port (on optic fibre or D connector – standard) with independent operation from the standard serial port.
This option may be used to access all the main UPS parameters thus permitting the use of two different diagnosis and control systems for the same UPS.

Option 25: Single battery for parallel operation

Should specific plant considerations so require, a single battery may be used to power several UPS units in parallel (max 4). By means of this option, the rectifiers actively distribute the current causing it to flow both towards the battery and towards the inverters. If one of the rectifiers fails, the remaining rectifiers will continue to power the inverters of all the UPS units. It is possible to set the system to perform a periodical battery test even when a single battery is used.

Option 26: Incorporated batteries

UPS units fitted with six-pulse power rectifiers up to 40KVA may be supplied with incorporated batteries; please contact SIEL S.p.A. to define the exact backup time according to the loads effectively powered by the UPS.
All sizes of UPS may be supplied with batteries housed in special cabinets designed to operate with and match the UPS units.

Option 27: 24-pulse rectifier bridge

When input current distortions of ≤5% are required for UPSs with capacities from 500kVA to 1MVA, an option with a 24-pulse rectifier bridge can be supplied which, without adding extra filters, naturally guarantees a harmonic current distortion lower than 5% (the technical specifications of these UPSs are given in technical specification SP117 which integrates this document).
The version with the 24-pulse rectifier bridge may be supplied for UPSs with lower capacities on request or, as an alternative, it is possible to fit this twelve-pulse equipment with an extra filter to current the input current phase; in this way the input current distortion reaches levels lower than 5% (for further information, please contact Siel SpA)

Option 28: Remote sensing circuit

In the event of the load being connected to the UPS by means of a particularly long line or by means of an external transformer, the UPS unit (or units in case of parallel system) can be equipped with a special circuit which, by detecting the power voltage near the load, changes the UPS power voltage so that the voltage at the ends of the load remains constant.
The correction signal to the UPS units is sent through optical fibres so as to maximise immunity.
If the sensor fails, the UPS units continues to work regularly, although it is no longer able to compensate the voltage supplied to utilities.

Option 29: Versions without disconnecting switches

If the plant includes input, output and bypass switches, you can use a version of UPS Safepower-EVO not featuring internal disconnecting switches.
This option is available for sizes exceeding 160kVA-12F and 200kVA-6F.
To define plant and switches configuration to be used, please contact the technical department of SIEL S.p.A.

TECHNICAL SPECIFICATIONS

MAXIMUM POWER OF INPUT AND OUTPUT CABLES: TABLE 1
RECTIFIER INPUT SPECIFICATIONS TABLE 2
RECTIFIER OUTPUT SPECIFICATIONS TABLE 3
RECTIFIER INPUT SPECIFICATIONS TABLE 4
RECTIFIER OUTPUT SPECIFICATIONS TABLE 5
STATIC SWITCH SPECIFICATIONS: TABLE 6
COMPLETE UPS SPECIFICATIONS: TABLE 7
MECHANICAL SPECIFICATIONS TABLE 8
OTHER DATA: TABLE 9
PARALLEL: TABLE 10
AVAILABLE OPTIONS: TABLE 11
EMERGENCY NETWORK FUSES: TABLE 12

Warning:
The technical specifications refer to the standard single machine.
The addition of a number of options may significantly change the technical data shown.
For further information, contact Siel S.p.A.

FORM 1: MAX CURRENT OF INPUT/OUTPUT CABLE

Form 1A: Size 20 - 160kVA

Size [kVA]	20	30	40	50	60	80	100	120	160
Rectifier input Phase R	49	66	93	109	127	171	215	249	336
Rectifier input Phase S	49	66	93	109	127	171	215	249	336
Rectifier input Phase T	49	66	93	109	127	171	215	249	336
Reserve input Neutral	48	74	96	122	144	192	240	288	383
Reserve input Phase R	32	49	64	81	96	128	160	192	255
Reserve input Phase S	32	49	64	81	96	128	160	192	255
Reserve input Phase T	32	49	64	81	96	128	160	192	255
Output Neutral	48	74	96	122	144	192	240	288	383
Output Phase R	32	49	64	81	96	128	160	192	255
Output Phase S	32	49	64	81	96	128	160	192	255
Output Phase T	32	49	64	81	96	128	160	192	255
+ Battery	52	78	103	129	154	206	257	308	410
- Battery	52	78	103	129	154	206	257	308	410

Form 1B: Size 200 - 1000kVA

Size [kVA]	200	250	300	400	500	600	800	1000
Rectifier input Phase R	406	493	633	800	1020	1238	1627	1966
Rectifier input Phase S	406	493	633	800	1020	1238	1627	1966
Rectifier input Phase T	406	493	633	800	1020	1238	1627	1966
Reserve input Neutral	477	597	717	954	1193	1431	1907	2384
Reserve input Phase R	318	398	478	636	795	954	1271	1589
Reserve input Phase S	318	398	478	636	795	954	1271	1589
Reserve input Phase T	318	398	478	636	795	954	1271	1589
Output Neutral	477	597	717	954	1193	1431	1907	2384
Output Phase R	318	398	478	636	795	954	1271	1589
Output Phase S	318	398	478	636	795	954	1271	1589
Output Phase T	318	398	478	636	795	954	1271	1589
+ Battery	513	643	636	841	1048	1250	1660	2075
- Battery	513	643	636	841	1048	1250	1660	2075

FORM 2: RECTIFIER INPUT TECHNICAL DATA

2a: RECTIFIER INPUT TECHNICAL DATA 20-80kVA 6-PULSE

Size	kVA	20	30	40	50	60	80
1) Nominal input votage 3Ph (Note 1)	Vca	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):							
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	22	33	43	54	64	85
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	29	40	57	68	79	106
8) Max input current @ 400V, without PFC, battery on recharge	Aac	42	58	83	99	115	153
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	95,7	95,8	95,8	95,8	95,9	96,8
11) THD	%	28	28	28	28	28	28

Note 1: 380Vac - 415Vac: Option
Note 2: 60Hz: Option
Note 3: PFC option (otherwise 0,83)

FORM 2: RECTIFIER INPUT TECHNICAL DATA

2b: RECTIFIER INPUT TECHNICAL DATA 20-80kVA 12-PULSE

Size	kVA	20	30	40	50	60	80
1) Nominal input votage 3Ph (Note 1)	Vca	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):							
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	22	33	44	54	65	86
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	30	41	58	68	79	107
8) Max input current @ 400V, without PFC, battery on recharge	Aac	44	60	84	99	115	155
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	94,4	94,6	94,6	95,5	95,6	95,6
11) THD (Note 4)	%	7	7	7	7	7	7

Note 1: 380Vac - 415Vac: Option
Note 2: 60Hz: Option
Note 3: PFC option (otherwise 0,83)
Note 4: Option (otherwise 9%)

FORM 2: RECTIFIER INPUT TECHNICAL DATA

2c: RECTIFIER INPUT TECHNICAL DATA 100-200kVA 6-PULSE

Size	kVA	100	120	160	200
1) Nominal input votage 3Ph (Note 1)	Vca	400	400	400	400
2a) Tolerance on voltage (Float charge):					
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	106	125	167	208
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	134	154	209	251
8) Max input current @ 400V, without PFC, battery on recharge	Aac	194	223	302	363
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30
10) Efficiency	%	96,8	98,1	98,1	98,3
11) THD	%	28	28	28	28

Note 1: 380Vac - 415Vac: Option
Note 2: 60Hz: Option
Note 3: PFC option (otherwise 0,83)

FORM 2: RECTIFIER INPUT TECHNICAL DATA

2d: RECTIFIER INPUT TECHNICAL DATA 100-200kVA 12-PULSE

Size	kVA	100	120	160	200
1) Nominal input votage 3Ph (Note 1)	Vca	400	400	400	400
2a) Tolerance on voltage (Float charge):					
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	107	127	169	210
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	135	156	211	255
8) Max input current @ 400V, without PFC, battery on recharge	Aac	195	226	305	369
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30
10) Efficiency	%	95,6	96,8	96,9	97,0
11) THD (Note 4)	%	7	7	7	7

Note 1: 380Vac - 415Vac: Option
Note 2: 60Hz: Option
Note 3: PFC option (otherwise 0,83)
Note 4: Option (otherwise 9%)

FORM 2: RECTIFIER INPUT TECHNICAL DATA

2e: RECTIFIER INPUT TECHNICAL DATA 250-1000kVA 12-PULSE

Size	kVA	250	300	400	500	600	800	1000
1) Nominal input votage 3Ph (Note 1)	Vca	400	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):								
- Pb Battery	%	-13 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15
- Sealed Pb Battery	%	-13 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	263	315	415	516	615	816	1020
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	310	398	503	642	779	1024	1238
8) Max input current @ 400V, without PFC, battery on recharge	Aac	448	575	727	927	1125	1479	1787
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	97,3	97,3	97,6	97,9	97,9	97,9	97,9
11) THD (Note 4)	%	7	7	7	7	7	7	7

Note 1: 380Vac - 415Vac: Option
Note 2: 60Hz: Option
Note 3: PFC option (otherwise 0,83)
Note 4: Option (otherwise 9%)

FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

3a: RECTIFIER OUTPUT: 20/80kVA

SIZE	kVA	20	30	40	50	60	80
1a) Output Voltage (Stationary Battery)							
- Float	Vcc	436	436	436	436	436	436
- Boost	Vcc	475	475	475	475	475	475
1b) Output Voltage (Sealed Battery)							
- Float	Vcc	446	446	446	446	446	446
1c) Output Voltage (Without Battery discharge)	Vcc	396	396	396	396	396	396
2) DC Voltage Range	%	330-500	330-500	330-500	330-500	330-500	330-500
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1	±1	±1
4) Voltage ripple (Vrms/Vb x 100)	%	<1	<1	<1	<1	<1	<1
5) Nominal current	Acc	41	61	81	100	120	160
6) Max output rectifier current	Acc	51	71	101	120	140	190
7a) Max battery charging current @ inverter full load	Acc	10	10	20	20	20	30
7b) Max battery charging current	Acc	46	64	91	108	126	171
8) Battery charging current range:							
- min	Acc	2	2	5	5	5	5
- max	Acc	46	64	91	108	126	171
9) Battery charging method		DIN41773					
10) Maximun time to recharge battery		360,720,1440, 2880 min.					

BATTERY

SIZE	kVA	20	30	40	50	60	80
1) Recommended N° of Pb cells	N°	198	198	198	198	198	198
2) Nominal voltage	Vcc	396	396	396	396	396	396
3) Float voltage	Vcc	446	446	446	446	446	446
4) N° of Ni-Cd cells	N°	Contact SIEL					
5) End of descharge voltage (Pb Battery)	Vcc	330	330	330	330	330	330
6) End of descharge current	Acc	52	78	103	129	154	206

FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

3b: RECTIFIER OUTPUT: 100-200kVA

SIZE	kVA	100	120	160	200
1a) Output Voltage (Stationary Battery)					
- Float	Vcc	436	436	436	436
- Boost	Vcc	475	475	475	475
1b) Output Voltage (Sealed Battery)					
- Float	Vcc	446	446	446	446
1c) Output Voltage (Without Battery discharge)	Vcc	396	396	396	396
2) DC Voltage Range	Vcc	330-500	330-500	330-500	330-500
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1
4) Voltage ripple (Vrms/Vb x 100)	%	<1	<1	<1	<1
5) Nominal current	Acc	200	240	320	399
6) Max output rectifier current	Acc	240	280	380	459
7a) Max battery charging current @ inverter full load	Acc	40	40	60	60
7b) Max battery charging current	Acc	216	252	342	414
8) Battery charging current range:					
- min	Acc	5	5	5	5
- max	Acc	216	252	342	414
9) Battery charging method		DIN41773			
10) Maximun time to recharge battery		360,720,1440, 2880 min.			

BATTERY

SIZE	kVA	100	120	160	200
1) Recommended N° of Pb cells	N°	198	198	198	198
2) Nominal voltage	Vcc	396	396	396	396
3) Float voltage	Vcc	446	446	446	446
4) N° of Ni-Cd cells	N°	Contact SIEL			
5) End of descharge voltage (Pb Battery)	Vcc	330	330	330	330
6) End of descharge current	Acc	257	308	410	513

FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

3c: RECTIFIER OUTPUT: 250-1000kVA 12 PULSE

SIZE	kVA	250	300	400	500	600	800	1000
1a) Output Voltage (Stationary Battery)								
- Float	Vcc	436	528	528	528	528	528	528
- Boost	Vcc	475	576	576	576	576	576	576
1b) Output Voltage (Sealed Battery)								
- Float	Vcc	446	540	540	540	540	540	540
1c) Output Voltage (Without Battery discharge)	Vcc	396	480	480	480	480	480	480
2) DC Voltage Range	%	330-500	400-580	400-580	400-580	400-580	400-580	400-580
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1	±1	±1	±1
4) Voltage ripple (Vrms/Vb x 100)	%	<1	<1	<1	<1	<1	<1	<1
5) Nominal current	Acc	500	495	654	815	972	1290	1612
6) Max output rectifier current	Acc	560	595	754	965	1172	1540	1862
7a) Max battery charging current @ inverter full load	Acc	60	100	100	150	200	250	250
7b) Max battery charging current	Acc	504	536	679	869	1055	1386	1676
8) Battery charging current range:								
- min	Acc	10	10	10	30	30	30	30
- max	Acc	504	536	679	869	1055	1386	1676
9) Battery charging method		DIN41773						
10) Maximun time to recharge battery		360,720,1440, 2880 min.						

BATTERY

SIZE	kVA	250	300	400	500	600	800	1000
1) Recommended N° of Pb cells	N°	198	240 Note 1	240 Note 1	240 Note 1	240 Note 1	240 Note 1	240
2) Nominal voltage	Vcc	396	480	480	480	480	480	480
3) Float voltage	Vcc	446	540	540	540	540	540	540
4) N° of Ni-Cd cells	N°	Contact SIEL						
5) End of descharge voltage (Pb Battery)	Vcc	330	400	400	400	400	400	400
6) End of descharge current	Acc	643	636	841	1048	1250	1660	2075

Note 1: 198 el. Battery also available; contact Siel SpA

FORM 4: INVERTER INPUT TECHNICAL DATA

4a: INVERTER INPUT: 20/100kVA

SIZE	kVA	20	30	40	50	60	80
1) Nominal voltage	Vcc	446	446	446	446	446	446
2) DC Voltage range	Vcc	330÷500	330÷500	330÷500	330÷500	330÷500	330÷500
3) Pre-alarm end discharge voltage	Vcc	350	350	350	350	350	350
4) DC current at nominal voltage	Acc	39	58	77	95	114	152
5) Max DC current at end discharge voltage	Acc	52	78	103	129	154	206

4b: INVERTER INPUT: 100/200kVA

SIZE	kVA	100	120	160	200
1) Nominal voltage	Vcc	446	446	446	446
2) DC Voltage range	Vcc	330÷500	330÷500	330÷500	330÷500
3) Pre-alarm end discharge voltage	Vcc	350	350	350	350
4) DC current at nominal voltage	Acc	190	228	304	380
5) Max DC current at end discharge voltage	Acc	257	308	410	513

4c: INVERTER INPUT: 250/1000kVA

SIZE	kVA	250	300	400	500	600	800	1000
1) Nominal voltage	Vcc	446	540	540	540	540	540	540
2) DC Voltage range	Vcc	330÷500	400-580	400-580	400-580	400-580	400-580	400-580
3) Pre-alarm end discharge voltage	Vcc	350	430	430	430	430	430	430
4) DC current at nominal voltage	Acc	476	471	622	776	925	1228	1535
5) Max DC current at end discharge voltage	Acc	643	636	841	1048	1250	1660	2075

FORM 5: INVERTER OUTPUT TECHNICAL DATA

5a: Inverter output: 20-120 kVA

SIZE	kVA	20	30	40	50	60	80	100	120
1) Nominal Power @P.F. 0.8 (Inductive)	kVA	20	30	40	50	60	80	100	120
2) Nominal Voltage (Note 1)	V	400	400	400	400	400	400	400	400
3) Setting range of output voltage	%	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5
4) Output Voltage Wave Shape		Sinusoidale							
5a) THD @ Linear full Load	%	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max
5b) THD @ Non linear full Load (Note 3)	%	<5	<5	<5	<5	<5	<5	<5	<5
6) Voltage stability in steady state condition for input DC variation and/or 100% load variation	%	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1
7) Voltage stability in dynamic condition for 100% load step variation	%	≤± 5	≤± 5	≤± 5	≤± 5	≤± 5	≤± 5	≤± 5	≤± 5
8) Tempo di ripristino entro ±1%	ms	<20	<20	<20	<20	<20	<20	<20	<20
9) Nominal output current @ 400Vac, 0.8 P.F.	A	29	44	58	73	87	116	145	174
10) Overload @ 400Vac, 0.8 P.F.	%Pn x 20' %Pn x 90"	125 150	125 150	125 150	125 150	125 150	125 150	125 150	125 150
10a) 3-Phase Short circuit current (<5s) (Note 2)	%	180	180	180	180	180	180	180	180
10b) 1-Phase Short circuit current (<5s) (Note2)	%	220	220	220	220	220	220	220	220
11) Voltage simmetry @ balanced load	%	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)
12) Voltage simmetry @ 100% unbalanced load	%	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)
13) Phase angle precision - balanced load - 100% unbalanced load	 % %	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°
14) Output frequency (Note1)	Hz	50	50	50	50	50	50	50	50
15) Output frequency precision: - free running (internal quarz oscillator) - sincronized to mains (selectable) - frequency slew-rate	 % % Hz/s	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1
16) Inverter efficiency @ full nominal load	%	94,7	94,8	95,1	95,3	95,3	95,3	95,3	95,3

Note 1: on demand: 380Vac, 415Vac, 60Hz
Note 2: in accordance with EN62040-1 (EN50091-1) (on demand up to 10s)
Note 3: in accordance with EN62040-3 (EN50091-3)

FORM 5: INVERTER OUTPUT TECHNICAL DATA

5b: Inverter output: 160-1000 kVA

SIZE	kVA	160	200	250	300	400	500	600	800	1000
1a) Apparent nominal power	kVA	160	200	250	300	400	500	600	800	1000
1b) Real nominal power @P.F. 1 (See Note 4)	kW	144	180	225	270	360	450	540	720	900
1c) Real maximum power (In % of apparent nominal power)	%	See Form 9b, column 4								
2) Nominal Voltage (Note 1)	V	400	400	400	400	400	400	400	400	400
3) Setting range of output voltage	%	>± 5	>± 5	>± 5	>± 5	>± 5	>± 5	>± 5	>± 5	>± 5
4) Output Voltage Wave Shape		Sinusoidale								
5a) THD @ Linear full Load	%	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max
5b) THD @ Non linear full Load (Note 3)	%	<5	<5	<5	<5	<5	<5	<5	<5	<5
6) Voltage stability in steady state condition for input DC variation and/or 100% load variation	%	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1
7) Voltage stability in dynamic condition for 100% load step variation	%	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5
8) Tempo di ripristino entro ±1%	ms	<20	<20	<20	<20	<20	<20	<20	<20	<20
9) Nominal output current @ 400Vac	A	231	289	361	434	578	722	867	1155	1444
10) Overload @ 400Vac	%Pn x 20' %Pn x 90"	125 150	125 150	125 150	125 150	125 150	125 150	125 150	125 150	125 150
10a) 3-Phase Short circuit current (<5s) (Note 2)	%	180	180	180	180	180	180	180	180	180
10b) 1-Phase Short circuit current (<5s) (Note2)	%	220	220	220	220	220	220	220	220	220
11) Voltage simmetry @ balanced load	%	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)
12) Voltage simmetry @ 100% unbalanced load	%	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)
13) Phase angle precision - balanced load - 100% unbalanced load	 % %	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°	 120° ±1° 120° ±1°
14) Output frequency (Note1)	Hz	50	50	50	50	50	50	50	50	50
15) Output frequency precision: - free running (internal quarz oscillator) - sincronized to mains (selectable) - frequency slew-rate	 % % Hz/s	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1	 ± 0,05 ±1 o ±4 0,1
16) Inverter efficiency @ full nominal load	%	95,3	95,3	95,0	95,2	96,0	96,2	96,8	97,2	97,2

Note 1: on demand: 380Vac, 415Vac, 60Hz
Note 2: in accordance with EN62040-1 (EN50091-1) (on demand up to 10s)
Note 3: in accordance with EN62040-3 (EN50091-3)
Note 4: limited only by the battery charge status

FORM 6: STATIC SWITCH TECHNICAL DATA

6a: Static Switch 20/80kVA

SIZE		20	30	40	50	60	80
1) Nominal Power	kVA	20	30	40	50	60	80
2) Input/Output Voltage (Note1)	V	400	400	400	400	400	400
3) Acceptance range of Mains Voltage (low and high theresold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50	50	50
5) Power Overload:							
- 30'	$\%I_N$	150	150	150	150	150	150
- 90s	$\%I_N$	300	300	300	300	300	300
- 5s	$\%I_N$	500	500	500	500	500	500
- 2s	$\%I_N$	680	680	680	680	680	680
- 1s	$\%I_N$	700	700	700	700	700	700
- 500ms	$\%I_N$	800	800	800	800	800	800
- 200ms	$\%I_N$	900	900	900	900	900	900
- 100ms	$\%I_N$	1000	1000	1000	1000	1000	1000
- 50ms	$\%I_N$	1100	1100	1100	1100	1100	1100
- 20ms	$\%I_N$	1200	1200	1200	1200	1200	1200
- 10ms	$\%I_N$	1400	1400	1400	1400	1400	1400
- 3ms	$\%I_N$	1500	1500	1500	1500	1500	1500
6) Transfer time:							
- FROM INVERTER TO RESERVE							
a) inverter fault	ms	0,9	0,9	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0	0	0
- FROM RESERVE TO INVERTER	ms	0	0	0	0	0	0
7) Efficiency @ full load	%	99,2	99,2	99,2	99,2	99,2	99,2

Note 1: On demand 380Vac, 415Vac, 60Hz

FORM 6: STATIC SWITCH TECHNICAL DATA

6b: Static Switch 100/200kVA

SIZE		100	120	160	200
1) Nominal Power	kVA	100	120	160	200
2) Input/Output Voltage (Note1)	V	400	400	400	400
3) Acceptance range of Mains Voltage (low and high theresold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50
5) Power Overload:					
- 30'	$\%I_N$	150	150	150	150
- 90s	$\%I_N$	300	300	300	300
- 5s	$\%I_N$	500	500	500	500
- 2s	$\%I_N$	680	680	680	680
- 1s	$\%I_N$	700	700	700	700
- 500ms	$\%I_N$	800	800	800	800
- 200ms	$\%I_N$	900	900	900	900
- 100ms	$\%I_N$	1000	1000	1000	1000
- 50ms	$\%I_N$	1100	1100	1100	1100
- 20ms	$\%I_N$	1200	1200	1200	1200
- 10ms	$\%I_N$	1400	1400	1400	1400
- 3ms	$\%I_N$	1500	1500	1500	1500
6) Transfer time:					
- FROM INVERTER TO RESERVE					
a) inverter fault	ms	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0
- FROM RESERVE TO INVERTER	ms	0	0	0	0
7) Efficiency @ full load	%	99,3	99,3	99,3	99,3

Note 1: On demand 380Vac, 415Vac, 60Hz

FORM 6: STATIC SWITCH TECHNICAL DATA

6c: Static Switch 250-1000kVA

SIZE	kVA	250	300	400	500	600	800	1000
1) Nominal Power	kVA	250	300	400	500	600	800	1000
2) Input/Output Voltage (Note1)	V	400	400	400	400	400	400	400
3) Acceptance range of Mains Voltage (low and high theresold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50	50	50	50
5) Power Overload:								
- 30'	$\%I_N$	150	150	150	150	150	150	150
- 90s	$\%I_N$	300	300	300	300	300	300	300
- 5s	$\%I_N$	500	500	500	500	500	500	500
- 2s	$\%I_N$	680	680	680	680	680	680	680
- 1s	$\%I_N$	700	700	700	700	700	700	700
- 500ms	$\%I_N$	800	800	800	800	800	800	800
- 200ms	$\%I_N$	900	900	900	900	900	900	900
- 100ms	$\%I_N$	1000	1000	1000	1000	1000	1000	1000
- 50ms	$\%I_N$	1100	1100	1100	1100	1100	1100	1100
- 20ms	$\%I_N$	1200	1200	1200	1200	1200	1200	1200
- 10ms	$\%I_N$	1400	1400	1400	1400	1400	1400	1400
- 3ms	$\%I_N$	1500	1500	1500	1500	1500	1500	1500
6) Transfer time:								
- FROM INVERTER TO RESERVE								
a) inverter fault	ms	0,9	0,9	0,9	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0	0	0	0
- FROM RESERVE TO INVERTER	ms	0	0	0	0	0	0	0
7) Efficiency @ full load	%	99,3	99,3	99,3	99,3	99,3	99,3	99,3

Note 1: On demand 380Vac, 415Vac, 60Hz

FORM 7: SYSTEM DATA

7a: 20/80kVA

SIZE		20	30	40	50	60	80
1a) AC/AC Efficiency (6-pulse)							
- 100% nominal load	%	89,89	90,1	90,41	90,53	90,66	91,52
- 75% nominal load	%	90,5	90,65	90,75	90,88	91,01	91,99
- 50% nominal load	%	90,08	90,12	90,2	90,34	90,49	91,66
- 25% nominal load	%	85,84	85,86	86,01	86,62	87,24	88,57
2a) Maximum Heat dissipation @ Full Load (6 pulse)	kW	1,8	2,6	3,4	4,2	4,9	5,9
1b) AC/AC Efficiency (12-puse)							
- 100% nominal load	%	88,72	88,93	89,23	90,32	90,36	90,37
- 75% nominal load	%	89,32	89,47	89,57	90,20	90,69	91,41
- 50% nominal load	%	88,91	88,95	89,03	89,30	89,84	90,03
- 25% nominal load	%	84,72	84,74	84,89	86,63	87,28	87,93
2b) Maximum Heat dissipation @ Full Load (12-pulse)	kW	2,0	3,0	3,9	4,3	5,1	6,8
3) Noise @ 1 metre as per ISO3746	dBA	60	60	60	60	60	60
4) Air Flow	m^3/h	1200	1200	1200	1200	1200	1200
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):							
(@ 40°C)	%	60	60	60	60	60	60
(@ 25°C)	%	90	90	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5					

7b: 100/200kVA

SIZE		100	120	160	200
1a) AC/AC Efficiency (6pulse)					
- 100% nominal load	%	91,63	92,82	92,87	93,01
- 75% nominal load	%	92,34	92,63	93,40	93,31
- 50% nominal load	%	91,25	91,25	91,86	93,05
- 25% nominal load	%	89,65	87,28	87,74	89,22
2a) Maximum Heat dissipation @ Full Load	kW	7,3	7,4	9,8	12,0
1b) AC/AC Efficiency (12pulse)					
- 100% nominal load	%	90,44	91,61	91,66	91,80
- 75% nominal load	%	91,14	91,43	92,19	92,10
- 50% nominal load	%	90,06	90,06	90,67	91,84
- 25% nominal load	%	88,48	86,15	86,60	88,06
2b) Maximum Heat dissipation @ Full Load	kW	8,5	8,8	11,6	14,3
3) Noise @ 1 metre as per ISO3746	dBA	60	60	60	60
4) Air Flow	m^3/h	1200	2000	3200	3200
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):					
(@ 40°C)	%	60	60	60	60
(@ 25°C)	%	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5			

FORM 7: SYSTEM DATA

7c: 250/1000kVA- 12Pulse

SIZE		250	300	400	500	600	800	1000
1) AC/AC Efficiency								
- 100% nominal load	%	91,80	92,00	93	93,5	94,1	94,5	94,5
- 75% nominal load	%	91,81	92,01	93,5	94,1	94,8	94,8	94,8
- 50% nominal load	%	92,40	92,60	93	93,6	94,3	94,4	94,4
- 25% nominal load	%	89,00	89,20	90	90,3	91	91,2	91,2
2) Maximum Heat dissipation @ Full Load	kW	17,9	20,9	24,1	27,8	30,1	37,2	46,6
3) Noise @ 1 metre as per ISO3746	dBA	70	70	70	78	78	78	78
4) Air Flow	m^3/h	3200	3200	10000	10000	10000	10000	10000
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):								
(@ 40°C)	%	60	60	60	60	60	60	60
(@ 25°C)	%	90	90	90	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5						

FORM 8: MECHANICAL DATA

8a: MECHANICAL DATA 20/100kVA - 6 Pulse

SIZE		20	30	40	50	60	80	100
1) Mechanical Dimensions:								
- Width	mm	550	550	550	550	550	698	698
- Depth	mm	850	850	850	850	850	866	866
- Height	mm	1055	1055	1055	1055	1055	1415	1415
2) Weight (Note 1)	kg	250	275	300	340	370	550	680
3) Protection degree (Note 3)		IP21	IP21	IP21	IP21	IP21	IP21	IP21
4) Colour (RAL scale)								
Frame	RAL	7035	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035	7035	7035	7035

Note 1: Weight without batteries
Note 2: Double frame
Note 3: IP31 on demand

8b: MECHANICAL DATA 20/80kVA - 12 Pulse

SIZE		20	30	40	50	60	80
1) Mechanical Dimensions:							
- Width	mm	550	550	550	698	698	698
- Depth	mm	850	850	850	866	866	866
- Height	mm	1055	1055	1055	1415	1415	1415
2) Weight (Note 1)	kg	300	320	350	560	620	680
3) Protection degree (Note 3)		IP21	IP21	IP21	IP21	IP21	IP21
4) Colour (RAL scale)							
Frame	RAL	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035	7035	7035

Note 1: Weight without batteries
Note 2: Double frame
Note 3: IP31 on demand

8c: MECHANICAL DATA 120/200kVA - 6 Pulse

SIZE		120	160	200
1) Mechanical Dimensions:				
- Width	mm	1100	1100	1100
- Depth	mm	800	800	820
- Height	mm	1400	1400	1950
2) Weight	kg	820	920	980
3) Protection degree (Note 3)		IP21	IP21	IP20
4) Colour (RAL scale)				
Frame	RAL	7035	7035	7035
Panels	RAL	7035	7035	7035

Note 1: Weight without batteries
Note 2: Double frame
Note 3: IP31 on demand

FORM 8: MECHANICAL DATA

8d: MECHANICAL DATA 100/200kVA - 12 Pulse

SIZE		100	120	160	200
1) Mechanical Dimensions:					
- Width	mm	1100	1100	1100	1100
- Depth	mm	800	800	820	820
- Height	mm	1400	1400	1950	1950
2) Weight	kg	880	980	1200	1400
3) Protection degree (Note 3)		IP21	IP21	IP20	IP20
4) Colour (RAL scale)					
Frame	RAL	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035

Note 1: Weight without batteries
Note 2: Double frame
Note 3: IP31 on demand

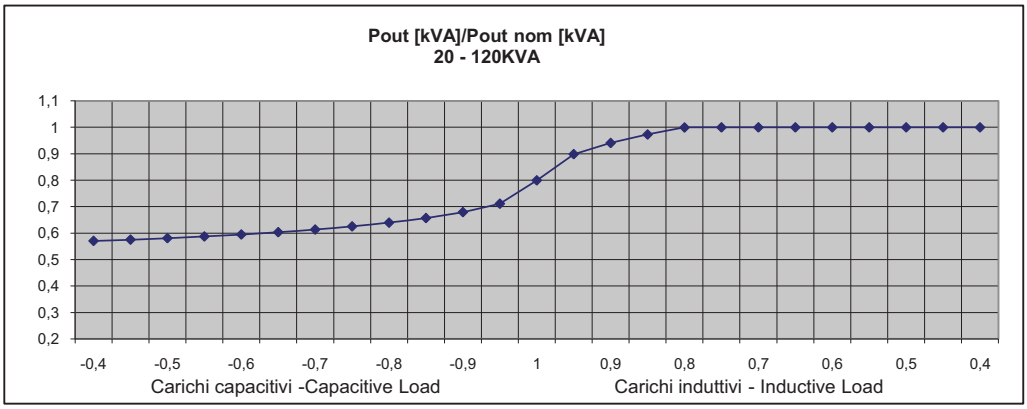
8e: MECHANICAL DATA 250/1000kVA - 12 Pulse

SIZE		250	300	400	500	600	800	1000
1) Mechanical Dimensions:								
- Width	mm	1100	1500	1500	2x1350 (Note2)	2x1350 (Note2)	2x1350 (Note2)	2x1350 (Note2)
- Depth	mm	820	1000	1000	1000	1000	1000	1000
- Height	mm	1950	2000	2000	2000	2000	2000	2000
2) Weight	kg	1600	1850	2100	2900	3100	3900	4800
3) Protection degree (Note 3)		IP20	IP20	IP20	IP20	IP20	IP20	IP20
4) Colour (RAL scale)								
Frame	RAL	7035	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7036	7036	7036	7036	7036	7036

Note 1: Weight without batteries
Note 2: Double frame
Note 3: IP31 on demand

FORM 9: Output Power as Function of Cos-phi

Form 9a: Load @ Cos-phi (20 - 120 kVA)			
	Cos-ph	**Apparent output power [kVA] (% of unit size)**	**Real output power [kW] (% of unit size)**
Cap.	-0,6	60	36
Cap.	-0,7	61	43
Cap.	-0,8	64	52
Cap.	-0,9	68	62
	1	80	80
Ind.	0,95	90	86
Ind.	0,9	94	85
Ind.	0,85	97	83
Ind.	0,8	100	80
Ind.	0,7	100	70
Ind.	0,6	100	60

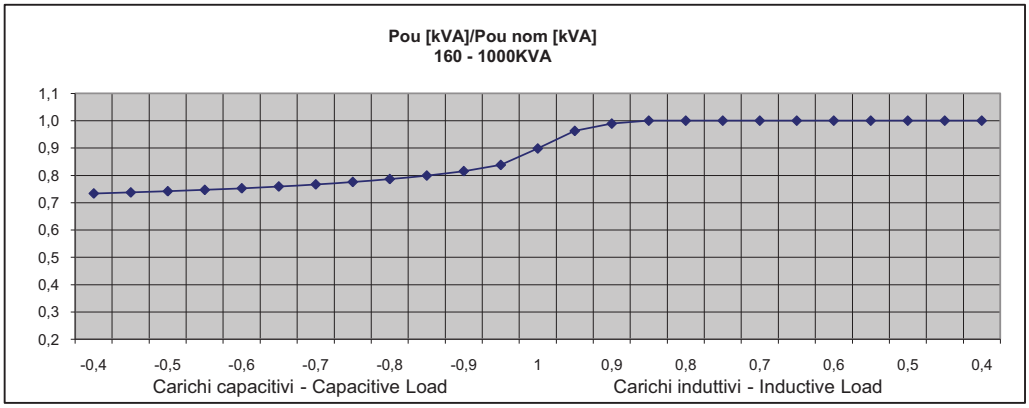


Example: 100 kVA unit size

	Cos-ph	**Apparent output power [kVA]**	**Real output power [kW]**
Cap.	-0,9	68	62
	1	80	80
Ind.	0,8	100	80

FORM 9: Output Power as Function of Cos-phi

Form 9b: Load @ Cos-phi (160 - 1000 kVA)			
	Cos-ph	**Apparent output power [kVA] (% of unit size)**	**Real output power [kW] (% of unit size)**
Cap.	-0,6	75	46
Cap.	-0,7	77	54
Cap.	-0,8	79	63
Cap.	-0,9	82	74
	1	90	90
Ind.	0,95	96	92
Ind.	0,9	99	90
Ind.	0,85	100	85
Ind.	0,8	100	80
Ind.	0,7	100	70
Ind.	0,6	100	60



Example: 600 kVA unit size

	Cos-ph	**Apparent output power [kVA]**	**Real output power [kW]**
Cap.	-0,9	492	443
	1	540	540
Ind.	0,8	600	480

FORM 10a: POWER PARALLEL

FORM 10a-1: Power parallel of 2 UPS

UPS CONDITION	LOAD SUPPLYED BY:
2 Inverter OK	Inverter
1 o 2 Inverter KO	Mains
1 UPS Disconnect or in test 1 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload.

FORM 10a-2: Power parallel of 3 UPS

UPS CONDITION	LOAD SUPPLYED BY:
3 Inverter OK	Inverter
1, 2 o 3 Inverter KO	Mains
1 UPS Disconnect or in test 2 Inverter OK	Inverter
1 UPS Disconnect or in test 1 o 2 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload

TABELLA 10a-3: Parallelo di potenza di 4 UPS

UPS CONDITION	LOAD SUPPLYED BY:
4 Inverter OK	Inverter
1, 2, 3 o 4 Inverter KO	Mains
1 UPS Disconnect or in test 3 Inverter OK	Inverter
1 UPS Disconnect or in test 1, 2 o 3 Inverter KO	Mains
2 o 3 UPS Disconnect or in test	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload

FORM 10b: REDUNTANT PARALLEL

FORM 10b-1: Reduntant parallel 2 UPS

UPS CONDITION	LOAD SUPPLYED BY:
2 Inverter OK	Inverter
1 Inverter KO	Inverter
2 Inverter KO	Mains
1 UPS Disconnect or in test 1 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload

FORM 10b-2: Reduntant parallel 3 UPS

UPS CONDITION	LOAD SUPPLYED BY:
3 Inverter OK	Inverter
1 Inverter KO	Inverter
2 o 3 Inverter KO	Mains
1 UPS Disconnect or in test 2 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Inverter
1 UPS Disconnect or in test 2 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload

FORM 10b-3: Reduntant parallel of 4 UPS

UPS CONDITION	LOAD SUPPLYED BY:
4 Inverter OK	Inverter
1 Inverter KO	Inverter
2, 3 o 4 Inverter KO	Mains
1 UPS Disconnect or in test 3 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Inverter
1 UPS Disconnect or in test 2 o 3 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.
"Inverter OK"= Inverter working normally with regular output voltage.
"Inverter KO"= Inverter stopped or output voltage out of limits or strong overload

FORM 11: OF AVAILABLES OPTIONS

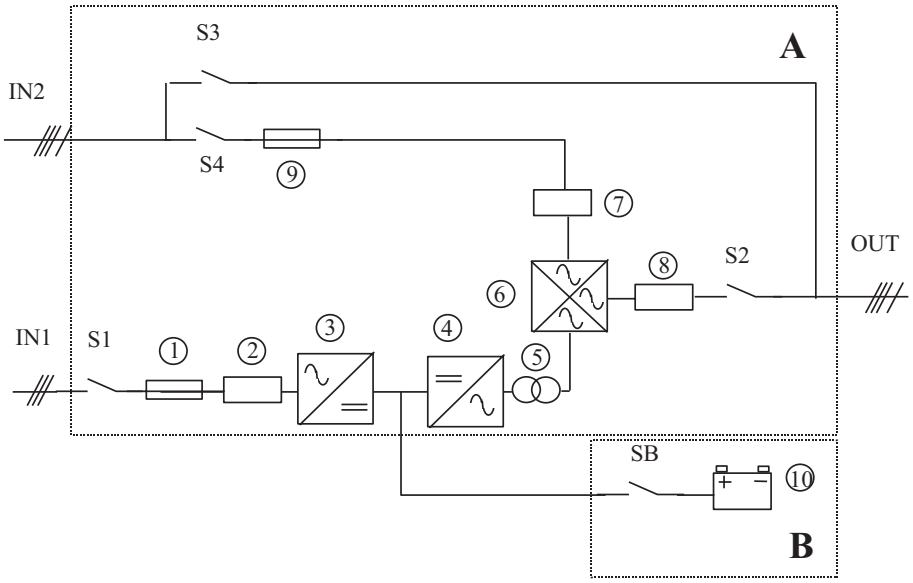
OPZ	SIZES																
	20	**30**	**40**	**50**	**60**	**80**	**100**	**120**	**160**	**200**	**250**	**300**	**400**	**500**	**600**	**800**	**1000**
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	INT	INT	INT	INT	INT	INT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EX
3	INT	INT	INT	INT	INT	INT	INT	INT	EXT	NA	NA	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA	NA	NA	INT	INT	INT	INT	EX	EX	EX	EX	EX
5	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
6	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	INT	INT	EX	EX
7	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
8	INT	INT	INT	INT	INT	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX
9	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
10	INT	INT	INT	INT	INT	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX
11	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
12	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
13	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
14	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
15	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
16	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
17	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
18	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
19	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
20	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
21	INT	INT	ND	ND	ND	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
22	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
23	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
24	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
25	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
26	INT	INT	INT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	EX	EX	EX	EX
28	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT

INT: Internal UPS
EX: External frame
ND: Please contact Siel S.p.A. for dimensioning
PC: PC or network software
NA: Not applicable

1	RFI filter for stricter limits that EN50091-2	15	RS232 customer interface
2	Input power factor compensation	16	Remote mimic panel
3	Current input distortion filter 6-pulse	17	OC System monitoring software
4	Current input distortion filter 12-pulse	18	SMS
5	Reserve insulation transformer	19	SNMP
6	Rectifier insulation transformer	20	Teleglobalservice
7	Reserve and rectifier insulation transformer	21	Tension adapter auto transformer
8	Insulation control output + mains contactor	22	UPS used as frequency converter
9	Back-Feed Protection	23	Double customer interface
10	Back-Feed Protection + contactor	24	2-nd RS232
11	Output insulation probe	25	Parallel Centralized Battery
12	Rectifier current limitation for Motor Generator Set	26	Internal Battery (only UPS 6-pulse)
13	Battery temperature probe	27	24-pulse Rectifier
14	Fiber optic insulated battery temperature probe	28	Output Voltage Remote Sensing

FORM 12: RESERVE MAINS FUSES

SIZE	FUSE TYPE
20	63A 660VAC FE
30	100A 660VAC FE
40	100A 660VAC FE
50	200A 660VAC FEE
60	200A 660VAC FEE
80	170M1571 Bussman (250A 660V ExtraFast)
100	350FM Bussman (350A 660V ExtraFast)
120	350FM Bussman (350A 660V ExtraFast)
160	350FM Bussman (350A 660V ExtraFast)
200	700 FMM Bussman (700A 660V ExtraFast)
250	700 FMM Bussman (700A 660V ExtraFast)
300	700 FMM Bussman (700A 660V ExtraFast)
400	700 FMM Bussman (700A 660V ExtraFast)
500	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)
600	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)
800	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)



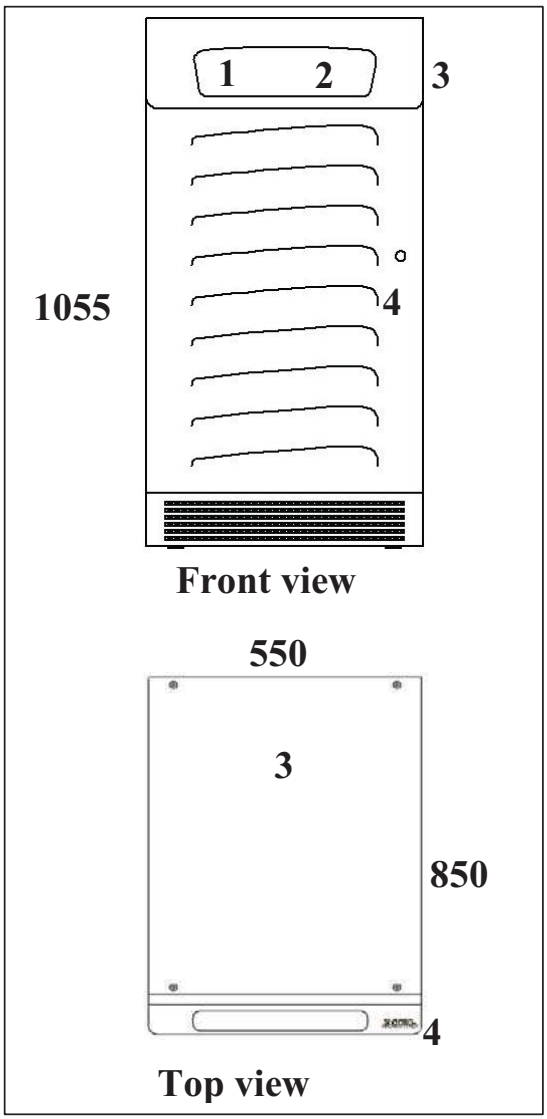
A UPS
B External Battery frame

S1 Rectifier switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve switch

SB Battery switch

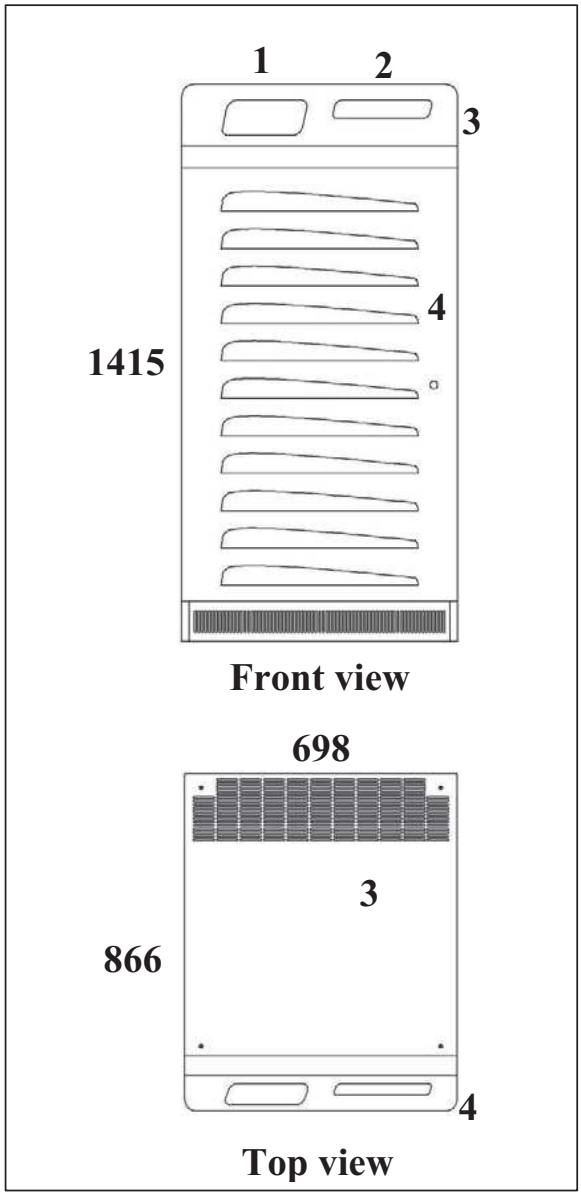
IN1 Mains
IN2 Reserve mains
OUT Out

1 Rectifier fuses
2 Rectifier EMI filter
3 Rectifier
4 Inverter
5 Isolation transformer between batteries and load
6 Static switch
7 Reserve EMI filter
8 Output EMI filter
9 Reserve fuses
10 Battery



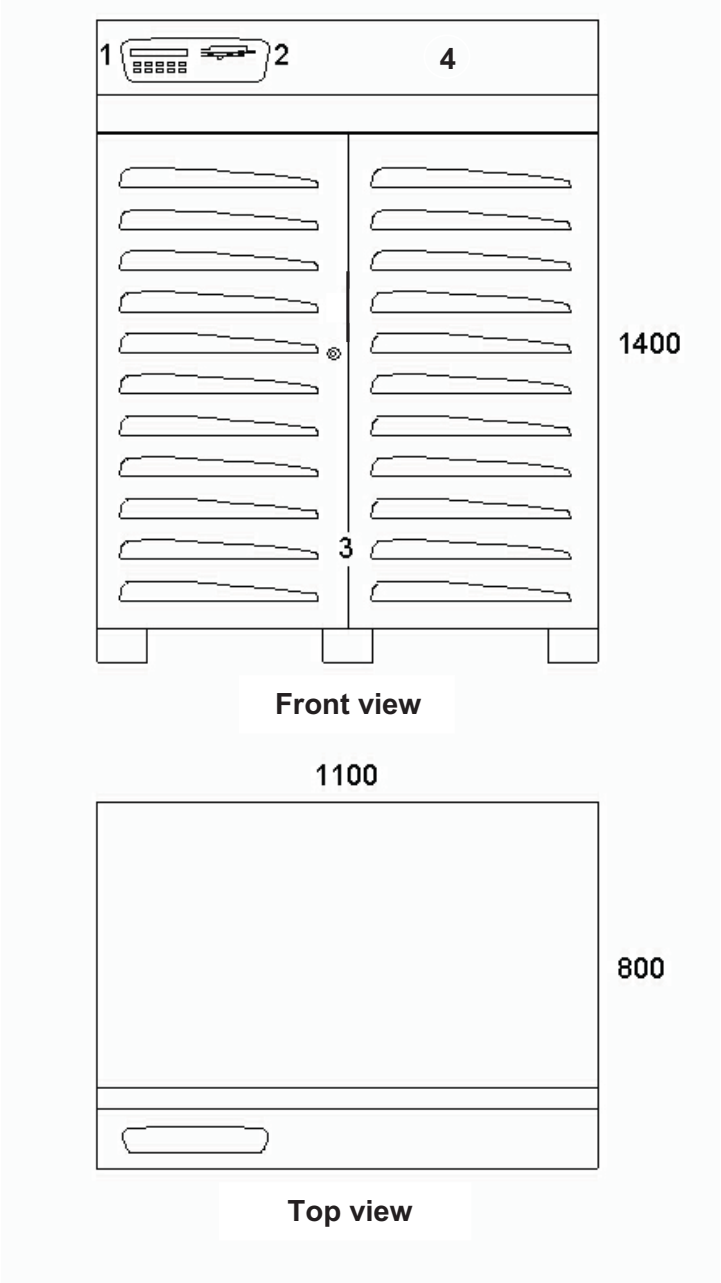
1: Control, measurement and signalling panel
2: Mimic diagram
3: Electronic cubicle
4: Input/output switch door.

Figure 2A: Size 20-60kVA 6-pulse and 20-40kVA 12-pulse without batteries
Size 20-40kVA 6-pulse with batteries included



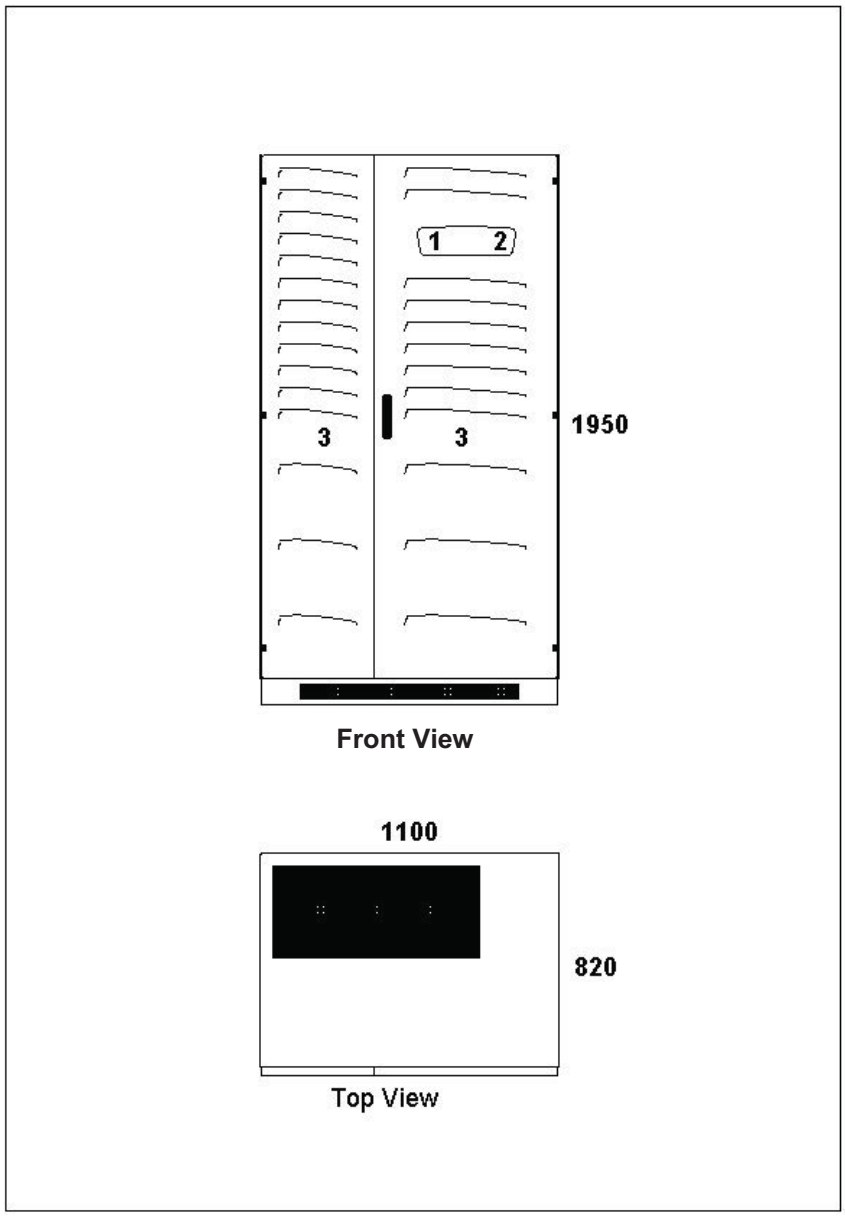
1: Control, measurement and signalling panel
2: Mimic diagram
3: Electronic cubicle
4: Input/output switch door.

Figure 2B: Size 80-100kVA 6-pulse and 50-80kVA 12-pulse



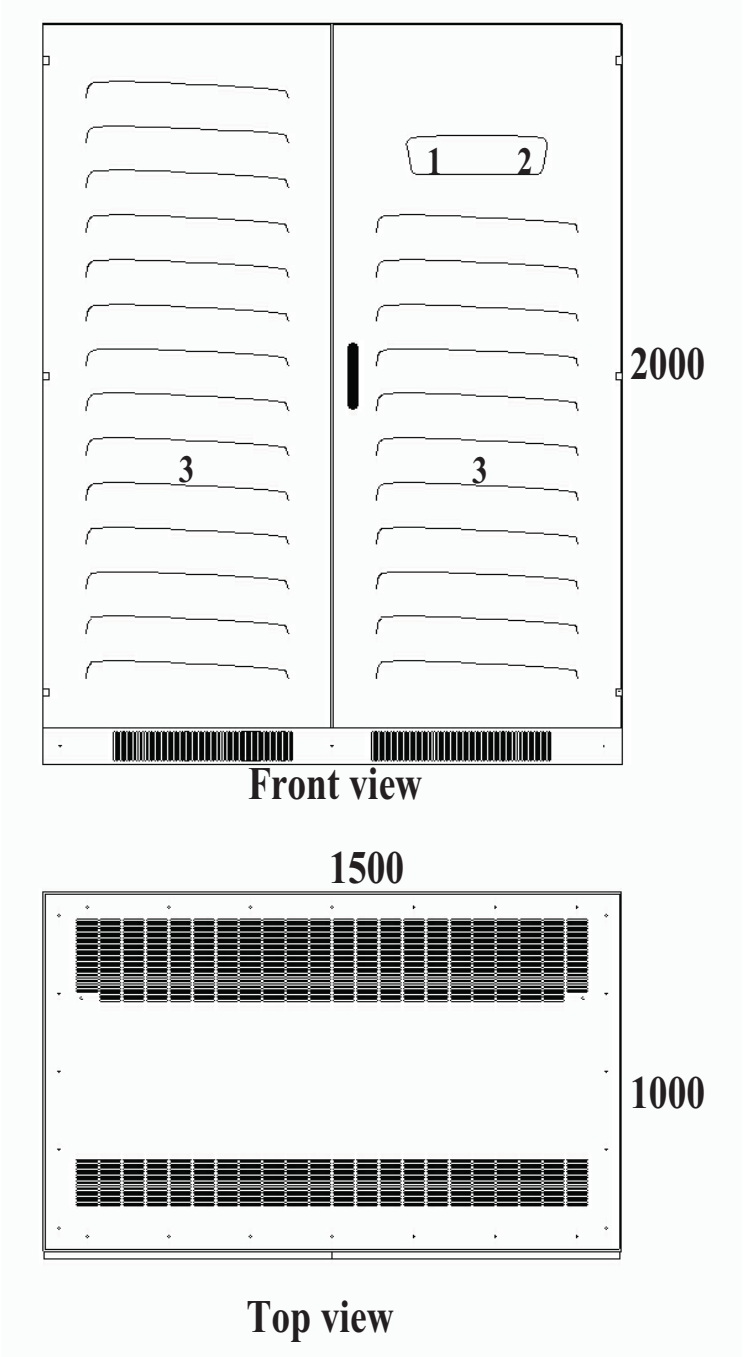
1: Control, measurement and signalling panel
2: Mimic diagram
3: Input/output switch box
4: Electronic cubicle

FIGURE 2C: Size 120-160kVA 6-pulse
100-120kVA 12-pulse



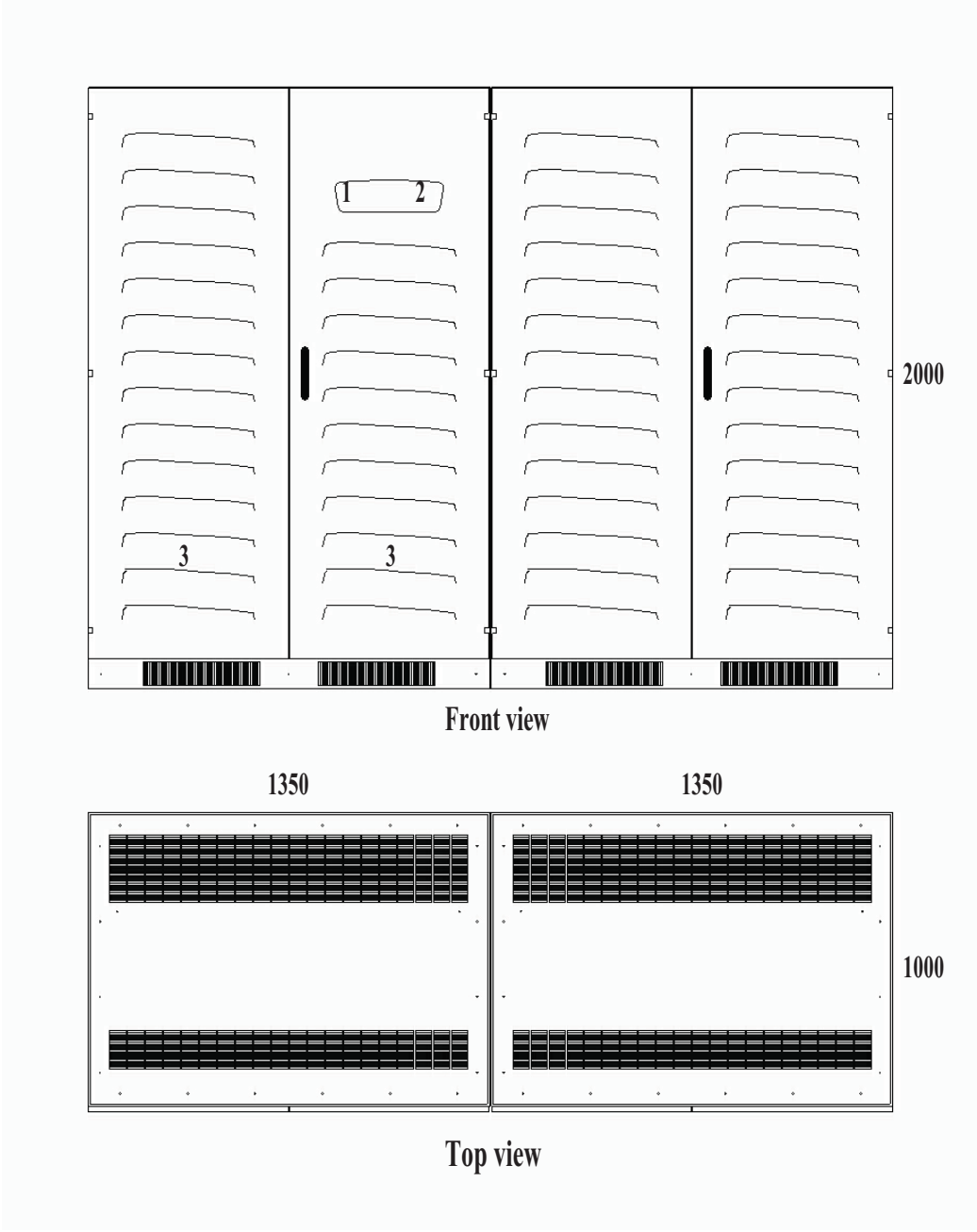
1: Control, measurement and signalling panel
2: Mimic diagram
3: Input/output switch door

FIGURE 2D: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse



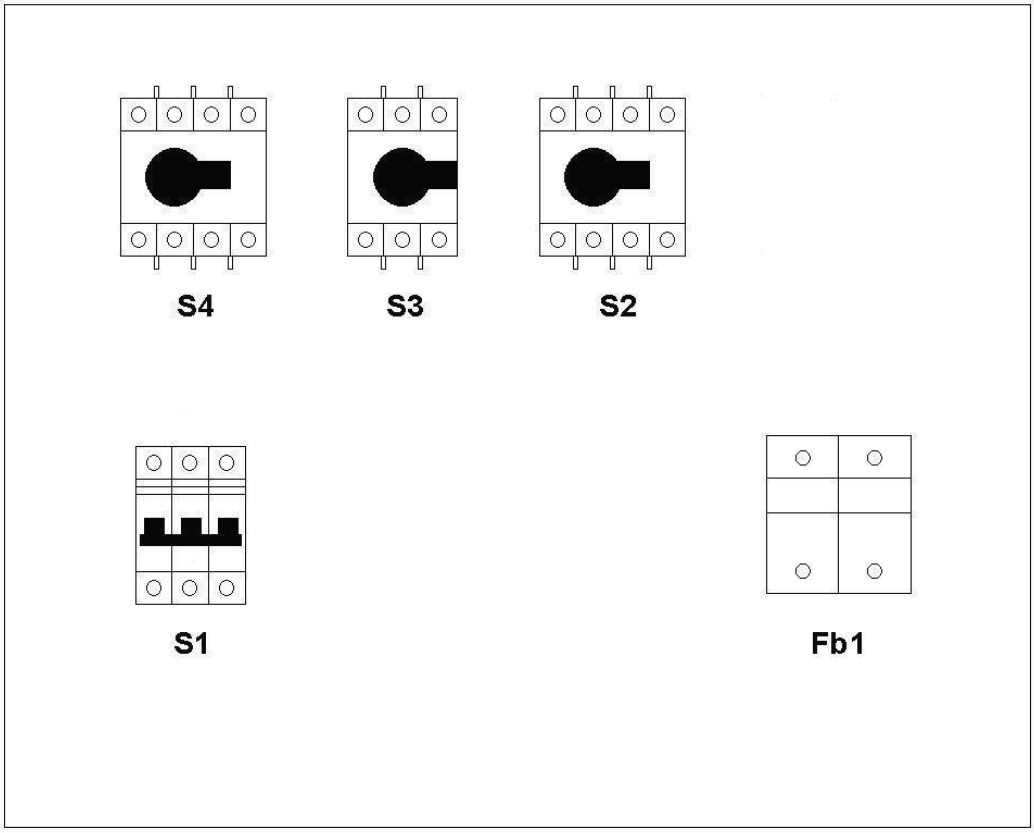
1: Control, measurement and signalling panel
2: Mimic diagram
3: Input/output switch door

FIGURE 2E: Size 300-400kVA



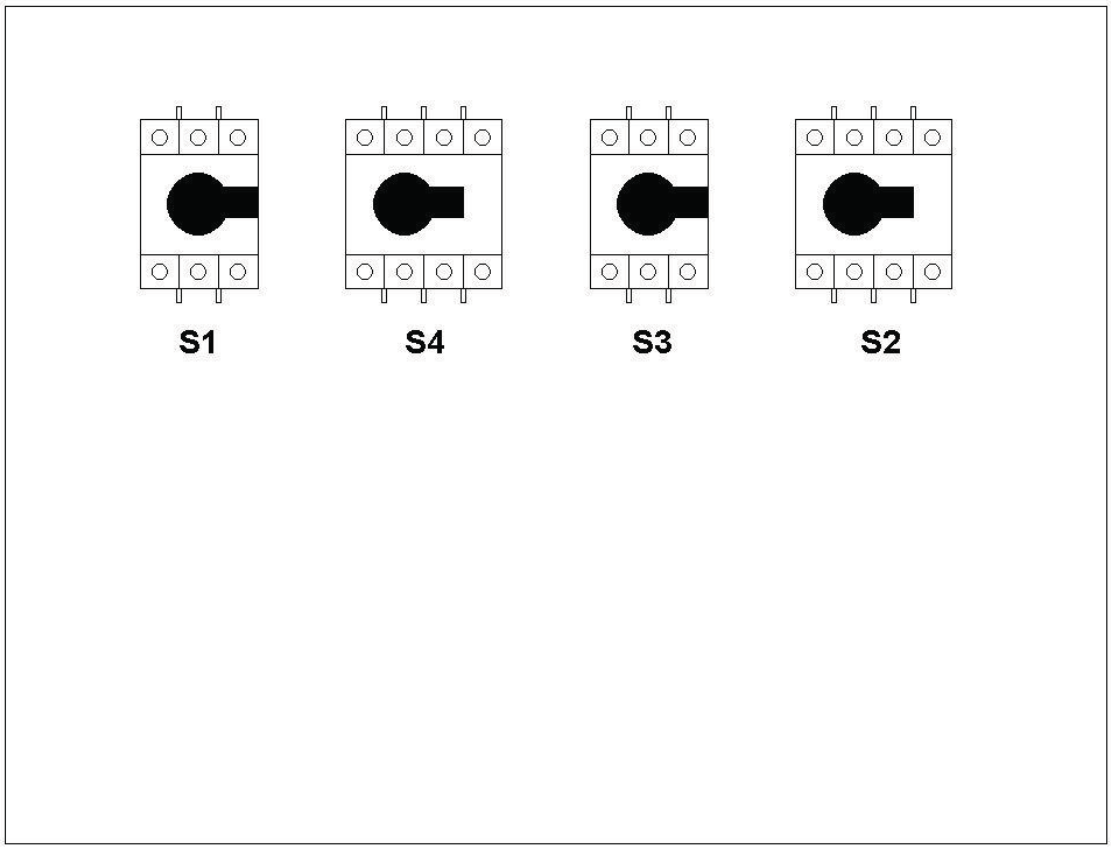
1: Control, measurement and signalling panel
2: Mimic diagram
3: Input-output switch door

FIGURE 2F: Size 500-1000kVA



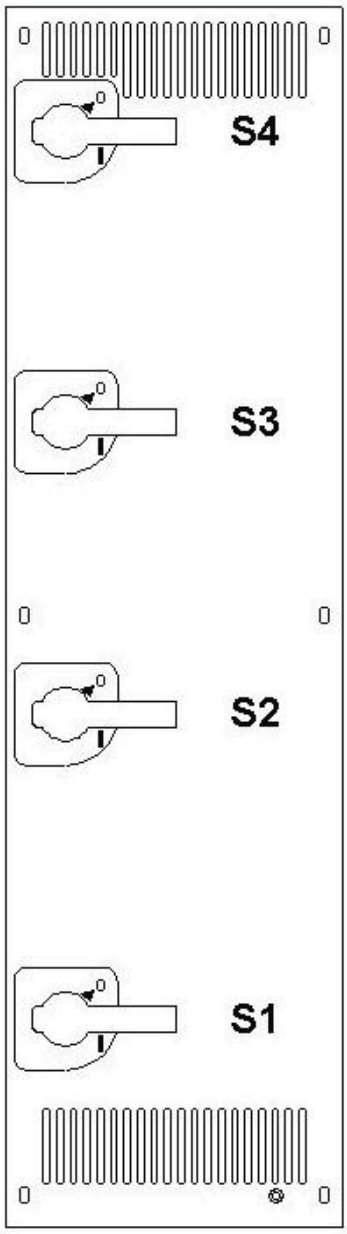
S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch
Fb1 Battery fuses

Figure 3A Size 20-40kVA 6-pulse and 12-pulse



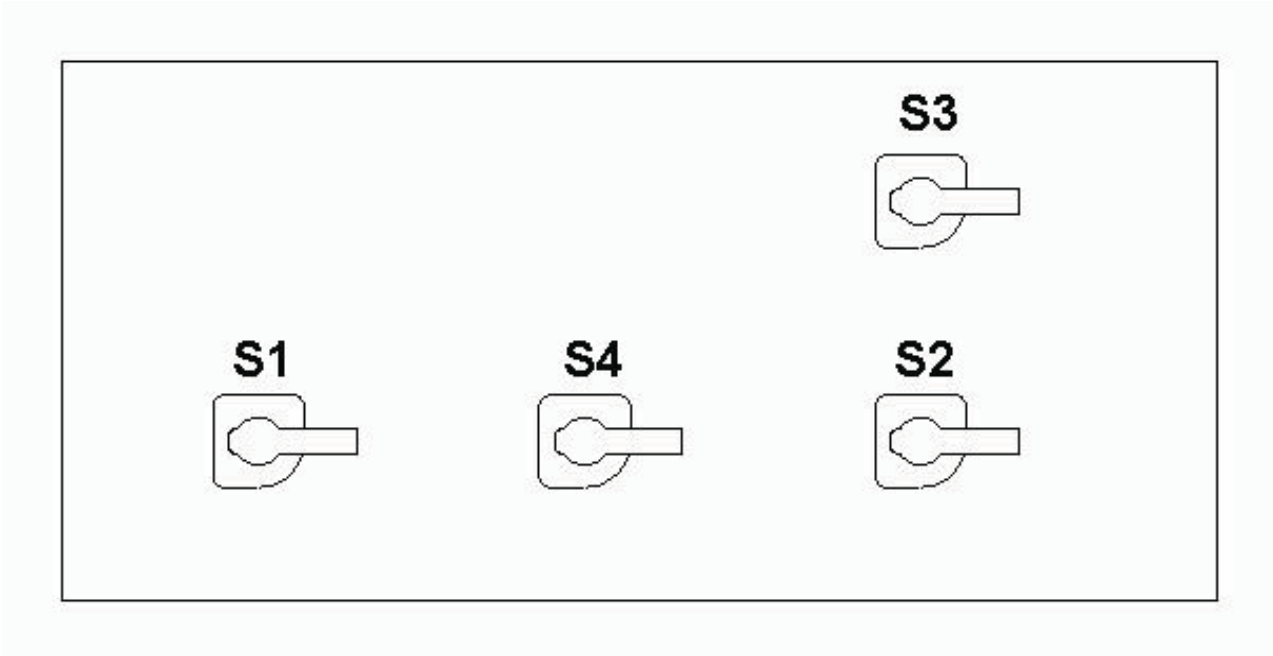
S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch

Figure 3B Size 50-60kVA 6-pulse



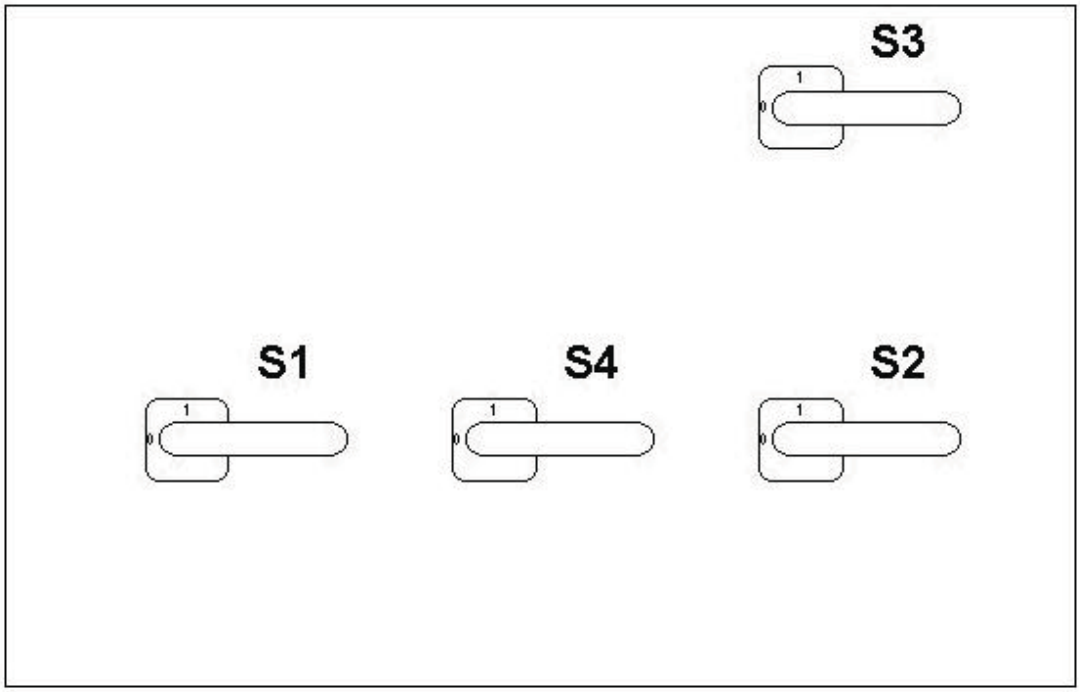
S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch

Figure 3C Size 80-100kVA 6-pulse and 50-80kVA 12-pulse



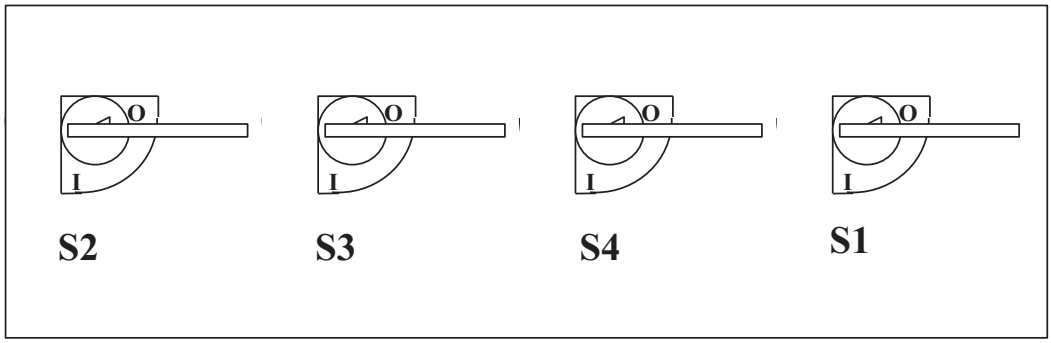
S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch

Figure 3D Size 120-160kVA 6-pulse and 100-120kVA 12-pulse



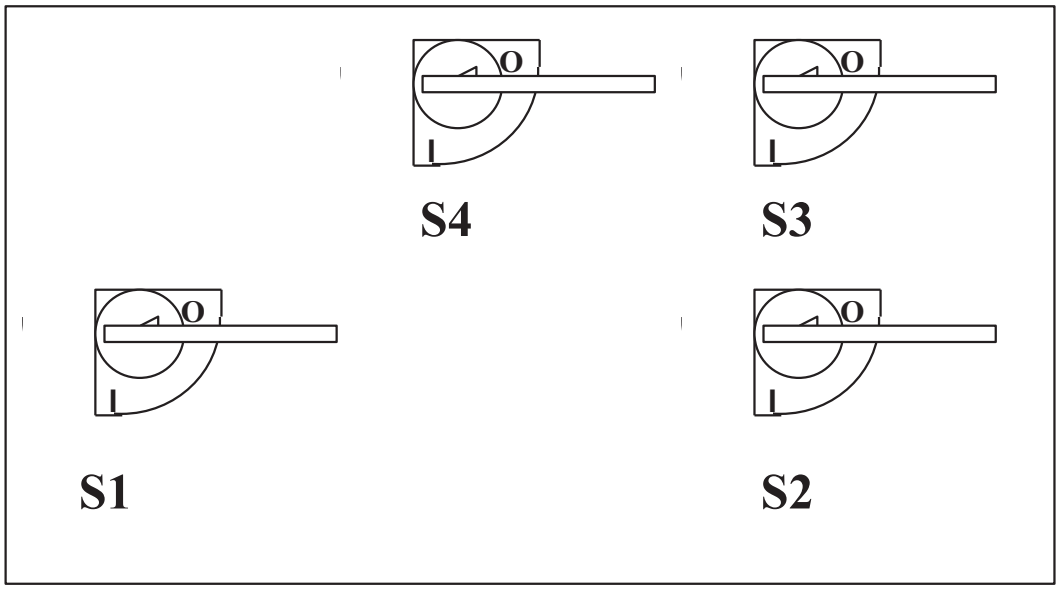
S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch

Figure 3E Size 200-250kVA 6-pulse and 160-250kVA 12-pulse



S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel)
S4 Reserve input switch

Figure 3F: Size 300-400kVA



S1 Mains input switch
S2 Output switch
S3 By-pass (Not for parallel) (Built in the inverter frame)
S4 Reserve input switch

Figure 3G: Size 500-800KVA

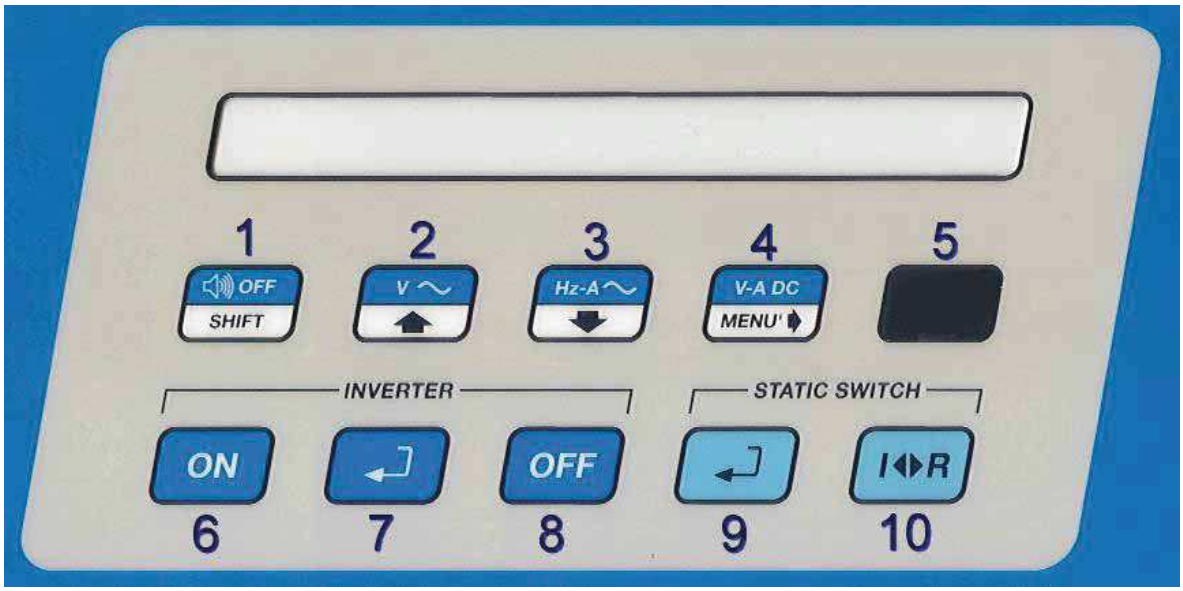


Figure 4A: Size 60-80KVA 12-pulse and 80-100KVA 6-pulse

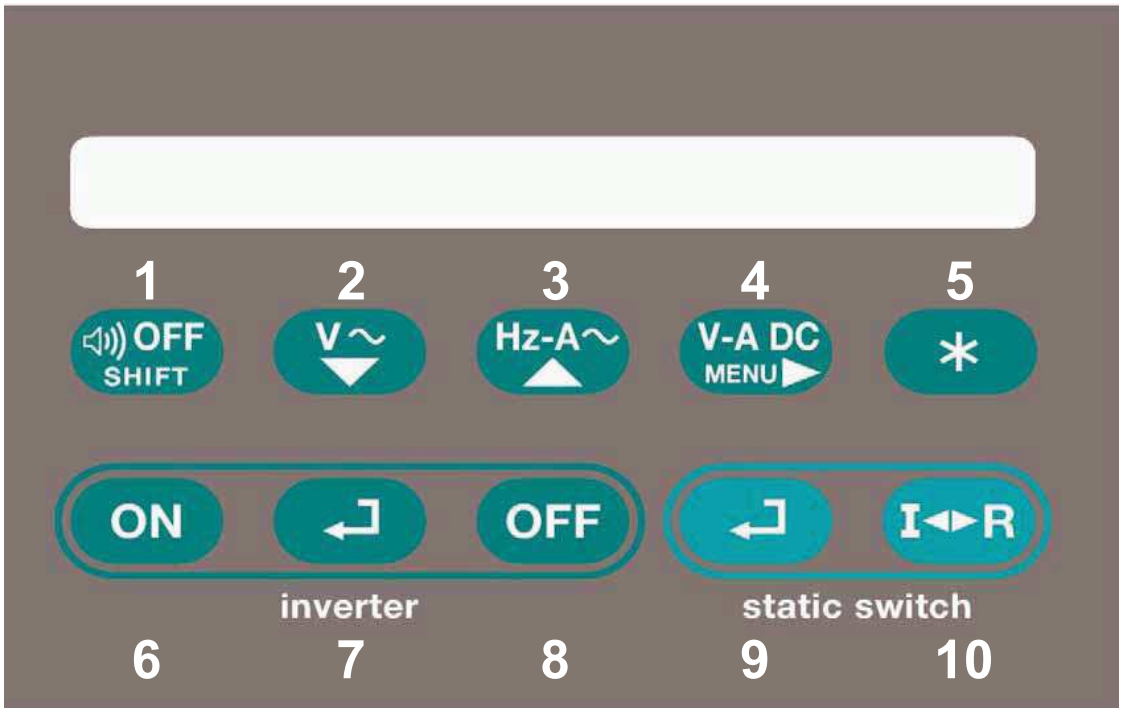


Figure 4B: Different size

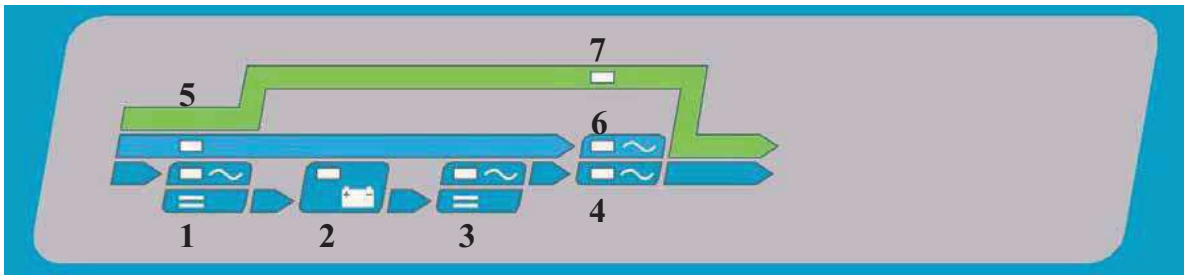


Figure 5A: Size 60-80KVA 12-pulse and 80-100KVA 6-pulse

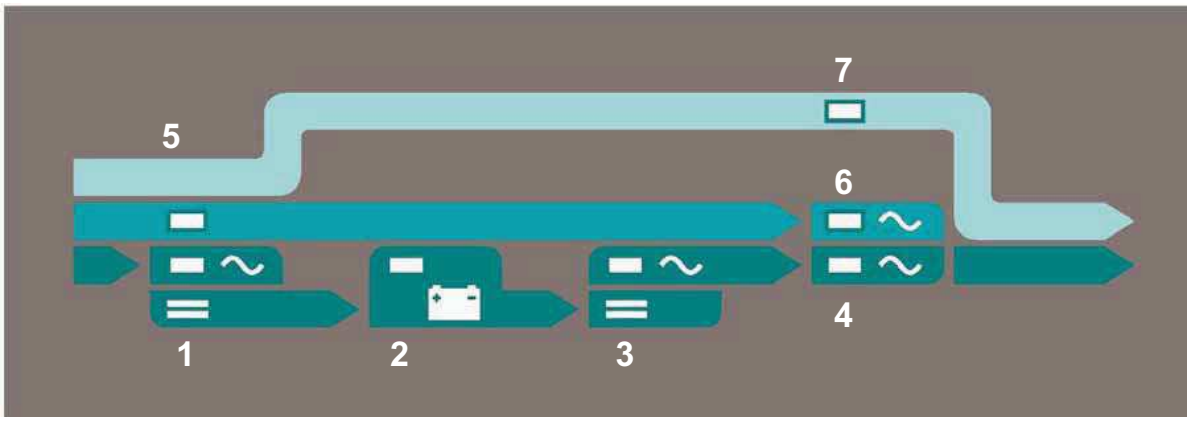
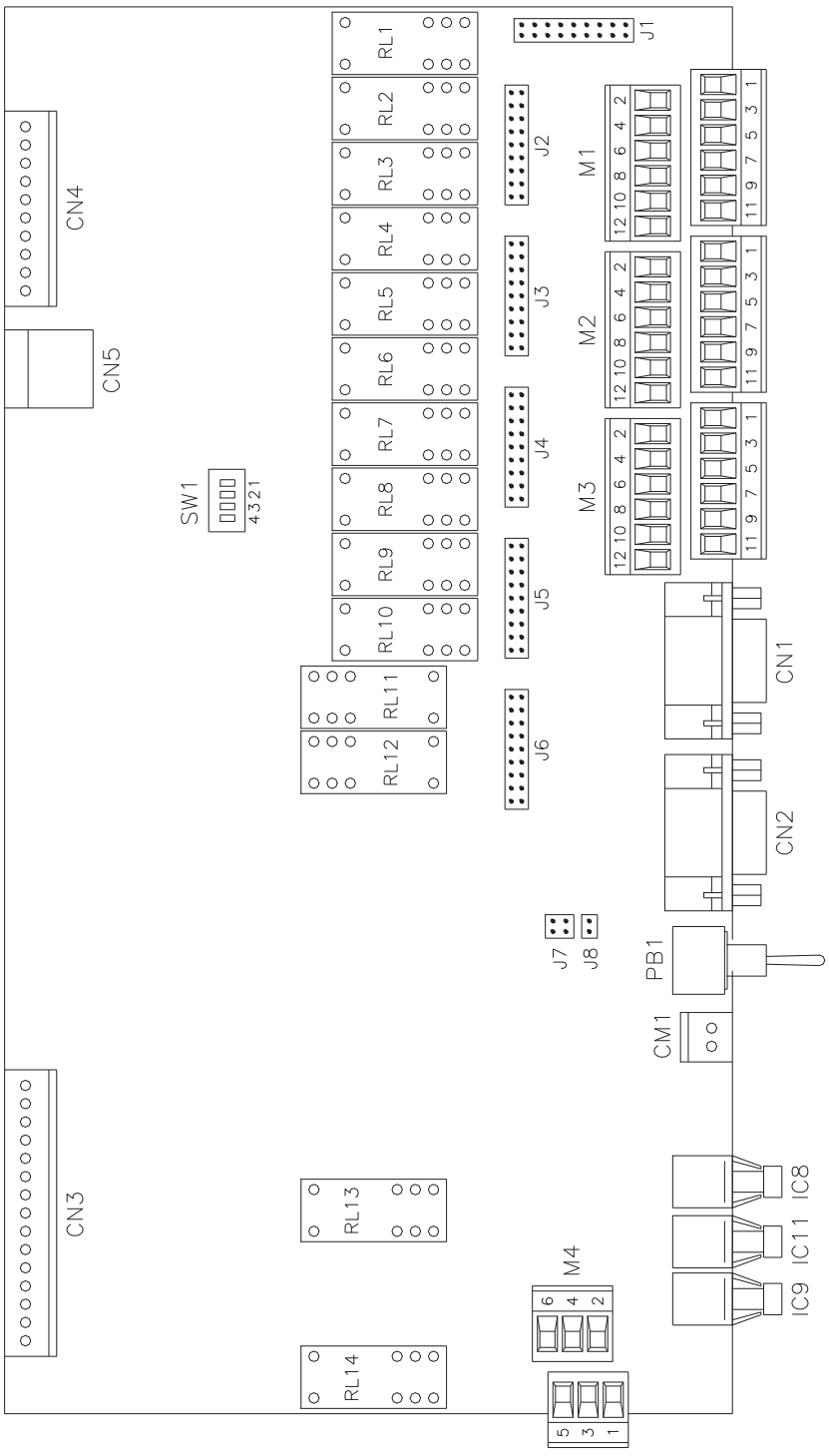
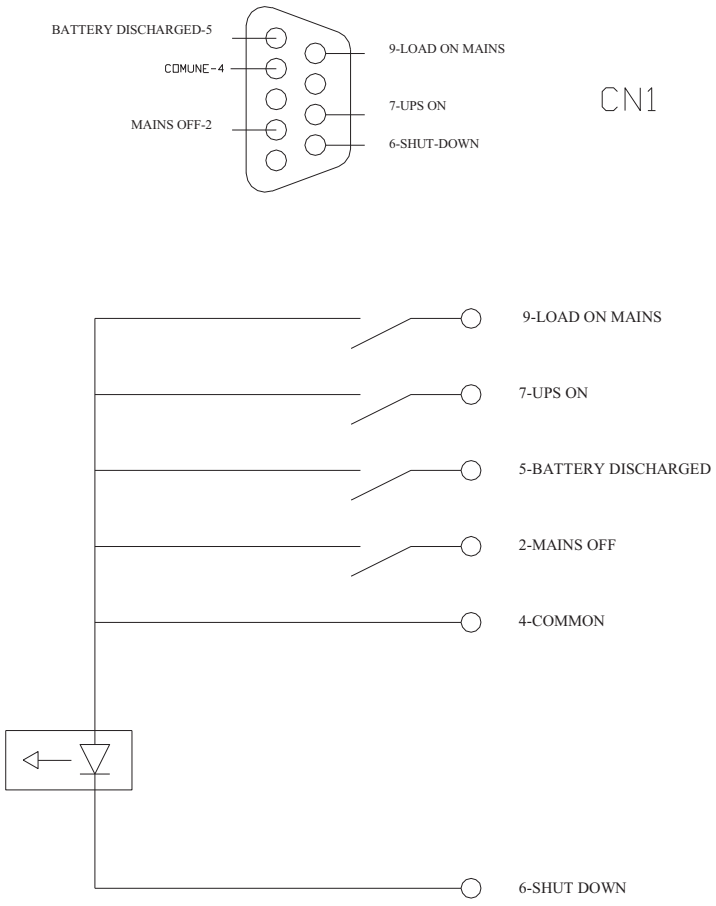
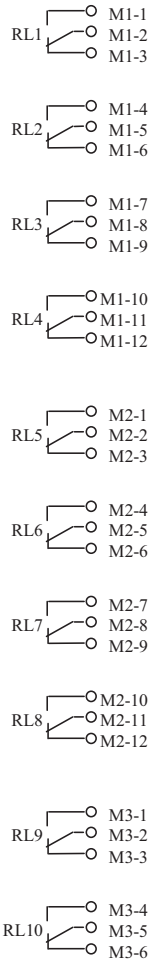


Figure 5B: Different size


CN4
CN5
CN3
SW1
4321
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
J1
J2
J3
J4
J5
J6
J7
J8
M1
M2
M3
M4
CN1
CN2
PB1
CM1
IC8
IC11
IC9


BATTERY DISCHARGED-5
COMUNE-4
MAINS OFF-2
9-LOAD ON MAINS
7-UPS ON
6-SHUT-DOWN
CN1
9-LOAD ON MAINS
7-UPS ON
5-BATTERY DISCHARGED
2-MAINS OFF
4-COMMON
6-SHUT DOWN

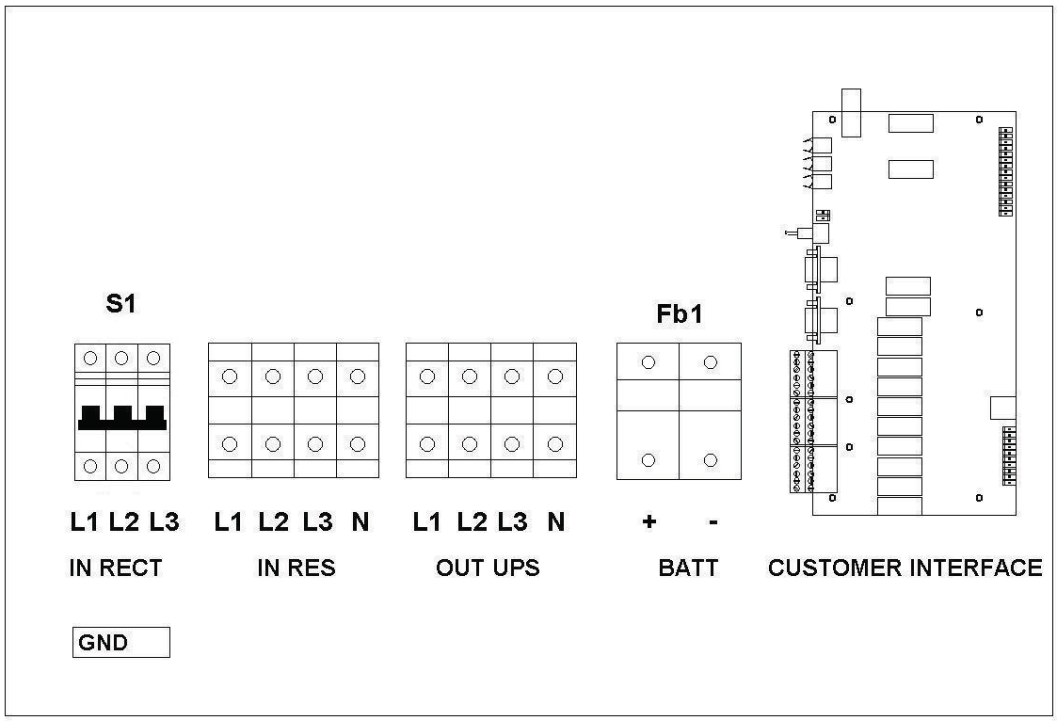


N.B.: The relays are drawn in the released state

Dip-Switch SW1					
1	***2***	***3***	***4***	***Setting***	***Description***
On	On	On	On	Test	All relays are energised (the contacts are in opposite state of the drawing)
Off	Off	Off	Off	Test	All relays are released (the contacts are in the same state of the drawing)
On	**On**	**On**	**Off**	**1 (Standard)**	**The relays are energised when the signal of drawing occurs**
On	On	Off	On	2	**RL9** is energised in case of: **SWITCHING LOCKED** *(All the remaining relays as standard)*
On	On	Off	Off	3	**RL9** is energised in case of: **OR OF ALARMS (Type 1)** (Rectifier OFF + rectifier over temperature + battery failure + battery discharged + inverter overload + inverter over temperature + phase R,S,T over current + switching locked + static switch failure) *(All the remaining relays as standard)*
On	Off	On	On	4	**RL9** is energised in case of: **INVERTER OVERLOAD** **RL10** is energised in case of: **OR OF ALARMS (Type 2)** (Mains OFF + battery discharged + inverter OFF + load on mains + reserve line voltage out of limits + inverter overload) *(All the remaining relays as standard)*
On	Off	On	Off	5	**RL8** is energised in case of: **INVERTER OVERTEMPERATURE** *(All the remaining relays as standard)*
On	Off	Off	On	6	**RL9** is energised in case of: **INVERTER/MAINS ARE SYNCHRONIZED**
All others position				…….. 8	All relays are released

Note: By “double customer interface” option it is possible have two different setting at the same time.

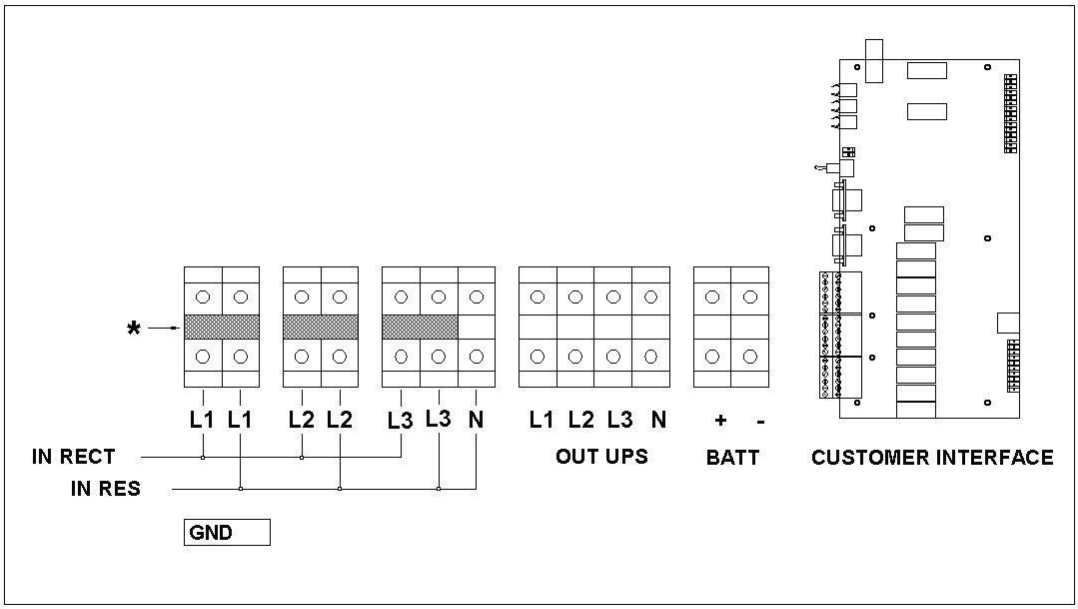
Jumper J7 –J8		
Fiber Optic Output	**J7** close 1-2	**J8** close
RS232 Serial Output	**J7** close 1-3 and 2-4	**J8** open



CONNECTIONS:
IN RECT = Mains input
IN RES = Reserve input
OUT UPS = Out UPS
BATT = Battery plug-in connector

N = Neutral
L1 = Phase L1 (R)
L2 = Phase L2 (S)
L3 = Phase L3 (T)
\+ = Battery +
\- = Battery -
GND = Ground connection

Figure 9A: Size 20-40kVA 6-pulse and 12-pulse

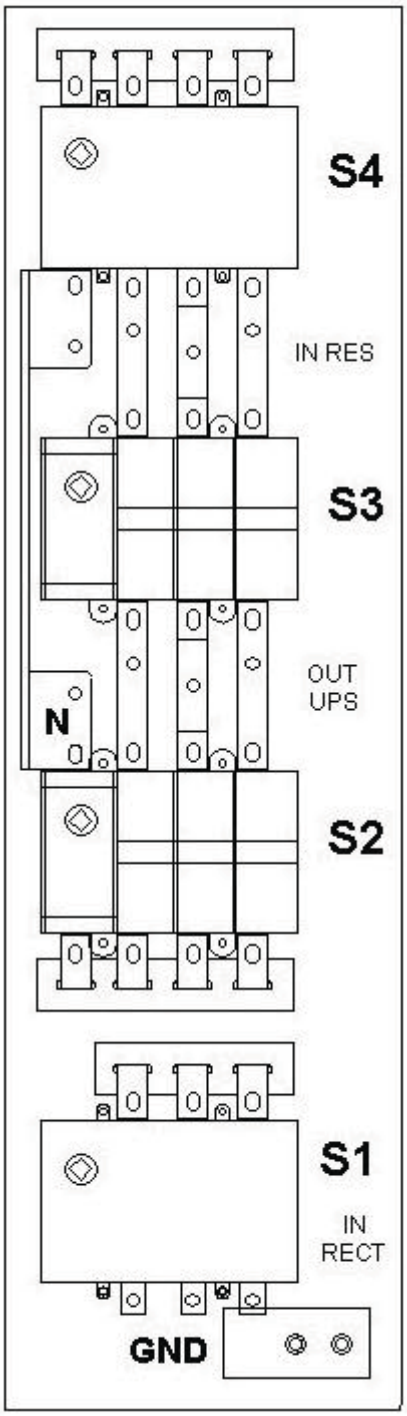


CONNECTIONS:
IN RECT = Mains input
IN RES = Reserve input
OUT UPS = Out UPS
BATT = Battery plug-in connector

*** In the standard configuration, we provide the jumper between the Rectifier and the Reserve input for a single line supply. In case of a double line supply these jumper must be remouved.**

N = Neutral
L1 = Phase L1 (R)
L2 = Phase L2 (S)
L3 = Phase L3 (T)
\+ = Battery +
\- = Battery -
GND = Ground connection

Figure 9B: Size 50-60kVA 6-pulse

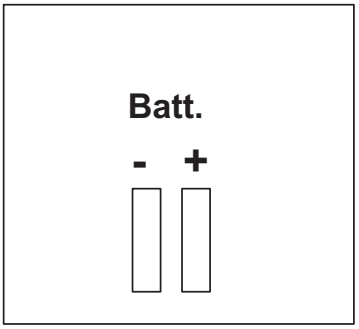


SWITCHES CUBICLE CONNECTIONS
S1= Rectifier switch
S2= Output switch
S3= By-pass (Not for parallel)
S4= Reserve switch

N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

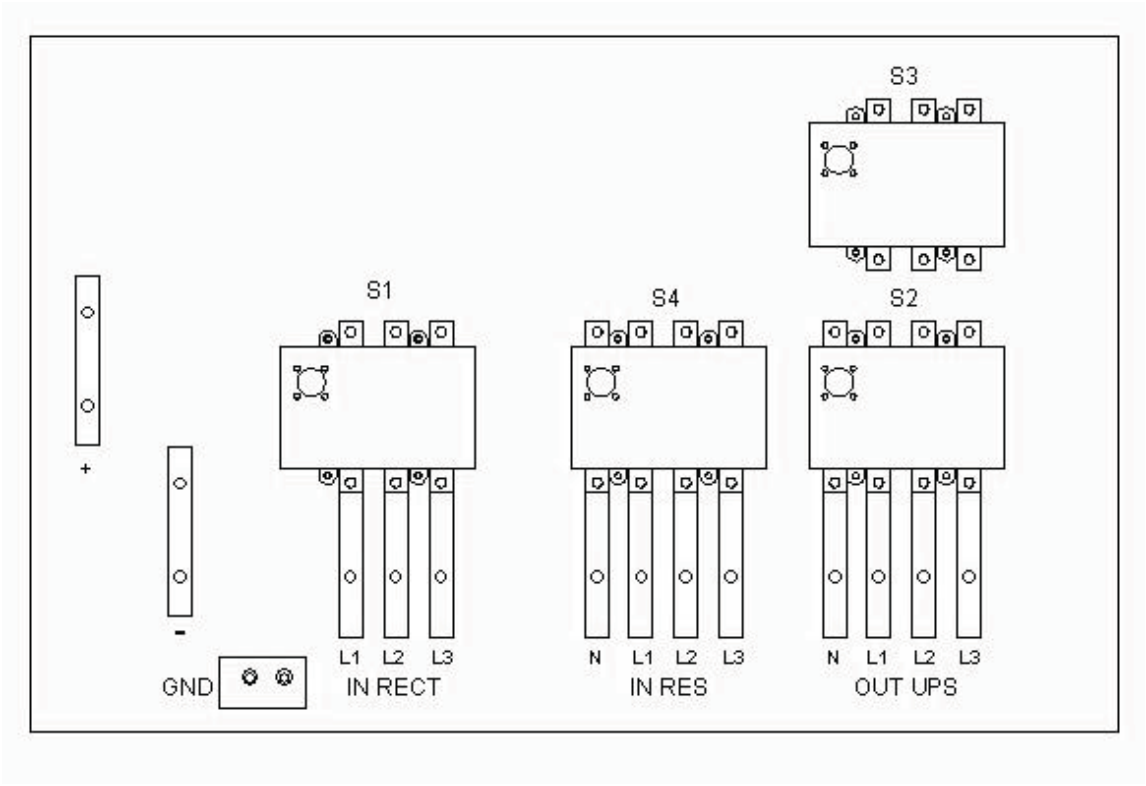
IN RES= Reserve input
IN RECT= Mains input
OUT UPS= Out UPS

BOTTOM-LEFT CUBICLE CONNECTIONS



Batt = Battery plug-in connector
\+ = Battery +
\- = Battery -
GND = Ground connection

Figure 9C: Size 80-100kVA 6-pulse and 50-80kVA 12-pulse



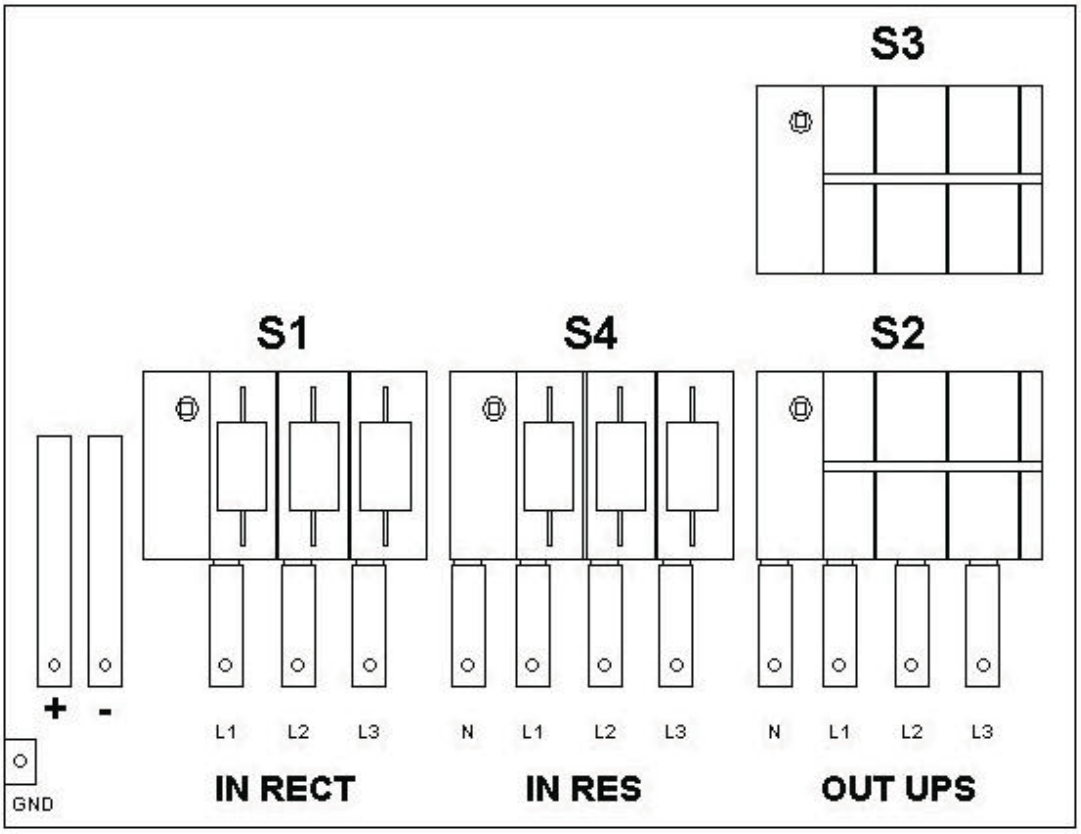
S1= Rectifier switch
S2= Output switch
S3= By-pass (Not for parallel)
S4= Reserve switch

N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

IN RES= Reserve input
IN RECT= Mains input
OUT UPS= Out UPS

GND = CONNECTING OF EARTH
+ = Battery +
- = Battery -

Figure 9D: Size 120-160kVA 6-pulse
100-120kVA 12-pulse



S1= Rectifier switch
S2= Output switch
S3= By-pass (Not for parallel)
S4= Reserve switch

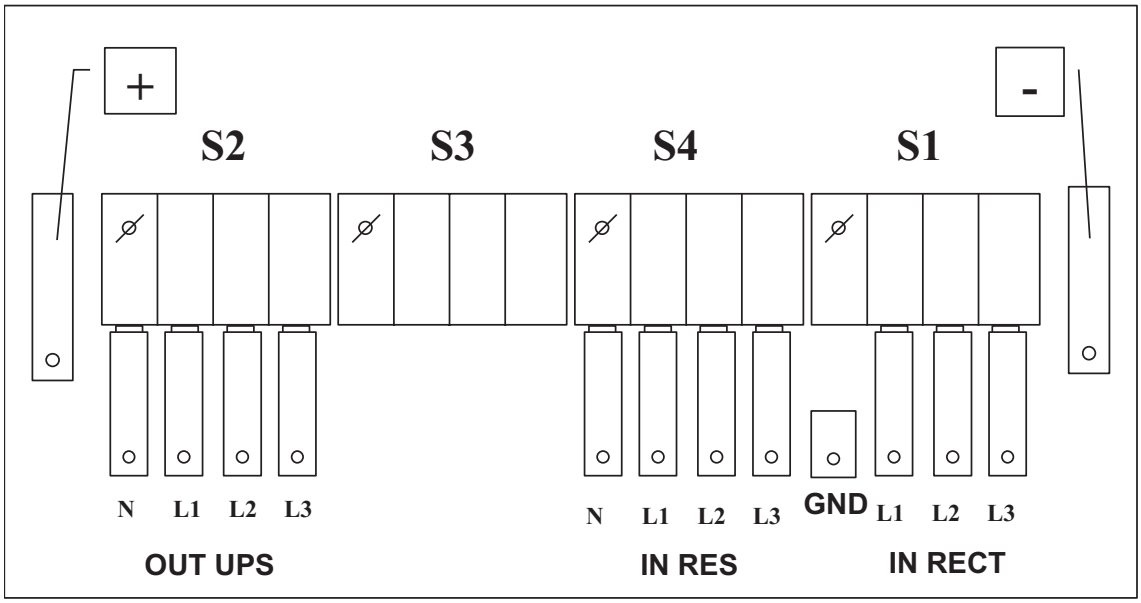
N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

IN RES= Reserve input
IN RECT= Mains input
OUT UPS= Out UPS

\+ = Battery +
\- = Battery -

GND = GROUND CONNECTION

Figure 9E: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse



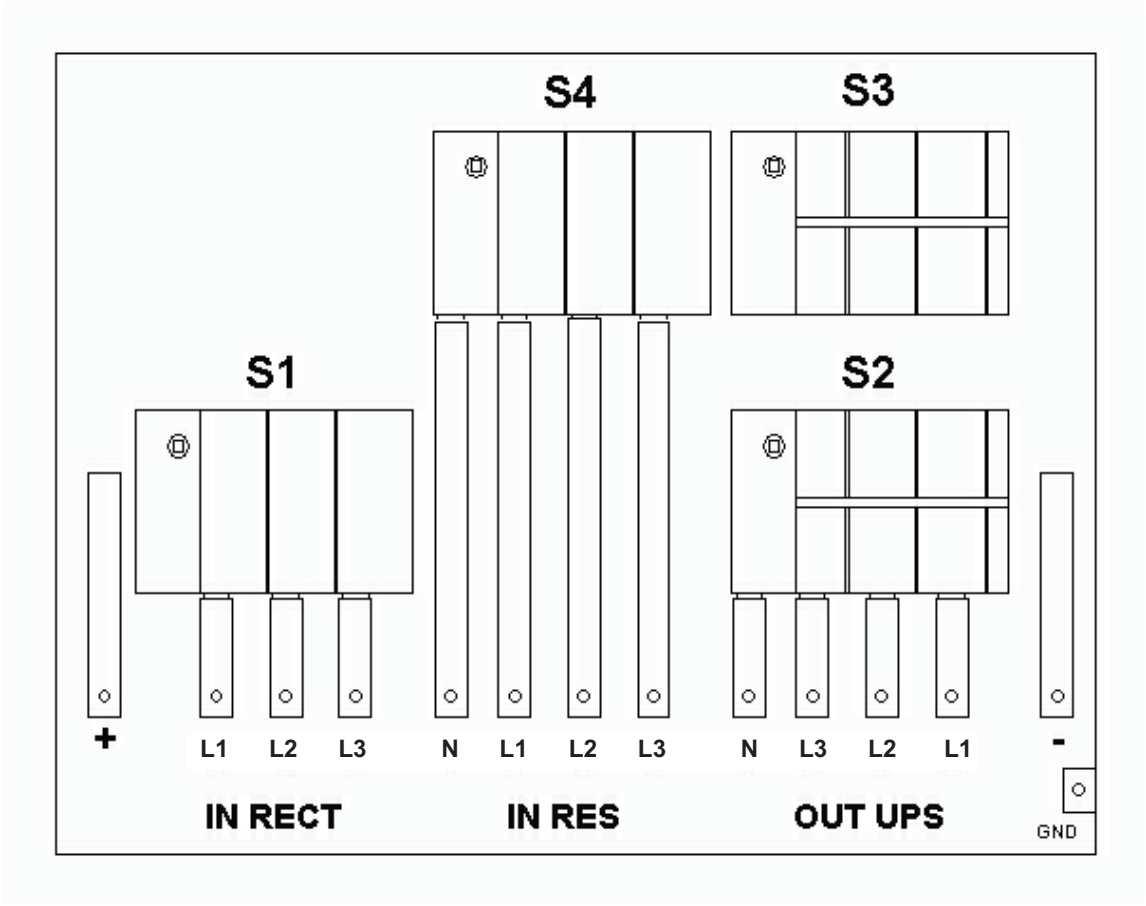
S1= Rectifier switch
S2= Output switch
S3= By-pass (Not for parallel)
S4= Reserve switch

N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

IN RES = Reserve input
IN RECT = Mains input
OUT UPS = Out UPS
\+ = Battery + connection
\- = Battery - connection
GND = Ground connection

Note: Only for 400kVA the connection bars are doubled to allow the connection of four wire.

Figure 9F: Size 300-400kVA



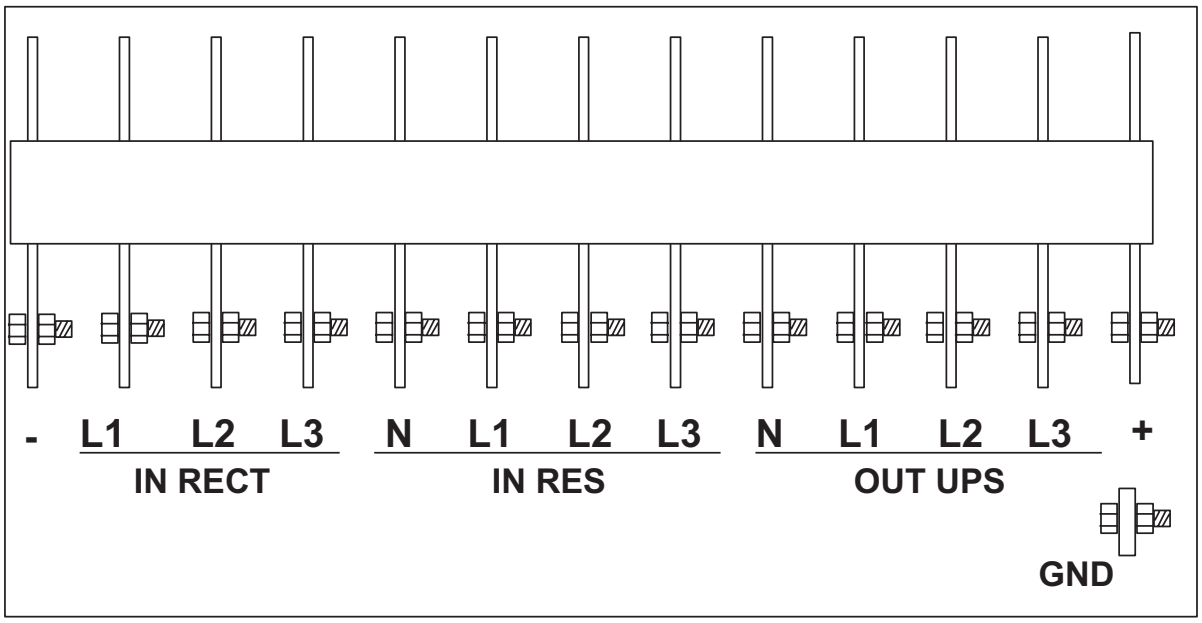
S1= Rectifier switch
S2= Output switch
S3= By-pass (Not for parallel)
S4= Reserve switch

N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

IN RES = Reserve input
IN RECT = Mains input
OUT UPS = Out UPS
\+ = Battery + connection
\- = Battery - connection
GND = Ground connection

Note: The connection bars are doubled to allow the connection of four wire.

Figure 9G: Size 500-800kVA



N= Neutral
L1= Phase L1 (R)
L2= Phase L2 (S)
L3= Phase L3 (T)

IN RES = Reserve input
IN RECT = Mains input
OUT UPS = Out UPS
\+ = Battery + connection
\- = Battery - connection
GND = Ground connection

Note: The connection bars are doubled to allow the connection of four wire.

Figure 9H: Size 1000 kVA

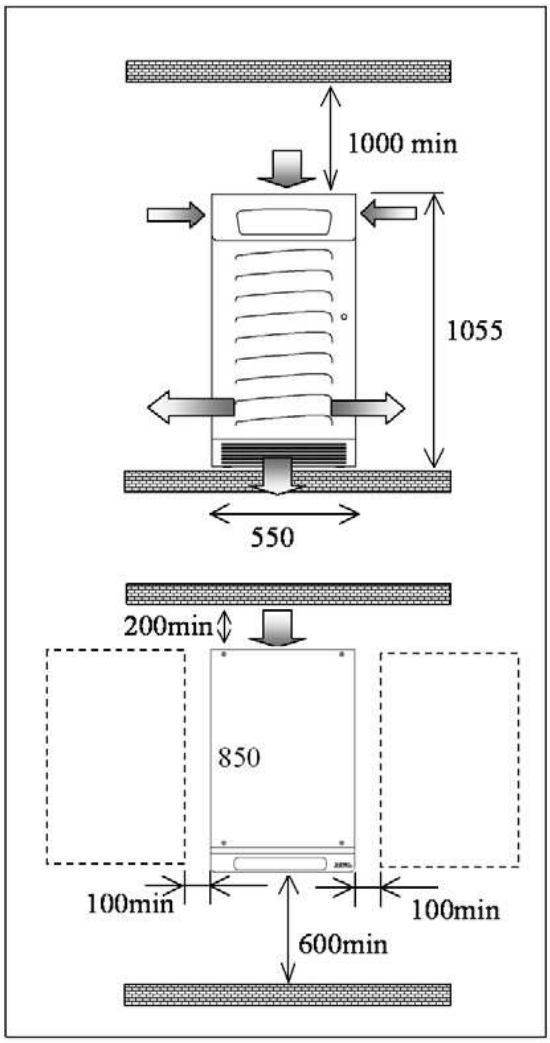


Figure 10A: Size 20-60kVA 6-pulse and 20-40kVA 12-pulse without batteries
Size 20-40KVA 6-pulse with batteries included

If clearing around the Ups is not sufficient, longer cables must be considered to perform extraordinary maintanance operations.(Castor with brakes are fitted to help moving the Ups).
Soft arrows are indicating the airflow(cooling air intake from the top – outgoing from the bottom)

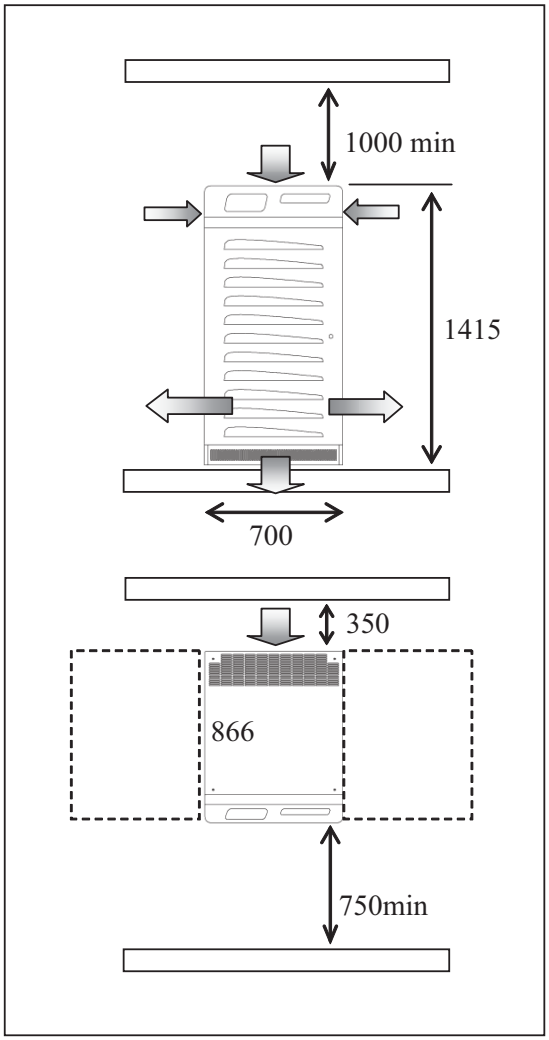


Figure 10B: Size 80-100kVA 6-pulse and 50- 80kVA 12-pulse

The UPS can be closed at wall; the 200mm dimensions is only for reference.
When it is impossible provide for a sufficient gaps from the wall, a suitable length of cables must be provided to remove the UPS in case of extraordinary repairs.
The shaded arrows show the air flow (in order to minimise the dust intake, the cooling air is sucked from top and discharged from bottom side).

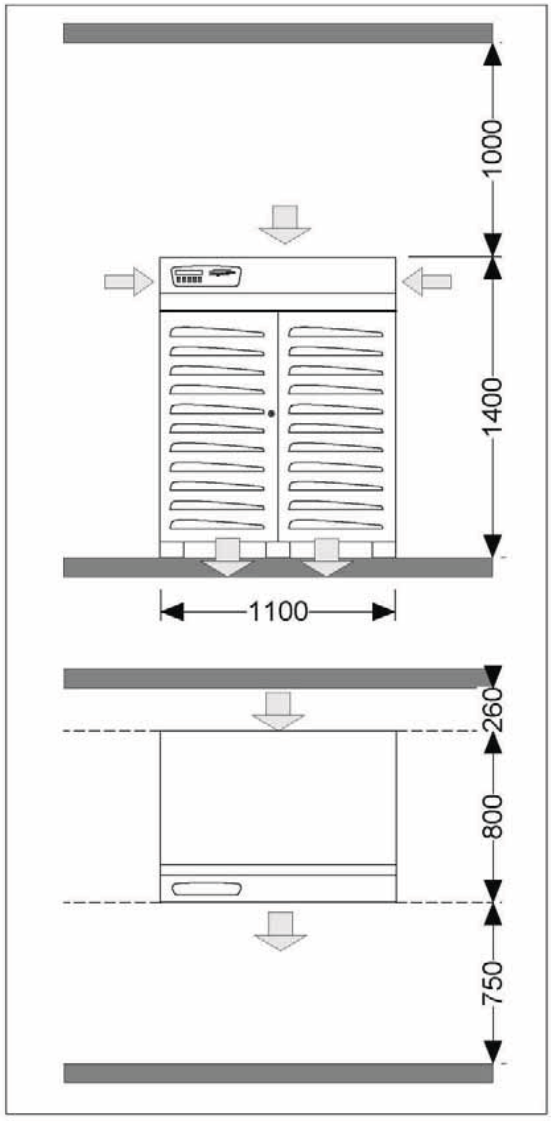


FIGURE 10C: Size 120-160kVA 6-pulse
Size 100-120kVA 12-pulse

200mm between UPS and wall must be provided in order to allow the cooling air inlet.
When it is impossible provide for a sufficient gaps from the wall, a suitable length of cables must be provided to remove the UPS in case of extraordinary repairs.
The shaded arrows show the air flow (in order to minimise the dust intake, the cooling air is sucked from top and discharged from bottom side).

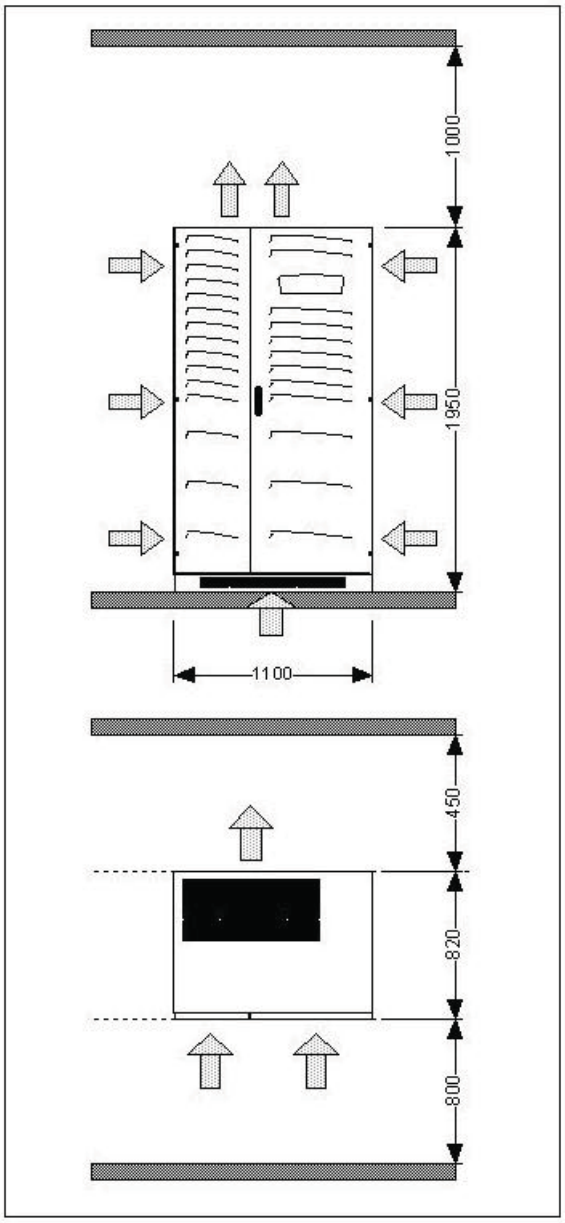


FIGURE 10D: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse

The arrows indicate the air flow.
The air is sucked from the front and from underneath and is released upwards and from the rear.
There is also a small upper suction inlet.
The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.
If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.

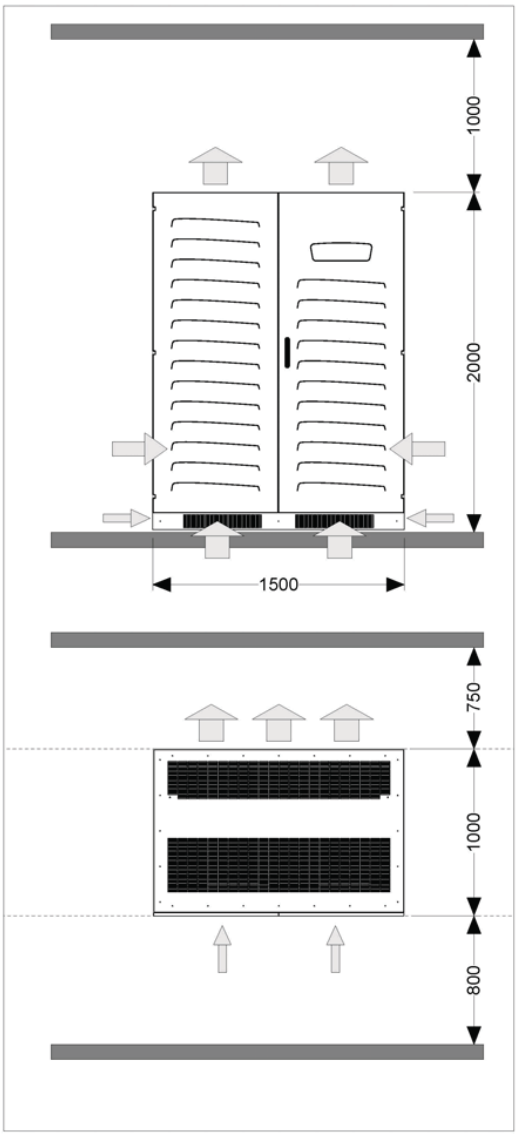


FIGURE 10E: Size 300-400kVA

The arrows indicate the air flow.
The air is sucked from the front and from underneath and is released upwards and from the rear.
There is also a small upper suction inlet.
The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.
If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.

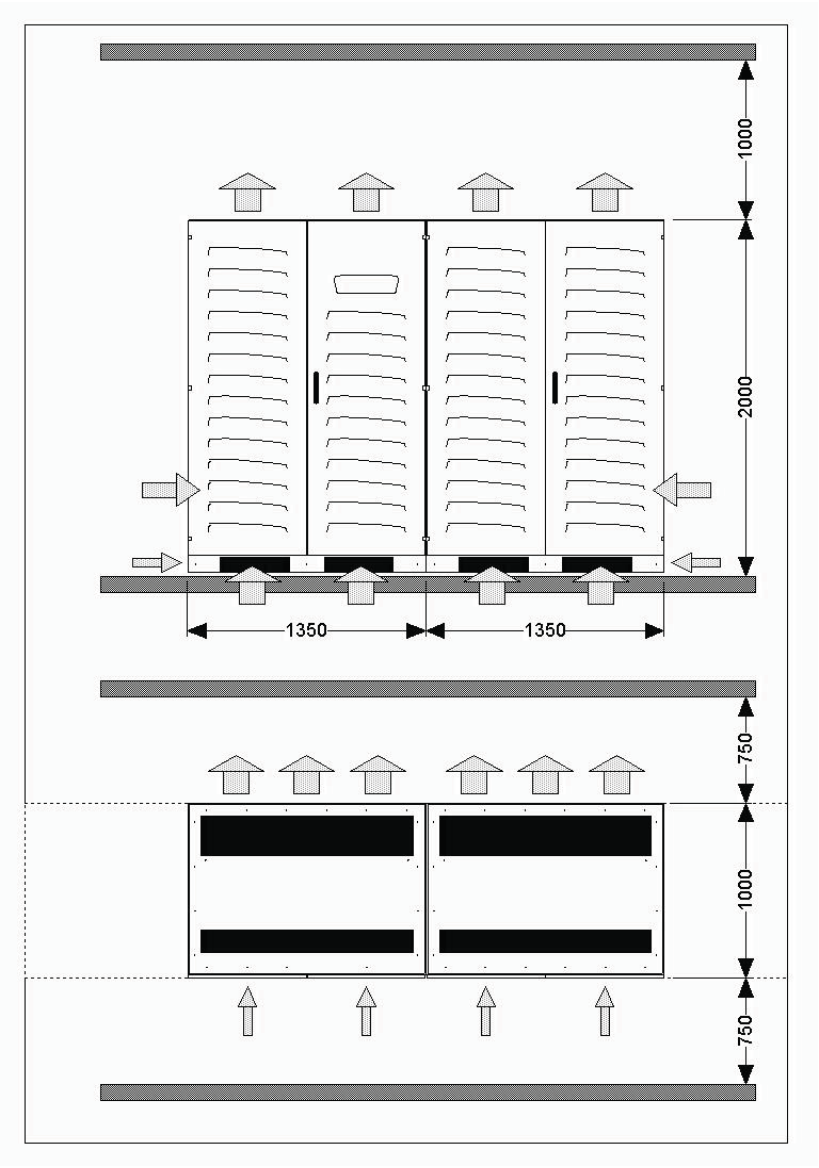
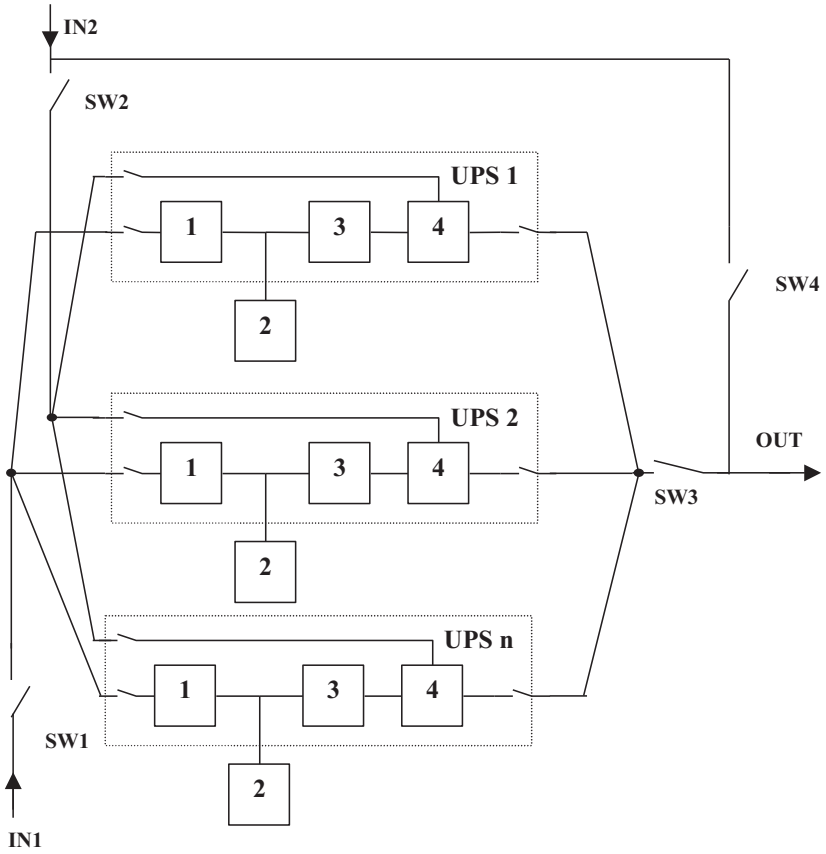


FIGURE 10F: Size 500- 1000kVA

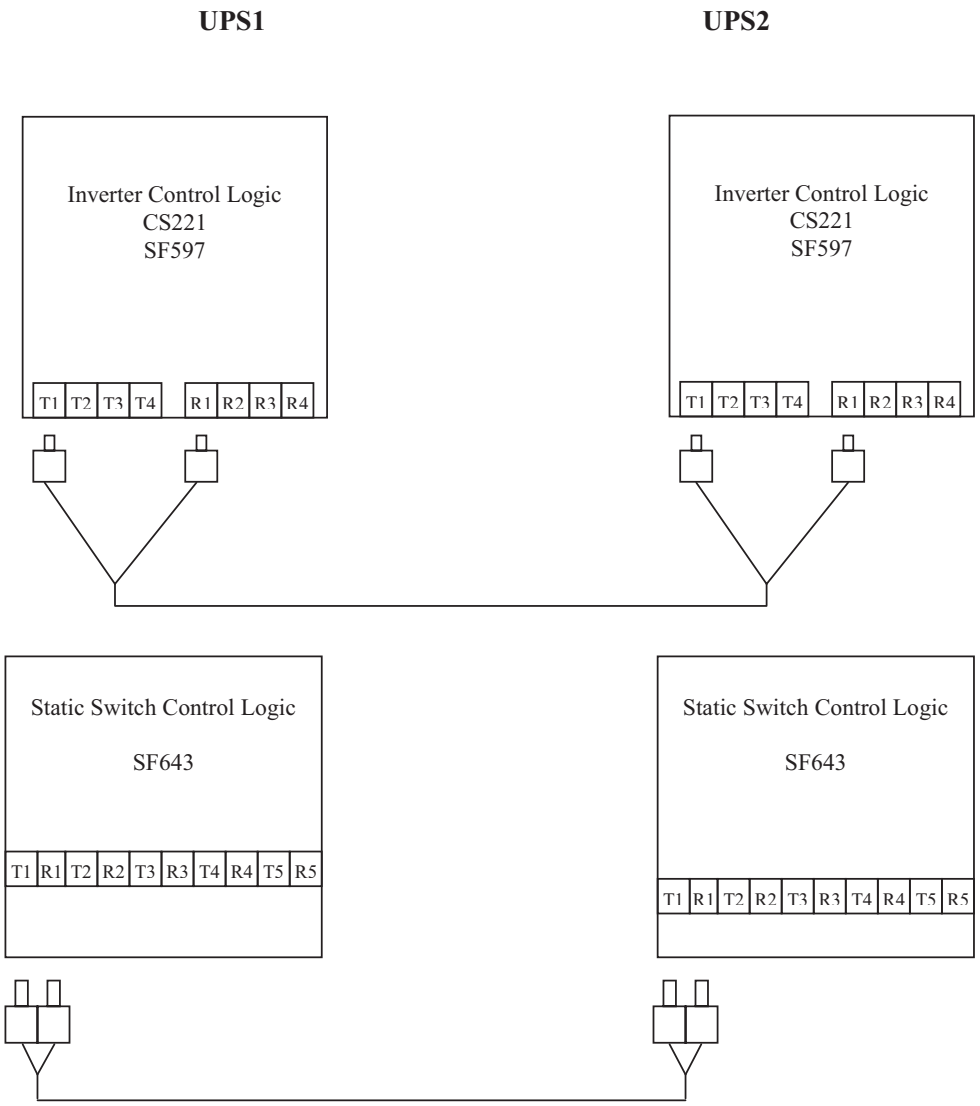
The arrows indicate the air flow.
The air is sucked from the front and from underneath and is released upwards and from the rear.
There is also a small upper suction inlet.
The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.
If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.

.

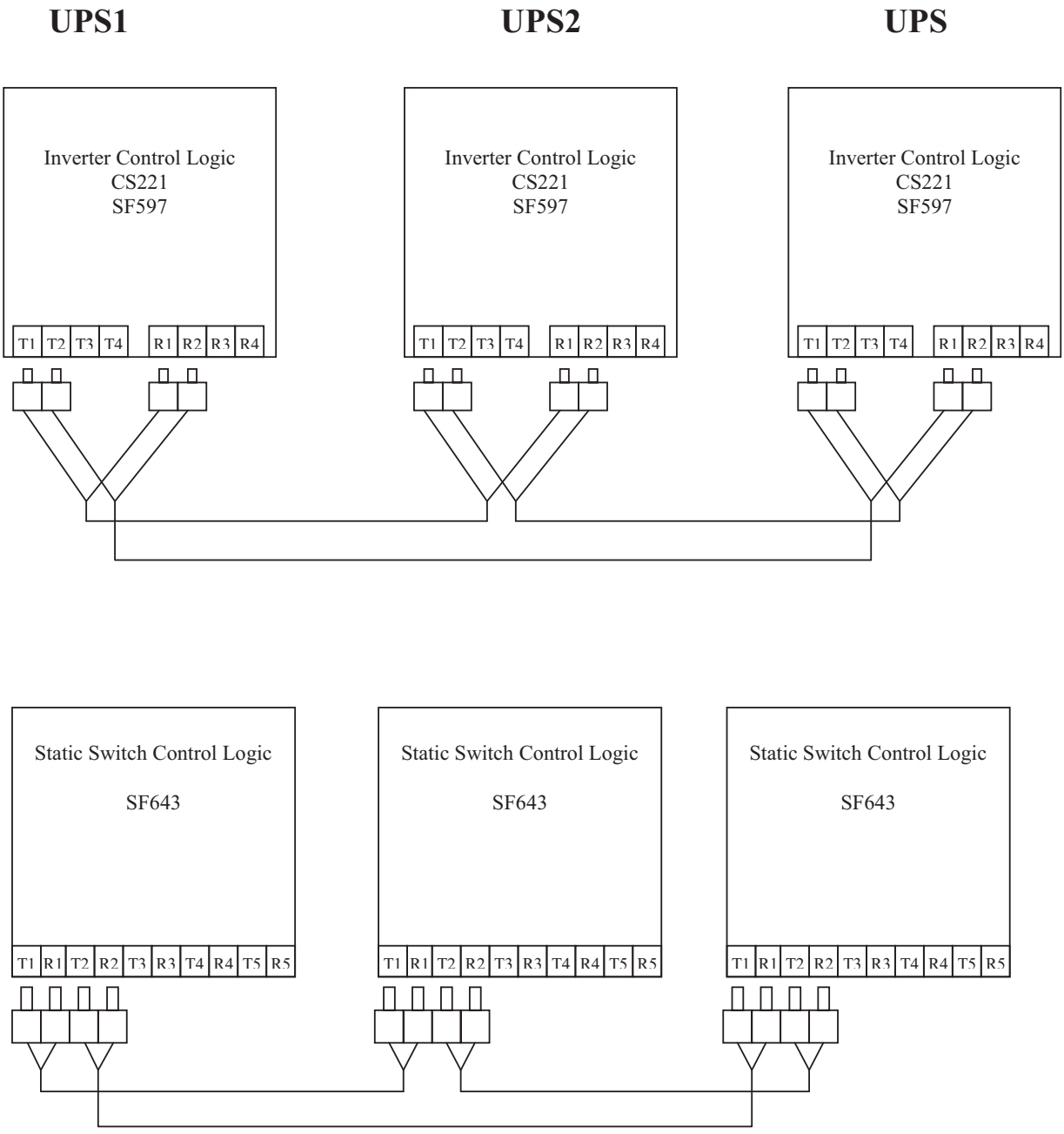


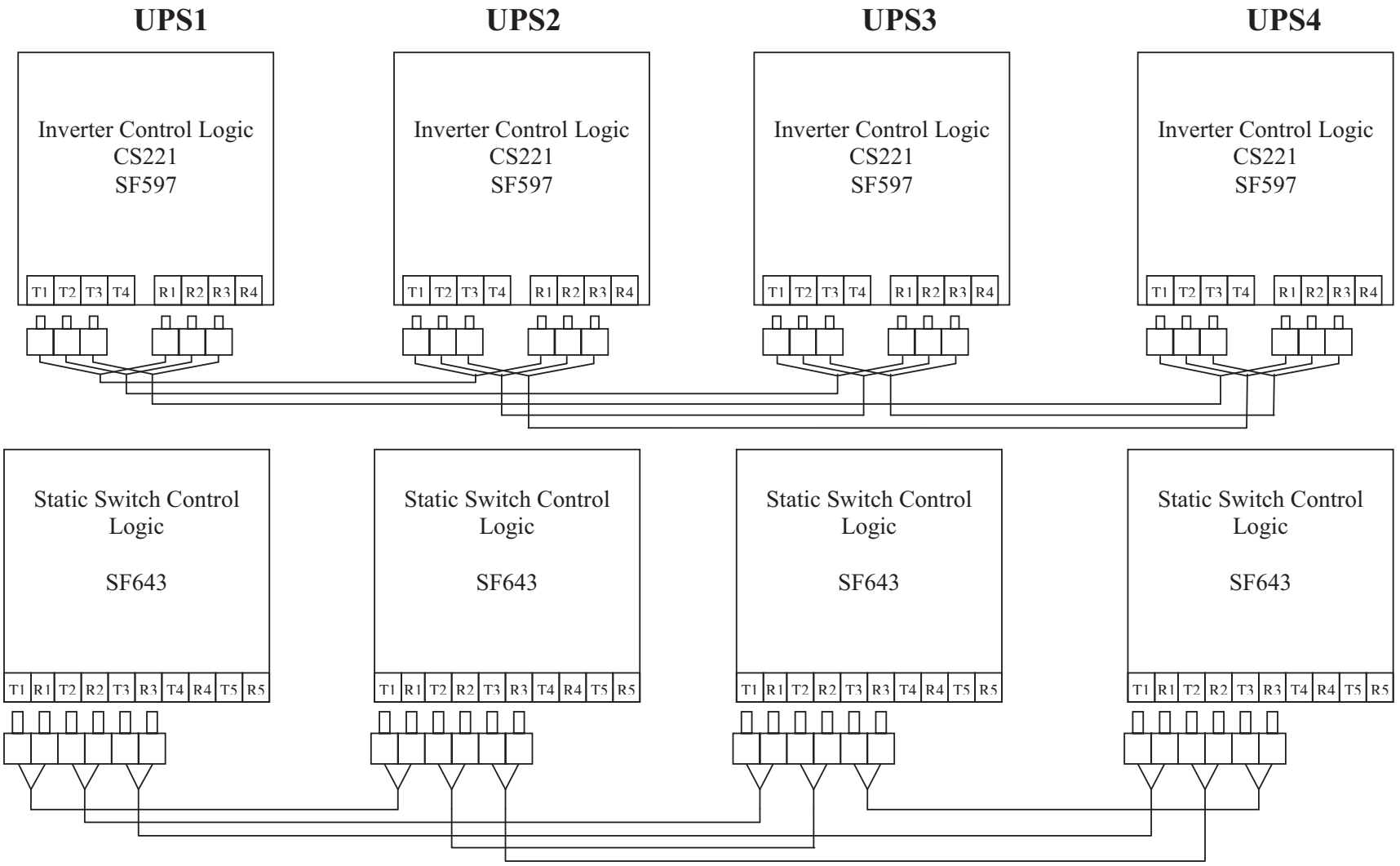
1	RECTIFIER	(Note 4)	IN1	Mains
2	BATTERY	(Note 1, 5)	IN2	Reserve mains
3	INVERTER	(Note 4)	OUT	Out
4	STATIC SWITCH	(Note 4)		
				Note 1: Batteries are always external to UPS
SW1	Mains input switch	(Note 5)		Note 2: System switches SW1 …. SW4 can be given by Siel and located
SW2	Reserve input switch	(Note 2, 5)		Note 4: Normally included
SW3	Output switch	(Note 2, 5)		Note 5: Normally not included
SW4	Manual By-Pass	(Note 2, 5)		Note 6: Interconnection cables not normally included

Using this configuration it is possible make the routine maintenance supplying the load (by the inverters connected in parallel) without any interruption.
Sometimes, in case of extraordinary repairs, can be necessary to feed the load by the reserve mains (IN2); the switching from the UPS to manual by-pass (SW4), when correctly made, do not cause any voltage failure to load.
When is necessary to design a UPS system able to supply by inverter the load in any situation of maintenance or repairs, please contact the technical department of Siel.



IV306E e SP133E Figure 12: Optic Fiber Connection: 2 UPS in Parallel Pag.1 of 1


UPS1
UPS2
UPS
Inverter Control Logic
CS221
SF597
Inverter Control Logic
CS221
SF597
Inverter Control Logic
CS221
SF597
T1 T2 T3 T4 R1 R2 R3 R4
T1 T2 T3 T4 R1 R2 R3 R4
T1 T2 T3 T4 R1 R2 R3 R4
Static Switch Control Logic
SF643
Static Switch Control Logic
SF643
Static Switch Control Logic
SF643
T1 R1 T2 R2 T3 R3 T4 R4 T5 R5
T1 R1 T2 R2 T3 R3 T4 R4 T5 R5
T1 R1 T2 R2 T3 R3 T4 R4 T5 R5


UPS1
UPS2
UPS3
UPS4
Inverter Control Logic
CS221
SF597
T1 T2 T3 T4 R1 R2 R3 R4
Static Switch Control Logic
SF643
T1 R1 T2 R2 T3 R3 T4 R4 T5 R5