PRODUCT GUIDE

UNINTERRUPTIBLE POWER SUPPLY (UPS)

SLC CUBE 3+
7.5 - 200 kVA

salicru

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1. INTRODUCTION.

These specifications describe the Uninterruptible Power Supplies from **SLC CUBE3+** series of Salicru as equipments that can work in single or parallel, 4 equipments maximum, without needing a common centralised bypass. The UPSs from **CUBE3+** series ensure an optimal protection of any critical load, keeping the AC mains to the loads between the specified parameters, with no break during the power outage, or deterioration or fluctuation of commercial electrical utility and with a wide range of available models (from 7,5 kVA up to 200 kVA), which allows adapting them to the needs of the end-user.

The design and construction of the UPS from **SLC CUBE3+** series has been done in accordance with the international standards (see section 2).

Thanks to the used PWM technology (pulse width modulation), the UPSs from **SLC CUBE3+** series are compact, cold, silent and with high efficiency.

A UPS from **SLC CUBE3+** series allows being upgraded by adding additional modules in parallel of the same power rate, in order to get redundancy (Ex.: N+1) or increasing the capacity of the system.

Therefore, this series has been designed in order to maximize the availability of the critical loads and to ensure that your business is protected against voltage and frequency fluctuations, electrical noises, blackouts and power outages, which are present in the electrical utility. This is the main goal of the UPSs from **SLC CUBE3+** series.

2. STANDARDS AND ENVIRONMENT.

2.1. STANDARDS.

The **SLC CUBE3+** series has been designed and manufactured in accordance with the norm **EN ISO 9001** of Quality Assurance. The CE marking shows the conformity with the EEC directives (which are quoted between brackets) by meeting the following standards:

- **2014/35/UE** since February 26th of 2014 about the harmonisation of Member States' laws in the electrical marketing destined to be used with determined voltage limits.
- **2014/30/UE** since February 26th of 2014 about the harmonisation of Member States' laws in electromagnetic compatibility marketing.
- **2011/65/UE** since June 8th of 2011 about the restrictions of the use of determined dangerous substances in electrical and electronic devices.

In accordance with the specifications of the harmonised standards and certified by a third body. Standards of reference:

- **EN-IEC 62040-1**: UNINTERRUPTIBLE POWER SUPPLIES (UPS) Part 1: General requirements and safety for the UPS.
- **EN-IEC 60950-1**: IT equipments. Safety Part 1: General requirements.
- **EN-IEC 62040-2:** Uninterruptible power supplies (UPS). Part 2: Electromagnetic Compatibility prescriptions(EMC).
- **EN-IEC 62040-3**: Uninterruptible power supplies (UPS). Part 3: Specification of the methods for performance and test equipments.

2.2. ENVIRONMENT

This product has been designed to respect the Environment and manufactured in accordance with **ISO 14001**.

Equipment recycling at the end of its useful life:
Our company commits to use the authorised companies services, which are in accordance with the regulation in force, in order to treat the recovered products at the end of its useful life.

Packaging:
To recycle the packaging, the regulations in force must be met, in accordance with the particular regulation of the country, where the equipment has been installed.

Batteries:
Batteries are a serious hazard for the health and environment. The disposal of them, must be done in accordance with the regulations in force.

3. PROTECTION

The electrical utility can't guarantee an energy free of perturbations. So, the end-user must take the actions in order to achieve the correct operating of his equipments.

The consequences of these perturbations can be several:

- Failure in the equipments
- Information lost (data, applications, etc.)
- Operating interruption.
- An a long etcetera.

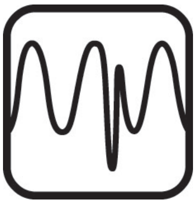
Despite of improving of the commercial utility in the last years, there is still an average of 300 minutes per year of low quality power supply (or power outage). Therefore, it means that electrical problems are the main cause of the lost of information in the IT systems (45%), against other problems like the virus (3%).

The 93% of such problems can be avoided by means of an uninterruptible power supply (UPS).
In general, a loss in the opportunity cost and availability can generate high expenses.

Next, the electrical utility phenomena, which causes the lost of information are quoted:

3.1. TRANSIENTS IMPULSES: SPIKES AND NOTCHES

- **Spikes**: they are created by the induction of the atmospheric phenomena (lightning) in the aerial lines.
- **Notch**: they are generated by sudden load inrush currents or short-circuits over the inductances of the lines and transformers

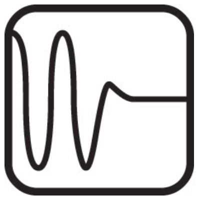


3.2. DROPOUTS

They are deep or total dropping voltages (below 60% of their nominal value), with a duration of several milliseconds (less than a cycle).

They can be caused by two different reasons:

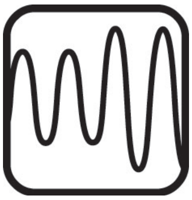
- Short-circuits close to the load, which are cancelled thanks to the action of the corresponding protections.
- Break in the power supply caused by the switching of two lines.

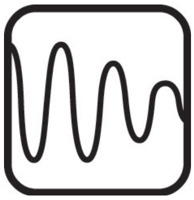


3.3. TRANSIENT SURGES AND SAGS

The transient surges are voltage increasing of short duration. And they are caused by the disconnection of the loads in lines with high impedance (weak lines).

The transients sags or dropping voltages of short duration caused by momentary overloads in the utility.

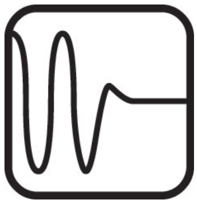




3.4. OVERVOLTAGES AND UNDERVOLTAGES OF LONG DURATION

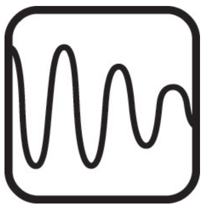
The overvoltages of long duration has the same origin as the transient ones, but in permanent conditions.

The undervoltages of long duration has the same origin as the transient ones, but in permanent conditions.



3.5. BROWNOUTS.

It happens when the voltage is going down slowly. That one that has a duration of 10 seconds or more. It is caused by the variation of the loads connected in the electrical utility with high impedance of short-circuit, lost of synchronisation, etc. If the static limits of the equipments are exceeded, they can cause failures during their running.

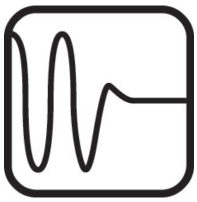


Most of the times, this progressive dropping voltage ends in a complete power outage.
On the other hand, a fast fluctuation voltage has a duration of less of 10 seconds. And they are produced by connection and disconnection of important loads and manoeuvring in the power supply. The damage that they can cause in the equipments de-

pends on their amplitude and duration, that the equipment can support a higher amplitude in less time and vice versa. As particular cases of these perturbations, flicker and blackouts can be find out.

3.6. BLACKOUTS.

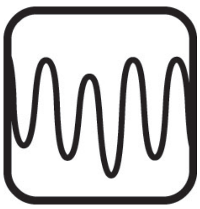
Long mains failures are power supply outages (or dropping voltages below 50% of its nominal value) with duration longer than one cycle. Generally they are caused by faults or disconnections of the power supplies and failures in the energy power supply generation or transformation.
Obviously, this type of perturbations cause a complete failure of the equipments that are fed; nevertheless, some small computers can support short blackouts (two duty cycles approximately).
Total power supply outages are generally caused the unexpected switching of a protection in the distribution power supply.



3.7. FLICKERS.

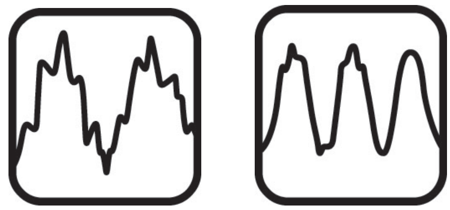
They are based on a fast and repetitive modulation of the voltage amplitude, which in lighting installations can be checked by the human eye. Its origin is caused by pulsant dropping voltages in the power supplies, which are caused by:

- Inertial resonances of high motors or alternators.
- Pulsant loads (pumps and piston compressors, etc.).
- Unstable regulators, arc furnace and soldering equipments.



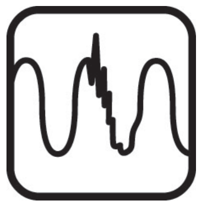
3.8. CURRENT AND/OR VOLTAGE HARMONIC DISTORTION.

It is a deformation in the wave shape of the voltage, due to the presence of harmonics. Its technical name is Total Harmonic Distortion (THD). Mainly, they are caused by the connection of electrical machines with saturated magnetic core, static converters (controlled and non-controlled rectifiers, uninterruptible power supplies, switch mode power supplies) and other nonlinear loads to the electrical mains. Almost all the critical loads, like the electronic equipments, supports a maximum distortion of 5%.
Some loads consume as non-linear type, so it means, harmonic currents. These currents make harmonic dropping voltages, which modify the sinewave voltage shape created at its origin (in the alternators of the power supply stations).



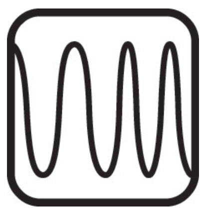
3.9. HIGH FREQUENCY PERTURBATIONS

They are high frequency signals overlapped to the power supply. They can consist in signals of any defined frequency or wide band; stationary, burst or repetitive impulses.
They are the result of unexpected coupling of the commercial power supplies with the those devices that use high frequency technologies. Depending on the type of the coupling, they can be found out in common or differential modes.



3.10. FREQUENCY FLUCTUATIONS

The continental power supplies are interconnected (like the most ones in Europe), which provide an almost invariable frequency and very close to the nominal one. This is possible, because this megasystem is controlled by huge quantity of synchronal machines, with a big total power and an inertia which trends to the infinite.
On the other hand, important frequency fluctuations are produced in many islands and remote areas, and even in separate installations provided with small power supply stations (or generators sets). These fluctuations cannot be avoided when there are load power connections and disconnections, which can be compared with the total power of the system.



3.11. CONCLUSIONS.

The most common types of perturbations in the electrical power supply has been shown, which can cause wrong operating in the electrical loads, even damage them; so it is compulsory to protect the electrical loads and also, to improve the quality of the power supply that feed them and in order to guarantee their correct operating.

The consequences of the caused problems by the electrical perturbations of the power supply can mean important economical losses in the industrial installations with continuous process, like: metallurgical industry, cement industry and chemical industries, among others; also they can cause problems in calculus centre, computer design centres, office data centres, or causes disorders in the daily life and even put in risk the human lives, in case we talk about those electronic devices that controls the vital signals of a patient or the computers that manage the nuclear power station.

4. MAIN QUALITY PERFORMANCES

Main quality performances of **SLC CUBE3+** series:

- Application adaptability: 4 equipments in one, configurable by software as I/I, I/III, III/I or III/III.
- Total digital control integrated in a DSP: inverter, PFC, battery buck-boost, bypass and parallel.
- User graphical interface.
- Parallel capacity up to 4 equipments.
- Master-slave management system of the equipments connected in parallel with high speed communication bus and robust protocol with error protection.
- Rectifier controlled by a DSP of floating point and THDi < 1% at full load, < 5% at 10% load and totally independent from the THDv of the power supply.
- Input power factor PFi=1 from 10% load.
- Perfect balancing of the input currents with total unbalanced output currents.
- Reactive current compensation, thanks to the input filter included in the input current regulation loop.
- Inverter with high quality performances controlled by a floating point DSP.
- THDv < 0.5% with linear loads and < 1,5% with non-linear loads with CF < 1 in the output current.
- Short-circuited inverter, managed by an inverter current control algorithm. Output RMS current limitation, both peak and IGBT saturation.
- Compatibility with any type of loads:
  - ❒ 100% leading.
  - ❒ 100% lagging.
  - ❒ 100% resistive.
  - ❒ Any resistive-inductive-capacitive combination.
  - ❒ Non-linear load with CF up to 3.5.
  - ❒ Motors.
  - ❒ High Intensity Discharge lamps.
- Transformerless technology.
- Batteries connected in parallel, in order to minimize the ripple current in the converters of the system.
- Smart battery connection, allowing to reduce the ripple of them and the managing of asymmetrical loads at the output of the inverter.
- Remote communications: RS-232, RS-485 and USB ports and Ethernet; Protocols: Modbus, SNMP, RCCMD, UNMS II.
- Compact and silent mechanical design.
- Power range from 7.5 to 200kVA.

5. VIEWS AND POWER TOPOLOGIES

5.1. UPS FRONT VIEWS

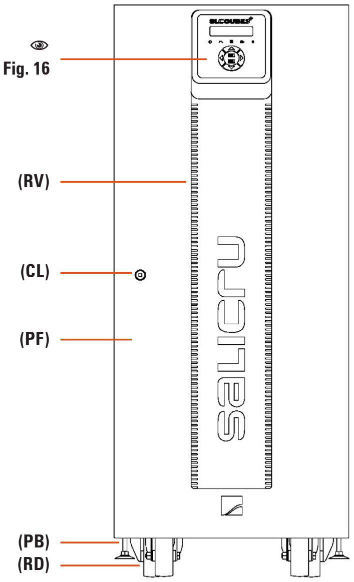


Fig. 1. UPS front view up to 60kVA

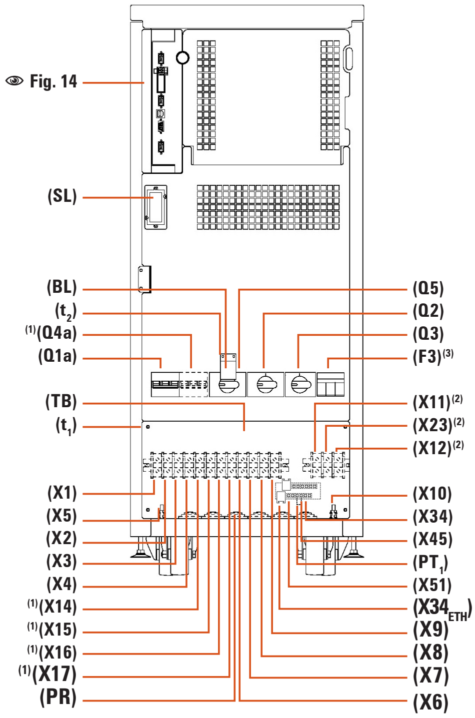


Fig. 2. UPS front view with door opened up to 60kVA

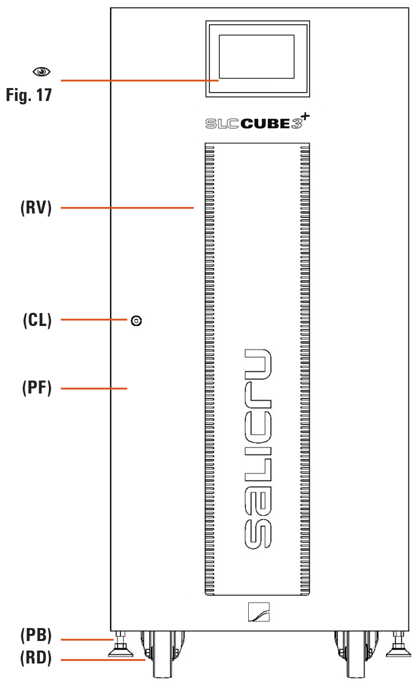


Fig. 3. UPS front view from 80 to120 kVA

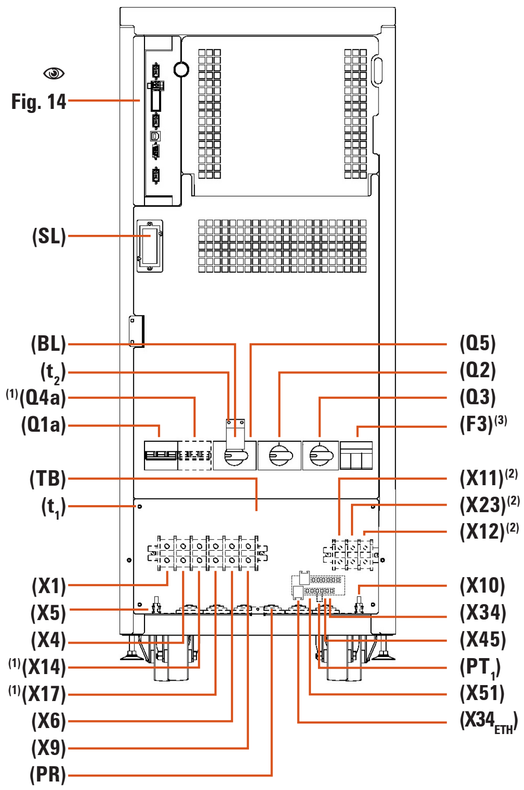


Fig. 4. UPS front view with door opened from 80 to120 kVA

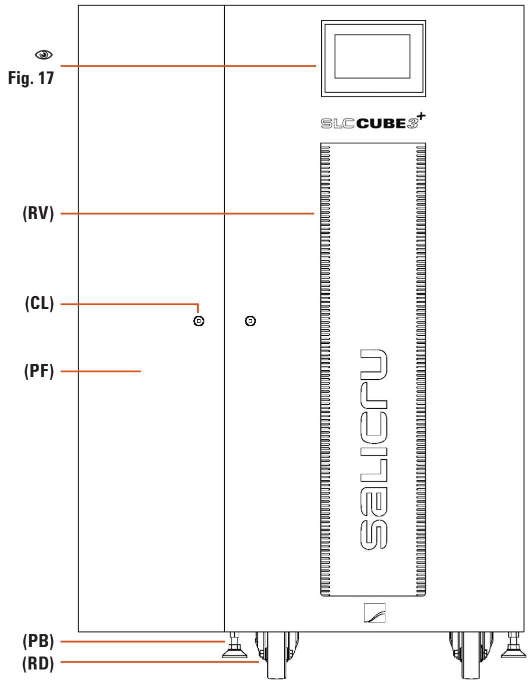


Fig. 5. UPS front view from 100kVA to 120kVA (-B)

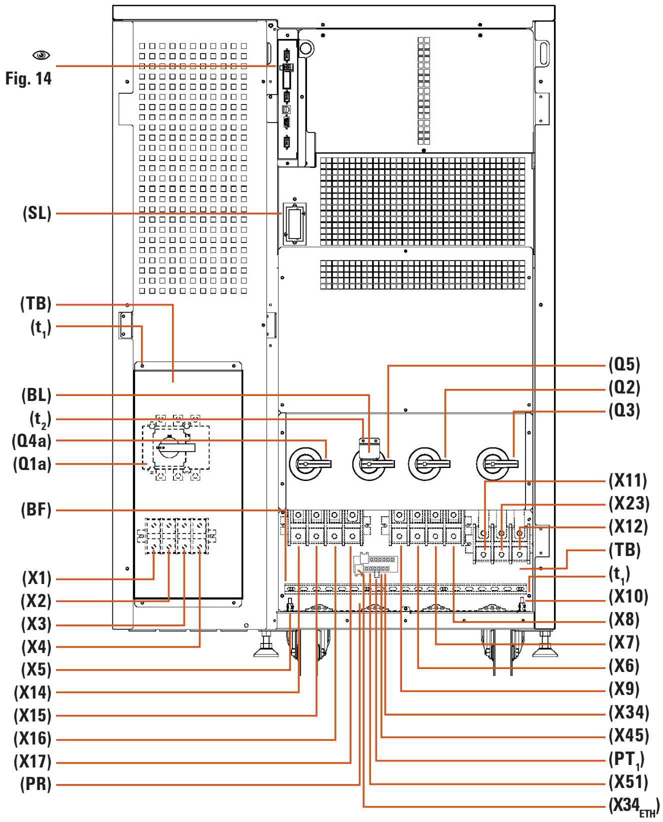


Fig. 6. UPS front view wit the door opened, from 100kVA to 120kVA (-B)

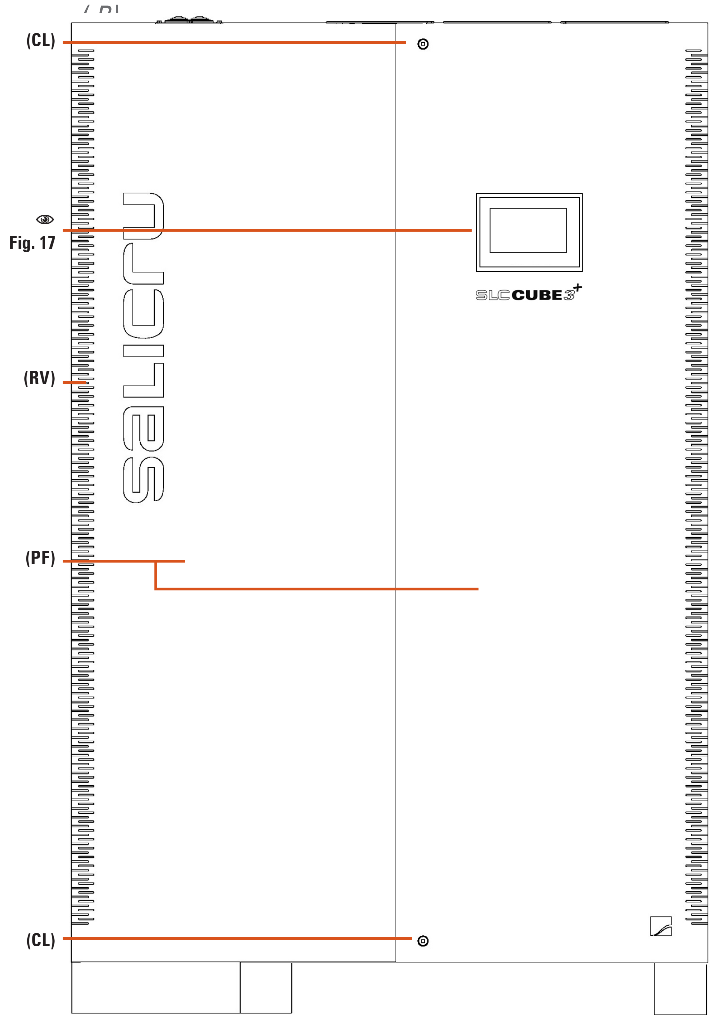


Fig. 7. UPS front view from 160kVA to 200kVA (-B)

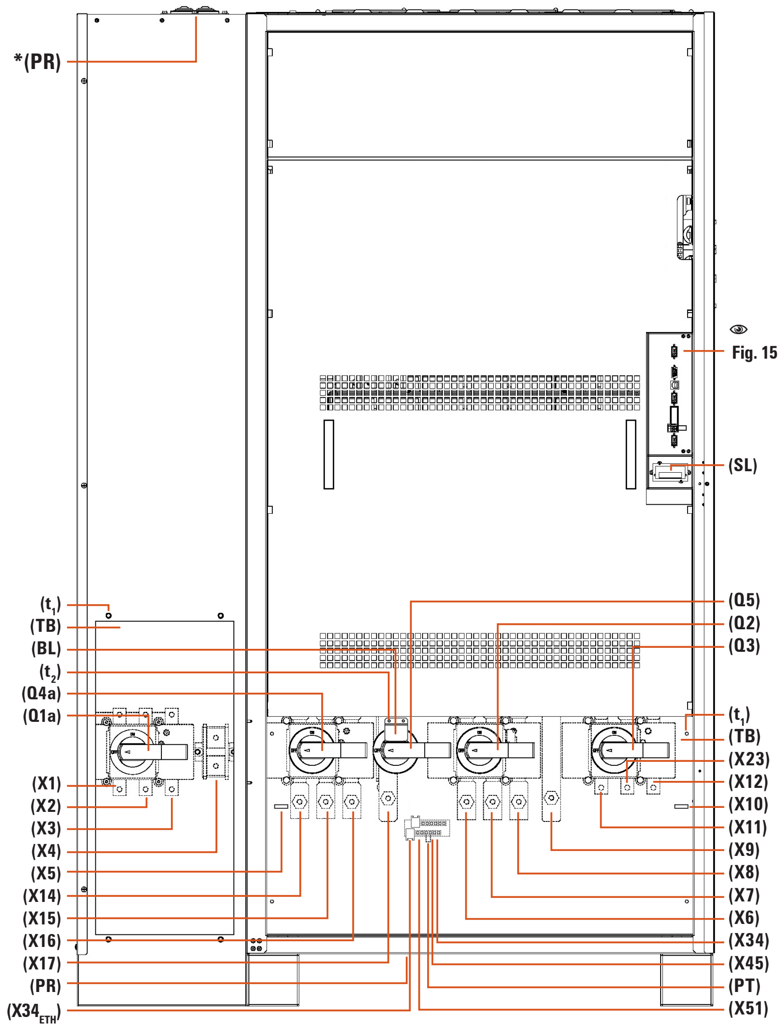
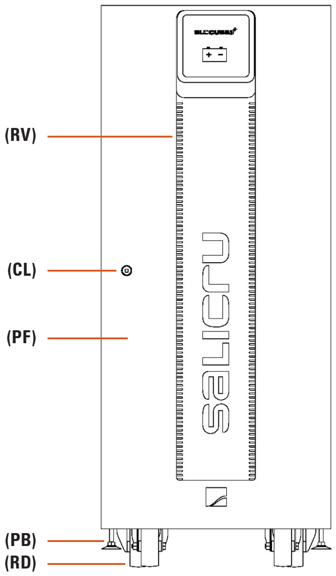


Fig. 8. UPS front view with door opened from 160kVA to 200kVA (-B)

5.2. BATTERY CABINET VIEWS



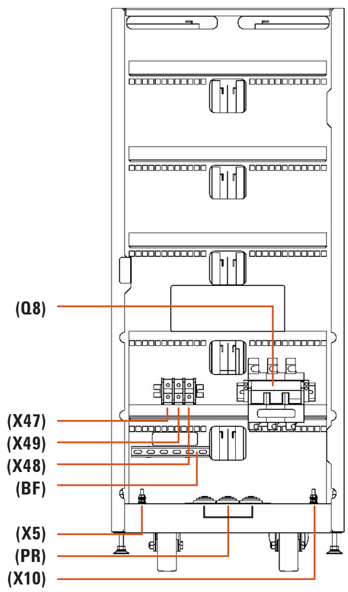
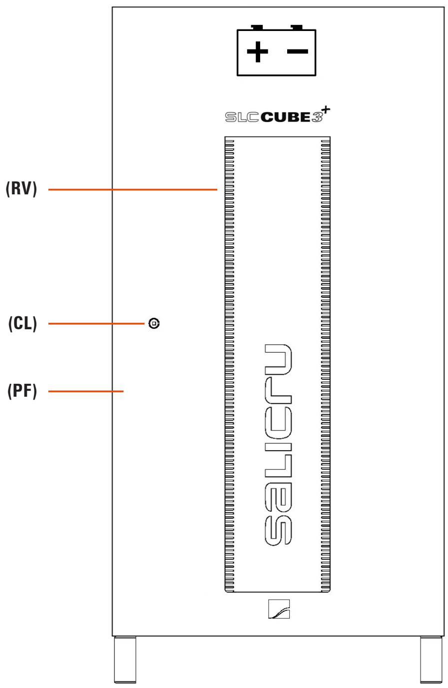


Fig. 9. Battery cabinet Nr1, with door closed

Fig. 10. Battery cabinet view Nr1, with door opened



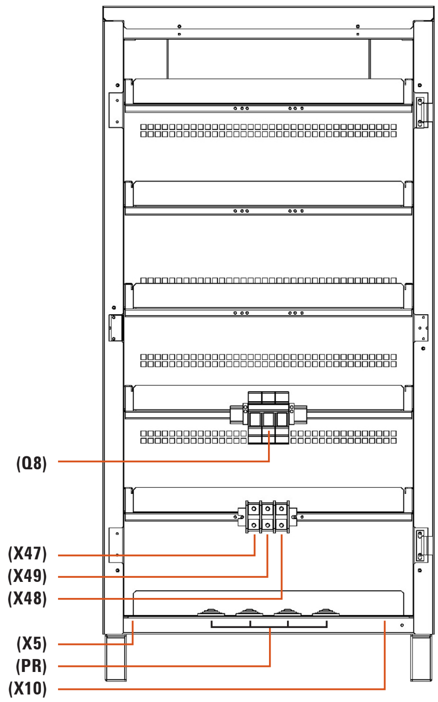
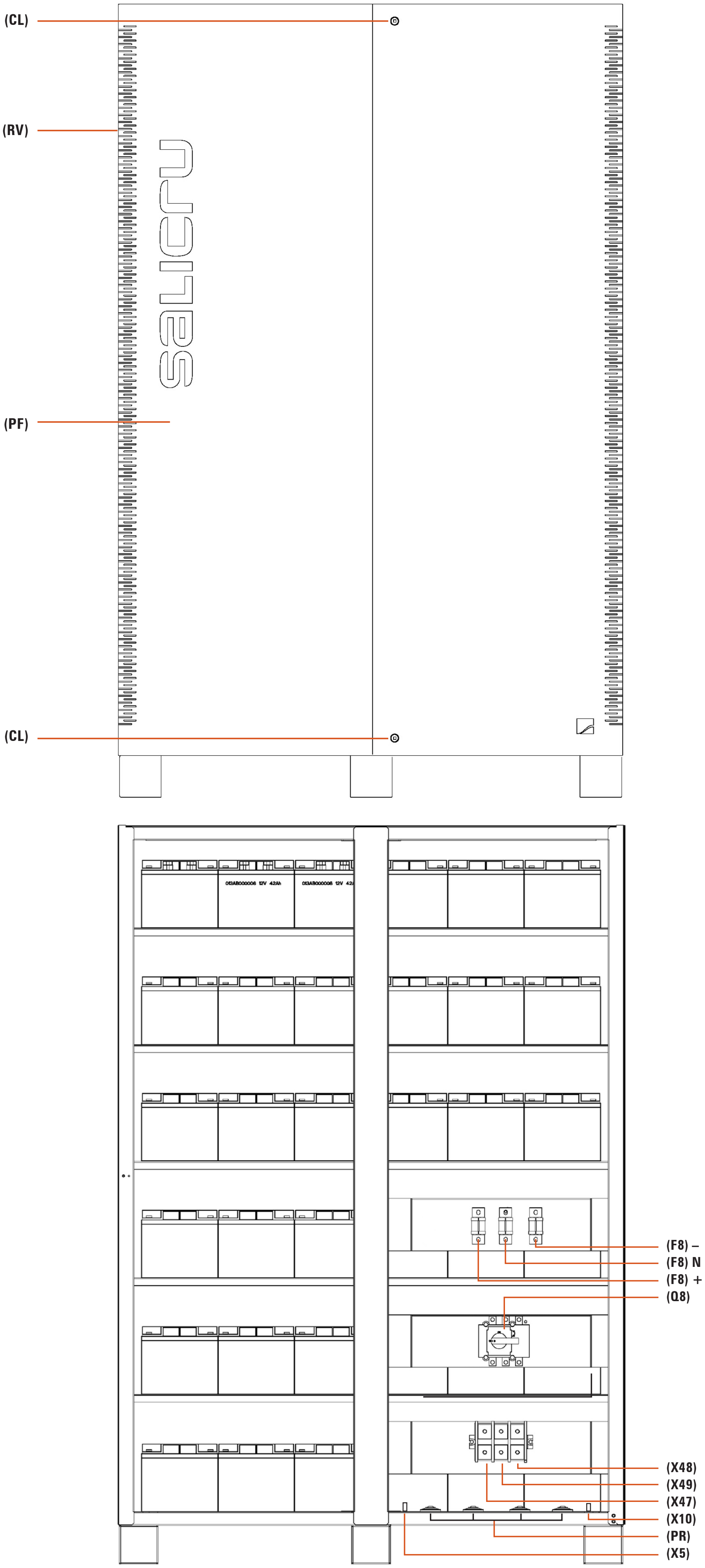


Fig. 11. Battery cabinet Nr2, with door closed

Fig. 12. Battery cabinet view Nr 2, with door opened



Battery cabinet view Nr3, with door closed and opened

5.3. VISTA PANEL DE CONTROL

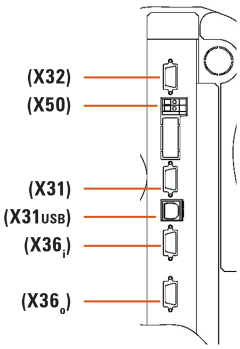


Fig. 13. Communication connections up to 120kVA

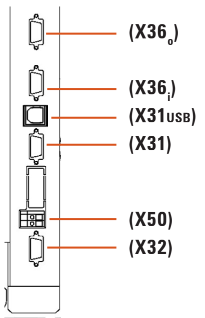


Fig. 14. Communications connections from 160kVA

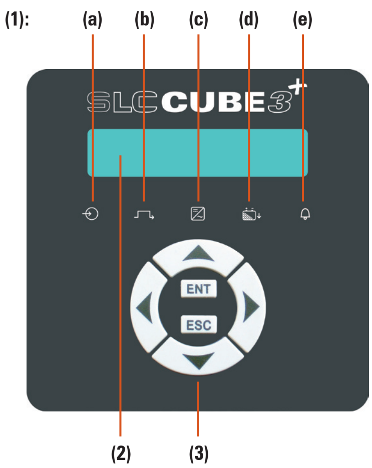


Fig. 15. Control panel up to 60kVA models

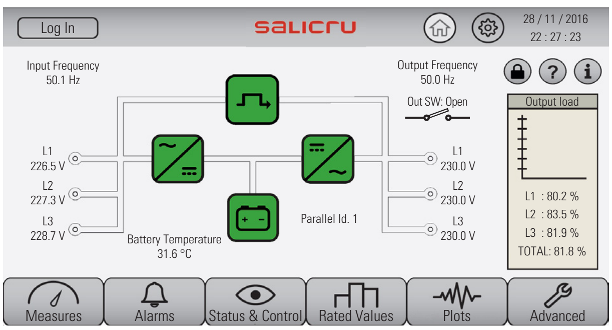


Fig. 16. Touchscreen panel for > 60kVA models

5.3.1. Description of the touchscreen panel

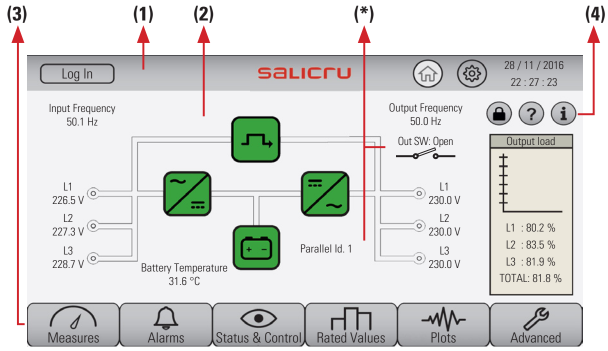


Fig. 17. Touchscreen structure

The information shown in the touchscreen panel is structured in four different sections:

Item	Category	Description
(1)	Title	It informs about the category where the end-user is and allows going to mains screen and the basic setting screen of the system. It can be found in the upper side of the screen.
(2)	Contents	It shows the information corresponding to the section where the end-user is and it allows setting the parameters depending on the section. It can be found in the mid part of the screen.
(3)	Main menu	At any time, it allows the shortcut access to the information of the equipment, because this menu is always visible in the lower side of the screen.
(4)	Side menu	Dynamic menu that allows moving inside of each section. The main screen is used to show the equipment load. It can be found in the right side of the screen.
(*)	Additional information	Information belonging to parallel systems only. Although any number can be set as «Id.», it is recommended to use from 1 to 4, being 4 the maximum quantity of units to be paralleled. The «Id.» assignation or modification address is reserved to authorised personnel with restricted access by password.

Tabla 1. Categories of the touchscreen.

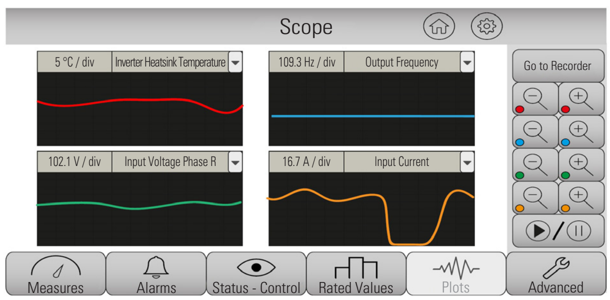


Fig. 18. Graphic section view of the touch screen

Graphic section has two data logger modes. The first mode allows displaying up to four meters of the equipment in a temporary way, by displaying the current status and previous instants. The second one, is called data logger, the end-user defines the time frame where the data can be recorded. In both modes, the end-user has the side zoom buttons to enlarge or reduction each division. In the contents part of the screen, the following measurements can be selected:

- PFC, inverter and battery heatsink temperatures.
- RMS input and output voltages, L1, L2 and L3.
- Input and output currents, L1, L2 and L3.
- Battery charge and discharge currents.
- Battery or DC bus positive and negative voltages.
- Input, output or bypass frequency.

In the log mode, the end-user has the <<setting>> button to check the status of the graphic log and set the duration of the record, besides of starting and stopping the recording. Meanwhile, no recording is done, the **STBY** icon is displayed in the left upper corner of the oscilloscope. The <<Setting>> buttons makes the following operating:

Recording start

Recording stop and clear data

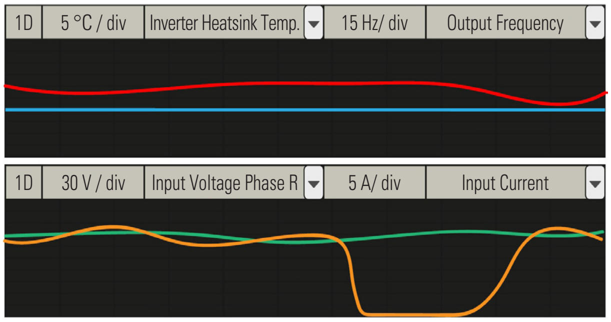


Fig. 19. Data log mode inside the graphic section

5.4. LEGEND CORRESPONDING TO THE EQUIPMENT VIEWS

Protection and manoeuvring parts (Q*):

(Q1a) Input circuit breaker or switch according to the power rate of the equipment or three poles depending on the power supply topology.

(Q2) Output switch.

(Q3) Battery fuse holder with 3 fuses in models up to 40 kVA or isolator switch for higher power rate models and/or B1 models.

(F3) Battery fuse holder with 3 fuses. In models up to 40 kVA models with extended back up time, with the batteries fitted in or ready to be built in part inside the UPS cabinet.

(Q4a) Static bypass switch, two or three poles depending on the power supply topology (-B version ony).

(Q5) Manual bypass switch.

Protection and manoeuvring parts (Q*) in the battery cabinet:

(Q8) Three poles battery fuseholder, for models up to 120kVA. Also, the equipment has three 3 fuses **(F8)** which are internal (inside the cabinet).

Connection parts (X*):

(X1) Input terminal phase R.

(X2) Input terminal phase S.

(X3) Input terminal phase T.

(X4) Input terminal neutral N.

(X5) Main protective earth (stud) **( )**.

(X6) Output terminal phase U.

(X7) Output terminal phase V.

(X8) Output terminal phase W.

(X9) Output terminal neutral N.

(X10) Earth bonding terminal (stud) for load or loads and/or battery cabinet **( )**.

(X11) Positive battery terminal (+).

(X12) Negative battery terminal (–).

(X14) Static bypass terminal phase R (-B version only).

(X15) Static bypass terminal phase S (-B version only).

(X16) Static bypass terminal phase T (-B version only).

(X17) Static bypass terminal neutral N (-B version only).

(X23) Battery terminal neutral N (middle tap).

(X31) DB9 connector for RS-232 and RS-485 ports.

(X31$_{USB}$) USB connector for communication port.

(X32) DB9 connector, dry contacts.

(X34) Two terminal strips for temperature/floating voltage. Equipments with separate battery module only.

(X34$_{ETH}$) Ethernet port for connecting the temperature probe located at the end of a cable bundle > 5 m. and ready to be fitted in the battery cabinet. It compensates the floating voltage according to the ambient temperature.

(X36i) Female HDB15 connector, parallel bus input. It is used in parallel systems only.

(X36o) Male HDB15 connector, , parallel bus input. It is used in parallel systems only.

(X45) Two terminal strip, for the output switch auxiliary contact. To be connected with its external homologous one.

(X47) Battery positive terminal (+) in the battery cabinet.

(X48) Battery negative terminal (–) in the battery cabinet.

(X49) Battery neutral terminal N in the battery cabinet (middle tap).

(X50) External EPO terminals.

(X51) Two terminal strip, for the manual bypass auxiliary contact. To be connected with its external homologous one.

Control panel (PC), keypad and optical indications:

(LCD) LCD panel.

(ENT) «ENTER» key.

(ESC) «ESC» key.

(➚) Upward arrow key.

(➘) Downward arrow key.

(➔) Right arrow key

(←) Left arrow key.

(a) Rectifier input voltage correct (green led).
(b) Equipment output voltage supplied by the Bypass (orange led).
(c) Inverter on (green led).
(d) Output voltage supplied from the batteries - power outage (red led).
(e) Equipment general alarm. It is triggered with any alarm (red led).

<u>Other abbreviations:</u>
(BL) Mechanical lock for manual bypass switch **(Q5)**.
(CL) Front door lock.
(PB) Levellers parts.
(PC) Control panel.
(PF) Front door.
(PR) Cable gland entry.
(PT) Cable as a bridge mode to close the circuit between both **(X45)** pins.
(RD) Casters.
(RV) Cooling grid.
(SL) Slot for SICRES card (option).
(TB) Hardwiring cover -connection parts-.
(t1) Hardwiring cover fixing screws **(TB)**.
(t2) Mechanical lock fixing screws **(BL)** of switch **(Q5)**.

5.5. NOMENCLATURE

Equipment

SLC-10-CUBE3+ LBT-P2 B1 0/62AB147 AWCO EE550714-2

EE*	Particular customer specifications.
CO	"Made in Spain" marking in the UPS and packaging (customs issues).
W	Neutral equipment brand.
A	For single phase 115.. 133 V or three phase 3x200.. 3x230 V.
147	Three last characters of the battery code (*).
AB	Acronym of the battery family (*).
62	Quantity of batteries in a single string (*).
0/	No batteries, but ready to fit them in for a standard or extended back up time. Accessories are supplied.
/	Batteries are not fitted in from factory. They are supplied in a separate bulk.
B1	Equipment ready to connect external batteries.
BC	Equipment ready to connect a common battery set (2 UPSs in parallel only).
	Omit for std back up time (internal batteries in the same UPS enclosure only).
P2	Parallel system based on two equipments.
P3	Parallel system based on three equipments.
P4	Parallel system based on four equipments.
T	Top entry cable (160 and 200 kVA only).
B	Separate bypass line version.
L	Single phase input/output configuration.
M	Single phase input / three phase output configuration.
N	Three phase input / single phase output configuration.
	Three phase input / three phase output configuration
CUBE3+	Series.
10	Power rate in kVA.
SLC	Brand acronym for UPS.
CF	Frequency converter 50/60 or 60/50 Hz (**).

External batteries or extended back up times

MOD BAT CUBE3+ 0/2x62AB147/213 100A BC AWCO EE550714-2

EE*	Particular customer specifications.
CO	"Made in Spain" marking in the UPS and packaging (customs issues).
W	Neutral equipment brand.
A	Battery set for single phase 115.. 133 V or three phase 3x200.. 3x230 V.
BC	Common battery bank (two UPSs parallel systems).
100A	Protection size.
213	Last three characters of the battery code type 2.
147	Last three characters of the battery code type 1.
AB	Acronym of the battery family.
62	Battery quantity in a single string.
2x	Quantity of batteries in parallel. Omit for single ones.
0/	Battery cabinet with no batteries, but with the needed accessories to fit them in.
S/	Battery cabinet with no batteries and no accessories to fit them in.
/	Batteries not installed from factory. They are supplied in a separate bulk.
CUBE3+	Series.
MOD BAT	Battery module or rack.

6. OPERATING

The UPS from **SLC CUBE3+** series is a double conversion system, AC/DC, DC/AC with sinewave output, which provides a safety protection in extreme conditions of power supply (voltage and frequency fluctuations, electrical noises, blackouts and power outages, etc...). These equipments are ready to assure the quality and continuity of the power supply for any kind of load to be protected.
Basically its operating is as follows:

- Rectifier, it is a three phase IGBT's rectifier, which converts the AC into DC by drawing a sinewave current (THDi < 1%) and charging the batteries with constant current/voltage.
- Batteries supply the energy required by the inverter in case of power outage.
- The inverter is in charge of converting the DC bus voltage into AC providing a full sinewave voltage at the output, which is stabilized in voltage and frequency and ready to feed the loads connected at the output.
- The basic structure of the double conversion is complemented by two new functional blocks, the static bypass switch and the manual bypass switch.

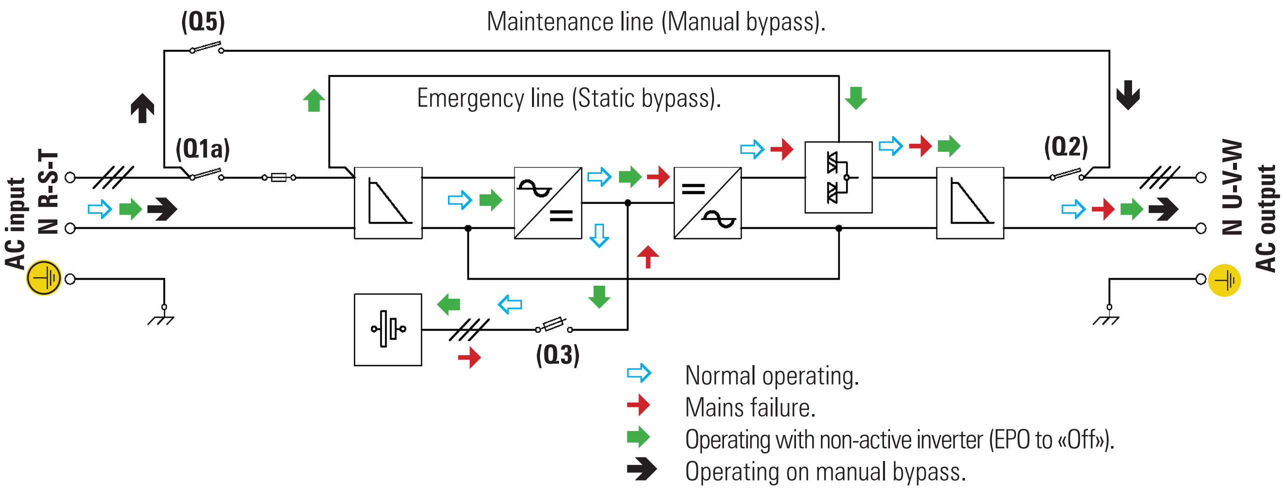


*Fig. 20. **UPS single line diagram SLC CUBE3+ series with operating flows***

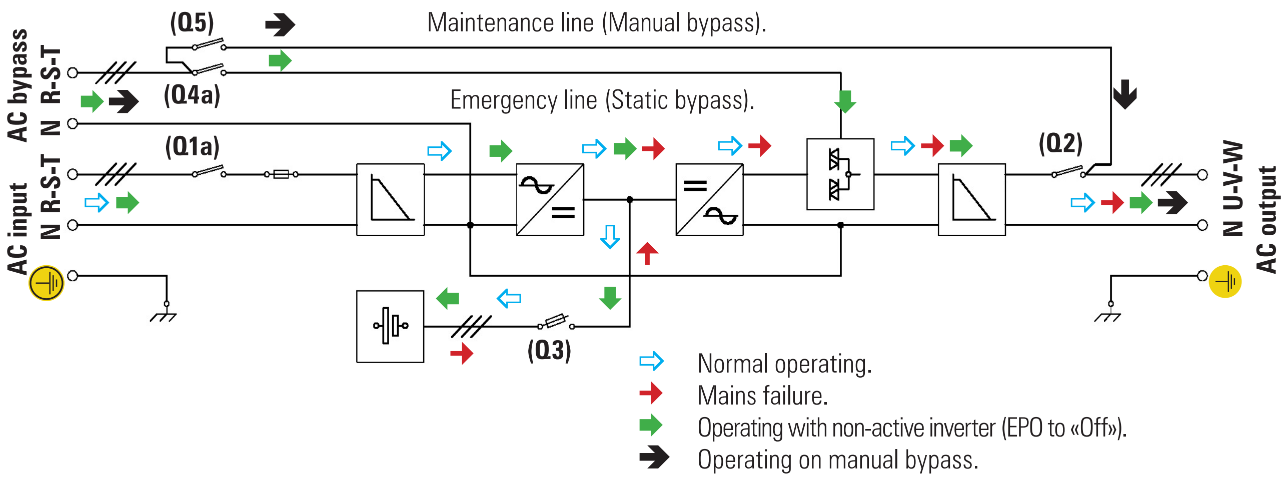


*Fig. 21. **UPS single line diagram SLC CUBE3+-B series with operating flows***

- The static bypass switch connects the output load to the bypass line directly in particular conditions like overload or overtemperature. And it is reconnected to the inverter again when the normal conditions are restored.
- **SLC CUBE3+-B** version has separate lines for the rectifier and bypass stages, increasing the safety of the installation, because it allows using a second power supply (genset, another company, etc...)
- The manual bypass switch isolates the UPS from mains and loads connected at its output, this operating mode allows the maintenance tasks inside the UPS without breaking the power supply to the loads
- Single line diagrams of 20 and 21 figures show (as an example mode) the basic structure of a standard equipment and another one with separate bypass line, for three phase input and output configuration. For any other configuration, the quantity of cables and terminals at the input, output and bypass will change only, but never the internal structure of the equipment.

- In equipments with separate bypass line, an isolation transformer must be fitted in any of the UPS two power supplies (rectifier or static bypass input), in order to avoid the direct join of the neutral of both lines through the internal wiring of the equipment.
- This is only applicable when the both lines come from two different power supplies, i.e.:
- Two different electrical companies.
- An electrical company and generator, ...

6.1. NORMAL OPERATING (⇨)

With mains present, the rectifier converts the AC input voltage into DC, by increasing the DC voltage into an optimal level ready to feed the inverter and the battery charger.
The inverter is in charge of converting the DC bus voltage into AC by providing an alternating sinewave shape, which is stabilized in voltage and frequency and ready to supply the loads connected at the output (20 and 21 figures).

6.2. MAINS FAILURE OPERATING (➔)

In case of mains failure or blackout, the battery set supplies the needed energy to feed the inverter.
The inverter stills work normally without taking care about the lack of input voltage, and it will only depend on the battery set capacity (20 and 21 figures).
When the battery voltage reaches the low voltage, the control blocks the output, in order to protect the batteries from a deep discharge. When mains is restored and after a few seconds of analysis, the UPS returns back to the «normal operating» described in the previous section.

6.3. NON-ACTIVE INVERTER OPERATING (➡)

The inverter is inactive because there alarm conditions like overloads, overtemperatures, end of back up time, etc..., as well as the UPS is set to the ECO mode operating. In this case the rectifier still charges the batteries, in order to keep their optimal charge.
The inverter remains inactive, unless it start up has been done through the control keypad.
In this case the rectifier will be inactive.
In both cases, the UPS output voltage is supplied through the emergency bypass line by means of the static switch (20 and 21 figures), meanwhile the EPO is inactive

6.4. MANUAL BYPASS OPERATING (➔)

When any maintenance task is needed in the equipment, it can be disconnected from mains without breaking the power supply to the critical loads. The UPS can be tested by technical or service personnel, with no risk thanks to manual bypass switch.

6.5. NO BATTERY OPERATING

In case the battery of the equipment is disconnected due to maintenance, it will be disconnected from the DC bus and the inverter by means of (Q3) switch. The UPS from **SLC CUBE3+** series will still be running with all its features and quality performances, less those ones when the inverter is fed by the batteries (power outage).

7. CONFIGURATIONS

7.1. INPUT/OUTPUT VOLTAGES. POWER TOPOLOGY

As regards its input and output, a system from **SLC CUBE3+** series can be set, by software, to single or three phase indistinctly. So, we can say that the equipment is four in one. Also, some mechanical changes must be done apart from these settings. This high flexibility in the power topology makes easier its adaptability in accordance with the installation:

- Three phase in/out (III/III)
- Three phase in / single phase out (III/I)
- Single phase in / out (I/I)
- Single phase in / three phase out (I/III)

7.2. REGARDING THE OPERATING MODE

7.2.1. Eco mode (➔)

For those less sensitive loads to the fluctuations to the commercial power supply, they can be directly fed by the static bypass switch meanwhile it is inside the acceptable voltage and frequency ranges. The inverter will be on but with the output disconnected, and keeping its parameters of voltage and phase shifting synchronised with the bypass mains. Therefore, there will only be the heat losses of the own bypass plus the converters with no load, so it will allow to reach an efficiency higher than 98%.
In case of power outage, the inverter will supply the loads through the static bypass switch and at the same time it will be fed from the batteries.

7.2.2. Standard or basic UPS (⇨)

The basic UPS is based on a PFC IGBT rectifier, charger, inverter, static switch, manual or maintenance bypass, protection switches and particular accessories.
The standard or basic structure requires an electrical commercial mains with neutral, where the output neutral is the same as the input one. Therefore, the output neutral can't be connected to a different protection earth from commercial mains.
See figures 20 and 21 for the operating flow of this mode.

7.2.3. Standard or basic UPS with transformer

This structure is identical to one presented in the previous clause, less that it is provided with an additional transformer with delta-star connection at the output.
This configuration allows:

- To create the neutral for those electrical installations where the commercial mains does not include it.
- To isolate the output from the input galvanically, so it will allow connecting the UPS output neutral to a different protection earth from the commercial mains.
- To cancel the 3rd harmonic from the non-linear loads, which should be supported by the UPS during the normal operating modes.

7.2.4. Standard or basic UPS with separate bypass line

As Figure 10 shows, the UPS is based on an active IGBT rectifier, three phase transformerless inverter, static switch, manual or maintenance bypass, protection switches and particular accessories.
The standard or basic structure, with separate bypass line, requires a commercial mains with the same neutral for the bypass and the active IGBT rectifier. The output neutral is the same as the rectifier and bypass input one, which means that the output neutral can't be connected to a different protection earth of commercial mains.

7.3. REGARDING THE PARALLEL CONNECTION

A system of **SLC CUBE3+** series can be made of a single UPS, or two or more (up to 4 maximum) equipments of the same power rate. The systems with more than one UPS working simultaneously, have them connected in active parallel, sharing the load equally among them. Less, when there is only one UPS, the system can be redundant or non-redundant depending on the needs and requirements of the application.

- **Redundant system**: a redundant system is that one that has one or more than one UPS of the minimum ones required by the total power of the system. Therefore, a failure in one of them, will make that the damaged UPS remains out of service and the rest will be still supplying the loads. Once the faulty UPS is fixed, it can be connected to the system again, in order to recover the redundancy condition.
- **Non-redundant system:** a non-redundant system is that one that the all the UPSs supply the power required by the loads. If anyone of them fails, the load will be shifted to bypass automatically with no-break, because the rest of the UPSs will not be able to hold the loads.

7.3.1. Hot Stand-by redundant

In this configuration, two UPSs with separate bypass line work in single mode. So the system can supply to type of loads: critical and noncritical.
Bypass mains of UPS 1, which is feeding the critical loads, is supplied by the UPS 2. In case of failure of UPS 1, the critical load will be supplied by the UPS 2 by means of the bypass from UPS 1, in order to guarantee the correct power supply for the critical loads. Also, this architecture allows feeding noncritical loads, by increasing the flexibility of this structure. Just, take into account the sum of both power rates loads: critical and noncritical can't be higher than the power rate of UPS 2.
This type of configuration allows increasing the reliability of the system without the need of modifying the electrical installation. So different UPS power rates, generations and manufacturers can be connected without requiring any connection between the UPSs of the system.

7.3.2. Simple parallel

This configuration is based on the standard UPS. It is possible to implement a system with a maximum of 4 UPSs in parallel, being able to increase the capacity the total power rate of the system, avoiding to change the unit in case of load power rate upgrading.

The total power of a system is based on N equipments with power rate P, is N x Pn. If the system works with a load close or equal to the maximum power rate and one the UPS fails, the system will shift to bypass due to the overload in the rest of the UPSs

7.3.3. Redundant parallel

This configuration is based on the standard UPS. It is possible to implement a system with a maximum of 4 UPSs in parallel.

The total power of the load must be lower or equal to the UPSs system power working on redundant parallel mode (depending on the redundancy level), being the load shared equitably among all the equipments that belong to the system. Therefore, the fault of one equipment will leave the faulty UPS out of service meanwhile the rest of the equipments will still supply the loads.

A system with this kind of configuration increases the reliability and assures an AC power supply of quality for the most critical loads.

The quantity of redundant equipments to be connected, must be studied according to the needs of the application.

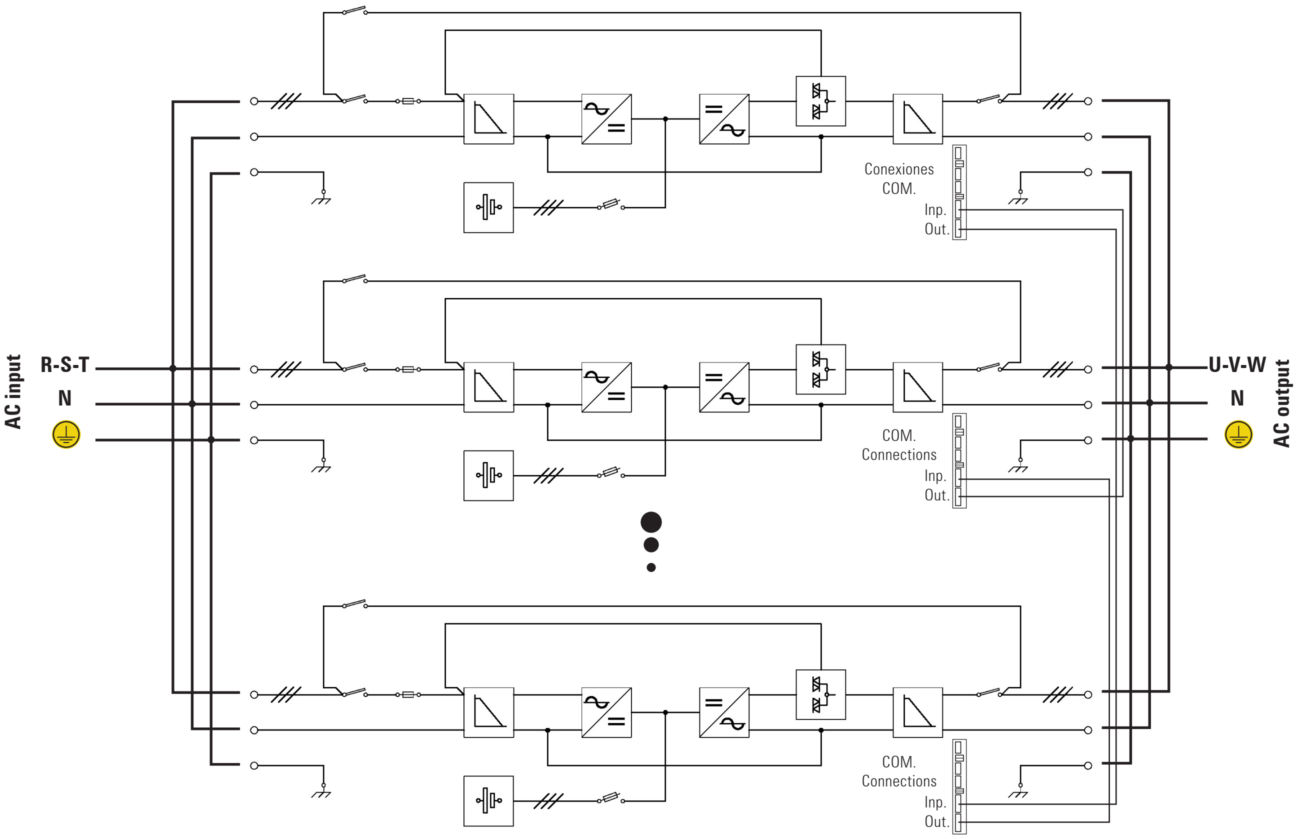


*Fig. 22. **Single line diagram, SLC CUBE3+ parallel system connection up to 4 equipments.***

8. UPS / PARTS DESCRIPTION

The UPS from **SLC CUBE3+** series is based on the following parts:

- I/O EMI filters.
- PFC rectifier (AC/DC).
- Batteries.
- Inverter (DC/AC).
- Static bypass.
- Manual or maintenance bypass.
- Control panel.
- Emergency power off EPO.
- Monitoring software and communications.

8.1. I/O EMI FILTERS

The EMI filter is a low-pass three phase filter, which attenuates and cancels any radio frequency interference. It is a bidirectional filter:

- It cancels any perturbation coming from mains, protecting the control circuits of the UPS.
- It avoids the possible radio frequency interferences, that the UPS could generate, going into the utility and affecting other devices connected to the same line.

8.2. PFC RECTIFIER STAGE

Constituent parts:

- **Input protection switch**: it is the particular protection of the PFC rectifier.
- **Current sensor**: it uses alternating current sensors (current transformers, CTs) to measure and control the input current to get a THDi < 3% at 100% load and depending on the quality of mains even < 1%.
- **"T" filter**: it is used to attenuate the current ripple of the PFC switching frequency.
- **Three phase IGBT converter**: It is used to make the AC/DC conversion with the lowest distortion and higher efficiency. To do it, IGBTs with Trench-gate technology of 4th generation are used.
- **Input chokes**: They are used by the PFC rectifier as an storage of energy element (during the switching times), to make the AC/DC conversion.
- **DC Bus**: it is used to filter the DC energy, in order to guarantee the correct operating of the PFC and inverter converters.

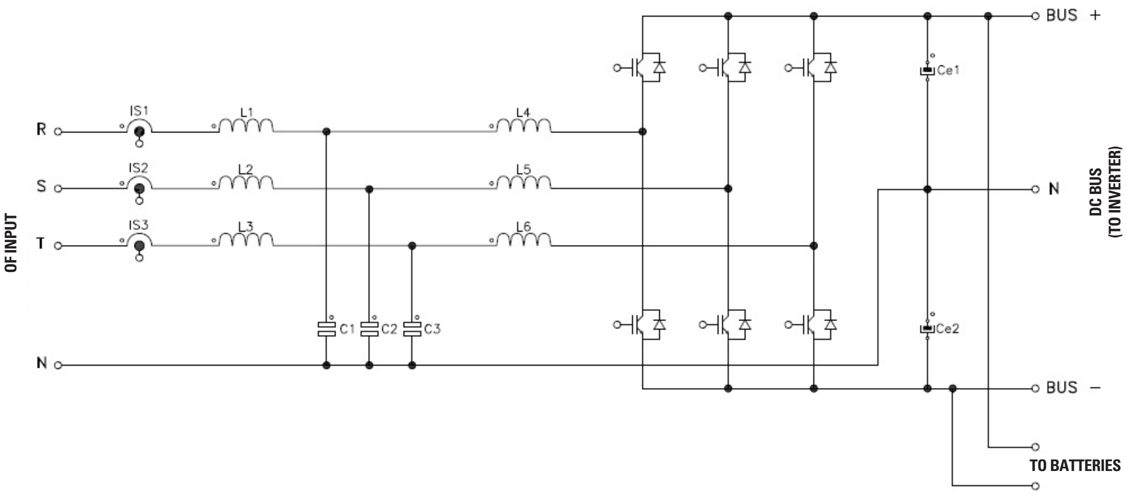


Fig. 23. PFC-Rectifier single line diagram

8.3. BATTERIES

The UPS from **SLC CUBE3+** series has a battery set, which stores energy during the normal operating (mains present) and it is discharged during the emergency operating modes (power outage), keeping the critical loads operative during the required period of time.

Batteries are sized to feed the critical loads, during the back up time period for any load condition. The standard accumulators are sealed lead acid, maintenance free and with VRLA technology.

Each cell or set (battery block) are duly marked in a permanent way, with polarity indication, voltage and required warning labels by the regulations.

The cells are duly assembled and electrically connected. The battery set is protected by a switch with ultrafast fuses, ready for the conditions described in the rectifier section.

On normal mode (mains present and batteries charged), the battery set is working on floating voltage.

As an option, it can be supplied with a Pb-Ca or Ni-Cd batteries in a separate cabinet or rack, which can be shared in parallel UPS systems of two UPSs.

8.4. INVERTER STAGE

Constituent parts:

- **DC bus**: it is used to filter the DC energy. And it is in charge of interconnecting the PFC and inverter converters through its protection fuses.
- **Three phase IGBT inverter**: Similar to the PFC stage, but in the opposite direction, it is used to make DC/AC conversion with the lowest distortion and higher efficiency. Also IGBTs with Trench-gate technology of 4th generation are used.
- **Current sensor**: as it has been quoted previously, in this case, it is also used conventional alternating current sensors (current transformers, CTs) to measure and control the output current to get a total harmonic voltage distortion lower than 1% at 100% load.
- **Output chokes**: It is used an identical solution as at the input stage. These chokes are used by the inverter as an storage of energy element (during the switching times), to make the DC/AC conversion.

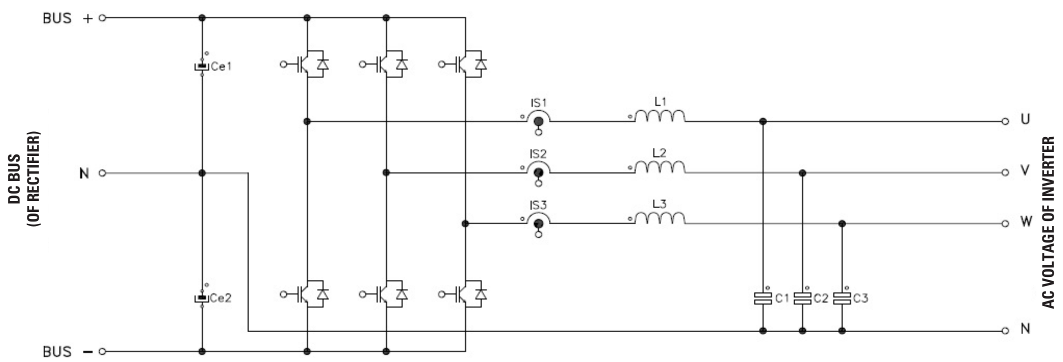


Fig. 24. Inverter single line diagram

8.5. BYPASS STAGE

When the inverter can't keep the critical loads due to overloads, short-circuits, current limits or faults, the UPS from **SLC CUBE3+** series has a bypass circuit, which provides the inverter isolation and feeds the critical loads from the electrical mains directly.

The UPS manages the availability inverter-bypass constantly in order to make the needed transferences between them.

The Bypass stage is based on six double thyristors in semipack format working as AC switches, three of them are for the input switching over the output and the other three are for the inverter switching over the output.

The management system of the SCR switches are based on drivers with a switching system with the following requirements:

- Total static switching system.
- Non-transient current switching.
- No transfer time switching.

The control algorithm of the triggering signals assures a nil transfer time, avoiding making short-circuits among the bypass and inverter thyristors too (switching during the zero current situation).

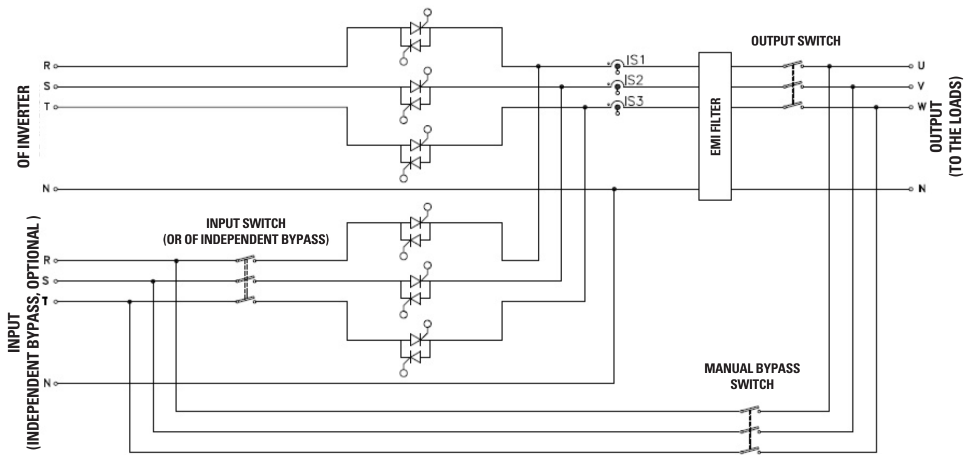


Fig. 25. Bypass single line diagram

8.6. MAINTENANCE OR MANUAL BYPASS

The UPS from **SLC CUBE3+** series are provided with an auxiliary protected line with a circuit breaker, which makes an electrical bridge between the input and output terminals.
By manoeuvring this switch suitably and together with the input and output switches, it will allow isolating electrically all the parts of the UPS from the electrical lines.
The type of manoeuvring is "make before break", with the purpose of having the critical loads always fed, even in case of making the maintenance tasks.

8.7. EPO TERMINAL STRIP

The UPS has two terminals to install an external button to make an emergency power off (EPO).

8.8. CONTROL PANEL

The UPS from **SLC CUBE3+** series has a sophisticated control panel, which is based on DSP (Digital Signal Processor) that acts as an interface between the UPS and end-user.
The UPS's up to 60kVA are equipped with an alphanumerical LCD panel, meanwhile the equipments above 80kVA include a touchscreen panel, as the previous sections show. Both panels inform the end-user about the current status and measurements of the equipment. The menu is based on a tree, allowing an easy browsing through their screens.

8.9. CONTROL SOFTWARE

AFC control (Adaptive Feedforward Cancellation)
It is based in the use of digital resonators connected in parallel, which are set to those frequencies where both several orders to follow and perturbations to cancel are expected.
This control technique allows following the reference sinewave signal of the inverter output voltage and rectifier input current.
It is important to highlight the different controls of the UPS do not work separately, they work interacting among them resulting in a global controller of coupled type. It has operating advantages like the immediate adapting condition of the rectifier to the loads conditions.
The digital control software operates in two different levels:

8.9.1. Low level control software

Three phase input rectifier controller: the PFC control and battery charging loops. The adopted control structure completely separate for each phase with cascade type, allows treating either single or three phase inputs.
Also, the AFC control technique has been used in order to assure sinewave currents with a THDi < 1% and in phase shifting with the voltage wave. It has a complete active balancing power of all the system and numbing it against the transient loads.
In normal conditions, the rectifier is working and charging the batteries and controlling their charging current and floating voltage according to the temperature of themselves at any time. Also the system is in charge of minimising the charging current ripple that flows through them.
When the input voltage or frequency of the rectifier are out of the operating ranges, the rectifier is shutdown and the batteries are the responsible ones to keep the inverter in operation, which at the same time keep the loads fed through the output of the equipment till the batteries are depleted.
Another important feature of the rectifier is its bidirectional operating capacity. This allow to set a battery discharge current even with mains present. This feature will allow making a battery test with both load and no load conditions.

Three phase output inverter controller: independent per phase, it is adapted easily to the different voltage configurations, either single or three phase.
To highlight the use of the AFC control technique, which allows having an output voltage with THDv less than 1.5% with non-linear load at the output and with a good dynamic response against unexpected load steps.

Switching algorithm of the bypass thyristors.

Parallel control: high speed communications and parallel connection of the inverters.

8.9.2. Equipment management software

Management and control of several parts.
Monitoring software for user interface.
Communication software and implemented with MODBUS protocol.
Management software of the parallel system.

8.10. COMMUNICATIONS

- **USB port:** A USB port is supplied in the standard equipments, connector type-B, and acting as a serial virtual port ("Virtual COM Port", or "VCP"). When connecting the PC to that port, the driver "VCP" will be installed automatically, so the USB port will act as a COM serial port of the equipment.
  The PC connection to the USB port of the UPS, disables the COM 0 port through the RS232 or RS485. So, it means, that the USB communication is priority over the RS232/RS485.
  The standard protocol supported by this USB port is the same as the RS232/RS485: Modbus.
- **Dry contact COM port:** It provides a digital signals in dry contact format, so it makes possible the dialogue between the equipment and other machines or devices through the male DB9 connector.
  The equipment is supplied with 4 dry contacts as standard with a factory preset programming, which can be changed at factory under request or by the S.T.S. later on. As an option and under request, a fifth dry contact can be supplied .
  Also, there is a "shutdown" input in order to stop the inverter.
  The most common use of this type of port is to provide information which is required by the closing file software.

- **RS-232 and RS-485 COM ports:** By means of the same DB9 connector, the RS-232 and RS-485 communication ports are provided. They are mutually exclusive between them, and they are used to connect the UPS with any device or machine that has a standard protocol.

  The **RS-232** port is a serial data transmission, so an important amount of information can be sent through a communication cable of three wires.

  The **RS-485,** unlike other serial communication links, it uses two wires only to dialogue between the connected systems and the network. The communication is established by sending and receiving signals in differential mode, so this system is very immune to the noise and it has a long reaching (800 m approx).

  The used protocol is "MASTER/SLAVE" type. The computer or information system ("MASTER") asks for a determined data, by next answering the UPS ("SLAVE").

8.11. OTHER CONSTITUENT PARTS OF THE UPS

- **As regards to software:**
  - ❒ Up to 6 available languages: English, Spanish, French, German, Turkish and Russian.
  - ❒ Management and control of the UPS parallel system.
  - ❒ Battery test (no risk for the load, by keeping the double conversion), and remaining back up time prediction.
  - ❒ Battery floating control according to the temperature.
  - ❒ Alarm data logger.
  - ❒ Parameters for particular and advanced settings.
- **As regards to physical parts ("hardware"):**
  - ❒ Ultrafast fuses to protect the converters and power parts of the UPS.
  - ❒ Auxiliary contact terminal strips for the external switches of the equipment (output switch, maintenance bypass switch).
  - ❒ Incorporated neutral disconnector, to make easier the maintenance tasks when the maintenance bypass is turned on.
  - ❒ Temperature sensors for: batteries (environment), rectifier and inverter.
  - ❒ Devices (and management) to attenuate the ripple current on the batteries.
  - ❒ SUB-HD15 connectors for parallel system communications.

9. ENCLOSURE

9.1. MATERIALS

Any material of the **SLC CUBE3+** series is new, with high quality and it has not been used previously, except those parts required for its testing. All the parts of the UPS are solid state.

9.2. CABINET

The set of rectifier, batteries, inverter, static bypass, maintenance bypass, control panel, etc., are fitted in a partitioned cabinet, made of zinced iron sheet of 1.5 mm. and 2 mm. thickness (depending on the model) for the structure, meanwhile the covers and doors are made of galvanised iron sheet with 1 mm. thickness.

Models up to 120kVA include swivel casters to make easier their movement through the floor.

The door has document folder, key lock and it allows 135º opening.

The **SLC CUBE3+** series is assembled in cabinet with protection degree IP20. And the paint coat is polyester type with RAL7015 and RAL9006 colour.

The cooling of the cabinet is forced, in order to assure that all components in the UPS enclosure are inside the suitable temperature ranges.

The equipment has temperature sensors to monitor the most important temperatures.

The cabinet of the **SLC CUBE3+** series is designed to be transported by means of fork lift.

9.3. WIRING

The internal wiring of the equipment meet the CE marking regulations. Any electrical connection is tightened to the required torque and marked with a visual indicator.

The wiring is ready in a bundle of single pole cables of flexible copper. Each end of the cable has a terminal with an anti shear and nonslip system.

The entry cable is through the bottom-front of the cabinet, less the power rated 160 kVA and 200 kVA with separate bypass which are through the top left side.

10. OPTIONS

10.1. EXTENDED BACK UP TIMES:

The **SLC CUBE3+** equipments already include a battery set with a standard back up time, which can be extended in the same enclosure, in battery cabinets or even part in the UPS enclosure and part in additional cabinets according to the needs of the client and depending on the **SLC CUBE3+** model and required back up time.

10.2. ETHERNET/SNMP ADAPTORS: INTEGRATION INTO IP NETWORKS:

To make the perfect UPS integration in an IT networks, it is always better to not depend on a single computer, this why the Ethernet/SNMP adaptor (SNMP, V1, V2 or V3) allows the UPS being independent completely, without the need of having any associated PC or server.

BOX or CARD versions. They allow integrating the UPS in the IT networks. Two formats are available: box and card, the last one can be inserted into the free slot of SALICRU's equipments. Also, there is the possibility to connect temperature and humidity probes, and to communicate this device with a TCP channel, RS-232 and RS-485 with MODBUS protocol.

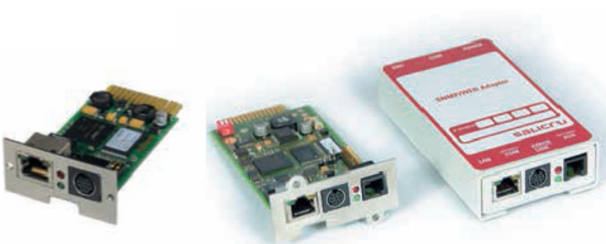


Fig. 26. SNMP adaptors.

10.3. RCCMD REMOTE "SHUTDOWN" SOFTWARE:

The management and monitoring of a UPS in a heterogeneous IT networks, where different systems live together, is almost impossible. The RCCMD is a software, which allows the simultaneous and safety shutdown of several servers or workstations with the 95% of the existent platforms. As well as the most complete monitoring software, the RCCMD is able to send messages or commands to all the clients in the network. It is compatible with all the operating systems, even with the virtual ones (vmware, citrix and hyperv).

10.4. UNMS II: THE UPS MANAGEMENT WITH NO LIMITS.

For those IT networks with more than one UPS to feed it and it is required the monitoring concentration from a single management point, the UNMS II software (UPS Network Management System) is the ideal solution. The UNMS II allows managing multiple equipments in the same installation that has a Ethernet/SNMP adaptor and/or sensor.

The UNMS II has different licence levels, which depend on the quantity of UPS to manage.

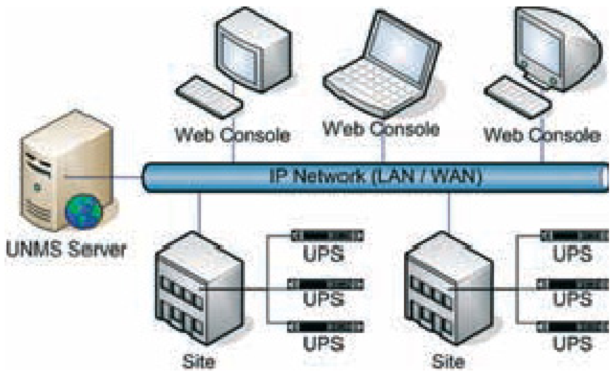


Fig. 27. UMNS, UPS management

10.5. ANDROID WIRELESS LINK:

Salicru has designed a monitoring system in real time of the operating fields of the equipment for cell phones and tablets with Android by means of bluetooth communication. The Android Wireless Link system is not compatible with Sicres.

Fig. 28. Android monitoring

10.6. SICRES ADAPTOR FOR THE REMOTE MANAGEMENT:

To be informed at any time about the status and even to predict the failures of the equipment to come, SALICRU provides the SICRES solution; the telemaintenance service by means of a Internet connection with different modalities: BASIC, MEDIUM, PREMIUM and PREMIUM PLUS, which allow warning the client in case of any fault, monitoring the equipment via website, accessing the equipment for its control, among others, avoiding the unnecessary displacements of the maintenance staff and informing and solving the problems before the end-user notice them.

Fig. 29. *SICRES Adaptors*

10.7. 1 X ADDITIONAL RS232/485 SERIAL PORT:

In case of need, the **SLC CUBE3+** equipments can include an extra RS232/485 serial port in addition to the standard communication card.

10.8. TEMPERATURE AND HUMIDITY PROBES:

For those cases, where having the environment data of the UPS room is essential, Salicru has a temperature and humidity sensor, which allows including these data in the own monitoring software without the need of any external system. The probe includes a communication cable to be connected with the Ethernet/SNMP adaptor.

Fig. 30. *Temperature and humidity probe module*

10.9. EXTERNAL MANUAL BYPASS.

As a UPS peripheral complement, an external manual bypass can be fitted in, which allows selecting the power supply to the loads coming from the UPS or commercial utility. As an option, an isolation transformer can be built in, which provides galvanic isolation between the primary and secondary winding, in order to attenuate the electrical noises and transients coming from the utility, and they are transferred to the secondary in lesser extent too.

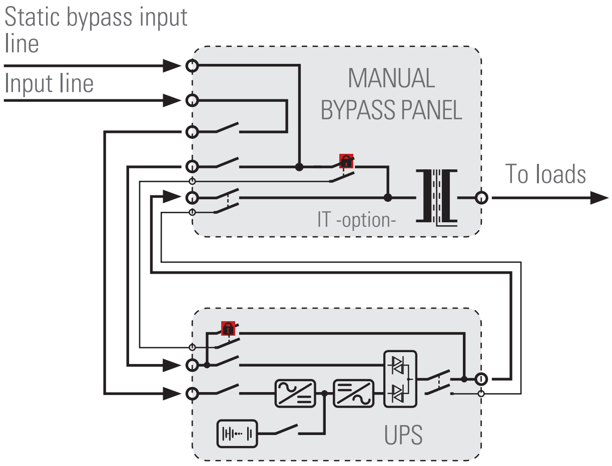


Fig. 31. *External manual bypass panel*

10.10. FREQUENCY CONVERTER 50 TO 60 HZ OR 60 TO 50 HZ:

The **SLC CF CUBE3+** equipments allow working with different input and output frequencies, either 50 Hz at the input and 60 Hz at the output or 60 Hz at the input and 50 Hz at the output.

10.11. BACS II:

Battery advanced care system integrated in a IT network for its monitoring and management. It checks the particular internal resistance, temperature and voltage of each single battery block. Also, the voltage charge of each battery and environment measurements managing (temperature, humidity, hydrogen gas content) can be set. This way, the operating will always be the optimum one. The constant monitoring and particular control of the charging voltage per each battery, allows a total availability of them at any moment.

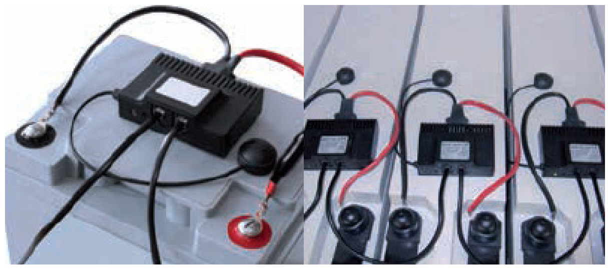


Fig. 32. *Battery Advanced Care System, BACS*

10.12. BATTERY COMMON SET FOR PARALLEL SYSTEMS:

The **SLC CUBE3+** equipment technology allows the operating of two equipments in parallel, sharing a single common battery set.

10.13. DOUBLE LEVEL BATTERY CHARGE FOR NI-CD AND GEL TYPES:

The equipments have a system ready to create a two stage charger (floating voltage and boost voltage), which allows using Ni-Cd and gel battery types.

10.14. INPUT/OUTPUT VOLTAGE CONFIGURATIONS:

The UPS from **SLC CUBE3+** series can be supplied from factory ready to be set to any input/output voltage configuration topology, as table 2 states.

Rectifier input configuration	Bypass input configuration (*)	Output configuration
Three phase	Three phase	Three phase
Three phase	Single phase	Single phase
Monofásica	Single phase	Single phase
Single phase	Three phase	Three phase

(*) Separate bypass line as an option. Obviously the topology of this line will always be the same as the output.

Tabla 2. UPS configurations

10.15. ISOLATION TRANSFORMER

The isolation transformer provides a galvanic isolation, which allows isolating the output from the input completely. The installation of an electrostatic shield between the primary and secondary of the transformer provides a high level attenuation of the electrical noises. The isolation transformer can be installed at the input or output of the UPS and it is an available option for those cases that the output loads have to be galvanically isolated from the utility.

11. TECHNICAL SPECIFICATIONS

Nominal power (kVA)	7,5	10	15	20	30	40	50	60	80	100	120	160	200
Nominal power (kW) III/III	6.75	9	13.5	18	27	36	45	54	72	90	108	144	180
Nominal power (kW) III/II, II/III or II/II	6	8	12	16	24	32	40	48	64				
INPUT													
Nominal voltage	Single phase 220V, 230V or 240V									-			
	Three phase 3x380V, 3x400V or 3x415V (5 wires : 3 phases + N + PE)												
Input voltage range	+15% / –20% (setteable)												
Frequency	50 / 60 Hz ±5 Hz (selectable between 0,5 - 1 - 2 and 5 Hz)												
Input current total harmonic distortion (depending on the quality of the utility)	100 % load: THD-i < 1.5 % 50 % load: THD-i < 2.5 % 10 % load: THD-i < 6.0 %				100 % load: THD-i < 1.0 % 50 % load: THD-i < 2.0 % 10 % load: THD-i < 5.0 %					100 % load: THD-i < 1.5 % 50 % load: THD-i < 2.0 % 10 % load: THD-i < 6.0 %			
Current limit	High overload: PFC limit (battery discharging)												
Power factor	1.0 from 10% load												
INVERTER													
Output nominal voltage	Single phase 220V, 230V or 240V									-			
	Three phase 3x380V, 3x400V or 3x415V (5 wires: 3 phases + N + PE)												
(*) Output power factor	0.9 for three phase in/out. 0.8 for L, M and N configurations												
Accuracy	Static : ±1 %. Dynamic: ±2 % (100-0-100 % load variations)												
Output frequency	50 / 60 Hz synchronised ±5 Hz. No mains ±0,05 %												
Maximum slew rate	From 1 to 10 Hz/s (selectable)												
Output wave shape	Sinewave												
Output voltage total harmonic distortion	Linear load: THD-v < 0.5 %. Non-linear load acc. to EN-62040-3: THD-v < 1.5 %												
Phase shifting	120 ±1º (balanced load). 120 ±2º (100% load unbalanced)												
Dynamic response time	10 ms. up to 98 % of the static value												
(**) Permissible overload	125% for 10 min.>125; 135% for 5 min.>135; 150% for 1 min.>150% for 20 ms.												
Permissible crest factor	3.4 to 1				3.2 to 1				2.8 to 1	3.2 to 1		3 to 1	
Permissible power factor	0.7 lagging to 0.7 leading												
Unbalanced output voltage (100 % unbalanced load)	< 1 %												
Current limit	High overload, shorti-circuit: RMS voltage limit. High current crest factor: Peak voltage limit												
Efficiency on battery mode (100% linear load) (%)	94.3	94.8	95.3	95.6	95.9	96.4	96.3	96.4	96.4	96.5	96.4	96.8	96.9
STATIC BYPASS													
Type	Static switch												
Bypass line	Common. As an option it can be separate (B)												
Nominal voltage	Single phase 220V, 230V or 240V									-			
	Three phase 3x380V, 3x400V or 3x415V (5 wires: 3 phases + N + PE)												
Voltage range	By default +12 % (selectable between +20... +5%) / –15% (selectable between –25... –5%												
Voltage hysteresis	±2 % as regards to the bypass voltage range. Standard equipment set to +10 /–13%												
Frequency	50 / 60 Hz												
Frequency range	±5 Hz (selectable between 0,5 - 1,0 - 2 and 5,0 Hz)												
Frequency hysteresis	1 Hz as regards to the frfequency (selectable between 0.2 - 0.5 - 1.0 and 2.0 Hz)												
Activation criteria	Microprocessor controlled												
Transference time	Nil, except in Smart Eco-mode < 4 ms												
Permissible overload	400 % for 10 s												
Bypass transference	Immediate, for overloads over 150 %												
Retransference	Automatic after alarm cancelling												
Efficiency on Smart Eco-mode (%)	95		95.5	96	97.4	97.8	98		98.4	98			
MANUAL BYPASS (MAINTENANCE)													
Type	No break												
Nominal voltage	Single phase 220V, 230V or 240V									-			
	Three phase 3x380V, 3x400V or 3x415V (5 wires: 3 phases + N + PE)												
Frequency	50 / 60 Hz												
SHORT CIRCUIT CURRENT (kA)	6						10		25	100			
GENERAL													
Total efficiency (100% linear load) (%)	91.0		92.0	92.5	93.5	94.0			95.0	94.5	94.0	95.0	
BATTERIES													
Number	31 + 31												
(***) Type	Pb-Ca												
Battery floating voltage	13.65 V to 20ºC												
Battery floating voltage compensation	Selectable (–18 mV/ºC by default)												
Capacity (Ah)	4.5			7	9	12	12	2x12	40			65	80
Standard charging current (Cx0,2) (A)	0.9			1.4	1.8	2.4	2.4	4.8	8.0			13	16

Nominal power (kVA)		7.5	10	15	20	30	40	50	60	80	100	120	160	200
Battery terminal torque		Depending on the battery manufacturer												
built int he UPS enclosure		YES						NO						
Dimensions and weight for UPS configuration with standard back up time														
Quantity of cabinets		1 (UPS + batteries)						1 (UPS) / 1 (batteries)						
Cabinet dimensions (mm) (Depth x Width x Heigth)	CUBE3+ / CUBE3+ B1	775x450x1100								880x590x1325			850x900x1905	
	CUBE3+ B / CUBE3+ B B1										880x870x1325		850x1225x1905	
	Batteries	-								1050x650x1325			850x1305x1905	
Casters with no brake. Equipment / batteries		YES / -						YES / YES		YES / NO			NO / NO	
Cabinet weight (kg)	CUBE3+ B1	97	97	99	102	147	172	-	-	-	-	-	-	-
	CUBE3+ B B1	99	99	101	105	150	175	-	-	-	-	-	-	-
	CUBE3+	207	207	209	235	319	417	185	185	265	290	290	540	550
	CUBE3+ B	209	209	211	237	322	420	190	190	275	310	310	570	580
	External batteries	-	-	-	-	-	-	321	551	1020	1020	1020	1655	1690

Tabla 3. Particular technical specifications for HV equipments

Nominal power (kVA)	5	7.5	10	15	20	30	40	50	60	80	100
Nominal power (kW) III/III	4.5	6.75	9	13.5	18	27	36	45	54	72	90
Nominal power (kW) III/II, II/III or II/II	4	6	8	12	16	24	-	-	-	-	-
INPUT											
Nominal voltage	Single phase 115V, 120V, 127V or 133V									-	
	Three phase 3x200V, 3x208V, 3x220V or 3x230V (5 wires: 3 phases + N + PE)										
Input voltage range	+15% / –20% (setteable)										
Frequency	50 / 60 Hz ±5 Hz (selecctable betwen 0.5 - 1 - 2 and 5 Hz)										
Input current total harmonic distortion (depending on the quality of the utility)	100 % load: THD-i < 1.5 % 50 % load: THD-i < 2.5 % 10 % load: THD-i < 6.0 %			100 % load: THD-i < 1.0 % 50 % load: THD-i < 2.0 % 10 % load: THD-i < 5.0 %				100 % load: THD-i < 1.5 % 50 % load: THD-i < 2.0 % 10 % load: THD-i < 6.0 %			
Current limit	High overload: PFC limit (battery discharging)										
Power factor	1.0 from 10% load										
INVERTER											
Output nominal voltage	Single phase 115V, 120V, 127V or 133V							-			
	Three phase 3x200V, 3x208V, 3x220V or 3x230V (5 wires: 3 phases + N + PE)										
(*) Output power factor	0.9 for three phase in/out. 0.8 for rest of configurations										
Accuracy	Static: ±1 %. Dynamic: ±2 % (100-0-100 % load variations)										
Output frequency	50 / 60 Hz synchronised ±5 Hz. No mains ±0,05 %										
Maximum slew rate	From 1 to 10 Hz/s (selectable)										
Output wave shape	Sinewave										
Output voltage total harmonic distortion	Linear load: THD-v < 0.5 %. Non-linear load acc. to EN-62040-3: THD-v < 1.5 %										
Phase shifting	120 ±1º (balanced load). 120 ±2º (100% unbalanced load)										
Dynamic response time	10 ms. up to 98 % from the static value										
(**) Permissible overload	125% for 10 min.>125; 135% for 5 min.>135; 150% for 1 min.> 150% for 20 ms.										
Permissible crest factor	3.4 a 1			3.2 a 1			2.8 a 1	3.2 a 1		3 a 1	
Permissible power factor	0.7 lagging to 0.7 leading										
Unbalanced output voltage (100 % unbalanced load)	< 1 %										
Current limit	High overload, shorto-circuit: RMS voltage limit. High current crest factor: Peack voltage limit										
Efficiency on battery mode (100% linear load) (%)	94.3	95.3	95.6	95.8	96.4			96.5	96.4	96.8	96.9
STATIC BYPASS											
Type	Solid state										
Bypass line	Common. It can be separate as an option (B)										
Nominal voltage	Single phase 115V, 120V, 127V or 133V							-			
	Three phase 3x200V, 3x208V, 3x220V or 3x230V (5 wires: 3 phases + N + PE)										
Voltage range	By default +12 % (selectable between +20… +5%) / –15% (selectable betwen –25… –5%										
Voltage hysteresis	±2 % as regards the bypass voltage range. In a standard equipment is set to +10 /–13%										
Frequency	50 / 60 Hz										
Frequency range	±5 Hz (selectable between 0.5 - 1.0 - 2 and 5,0 Hz)										
Frequency hysteresis	1 Hz as regards to the frequency range (selectable between 0.2 - 0.5 - 1.0 and 2.0 Hz)										
Activation criteria	Controlled by microprocessor										
Transference time	Nil, less on Smart Eco-mode < 4 ms										
Permissible overload	400 % for 10 s										
Bypass transference	Immediatge, for overloads over150 %										
Retransference	Automatic after alarm cancelling										

Efficiency on Smart Eco-mode (%)		95.0	95.5	96.0	97.4	97.8	98.0	98.4	98.0			
Nominal power (kVA)		**5**	**7.5**	**10**	**15**	**20**	**30**	**40**	**50**	**60**	**80**	**100**
MANUAL BYPASS (MAINTENANCE)												
Type		No break										
Nominal voltage		Single phase 115V, 120V, 127V or 133V							-			
		Three phase 3x200V, 3x208V, 3x220V or 3x230V (5 wires : 3 phases + N + PE)										
Frequency		50 / 60 Hz										
SHORTI-CIRCUIT CURRENT (kA)		6					10	25	100			
GENERAL												
Total efficiency (100% linear load) (%)		89	89.5	90	91	91.5	92	93	92.5	92	93	
BATTERIES												
Quantity		38		36				40	38		40	
(***) Type		Pb-Ca										
Battery floating voltage		13.65 V a 20ºC										
Battery floating voltage compensation		Selectable (–18 mV/ºC by default)										
Capacity (Ah)		7			12	18	26		40		65	
Standard charging current (Cx0,2) (A)		1.4			2.4	3.6	5.2		8		13	
Battery terminal torque		Depending on the battery manufacturer										
Integrated in the UPS cabinet		YES					NO					
DIMENSIONS AND WEIGHTS FOR UPS WITH STANDARD BACK UP TIME CONFIGURATION												
Cabinet quantity		1 (UPS + batteries)					1 (UPS) / (batteries)					
Cabinet dimensions (mm) (Depth x Width x Height)	**CUBE3+ / CUBE3+ B1**	775x450x1100						880x590x1325			850x900x1905	
	CUBE3+ B / CUBE3+ B B1								880x870x1325		850x1225x1905	
	Batteries	-						1050x650x1325			850x1305x1905	
Casters with no brake. Equipment / batteries		YES/-					YES/YES	YES/NO			NO/NO	
Cabinet weights (kg)	**CUBE3+ B1**	97	99	102	147	172	-	-	-	-	-	-
	CUBE3+ B B1	99	101	105	150	175	-	-	-	-	-	-
	CUBE3+	207	209	235	319	417	185	265	290	290	540	550
	CUBE3+ B	209	211	237	322	420	190	275	310	310	570	580
	External batteries	-					424	501	594		1096	

Tabla 4. Particular technical specifications for LV equipments

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The Technical Service and Support (T.S.S.) network, Commercial network and warranty information are available in website:
www.salicru.com

Product Range
Uninterruptible Power Supplies (UPS)
Lighting Flow Dimmer-Stabilisers
DC Power Systems
Static Inverters
Photovoltaic Inverters
Voltage stabilisers

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