



Product Description

SitePro

Models: 10 - 500 kVA / Series 6

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1. INTRODUCTION

SitePro family is an Uninterruptible Power Supply (UPS) designed to meet highest requirements concerning reliability and quality of electrical energy supply even in the most demanding applications.

The **SitePro** UPS are based on double conversion technology and are "true On-line" or "continuous operation" UPS with integrated output transformer for galvanic isolation.

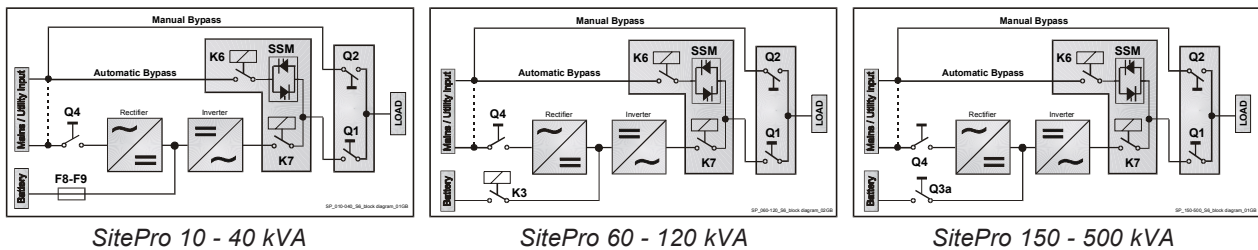
The new term "VFI" (Voltage & Frequency Independent) applies for this concept, where the AC input voltage is first converted to DC voltage, also used to charge the battery, and then re-converted to AC voltage to supply the load.

This design and product topology is recognized as the only one able to reach the highest requirements of power reliability for critical applications.

High output power quality, excellent behavior with dynamic load variations, "zero" interruption transfer time, adequate overvoltage protection and filtering are some of the most important features of this kind of UPS.

Thanks to RPA (Redundant Parallel Architecture) the system power can be expanded by paralleling units or the system reliability can be increased by adding redundant units.

The double conversion static UPS system **SitePro** consists of the following main building blocks:



Rectifier/Charger

The rectifier converts the 3-phase mains input voltage into a controlled and regulated DC-voltage in order to supply the inverter and charge the battery.

The standard version employs software control to limit rectifier start-up current and voltage (soft start procedure).

Inverter

Converts the DC-voltage into 3-phase alternating voltage with constant amplitude and stable frequency.

Thanks to the inverter and its output transformer, the output voltage is unaffected by mains disturbances or mains failure. The **SitePro** uses an IGBT based inverter with SVM (Space Vector Modulation) regulation to achieve extremely high efficiency even at partial load conditions and extremely low distortion in case of non-linear load conditions.

Electronic bypass

Serves to temporarily transfer the load automatically and interruption-free to mains in case of overload or inverter failures conditions. In the case of an overload, the load will automatically be re-transferred to the inverter after an adjustable time interval.

Maintenance bypass

Serves to transfer the load interruption-free to mains for maintenance purposes.

Battery

The battery is used to supply the inverter with energy in case of mains failures.

It is normally selected to supply the inverter at rated load during the required back-up time.



2. SINGLE UPS

2.1 Principles of Operation

To ensure an uninterrupted supply of the load under all operating conditions, the standard **SitePro** UPS already offers four different operating modes!

Additionally to the primary AC / DC / AC energy supply, connected batteries and a static bypass offer two more possibilities to assure energy to the critical load.

The fact of having multiple energy sources for the load greatly increases the load's reliability and introduces also the concept of redundancy.

This, for the S (single) model internal, redundancy concept, will be emphasized when the Redundant Parallel Architecture (RPA) configuration is discussed.

Transfer from one operating mode to another takes place interruption-free for the load.

SitePro offers all the following operating modes as a standard:

- Normal mode (On-line mode)
- Battery mode
- Bypass mode
- Maintenance bypass mode

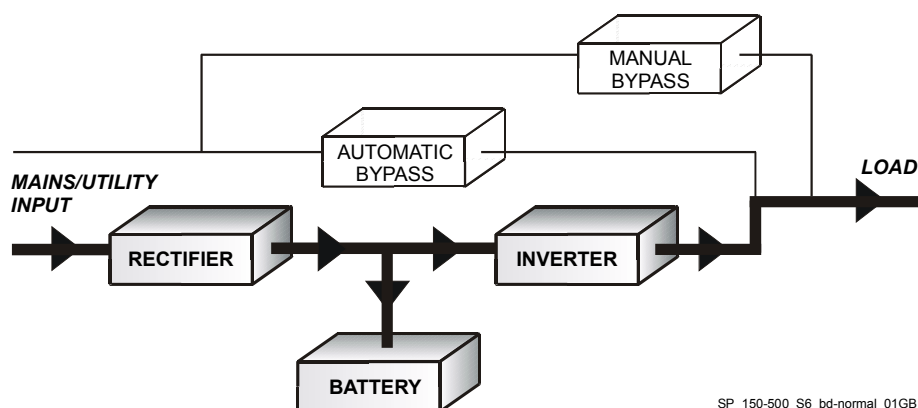
2.2 Normal operation mode (On-line mode)

During normal in operation, the rectifier converts input AC power to DC.

The DC power provides input power for the inverter and charging power for the battery.

The inverter converts the DC power to continuous and regulated AC power, which supplies the critical load.

The control panel reports the battery charge status and the expected backup time with the actual load.



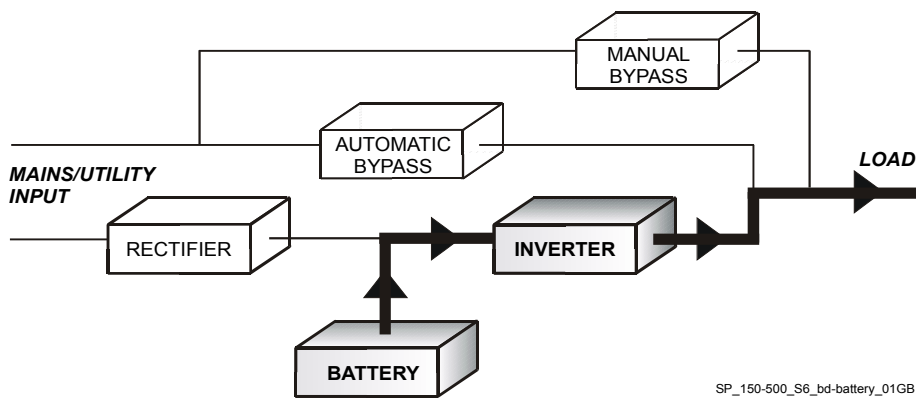
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2.3 Battery Mode (Utility failure condition)

In the event of a utility failure, the DC power to the inverter will be provided by the battery in order to maintain a continuous AC power to the load for the specified time at the rated load (or longer at a reduced load), until the battery voltage reaches the lower limit of the inverter operation capability.

During the discharge, the LCD screen displays the estimated time the battery can support the critical load.

Prior to the battery completely discharging, the alarm “**Stop operation**” (load shutdown imminent) warns the operator that the battery is almost discharged and the UPS is about to shut down. “Stop Operation” time activation is settable.



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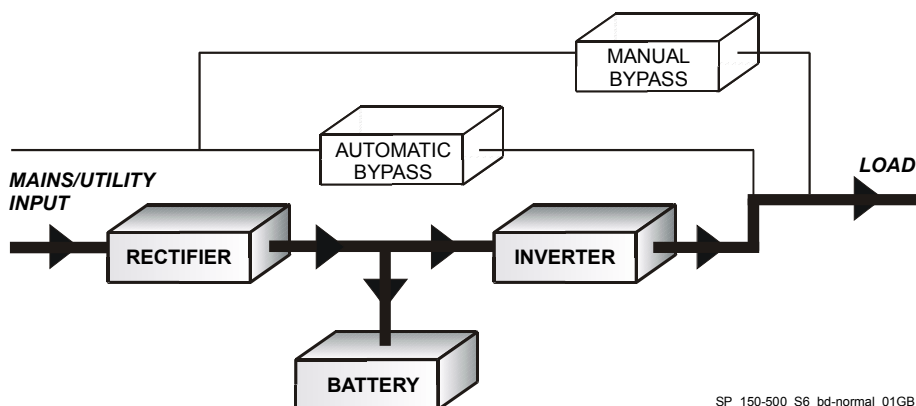
2.4 Utility recovery operation

The load is powered from the battery if the utility power does not conform to the specified parameters.

As soon as the AC input power recovers, the rectifier starts up automatically (soft-start) supplying the DC power and recharging the battery.

During utility mains recovery, in case a utility power failure is major than the back-up time, the battery is recharged enough to ensure a minimum time of operation with the present load, the inverter starts automatically and the load will be transferred from the static bypass back to the inverter (normal mode).

No additional operations are necessary.



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2.5 Bypass mode

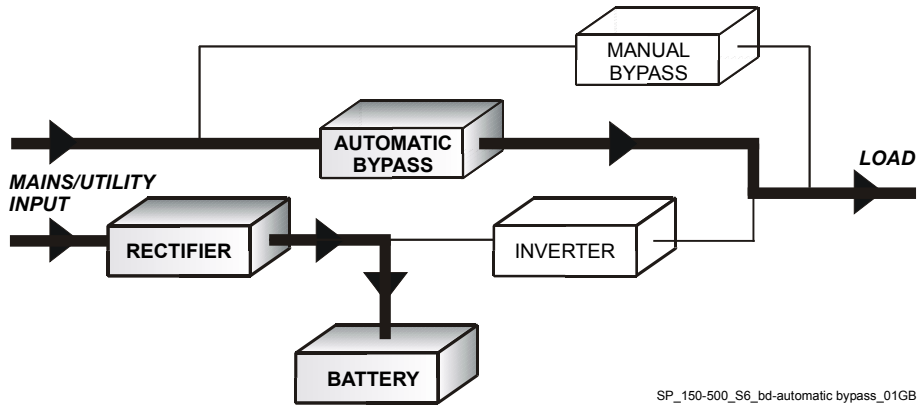
In normal operation, the load is permanently supplied by the inverter.

When the control system detects a fault in the inverter, an overload, overtemperature or a short-circuit condition, the static switch transfers the critical load to the utility without interruption.

When the inverter recovers, or the overload, overtemperature or short-circuit condition is corrected, the load will be transferred automatically back to the inverter interruption-free.

If the UPS is transferred to bypass mode for maintenance purpose, any an alarm condition is notified, however, if the UPS is unable to return to normal mode following an automatic transfer to bypass mode, an alarm is activated.

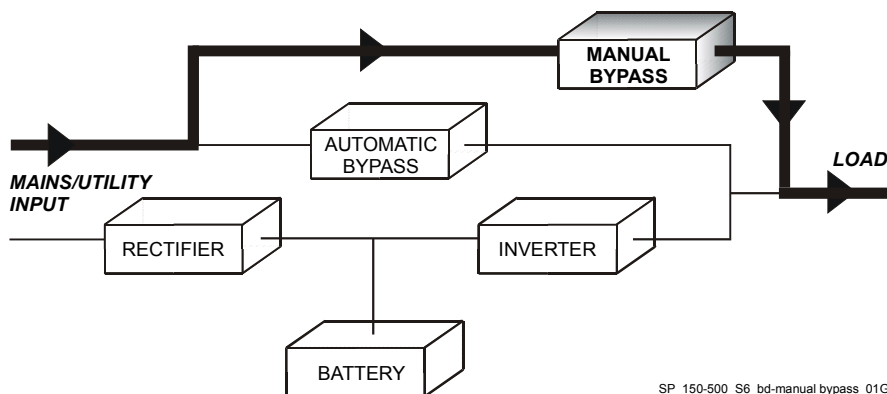
The admissible transfer time is settable.



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2.6 Maintenance mode

The maintenance bypass circuit consist of two manual Switches, which permits, for maintenance purposes, to transfer of the load directly to the unconditioned AC power without interruption.



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3. REDUNDANT PARALLEL ARCHITECTURE (RPA)

Whenever **SitePro** UPS are applied in Mission Critical Applications, a single unit protection is no longer sufficient.

To respond to this requirement for the highest level of reliability, GE developed a redundant-parallel system, known as RPA (Redundant Parallel Architecture), an GE exclusivity.

To achieve highest levels of reliability, two or more SitePro are linked in a peer-to-peer configuration, concurrently supplying the load.

Thanks to the total modularity of RPA, the system can be easily expanded to higher power or higher redundancy levels at any time under full working conditions.

3.1 Principles of a RPA based redundant-parallel system

RPA (Redundant Parallel Architecture) is a unique system to provide highest power reliability, respecting the reflections, patterns and standards as defined by the relevant industries for mission critical applications for the technical term “redundancy”.

Fundamental elements to the term “redundancy” are:

- No single failure point
- Fault tolerance - means the system can accept any type of one single failure without any influence to the critical function – in UPS applications this means to accept any event from a simple fuse failure to the failure of an entire inverter without any influence to the load.
- Error masking – error isolation and error removal under active load conditions.
- Restore full operating condition without by-pass operation for the critical load.

To comply with term “redundancy”, a UPS system generally needs to be designed as follows:

- Decentralized by-pass concept.
- Decentralized control electronics.
- Redundant (n+1) operation and control for critical functions as “Synchronization” and “Bypass operation”.
- Redundant communication link between individual units.

Note: not every parallel UPS is a redundant UPS; some UPS manufacturers honestly disclose this difference, some promote parallel UPS as “redundant”, without respecting the above rules!

3.2 Redundant control electronic

Each individual unit has its own operation controller (Microprocessor) for redundant-parallel operation. When active, all controllers continuously intercommunicate in order to manage the entire system in a democratic way.

Example:

If, in a RPA system of 3 UPS “A”, “B”, “C”, unit “A” detects a utility failure and “B” and “C” cannot “see” this failure, “A” will be isolated and it’s functions will be managed by the two remaining units as long as there is no immediate risk for the critical load RPA does not have any “Master-Slave” condition.



3.3 Load sharing

The RPA operation controller is the supervisor to monitor the equal load distribution on each UPS. It does this by separately regulating the power exchange (which must be as near as possible to zero) between each single installation.

To achieve this, the RPA operation circuitry engages in continuous calculation of an index value, defined by the sum of the measured values of all the single installations divided by the number of units active. This index value is then passed to the individual units as a reference parameter for the regulation of the inverter.

Due to the extremely precise synchronization (see below), the load sharing follows physical rules in a natural (and dynamic) way, the need to intercept for the controller is therefore almost not existent.

3.4 Synchronization

The most important feature of the RPA operation is to ensure the synchronization of the entire system – on one hand between all RPA UPS's and on the other hand via the bypass's to utility. With advanced signal elaboration and enhanced high precision tracking, RPA reaches the highest precision in synchronization in the industry.

The unique precision of 0.05 milliseconds between units allows a high speed, voltage based, load sharing.

3.5 Redundancy to the Max!

With RPA, principally all modules as rectifier, inverter, bypass, controllers and communications are redundant. There are no single failure points, centralized elements or Master-Slave situations.

3.6 Failure handling

RPA is able to keep a single unit isolated in the event of disturbances in the redundant-parallel system. In this case, the RPA logic of the affected unit will communicate the "problem" to the shared system information. If necessary, RPA will automatically "isolate" the affected unit until the problem is solved.

The level of isolation is defined by system parameters, the goal to keep the load UPS protected as long as possible, has the highest importance.

As a consequence, an affected unit may be managed by the system and continue to work in RPA or it may be totally excluded from the process.

For example: the measured values received from a "isolated" UPS are not taken into account when the index value for the load sharing is calculated.

As long as the output of the remaining UPS's is enough to supply the load, RPA will remain active and feed the load via the inverters. It may be, the remaining inverters are no longer able to provide "redundancy", in this case RPA acts as "parallel" system. In case the available power is insufficient (overload condition), RPA will switch all units to bypass mode.

3.7 RPA Summary

Redundant Inverters: RPA sustains the load as long as possible via the paralleled inverters of the **true On-line** individual units. If one or more single units suffer a disturbance, the then parallel system only switches to "bypass" mode when the total power of all the available inverters is no longer sufficient to sustain the load in "On-line" mode.

Decentralized Bypass and redundant control: Even at full load the static bypass of a single installation can fail without jeopardizing the power supply of the load.

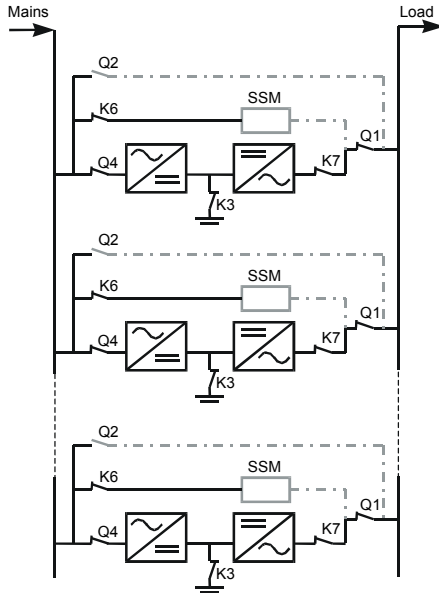
Redundant Microprocessors: Due to multiple redundancy and shared tasks there is no common point of failure or bottleneck.

4. RPA operating modes

In order to ensure no-break power supply under all operating conditions, the RPA system has several operating modes.

Transfers from one mode to the other are performed without interruption for the load.

4.1 On-line mode



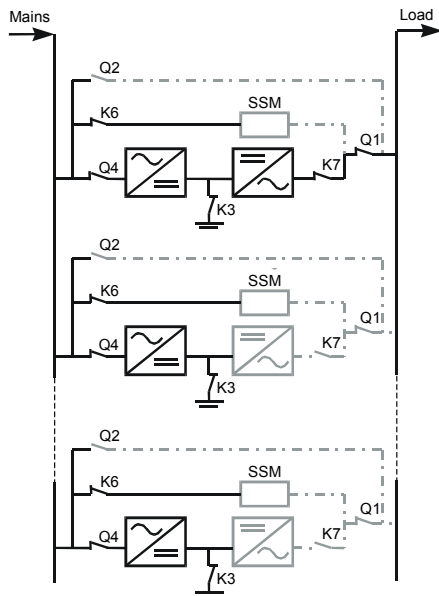
When the system is in On-line mode, all the rectifiers as well as all the inverters of the installation are operating.

The utility supplies the parallel-connected rectifiers.

Each rectifier supply both battery and inverter by converting the utility AC voltage into a DC voltage.

The load is equally shared by all the inverters.

4.2 Intelligent Energy Management (IEM)



IEM is an award winning software package, which allows RPA systems to save energy during low load conditions.

Individual inverters, which are not required to sustain the load, can **automatically** be switched off to save energy.

Depending on load level, inverters are switched off **cyclically**, so that every UPS has the same amount of operating hours over a period of time.

The load is sustained by the remaining inverters.

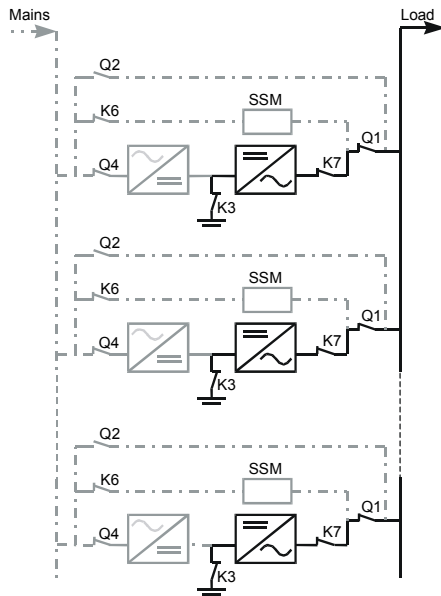
Furthermore, the customer can define if the rectifiers remain operational to charge the batteries on those installations that have their inverters switched off or if the rectifiers are switched off.

Customer set-up will define, after how long or at what battery voltage level the rectifier will be switched on again.

The IEM mode can be freely programmed and the customer defines the degree of redundancy (i.e. security) required in a given situation.

The reaction of the system in case of problems can also be selected (what must the system do in case for ex. of utility failure?)

4.3 Battery mode



A utility failure will trigger “Battery Mode”.

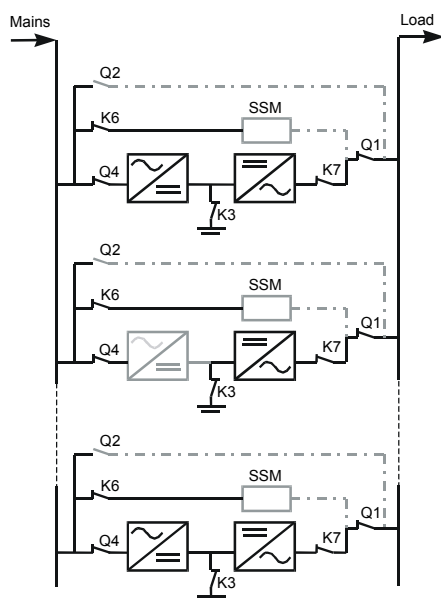
The rectifiers do not supply any energy.
The batteries supply the inverters with the required energy.

If the utility does not recover and the batteries are used up, the load will be cut off.

In this situation, when the utility recovers, the load will be supplied by the parallel bypass.,

For security reasons, the inverters will have to be switched on manually.

4.4 Rectifier failure

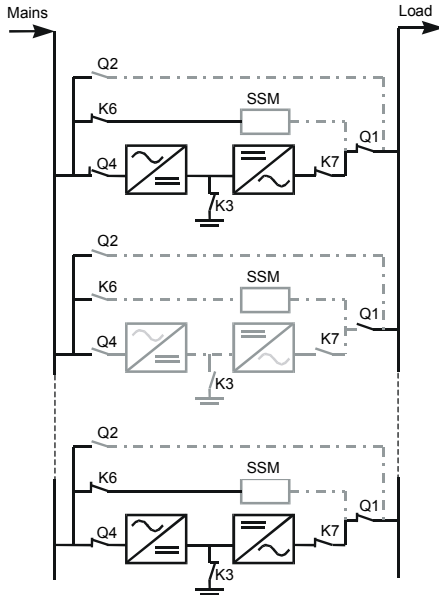


In case the rectifier fails the batteries supply the inverter with the required energy.

In case the utility is not available and the batteries are used up, the inverter will be switched off.

In a redundant parallel system the other units will continue to supply the load.

4.5 Inverter disturbance



“Inverter disturbance mode” is triggered by a disturbance in one or more inverters.

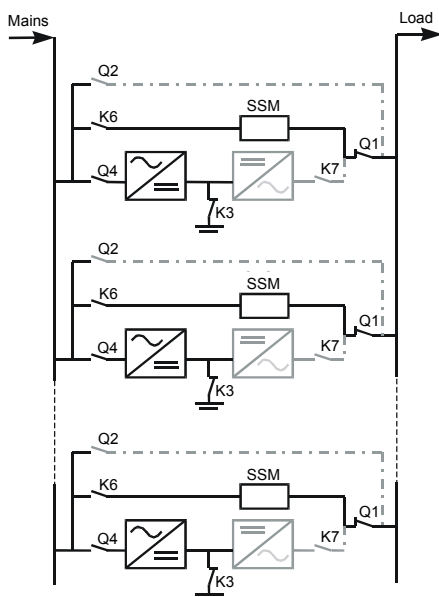
As long as the output of the remaining single units is sufficient to sustain the load, RPA remains in on-line mode – but the system may become “parallel” and is no longer “redundant”.

The inverter output contactor (K7) of the disturbed unit opens automatically to isolate the disturbed unit from the load.

The rectifiers of the disturbed units, depending on the nature of the disturbance, will continue to charge the batteries.

The disturbed units can also be completely separated from the utility and from the load, as illustrated, to enable repair work to be carried out.

4.6 Bypass mode



“Bypass mode” is triggered when all the available inverters are unable to sustain the load (e.g. in the case of disturbance of several inverters or severe overload).

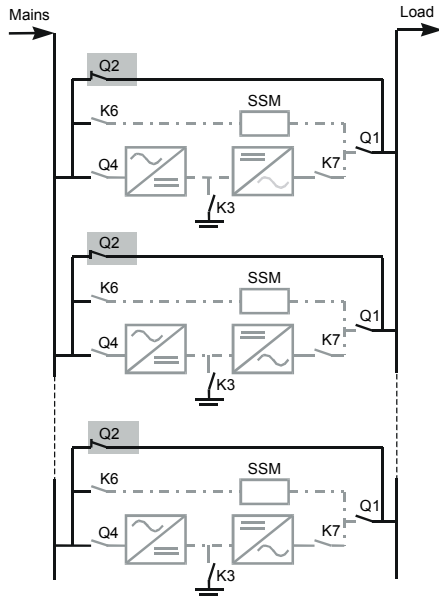
If the load exceeds 110% of the sum of the rated outputs of all inverters, the load will be sustained directly from the utility via the static bypasses.

All inverter output contactors (K7) are opened automatically and the inverters, depending on the type of disturbance, continue to operate and the rectifiers continue to charge the batteries.

If the load level once again returns below 100% of the sum of the outputs of all the available inverters, RPA will close all K7 and automatically switches back to “On-line mode”.



4.7 Maintenance bypass mode



The “maintenance bypass mode” is used in case, all units are switched off and the system output has to remain powered.

One maintenance bypass for each UPS

The subcomponents of each UPS can be made voltage free.

During this mode of operation the load is not protected.



5. OPTIONS

A wide range of options, makes **SitePro** model ready to fulfill all kind of needs.

5.1 RPA configuration

This option allows to connect up to 8 units in parallel operation.

For each unit to be connected in parallel with an other unit, a RPA kit is required.

The RPA option provides high reliability by creating a redundant system; even the bypass circuit is redundant. Another reason to parallel two or more UPSs can be the need for higher output power.

5.2 Rectifier and/or bypass input transformer

Input transformer for galvanic isolation of the mains, the DC circuit and/or the bypass.

5.3 Voltage adapting in/out (auto)transformer

Transformer to adapt the input/output voltage to customer utility/load requests.

5.4 Input filter for 5th harmonic

The Input filter 5th harmonic is used for reducing the 5th harmonic generated by the rectifier.

Thanks to this filter the total amount of THD (current) is less than 10%, in addition the input power factor is 0.9.

The input filter 5th harmonic is activated when the UPS load achieve 50% (adjustable depending of the customer needs/configuration).

(Not available for **SitePro** 400-500 kVA because this units are equipped already with 12 pulse rectifier as standard).

5.5 12 pulse rectifier with or without galvanic isolation

12 pulse rectifier (with or without galvanic isolation) in order to reduce the input THD <9.4%.

(The **SitePro** 400 - 500 kVA units have 12 pulse rectifiers without galvanic separation as standard).

5.6 DCU (Distortion Control Unit)

The DCU is used to eliminate the above mentioned harmonics generated by the rectifier.

Thanks to the DCU, the total amount of THD (current) is less than 5%, in addition the input power factor is 0.98.

The DCU is activated in two steps: first when the UPS load achieve 50% (adjustable depending of the customer needs/configuration), second when the UPS load achieve 75% (adjustable depending of the customer needs / configuration).

5.7 Battery cabinets

Matching battery cabinets with variable shelves.

5.8 Battery fuses

Battery fuses in battery cabinet or in a separate box for wall mounting.



5.9 RPA Power distribution cabinet

Output centralized maintenance bypass and parallel cabinets for RPA configuration.

5.10 Top cable entry box (*SitePro* 60 - 120 kVA only)

When a cable entry from top is required this additional box allowed this possibility.

5.11 Special cabinets colour

All colours are at your disposal to satisfy your requests.

5.12 Remote signalling box

Remote signalling box equipped with: synoptic diagram, alarm reset and lamp test keys.
Cable connection to UPS not included.