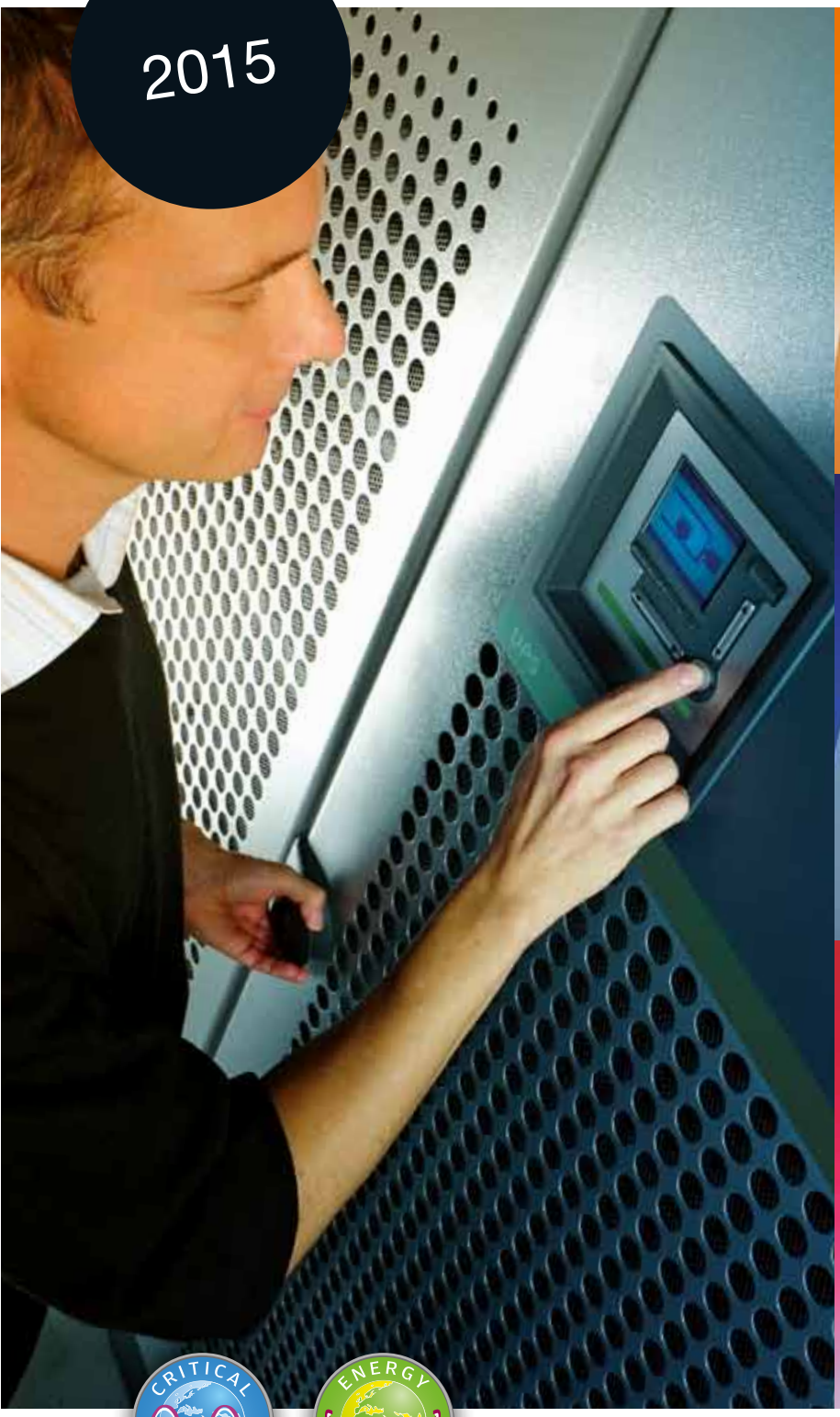
PRODUCT TECHNICAL GUIDE

UPS and Critical Power Solutions

2015



CRITICAL POWER

ENERGY EFFICIENCY

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Innovative Power Solutions

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The system setup

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1. POWER QUALITY ISSUES AND SOLUTIONS

It goes without saying that in order for power to be used by the load, it must be present. A less obvious concept is that the power must have characteristics that make it ideal for use, e.g. it must fall within the tolerances permitted by the electric load or utility.

The concept of Power Quality (PQ) is, therefore, the set of limits which make energy useable and, consequently, the branch of study which defines assessment criteria and methods of measurement, in addition to analysing causes and proposing solutions.

The concept of PQ is not absolute, but always depends on the energy load. For example, in general terms, it can be stated that IT equipment has more stringent PQ requirements than a motor for industrial applications. Normally, PQ requirements and the measures for achieving them, depend on techno-economical considerations and compromises.

Loads, in addition to being sensitive to poor-quality power, are often also the cause of power quality issues. The diffusion of non-linear loads (typically electronic equipment) and the connection of large utilities on weak lines are just some of the many causes. Another cause is atmospheric phenomena.

The most common disturbances that adversely affect the operation of a component or an electrical utility are:

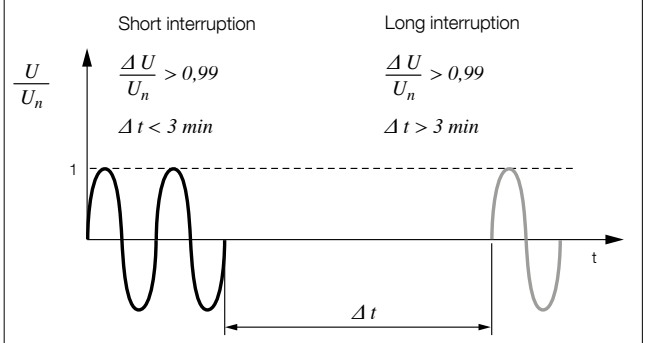
- power sags or outages due to network faults
- short voltage variations due to the connection of heavy loads or the presence of faults in the network
- distortion of currents and voltages due to non-linear loads present in the system or in the systems of other utilities, etc.
- flicker due to large intermittent loads
- asymmetry in the supply voltage system

1.1. Power interruptions and voltage dips

All elements in an electrical system are sensitive, in different ways, to power dips or interruptions.

Long interruptions are the result of permanent faults which occur in public distribution networks or within the user's system. The duration may vary from a few minutes to several hours in the most critical cases. By contrast, micro-interruptions are linked to faults which occur in the distributor's networks and normally last for less than a second.

1.1-1 Accidental power interruptions.



1.2. Voltage and current distortions

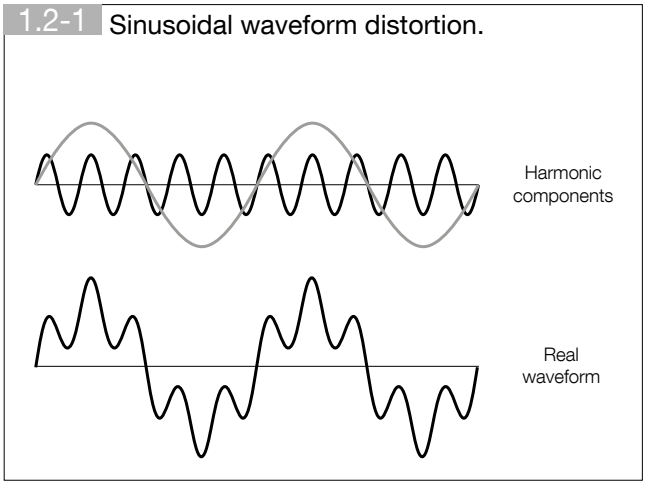
Waveform distortions are mainly caused by non-linear loads which, even if powered using sinusoidal voltages, draw highly distorted currents.

Typical non-linear loads include:

- devices which perform AC/DC and DC/AC conversions (present in all electronic power supplies, for example computers)
- fluorescent lamps
- electric soldering irons
- arc furnaces (also responsible for flicker)
- electrical drives

Any periodic waveform can be represented through Fourier series analysis by a fundamental sinewave and by sinusoidal components of varying amplitude and with multiple frequencies, known as harmonics (Figure 1.2-1).

1.2-1 Sinusoidal waveform distortion.



Harmonic currents circulating in the network cause voltage drops of the same order of magnitude and depending on the line impedance, with resulting voltage distortion.

This means that the magnitude of the disturbance caused at each point of the system (both the user and at the point of delivery) depends not only on the characteristics of the load, but also on the characteristics of the plant itself. All electrical components are affected by waveform distortion.

Harmonic distortion is also known as THD (total harmonic distortion).

The negative consequences of harmonics generally include thermal overloading and sometimes dielectric problems (which can occur in power-factor correction batteries, for example).

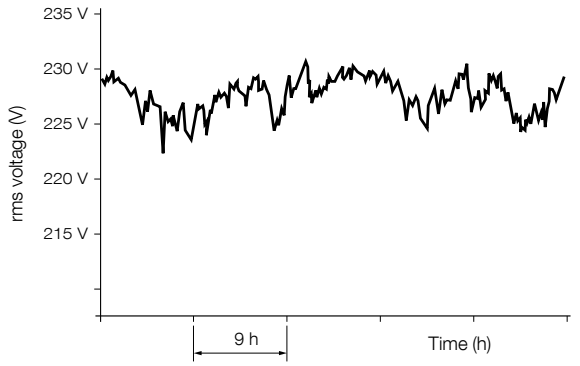
Harmonics typically increase the risk of overheating in system components or nuisance trips.

1.3. Flicker

The connection and disconnection of loads in an electrical system generate rapid and repetitive voltage variations. In particular, certain types of consumers such as arc furnaces and soldering irons draw current in an irregular and variable manner during their operating cycle, giving rise to *flicker*.

Loads which are most sensitive to voltage fluctuations are incandescent lamps, as the flicker produced by variations in light flow can cause irritation to those who use them.

1.3-1 Example of fluctuations of voltage RMS value



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1.4. Voltage asymmetry

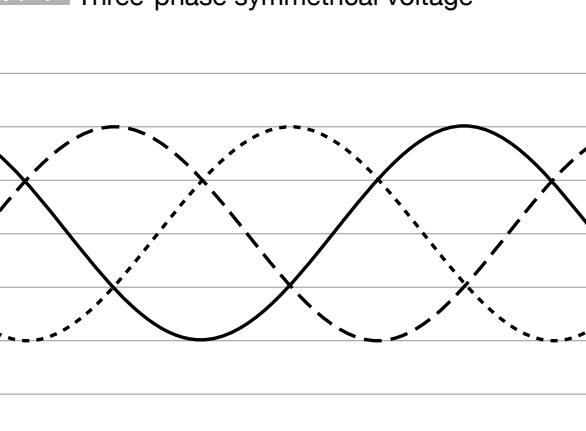
There are two main causes for asymmetry in the supply voltage system, with the first one being most prevalent:

- Presence of highly unbalanced loads supplied from the same line. This includes high-power single-phase loads which in certain cases may also be intermittent (e.g. high-power single-phase soldering irons). The severity of this phenomenon increases in proportion to the degree of load imbalance and the impedance of the power supply line (length, diameter). The worst affected loads are those located near to or downstream of the unbalanced load.
- Asymmetrical impedance of the power line. This problem is significant in the case of long backbone lines with no transpositions between the conductors along the route.

Asymmetrical voltage can create problems especially in rotating synchronous and asynchronous machines such as, for example, overheating windings, reduced starting torque and vibrations.

In general, even the nominal power of the transformers and the cable ratings are reduced in the case of significant asymmetry.

1.4-1 Three-phase symmetrical voltage



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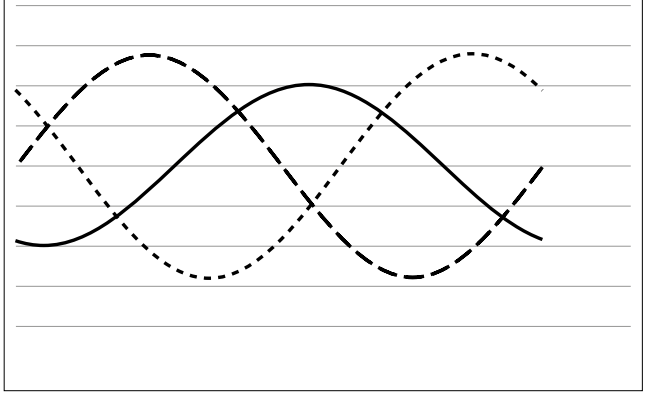
In fact, the operating limit of these components is determined by the effective value of the total current which, in the case of imbalance, also consists of non-direct sequence currents. This fact must also be taken into account when adjusting the trip thresholds of protection devices which are sensitive to the total current.

1.4-2 Three-phase asymmetrical voltage



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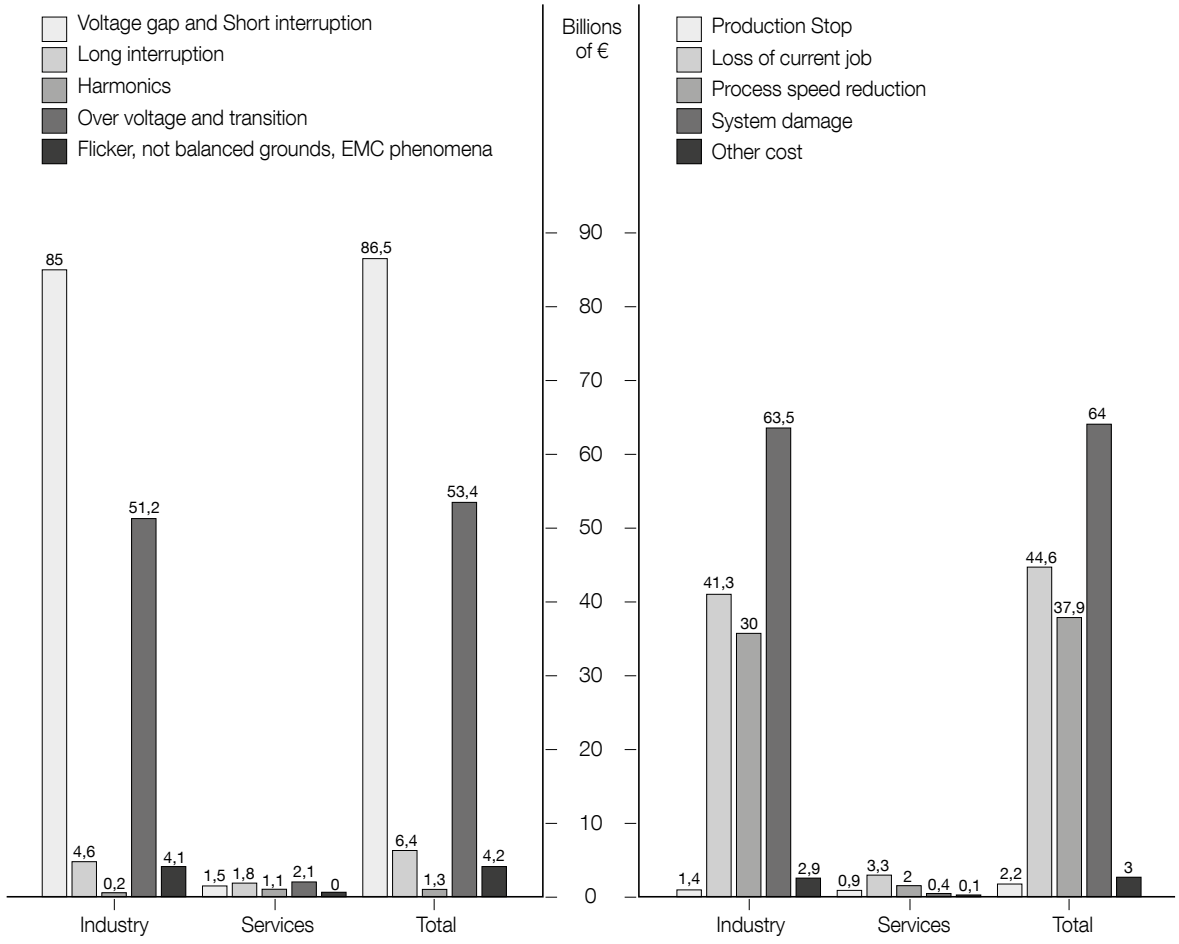
1.5. Costs of poor-quality power

The following estimated costs of poor power quality are provided for indication purposes (source: LPQI).

1.5-1 Power quality costs in Europe (billions of €)



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2. ELECTRICAL POWER AVAILABILITY

2.1. Definition

The general concept of availability (A) refers to the length of time that a system is able to perform its intended function.

Normally, availability is indicated as a value per unit or as a percentage of the system's total lifespan.

Electrical power availability refers to the length of time a load is supplied with high-quality power. More intuitively, it is the length of time the power distribution system performs its intended function without interruptions due to breakdown or [routine] maintenance. In information technology terms, this concept is known as 'uptime' and is the opposite of downtime, e.g. periods when a system is unavailable.

The mathematical definition of availability is:

$$A = \frac{MTBF}{MTBF + MTTR} = 1 - \frac{MTTR}{MTBF + MTTR} \cong 1 - \frac{MTTR}{MTBF}$$

All parameters involved are statistical and describe:

- MTBF: mean time between failure;
- MTTR: mean time to repair.

The approximation derives from the fact that, due to the intrinsic characteristics of standard-compliant power supply systems, MTTR is at least two orders of magnitude less than MTBF.

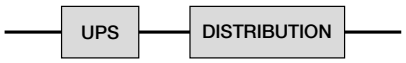
Availability is always less than 1 or at 100% and is always expressed in nines (99.99..%)

It is self-evident that the availability of an electrical power supply depends on the availability of its constituent components: distribution network, transformers, lines or cables, protection devices, UPS, generator sets, etc.

2.2. Availability of parallel or series systems

Below are three examples for comparing availability based on the different topologies. For simplicity, the availability value of both the source and the load are the same and are equal to 0.998.

2.2-1 Single source with single distribution



$A_{tot} = A*A \cong 0.996004$

Statistical annual downtime: 35 hours.

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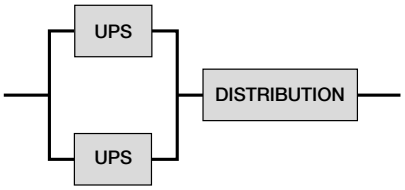
2.2-2 Double source with single distribution



$A_{tot} = A^2 (2\text{-}A) \cong 0.997996$

Statistical annual downtime: 17 hours.

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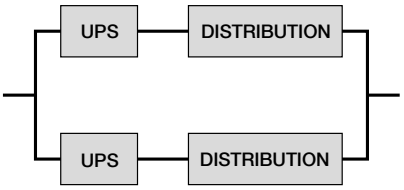
2.2-3 Double source with double distribution



$A_{tot} = A^2 (2\text{- }A2) \cong 0.999984$

Statistical annual downtime: 8 minutes.

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2.3. Importance of topology

Topology is fundamental. This is demonstrated not only by the previous example but by experience. Human error, fire and flooding are just some of the possible causes of physical damage to equipment. You can imagine the consequences of having two redundant UPS systems installed in the same equipment room or two distribution lines in the same channels or conduits: a vital and expensive redundancy system would be at serious risk due to physical causes.

In view of technical and economic considerations, it is advisable not only to ensure redundancy of the various systems, but also to physically separate them.

3. STATIC UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEMS

3.1. Definition

Uninterruptible power systems, perhaps more commonly known as UPS, primarily consist of an energy storage system in various forms, on the basis of which an initial classification can be made, and a system for converting this into power.

In a static UPS, energy is stored in an electrochemical form in either special storage batteries or in kinetic form, using flywheels, and reconverted into the desired form using static electronic converters.

In dynamic UPS systems, energy storage is exclusively in kinetic form, and uses a rotary generator for reconversion.

3.2. Types

The standard EN 62040-3 was developed in response to the need to classify the various types of static UPS systems currently available on the market. It distinguishes between three major product families, according to the internal schemes adopted:

- VFD - passive standby;
- VI - line-interactive;
- VFI - double conversion.

3.2.1. Passive Standby

Utilities are normally powered by the mains supply. At the same time, the mains power supply also supplies the battery charger, which maintains the storage batteries at the maximum load level.

In the event of power loss, a solid-state or electromechanical commutator transfers the load to the inverter, which now activates, supported by the batteries. This mode of functioning continues until ordinary mains power conditions are restored or until the stored energy is exhausted.

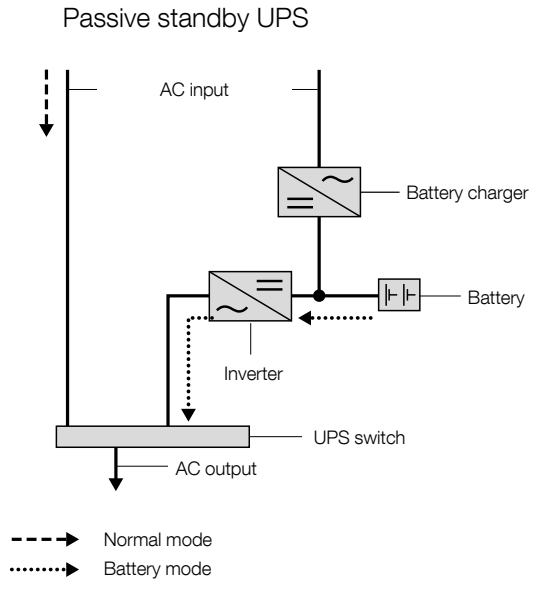
The merits of this solution are essentially in its simple design, which helps to contain the cost of the equipment.

Being the least expensive option, this type of UPS offers extremely limited performance, e.g:

- no decoupling between the upstream distribution system and the load;
- switching times of approximately 10 milliseconds, which are not always compatible with the loads needs;
- no system for regulating the output frequency;

Because of these disadvantages, UPS systems in this category are now used only for loads with low power ratings, typically up to 2kVA.

3.2-1 Operation of passive standby UPS



3.2.2. Line-Interactive

This configuration is characterised by the presence of a reversible AC/DC converter which can function both as an inverter and as a battery charger. In ordinary conditions, the load is supplied by the mains power supply through a solid-state breaker, which allows isolation of the system when the inverter is activated, preventing power from being fed back to the mains power supply. The voltage supplied to the load is conditioned by an AVR autotransformer (Automatic Voltage Regulator). In contrast to a passive-standby system, a line-interactive UPS system operates when mains power is available. Owing to its position in parallel with the ordinary power supply line, it guarantees a certain improvement in voltage quality, although this is limited to aspects such as magnitude fluctuations.

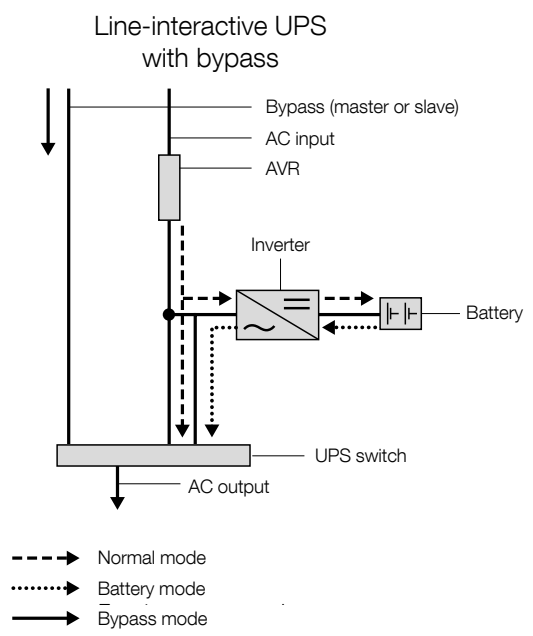
If the mains power is lost, the solid-state breaker is opened automatically, and the load is powered exclusively by the battery

- inverter unit, until ordinary conditions are restored or until the storage batteries are exhausted.

Compared to passive-standby systems, line-interactive UPS provide better waveform conditioning, but with some drawbacks:

- no decoupling between the upstream distribution system and the load;
- no system for regulating the output frequency;
- switching times of a few milliseconds (4-5 ms).

3.2-2 Operation of line-interactive UPS with bypass



3.2.3. Double conversion

Unlike the configurations considered above, double-conversion UPS systems constitute true electric generators that are completely isolated - with few exceptions - from the mains network, in which power is supplied by the mains network itself. Since the power to the load is transformed solely by the UPS inverter, without any interaction with the mains network and regardless of whether the power originates from the mains supply or the battery, it is possible to fully exploit the versatility of the static converter, which is able to manipulate the voltage supplied to the load under any condition. In fact, based on the direct current supplied from other components of the UPS such as the rectifier or battery, the inverter control system ensures an output waveform which is totally independent of the input waveform, with an undistorted frequency and amplitude.

The advantages of this type of UPS system are numerous:

- isolation of loads from the upstream distribution network (thereby allowing for precise regulation of the output frequency)
- very wide input voltage tolerance
- instantaneous switching between mains power and battery (more a case of seamless transfer than switching)
- no-break transfer to bypass mode

The efficiency of double conversion UPS, typically 90-96%, is less than that of a *line-interactive* or *passive-standby* system, since the current supplied by the mains power is converted twice by a rectifier and an inverter, each of which are equipped with semiconductors (diodes, SCR, IGBT), which are prone to conduction and commutation losses. Nevertheless, the advantages of maximum-quality power obtained using a double-conversion system compensate for the losses which would otherwise occur on the cables and switches as a result of harmonics or other power quality issues. It is the recommended and most widely used technology for applications with a power rating of 5 kVA or higher.

3.2.4. Classification in accordance with EN 62040-3

In addition to the technology, the EN 62040-3 standard classifies UPS systems according to the output waveform and voltage drops, both in clearly defined switching conditions.

Standard EN 62040-3 table D.1 - Type of UPS, additional characteristics and system requirements

a) single

b) multi-module

c) bypass to primary power or backup power

d) AC generator backup power system (if applicable)

e) bypass transfer time (if applicable)

f) galvanic separation between input and/or DC connection and/or output

g) earthing of the input and/or DC connection and/or output

h) bypass circuits for maintenance and other installation requirements, such as UPS disconnectors and connection switches

i) compatibility with the existing power system (for example according to IEC 60364-4)

j) remote shutdown or emergency power-off (EPO) device

3.3. Double conversion UPS functional modules

3.3.1. Rectifier

When mains power is available, the rectifier converts alternating voltage into direct voltage (AC/DC converter) to power the DC bus.

Different types of rectifier are available according to the electronic components used, the topology and the control system.

The quality of the rectifier is determined by three parameters, namely:

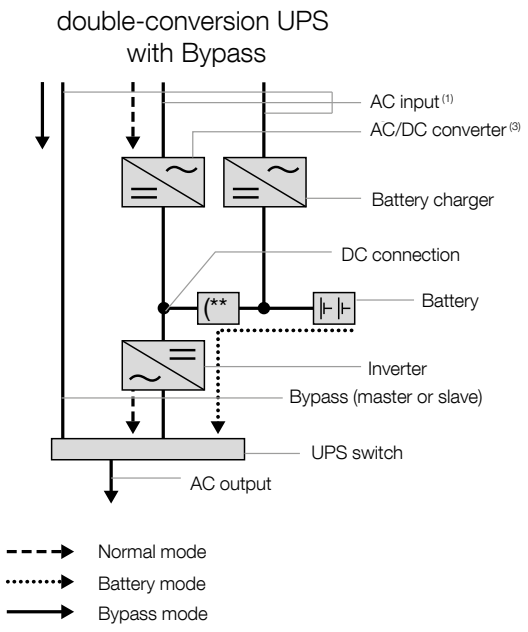
- conversion efficiency;
- input frequency and voltage tolerances;
- input power factor
- generation of harmonics to the mains.

The most widespread types of rectifier and the typical harmonic content of three-phase current absorbed by the mains are:

- 6-pulse SCR: 32%
- 12-pulse SCR: 12%
- Boost: 27%
- Inverter: 4%

From the DC side, the battery charger is unable to supply perfect direct voltage due to residual ripple which causes premature ageing of the batteries.

3.3-1 Operation of double-conversion UPS



(1) AC input can be combined.

(2) Blocking diode or switch.

(3) The converter could be a rectifier, a phase shift rectifier or a mix of rectifier and DC/DC converter.

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3.3.2. DC bus

The DC bus is the part of the UPS power circuit in DC voltage.

A high-quality automatic bypass typically has a wide range of tolerable DC voltages: it therefore provides greater flexibility in the number of batteries based on the required back-up time.

3.3.3. Battery charger

The battery charger is the DC/DC converter which decouples the battery voltage from the DC bus voltage.

The advantage of this is twofold:

- the battery voltage is independent of the DC bus voltage;
- elimination of output *ripple* from the rectifier

3.3.4. Inverter

Converts direct current from the rectifier into sinewave current of perfectly stable magnitude and frequency. The inverter is therefore a DC/AC converter.

The quality of the rectifier is determined by three parameters, namely:

- conversion efficiency;
- ability to supply leading power factor loads;
- ability to withstand overloads and short-circuits;
- quality of the voltage waveform in the presence of distorting loads.

3.3.5. Transformers

The transformer is not an obligatory component and is the source of an informal classification which divides UPS systems into "*trafoless*" (transformer-less) and "trafo" systems It is necessary to determine whether the transformer is present as a functional component of the UPS system or whether its purpose is to manage the neutral.

In UPS units with a transformer on the inverter output, the output neutral, when available, is bonded to the bypass neutral downstream of the transformer, whereas in *trafoless* systems, the rectifier neutral and bypass neutral are common even inside the unit.

The insertion of a transformer on the static UPS line guarantees the galvanic isolation of the system and a single neutral system downstream of the UPS, in any operating condition.

In any case, it it important to bear in mind that the built-in UPS transformer does not permit the neutral state to be changed.

Advantages of *trafo* technology compared to *trafoless* technology:

- high short-circuit capacity, therefore greater flexibility in the choice of protection devices;
- no DC components in the output voltage.

Disadvantages of *trafo* technology compared to *trafoless* technology:

- higher weight;
- larger footprint.

In any case, technical and economic factors should be considered on a case-by-case basis, making selection straightforward and unambiguous.

3.3.6. Automatic bypass

Switches the UPS output to the auxiliary network in the event of an overload or fault in the inverter module.

The network bypass circuit is formed by a SCR module and directly connects the network with the load.

The quality of the automatic bypass is mainly determined by its ability to withstand overloads and short-circuits.

In the case of separate input power supplies, it's common to use a *bypass input* or *back-up input* (to distinguish it from the *rectifier input*), an input which is dedicated exclusively to the *bypass* with the aim of minimising the probability of the *rectifier supply* and *bypass supply* failing at the same time. The *bypass supply* can be a different power line to that of the *inverter input* or generator. If there is no separation of the power supplies, this is referred to as a *common input*.

3.3.7. Maintenance bypass

The manual or maintenance bypass module is not necessary for operation of the UPS and therefore it is not always supplied in the standard configuration.

The aim of this module is to enable routine or non-routine maintenance to be carried out without interrupting the power supply.

3.3.8. Storage systems

The storage system is the power source which supplies the inverter during a mains power outage, preventing power interruptions to the connected applications.

- Batteries.

  Batteries are the most common means of storing energy. They are electrochemical devices and are therefore sensitive to operating conditions: temperature, charge and discharge cycles. The most commonly used batteries for this purpose are sealed, lead-acid maintenance-free batteries, open-vented or nickel-cadmium.

  Battery performance is expressed in terms of design life and the type of discharge permitted. Excellent performance is provided by long-life batteries (10-12 years) with high-rate discharge.

  Battery life is theoretical. In practice, it depends on the charge/discharge cycles and the temperature of the place of installation.

  To illustrate how temperature affects battery life, EUROBAT (Association of European Storage Battery Manufacturers) states that the expected service life is halved for every 10°C above 25°C. This means that batteries with a "10-12 year" design life which are installed in places within an ambient temperature of 35°C or 45°C will last no longer than 5-6 years and 2.5-3 years respectively.

  The place where the batteries are installed must be equipped with adequate ventilation and air conditioning to guarantee the correct operation of the batteries and the safety of the installation. To this effect the following formula can be applied in accordance with Standard EN 50272, which aims to keep the concentration of hydrogen in the room below the threshold of 4%vol.

$$Q = v \cdot q \cdot s \cdot n \cdot I_{gas} \cdot C_{rt} \cdot 10^{-3} \; [m^3/h]$$

  where:

  Q = ventilation air flow in m^3/h

  v = necessary hydrogen dilution factor

  q = 0.42 x 10-3 m^3/Ah hydrogen generation

  s = 5, general safety factor

  n = number of battery cells

  I_{gas} = current producing gas expressed in mA/Ah of assigned capacity, for float charging current or for boost charging current

  C_{rt} = C10 capacity for lead-acid cells

  (Ah), Uf = 1.80 V/cell at 20°C or C5 for nickel-cadmium cells (Ah), Uf = 1.00 V/cell at 20°C.

  By combining the constants the formula is simplified to:

$$Q = 0.05 \cdot n \cdot I_{gas} \cdot C_{rt} \cdot 10^{-3} \; [m^3/h]$$

  Unless otherwise specified by the battery manufacturer:

I_{gas}	Open cells of lead-acid batteries	VRLA cells of lead-acid batteries	Open cells of nickel-cadmium batteries
During float charge	5	1	5
During boost charge	20	8	50

- Flywheels.

The flywheel is a system whereby energy is accumulated and stored in mechanical form. It can be as a replacement or supplement for a bank of conventional chemical batteries. Connected to the DC bus of UPS units, the flywheel delivers power and energy to the UPS when mains input power sags or is interrupted.

Two types of flywheel are commercially available: low-speed and high-speed.

	Low speed Flywheel	High speed Flywheel
Speed	8000 rpm	> 30000 rpm
Weight	1000 kg approx	200 kg approx
Footprint	High	Minimal
Storable energy	1-2 MW for 10-15 seconds	1 MW for 10-15 seconds
Charging	Minutes	Minutes
Maintenance	Frequent	Minimal

High-speed flywheels store kinetic energy in an ultra-fast, carbon/glass fibre composite rotor which rotates in a vacuum (integrated internal vacuum system). Due to an active magnetic levitation system that reduces friction, maintenance requirements are minimal and there are no mechanical bearings to replace.

Like a chemical battery bank, it receives recharge and float power from the DC bus and returns power whenever the DC bus voltage drops below a programmable threshold level.

The flywheel can eliminate the need for batteries by ensuring uninterrupted power

Protection against power micro-interruptions.

Flywheel and batteries can also be used simultaneously in UPS units, with the advantage of increased battery life. This is possible because the flywheel, in parallel with the batteries, ensures protection during brief interruptions, therefore preserving the capacity of the batteries for longer outages and improving their lifecycle.

The service life of flywheels is over four times longer than batteries. They are also stable, reliable and require minimal maintenance. Furthermore, unlike batteries, they are not subject to significant fluctuations in the cost of lead.

Control.

The brain of the UPS is its control system. The best architectures are based on digital signal processing (DSP) microprocessors which are able to perform complex calculations and algorithms. Architectures enable the machine to respond to different events and to report states and events via communication interfaces.

3.4. Backfeed protection

Backfeed protection prevents voltage from returning to the mains power supply. This issue is governed by standard EN 62040-1-1.

Backfeed protection is mandatory in fixed and mobile installations. In the case of fixed installations, the backfeed protection can be external to the UPS unit when indicated by a suitable warning label.

3.5. UPS sizing

Choosing the power rating of a UPS unit is a process which involves taking into account various elements, both functional and regulatory.

The main elements to be considered may include:

• two of the following parameters regarding the loads to be supplied:

- Active Power (P_{RL});
- Apparent Power (S_{RL});
- Power Factor (PF).

• type of load power supply (voltage, frequency, number of phases);

• load coincidence factor;

• required back-up time;

• type of mains power supply (voltage, frequency, number of phases).

In the event of a particular load, which for example requires a high inrush current, this current value must be taken into account. Once the following parameters are known:

• $\hat{I}_{UPS}$ - maximum current of the UPS;

• t_{UPS} - the time for which $\hat{I}_{UPS}$ is sustainable;

• $\hat{I}_L$ - overload current required by the load;

• S_L - apparent power of the load

the apparent power rating, in case of load crest factor 3:1, is

$$S_{UPS} = S_L \cdot \frac{\hat{I}_L}{\hat{I}_{UPS}}$$

If the load is also strongly non-linear, as is the case with electronic equipment for example, and if the crest factor is higher than that tolerated by the UPS, it is advisable to consider a derating factor.

3.6. Temperature control in the place of installation

Normally, uninterruptible power systems can function at nominal powers for ambient temperatures up to 40 °C, heating the environment in which they are installed due to electrical losses dissipated in the form of heat. These losses cause the natural temperature to increase (ΔT) and are normally indicated by UPS manufacturers. The temperature of a room, which is 25 °C with the UPS switched off, may increase by up to 15 °C before it is necessary to derate the equipment. Room ventilation or air conditioning may enable these limits to be respected.

For ventilation, the following empirical formula is provided:

$$Q\left[m^3/h\right] = \frac{P\left[kcal/h\right]}{0{,}288 \cdot \Delta T\left[W\right]} = \frac{P\left[W\right]}{0{,}248 \cdot \Delta T\left[K\right]}$$

where:

Q = Air flow rate

P = Power dissipated in the enclosure

ΔT = Difference between maximum air temperature permitted in the enclosure and the maximum temperature of air used for cooling

In terms of temperature difference, degrees Kelvin (°K) and Centigrade (°C) are equal (this does not apply to absolute values).

For ventilation, see also the paragraph "Batteries" regarding safety in the battery room.

Meanwhile as regards air conditioning, you are recommended to contact the equipment supplier with the characteristics of the place of installation and the electrical losses of the UPS. It is advisable to consider the worst-case operating conditions: typically at midday in summer.

3.7. Central power supply systems (CPSS)

Central power supply systems (CPSS) provide a centralized, independent energy supply to essential safety equipment such as emergency escape lighting, electrical circuits of automatic fire extinguishing systems, paging systems and signalling safety installations, smoke extraction equipment and carbon monoxide warning systems for specific buildings (e.g. in high-risk areas).

An uninterruptible power supply, when used to power essential safety systems such as those listed above, must comply not only with the requirements of the EN 62040 series of product standards, but also with the additional requirements of system standard EN 50171.

The main additional characteristics which the system must have can be summarised as follows:

- the enclosures must be resistant to specific thermal stresses (glow wire tests)
- the input voltage must be in conformity with HD472 S1, with frequency within ±2% of the nominal value
- specifically the batteries must be:

- protected against total discharge
- long-life batteries
- protected against polarity inversion of the connection cables
- quick charging

In order for the power supply system to be effective, suitable precautions must be taken with respect to all of its component parts (protection devices, lines, etc.).

Note that other national requirements may exist in addition to those specified here.

3.8. Generator sizing

When the power source of the uninterruptible power supply includes a generator, in determining the latter it is necessary to take into account the voltage drop in the series impedance of the generator set due to harmonic variations.

The most suitable parameter for this calculation is the subtransitory reactance of the alternator, calculated for each frequency involved.

The subtransitory reactance value is provided in the generator set data sheets and is normally indicated with X''_d.

$$\Delta V_{\%} = \sqrt{\frac{\sum_i X''_d I_i^2}{I_n^2}}$$

The criteria is to choose the generator set which, given the current harmonics of the UPS, has a harmonic voltage drop, and therefore distortion, within the tolerance limit permitted by the line.

3.9. Protection devices

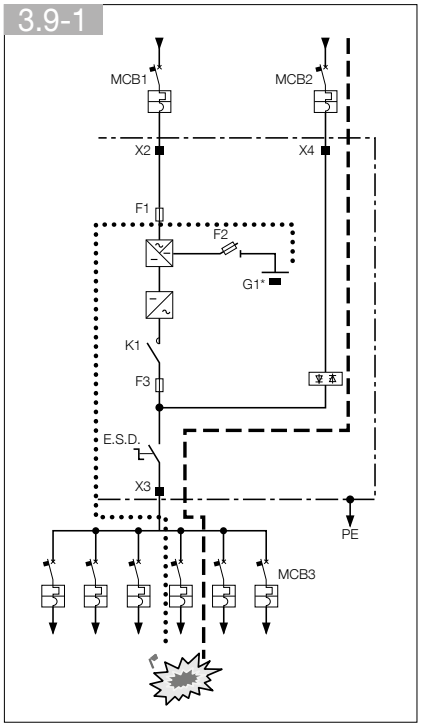
3.9.1. Definitions

- Total selectivity: is guaranteed for all types of fault (overload, short-circuit, earth fault) and for all overcurrent values, between the trip threshold of the upstream device and the prospective short-circuit current at the point where the downstream device is installed.
- Partial selectivity: is guaranteed up to a certain overcurrent limit Is (selectivity limit current).

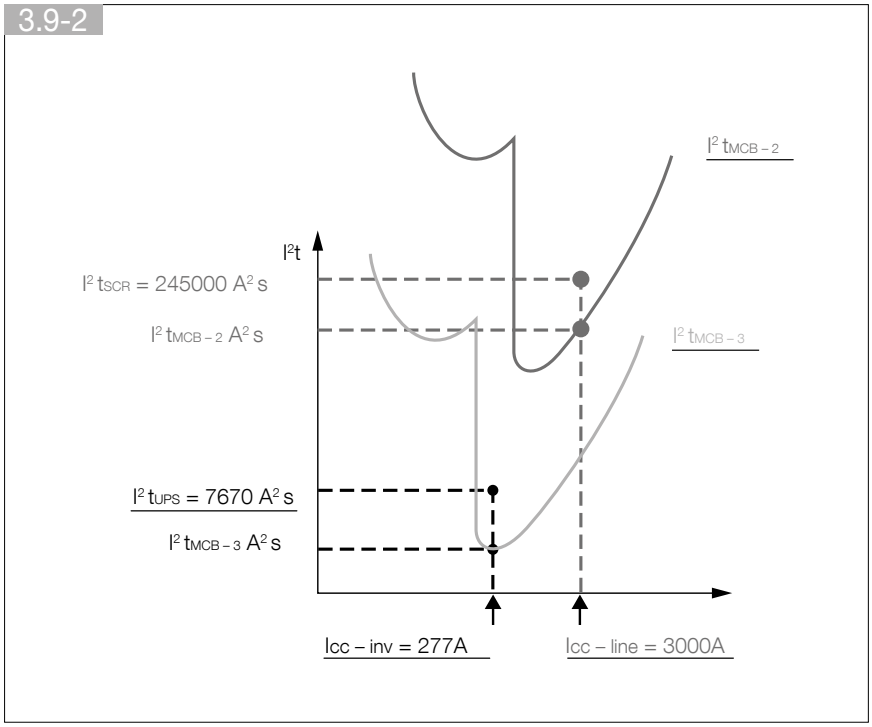
3.9.2. Selecting and co-ordinating devices to protect against overloads and short-circuits

- **Overload selectivity**: for breaker trip times from several hours to several seconds (overcurrents up to 6-8 times the nominal current), the co-ordination curves (breaker time-current curves) must never overlap. In the event of overload, the UPS continues normal operation by switching to the bypass when the thermal limits of the inverter are reached. Consequently, this transfer must be taken into account during co-ordination of the various protection devices. The UPS data sheets normally indicate the overload currents "per unit" or "as a percentage" and the corresponding tolerance time.
- **Short-circuit selectivity**: short-circuit currents can be very high, so the protection devices must be tripped within a few milliseconds to prevent burn-out of the cables. The time-current curves used as criteria for selecting overload protection are not valid when considering short-circuit protection, on account of the short trip times. In this case, the breakers must be sized based on the Joule integral curves of the devices. In practice, for a given prospective short-circuit current value, the minimum I2t let-through of the upstream device must be greater than the maximum I2t let-though of the downstream device.

3.9-1



3.9-2



In the case of short-circuit of one of the loads connected downstream of the UPS, two cases must be distinguished:

- **The bypass (back-up supply) upstream of the UPS is available.**

  For an output short-circuit, the UPS will transfer the load onto the bypass after a delay dependent on the individual model. The thermal-magnetic breakers of the bypass (MCB2) and output which protect the short-circuited load line (MCB3) are positioned in series (short-circuit marked in the diagram by means of the dashed line). For proper co-ordination, the output switch (MCB3) must open before the main input switch (MCB2). Then, the I^2t let-through of MCB3 must be lower than the let-through of MCB2 (at the prospective short-circuit current value): $I^2t_{MCB3} < I^2t_{MCB2}$.

  Furthermore, it is necessary to verify the selectivity between the bypass input thermal-magnetic switch and the maximum power tolerated by the bypass SCRs (in the example 245000 A^2s) at the prospective short-circuit (line) current (in the example 3000 A), e.g. $I^2t_{SCR} > I^2t_{MCB2}$.

In this case, the line impedance for estimating the short-circuit is that which takes into account the routing of power via the bypass. In the case of a back-up supply provided by a generator set, it is the short-circuit current of the generator set that must be used to correctly co-ordinate the protection devices.

- **The bypass (back-up supply) upstream of the UPS is unavailable.**

  Since the load cannot be transferred to the bypass (which is unavailable), the short-circuit energy is supplied entirely by the inverter and batteries. The downstream protection devices must be triggered before the electronic activation of the UPS protection in order to prevent healthy loads being switched off.

  The example (in the figure the short-circuit is represented by the dotted line), considers the three-phase short-circuit current from a 277 A battery for a maximum time of 100ms .

  The output short-circuit energy supplied by the UPS is: $I^2t_{UPS} = (277\ A)^2 \times 0.1\ s = 7672\ A^2s$

  At the short-circuit current value, in this case is not prospective but actual and coinciding with the short-circuit current value of the UPS, for correct selectivity it must be verified that $I^2t_{MCB3} < I^2t_{UPS}$.

  This second case (short-circuit without upstream supply) is nevertheless highly unlikely. In fact the absence of the upstream supply presupposes that a fault has occurred, and it is unlikely that a second fault (output short-circuit) would occur during the period of the power outage, which is usually short. In general, this period coincides with the time that the battery is supplying power (if the rectifier and the bypass do not have separate power supplies) or with the MTTR of the fault by an operator (if the UPS rectifier and the bypass have two different power supplies, as in this example).

  In the case of short-circuit without bypass supply, the current will be distorted to a square waveform.

3.9.3. Selecting and sizing differential breakers

There is no hard and fast rule since the behaviour of the mains supply to faults essentially depends on the neutral system used, the UPS filters (which divert certain harmonic components to earth) and the point of the fault.

Note.
The presence of isolation transformers can change the neutral system upstream or downstream of the UPS.

Generally speaking it is advisable to use:

- a single differential in the case of parallel UPS;
- type A differentials for single-phase in, single-phase out UPS;
- type B differentials for three-phase in, single-phase out UPS and three-phase in, three-phase out UPS.

3.9.4. Overvoltage protection devices

In conformity with IEC requirements, UPS systems are equipped with overvoltage protection. Unless otherwise required, the most common protection devices are Class 2. Usually, when the units are installed on the customer's premises, it is not necessary to increase the overvoltage protection class of the device. Nevertheless, if the units are installed in a transformer cabinet, the overvoltage protection class of the connection must be analysed and, if necessary, increased by installing additional protection devices.

3.10. Maintenance

In order to maximise uptime, it is advisable to perform periodic maintenance on components subject to wear:

- Capacitors;
- Fans;
- Batteries:

It is important that the maintenance is performed by expert personnel authorised by the UPS manufacturer.

3.11. Directives and Standards

3.11.1. Directives

- Low Voltage Directive 2006/95/EC
- Electromagnetic Compatibility Directive 2004/108/EC.

3.11.2. Safety Standards

- EN 62040-1-1 "Uninterruptible power systems (UPS) Part 1-1: General and safety requirements for UPS used in operator access areas"
- EN 62040-1-2 "Uninterruptible power systems (UPS) Part 1-2: General and safety requirements for UPS used in restricted access locations".

3.11.3. Electromagnetic Compatibility Standards

EN 62040-2 "Uninterruptible power systems (UPS) Part 2: Electromagnetic compatibility (EMC) requirements"

3.11.4. Performance

EN 62040-3 "Uninterruptible power systems (UPS) Methods of specifying the performance and test requirements".

3.11.5. Other standards

- IEC 60364-X-X "Electrical installations in buildings";
- IEC 60439-1 "Low-voltage switches";
- IEC 60529 "Degrees of protection provided by enclosures"
- EN 50272-2 "Safety requirements for secondary batteries and battery installations - Part 2: Stationary batteries".

4. STATIC TRANSFER SYSTEMS (STS)

4.1. Definition

Static Transfer Systems (STS) are intelligent units which, in the event that the primary power source does not return the tolerance values permitted by the load, transfer the load to an alternative source). This ensures "high availability" of the power supply for sensitive or critical installations.

The purpose of STS devices is to:

- ensure the redundancy of the power supply to critical installations by means of two independent power sources;
- increase power supply reliability for sensitive installations;
- facilitate the design and expansion of installations that guarantee a high-availability power supply.

STS systems incorporate reliable and proven solid-state switching technologies (SCR), enabling them to perform fast, totally safe automatic or manual switching without interrupting power to the supplied systems.

The use of high-quality components, fault-tolerant architecture, the ability to determine the location of the fault, management of faults and loads with high inrush currents: these are just some of the characteristics that make STS systems the ideal solution for achieving maximum power availability.

4.2. Performance (IEC 62310-3 definition)

Standard IEC 62310-3 establishes a code that clearly defines the performance of a STS:

XX	YY	B	TS

where:

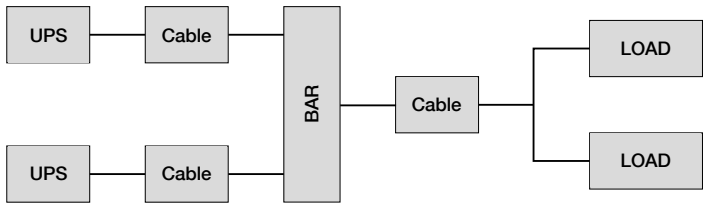
- **XX** characterises the management of the fault current:
  - which can be CB (STS is capable of withstanding specific short-circuit currents, which incorporates overvoltage protection devices)
  - PC (STS capable of withstanding specific short-circuit currents, which does not incorporate overvoltage protection devices).
- **YY** refers to the neutral management characteristics:
  - 00: no neutral management;
  - NC: both input neutrals are combined;
  - NS: separation of the two input neutrals by switching;
  - NI: neutral separation by isolation transformer (typically external to the machine).
- **B** are the transfer characteristics:
  - B: break-before-make (open transition transfer), there is no conduction path between the two sources during switching;
  - M: make-before-break (closed transition transfer), conduction possible between the two sources during switching.
- **TS** characteristics of the voltage limits permitted by the critical load:
  - T: total transient time to the terminals of the load, including switching time;
  - S: voltage tolerance before the transfer process is activated.

4.3. STS usage examples

Comparison between availability estimates between two architectures respectively with and without STS.

It is advisable to install the STS device as close as possible to the load, so as to ensure redundancy of the upstream distribution and to keep the single fault point (the conductor between STS and load) as short as possible.

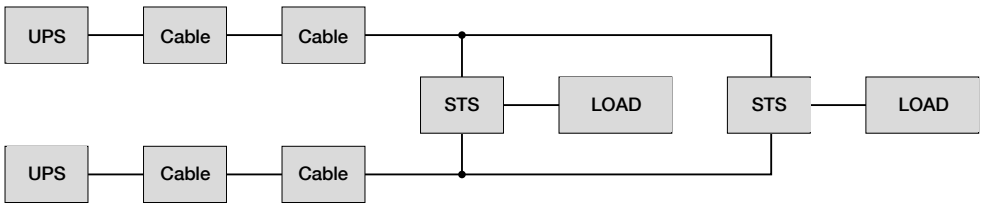
4.3-1 N+1 without STS



Estimated availability: 0.99749 (22 hours of downtime).

TBK000014

4.3-2 2N with STS



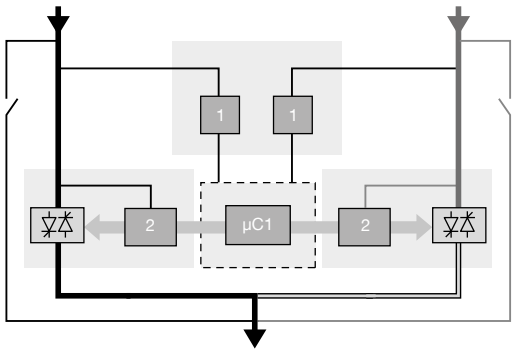
Estimated availability: 0.99991 (0.8 hours of downtime).
The double cable upstream of the STS serves to cover the same physical distance as the previous case (UPS and STS installed near to the load).

TBK000015

4.4. Functional modules

The aim of the STS is to increase the overall system availability. To achieve this it must be *fault-tolerant*: the load must be supplied even in the event of an internal fault.

4.4-1



TBK000016

4.4.1. SCR modules

Silicon-controlled rectifiers are solid-state switches which control the flow of current to the load. The SCR is only able to interrupt the current as it passes through zero. In a sinusoidal steady-state, this implies switching times of between 0ms and a semi-period.

4.4.2. Power supply module

Module which draws power from the *primary or* alternative source, or from both sources, to supply all of the control electronics. It could be redundant allowing an higher fault tollerance.

4.4.3. Control

- **Control logic**: the brain of the STS is a microcontroller where all of the decision-making logic is located.
- **SCR control modules**: components which translate the control signal received by the logic into commands to the SCR.

It could be redundant allowing an higher fault tollerance.

4.4.4. Maintenance bypass

Normally built into the STS, the aim of the bypass is to enable routine and non-routine maintenance to be carried out. When the bypass is in operation, switching is not possible in case the conducting source exceeds the tolerance limits permitted by the load.

The STS device must be designed and operate so the two sources cannot be directly connected, not even in the event of human error.

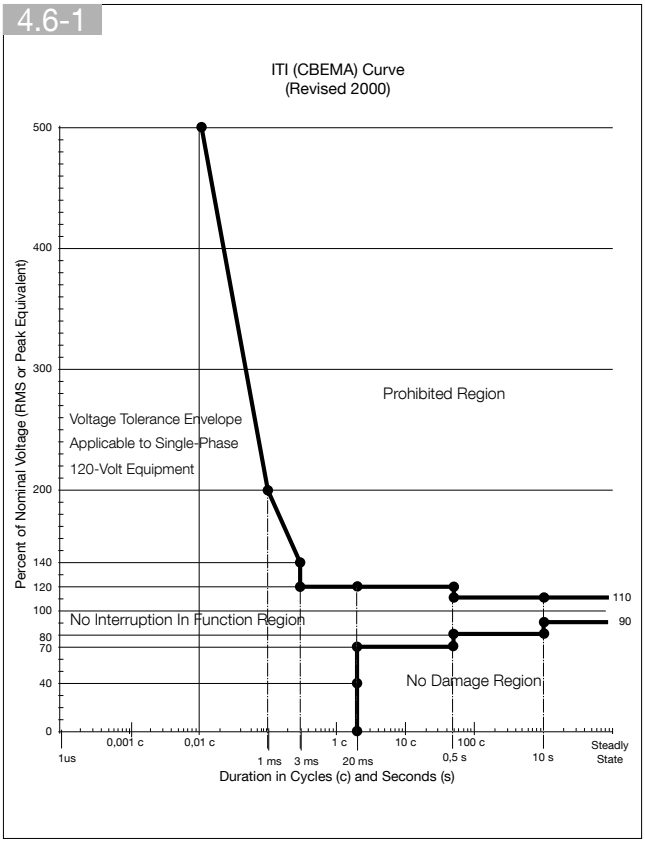
4.5. Backfeed protection

Product standard IEC 62310 establishes a minimum requirement that the STS must control upstream breakers that trip to prevent power flowing from one source to the other.

4.6. Selecting a STS

The STS must be sized on the basis of the system diagram, the currents of the loads supplied by the STS, the distribution network and the power dips admitted by the load. With regard to the power failure tolerance of loads, the Information Technology Industry Council has published a guideline curve which helps users to determine the power supply conditions which can be tolerated by IT loads.

4.6-1



Firstly, it is necessary to identify the rating characteristics of the electrical system and the neutral:

- Voltage and frequency;
- Single or three-phase;
- With or without distributed neutral;
- Neutral condition (TN-C, TN-S, IT, TT);
- Sources (line/line, UPS/generator, UPS/UPS, etc).

Next it is necessary to determine whether the neutral must be switched (broken). In this respect, SOCOMEC offers the following advice:

- TN-C: no switching (regulatory requirement);
- TN-S: switching (requirement if sources provided with differential protection);
- IT: switching.
- TT: switching.

It is then necessary to determine the total current that must pass through the STS device as the sum of the nominal currents of the various downstream loads.

It is also important to verify the installation of loads such as transformers or electric motors downstream of the STS, in order to prevent nuisance trips due to high inrush currents when switching between sources, or residual downstream voltage which impairs power failure detection. If such loads are installed, this must be taken into account during selection and configuration of the STS.

4.7. Protection devices

4.7.1. Selecting and coordinating thermal-magnetic breakers

In order to select the right overload or short-circuit protection devices, it is important to consider the STS system's behaviour in the event of overloads. Normally, the conducting branch of the STS withstands the overload/short-circuit for a time depending on the intensity of the currents, before the STS switches to the other branch. If the two networks have different impedances or short-circuit capacities, these must be taken into account. If the values are insufficient to trigger the breakers within the time limit permitted by the STS, the STS will interrupt the power supply upstream, resulting in all downstream loads being switched off.

4.7.2. Selecting and sizing differential breakers

When present, the neutral between the two sources can be combined and switched or otherwise (see paragraph Choosing an STS). In the case of a TN-C system, the neutral acts as an earth conductor and therefore cannot be broken. In the case of a TN-S system, the installation depends on what type of downstream STS has been selected. If the device does not switch the neutral, any neutral currents could be divided between the two parallel networks by means of the earth connection in the cabinet. The installation of differential breakers is not recommended due to the high probability of them tripping.

By contrast, if the STS device switches the neutral, this will avoid any unexpected current between both sources and earthing.

Differential protection may be installed.

Each IT systems has his own IMD (Insulation Measurement Device). Therefore every neutral has to be switched to avoid any mutual disturbances between the IMDs.

TT systems are typically used in residential or civil applications. This implies the use of differential protection and therefore a STS system which switches the neutral.

4.8. Maintenance

In order to maximise uptime, it is advisable to perform periodic maintenance on the fans (since they are components subject to wear). It is important that maintenance is performed by expert personnel authorised by the STS system manufacturer.

4.9. Directives and Standards

EEC 73/23 "Low-Voltage Directive"

EEC 89/336 "Electromagnetic Compatibility Directive"

IEC 62310-1 "Static Transfer Systems: general and safety requirements"

IEC 62310-2 "Static Transfer Systems: electromagnetic compatibility (EMC) requirements"

IEC 62310-3 "Static Transfer Systems: Method for specifying performance and test requirements"

IEC 60364-4 "Electrical installations of buildings"

IEC 60950-1 "Safety of IT. equipment"

IEC 60529 "Degrees of protection provided by enclosures (IP)"

IEC 60439-1 "Low-voltage switchgear and control gear assemblies"

5. DC POWER STATIONS

5.1. Definition

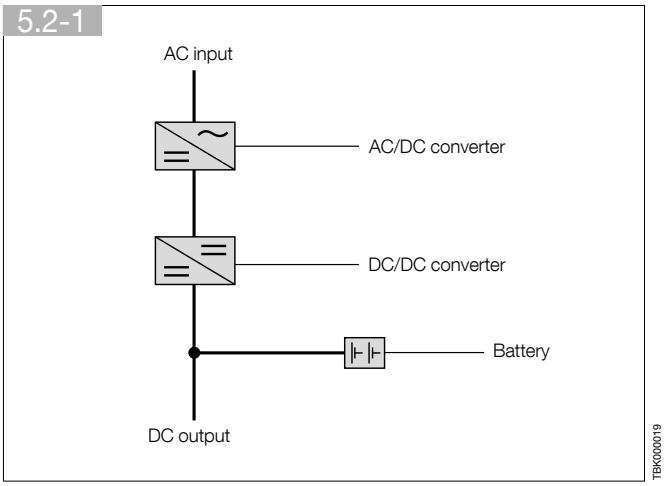
Direct Current (DC) power stations are uninterruptible power systems for DC loads. Their purpose is to supply the apparatus and batteries in parallel to the load so as to prevent power interruptions in the event of a mains failure.

5.2. Functional modules

The most modern power stations on the market consist of 4 modules:

- AC/DC converter;
- High-frequency DC/DC converter;
- Energy storage system;
- Control.

5.2-1



5.2.1. AC/DC converter

Device which converts the voltage applied to its input from alternating to direct current.

It uses a switching frequency in the kHz-range. It also employs input power factor correction (PFC) and reduces the harmonic content of the input current.

5.2.2. DC/DC converter

The second conversion phase is performed by a high-frequency DC/DC switching converter; this is a bridge inverter functioning in soft-switching mode with phase control.

5.2.3. Energy storage system

Energy is normally stored by means of VRLA batteries. Refer to the "Batteries" paragraph in the UPS section.

5.2.4. Control

The brain of a Power Station is its control system. The best architectures are based on digital microcontrollers which are able to perform complex calculations and algorithms. Architectures enable the machine to respond to different events and to report states and events via communication interfaces.

Modern technologies prevent faults in the control system from impairing the operation of power components which guarantee the continuity of the power supply.

5.3. Power station sizing

Choosing the power rating of a station is a process which involves taking into account various factors, both functional and regulatory. The main factors to be considered are:

- power rating of the load (PRL);
- supply voltage of the load;
- load coincidence factor;
- required back-up time;
- type of mains power supply (voltage, frequency, number of phases);
- maximum acceptable time to charge batteries fully.

In the case of a particular load which for example requires a high inrush current, this current value must be taken into account. Another parameter to bear in mind is the configuration of the output polarities of the loads, which may be:

- isolated from ground;
- positive pole to earth;
- negative pole to earth.

5.4. Temperature of the place of installation

Commercially available power stations are suitable for operating in ambient temperature of 40°C without the need for derating. Refer to the corresponding paragraph in the UPS section.

5.5. Protection devices

5.5.1. Selecting and co-ordinating devices to protect against overloads and short-circuits

- **Input**: to ensure wide input voltage tolerance, protection devices installed upstream of the power station must be selected for the maximum current draw of the station. Normally the power station manufacturer provides information about compatible types and ratings.
- **Downstream**: normally, the batteries are protected by the manufacturer using fast-blow fuses. It is vital to ensure that there is co-ordination between the thermal-magnetic breakers of the downstream loads and the fuse in question; this is why manufacturers indicate the ratings of fuses used in their equipment.

5.5.2. Selecting and sizing differential breakers

- **EPO**: on request, an Emergency Power Off (EPO) button may be included so the batteries can be disconnected from the load by means of a remote control switch.

5.5.3. Low Voltage Disconnect (LVD)

When installed, Low Voltage Disconnect prevents deep discharge of the batteries when the equipment is running in battery mode. The optional LVD function includes a remote control switch which opens the battery circuit when the minimum voltage is detected. As soon as normal mode is restored, the remote control switch closes and the battery starts recharging.

5.5.4. Overvoltage protection devices

In conformity with IEC regulations, power stations are equipped with overvoltage protection. Unless otherwise required, the most common protection devices are Class 2. Usually, when the units are installed on the customer's premises, it is not necessary to increase the overvoltage protection class of the device. Nevertheless, if the units are installed in a transformer cabinet, the overvoltage protection class of the connection must be analysed and, if necessary, increased by installing additional protection devices.

5.5.5. Earth Leakage Control (ELC)

The earth leakage control device continuously monitors the isolation of the output line from the earth conductor. This option is suitable for isolated polarity configurations in which both output power cables are isolated from the earth conductor. ELC may be deemed mandatory depending on the installation standards applicable to the system.

5.6. Maintenance

In order to maximise uptime, it is advisable to perform periodic maintenance on the fans and batteries.

It is important that maintenance is performed by expert personnel authorised by the power station manufacturer.

5.7. Directives and Standards

5.7.1. Directives

- Low Voltage Directive 2006/95/EC
- Electromagnetic Compatibility Directive 2004/108/EC

5.7.2. Safety Standards

- EN 61204-7 "Low-voltage power supply devices, d.c. output - Part 7: Safety requirements";
- EN 60950 "Safety of information technology equipment"

5.7.3. Electromagnetic Compatibility Standards

- EN 61204-3 "Low-voltage power supply devices, d.c. output - Part 3: Electromagnetic Compatibility (EMC)"
- EN 61000-3-3 "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection"
- EN 61000-6-2 "Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments"
- EN 61000-6-4 "Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments"

5.7.4. Performance

EN 61204 "Low-voltage power supply devices, d.c. output - Performance characteristics and safety requirements"

5.7.5. Other standards

- IEC 60364-X-X "Electrical installations in buildings";
- IEC 60439-1 "Low-voltage switches";
- IEC 60529 "Degrees of protection provided by enclosures";
- EN 50272-2 "Safety requirements for secondary batteries and battery installations - Part 2: Stationary batteries"

6. COMMUNICATION

6.1. Protocols

- SMTP: communication protocol for email transmission, supported by all email clients;
- SNMP: protocol used to monitor networked devices; requires compatible software;
- HID: Human Interface Device, a protocol included in Windows and MAC OSx operating systems;
- JBUS/MODBUS: the most commonly available communications protocol for connecting industrial electronic devices;
- PROFIBUS & PROFINET: protocol for industrial and process automation, used by Siemens;
- TCP/IP: a suite protocols used to transmit information over the Ethernet;
- http: protocol used to transfer web pages in HTML format.

6.2. Physical supports

Physical infrastructures which convey information using communication protocols.

- USB: serial communication standard which enables various peripherals to be connected to a computer;
- Ethernet: interface for local area networks (LAN);
- RS 232: low-speed serial interface for data exchange between digital devices, suitable for distances of up to 10 m;
- RS 485: serial interface for data exchange between digital devices, suitable for distances of up to 1000 m;
- Dry contacts. interface with contacts which have no electrical potential and which can be NO (normally open) or NC (normally closed).

6.3. Remote services

UPS and STS systems must be able to remotely communicate their operating statuses, electrical / environmental parameters and fault alarms. Furthermore, certain commands should be possible for remote control of the equipment.

Some remote monitoring services operate 24 hours a day, 365 days a year, enabling equipment to be installed in places where human supervision is limited (to working hours) or absent. The rapid notification of abnormal events allows for prompt intervention by the technical support service, resulting in reduced risk and MTTR.

7. TOTAL COST OF OWNERSHIP (TCO)

7.1. Definition

Total Cost of Ownership (TCO) includes all of the direct and indirect costs over the lifetime of the equipment. It defines:

- CAPEX: cost of the equipment, its installation, system modifications if required and operator training;
- OPEX: costs of running the equipment, e.g. power consumption, cost of installation space (for example, the share of building rent proportional to the area occupied by the equipment), as well as routine and non-routine maintenance.

7.2. Impact of UPS or STS systems on the TCO

7.2.1. THDi and cosφ input

Valid only for UPS.

High harmonic content of the input current and low cos φ imply the use of harmonic filters, overrating of cables and protection devices as well as the risk of nuisance trips. In economic terms, this means higher project, system and installation costs and higher costs due to system downtime. Optimum situation: low harmonic content and high cos φ.

7.2.2. Footprint

The floor space occupied by the equipment. Can be net or gross, plan dimensions of the equipment and plan dimensions plus space required for operation and maintenance respectively.

UPS and STS systems do not generate value, but their purpose is to protect equipment which does generate value (servers, industrial processes). Therefore the space occupied is not available to the actual production process itself. In the case of *data centres*, it is the space where it is not possible to install the servers. Optimum situation: minimal footprint.

7.2.3. Performance

Efficiency refers to the proportion of input energy available to the load. Indirectly it is the measurement of losses, e.g. energy paid for but not used. Given that fossil fuels can be used to produce electrical energy (releasing gases that cause the greenhouse effect in the atmosphere), energy losses also entail unnecessary gas emissions and their corresponding impact on the environment.

Optimum situation: high efficiency.

7.2.4. Front access and ventilation

An equipment unit with front access notably simplifies routine and non-routine maintenance operations, leading to a considerable reduction in repair times (MTTR) compared to equipment which must be moved in order to gain access to the sides or rear.

Furthermore, equipment with front access only, incorporating a front air inlet and top air outlet, allows for wall-mounted installation and therefore a reduced gross footprint.

7.2.5. Ease of use

In its popular publication *Tier Classifications define site infrastructure performance*, the Uptime Institute states that 70% of downtime is caused by human error (mistakes in checking and routine maintenance).

Equipment which is easy to use reduces these risks, lowers downtime costs and requires shorter, less intensive training for operators.

7.2.6. Communication systems

Remote monitoring and control enable time and human resources to be streamlined while reducing maintenance and repair times in the event of abnormal situations. For this reason, the equipment must be capable of being integrated into Building Management Systems (BMS).

8. ENVIRONMENTAL COMPATIBILITY

8.1. RoHS and WEEE directives

The official stance of CEMEP (Comité Européen de Constructeurs de Machines Electriques et d'Electronique de Puissance - European Committee of Manufacturers of Electrical Machines and Power Electronics) is that the RoHS and WEEE directives do not apply to UPS.

8.2. Performance

The only reference for efficiency performance is given by the European Code of Conduct (http://re.jrc.ec.europa.eu/energyefficiency/html/AC%20UPS-ParticipantsCoC.htm). Manufacturers can adhere to it on a voluntary basis by committing to the minimum efficiency requirements of the code.

9. DIRECT ENERGY IMPACT

The energy efficiency of an equipment unit is defined as:

$$\eta = \frac{P_{out}}{P_{in}}$$

where:

- Pin is the input power
- Pout is the output power, which in the case of the UPS coincides with the Pn (nominal power).

Using simple calculations we can determine heat loss (Perd) as follows:

$$P_{erd} = P_n \left[\frac{1-\eta}{\eta} \right]$$

Approximately 0.61kg of carbon dioxide is generated per kWh of energy lost (http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2report.html#electric), with the resulting environmental consequences and an average energy cost in Europe of 0.12€.

$$P_{erd\,93\%} = 150\ kW \left[\frac{1-0{,}93}{0{,}93} \right] \cdot 24 \cdot 365 = 98{,}9\ MWh \longrightarrow 60\ t_{CO2} + 11800\ €$$

$$P_{erd\,96\%} = 150\ kW \left[\frac{1-0{,}96}{0{,}96} \right] \cdot 24 \cdot 365 = 54{,}7\ MWh \longrightarrow 33\ t_{CO2} + 6600\ €$$

On a load-for-load basis, the UPS with 96% efficiency achieves an annual saving of 5200€ and 27t of carbon dioxide for air conditioning alone, the same output as a car manufactured in 2005 with 170,000km on the clock. (http://en.wikipedia.org/wiki/European_emission_standards).

10. IMPACT ON AIR CONDITIONING

Electrical losses are dispersed, in the form of heat, into the environment. In applications where the temperature must be controlled and the heat capacity of the environment is insufficient, measures must be taken to cool the environment. There are different ways of doing this: from simple ventilation, e.g. the movement of air masses of the desired temperature which are already available in the vicinity of the installation, to air conditioning, e.g. the cooling and circulation of air masses.

There are also technologies based on the use of water as a heat transfer fluid, but this is less common.

Air conditioning is the most frequently used technology. The parameter which measures the electrical energy needed to release energy in the form of heat is Coefficient of Performance (COP). When talking about electricity, we normally refer to power instead of energy, consequently the definition of COP. becomes:

$$C.O.P. = \frac{P_t}{P_e}$$

where:

- Pt: the thermal power to be released;
- Pe is the electric power needed to do it.

With close approximation, 3 can be considered as a typical COP value.

This means that for every 3 kW of thermal power dissipated, 1 electrical kW is needed.

This means that the efficiency rating of plant equipment is only partly able to quantify heat dissipation, since it does not take into account the energy needed to achieve it.

By way of indication, below are the annual air conditioning costs in relation to the example given in the previous paragraph (two different UPS with respective efficiency ratings of 93% and 96%, considering an average annual energy cost in Europe of 0.12 €/kWh).

$$HVAC_{93\%} = \frac{98{,}9\ MWh}{3} \cong 33\ MWh \longrightarrow 20\ t_{CO2} + 4000\ €$$

$$HVAC_{96\%} = \frac{54{,}7\ MWh}{3} \cong 11\ MWh \longrightarrow 11\ t_{CO2} + 2200\ €$$

On a load-for-load basis, the UPS with 96% efficiency achieves an annual saving, for air conditioning alone, of 1800 € and 9 t of carbon dioxide. Taking into account direct heat loss, the savings increase to 7200 € and 36 t of CO_2.

Standard 200 kVA UPS emissions	**72.100 CO^2 kg**
Green Power 200 kVA UPS emissions	**40.400 CO^2 kg**

MASTERYS BC

15 to 120 kVA

TÜV SÜD
Production monitored
Safety tested

socomec
Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

MASTERYS BC is a full range of high performing UPS designed to protect critical and sensitive appliances in “business critical” applications such as data servers.

Models								
Rated power (kVA)	15	20	30	40	60	80	100	120
MASTERYS BC 3/1	•	•	-	-	-	-	-	-
MASTERYS BC 3/3	•	•	•	•	•	•	•	•

Matrix table for model and kVA power rating

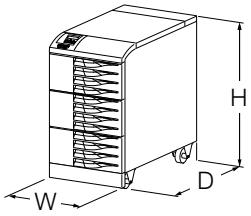
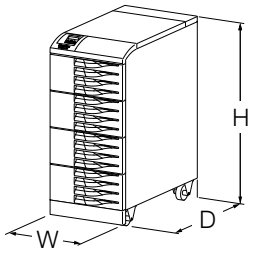
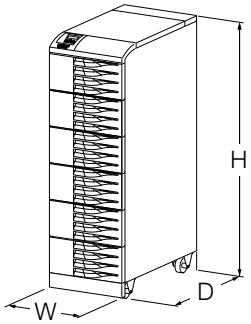
Each family has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings

2.1.1. MASTERYS BC 15 to 80 kVA

The entire range is compatible with 3 cabinets, all with the same footprint. The UPS's power and autonomy thus translates into the height of the cabinet itself (800 mm, 1000 mm, 1400 mm).

Dimensions			
Cabinet type	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 S (short)	444	795	800
 M (medium)	444	795	1000
 T (tall)	444	795	1400

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms and communication interfaces are located in the upper front part and can be accessed from the first panel with the red surround.

The air inlet is on the front, with outflow to the rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

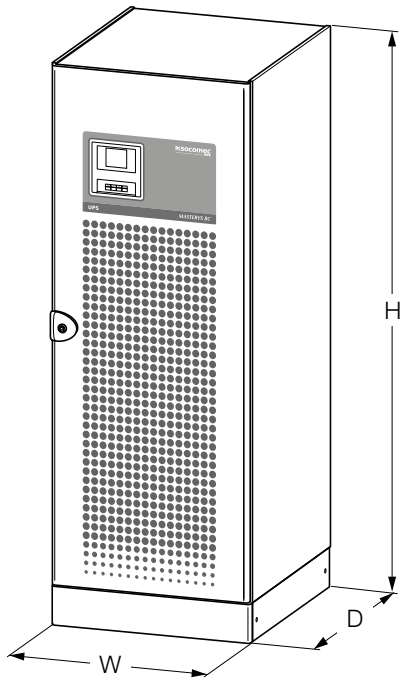
2.1.2. MASTERYS BC 100 to 120 kVA

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms are located in the front bottom side, while the communication interfaces in the internal upper side of the door.

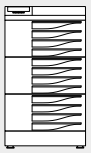
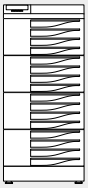
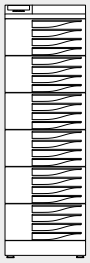
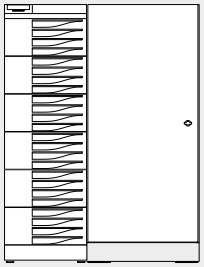
The air inlet is on the front, with outflow from the upper side; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

Dimensions			
	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
	700	800	1930

2.2. Flexible back-up time

Different extended back-up times are possible by using the standard UPS cabinet or the larger sized cabinet, both of which occupy minimum floor space.

For powers greater than or equal to 40 kVA, or long back-up power periods, an additional cabinet should be used, optionally with a supplementary battery charger.

BACK-UP times in minutes (max @ 70% of load)				
	 S	 M	 T	 T with supplementary battery cabinet(*)
MASTERYS BC 15 kVA	9	25	42	•
MASTERYS BC 20 kVA	5	16	29	•
MASTERYS BC 30 kVA	-	9	25	•
MASTERYS BC 40 kVA	-	5	16	•

* Supplementary battery cabinet (WxDxH): 600 x 835 x 1400 mm

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages.

The batteries are organised internally into racks based on their relative sizes, so as to ensure a compact unit while still guaranteeing substantial back-up times.

The UPS system's internal batteries consist of distinct strings of battery packs connected in series; each individual pack is connected using polarised connectors to facilitate battery configuration and maintenance.

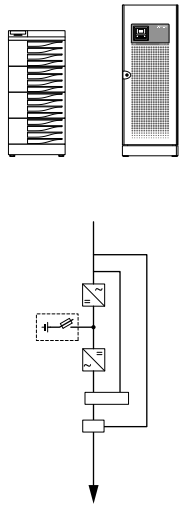
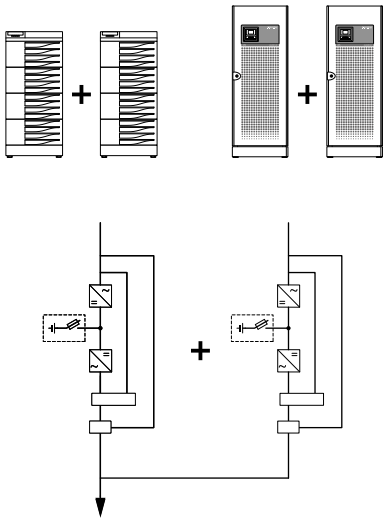
Each pack is sealed in an acid-proof container which is designed to prevent damage in the case of acid leakage.

To guarantee maximum back-up time availability and battery life, MASTERYS BC 10-120 kVA is equipped with EBS (Expert Battery System).

2.3. Horizontal and vertical parallel

MASTERYS BC offers 2 “configurations” of UPS in the same range.

The standard model is prepared for a 1+1 redundant system. Upon request, it is possible to have connected up to 6 modules in a parallel system.

	
Single unit configuration	1+1 redundant configuration

2.4. Availability, redundancy and efficiency

To increase the availability of the power supply, redundant parallel configurations are becoming increasingly common. Consequently, the overall efficiency of the UPS system risks being reduced due to the low load on each individual machine.

3. STANDARD AND OPTIONS

3.1. Standard electrical features

- Dual input mains (BC 15 to 40, BC 100-120).
- Internal manual bypass.
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.

3.2. Electrical options.

- Dual input mains (BC 60-80).
- External battery cabinet.
- External temperature sensor.
- Additional battery chargers.
- Galvanic isolation transformer.
- Parallel kit.
- ACS synchronization system.

3.3. Standard communication features.

- MODBUS RTU.
- 2 slots for communication options.

3.4. Communication options.

- Dry-contact interface.
- MODBUS TCP.
- PROFIBUS.
- NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.5. Remote monitoring service.

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters											
Rated power (kVA)		15	20	15	20	30	40	60	80	100	120
Phase in/out		3/1		3/3							
Active power (kW)		13.5	18	13.5	18	27	36	54	72	90	108
Rated/maximum rectifier input current (EN 62040-3) (A)		21/29	28/37	21/29	28/37	42/53	56/70	83/101	111/132	139/177	166/210
Rated bypass input current (A)		65	87	22	29	44	58	88	116	145	174
Inverter output current @ 230 V (A)		65	87	22	29	44	58	88	116	145	174
Maximum air flow (m^3/h)		280				465		1330		2000	
Sound level (dBA)		< 52				< 55		< 62		< 65	
Dissipation at rated load (minimum mains power present and batteries charged)	(W)	883	1211	876	1185	1706	2142	5341	7121	5299	7136
	(kcal/h)	760	1042	754	1019	1467	1826	4592	6123	4556	6136
	(BTU/h)	3016	4135	2992	4045	5823	7250	18234	24312	18091	24362
Dimensions (with standard back-up time)	W (mm)	444								700	
	D (mm)	795								800	
	H (mm)	800/1000/1400						1400		1930	
Weight, without batteries (kg)		105	110	105	110	135	152	180	200	410	430
Weight, with batteries (kg)		195	240	195	240	315	415	-	-	-	-

4.2. Electrical characteristics

Electrical characteristics - **Input**										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Rated mains supply voltage	400 V 3ph + N									
Voltage tolerance	3Ph+N 400 V -15% +20% (up to -40% @50% of nominal load)									
Rated frequency	50/60 Hz (selectable)									
Frequency tolerance	±10%									
Power factor (input at full load and rated voltage)	≥ 0.99									
Total harmonic distortion (THDi)	< 3%									
Max inrush current at start-up	< In (no overcurrent)									

Electrical characteristics - **Bypass**										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Bypass frequency variation speed	1 Hz/s (settable up to 3 Hz/s)									
Bypass rated voltage	Nominal output voltage ±15%									
Bypass rated frequency (selectable)	50/60 Hz									
Bypass frequency tolerance	±2% (configurable from 1% to 8%)									

Electrical characteristics - **Inverter**											
Rated power (kVA)		15	20	15	20	30	40	60	80	100	120
Phase in/out		3/1		3/3							
Rated output voltage (selectable)		220/230/240 V		380/400/415 V							
Output voltage tolerance		Static: ±1% Dynamic: VF-SS-111 (EN62040-3) compliant									
Rated output frequency		50/60 Hz (selectable)									
Output frequency tolerance		±0.01% (on mains power failure)									
Load crest factor		≥ 2.7:1									
Voltage harmonic distortion		< 1% with linear load									
Overload tolerated by the inverter	10 min	16.8 kW	22.5 kW	16.8 kW	22.5 kW	33.7 kW	45 kW	67.5 kW	90 kW	112.5 kW	135 kW
	1 min	20.2 kW	27 kW	20.2 kW	27 kW	40.5 kW	54 kW	81 kW	108 kW	135 kW	162 kW

Electrical characteristics - **Efficiency**										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Double conversion efficiency (normal mode) - full load	up to 94.5%									
Efficiency in Eco-Mode	98%									

Electrical characteristics - **Environment**										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Storage temperatures	-5 to +45 °C (23 to 113 °F) (15 to 25 °C for better battery life)									
Working temperature	0 to +40(1) °C (32 to 104 °F) (15 to 25 °C for better battery life)									
Maximum relative humidity (non-condensing)	95%									
Maximum altitude without derating	1000 m (3300 ft)									
Degree of protection	IP20 (IP21 optional)								IP20	
Portability	ASTM D999-08, ASTM D-880, AFNOR NF H 00-042									
Colour	RAL 7012								RAL 7012, silver grey frontal door	

(1) Conditions apply.

4.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
D curve circuit breaker (A)	32	40	32	40	63	80	125	160	250	250
gG fuse (A)	32	40	32	40	63	80	125	160	250	250

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Maximum I^2t supported by the bypass (A^2s)	80000		8000		15000		80000	125000	320000	
Icc max (A)	4000		1200		1700		4000	5000	8000	8000
D curve circuit breaker (A)	100	125	32	40	63	80	125	160	250	250
gG fuse (A)	100	125	32	40	63	80	125	160	250	250

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Input residual current circuit breaker	> 0.5 A Selective									

RECOMMENDED PROTECTION DEVICES - **Output**[3]										
Rated power (kVA)		15	20	15	20	30	40	60	80	100	120
Phase in/out		3/1		3/3							
Short-circuit inverter current (A) (when AUX MAINS is not present)	0 to 40 ms	165	216	56	74	117	156	206	270	470	
	40 to 100 ms	140	183	48	62	95	126	206	270	420	
C curve circuit breaker[3] (A)		≤ 16	≤ 20	≤ 4	≤ 6	≤ 10	≤ 13	≤ 16	≤ 20	≤ 40	
B curve circuit breaker[3] (A)		≤ 32	≤ 40	≤ 8	≤ 12	≤ 20	≤ 25	≤ 25	≤ 32	≤ 80	
High-speed fuse[3] (A)		≤ 18	≤ 24	≤ 6	≤ 10	≤ 12	≤ 16	≤ 25	≤ 32	≤ 80	

CABLES - **Maximum cable section**										
Rated power (kVA)	15	20	15	20	30	40	60	80	100	120
Phase in/out	3/1		3/3							
Rectifier terminals	4xCBD25 (35 mm^2)		4xCBD16 (25 mm^2)		4xCBD25 (35 mm^2)		4xCBD35 (50 mm^2)		150 mm^2	
Bypass terminals	2xCBD25 (35 mm^2)									
Battery terminals	4xCBD25 (35 mm^2)						4xCBD70 (95 mm^2)			
Output terminals	2xCBD25 (35 mm^2)						4xCBD35 (50 mm^2)			

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility.

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 62040-2 Electromagnetic compatibility (Class A)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations (certified by TÜV SÜD)
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

Once installed in a system, the UPS will not alter the neutral conditions; this is because the neutral input terminal "N" is connected directly to output terminal "N1" inside the equipment. If the neutral condition of the system downstream of the UPS needs to be modified, it will be necessary to use the isolation transformer option.

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

DELPHYS BC

160 to 300 kVA

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

DELPHYS BC is a full range of high performing UPS designed to protect critical and sensitive appliances in “business critical” applications such as data centres.

Models			
Rated power (kVA)	160	200	300
DELPHYS BC 3/3	•	•	•

Matrix table for model and kVA power rating

Each range has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 160 to 300 kVA

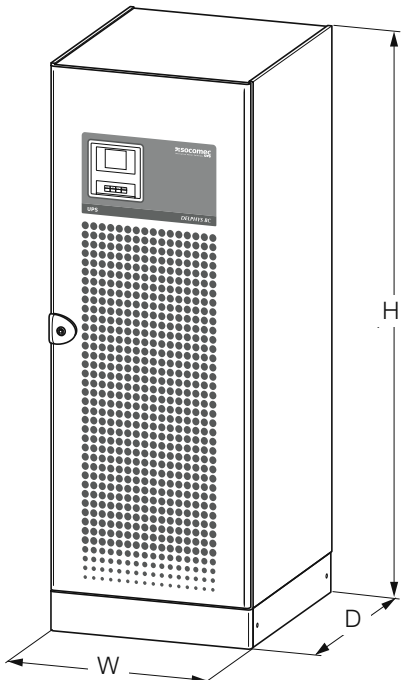
The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

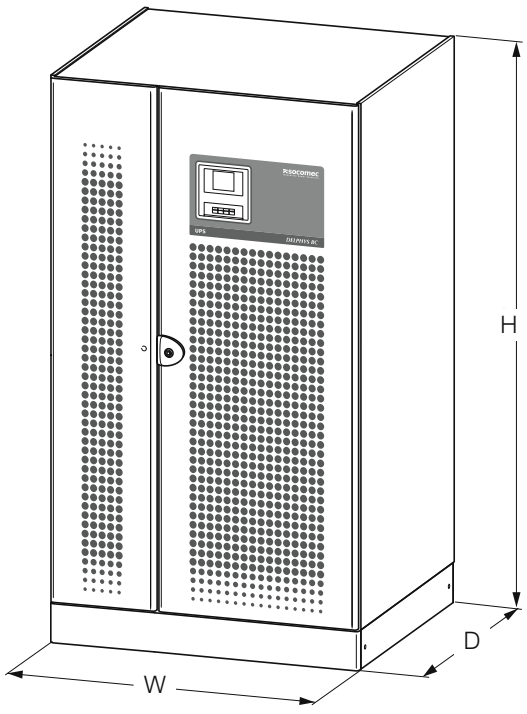
All of the control mechanisms are located in the front bottom side, while the communication interfaces in the internal upper side of the door.

The air inlet is on the front, with outflow from the upper side; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

Dimensions			
	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
DELPHYS BC 160 and 200 kVA	700	800	1930
DELPHYS BC 300 kVA	1000	950	1930



DELPHYS BC 160 kVA
DELPHYS BC 200 kVA



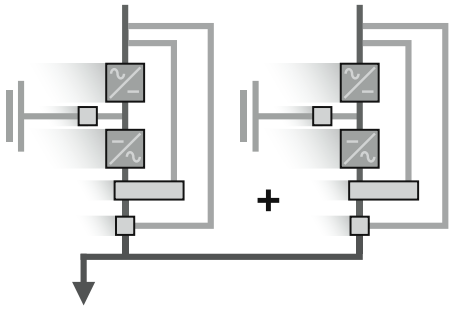
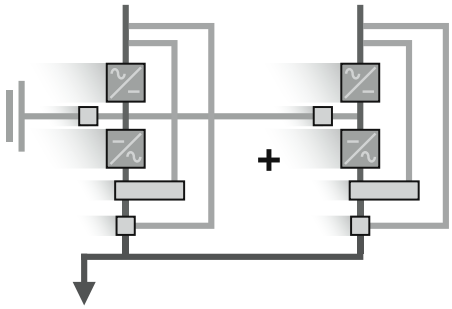
DELPHYS BC 300 kVA

2.2. Battery management

Available with distributed batteries, DELPHYS BC allows to optimise the batteries size thanks to a shared battery operation. This reduces the overall system footprint, the weight of the required batteries, the battery monitoring system, the amount of wiring needed and the amount of lead.

To guarantee maximum back-up time availability and battery life, DELPHYS BC includes:

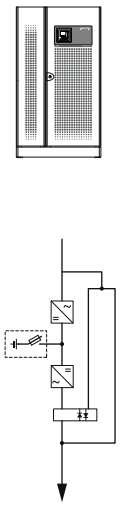
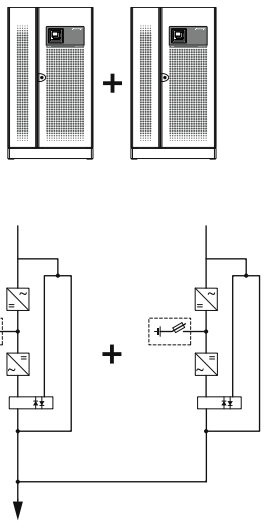
- EBS (Expert Battery System), smart battery charging management.
- **Distributed** or **shared battery** for energy storage optimization on parallel systems.

	
Distributed battery	Shared battery

2.3. Horizontal and vertical parallel

DELPHYS BC offers 2 “configurations” of UPS in the same range.

The standard model is prepared for a 1+1 redundant system. Upon request, it is possible to have connected up to 6 modules in a parallel system.

	
Single unit configuration	1+1 redundant configuration

3. STANDARD AND OPTIONS

3.1. Standard electrical features.

- Dual input mains.
- Integrated maintenance bypass.
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.

3.2. Electrical options.

- External battery cabinet.
- External temperature sensor.
- Additional battery chargers.
- Shared battery.
- Galvanic isolation transformer.
- Parallel kit.
- ACS synchronization system.

3.3. Standard communication features.

- 2 slots for communication options.

3.4. Communication options.

- ADC interface (configurable voltage-free contacts).
- MODBUS TCP.
- MODBUS RTU.
- PROFIBUS.
- NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.5. Remote monitoring service.

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters				
Rated power (kVA)		160	200	300
Phase in/out		3/3		
Active power (kW)		144	180	270
Rated/maximum rectifier input current (EN 62040-3) (A)		220/290	278/340	417/425
Rated bypass input current (A)		232	290	433
Inverter output current @ 400 V (A) P/N		232	290	433
Maximum air flow (m^3/h)		2250		2700
Sound level (dBA)		< 68		< 71
Power dissipation in nominal conditions(1)	W	9200	11500	17300
	kcal/h	7911	9888	14875
	BTU/h	31391	39239	59029
Power dissipation (max) in the worst conditions(2)	W	10600	13300	18000
	kcal/h	9114	11436	15477
	BTU/h	36168	45380	61418
Dimensions	W (mm)	700		1000
	D (mm)	800		950
	H (mm)	1930		1930
Weight (kg)		480	500	830

(1) Considering nominal input current (400 V, battery charged) and rated output active power (PF 0.9).

(2) Considering maximum input current (low input voltage, battery recharge) and rated output active power (PF 0.9).

4.2. Electrical characteristics

Electrical characteristics - **Rectifier(1) Input**			
Rated power (kVA)	160	200	300
Rated mains supply voltage	400 V 3ph		
Voltage tolerance	240 to 480 V(2)		
Rated frequency	50/60 Hz (selectable)		
Frequency tolerance	±10%		
Power factor (input at full load and rated voltage)	≥ 0.99		
Total harmonic distortion (THDi)	< 3%		
Max inrush current at start-up	<In (no overcurrent)		

(1) IGBT rectifier. (2) Conditions apply.

Electrical characteristics - **Bypass**				
Rated power (kVA)		160	200	300
Bypass frequency variation speed		1.5 Hz/s (settable up to 3 Hz/s)		
Bypass rated voltage		Nominal output voltage ±15%		
Bypass rated frequency		50/60 Hz (selectable)		
Bypass frequency tolerance		from ±1% to ±8% (operation with generator unit)		

Electrical characteristics - **Inverter**				
Rated power (kVA)		160	200	300
Rated output voltage (selectable)		380/400/415 V		400/415 V
Output voltage tolerance		Static: ±1% Dynamic: VF-SS-111 (EN 62040-3) compliant		
Rated output frequency (selectable)		50/60 Hz (selectable)		
Output frequency tolerance		±0.01% on mains power failure		
Load crest factor (according to IEC 62040-3)		3:1		
Voltage harmonic distortion		< 1.5% with linear load		
Overload tolerated by the inverter - 25 °C	1 min	225 kW	270 kW	311 kW

Electrical characteristics - **Efficiency**			
Rated power (kVA)	160	200	300
Double conversion efficiency (normal mode) - full load	up to 94%		

Electrical characteristics - **Environment**			
Rated power (kVA)	160	200	300
Storage temperatures	-5 to +45 °C (23 to 113 °F) (15 to 25 °C for better battery life)		
Working temperature	0 to +40(1) °C (32 to 104 °F) (15 to 25 °C for better battery life)		
Maximum relative humidity (non-condensing)	95%		
Maximum altitude without derating	1000 m (3300 ft)		
Degree of protection	IP20		
Colour	RAL 7012, silver grey frontal door		

(1) Conditions apply.

4.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]			
Rated power (kVA)	160	200	300
D curve circuit breaker (A)	315	400	630
gG fuse (A)	315	400	630

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]			
Rated power (kVA)	160	200	300
Maximum I^2t supported by the bypass (A^2s)	320000		
Icc max (A)	8000		
D curve circuit breaker (A)	400		630
gG fuse (A)	400		630

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]			
Rated power (kVA)	160	200	300
Input residual current circuit breaker	3 A		

RECOMMENDED PROTECTION DEVICES - **Output**[3]			
Rated power (kVA)	160	200	300
Short-circuit inverter current (A) - (0 to 100 ms) (when AUX MAINS is not present)	720 A		900
C curve circuit breaker[3] (A)	≤ 63 A		≤ 80
B curve circuit breaker[3] (A)	≤ 125 A		-
High-speed fuse[3] (A)	≤ 160 A		

CABLES CONNECTION - **Maximum capability per pole**			
Rated power (kVA)	160	200	300
Rectifier terminals	2 x 150 mm^2		2 x 240 mm^2
Bypass terminals	2 x 150 mm^2		2 x 240 mm^2
Battery terminals	2 x 240 mm^2		2 x 240 mm^2
Output terminals	2 x 150 mm^2		2 x 240 mm^2

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 62040-2 Electromagnetic compatibility (C3 category)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

Green Power 2.0

MASTERYS GP

10 to 40 kVA/kW

3 LEVEL TECHNOLOGY

96% EFFICIENCY

kW = kVA

TÜV SÜD Production monitored Safety tested

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

GREEN POWER 2.0 is a full range of high performing UPS designed to:

- ensure 24/7/365 availability and business continuity to datacentre infrastructures,
- to avoid data losses and downtime of company operations,
- to reduce the electrical infrastructure's total cost of ownership,
- to adopt a sustainable development approach.

GREEN POWER 2.0					
Rated power (kVA)	10	15	20	30	40
MASTERYS GP 3/1	•	•	•	-	-
MASTERYS GP 3/3	•	•	•	•	•

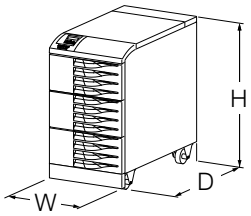
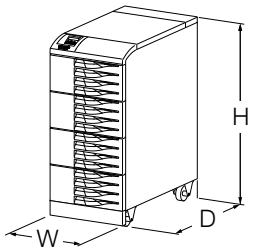
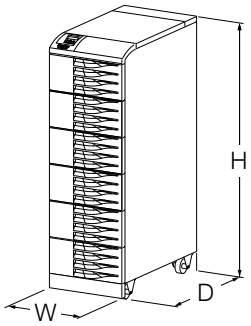
Matrix table for model and kVA power rating

Each family has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 10 to 40 kVA/kW

The entire range is compatible with 3 cabinets, all with the same footprint. The UPS's power and autonomy thus translates into the height of the cabinet itself (800 mm, 1000 mm, 1400 mm).

Dimensions			
Cabinet type	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 S (short)	444	795	800
 M (medium)	444	795	1000
 T (tall)	444	795	1400

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

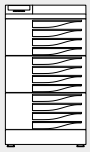
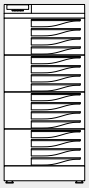
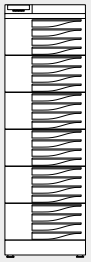
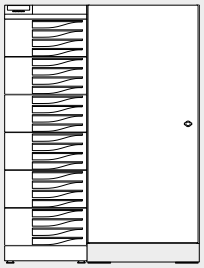
All of the control mechanisms and communication interfaces are located in the upper front part and can be accessed from the first panel with the red surround.

The air inlet is on the front, with outflow to the rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Flexible back-up time

Different extended back-up times are possible by using the standard UPS cabinet or the larger sized cabinet, both of which occupy minimum floor space.

For long back-up power periods, an additional cabinet should be used, optionally with a supplementary battery charger.

BACK-UP times in minutes (max @ 70% of load)				
GREEN POWER 2.0	 S	 M	 T	 T with supplementary battery cabinet(1)
MASTERYS GP 10 kVA/kW	19	49	105	•
MASTERYS GP 15 kVA/kW	12	28	67	•
MASTERYS GP 20 kVA/kW	7	19	50	•
MASTERYS GP 30 kVA/kW	-	12	28	•
MASTERYS GP 40 kVA/kW	-	7	19	•

(1) Supplementary battery cabinet 1000 x 800 x 1800mm (WxDxH)

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages.

The batteries are organised internally into racks based on their relative sizes, so as to ensure a compact unit while still guaranteeing substantial back-up times.

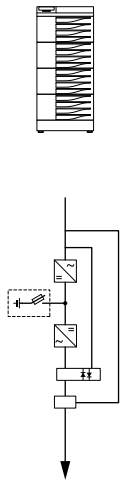
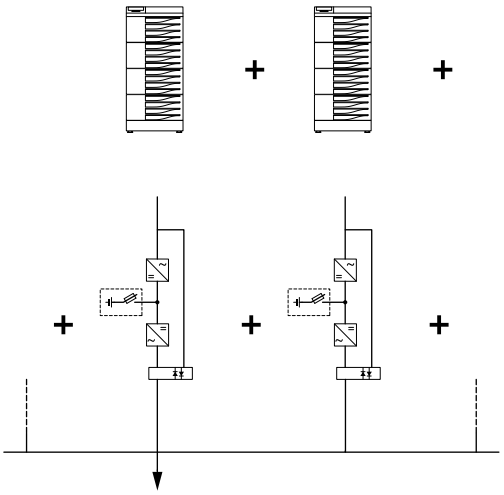
The UPS system's internal batteries consist of distinct strings of battery packs connected in series; each individual pack is connected using polarised connectors to facilitate battery configuration and maintenance.

Each pack is sealed in an acid-proof container which is designed to prevent damage in the case of acid leakage.

To guarantee maximum back-up time availability and battery life, the GREEN POWER 2.0 MASTERYS GP series is equipped with EBS systems, depending on the model.

2.3. Horizontal and vertical parallel

GREEN POWER 2.0 MASTERYS GP offers 2 “configurations” of UPS in the same range.

	
Single unit configuration	Modular parallel UPS configuration (up to 6 units)

2.4. Availability, redundancy and efficiency

To increase the availability of the power supply, redundant parallel configurations are becoming increasingly common. Consequently, the overall efficiency of the UPS system risks being reduced due to the low load on each individual machine.

3. STANDARD AND OPTIONS

3.1. Standard electrical features.

- Dual input mains.
- Internal maintanance bypass.
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.
- Battery temperature sensor.

3.2. Electrical options.

- External maintanance bypass.
- External battery cabinet.
- Additional battery chargers.
- Galvanic isolation transformer.
- Parallel kit.
- ACS synchronization system.

3.3. Standard communication features.

- User-friendly multilingual interface with color graphic display.
- Commissioning wizard.
- 2 slots for communication options.
- MODBUS TCP.
- MODBUS RTU.
- Embedded LAN interface (web pages, email).

3.4. Communication options.

- Dry-contact interface.
- PROFIBUS.
- BACnet/IP interface
- NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.5. Remote monitoring service.

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters									
Rated power (kVA)		10	15	20	10	15	20	30	40
Phase in/out		3/1			3/3				
Active power (kW)		10	15	20	10	15	20	30	40
Rated/maximum rectifier input current (EN 62040-3) (A)		16/22	24/30	31/39	16/22	24/30	31/39	47/56	62/73
Rated bypass input current (A)		44	65	87	15	22	29	44	58
Inverter output current @ 230 V (A)		44	65	87	15	22	29	44	58
Maximum air flow (m^3/h)		280						465	
Sound level (dBA)		< 52						< 55	
Power dissipation in nominal conditions[1]	(W)	652	922	1274	646	927	1225	1709	2176
	(kcal/h)	561	793	1095	555	797	1053	1469	1871
	(BTU/h)	2226	3148	4350	2206	3165	4182	5835	7429
Power dissipation (max) in the worst conditions[2]	(W)	661	974	1382	686	1005	1333	1902	2474
	(kcal/h)	568	837	1188	590	864	1146	1635	2128
	(BTU/h)	2256	3324	4720	2340	3432	4550	6492	8448
Dimensions (with standard back-up time)	W (mm)	444							
	D (mm)	795							
	H (mm)	800		1000	800		1000		1400
Weight (kg)		190	195	240	190	195	240	315	415

1) Considering nominal input current (400 V, battery charged) and rated output active power (PF1).

2) Considering maximum input current (low input voltage, battery recharge) and rated output active power (PF1).

4.2. Electrical characteristics

Electrical characteristics - **Rectifier[1] Input**								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Rated mains supply voltage	400 V 3ph + N							
Voltage tolerance	240 V to 480 V[2]							
Rated frequency	50/60 Hz (selectable)							
Frequency tolerance	±10%							
Power factor (input at full load and rated voltage)	≥ 0.99							
Total harmonic distortion (THDi)	< 2.8%	< 2.1%	< 2.0%	< 2.7%	< 2.7%	< 2.0%	< 2.2%	< 1.9%
Max inrush current at start-up	< In (no overcurrent)							

(1) IGBT rectifier. (2) Conditions apply.

Electrical characteristics - **Bypass**								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Bypass frequency variation speed	1 Hz/s (settable up to 3 Hz/s)							
Bypass rated voltage	Nominal output voltage ±15%							
Bypass rated frequency (selectable)	50/60 Hz (selectable)							
Bypass frequency tolerance	±2% (configurable from 1% to 8%)							

Electrical characteristics - **Inverter**									
Rated power (kVA)		10	15	20	10	15	20	30	40
Phase in/out		3/1			3/3				
Rated output voltage (selectable)		220/230/240 V			380/400/415 V				
Output voltage tolerance		Static: ±1% Dynamic: VF-SS-111 (EN62040-3) compliant							
Rated output frequency		50/60 Hz (selectable)							
Output frequency tolerance		±0.01%							
Load crest factor		≥ 2.7:1							
Voltage harmonic distortion		< 1% with linear load							
Overload tolerated by the inverter	10 min	11.5 kW	17.25 kW	23.0 kW	11.5 kW	17.25 kW	23.0 kW	34.5 kW	46.0 kW
	1 min	13.9 kW	20.85 kW	27.8 kW	13.9 kW	20.85 kW	27.8 kW	41.7 kW	55.6 kW

Electrical characteristics - **Efficiency**								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Double conversion efficiency (normal mode - @ full load	up to 96%							
Efficiency in EcoMode	98%							

Electrical characteristics - **Environment**								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Storage temperatures	-5 to +45 °C (23 to 113 °F) (15 to 25 °C for better battery life)							
Working temperature	0 to +40(1) °C (32 to 104 °F) (15 to 25 °C for better battery life)							
Maximum relative humidity (non-condensing)	95%							
Maximum altitude without derating	1000 m (3300 ft)							
Degree of protection	IP20 (IP21 optional)							
Portability	ASTM D999-08, ASTM D-880, AFNOR NF H 00-042							
Colour	RAL 7012							

(1) Conditions apply.

4.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
D curve circuit breaker (A)	32		40	32		40	63	80
gG fuse (A)	32		40	32		40	63	80

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Maximum I^2t supported by the bypass (A^2s)	80000			8000			15000	
Icc max (A)	4000			1200			1700	
D curve circuit breaker (A)	100		125	32		40	63	80
gG fuse (A)	100		125	32		40	63	80

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]								
Rated power (kVA)	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Input residual current circuit breaker	> 0.5 A Selective							

RECOMMENDED PROTECTION DEVICES - **Output**[3]									
Model		10	15	20	10	15	20	30	40
Phase in/out		3/1			3/3				
Short-circuit inverter current (A) (when AUX MAINS is not present)	0 to 40 ms	113	165	216	38	56	74	117	156
	40 to 100 ms	95	140	183	32	48	62	95	126
C curve circuit breaker[3] (A)		≤ 10	≤ 16	≤ 20	≤ 4		≤ 6	≤ 10	≤ 13
B curve circuit breaker[3] (A)		≤ 20	≤ 32	≤ 40	≤ 8		≤ 12	≤ 20	≤ 25
High-speed fuse[3] (A)		≤ 12	≤ 18	≤ 24	≤ 6		≤ 10	≤ 12	≤ 16

CABLES - **Maximum cable section**								
Model	10	15	20	10	15	20	30	40
Phase in/out	3/1			3/3				
Rectifier terminals	MKDSP 25/4 - 25 mm^2 (flexible cable), 35 mm^2 (rigid cable)							
Bypass terminals	MKDSP 25/4 - 25 mm^2 (flexible cable), 35 mm^2 (rigid cable)							
Battery terminals	MKDSP 25/4 - 25 mm^2 (flexible cable), 35 mm^2 (rigid cable)							
Output terminals	MKDSP 25/4- 25 mm^2 (flexible cable), 35 mm^2 (rigid cable)							

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

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Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 62040-2 Electromagnetic compatibility (C2 category)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations (certified by TÜV SÜD)
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

Once installed in a system, the UPS will not alter the neutral conditions; this is because the neutral input terminal "N" is connected directly to output terminal "N1" inside the equipment. If the neutral condition of the system downstream of the UPS needs to be modified, it will be necessary to use the isolation transformer option.

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

Green Power 2.0

MASTERYS GP

60 to 120 kVA/kW

3 LEVEL TECHNOLOGY

96% EFFICIENCY

kW = kVA

TÜV SÜD
Production monitored
Safety tested

socomec
Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

GREEN POWER 2.0 is a full range of high performing UPS designed to:

- ensure 24/7/365 availability and business continuity to datacentre infrastructures,
- to avoid data losses and downtime of company operations,
- to reduce the electrical infrastructure's total cost of ownership,
- to adopt a sustainable development approach.

GREEN POWER 2.0				
Rated power (kVA)	60	80	100	120
MASTERYS GP 3/3	•	•	•	•

Matrix table for model and kVA power rating

GREEN POWER 2.0 has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

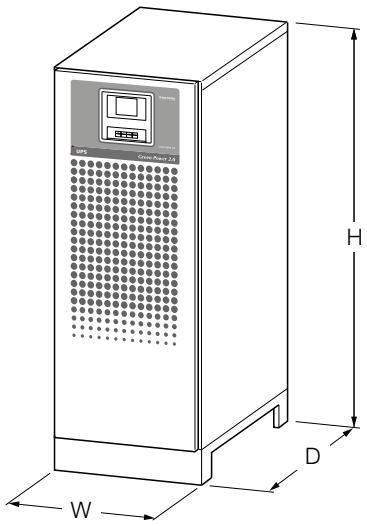
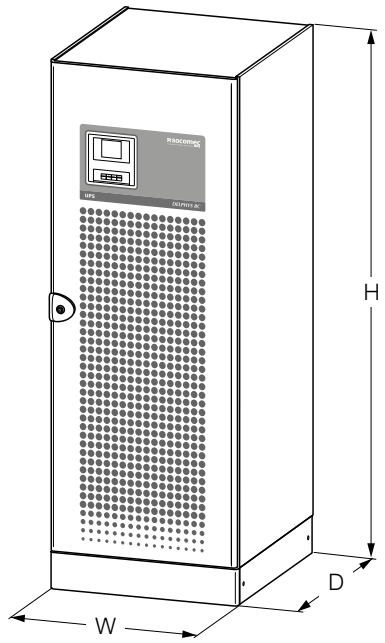
2.1. Power ratings from 60 to 120 kVA/kW

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms are located in the front bottom side, while the communication interfaces in the internal upper side of the door.

The air inlet is on the front, with outflow from the rear side (60 to 80 kVA) or upper side (100 to 120 kVA); this means other equipment or external battery enclosures can be placed alongside the UPS unit.

Dimensions			
GREEN POWER 2.0	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 MASTERYS GP 60 to 80 kVA/kW	600	800	1400
 MASTERYS GP 100 to 120 kVA/kW	700	800	1930

2.2. Flexible back-up time

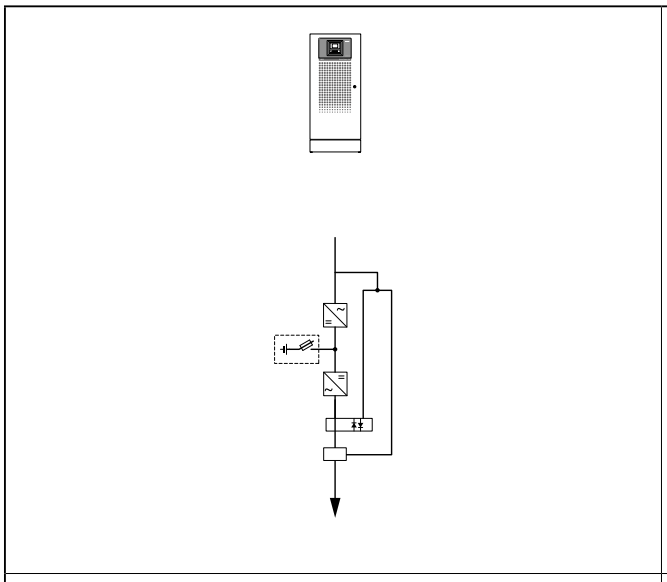
Different extended back-up times are possible by using external battery cabinets, optionally with a supplementary battery charger

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages.

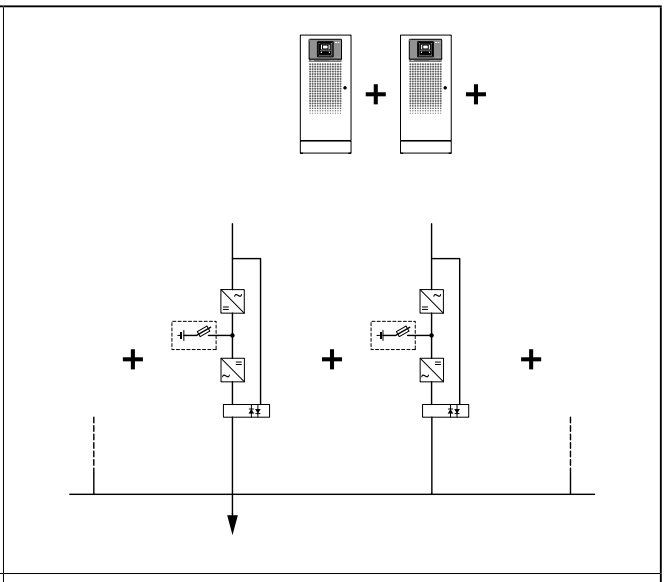
To guarantee maximum back-up time availability and battery life, the GREEN POWER 2.0 MASTERYS GP series is equipped with EBS systems, depending on the model.

2.3. Horizontal and vertical parallel

GREEN POWER 2.0 MASTERYS GP offers 2 “configurations” of UPS in the same range.



Single unit configuration



Modular parallel UPS with distributed bypass

2.4. Availability, redundancy and efficiency

To increase the availability of the power supply, redundant parallel configurations are becoming increasingly common. Consequently, the overall efficiency of the UPS system risks being reduced due to the low load on each individual machine.

3. STANDARD AND OPTIONS

3.1. Standard electrical features

- Dual input mains.
- Internal maintanance bypass.
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.
- Battery temperature sensor.

3.2. Electrical options

- External maintanance bypass.
- External battery cabinet.
- Additional battery chargers.
- Galvanic isolation transformer.
- Parallel kit.
- ACS synchronization system.

3.3. Standard communication features

- User-friendly multilingual interface with color graphic display.
- Commissioning wizard.
- 2 slots for communication options.
- MODBUS TCP.
- MODBUS RTU.
- Embedded LAN interface (web pages, email).

3.4. Communication options

- Dry-contact interface.
- PROFIBUS.
- BACnet/IP interface
- NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.5. Remote monitoring service

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters					
Rated power (kVA)		60	80	100	120
Phase in/out		3/3			
Active power (kW)		60	80	100	120
Rated/maximum rectifier input current (EN 62040-3) (A)		93/112	123/146	154/184	185/218
Rated bypass input current (A)		87	116	145	174
Inverter output current @ 400 V (A) P/N		87	116	145	174
Maximum air flow (m^3/h)		510		2000	
Sound level (dBA)		< 58	< 59	< 65	
Power dissipation in nominal conditions[1]	W	3857	4961	5920	7840
	kcal/h	3316	4266	5090	6741
	BTU/h	13168	16937	20211	26751
Power dissipation (max) in the worst conditions[2]	W	4240	5382	6195	8258
	kcal/h	3645	4628	5327	7100
	BTU/h	14475	18375	21152	28194
Dimensions	W (mm)	600		700	
	D (mm)	800		830	
	H (mm)	1400		1925	
Weight (kg)		210	220	400	400

1) Considering nominal input current (400 V, battery charged) and rated output active power (PF1).

2) Considering maximum input current (low input voltage, battery recharge) and rated output active power (PF1).

4.2. Electrical characteristics

Electrical characteristics - **Rectifier[1] Input**				
Rated power (kVA)	60	80	100	120
Rated mains supply voltage	400 V 3ph + N			
Voltage tolerance	240 to 480 V[2]			
Rated frequency	50/60 Hz (selectable)			
Frequency tolerance	±10%			
Power factor (input at full load and rated voltage)	≥ 0.99			
Total harmonic distortion (THDi)	< 2.7%		< 1.7%	< 1.4%
Max inrush current at start-up	<In (no overcurrent)			

(1) IGBT rectifier. (2) Conditions apply.

Electrical characteristics - **Bypass**					
Rated power (kVA)		60	80	100	120
Bypass frequency variation speed		1 Hz/s (settable up to 3 Hz/s)			
Bypass rated voltage		Nominal output voltage +20% to -10%		Nominal output voltage ±15%	
Bypass rated frequency		50/60 Hz (selectable)			
Bypass frequency tolerance		±2% (configurable from 1% to 8%)			

Electrical characteristics -**Inverter**					
Rated power (kVA)		60	80	100	120
Rated output voltage (selectable)		380/400/415 V			
Output voltage tolerance		Static: ±1% Dynamic: VF-SS-111 (EN 62040-3) compliant			
Rated output frequency (selectable)		50/60 Hz (selectable)			
Output frequency tolerance		±0.01% on mains power failure			
Load crest factor		≥ 2.7:1			
Voltage harmonic distortion		< 1% with linear load			
Overload tolerated by the inverter	10 min	69 kW	92 kW	115 kW	138 kW
	1 min	83.4 kW	111.2 kW	139 kW	166.8 kW

Electrical characteristics - **Efficiency**				
Model	GP 60	GP 80	GP 100	GP 120
Double conversion efficiency (normal mode - @ full load)	up to 96%			
Efficiency in EcoMode	98%			

Electrical characteristics - **Environment**				
Model	GP 60	GP 80	GP 100	GP 120
Storage temperatures	-5 to +45 °C (23 to 113 °F) (15 to 25 °C for better battery life)			
Working temperature	0 to +40(1) °C (32 to 104 °F) (15 to 25 °C for better battery life)			
Maximum relative humidity (non-condensing)	95%			
Maximum altitude without derating	1000 m (3300 ft)			
Degree of protection	IP20 (other IP as option)			

(1) Conditions apply.

4.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]				
Rated power (kVA)	60	80	100	120
D curve circuit breaker (A)	125	160	250	
gG fuse (A)	125	160	250	

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]				
Rated power (kVA)	60	80	100	120
Maximum I^2t supported by the bypass (A^2s)	80000	125000	320000	
Icc max (A)	4000	5000	8000	
D curve circuit breaker (A)	125	160	250	
gG fuse (A)	125	160	250	

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]				
Rated power (kVA)	60	80	100	120
Input residual current circuit breaker	> 0.5 A Selective			

RECOMMENDED PROTECTION DEVICES - **Output**[3]					
Rated power (kVA)		60	80	100	120
Short-circuit inverter current (A) (when AUX MAINS is not present)	0 to 40 ms	235	313	470	
	40 to 100 ms	188	250	420	
C curve circuit breaker[3] (A)		≤ 16	≤ 20	≤ 40	
B curve circuit breaker[3] (A)		≤ 25	≤ 32	≤ 80	
High-speed fuse[3] (A)		≤ 25	≤ 32	≤ 80	

CABLES - **Maximum cable section**					
Rated power (kVA)		60	80	100	120
Rectifier terminals		4x CBD 50 50 mm^2 (flexible cable), 70 mm^2 (rigid cable)		4x bus bar with holes ø 11 mm 2x150 mm^2 (flexible cable and rigid cable)	
Bypass terminals		4x CBD 70 95 mm^2 (flexible cable and rigid cable)			
Battery terminals				4x bus bar with holes ø 11 mm 2x120 mm^2 (flexible cable and rigid cable)	
Output terminals	phases	3x CBD 50 50 mm^2 (flexible cable), 70 mm^2 (rigid cable)		4x bus bar with holes ø 11 mm 2x150 mm^2 (flexible cable and rigid cable)	
	neutral	1x CBD 70 95 mm^2 (flexible cable and rigid cable)			

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

“Electromagnetic Compatibility Provisions (EMC)”

EN 62040-2 Electromagnetic compatibility (C3 category)

5.2.2. Safety

“General and safety requirements for UPS used in operator access areas”

EN 60950-1 General and safety requirements for equipment used in operator access areas

EN 62040-1 General and safety requirements for UPS used in restricted access locations (certified by TÜV SÜD)

5.2.3. Type and performances

“Performance requirements and methods of test”

EN 62040-3 Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

Once installed in a system, the UPS will not alter the neutral conditions; this is because the neutral input terminal is connected directly to output terminal inside the equipment. If the neutral condition of the system downstream of the UPS needs to be modified, it will be necessary to use the isolation transformer option.

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g.EN 60364).

DELPHYS GP

Green Power 2.0 range

160 to 800 kVA/kW

3 LEVEL TECHNOLOGY

96% EFFICIENCY

kW = kVA

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OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

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INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

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- ensure 24/7/365 availability and business continuity to datacentre infrastructures,
- to avoid data losses and downtime of company operations,
- to reduce the electrical infrastructure's total cost of ownership,
- to adopt a sustainable development approach.

GREEN POWER 2.0								
Rated power (kVA)	160	200	250	320	400	500	600	800
DELPHYS GP 3/3	•	•	•	•	•	•	•	•

Matrix table for model and kVA power rating

DELPHYS GP has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

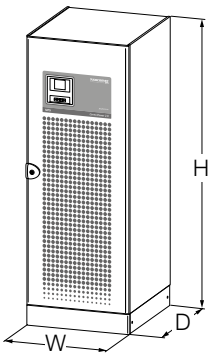
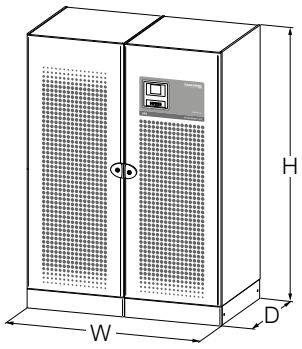
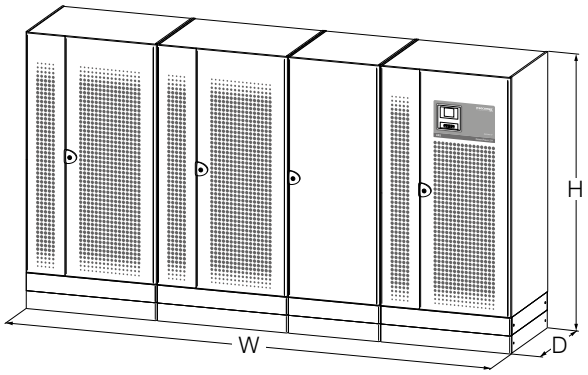
2.1. Power ratings from 160 to 800 kVA/kW

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms and communication interfaces are located in the front side and can be accessed from a door provided with handle and lock.

The air inlet is on the front, with outflow from the upper side; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

DELPHYS GP - Dimensions				
		Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
	160 kVA/kW	700	800	1930
	200 kVA/kW			
	250 kVA/kW	1000	950	1930
	320 kVA/kW	1400	800	
	400 kVA/kW			
	500 kVA/kW	1600	950	
	600 kVA/kW	2800	950	2060
	800 kVA/kW	3700		

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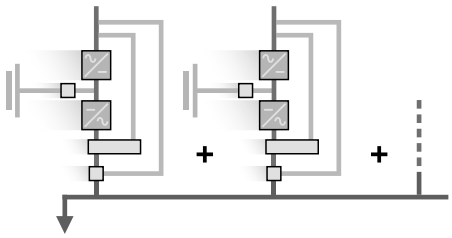
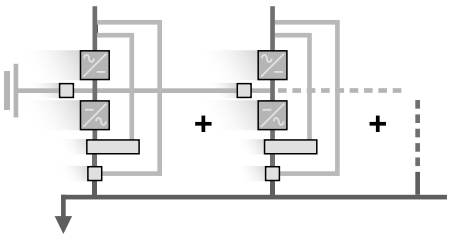
2.2. Battery management

Available with distributed batteries, DELPHYS GP allows to optimise the batteries size thanks to a shared battery operation. This reduces the overall system footprint, the weight of the required batteries, the battery monitoring system, the amount of wiring needed and the amount of lead.

To guarantee maximum back-up time availability and battery life, DELPHYS GP includes:

- EBS (Expert Battery System), smart battery charging management.
- Distributed or shared battery for energy storage optimization on parallel systems.
- Capability to discharge the battery at a programmable power (“BCR” option), without any load bank.

	
Distributed battery	Shared battery

2.3. UPS and system architectures

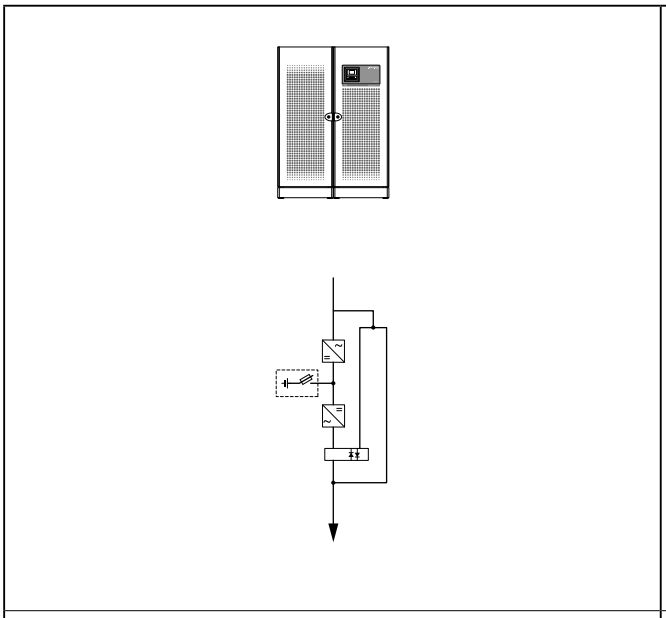
DELPHYS GP units (rectifier, battery, inverter and bypass) can be connected in parallel with distributed or central bypass:

- up to 8 units (160, 200, 250 and 500 kVA/kW)
- up to 6 units (320 and 400 kVA/kW)
- up to 4 units (600 and 800 kVA/kW)

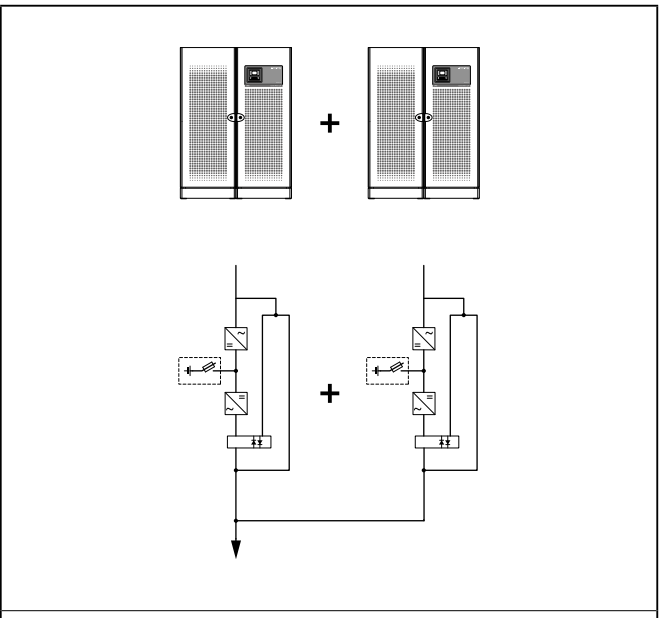
This solution, which is ideally suited for N+1 redundancy, offers flexible power upgrading and enables stand-alone UPS units to be expanded.

Each single UPS unit has a built-in maintenance bypass (single unit or 1+1 distributed bypass).

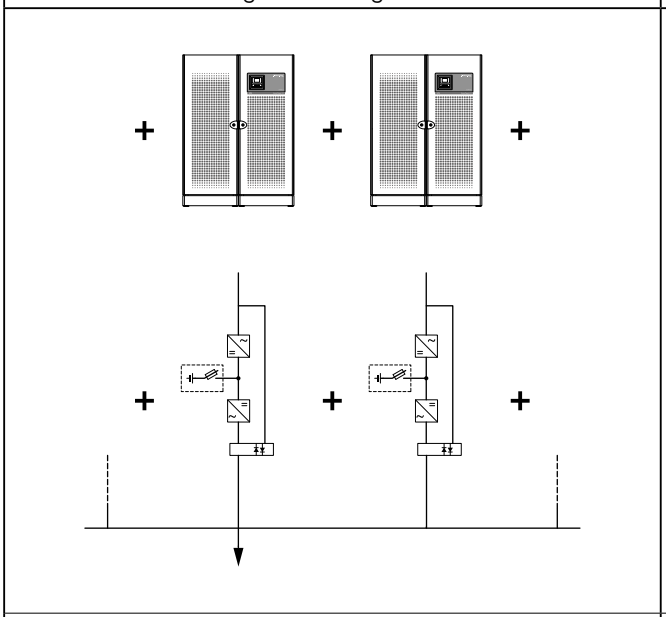
It is possible to add an external maintenance bypass, common to all of the UPS units, for maintenance access. A central bypass configuration has a common maintenance bypass for the complete system.



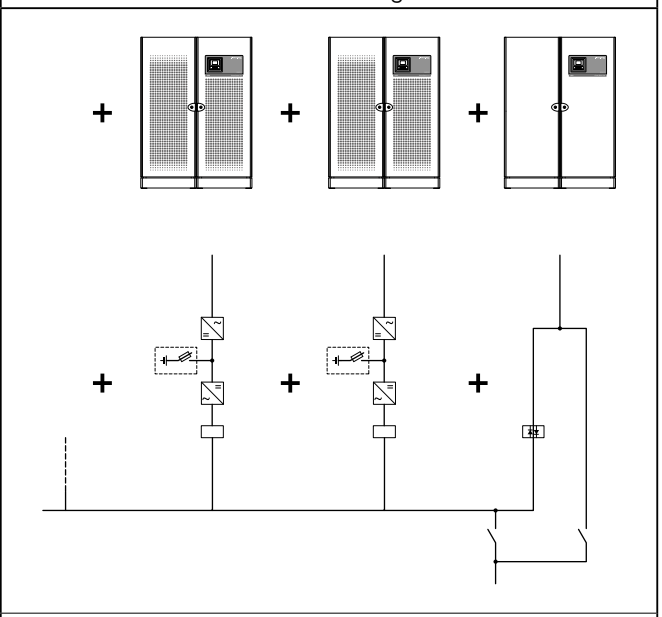
Single unit configuration



1+1 redundant configuration



Modular parallel UPS with distributed bypass



Modular parallel UPS with centralised bypass

3. STANDARD AND OPTIONS

3.1. Standard electrical features.

- Integrated maintenance bypass (single and 1+1 redundant units).
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.
- Redundant cooling.
- Battery temperature sensor.

3.2. Electrical options.

- Separated or common input mains.
- External maintenance bypass.
- Extended battery charger capability.
- Shared battery.
- Flywheel compatible.
- Galvanic isolation transformer.
- Backfeed isolation device.
- ACS synchronisation system.
- BCR (Battery Capacity Re-injection).
- FAST ECOMODE.

3.3. Standard communication features.

- User-friendly multilingual interface with graphic display.
- 2 slots for communication options.
- Ethernet connection (WEB/SNMP/email).
- USB port for event log access.

3.4. Communication options.

- Advanced server shutdown options for stand-alone and virtual servers.
- 4 additional slots for communication options.
- ADC interface (configurable voltage-free contacts).
- MODBUS TCP.
- MODBUS RTU.
- BACnet/IP interface.

3.5. Remote monitoring service.

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters									
Rated power (kVA)		160	200	250	320	400	500	600	800
Phase in/out		3/3							
Active power (kW)		160	200	250	320	400	500	600	800
Rated/maximum rectifier input current (EN 62040-3) (A)		244/290	305/340	380/425	488/580	610/680	760/850	915/1020	1140/1275
Rated bypass input current (A)		231	289	361	462	578	722	866	1155
Inverter output current @ 230 V (A) P/N		231	289	361	462	578	722	866	1155
Maximum air flow (m^3/h)		2250		2700	4500		5400	6750	8100
Sound level (dBA)		≤ 65	≤ 67	≤ 70	≤ 68	≤ 70	≤ 72		≤ 74
Power dissipation in nominal conditions[1]	(W)	7900	10400	12800	17000	22000	24300	31800	45000
	(kcal/h)	6797	8948	11013	14627	18929	20908	27361	38718
	(BTU/h)	26956	35486	43675	58006	75066	82914	108505	153545
Power dissipation (max) in the worst conditions[2]	(W)	10000	13000	15000	20000	26000	30000	39000	48000
	(kcal/h)	8604	11185	12906	17208	22370	25812	33555	41300
	(BTU/h)	34121	44358	51182	68242	88716	102364	133074	163782
Dimensions	W (mm)	700		1000	1400		1600	2800	3700
	D (mm)	800		950	800		950	950	
	H (mm)	1930						2060	
Weight (kg)		470	490	850	980	1000	1500	2300	3400

1) Considering nominal input current (400 V, battery charged) and rated output active power (PF1).
2) Considering maximum input current (low input voltage, battery recharge) and rated output active power (PF1).

4.2. Electrical characteristics

Electrical characteristics - **Rectifier[1] Input**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Rated mains supply voltage (V)	400 3ph							
Voltage tolerance	200 V to 480 V[2]							
Rated frequency	50/60 Hz							
Frequency tolerance	42 to 65 Hz							
Power factor	> 0.99							
Total harmonic distortion (THDi) (at full load and rated voltage)	< 2.5%[3]							
Max inrush current at start-up	< In (no overcurrent)							
Soft start	50 A/sec (settable)			100 A/sec (settable)			150 A/sec (settable)	

(1) IGBT rectifier. (2) Conditions apply. (3) With input THDV < 1%.

Electrical characteristics - **Battery**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Min/Max number of battery cells with load PF=1	216/258	258/258	252/258	216/258	258/258	252/258	258/258	258/258
Min/Max number of battery cells with load PF ≤ 0,9	216/258	234/258	234/258	216/258	234/258	234/258	234/258	246/258
Min/Max number of battery cells with load PF ≤ 0,8	216/258	216/258	216/258	216/258	216/258	216/258	216/258	234/258
Battery AC ripple current	< 3% C10							
Battery AC ripple voltage	< 1% on the battery bloc							

Electrical characteristics - **Bypass**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Bypass frequency variation speed	1.5 Hz/s settable from 1 to 3 Hz/s							
Bypass rated voltage	Nominal output voltage ±15% (settable)							
Bypass rated frequency	50/60 Hz (selectable)							
Bypass frequency tolerance	±2% (from ±1% to ±8% (operation with generator unit))							

Electrical characteristics - **Inverter**									
Rated power (kVA)		160	200	250	320	400	500	600	800
Rated output voltage (selectable) (V)		400 3ph + N (380/415 configurable)							
Output voltage tolerance		static load ±1%, dynamic load VF-SS-111 compliant							
Rated output frequency (Hz)		50/60 Hz (selectable)							
Autonomous frequency tolerance		±0.02% on mains power failure							
Load crest factor (according IEC 62040-3)		3:1							
Harmonic voltage distortion		ThdU ≤ 1,5 % with rated linear load							
Overload tolerated by the inverter - 25 °C	10 min	200 kW	225 kW	280 kW	400 kW	450 kW	560 kW	675 kW	840 kW
	1 min	240 kW	270 kW	312 kW	480 kW	540 kW	625 kW	810 kW	935 kW

Electrical characteristics - **Efficiency**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Double conversion efficiency (normal mode - VFI)	up to 96%							
Fast EcoMode	up to 99%							

Electrical characteristics - **Environment**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Storage temperatures	-20 to +70 °C (-4 to +158 °F) (15 to 25 °C for better battery life)							
Start-up and working temperature	+10 to +40 °C(1) (+50 to +104 °F) (15 to 25 °C for better battery life)							
Maximum relative humidity (non-condensing)	95%							
Maximum altitude without derating	1000 m (3,300 ft)							
Degree of protection	IP 20 (other IP as option)							
Portability	EN 60068-2							
Colour	cabinet: RAL 7012, door: silver grey							

(1) Conditions apply.

4.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]								
Rated power (kVA)	160	200	250	320	400	500	600	800
Circuit breaker (A)	315	400	630		800	1000	1250	1600
gG fuse (A)	315	400	630		800	1000	1250	1600

RECOMMENDED PROTECTION DEVICES - **General bypass** [1]								
Rated power (kVA)	160	200	250	320	400	500	600	800
Maximum I^2t supported by the bypass (A^2s)	320000			780000		1050000	1843000	
$I_{s/c}$ max (A peak)	8000			12500		14500	19200	
Circuit breaker (A)	400		630		800		1000	1250

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker** [2]								
Rated power (kVA)	160	200	250	320	400	500	600	800
Phase in/out	3/3							
Input residual current circuit breaker	3 A							

RECOMMENDED PROTECTION DEVICES - **Output** [3]								
Rated power (kVA)	160	200	250	320	400	500	600	800
Short-circuit inverter current Ik1=Ik2=Ik3[4] (A) - (0 to 100 ms) (when AUX MAINS is not present)	800		900	1600		1800	2200	2500
C curve circuit breaker (A)	≤ 80			≤ 160			≤ 200	≤ 250
B curve circuit breaker (A)	≤ 125		-					

CABLES CONNECTION - **Maximum capability per pole**								
Rated power (kVA)	160	200	250	320	400	500	600	800
Rectifier terminals (mm^2)	2 x 150		2 x 240	3 x 300			4 x 300	
Bypass terminals (mm^2)	2 x 150		2 x 240	3 x 300			4 x 300	
Battery terminals (mm^2)	2 x 240		2 x 240	2 x 300		3 x 300	4 x 300	
Output terminals (mm^2)	2 x 150		2 x 240	3 x 300			4 x 300	

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

(4) Ik1: phase to neutral, Ik2: phase to phase, Ik3: three-phase.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force. In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 62040-2 Electromagnetic compatibility (C3 category)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

MODULYS GP

Green Power 2.0 range

25 to 600 kVA / kW

3 LEVEL TECHNOLOGY

96% EFFICIENCY

kW = kVA

TÜV SÜD
Production monitored
Safety tested

socomec
Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide the information required to prepare the system and installation site.
The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

For detailed information, see the installation and operating manual.

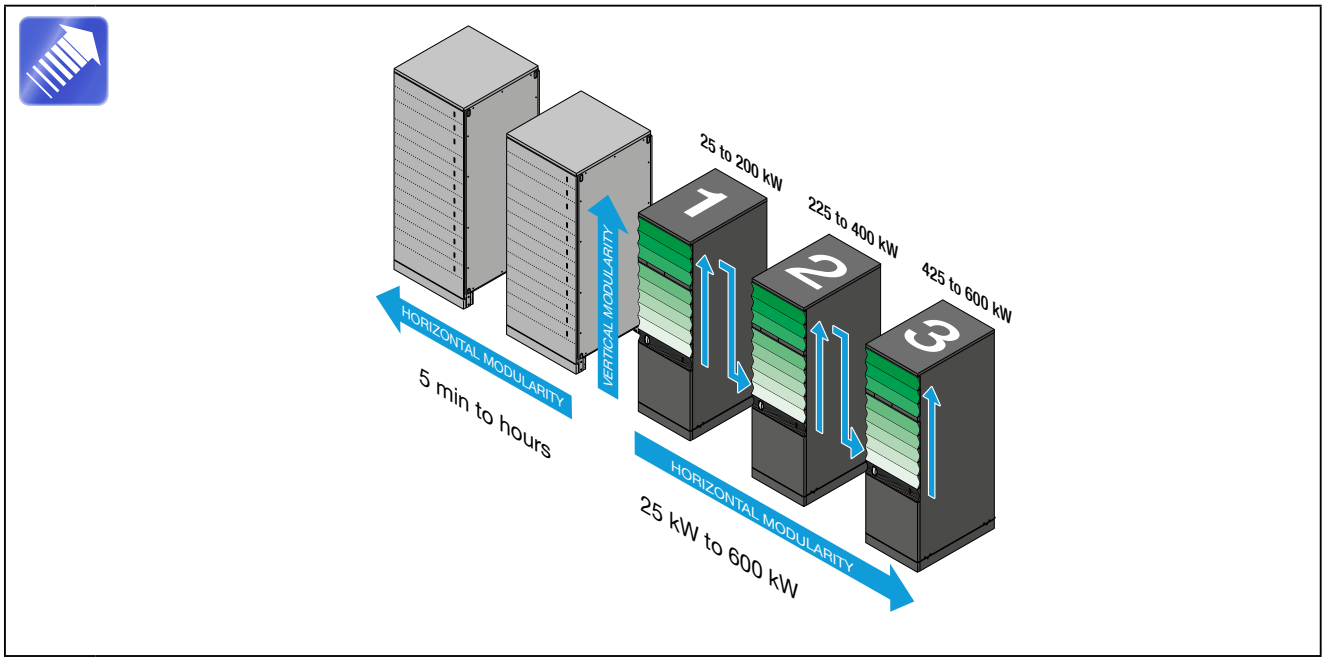
1. ARCHITECTURE

1.1. Range and Power Flexibility

MODULYS GP is a modular, scalable UPS system with power ratings from 25 kW to 600 kW, based on parallelable plug-in power modules.

The vertical modularity allows power scalability by simply plugging one or more additional modules into the existing system (up to 8 modules per system).

The horizontal modularity enables maximum scalability up 600 kW (24 modules) by coupling three modular systems.



CONFIGURATIONS AND RATED POWER																								
	Number of Systems																							
	1								2								3							
	Number of Modules																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Power (kW) without redundancy	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
Power (kW) N+1 redundant	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575
Power (kW) N+2 redundant	-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550

1.2. Flexible back-up time

Different extended back-up times are possible by using: (1) the internal battery; (2) a modular battery cabinet; (3) a high capacity battery cabinet. The latter two occupy minimum floor space.

Each battery pack comprises an acid-proof container designed to prevent damage in the case of acid leakage.

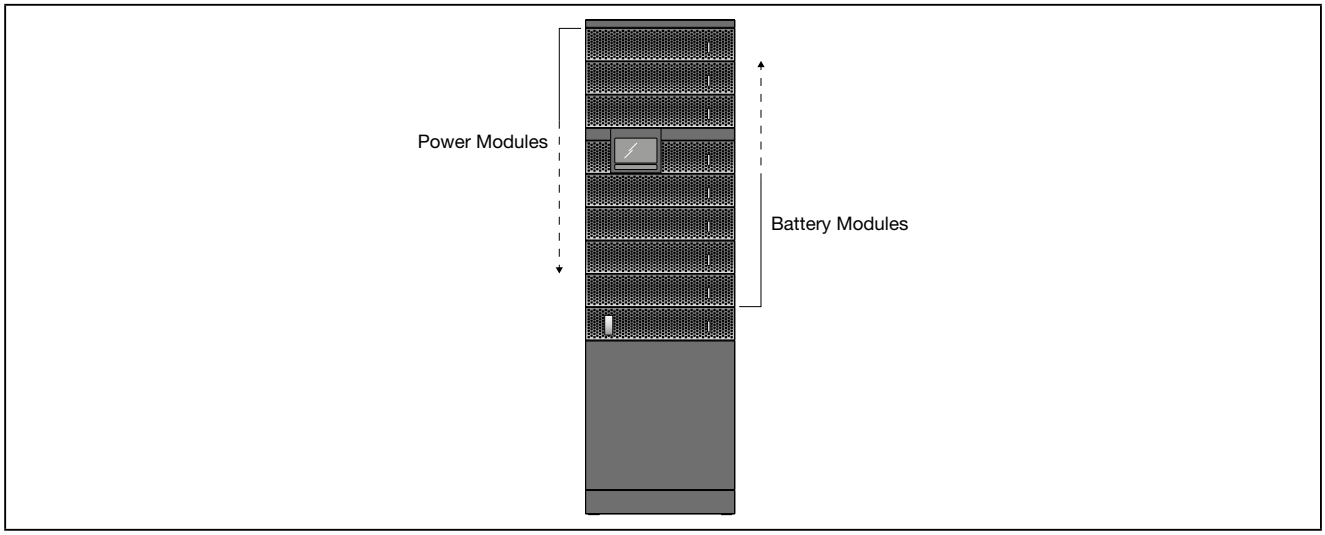
Each Power Module has a powerful embedded battery charger able to provide up to 8 A (without derating).

A special Power Module with double battery charger inside is available when very long back-up times are required.

1.2.1. Internal hot-swap battery

A standard UPS cabinet can house both Power Modules and Battery Boxes, thus providing a compact solution with a small footprint and optimised costs.

Each battery box has its own independent protection and it is hot-swappable.



DIMENSIONS AND WEIGHT												
	Number of battery strings											
	1	2	3	4	5	6	7	8	9	10	11	12
Height (mm)	1990											
Depth (mm)	890											
Width (mm)	600											
Weight (kg)	260	360	460	560	660	760	860	960	1060	1160	1260	1360

Internal hot-swap battery
Back-up times in minutes @ 75% of rated load

			Number of Power Modules							
Without redundancy			1	2	3	4	5	6	7	8
Number of battery strings	1	5	-	-	-	-	-	-	-	-
	2	10	6	-	-	-	-	-	-	-
	3	15	11	-	-	-	-	-	-	-
	4	20	16	6	-	-	-	-	-	-
	5	25	21	8	-	-	-	-	-	-
	6	30	26	11	-	-	-	-	-	-
	7	35	34	-	-	-	-	-	-	-
Cumulative Ah										

Internal hot-swap battery
Back-up times in minutes @ 75% of rated load

			Number of Power Modules							
N+1 redundancy			2	3	4	5	6	7	8	
Number of battery strings	1	5	-	-	-	-	-	-	-	
	2	10	6	-	-	-	-	-	-	
	3	15	11	-	-	-	-	-	-	
	4	20	16	6	-	-	-	-	-	
	5	25	21	8	-	-	-	-	-	
	6	30	26	-	-	-	-	-	-	
	7	35	-	-	-	-	-	-	-	
Cumulative Ah										

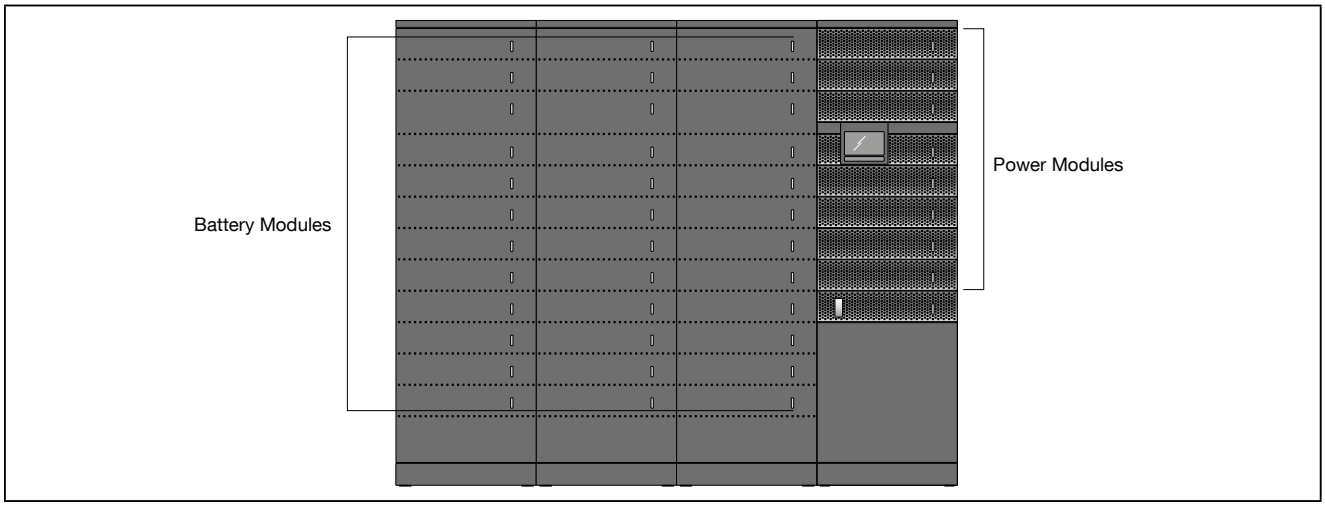
Internal hot-swap battery
Back-up times in minutes @ 75% of rated load

			Number of Power Modules							
N+2 redundancy			3	4	5	6	7	8		
Number of battery strings	1	5	-	-	-	-	-	-	-	
	2	10	6	-	-	-	-	-	-	
	3	15	11	-	-	-	-	-	-	
	4	20	16	6	-	-	-	-	-	
	5	25	21	-	-	-	-	-	-	
	6	30	-	-	-	-	-	-	-	
	7	35	-	-	-	-	-	-	-	
Cumulative Ah										

1.2.2. Modular hot-swap battery cabinet - medium capacity

The modular battery system is based on vertical and horizontal modularity thanks to independent battery strings connected in parallel, each one made of hot-swap long life battery packs.

Each battery string has its own independent protection and its own independent switch for fast and safe maintenance.



DIMENSIONS AND WEIGHT																																				
	Number of Modular hot-swap battery cabinets - medium capacity																																			
	1												2												3											
	Number of battery strings																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Height (mm)	1990																																			
Depth (mm)	950																																			
Width (mm)	810												1620												2430											
Weight (kg)	384	508	632	756	880	1004	1128	1252	1376	1500	1624	1748	2132	2256	2380	2504	2628	2752	2876	3000	3124	3248	3372	3496	3880	4004	4128	4252	4376	4500	4624	4748	4872	4996	5120	5244

Vertical modularity using a modular battery cabinet with hot-swap battery boxes provides scalable power back-up with to 12 battery strings per cabinet.

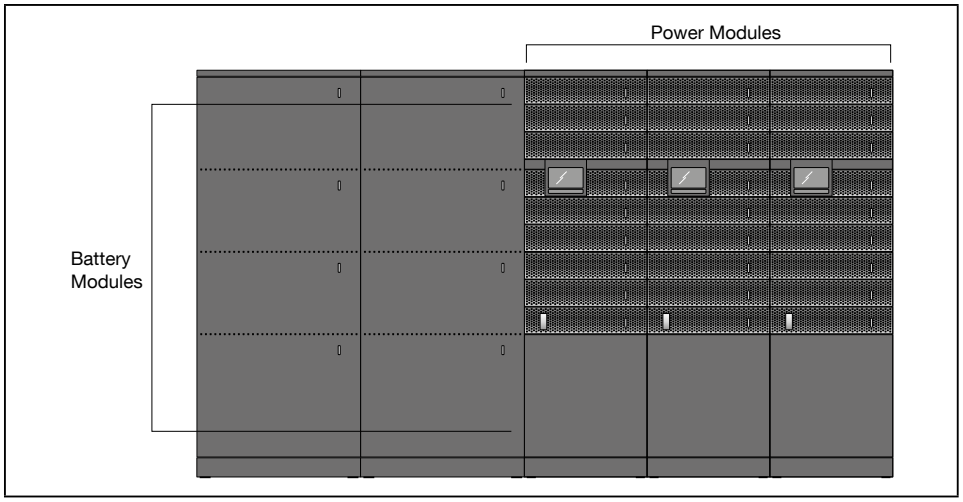
Horizontal modularity provides very high and scalable back-up.

A standard temperature sensor optimises the battery recharging parameters according to the ambient operating temperature to extend battery life.

MODULAR HOT-SWAP BATTERY CABINET - MEDIUM CAPACITY
BACK-UP TIMES IN MINUTES @75% OF RATED LOAD

						Number of Power Modules																							
Without redundancy						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N+1 redundant						2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	-
N+2 redundant						3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	-	-
Number of battery cabinets		Numer of battery strings		Cumultative Ah																									
	1		1		9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			2		18	15	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3		27	23	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			4		36	34	15	8	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			5		45	44	19	11	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			6		54	57	23	15	9	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			7		63	68	28	18	12	8	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			8		72	80	34	20	15	11	8	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			9		81	92	40	23	17	13	9	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			10		90	103	44	23	19	15	11	9	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			11		99	116	51	30	21	17	13	10	8	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-
			12		108	129	57	34	23	18	15	12	9	8	6	6	5	-	-	-	-	-	-	-	-	-	-	-	-
	2		13		117	141	63	38	25	20	16	13	11	9	7	6	5	5	-	-	-	-	-	-	-	-	-	-	-
			14		126	151	68	41	28	22	18	15	12	10	8	7	6	5	5	-	-	-	-	-	-	-	-	-	-
			15		135	163	73	44	31	23	19	16	14	11	9	8	7	6	5	5	-	-	-	-	-	-	-	-	-
			16		144	177	80	48	34	25	20	17	15	13	11	9	8	7	6	5	5	-	-	-	-	-	-	-	-
			17		153	190	86	53	37	27	22	18	16	14	12	10	9	7	7	6	5	5	-	-	-	-	-	-	-
			18		162	206	92	57	40	29	23	19	17	15	13	11	9	8	7	6	6	5	5	-	-	-	-	-	-
			19		171	221	98	61	42	32	25	21	18	16	14	12	10	9	8	7	6	6	5	5	-	-	-	-	-
			20		180	235	103	65	44	34	26	22	19	17	15	13	11	10	9	8	7	6	6	5	5	-	-	-	-
			21		189	249	109	68	47	37	28	23	20	18	16	14	12	11	9	8	8	7	6	6	5	5	-	-	-
			22		198	261	116	71	51	39	30	25	21	18	17	15	13	12	10	9	8	7	7	6	6	5	5	-	-
			23		207	272	123	75	54	41	32	26	22	19	17	16	14	12	11	10	9	8	7	7	6	6	5	5	-
			24		216	282	129	80	57	43	34	27	23	20	18	17	15	13	12	11	9	9	8	7	6	6	6	5	5
	3		25		225	294	135	84	60	44	36	29	24	22	19	17	16	14	13	11	10	9	8	8	7	6	6	5	5
			26		234	310	141	88	63	46	38	31	25	23	20	18	16	15	13	12	11	10	9	8	7	7	6	6	5
			27		243	326	146	92	66	49	40	33	26	23	21	19	17	16	14	13	11	10	9	9	8	7	7	6	6
			28		252	341	151	96	68	52	41	34	28	24	22	19	18	16	15	14	12	11	10	9	8	8	7	7	6
			29		261	354	156	99	81	55	43	36	30	25	23	20	18	17	16	14	13	12	11	10	9	8	8	7	7
			30		270	367	163	103	73	57	44	38	31	26	23	21	19	17	16	15	14	12	11	10	9	9	8	7	7
			31		279	383	180	108	86	59	46	39	33	27	24	22	20	18	17	15	14	16	12	11	10	9	8	8	7
			32		288	402	177	111	80	62	48	41	34	29	25	23	20	19	17	16	15	14	13	11	11	10	9	8	8
			33		297	419	183	116	83	64	51	42	36	30	26	23	21	19	18	17	15	14	13	12	11	10	9	9	8
			34		306	436	190	120	86	66	53	43	37	32	27	24	22	20	18	17	16	15	14	13	12	11	10	9	9
			35		315	451	197	125	89	68	55	44	39	33	28	25	23	21	19	18	17	15	14	13	12	11	10	10	9
			36		324	466	206	129	92	70	57	46	40	34	29	25	23	21	19	18	17	16	15	14	13	12	11	10	9

1.2.3. Modular battery cabinet - high capacity



DIMENSIONS AND WEIGHT	
Height (mm)	1990
Depth (mm)	890
Width (mm)	810
Weight (kg)	1792

Modular battery cabinets - high capacity are designed for long BUT also with higher power.

A standard temperature sensor optimizes the battery recharging parameters according to the ambient operating temperature to extend battery life.

MODULAR BATTERY CABINET - HIGH CAPACITY
BACK-UP TIMES IN MINUTES @75 % OF RATED LOAD

						Number of Power Modules																					
Without redundancy						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N+1 redundant						2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	-
N+2 redundant						3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	-	-
Number of battery cabinets	1	Numer of battery strings	1	Cumultative Ah	92	119	56	33	21	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2		2		184	279	119	75	56	45	33	25	21	17	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3		3		176	447	201	119	84	66	56	49	41	33	27	24	21	18	17	15	-	-	-	-	-	-	-	-	-
	4		4		268	654	279	170	119	89	75	62	56	50	45	39	33	28	25	23	21	19	17	16	15	-	-	-	-
	5		5		460	-	378	226	154	119	92	81	70	60	56	51	47	43	38	33	29	26	24	22	21	19	18	17	16
	6		6		552	-	-	279	201	146	119	96	84	75	66	59	56	52	49	45	41	37	33	30	27	25	24	22	21

2. SPECIFICATIONS

2.1. Installation parameters

RATED POWER																								
	Number of Systems																							
	1								2								3							
	Number of Modules																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Power (kW) without redundancy	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
Power (kW) N+1 redundant	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575
Power (kW) N+2 redundant	-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550

The number of modules should be defined according to the load power and the required level of redundancy.

RATED POWER AND MAX CURRENT																								
	Number of Systems																							
	1								2								3							
	Number of Modules																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Rated rectifier input current (A) (EN 62040-3)	38	75	131	152	189	226	264	302	339	377	415	452	490	528	566	603	641	679	716	754	792	829	867	905
Max rectifier input current (A) (EN 62040-3)	45.0	90	135	180	225	270	315	360	405	450	495	540	585	630	675	720	765	810	855	900	945	990	1035	1080
Inverter output current @ nominal voltage (A)	36.2	72	109	145	181	217	253	290	326	362	398	434	471	507	543	579	615	652	688	724	760	796	833	869
Maximum bypass input current (A) (EN 62040-3)	320								640								960							
Max battery current (A)	80	160	240	320	400	480	560	640	720	800	880	960	1040	1120	1200	1280	1360	1440	1520	1600	1680	1760	1840	1920

In case of 3 single-phase distorting loads downstream of the UPS, when the bypass is in operation the neutral current can be 1.5-2 times higher than the phase current. This is due to the harmonic current distortion produced by the load itself, which is no longer corrected by the UPS rectifier as occurs in normal operation.

COOLING																									
		Number of Systems																							
		1								2								3							
		Number of Modules																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Maximum air flow (m^3/h)		400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400	6800	7200	7600	8000	8400	8800	9200	9600
Max dissipation in nominal conditions[1]	(W)	1140	2280	3420	4560	5700	6840	7980	8120	10260	11400	12540	13680	14820	14960	17100	18240	19380	20520	21660	22800	23940	25080	26220	27360
	(kcal/h)	980	1961	2941	3922	4902	5882	6863	7843	8824	9804	10758	11765	12745	13726	14706	15686	16667	17647	18628	19608	20588	21569	22549	23530
	(BTU/h)	3891	7782	11672	15563	19454	23345	17136	31127	35017	38908	42799	46690	5081	54471	58362	62253	66144	70035	73926	77816	81707	85598	89489	93380
Max dissipation in worst conditions[2]	(W)	1350	2650	3950	5250	6550	7850	9150	10450	11800	13100	14400	15700	17000	18300	19600	20900	22250	23550	24850	26150	27450	28750	30050	31350
	(kcal/h)	1161	2289	3397	4515	5633	6751	7869	8987	10148	11266	12384	13502	14620	15738	16856	17974	19135	20253	21375	22489	23607	24725	25843	26961
	(BTU/h)	4608	9044	13481	17918	22355	26792	31229	35666	40273	44710	49147	56584	58021	62458	66895	71332	75939	80376	84813	89250	93687	98124	102561	106998

(1) Nominal input voltage and rated output active power (PF1).

(2) Low input voltage, battery recharge and rated output active power (PF1).

ACOUSTIC NOISE																									
	Number of Systems																								
	1								2								3								
	System Power (kW)																								
Without redundancy	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
N+1 redundant	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575
N+2 redundant	-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550
Acoustic noise at 1m (dBA)[1]	51	53	54	55	56	57	58	59	60	60	60	60	62	62	62	62	63	63	63	63	63	63	63	63

(1) 75 % of nominal load.

DIMENSIONS AND WEIGHT																								
	Number of Systems																							
	1								2								3							
	Number of Modules																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Height (mm)	1990																							
Depth (mm)	890																							
Width (mm)	600								1200								1800							
Weight (mm)	286	319	352	385	418	451	484	517	803	836	869	902	935	968	1001	1034	1320	1353	1386	1419	1452	1485	1518	1551

ENVIRONMENT	
Storage temperature	-5 to +50 °C
Operating temperature	0 to 40 °C[1][2]
Maximum relative humidity	95 % condensation-free
Degree of protection	IP20

(1) According to EN 62040-3.

(2) For best battery lifetime the suggested temperature range is 15 °C - 25 °C.

SYSTEM CABLES - MAX SECTION									
		Number of Modules							
		1	2	3	4	5	6	7	8
Rectifier terminals (mm^2)	Flexible	2x150							
	Rigid	2x150							
Bypass terminals (mm^2)	Flexible	2x150							
	Rigid	2x150							
Battery terminals (mm^2)	Flexible	2x150							
	Rigid	2x150							
Output terminals (mm^2)	Flexible	2x150							
	Rigid	2x150							

Max section is determined by the size of the terminals.

As specified in EN 62040-3 Appendix 3 (Non-Linear Load Reference), in the event of three-phase non-linear loads connected downstream of the UPS, the neutral current on the load can be 1.5 - 2 times higher than the phase current. This should be taken into account when estimating the correct size of the output and the auxiliary neutral cables.

2.2. Electrical characteristics

2.2.1. Electrical characteristics independent of the number of systems/modules

Electrical characteristics - **Input**	
Rated mains supply voltage (V)	400 V 3-phase+N
Voltage tolerance at full load	340 V to 480 V (+20/-15 %)
Voltage tolerance at derated load	up to 240 V @ 50 % of nominal load (linear decrease)
Rated frequency (Hz)	50/60 ±10 %
Power factor	> 0.99(1)
Total harmonic input current distortion (THDi)	≤ 3% (@: Pn, Resistive load, Mains THDv ≤ 1 %)
Max inrush current at start-up	Power walk-in/Soft-start (selectable parameters)

(1) P_{out} ≥ 50 % Sn.

Electrical characteristics - **Bypass**	
Bypass rated voltage (V)	Nominal output voltage ±15 % (±20% if GENSET is used)
Bypass rated frequency (Hz)	50/60
Bypass frequency tolerance (Hz)	±2 % selectable (±8% if GENSET is used)
Bypass frequency variation speed	50/60 ±10 %

Electrical characteristics - **Inverter**	
Rated output voltage (V)	(3ph + N) 400/380/400/415(2) selectable
Output voltage tolerance (Hz)	±1
Rated output frequency (Hz)	50/60 (selectable)
Output frequency tolerance	±0.05 % (on battery mode)
Load crest factor	≥ 2.7:1
Total output voltage distortion (THDv)	≤ 1 % (Ph/Ph); ≤ 2% (Ph/N) (@: Pn, Resistive load)

Electrical characteristics - **Stored energy operating mode**	
Number of battery blocks (VRLA)	From 18+18 to 24+24

Electrical characteristics - **Efficiency**	
Efficiency (on-line mode)	up to 96.5 %
Efficiency (eco-mode)	up to 99.3 %

2.2.2. Electrical characteristics dependent on the number of systems / modules

ELECTRICAL CHARACTERISTICS - **Inverter overload and short-circuit**																										
			System Power (kW)																							
Without redudancy		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	
N+1 redundant		-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	
N+2 redundant		-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	
Inverter overload (kW)[1]	10’	31.2	62.4	94	125	157	188	219	250	282	313	344	376	407	438	470	501	532	563	595	626	657	689	720	751	
	5’	33.3	66.5	100	133	166	200	233	266	299	333	366	399	432	466	499	532	565	599	632	665	698	732	765	798	
	1’	37.5	75.0	113	150	188	225	263	300	338	375	413	450	488	525	563	600	638	675	713	750	788	825	863	900	
Inverter short-circuit (A) Ik1 = Ik2 = Ik3	40 ms	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	
	40 to 80 ms	80	160	240	320	400	480	560	640	720	800	880	960	1040	1120	1200	1280	1360	1440	1520	1600	1680	1760	1840	1920	

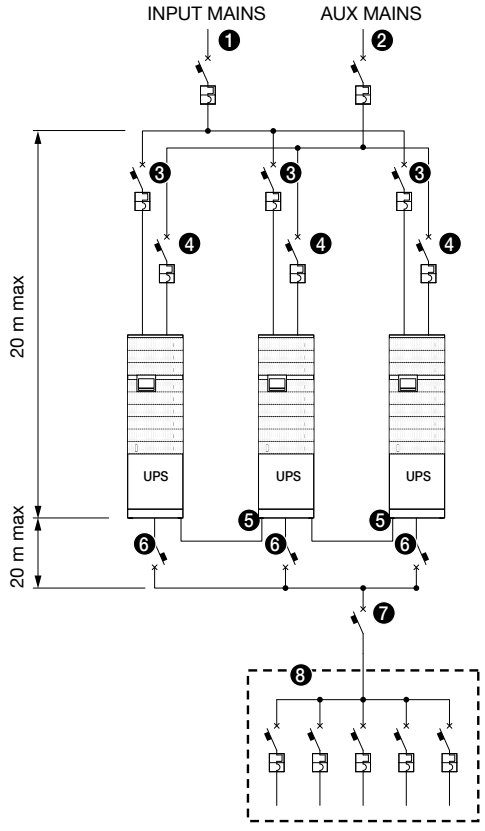
(1) Initial condition $P_{out} \leq 80\%$ Pn.

ELECTRICAL CHARACTERISTICS - **Bypass overload and short-circuit**																										
		Number of Systems																								
		1								2								3								
		System Power (kW)																								
Without redudancy		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	
N+1 redundant		-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	
N+2 redundant		-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	
Bypass overload (A)	Nominal	290								580								870								
	Continuous	350								640								960								
	10’	362								724								1086								
	1’	450								900								1350								
	1″	510								1020								1530								
Bypass max. short-circuit current (A)	20 ms	9000								18000								27000								

ELECTRICAL CHARACTERISTICS - **Bypass rating**			
	Number of Systems		
	1	2	3
Bypass I^2t (A^2s)	400000	1600000	3600000
Bypass Max Peak Current (A)	9000	18000	27000

ELECTRICAL CHARACTERISTICS - **Battery charger max. current**																									
	System Power (kW)																								
Without redudancy	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	
N+1 redundant	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	
N+2 redundant	-	-	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	
Standard max. current (A)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	
Enhanced battery charger max. current (A)	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	

2.3. Recommended protection devices



Key

1. Input mains magneto-thermal switch

2. Auxiliary mains magneto-thermal switch

3. Single UPS magneto-thermal input mains switch

4. Single UPS magneto-thermal auxiliary mains switch

5. Parallel bus cable

6. Single output switch

7. System shutdown switch

8. Distribution

The installation and system should comply with national plant regulations.

The electrical distribution panel should have a sectioning and protection system installed for input and auxiliary mains.

RECOMMENDED PROTECTION DEVICES - **Rectifier**									
		Number of Modules							
		1	2	3	4	5	6	7	8
		System Power (kW)							
Without redudancy		25	50	75	100	125	150	175	200
N+1 redundant		-	25	50	75	100	125	150	175
N+2 redundant		-	-	25	50	75	100	125	150
C curve circuit breaker (A)	Min	50	100	160	200	250	320	400	400
	Max	400	400	400	400	400	400	400	400
Gg fuse (A)	Min	50	100	160	200	250	315	350	400
	Max	400	400	400	400	400	400	400	400

A circuit breaker switch is recommended with a magnetic tripping threshold of ≥ 10 In (curve C). A D curve selective breaker should be fitted if an optional external transformer is used.

The minimum value depends on the size of the power cables in the installation, while the maximum value is limited by the UPS cabinet.

The system can accept the max. value of protection, whatever the number of modules installed, in order to allow future scalability, while the min. value depends on the size of the power cables in the installation. A value of protection less then Max shall be used when the mains network structure cannot support the full power load, and shall be chosen between max. and min. values (as per the table above) according to mains network design.

Rectifier protection should be taken into account in the event of separate inputs; when the auxiliary mains and rectifier inputs are combined (common input), the general input protection rating should be higher than both (auxiliary mains or rectifier).

RECOMMENDED PROTECTION DEVICES - **Auxiliary mains**									
		Number of Modules							
		1	2	3	4	5	6	7	8
		System Power (kW)							
Without redudancy		25	50	75	100	125	150	175	200
N+1 redundant		-	25	50	75	100	125	150	175
N+2 redundant		-	-	25	50	75	100	125	150
C curve circuit breaker (A)	Min	50	100	160	200	250	320	400	400
	Max	400	400	400	400	400	400	400	400
Gg fuse (A)	Min	50	100	160	200	250	315	350	400
	Max	400	400	400	400	400	400	400	400

If an optional external transformer is used, a D curve selective breaker should be used.

Auxiliary mains protection should be taken into account in the event of separate inputs; when the auxiliary mains and rectifier inputs are combined (common input), the general input protection rating should be higher than both (auxiliary mains or rectifier).

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**																							
	Number of Systems																						
	1								2								3						
	Number of Modules																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Input residual current circuit breaker (A)	1																						

An RCD is not necessary when the UPS is installed in TN-S system. RCDs are not allowed on TN-C systems. If an RCD is required, a B type should be used.

Caution!

Use four-pole selective (S) residual current detectors (RCDs). Load leakage currents are to be added to those generated by the UPS and during transitory phases (power failures and power returns) short current peaks may occur. If loads with high leakage current are present, adjust the residual current protection. It is advisable in all cases to carry out a preliminary check on the earth current leakage with the UPS installed and operating with the definitive load, so as to prevent the sudden activation of the RCD switch.

OUTPUT SELECTIVITY ON BATTERY MODE (AUX MAINS NOT PRESENT)																								
	Number of Power Modules																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	System Power (kW)																							
Without redudancy	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
N+1 redundant	/	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575
N+2 redundant	/	/	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550
B curve circuit beaker (A)	≤ 20	≤ 40	≤ 50	≤ 80	≤ 100	≤ 100	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125
C curve circuit breaker (A)	≤ 10	≤ 20	≤ 25	≤ 40	≤ 50	≤ 50	≤ 63	≤ 80	≤ 100	≤ 100	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125	≤ 125

Selectivity of distribution downstream of UPS with downstream short-circuit (AUX MAINS not present).

3. REFERENCE STANDARDS AND DIRECTIVES

3.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force. In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility.

3.2. Standards

STANDARD	
Safety	IEC 62040-1
EMC	IEC62040-2 (C2)
Performance	IEC 62040-3 (VFI-SS-111)
Product certifications	CE - TUV SÜD
Degree of protection standard	IP20

MASTERYS IP+

10 to 80 kVA

TÜV SÜD
Production monitored
Safety tested

socomec
Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

MASTERYS IP+ is a full range of high performing UPS designed to provide reliable power supply in harsh operating environments.

Models							
Rated power (kVA)	10	15	20	30	40	60	80
MASTERYS IP+ 3/1	•	•	•	•	•	•	-
MASTERYS IP+ 3/3	•	•	•	•	•	•	•

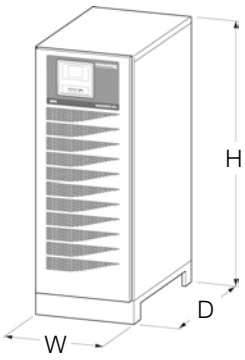
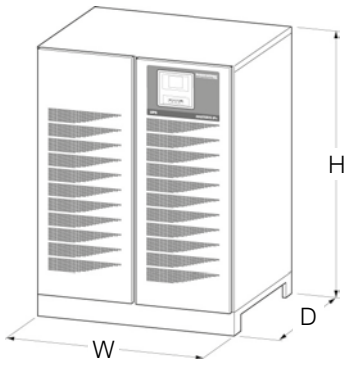
Matrix table for model and kVA power rating

Each range has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 10 to 80 kVA

The entire range (13 basic products) are compatible with 2 cabinets.

Dimensions				
Model	Cabinet type	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
MASTERYS IP+ 10 kVA 3/1-3/3		600	800	1400
MASTERYS IP+ 15 kVA 3/1-3/3				
MASTERYS IP+ 20 kVA 3/1-3/3				
MASTERYS IP+ 30 kVA 3/1-3/3				
MASTERYS IP+ 40 kVA 3/3				
MASTERYS IP+ 40 kVA 3/1		1000	835	1400
MASTERYS IP+ 60 kVA 3/1-3/3				
MASTERYS IP+ 80 kVA 3/1-3/3				

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

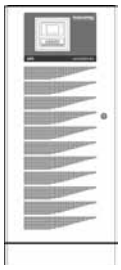
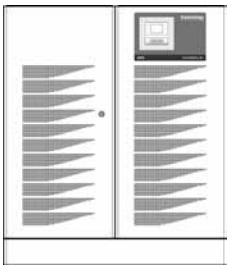
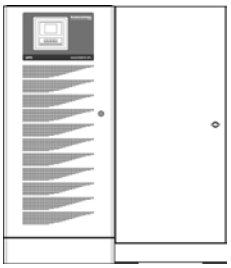
All of the control mechanisms and communication interfaces are located in the front part inside to metal door.

The air inlet is on the front, with outflow to the rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Flexible back-up time

Different extended back-up times are possible by using voth UPS cabinet, both of which occupy minimum floor space.

For powers greater than or equal to 40 kVA, or long back-up power periods, an additional cabinet should be used, optionally with a supplementary battery charger.

BACK-UP times in minutes (max @ 70% of load)			
			
	Masterys IP+ 10 to 40 kVA	Masterys IP+ 40 to 80 kVA	UPS with battery cabinet
MASTERYS IP+ 10 3/1	19	-	•
MASTERYS IP+ 15 3/1	11	-	•
MASTERYS IP+ 20 3/1	7	-	•
MASTERYS IP+ 30 3/1	4	-	•
MASTERYS IP+ 40 3/1	-	-	•
MASTERYS IP+ 60 3/1	-	-	•
MASTERYS IP+ 10 3/3	19	-	•
MASTERYS IP+ 15 3/3	11	-	•
MASTERYS IP+ 20 3/3	7	-	•
MASTERYS IP+ 30 3/3	4	-	•
MASTERYS IP+ 40 3/3	-	-	•
MASTERYS IP+ 60 3/3	-	-	•
MASTERYS IP+ 80 3/3	-	-	•

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages.

The batteries are organised internally into racks based on their relative sizes, so as to ensure a compact unit while still guaranteeing substantial back-up times.

The UPS system's internal batteries consist of distinct strings of battery packs connected in series; each individual pack is connected using polarised connectors to facilitate battery configuration and maintenance.

Each pack is sealed in an acid-proof container which is designed to prevent damage in the case of acid leakage.

To guarantee maximum back-up time availability and battery life, the Masterys series is equipped with EBS systems, depending on the model.

2.3. Energy storage option: ultracapacitor

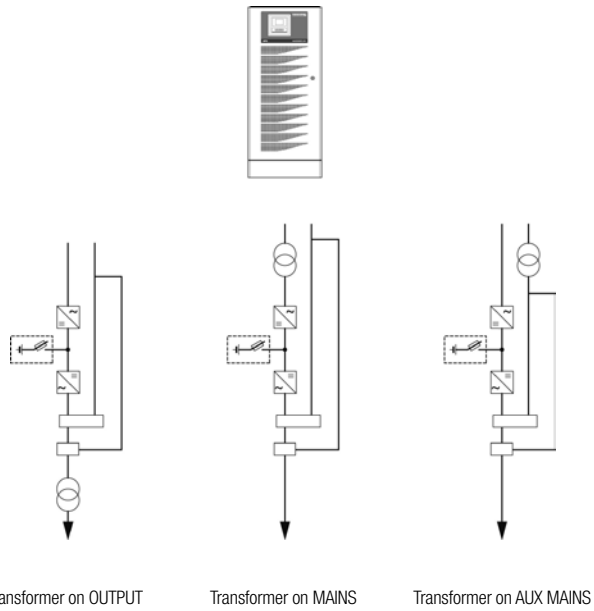
Ultracapacitor could be a suitable battery replacement in special situations where a long back-up time is not required. This solution is targeted specifically to ride-through frequent voltage dips and short power outages, or simply bridge the startup of a generator, or where ambient temperatures could compromise battery lifetime. This would result in a highly reliable energy storage system that would require no maintenance.

Advantages:

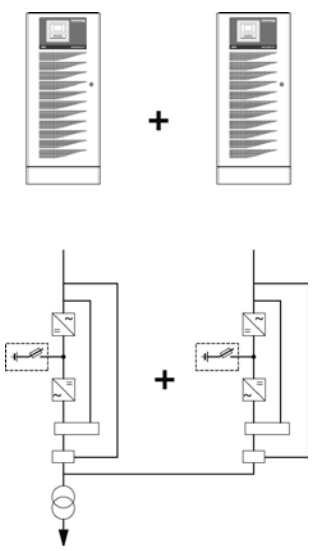
- Extremely long lifetime: 15 years with virtually unlimited cycling.
- High-reliability – No maintenance.
- Wide temperature range up to 45 °C.
- Ultra rapid charging.
- Battery-free, lead-free and environmentfriendly.

2.4. Parallel configuration.

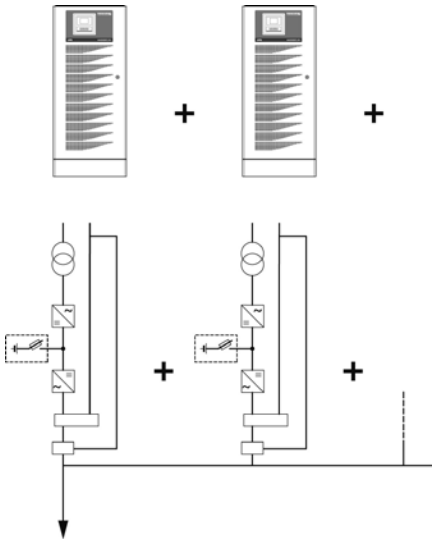
MASTERYS IP+ offers various configurations.



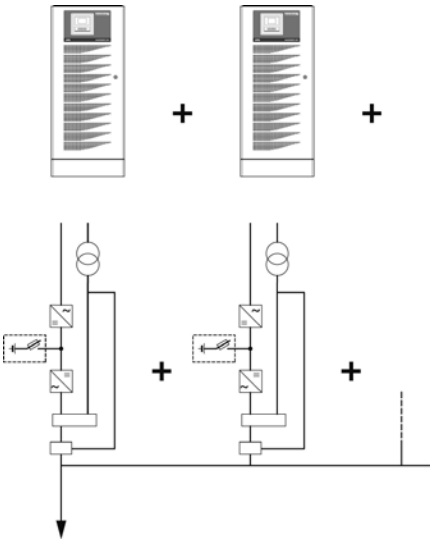
Stand-alone UPS configuration



Parallel 1+1 redundant configuration



Parallel N+1 power configuration (up to 6 UPS) transformer on MAINS



Parallel N+1 power configuration (up to 6 UPS) transformer on AUX MAINS

2.5. Availability, redundancy and efficiency

To increase the availability of the power supply, redundant parallel configurations are becoming increasingly common. Consequently, the overall efficiency of the UPS system risks being reduced due to the low load on each individual machine.

3. STANDARD AND OPTIONS

3.1. For industrial loads

- 100 % non-linear loads.
- 100 % unbalanced loads.
- 100 % “6-pulse” loads (motor speed drivers, welding equipment, power supplies…).
- Motors, lamps, capacitive loads.

3.2. Standard electrical features

- Dual input mains.
- Internal maintenance bypass.
- Backfeed protection: detection circuit.
- EBS (Expert Battery System) for battery management.

3.3. Electrical options.

- Long-life batteries.
- External battery cabinet (degree of protection up to IP32).
- External temperature sensor.
- Additional battery chargers.
- Additional transformer.
- Parallel kit.
- Cold start.
- ACS synchronization system.
- Neutral creation kit for mains without neutral.
- Tropicalization and anti-corrosion protection for electrical boards.

3.4. Standard communication features.

- Multilanguage graphic display.
- Dry contact interface.
- MODBUS RTU.
- Embedded LAN interface (web pages, email).
- 2 slots for communication options.

3.5. Communication options.

- Profibus.
- MODBUS TCP.
- NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.6. Remote monitoring service.

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters														
Rated power (kVA)		10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out		3/1				3/3					3/1		3/3	
Active power (kW)		9	13.5	18	27	9	13.5	18	27	36	32	48	48	64
Rated/maximum rectifier input current (EN 62040-3) (A)		14/17[1]	21/25[1]	28/34[1]	42/50[1]	14/17	21/25	28/34	42/50	56/67	52/70[1]	78/ 100[1]	78/ 100	106/ 133
Rated bypass input current (A)		44[1]	65[1]	87[1]	131[1]	15[2]	22[2]	29[2]	44[2]	58[2]	174[1]	261[1]	87[2]	116[2]
Inverter output current @230 V (A) P/N		44	65	87	131	15	22	29	44	58	174	261	87	116
Maximum air flow (m^3/h)		440									1810			
Sound level (dB)		50							55		62			
Dissipation at rated load (minimum mains power present and batteries charged)	(W)	890	1335	1780	2670	890	1335	1780	2670	3560	4364	5933	6100	8100
	(kcal/h)	765	1148	1531	2296	765	1148	1531	2296	3062	3753	5102	5250	6970
	(BTU/h)	3035	4553	6071	9106	3035	4553	6071	9106	12141	14880	20230	20820	27650
Dimensions (with standard back-up time)	W (mm)	600									1000			
	D (mm)	800									830			
	H (mm)	1400									1400			
Weight (kg)		230	250	270	330	230	250	270	320	370	490	540	500	550

([1]) Input current in bypass mode is single-phase. Consequently, the rated current of the neutral and of the phase common to the bypass is three times higher than the current drawn during normal operation by the rectifier.

([2]) In the case of single-phase distorting loads downstream of the UPS, when the bypass is in operation the neutral current can be 1.5-2 times higher than the phase current; this is due to the harmonic current distortion produced by the load itself, which is no longer corrected by the UPS rectifier as occurs in normal operation.

4.2. Electrical characteristics

Electrical characteristics - **Input**														
Rated power (kVA)	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Rated mains supply voltage	400 V 3ph + N												
Voltage tolerance	-15% to +20% (pf 0.9) -20% to +20% (pf 0.8) Up to -40% to 50% of rated power (pf 0.9)									-20% to +20% (pf 0.8) -35% to +20% @ 70% of rated power (pf 0.8)			
Rated frequency	50/60 Hz (selectable)												
Frequency tolerance	±10%												
Power factor (input at full load and rated voltage)	≥ 0.99												
Total harmonic distortion (THDi)	< 3%									< 7%			
Max inrush current at start-up	< In (no overcurrent)												

Electrical characteristics - **Bypass**													
Rated power (kVA)	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Bypass frequency variation speed	1 Hz/s - 3 Hz/s												
Bypass rated voltage	Nominal output voltage ±15%												
Bypass rated frequency (selectable)	50/60 Hz												
Bypass frequency tolerance	±2% (from ±1% to ±8% (operation with generator unit))												

Electrical characteristics - **Inverter**														
Rated power (kVA)		10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out		3/1				3/3					3/1		3/3	
Rated output voltage (selectable)		208[1]/220/230/240 V (1ph) 380/400/415 V (3ph)												
Output voltage tolerance		Static: ±1%												
Rated output frequency (selectable)		50/60 Hz												
Output frequency tolerance		±0.01% (on mains power failure)												
Load crest factor		3:1												
Voltage harmonic distortion		< 1% with linear load												
Overload tolerated by the inverter[2]	10 min	10 kW	15 kW	20 kW	30 kW	10 kW	15 kW	20 kW	30 kW	40 kW	40 kW	60 kW	60 kW	80 kW
	1 min	12 kW	18 kW	24 kW	36 kW	12 kW	18 kW	24 kW	36 kW	48 kW	48 kW	72 kW	72 kW	96 kW

(1) @ 208 V Pout = 90% Pnom, (2) @ pf 0.9 (10 to 30 kVA 3/1, 10 to 40 kVA 3/3), @ pf 0.8 (40 and 60 kVA 3/1, 60 and 80 kVA 3/3)

Electrical characteristics - **Efficiency**													
Rated power (kVA)	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Double conversion efficiency (normal mode) at rated load, trafo on the output	91%									89%			
Double conversion efficiency (normal mode) at rated load, trafo on bypass	95%				94%					93%		92%	

Electrical characteristics - **Efficiency**													
Rated power (kVA)	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Storage temperatures	-5 to +45 °C (23 to 113 °F) (15 to 25 °C for better battery life)												
Working temperature	0 to +50[1] °C (32 to 122 °F) (15 to 25 °C for better battery life)												
Maximum relative humidity (non-condensing)	95%												
Maximum altitude without derating	1000 m (3300 ft)												
Degree of protection	IP31 and IP52								IP31				
Portability	ASTM D999-08, ASTM D-880, AFNOR NF H 00-042												
Colour	RAL 7012												

(1) Conditions apply.

4.3. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]													
Model IP+	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
D curve circuit breaker (A)	32		40	63	32		40	63	80	80	125	125	160
gG fuse (A)	32		40	63	32		40	63	80	125	160	125	160

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]													
Model IP+	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Maximum I^2t supported by the bypass (A^2s)	80000			125000	8000			15000		320000	500000	80000	125000
Icc max (A)	4000			5000	1200			1700		8000	10000	4000	4000

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]													
Model IP+	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1	3/1	3/1	3/1	3/3	3/3	3/3	3/3	3/3	3/1	3/1	3/3	3/3
Input residual current circuit breaker	> 0.5 A Selective												

RECOMMENDED PROTECTION DEVICES - **Output**													
Model IP+	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
C curve circuit breaker[3] (A)	< 10	< 16	< 20	< 32	< 4		< 6	< 10	< 13	< 32	< 50	< 20	< 40
B curve circuit breaker[3] (A)	< 20	< 32	< 40	< 63	< 8		< 12	< 20	< 25	< 63	< 100	-	-
High-speed fuse[3] (A)	< 12	< 18	< 24	< 36	< 6		< 10	< 12	< 16	< 40	< 63	< 32	< 25

CABLES - **Maximum cable section**													
Model IP+	10	15	20	30	10	15	20	30	40	40	60	60	80
Phase in/out	3/1				3/3					3/1		3/3	
Rectifier terminals	4x CBD 35 35 mm^2 (flexible cable) 50 mm^2 (rigid cable)				4x CBD 35 35 mm^2 (flexible cable) 50 mm^2 (rigid cable)					4x CBD 50 50 mm^2 (flexible cable) 70 mm^2 (rigid cable)			
Bypass terminals	2x CBD 35 35 mm^2 (flexible cable) 50 mm^2 (rigid cable) 2x CBD 50 50 mm^2 (flexible cable) 70 mm^2 (rigid cable)									2x ACB 120 120 mm^2 (flexible cable) 185 mm^2 (rigid cable)		4x CBD 50 50 mm^2 (flexible cable) 70 mm^2 (rigid cable)	
Battery terminals	4x CBD 35 35 mm^2 (flexible cable) 50 mm^2 (rigid cable)									4x CBD 70 70 mm^2 (flexible cable) 95 mm^2 (rigid cable)			
Output terminals	2x CBD 50 50 mm^2 (flexible cable) 70 mm^2 (rigid cable)									2x ACB 120 120 mm^2 (flexible cable) 185 mm^2 (rigid cable)		4x CBD 50 50 mm^2 (flexible cable) 70 mm^2 (rigid cable)	

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(4) Selectivity of distribution after the UPS with inverter short-circuit current (with AUX MAINS not present).

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 62040-2 Electromagnetic compatibility (C2 category for 10-40 kVA 3/3 models, C3 category for all other models)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

Neutral isolated from input.

On TNS distribution connect the neutral to ground.

DELPHYS **MP** *elite*

80 to 200 kVA

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

DELPHYS MP ELITE is a high performing transformer based UPS designed to secure power supply to critical industrial applications. It is the ideal solution for grouping with generator sets without using an excessively large generator.

The isolation transformer installed on the inverter output ensures complete galvanic isolation between DC circuit and load output.

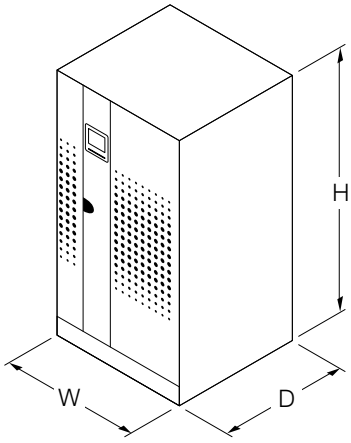
Models					
Rated power (kVA)	80	100	120	160	200
DELPHYS MP ELITE 3/3	•	•	•	•	•

Matrix table for model and kVA power rating

DELPHYS MP ELITE has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 80 to 200 kVA

Dimensions			
Cabinet type	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
	1000	800	1930

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation:

- all of the control mechanisms and communication interfaces are located and can be accessed in the front part,
- the air inlet is on the front, with outflow from the upper side; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Flexible backup time

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages. The batteries are organised internally into racks based on their relative sizes, so as to ensure a compact unit while still guaranteeing substantial backup times.

To guarantee maximum back-up time availability and battery life, the DELPHYS MP ELITE includes EBS system smart battery charging management.

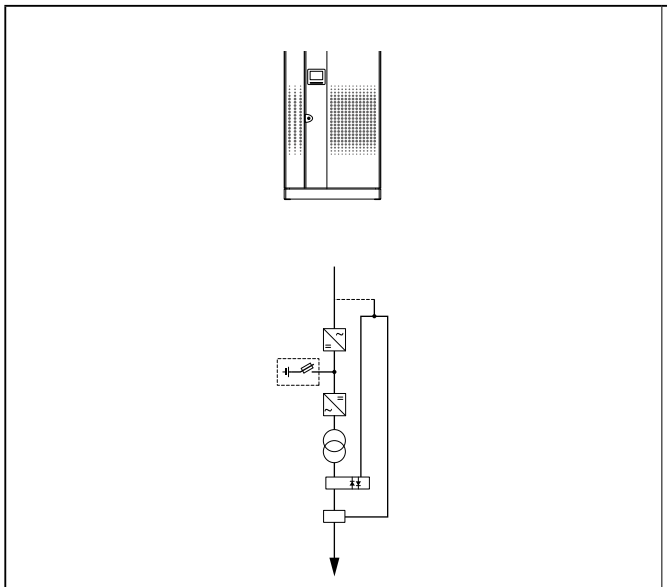
2.3. UPS and system architectures

DELPHYS MP ELITE UPS units (rectifier, battery, inverter and bypass) can be connected in parallel (up to 6 units) with distributed or central bypass.

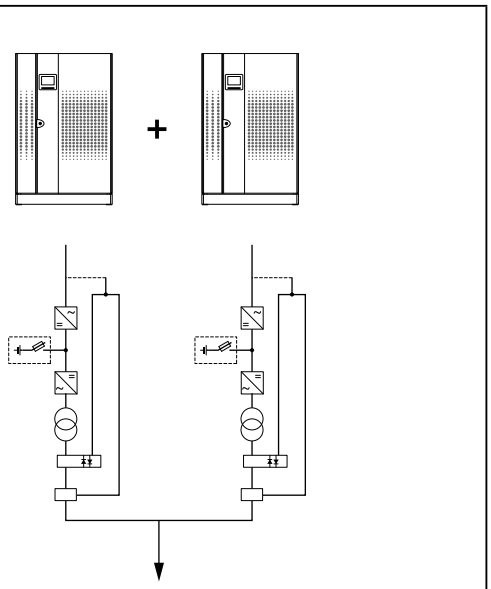
This solution, which is ideally suited for N+1 redundancy, offers flexible power upgrading and enables stand-alone UPS units to be expanded.

Each single UPS unit has a built-in maintenance bypass (single unit or distributed bypass).

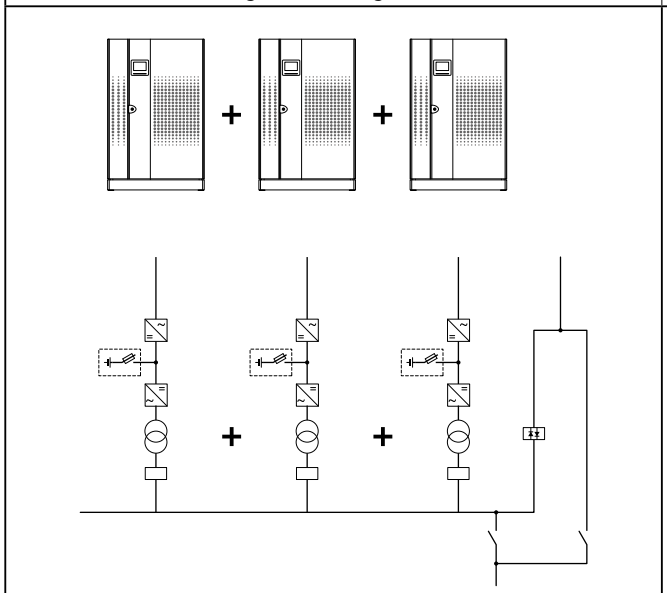
It is possible to add an external maintenance bypass, common to all of the UPS units, for maintenance access. A central bypass configuration has a common maintenance bypass for the complete system.



Single unit configuration



1+1 redundant configuration



Modular parallel UPS with centralized bypass

3. STANDARD AND OPTIONS

3.1. Standard electrical features.

• Slots for 6 communication cards.
• Backfeed protection: detection circuit.
• Standard interface:
- 3 inputs (emergency stop, generating set, battery protection),
- 4 outputs (general alarm, back-up, bypass, preventative maintenance needs).
• Parallel connection up to 6 units.

3.2. Electrical options.

• EBS (Expert Battery System).
• FLYWHEEL compatible.
• ACS synchronisation system.
• Redundant electronic power supplies.

3.3. Mechanical options.

• Reinforced IP protection degree.
• Ventilation filters.
• Redundant ventilation with failure detection.
• Top entry connection.

3.4. Standard communication features.

• Multilanguage graphic display.
• Embedded dry contacts.

3.5. Communication options.

• GTS (Graphic Touch Screen).
• ADC interface (configurable voltage-free contacts).
• MODBUS RTU.
• MODBUS TCP.
• PROFIBUS.
• BACnet/IP interface.
• NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.6. Remote monitoring service.

• LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters						
Rated power (kVA)		80	100	120	160	200
Phase in/out		3/3				
Active power (kW)		64	80	96	128	160
Rated/maximum rectifier input current (EN 62040-3) (A)		114/128	142/151	177/182	228/242	300/382
Rated bypass input current (A)		161	144	174	216	290
Inverter output current @230V (A) P/N		116	144	174	232	290
Maximum air flow (m^3/h)		2000			2400	
Sound level (dBA)		65		67		
Dissipation at rated load (minimum mains power present and batteries charged)	W	5700	6500	8500	10200	15400
	kcal/h	4900	5600	7300	8800	13200
	BTU/h	19450	22250	29000	34950	52400
Dimensions (with standard back-up time)	W (mm)	1000				
	D (mm)	800				
	H (mm)	1930				
Weight (kg)		740	860		1020	

4.2. Electrical characteristics

Electrical characteristics - **Input**					
Rated power (kVA)	80	100	120	160	200
Phase in/out	3/3	3/3	3/3	3/3	3/3
Rated mains supply voltage	380/400/415 V (208/220/240 V on request)				
Voltage tolerance (ensuring battery recharge)	-12% to +15%(380 V) / ±15% (400 V) / -15% to +10% (415 V)				
Rated frequency	50/60 Hz				
Frequency tolerance	± 5 Hz				
Power factor (input at full load and rated voltage)	0.99				
Total harmonic distortion (THDi)	< 3%				
Max inrush current at start-up	<In (no overcurrent)				
Soft start	50 A/sec (settable)				

Electrical characteristics - **Bypass**					
Rated power (kVA)	80	100	120	160	200
Bypass frequency variation speed	2 Hz/s (settable)				
Bypass rated voltage	Rated output voltage ±10% (settable)				
Bypass rated frequency	50/60 Hz (selectable)				
Bypass frequency tolerance	±2 Hz (from 0.2 to 4 Hz settable (operation with generator unit))				

Electrical characteristics - **Inverter**					
Rated power (kVA)	80	100	120	160	200
Rated output voltage (selectable)	380/400/415 V (1)				
Output voltage tolerance	Static: ±1% Dynamic: (0-100% Pn) -4% +2%				
Rated output frequency	50/60 Hz (selectable)				
Autonomous frequency tolerance	0.02 on mains power failure				
Load crest factor	3:1				
Voltage harmonic distortion	< 2% on linear load < 4% with non linear load				
Overload tolerated by the inverter (with mains power present)	125% x 10 min 150% x 1 min				

(1) Other voltages on request.

Electrical characteristics - **Efficiency**					
Rated power (kVA)	80	100	120	160	200
Double conversion efficiency (normal mode)	93.5% @ full load				
Efficiency in Eco Mode	98%				

Electrical characteristics - **Environment**					
Rated power (kVA)	80	100	120	160	200
Storage temperatures	-20 to +70 °C (-4 to 158 °F) (15 to 25 °C for better battery life)				
Working temperature	0 to +35 °C (32 to 95 °F) (15 to 25 °C for better battery life)				
Maximum relative humidity (non-condensing)	95%				
Maximum altitude without derating	1000 m (3300 ft)				
Degree of protection	IP20 (other IP as option)				
Portability	EN 60068-2				
Colour	RAL 9006 (Grey Toyo)				

4.2.1. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]					
Rated power (kVA)	80	100	120	160	200
D curve circuit breaker (A)	125	160	200	250	400
gG fuse (A)	125	160	200	250	400

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]					
Rated power (kVA)	80	100	120	160	200
Maximum I^2t supported by the bypass (A^2s)	160000	250000		640000	
Icc max (A)	4000	5000		8000	
D curve circuit breaker (A)	160	200	250	400	
gG fuse (A)	160	200	250	400	

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]					
Rated power (kVA)	80	100	120	160	200
Input residual current circuit breaker	0.5 A				

RECOMMENDED PROTECTION DEVICES - **Output**[3]					
Rated power (kVA)	80	100	120	160	200
Short-circuit inverter current (A) - (0 to 100 ms) (when AUX MAINS is not present)	485	620		1060	
C curve circuit breaker[3] (A)	40	50		100	
High-speed fuse[3] (A)	80	125		250	

CABLES - **Maximum cable section**					
Rated power (kVA)	80	100	120	160	200
Rectifier terminals	Copper bar 63 x 4 mm (2x120 mm)				
Bypass terminals					
Battery terminals	Copper bar 40 x 5 mm (2x240 mm)				
Output terminals	Copper bar 63 x 4 mm (2x120 mm)				

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all current laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC	Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.
2004/108/EC	On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

Electromagnetic Compatibility Provisions (EMC)

EN 62040-2.	Electromagnetic compatibility (class C3 standard - C2 optional)
EN 61000-2-2	Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems
EN 61000-4-2	Electrostatic discharge immunity test,
EN 61000-4-3	Radiated radio-frequency electromagnetic field immunity test,
EN 61000-4-4	Electrical fast transient/burst immunity test,
EN 61000-4-5	Surge immunity test,
EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields.
EN 55011 class A	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.

5.2.2. Safety

General and safety requirements for UPS used in operator access areas

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations
EN 60439-1	Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies,
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60896-1	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Vented types
EN 60896-2	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Valve-regulated types
EN 60146	Semiconductor convertors
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

Performance requirements and methods of test

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

The regulations refer to the unit (UPS) and the manufacturer is therefore obliged to comply with them. The UPS engineer adhere's to current legislation on installation for the specific electrical system (e.g. EN 60364).

DELPHYS **MX**

250 to 900 kVA

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

DELPHYS MX is a high performing transformer based UPS designed to secure power supply to critical industrial applications up to 5.4 MVA.

The isolation transformer installed on the inverter output ensures complete galvanic isolation between DC circuit and load output.

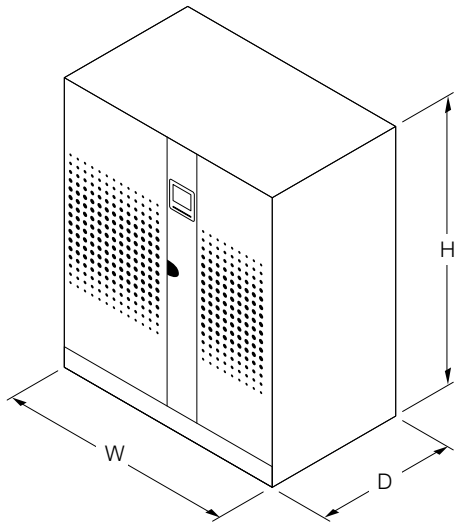
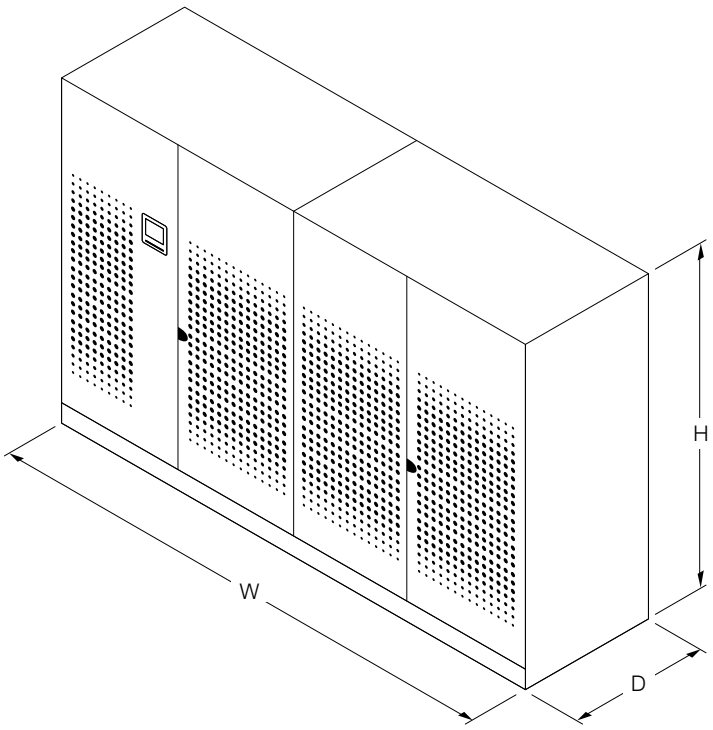
Models						
Rated power (kVA)	250	300	400	500	800	900
DELPHYS MX 3/3	•	•	•	•	•	•

Matrix table for model and kVA power rating

DELPHYS MX has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 250 to 900 kVA

Dimensions			
	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 DELPHYS MX 250 to 500 kVA	1600	995	1930
 DELPHYS MX 800 and 900 kVA	3200	995	2210

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation:

- all of the control mechanisms and communication interfaces are located and can be accessed in the front part,
- the air inlet is on the front, with outflow from the upper side; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Flexible backup time

Selection of the back-up time is flexible thanks to the wide range of DC bus voltages. The batteries are organised internally into racks based on their relative sizes, so as to ensure a compact unit while still guaranteeing substantial backup times.

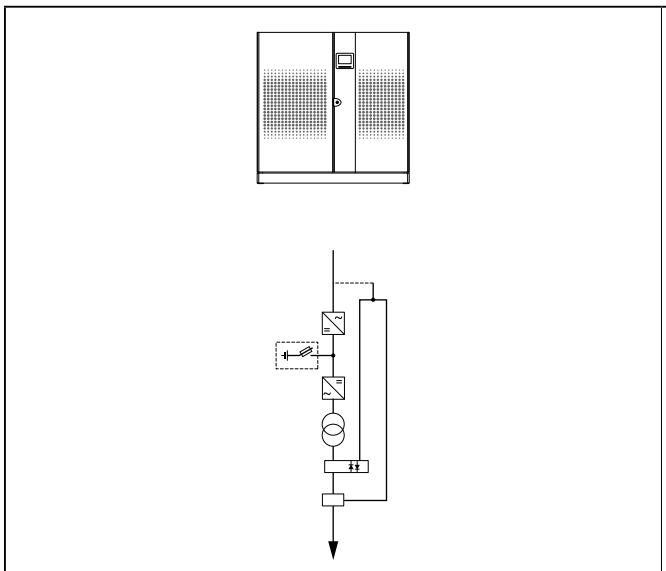
To guarantee maximum back-up time availability and battery life, the DELPHYS MX includes:

• EBS (Expert Battery System), smart battery charging management.

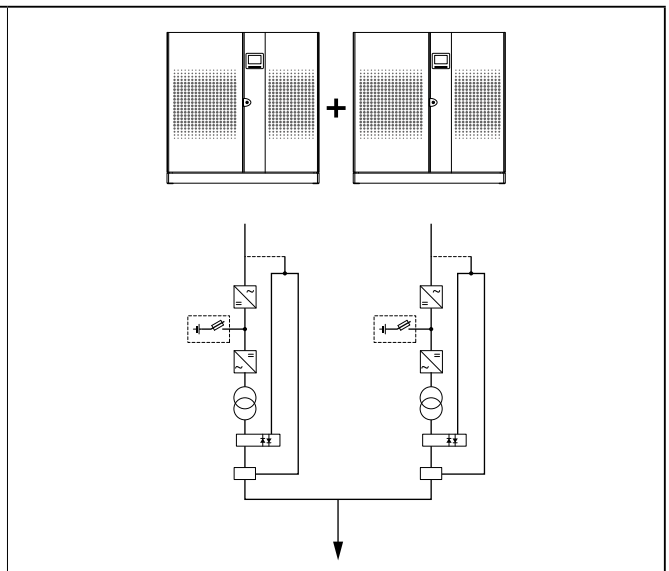
2.3. Parallel

DELPHYS MX UPS units (rectifier, battery, inverter and bypass) can be connected in parallel (up to 6 units) with distributed or central bypass. This solution, which is ideally suited for 1+1 redundancy, offers flexible power upgrading and enables stand-alone UPS units to be expanded. Each single UPS unit has a built-in maintenance bypass (single unit or distributed bypass).

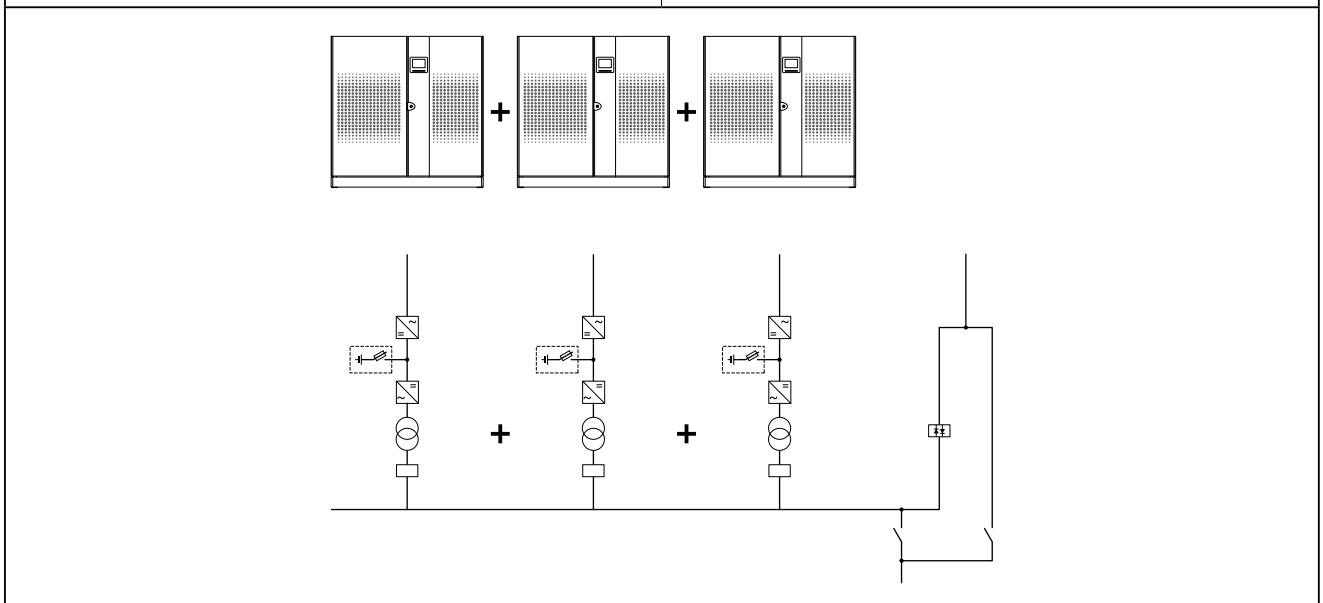
It is possible to add an external maintenance bypass, common to all of the UPS units, for maintenance access.



Single unit configuration



1+1 redundant configuration



Modular parallel UPS with centralized bypass

3. STANDARD AND OPTIONS

3.1. Standard electrical features.

• Backfeed protection: detection circuit.
• Standard interface:
- 3 inputs (emergency stop, generating set, battery protection),
- 4 outputs (general alarm, back-up, bypass, preventative maintenance needs).
• EBS (Expert Battery System).

3.2. Electrical options.

• EBS (Expert Battery System).
• FLYWHEEL compatible.
• ACS synchronisation system.
• Redundant electronic power supplies.

3.3. Mechanical options.

• Reinforced IP protection degree.
• Ventilation filters.
• Redundant ventilation with failure detection.
• Top entry connection.

3.4. Standard communication features.

• Multilanguage graphic display.
• Embedded dry contacts.

3.5. Communication options.

• GTS (Graphic Touch Screen).
• ADC interface (configurable voltage-free contacts).
• MODBUS RTU.
• MODBUS TCP.
• PROFIBUS/PROFINET.
• BACnet/IP interface.
• NET VISION: professional WEB/SNMP interface for UPS monitoring and shutdown management of several operating systems.

3.6. Remote monitoring service.

• LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation parameters							
Rated power (kVA)		250	300	400	500	800	900
Phase in/out		3/3					
Active power (kW)		225	270	360	450	720	800
Rated/maximum rectifier input current (EN 62040-3) (A)		374/478	453/543	598/705	780/889	1273/1547	1428/1611
Rated bypass input current (A)		362	433	580	722	1155	1300
Inverter output current @230V (A) P/N		361	433	577	722	1155	1300
Maximum air flow (m^3/h)		6140				14600	
Sound level (dBA)		≤ 70			≤ 72	≤ 75	
Dissipation at rated load (minimum mains power present and batteries charged)	W	17200	20630	27300	34000	48000	53000
	kcal/h	14800	17730	23250	29260	41310	45610
	BTU/h	58730	70357	92262	116111	163928	180992
Dimensions (with standard back-up time)	W (mm)	1600				3200	
	D (mm)	995				995	
	H (mm)	1930				2210	
Weight (kg)		2500		2800	3300	5900	

4.2. Electrical characteristics

Electrical characteristics - **Input**						
Rated power (kVA)	250	300	400	500	800	900
Phase in/out	3/3					
Rated mains supply voltage	380/400/415 V					
Voltage tolerance (ensuring battery recharge)	340 to 460 V				360 to 460 V	
Rated frequency	50/60 Hz					
Frequency tolerance	± 5%					
Power factor (input at full load and rated voltage)	0.93				0.94	
Total harmonic distortion (THDi)	< 4.5%				< 5%	
Max inrush current at start-up	<In (no overcurrent)					
Soft start	50 A/sec (settable)					

Electrical characteristics - **Bypass**						
Rated power (kVA)	250	300	400	500	800	900
Bypass frequency variation speed	2 Hz/s settable					
Bypass rated voltage	Rated output voltage ±10%					
Bypass rated frequency	50/60 Hz selectable					
Bypass frequency tolerance	±2 Hz (from 0.2 to 4 Hz settable (operation with generator unit))					

Electrical characteristics - **Inverter**						
Rated power (kVA)	250	300	400	500	800	900
Rated output voltage (selectable)	380/400/415 V					
Output voltage tolerance	Static: < 1% Dynamic: (0-100% Pn) ±2%					
Rated output frequency	50/60 Hz (selectable)					
Output frequency tolerance	0.02 on mains power failure					
Load crest factor (according IEC 62040-3)	3:1					
Voltage harmonic distortion (ThdU)	< 2% on linear load < 4% on distorting load (Ph/N)				< 2% on linear load < 2.5% on distorting load (Ph/N)	
Overload tolerated by the inverter (with mains power present)	125% x 10 min 150% x 1 min					

Electrical characteristics - **Efficiency**						
Rated power (kVA)	250	300	400	500	800	900
Double conversion efficiency (normal mode)	93.5% at full load					
Efficiency in Eco Mode	98%					

Electrical characteristics - **Environment**						
Rated power (kVA)	250	300	400	500	800	900
Storage temperatures	-20 to +70 °C (-4 to 158 °F) (15 to 25 °C for better battery life)					
Working temperature	0 to +35 °C (32 to 95 °F) (15 to 25 °C for better battery life)					0 to +35 °C (32 to 95 °F)(1) (15 to 25 °C for better battery life)
Maximum relative humidity (non-condensing)	95%					
Maximum altitude without derating	1000 m (3300 ft)					
Degree of protection	IP20 (up to IP52 optional)					
Portability	EN 60068-2					
Colour	RAL 9006 (Grey Toyo)					

(1) Conditions apply.

4.3. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]						
Rated power (kVA)	250	300	400	500	800	900
D curve circuit breaker (A)	630		860	1000	1600	

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]						
Rated power (kVA)	250	300	400	500	800	900
Maximum I^2t supported by the bypass (A^2s)	2250000				5120000	
Icc max (A)	10600				24700	
D curve circuit breaker (A)	630		800		1250	1600

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]						
Rated power (kVA)	250	300	400	500	800	900
Input residual current circuit breaker	300 mA					

RECOMMENDED PROTECTION DEVICES - **Output**[2]						
Rated power (kVA)	250	300	400	500	800	900
Short-circuit inverter current (A) - (0 to 100 ms) (when AUX MAINS is not present)	256000	256000	400000	841000	1600000	
C curve circuit breaker[3] (A)	160		200	250	400	
High-speed fuse[3] (A)	400		500	700	800	

CABLES - **Maximum cable section**						
Rated power (kVA)	250	300	400	500	800	900
Rectifier terminals	Copper bar (3x300 mm^2)				Copper bar (4x300 mm^2)	
Bypass terminals						
Battery terminals						
Output terminals						

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

(3) Selectivity of distribution after the UPS with inverter short-circuit current (short-circuit with AUX MAINS not present). The rating of the protection can be increased by “n” times downstream a parallel UPS system, with “n” equal to the number of parallel modules.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all current laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC	Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.
2004/108/EC	Council Directive 2004/108/EEC, dated 15 December 2004, on the harmonisation of legislation within Member States regarding electromagnetic compatibility, in abrogation of directive 89/336/EEC.

5.2. Standards

5.2.1. Electromagnetic compatibility

Electromagnetic Compatibility Provisions (EMC)

EN 62040-2.	Electromagnetic compatibility (class C3 standard - C2 optional)
EN 61000-2-2	Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems
EN 61000-4-2	Electrostatic discharge immunity test,
EN 61000-4-3	Radiated radio-frequency electromagnetic field immunity test,
EN 61000-4-4	Electrical fast transient/burst immunity test,
EN 61000-4-5	Surge immunity test,
EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields.
EN 55011 class A	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.

5.2.2. Safety

General and safety requirements for UPS used in operator access areas

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations
EN 60439-1	Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies,
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60896-1	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Vented types
EN 60896-2	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Valve-regulated types
EN 60146	Semiconductor convertors
EN 60529	Degrees of protection provided by enclosures

5.2.3. Type and performances

Performance requirements and methods of test

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

EMergency CPSS

3 to 500 kVA

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right uninterruptible power supply for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the UPS must be installed. This electrical control station must be equipped with a circuit breaker (or two, if there is a separate bypass line) of an appropriate rating for the power draw at full load.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed.

We recommend fitting two metres of unanchored flexible cable between the UPS output terminals and the cable anchor (wall or cabinet). This makes it possible to move and service the UPS.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

The EMergency CPSS range has been designed to protect the power supply to safety systems.
All our EMergency products are compliant with compliant with standard EN 50171.

The EMergency CPSS products are intended to ensure energy supply to emergency escape lighting in the event of normal supply failure. Depending on the local legislation, it may be suitable for energizing other essential safety equipment, for example:

- electric circuits of automatic fire extinguishing installations;
- paging systems and signalling safety installations;
- smoke extraction equipment;
- carbon monoxide warning systems;
- special safety installations related to specific buildings, e.g. high-risk areas.

CPSS Emergency EM from 3 to 500 kVA

- Designed and manufactured in compliance with standard EN 50171.
- Ensures the power supply to emergency lighting, safety signalling lighting and anti-panic systems.

Models[1][2]												
Rated power (kVA)		3	4.5	6	10	15	20	30	40	60	80	up to 500
EM	MODULYS 1/1	•	•	•	-	-	-	-	-	-	-	-
	MASTERYS 3/1	-	-	-	•	•	•	-	-	-	-	-
	MASTERYS 3/3	-	-	-	•	•	•	•	•	•	•	-
	DELPHYS 3/3	-	-	-	-	-	-	-	-	-	-	Contact us

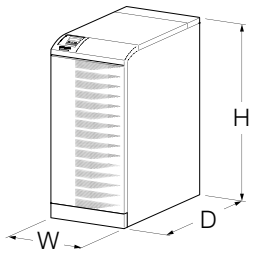
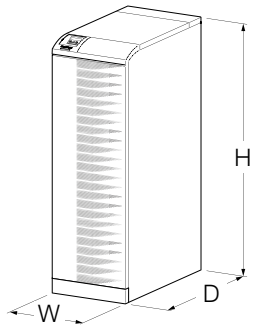
Matrix table for model and kVA power rating.

(1) Check the product availability for your country. (2) Products can be adapted to application and site specifications.

Each range has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Power ratings from 3 to 500 kVA(1)

Dimensions				
Cabinet type		Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 MODULYS	3 to 6 kVA	444	795	1000
 MASTERYS	10 to 80 kVA	444	795	1400

(1) Power higher than 80 kVA, please contact us.

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms and communication interfaces are located in the upper front part and can be accessed from the metal door.

The air inlet is at the front, with outflow from the top/rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

3. STANDARD AND OPTIONS

3.1. EMergency CPSS EM from 3 to 500 kVA

The wide range is suitable for all standard requirements.

For non-standard requests, our team of experts is on hand to adapt the products to your needs. Our expert team will be at your service to adapt the products to your needs.

Highlights

- IP20 metal enclosure compliant with EN 60598-1.
- Battery charging: 80% in 12 h.
- Battery protection against the damage due to a polarity inversion.
- Battery protection against deep discharge.
- Battery with 10-year life expectancy.
- Designed to withstand 120% of the nominal charge during the entire back-up period.
- Specific remote contacts and notifications.

Options

- Transformer embedded in the UPS enclosure (contact us for technical information).
- Connection to downstream IT system.
- Eco mode to reach up to 98% efficiency.
- Other types of battery available.

4. SPECIFICATIONS

4.1. Modulys EM

4.1.1. Installation parameters

Installation paramenters				
Sn - rated power (kVA)		3	4.5	6
Pn - active power (kW)		2.1	3.2	4.2
Pn according to EN 50171 (kW)		1.8	2.6	3.5
Phase in/out		1/1		
Rated/maximum rectifier input current (EN 62040-3) (A)		13/17	20/25	26/33
Rated/maximum bypass input current (EN 62040-3) (A)		15/17	22/25	28/33
Inverter output current @ 230 V (A) P/N		14	21	26
Maximum air flow (m^3/h)		180		
Sound level (dBA)		52		
Dissipation at rated load (minimum mains power present and batteries charging)	W	300	450	600
	kcal/h	258	387	516
	BTU/h	1023	1535	2047
Dimensions (W x D x H) (mm)		444 x 795 x 1000		
Maximum weight with embedded battery (kg)		≤ 220	≤ 275	≤ 380

(1) In the case of single-phase distorting loads downstream of the UPS, when the bypass is in operation the neutral current can be 1.5-2 times higher than the phase current; this is due to the harmonic current distortion produced by the load itself, which is no longer corrected by the UPS rectifier as occurs in normal operation.

4.1.2. Electrical characteristics

Installation paramenters			
Rated power (kVA)	3	4.5	6
Phase in/out	1/1		
Rated mains supply voltage	230 V (1ph+N)		
Voltage tolerance (ensuring battery recharge)	±20% (up to -30% to 70% of rated power)		
Rated frequency	50/60 Hz (selectable)		
Frequency tolerance	±10%		
Power factor (input at full load and rated voltage)	≥ 0.98		
Total harmonic distortion (THDi)	< 6%		
Max inrush current at start-up	< In		

Electrical characteristics - **Bypass**			
Rated power (kVA)	3	4.5	6
Bypass frequency variation speed	1 Hz/s - 3 Hz/s		
Bypass rated voltage	Nominal output voltage ±15%		
Bypass rated frequency (selectable)	50/60 Hz (selectable)		
Bypass frequency tolerance	±2% (from ±1% to ±8% (operation with generator unit))		

Electrical characteristics - **Inverter**			
Rated power (kVA)	3	4.5	6
Rated output voltage (selectable)	208(1)/230 V		
Output voltage tolerance	Static: ±3% Dynamic: VF-SS-111 (EN62040-3) compliant		
Rated output frequency (selectable)	50/60 Hz (selectable)		
Output frequency tolerance	±0.1% (on mains power failure)		
Load crest factor	3:1		
Total voltage distortion	< 3% on linear load < 7% on distorting load (EN 62040-3)		
Overload tolerated by the inverter	110% x 5 min, 130% x 5 sec		

(1) With 70% of rated power

Electrical characteristics - **Efficiency**			
Rated power (kVA)	3	4.5	6
Double conversion efficiency (normal mode)	90% with nominal load		
Efficiency in Eco Mode	97%		

Electrical characteristics - **Environment**			
Rated power (kVA)	3	4.5	6
Storage temperatures	-5 to +50 °C (23 to 122 °F) (15 to 25 °C for better battery life)		
Working temperature	0 to +40 °C (32 to 104 °F) (15 to 25 °C for better battery life)		
Maximum relative humidity (non-condensing)	95%		
Maximum altitude without derating	1000 m (3300 ft)		
Degree of protection	IP20		
Portability	EN 60068-2		
Colour	RAL 7012		

4.1.3. Recommended protections

RECOMMENDED PROTECTION - **Rectifier**			
Rated power (kVA)	3	4.5	6
C curve circuit breaker (A)	20	32	32

RECOMMENDED PROTECTION - **General bypass**			
Rated power (kVA)	3	4.5	6
C curve circuit breaker (A)	20	32	32

RECOMMENDED PROTECTION - **Input residual current circuit breaker**			
Rated power (kVA)	3	4.5	6
Input residual current circuit breaker	100 mA selective		

CABLES - **Maximum cable section**			
Rated power (kVA)	3	4.5	6
Rectifier terminals	4 mm^2		
Bypass terminals			
Output terminals			

4.2. Masterys EM

4.2.1. Installation parameters

Installation paramenters											
Sn - rated power (kVA)		10	15	20	10	15	20	30	40	60	80
Pn - active power (kW)		9	13.5	18	9	13.5	18	27	36	48	64
Pn according to EN50171 (kW)		7.5	11.3	15	7.5	11.3	15	22.5	30	40	53.5
Phase in/out		3/1			3/3						
Rated/maximum rectifier input current (EN 62040-3) (A)		14/17(1)	21/25(1)	28/34(1)	14/17(1)	21/25	28/34	42/50	56/67	77/142	102/190
Rated/maximum bypass input current (EN 62040-3) (A)		43/50(1)	65/75(1)	87/100(1)	15/17(1)	22/25(2)	29/34(2)	43/50(2)	58/67(2)	87/152(2)	116/203(2)
Inverter output current @ 230 V (A) P/N		44	65	87	15	22	29	44	58	87	116
Maximum air flow (m^3/h)		280						460		1330	
Sound level (dBA)		< 50						< 55		< 62	
Dissipation at rated load (nominal mains power present and batteries charging)	(W)	679	902	1193	679	902	1193	1775	2326	4500	6000
	(kcal/h)	581	776	1026	581	776	1026	1526	2000	3870	5160
	(BTU/h)	2317	3078	4072	2317	3078	4072	6058	7939	15360	20478
Dimensions (W x D x H) (mm)		444 x 795 x 1400									
Weight (external battery) (kg)		120	124	127	120	124	127	138	158	201	211

(1) Input current in bypass mode is single-phase. Consequently, the rated current of the neutral and of the phase common to the bypass is three times higher than the current drawn during normal operation by the rectifier.

(2) In the case of single-phase distorting loads downstream of the UPS, when the bypass is in operation the neutral current can be 1.5-2 times higher than the phase current; this is due to the harmonic current distortion produced by the load itself, which is no longer corrected by the UPS rectifier as occurs in normal operation.

4.2.2. Electrical characteristics

Electrical characteristics - **Input**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Rated mains supply voltage	400 V (3ph + N)									
Voltage tolerance(1) (ensuring battery recharge)	±20% Up to -40% to 50% of rated power								±20% Up to -40% to 50% of rated power	
Rated frequency	50/60 Hz (selectable)									
Frequency tolerance	±10%									
Power factor (input at full load and rated voltage)	≥ 0.99									
Total harmonic distortion (THDi)	< 5%			< 3%						
Max inrush current at start-up	< In (no overcurrent)									

(1) Condition apply.

Electrical characteristics - **Bypass**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Bypass frequency variation speed	1 Hz/s - 3 Hz/s									
Bypass rated voltage	Nominal output voltage ±15%									
Bypass rated frequency (selectable)	50/60 Hz (selectable)									
Bypass frequency tolerance	±2% (from ±1% to ±8% (operation with generator unit))									

Electrical characteristics - **Inverter**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Rated output voltage (selectable)	220/230/240 V			380/400/415 V						
Output voltage tolerance	Static: ±1% Dynamic: VF-SS-111 (EN62040-3) compliant									
Rated output frequency (selectable)	50/60 Hz (selectable)									
Output frequency tolerance	±0.01% (on mains power failure)									
Load crest factor	3:1									
Voltage harmonic distortion	< 1% on linear load < 5% on distorting load (EN 62040-3)									< 1% on linear load < 7% on distorting load (EN 62040-3)
Overload tolerated by the inverter	125% x 10 min, 150% x 1 min									

Electrical characteristics - **Efficiency**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Double conversion efficiency @ full load (normal mode)	≤ 96%								92%	
Efficiency in Eco Mode	≤ 98%									

Electrical characteristics - **Environment**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Storage temperatures	-5 to +50 °C (23 to 122 °F) (15 to 25 °C for better battery life)									
Working temperature	0 to +40 °C(1) (32 to 104 °F) (15 to 25 °C for better battery life)									
Maximum relative humidity (non-condensing)	95%									
Maximum altitude without derating	1000 m (3300 ft)									
Degree of protection	IP20 (IP21 optional)									
Portability	EN 60068-2									
Colour	RAL 7012									

(1) Conditions apply.

4.2.3. Recommended protections

RECOMMENDED PROTECTION DEVICES - **Rectifier**[1]										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
D curve circuit breaker (A)	32	32	40	32		40	63	80	125	160
gG fuse (A)	32	32	40	32		40	63	80	125	160

RECOMMENDED PROTECTION DEVICES - **General bypass**[1]										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Maximum I^2t supported by the bypass (A^2s)	80000			8000			15000		80000	125000
Icc max (A)	4000			1200			1700		4000	5000
D curve circuit breaker (A)	100		125	32		40	63	80	125	160
gG fuse (A)	100		125	32		40	63	80	125	160

RECOMMENDED PROTECTION DEVICES - **Input residual current circuit breaker**[2]										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Input residual current circuit breaker	> 0.5 A Selective									

RECOMMENDED PROTECTION DEVICES - **Output**[3]											
Rated power (kVA)		10	15	20	10	15	20	30	40	60	80
Phase in/out		3/1			3/3						
Short-circuit inverter current (A) (when AUX MAINS is not present)	0 to 40 ms	113	165	216	38	56	74	117	156	206	270
	40 to 100 ms	95	140	183	32	48	62	95	126	206	270
C curve circuit breaker[3] (A)		≤ 10	≤ 16	≤ 20	≤ 4		≤ 6	≤ 10	≤ 13	< 20	< 25
B curve circuit breaker[3] (A)		≤ 20	≤ 32	≤ 40	≤ 8		≤ 12	≤ 20	≤ 25	< 32	< 40
High-speed fuse[3] (A)		≤ 12	≤ 18	≤ 24	≤ 6		≤ 10	≤ 12	≤ 16	< 32	< 40

CABLES - **Maximum cable section**										
Rated power (kVA)	10	15	20	10	15	20	30	40	60	80
Phase in/out	3/1			3/3						
Rectifier terminals	4xCBD25 (35 mm^2)			4xCBD25 (35 mm^2)					4xCBD35 (50 mm^2)	
Bypass terminals	2xCBD25 (35 mm^2)									
Battery terminals	4xCBD25 (35 mm^2)								4xCBD70 (95 mm^2)	
Output terminals	2xCBD25 (35 mm^2)								4xCBD35 (50 mm^2)	

(1) Rectifier protection should only be considered in the event of separate inputs. The bypass protection is given by recommendation. When the bypass and rectifier inputs are combined (common input), the general input protection rating must be the highest of both (bypass or rectifier).

(2) Must be selective with residual current circuit breakers downstream of the UPS connected to the UPS output. If the bypass network is separate from the rectifier circuit, or in the event of parallel UPS, use a single residual current circuit breaker upstream of the UPS.

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. CPSS

EN 50171	General requirements for central power supply systems for an independent energy supply to essential safety equipment

5.2.2. Electromagnetic compatibility

“Electromagnetic Compatibility Provisions (EMC)”

EN 62040-2 (2nd ed.) Electromagnetic compatibility (Class A)

5.2.3. Safety

“General and safety requirements for UPS used in operator access areas”

EN 60950-1	General and safety requirements for equipment used in operator access areas
EN 62040-1	General and safety requirements for UPS used in restricted access locations (certified by TÜV SÜD)
EN 50272-2	Safety requirements for secondary batteries and battery installations
EN 60896-1	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Vented types
EN 60896-2	Stationary lead-acid batteries. General requirements and methods of test. Part 1: Valve-regulated types
EN 60529	Degrees of protection provided by enclosures

5.2.4. Type and performances

“Performance requirements and methods of test”

EN 62040-3	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

5.3. System and installation guidelines

Once installed in a system, the UPS will not alter the neutral conditions; this is because the neutral input terminal "N" is connected directly to output terminal "N1" inside the equipment. If the neutral condition of the system downstream of the UPS needs to be modified, it will be necessary to install the IP version or to use the isolation transformer option.

The regulations refer to the unit (UPS) to which the manufacturer must comply with. The UPS engineer adhere's to current legislation for the specific electrical system (e.g. EN 60364).

STATYS

32 to 4000 A

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right Static Transfer System (STS) for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

Connection to the mains power supply and to the load(s) must be made using cables of suitable size, in accordance with current standards. If not already present, an electrical control station which can isolate the network upstream of the STATYS must be installed. This electrical control station must be equipped with a circuit breaker of an appropriate rating for the power draw at full load.

Current flowing to earth varies depending on the size of the STATYS, therefore installation engineers must install a residential current circuit breaker of an appropriate rating upstream of the STATYS using a selective model (not sensitive to transitory currents).

Potential dispersion of current from utilities downstream of the STS should be added to that discharged from the STATYS, and it should also be noted that current peaks are also reached, albeit very briefly, during transitory phases.

If an external manual bypass is required, only the model supplied by the manufacturer must be installed. For the Integrable Chassis version, STATYS is able to manage the PDU's switches (input/output/maintenances bypasses) in order to protect against users miss-operation.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

STATYS is a range of high performing STS designed to protect critical and sensitive appliances applications in the IT, telecom and industrial fields, such as enterprise servers, storage systems, networking equipment, telecommunications systems, diagnostic/ medical devices and industrial applications.

Models													
		1-phase (A)	32	63	-	-	-	-	-	-	-	-	-
		3-phase (A)	-	-	63	100	200	300	400	600	800	1000	up to 4000
STATYS	19” RACK		•	•	•	•	-	-	-	-	-	-	-
STATYS	Integrable Chassis (OEM)		-	-	-	-	•	•	•	•	•	•	•
STATYS	Cabinet		-	-	-	-	•	•	•	•	•	•	•

Matrix table for model and A current rating

Each range has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the product and to facilitate its integration within the system.

2. FLEXIBILITY

2.1. Currents from 32 to 4000 A

Dimensions				
Model	Range	Width (mm)	Depth (mm)	Height (mm)
19” Rack	32/63 A	483 (19”)	747(1)	89 (2U)
	63/100 A	483 (19”)	648(1)	400 (9U)
Integrable Chassis (OEM)	200 A	400	586	765
	300/400 A	600	586	765
	600 A	800		
	800/1000 A	1000	950(1)	1930
	up to 4000 A	Contact us	Contact us	Contact us
Cabinet	200 A	500	600(1)	1930
	300/400 A	700	600(1)	1930
	600 A	900	600(1)	1930
	800/1000 A	1400	950(1)	1930
	up to 4000 A	Contact us	Contact us	Contact us

(1) Depth does not include handles (+40 mm)

The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

2.2. Neutral management

STATYS is well adapted to all electrical environments.

For single-phase units, STATYS is available in 2-pole switching.

For three-phase units, it is available in 3 or 4-poles switching.

Built with fully rated thyristors, STATYS forces a short "make before break" neutral switching principle in order to keep the load reference and reduce the transfer time.

2.3. Transformer Management

In case of downstream transformer and asynchronous power, STATYS handles source switching which prevents untimely protection tripping, thanks to the ATSM system

3. STANDARD AND OPTIONS

3.1. Internal redundant design

- Redundant control system by using two microprocessor control boards,
- Redundant power supplies of the control boards,
- Individual driver per SCR paths, with dedicated redundant power supplies,
- Redundant cooling with fan failure monitoring,
- Real-time SCR fault sensing,
- Separation of main functions to prevent internal fault propagation,
- Robust internal field communication bus,
- Internal monitoring of sensors to ensure maximum system reliability,
- 24/7/365 real-time remote monitoring.

3.2. Compact design

- Small footprint and compact units,
- Adjacent or back to back mounting,
- Front access for easy maintenance procedures,
- Compact Hot Swap 19” rack system.

3.3. Standard features

- Smart commutation system configurable according to the load.
- Synchronised and non-synchronised sources management (fully settable transfer modes).
- Fuse-free or fuse-protected design.
- Output fault management.
- Double maintenance bypass (rack and cabinet versions).
- Neutral oversizing for non-linear loads compatibility.

3.4. Standard communication features

- Ethernet network connection (WEB/SNMP interface, including SNMP and MODBUS TCP protocols).
- I/O dry contacts interfaces.
- Flexible Com Slots.
- LCD and Graphic Mimic Panel.
- Full digital configuration and setting.

3.5. Options

- Additional dry contacts interface board.
- MODBUS RTU.
- Profibus interface.
- Automatic maintenance bypass interlock.
- Voltage adaptation.

3.6. Remote monitoring service

- LINK-UPS, remote monitoring service that connects your UPS to your Critical Power specialist 24/7.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters												
Model		32	63	63	100	200	300	400	600	800	1000	up to 4000
Phase in/out		1/1	1/1	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Rated power (A)		32	63		100	200	300	400	600	800	1000	up to 4000
Maximum current on neutral[2]		32	63	160		315	630		600	800	1000	Contact us
Crest factor		< 3.5								< 2.1	< 1.7	
Minimum air flow (m^3/h)		26				553	642		627	1950		
Sound level (dBA)		< 45				60	56		54	61		
Dissipation at rated load[1]	(W)	80	184	340	540	1330	1690	2530	3730	4272	5597	
	kcal/h	69	160	293	464	1147	1457	2181	3216	3674	4813	
	BTU/h	272	628	1160	1843	4538	5766	8632	12727	14536	19042	
Dimensions Rack	W (mm)	483				-	-		-	-	-	
	D (mm)	747		648		-	-		-	-	-	
	H (mm)	89		400		-	-		-	-	-	
Dimensions OEM	W (mm)	-	-	-	-	400	600		800	1000		
	D (mm)	-	-	-	-	586				995		
	H (mm)	-	-	-	-	765				1930		
Dimensions CABINET	W (mm)	-	-	-	-	500	700		900	1400		
	D (mm)	-	-	-	-	600				995		
	H (mm)	-	-	-	-	1930						
Weight (kg)	Rack	26		58		-	-		-	-	-	
	OEM	-	-	-	-	70	105		130	495		
	Cabinet	-	-	-	-	195	270		345	685		

(1) Worst case:
- 4 pole switching
- cabinet version with internal input protection
- 4 wires
- no linear load

(2) Contact us for higher neutral sizing

4.2. Electrical characteristics

Electrical characteristics - **Operating range**			
Model	RACK 32/63 A	RACK 63/100 A	CABINET / OEM
Rated mains supply voltage(1)	120 to 127 V / 220 to 240 V / 254 V (ph+N or ph+ph)	208 to 220 V / 380 to 415 V / 440 V(1) (3ph+N or 3ph)	
RMS voltage tolerance	±10% (configurable)		
Tolerance to fast transients	±25% (configurable)		
Rated Frequency	50/60 Hz		
Frequency tolerance	±5% (configurable)		
Admitted Power Factor	no restriction		
Admitted overload	110% for 60 minutes, 150% for 2 minutes		

(1) Consult us for other voltage requirements or 440 V above 800 A.

Electrical characteristics - **Environment**			
Model	RACK 32-63	RACK 63-100	CABINET / OEM
Storage temperature	-25 to +70 °C (-13 to +158 °F)		
Working temperature	0 to +40 °C (32 to +104 °F) up to 50 °C with derating		
Maximum relative humidity (non-condensing)	95%		
Maximum altitude without derating	1000 m (3300 ft)		
Degree of protection	IP30		IP20 (cabinet), IP20 C (OEM)
Colour	Dark grey, door: light grey		
Performance	up to 99%		

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all current laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EEC 89/336	EMC Directive
IEC 62310-2	Static transfer systems : Electromagnetic Compatibility Provisions (EMC)

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

IEC 62310-1	Static transfer systems : general safety requirements
IEC 60364-4	Electrical installations of buildings
IEC 60950-1	General and safety requirements for equipment used in operator access areas
IEC 60529	Degrees of protection provided by enclosures
IEC 60439-1	Low-voltage switches
EEC 73/23	Low Voltage Directive

5.2.3. Type and performances

Performance requirements and methods of test

IEC 62310-3	Static transfer systems : Methods of specifying the performance and test requirements

SHARYS IP

15 to 200 A

TÜV SÜD
Production monitored
Safety tested

socomec
Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right SHARYS IP station for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

The network connection and connection of utilities must be done using cables of the appropriate size and compliant with regulations.

An electrical protection (circuit breaker) which can isolate the network upstream of the SHARYS IP station must be installed. It must be sized properly according to the power draw at full load.

Current flowing to earth varies depending on the size of the SHARYS IP station. Should an earth leakage device is needed, it must be a selective model (not sensitive to transitory currents) and installed upstream the SHARYS IP station.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

SHARYS IP is a full range of high performing rectifiers designed to provide reliable DC supply to industrial applications.

Models[1]												
	Input	Output										
		V \ A	15	20	30	40	50	60	80	100	150	200
SHARYS IP Enclosure ED Max 2 rectifier modules Redundancy 1+1 or full power	230 V 1ph + N	24	-	-	-	-	1x50	-	-	2x50	-	-
		48	1x15	-	2x15 1x30	-	1x50	2x30	-	2x50	-	-
		108	-	1x20	-	2x20	-	-	-	-	-	-
		120	-	1x20	-	2x20	-	-	-	-	-	-
SHARYS IP Enclosure EX Max 2 rectifier modules Redundancy 1+1 or full power Integrated input transformer	400 V 2ph	24	-	-	-	-	1x50	-	-	2x50	-	-
		48	1x15	-	2x15 1x30	-	1x50	2x30	-	2x50	-	-
		108	-	1x20	-	2x20	-	-	-	-	-	-
		120	-	1x20	-	2x20	-	-	-	-	-	-
SHARYS IP System IS Max 4 rectifier modules Redundancy N+1	230 V 1ph + N 400 V 3ph + N	24	-	-	-	-	1x50	-	-	2x50	3x50	4x50
		48	-	-	-	-	1x50	-	-	2x50	3x50	4x50
		108	-	1x20	-	2x20	-	3x20	4x20	-	-	-
		120	-	1x20	-	2x20	-	3x20	4x20	-	-	-
SHARYS IP System IX Max 3 rectifier modules Redundancy N+1 Integrated input transformer	400 V 3ph	24	-	-	-	-	1x50	-	-	2x50	3x50	-
		48	-	-	-	-	1x50	-	-	2x50	3x50	-
		108	-	1x20	-	2x20	-	3x20	-	-	-	-
		120	-	1x20	-	2x20	-	3x20	-	-	-	-

Matrix table for model and current rating

(1) The value written in the cells means “number of modules x power of the module”

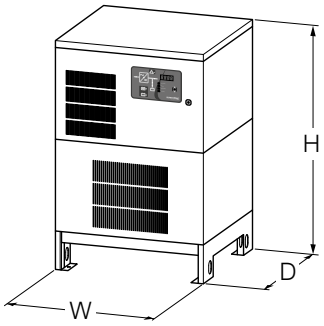
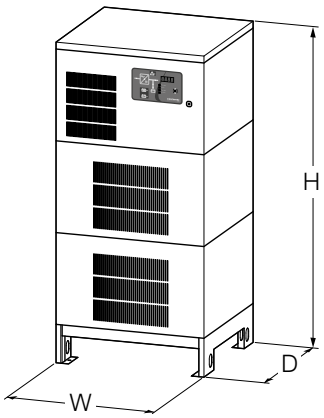
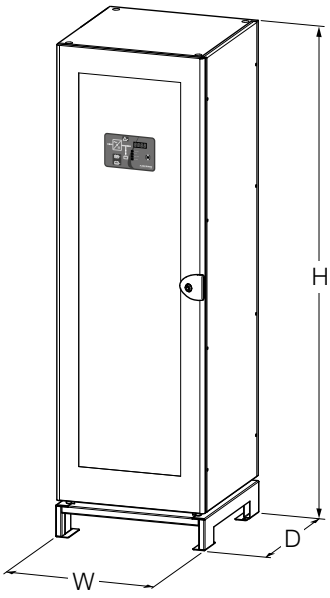
The SHARYS IP series have been designed with the objective of reliable DC supply.

Ideally suited for industrial applications, SHARYS IP combines telecom features like modularity, hot swap module replacements, redundancy N+1 and scalability along with a robustly designed frame creating an innovative mix.

Flexible design and a wide range of customization possibilities complete the package and enable the use of SHARYS IP in a wide range of situations.

2. FLEXIBILITY

2.1. Power ratings from 15 to 200 A

Dimensions			
Cabinet type	Width (W) [mm]	Depth (D) [mm]	Height (H) [mm]
 SHARYS IP Enclosure	600	535	894
 SHARYS IP Enclosure	600	535	1254
 SHARYS IP System	600	600	1900

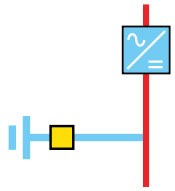
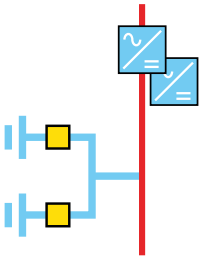
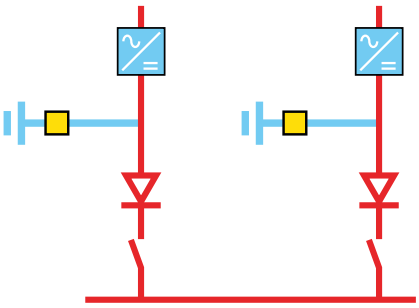
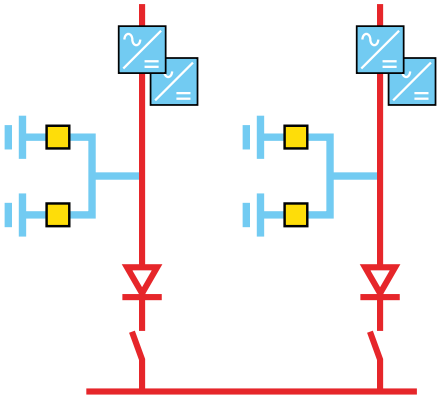
The equipment has been designed with a minimum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

All of the control mechanisms and communication interfaces are located in the upper front part and can be accessed from the door.

The air inlet is at the front, with outflow to the rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Typical configurations

	
Single	Redundant N+1
	
Full redundant 1+1	**Extended full redundant**

3. STANDARD AND OPTIONS

3.1. Standard electrical features

- Polarity insulated or grounded.
- Internal battery fuse protection.
- Fitting for output DC distribution.
- Battery temperature sensor.
- PCB tropicalization.
- IP30 steel cabinet.
- Pallet truck friendly base.

3.2. Electrical options

- BLVD battery low voltage disconnector.
- Output distribution.
- Double AC power supply.
- Double string battery protection.
- Emergency Power Off (EPO).
- Power Share.
- Coupling kit.
- Earth leakage control.
- Input surge suppressors.
- Battery cabinet.
- Enhanced protection degree.

3.3. Standard communication features

- Dry contact interface.
- SHARYS PLUS, advanced digital controller (System only).
- MODBUS RTU (System only).
- 2 slots for communication options (System only).

3.4. Communication options

- NET VISION for DC systems: professional WEB/SNMP interface for DC system monitoring and shutdown management of several operating systems (System only).

4. SPECIFICATIONS

4.1. SHARYS IP Enclosure

4.1.1. Installation parameters

Installation paramenters													
Models		Enclosure ED						Enclosure EX					
Phase		1ph + N						2ph					
Max number of rectifiers		2						2					
Rated output voltage (V)		24	48			108	120	24	48			108	120
Rated output current (A)(1)		100	30	60	100	40		100	30	60	100	40	
Rated input current (A)		18	12	20	34	30	34	12	7	14	24	20	24
Dissipation at rated load (minimum mains power present and batteries charging)	(W)	352	196	370	562	420	484	370	206	389	591	442	509
	(kcal/h)	303	169	318	483	361	416	318	177	334	508	380	438
	(BTU/h)	1201	669	1262	1918	1433	1651	1262	703	1327	2017	1508	1737
Dimensions	W (mm)	600											
	D (mm)	535											
	H (mm)	894				1254		1254					
Weight (without batteries) (kg)		70				85		105				110	

(1) With 2 modules installed.

4.1.2. Electrical characteristics

Electrical characteristics - **Input**		
	Enclosure ED	Enclosure EX
Rated mains supply voltage	230 V 1ph + N	400 V 2ph
Voltage tolerance (ensuring battery recharge)	±20% (-50% at 40% of rated current)	
Frequency tolerance	47.5 to 63 Hz	
Power factor (input at full load and rated voltage)	0.99	
Total harmonic distortion (THDi)	EN 61000-3-3 compliant	
Max inrush current at start-up	< In (limited by precharge circuit)	

Electrical characteristics - **Output**		
	Enclosure ED	Enclosure EX
Rated output voltage	24 / 48/ 108 / 120 V DC	
Output voltage with battery fully charged(1)	26.6 / 53.3 / 119.8 / 133.2 V	
Output voltage tolerance	Static: < 1%	
Isolation towards input pulse overvoltage	4 kV 1.2/50 µs	
Dielectric strength	3 kV / 50 Hz / 60 s (I/O) 2.5 kV / 50 Hz / 60 s (I/GND) 500 V / 50 Hz / 60 s (O/GND)	
Residual ripple with Iu >10%	< 50 mV rms	
Permanent output overload with constant power	105% In	

(1) Output voltage variation depends on the recharging voltage and on the end of the discharging voltage settings (typically 1.13 Vn with mains present and battery charged, 0.90 Vn when batteries are completely discharged).

Electrical characteristics - **Efficiency**		
	Enclosure ED	Enclosure EX
Efficiency at rated power	90% to 93% depending on version	

Electrical characteristics -**Environment**		
	Enclosure ED	Enclosure EX
Storage temperature	-5 to +50 °C (23 to 122 °F)	
Operating temperature	-5 to +45 °C (23 to 113 °F) up to 55 °C at 60% of rated power	
Maximum relative humidity (non condensing)	95%	
Maximum altitude without de-rating	1000 m (3300 ft)	
Degree of protection	IP30	
Colour	Dark Grey	

4.1.3. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Input**												
Models	Enclosure ED						Enclosure EX					
Phases in	1											
Output voltage (V)	24	48			108	120	24	48			108	120
Output current (A)	100	30	60	100	40	40	100	30	60	100	40	40
Automatic switch (A) - 230 V (1ph + N)	D20	C16	D20	D40	D32	D40	-	-	-	-	-	-
Automatic switch (A) - 400 V (2ph)	-	-	-	-	-	-	D20	D16	D20	D40	D32	D40
Number of rectifiers	2						2					

RECOMMENDED PROTECTION - **Input residual current circuit breaker**		
Models	Enclosure ED	Enclosure EX
Earth leakage device	> 0.1 A Selective	

4.2. SHARYS IP System

4.2.1. Installation parameters

Installation paramenters																					
Models		System IS																System IX			
Phases in		1+N		3+N		1+N		3+N		1+N		3+N		1+N		3+N		3			
Output voltage (V)		24				48				108				120				24	48	108	120
Output current (A)[1][2]		50	100	150	150	50	100	150	150	20	40	60	60	20	40	60	60	150	150	60	60
Number of rectifiers		1	2	3	3+1	1	2	3	3+1	1	2	3	3+1	1	2	3	3+1	3	3	3	3
Power (kW)		1.6	3.2	4.8	4.9	3.2	6.4	9.6	9.7	2.9	5.7	8.6	8.7	3.2	6.4	9.6	9.7	3.6	7.2	6.5	14.4
Rated input current (A)		9	18	9	18	17	34	17	34	15	30	15	30	17	34	17	34	9	17	15	17
Dissipation at rated load (minimum mains power present and batteries charging)	(W)	205	428	627	630	322	630	926	932	237	448	654	662	270	519	756	765	815	1275	955	1099
	(kcal/h)	176	368	539	542	277	542	796	801	204	386	562	570	232	446	650	658	701	1096	822	945
	(BTU/h)	700	1460	2140	2150	1100	2150	3160	3180	810	1530	2230	2260	920	1770	2580	2610	2780	4350	3260	3750
Dimensions (L x D x H) (mm)		600 x 535 x 1900																			
Weight (kg)		245																305			

(1) The output current is the sum of the load and the battery recharge currents.

(2) Contact us for power extension or customization needs.

4.2.2. Electrical characteristics

Electrical characteristics - **Input**		
	System IS	System IX
Rated mains supply voltage	230 V (1ph + N) / 400 V (3ph + N)	
Voltage tolerance (ensuring battery recharge)	±20% (-50% at 40% of rated current)	
Frequency tolerance	47.5 to 63 Hz	
Power factor (input at full load and rated voltage)	0.99	
Total harmonic distortion (THDi)	EN 61000-3-3 compliant	
Max inrush current at start-up	< In (limited by precharge circuit)	

Electrical characteristics - **Output**		
	System IS	System IX
Nominal output voltage	24 / 48 / 108 / 120 V DC	
Output voltage with battery fully charged[1]	26.6 / 53.3 / 119.8 / 133.2 V	
Output voltage tolerance	Static: <1%	
Isolation towards input pulse overvoltage	4 kV 1.2/50 µs	
Dielectric strength	3 kV / 50 Hz / 60 s (I/O) 2.5 kV / 50 Hz / 60 s (I/GND) 500 V / 50 Hz / 60 s (O/GND)	
Residual ripple with Iu >10%	< 50 mV rms	
Permanent output overload with constant power	105% In	

(1) Output voltage variation depends on the recharging voltage and on the end of the discharging voltage settings (typically 1.13 Vn with mains present and battery charged, 0.90 Vn when batteries are completely discharged).

Electrical characteristics - **Environment**		
	System IS	System IX
Storage temperature	-5 to +50 °C (23 to 122 °F)	
Operating temperature	-5 to +45 °C (23 to 113 °F) up to 55 °C at 60% Pmax	
Maximum relative humidity (non condensing)	95%	
Maximum altitude without derating	1000 m (3300 ft)	
Degree of protection	IP30(1)	
Colour	Dark Grey	

(1) Other IP as option.

4.2.3. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Input**																				
Models	System IS																System IX			
Phases in	1+N		3+N		1+N		3+N		1+N		3+N		1+N		3+N		3			
Output voltage (V)	24				48				108				120				24	48	108	120
Output current (A)	50	100	150	150	50	100	150	150	20	40	60	60	20	40	60	60	150	150	60	60
Automatic switch (A) - 230 V	C16	D20			C20	D32			C20	D32			C20	D32			D32			
Number of rectifiers	1	2	3	3+1	1	2	3	3+1	1	2	3	3+1	1	2	3	3+1	3	3	3	3

RECOMMENDED PROTECTION - **Input residual current circuit breaker**		
Models	System IS	System IX
Earth leakage device	> 0.1 A Selective	

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

Electromagnetic Compatibility Directive

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 61204-3	"Low-voltage power supply devices, d.c. output - Part 3: Electromagnetic Compatibility (EMC);"
EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments;
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Immunity for industrial environments;

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950	Safety of information technology equipment
EN 61204	Low-voltage power supply devices, d.c. output - Performance characteristics and safety requirements.

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 61204	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

SHARYS

30 to 600 A

socomec

Innovative Power Solutions

OBJECTIVES

The aim of these specifications is to provide:

- the information required to choose the right power station for a specific application.
- the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

INSTALLATION REQUIREMENTS AND PROTECTION

The network connection and connection of utilities must be done using cables of the appropriate size and compliant with regulations. If not already present, an electrical control station which can isolate the network upstream of the SHARYS system must be installed. This electrical control station must be equipped with a circuit breaker of an appropriate rating for the power draw at full load.

For detailed information, see the installation and operating manual.

1. ARCHITECTURE

1.1. Range

SHARYS is a complete range of high performing rectifiers systems designed to protect critical and sensitive appliances in telecom applications, transmission systems and telephone exchanges.

Models								
	60	100	120	200	270	420	450	600
SHARYS MICRO	•	•	-	-	-	-	-	-
SHARYS MINI	-	-	•	•	-	-	-	-
SHARYS ELITE	•	•	•	•	•	•	•	•

Matrix table for model and current rating

Each range has been specifically designed to meet the demands of loads in specific application contexts, in order to optimise the features of the unit and to facilitate its integration within the system.

SHARYS rectifiers are independent modular units rated at 30 and 50 A which, in converting single phase AC into 48 V DC, use high frequency conversion technology.

SHARYS rectifiers are an effective choice for their power factor (close to 1), high conversion efficiency, very limited weight and small footprint.

They are built to allow for quick swapping out of the individual Power Station modules.

2. FLEXIBILITY

2.1. Power ratings from 30 to 600 A

Dimensions			
Cabinet type	Width [mm]	Depth [mm]	Height [mm]
SHARYS MICRO	48.5 (19”)	500	262 (6U)
SHARYS MINI			524 (12U)
SHARYS ELITE	600		1800

The equipment has been designed with a MINImum direct and indirect footprint (the actual space occupied by the unit and the space required around it for maintenance, ventilation and access to the operating mechanisms and communication devices).

The careful design also provides easy access for maintenance and installation.

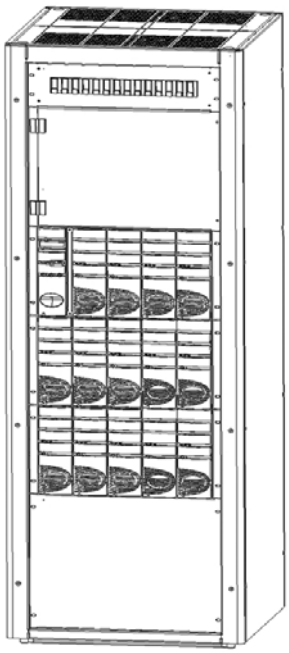
All of the control mechanisms and communication interfaces are located in the upper front part and can be accessed from the door.

The cooling air inlet is at the front, with outflow from the top/rear only; this means other equipment or external battery enclosures can be placed alongside the UPS unit.

2.2. Modular system

The modularity of the SHARYS system means that system power and redundancy can be increased simply by installing a supplementary rectifier module.

SHARYS MICRO and MINI



SHARYS ELITE

3. STANDARD AND OPTIONS

3.1. SHARYS PLUS control module

- It is included as standard on all Sharys DC systems.
- Microprocessor control with CAN-BUS protocol communication and RS 232/485 port for external communication.
- Additional easy frontal LEDs indications.
- Plug-in «hot-swap» solution, easy to replace.

3.2. Rectifier modules

- Double conversion switching technology.
- Plug-in “hot-swap”.
- Microprocessor control with CAN-BUS protocol communication.
- Parallel connection with active load sharing and selective disconnection of a faulty module.
- Wide temperature and input mains voltage tolerance.

3.3. Standard electrical features

- Positive pole grounded.
- Internal battery fuse protection.
- Fitting for output DC distribution (SHARYS MICRO and MINI only).
- Battery temperature sensor.

3.4. Electrical options

- BLVD - Battery Low Voltage Disconnector.
- Output distribution.
- Double battery protection.
- Internal batteries (SHARYS ELITE only).

3.5. Standard communication features

- SHARYS PLUS advanced digital controller.
- MODBUS RTU.
- 1 slot for communication options (SHARYS MICRO and MINI only).
- 2 slots for communication options (SHARYS ELITE).

3.6. Standard communication features

- NET VISION for DC systems: professional WEB/ SNMP interface for DC system monitoring and shutdown management of several operating systems.
- Dry-contact interface.

4. SPECIFICATIONS

4.1. Installation parameters

Installation paramenters													
Models		SHARYS MICRO		SHARYS MINI		SHARYS ELITE							
Input voltage (V)		230 1ph		230 1ph / 400 3ph+N		230 1ph (up to 200 A) / 400 3ph+N							
Output current (A)		60	100	120	200	60	100	120	200	270	420	450	600
Power (kW)		3.2	5.4	6.4	13.5	3.2	5.4	6.4	13.5	14.4	22.4	24.3	32.4
Rated inrush current (A)	1ph	20	32	40	64	20	32	40	64	-	-	-	-
	3ph	-	-	20	32	-	-	20	32	30	50		80
Dissipation at rated load (MINImum mains power present and batteries charging)	(W)	358	563	656	1073	358	563	656	1073	1413	1865	2603	3640
	(kcal/h)	307	484	564	922	307	484	564	922	1215	2169	2238	3130
	(BTU/h)	1220	1920	2240	3660	1220	1920	2240	3660	4820	7400	8880	12420
Dimensions	W (mm)	19”				600							
	D (mm)	500											
	H (mm)	262		524		1800							
Weight (kg)		20		25		72		82		135		145	

4.2. Rectifier module

Electrical characteristics - **Input**		
	SH 1600W	SH 2700W
Rated mains supply voltage	230 V	
Voltage tolerance (ensuring battery recharge)	± 20% (-40% at 60% of rated power)	
Frequency tolerance	47.5 to 63 Hz	
Power factor (input at full load and rated voltage)	0.99	
Total harmonic distortion (THDi)	EN 61000-3-2 compliant	
Max inrush current at start-up	< In	

Electrical characteristics - **Output**		
	SH 1600W	SH 2700W
Rated output voltage (selectable)	48 V DC	
Output voltage tolerance	Static: < 1%	
Rated current (A)	30	50
Isolation towards input pulse overvoltage	4 kV 1.2/50 µs	
Dielectric strength	3 kV/ 50 Hz / 60 s (I/O) 2.5 kV / 50 Hz / 60 s (I/GND) 500 V / 50 Hz / 60 s (O/GND)	
Residual ripple with Iu >10%	< 50 mV rms	
Admitted output overload	105% In	

Electrical specification - **Efficiency**		
	SH 1600W	SH 2700W
Efficiency	91%	

Electrical characteristics - **Environment**		
	SH 1600W	SH 2700W
Storage temperatures	-5 to +50 °C (23 to 122 °F)	
Working temperature	0 to +45 °C (32 to 104 °F) up to 55 °C at 60% Pmax	
Maximum relative humidity (non-condensing)	95%	
Maximum altitude without derating	1000 m (3300 ft)	
Degree of protection	IP20	
Portability	EN 60068-2	
Colour	Dark Grey	

4.3. Recommended protection devices

RECOMMENDED PROTECTION DEVICES - **Input**																	
Model	SHARYS MICRO		SHARYS MINI				SHARYS ELITE										
Input voltage	230 V 1ph		230 V 1ph		400 V 3ph+N		230 V 1ph				400 V 3ph+N						
Rated current	60	100	120	200	120	200	60	100	120	200	120	200	270	420	450	600	
C curve automatic switch (A)	20	32	40	64	20	32	20	32	40	64	20	32	30	50	50	80	
Number of rectifiers	2		4				2		4				9	14	9	14	
Protection on input of individual rectifier (A) (gG fuse)	10	20	10	20	10	20	10	20	10	20	10	20	10	10	20	20	
gG Station fuse (A)	-	-	-	-	-	-	-	-	-	-	-	-	50 4P	63 4P	63 4P	100 4P	

RECOMMENDED PROTECTION - **Input residual current circuit breaker**			
Model	SHARYS MICRO	SHARYS MINI	SHARYS ELITE
Input residual current circuit breaker	> 0.1 A Selective		> 0.5 A Selective

RECOMMENDED PROTECTION DEVICES - **Battery**																
Model	SHARYS MICRO		SHARYS				SHARYS ELITE									
Phase in	1ph (230 V)		1ph (230 V)		3ph (3x400 V +N)		1ph (230 V)				3ph (3x400 V +N)					
Rated current	60	100	120	200	120	200	60	100	120	200	120	200	270	420	450	600
22x58 battery fuse	63	125	2x 80	2x 125	2x 50	2x 125	63	125	2x 80	2x 125	2x 80	2x 125	315 NH2	500 NH3	500 NH3	630 NH3

5. REFERENCE STANDARDS AND DIRECTIVES

5.1. Overview

The construction of the equipment and choice of materials and components comply with all applicable laws, decrees, directives and standards currently in force.

In particular, the equipment is fully compliant with all European Directives concerning CE marking.

2006/95/EC

Council Directive 2006/95/EC, dated 16 February 2007, on the reconciliation of legislation within Member States regarding electrical material for use within specific voltage ranges.

2004/108/EC

On the approximation of the laws of the Member States relating to electromagnetic compatibility

5.2. Standards

5.2.1. Electromagnetic compatibility

"Electromagnetic Compatibility Provisions (EMC)"

EN 61204-3	Low-voltage power supply devices, d.c. output - Part 3: Electromagnetic Compatibility (EMC);
EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments;
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Immunity for industrial environments;
EN 61000-3-3	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16A per phase and not subject to conditional connection.

5.2.2. Safety

"General and safety requirements for UPS used in operator access areas"

EN 60950	Safety of information technology equipment
EN 61204	Low-voltage power supply devices, d.c. output - Performance characteristics

5.2.3. Type and performances

"Performance requirements and methods of test"

EN 61204	Uninterruptible power systems (UPS). Methods of specifying the performance and test requirements

Glossary

Terms and accessories

socomec

Innovative Power Solutions

GLOSSARY

ACS

Automatic Cross Synchronisation (ACS) is an option which can be integrated into the machine without adding external enclosures and which synchronises the output voltage with an external source or with another stand-alone UPS (single or parallel system, SOCOMEC or other brands).

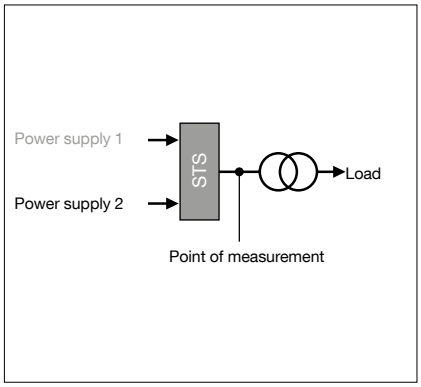
ADC

The Advanced Dry Contact (ADC) circuit board is an interface fitted with programmable dry contacts. It consists of up to four normally open or normally closed outputs and up to three digital inputs, all fully configurable. Up to four operating modes can be selected.

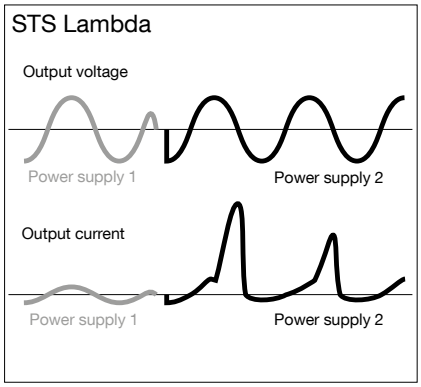
ADVANCED TRANSFORMER SWITCHING MANAGEMENT (ATSM)

Advanced switching management of downstream transformers for static transfer systems.

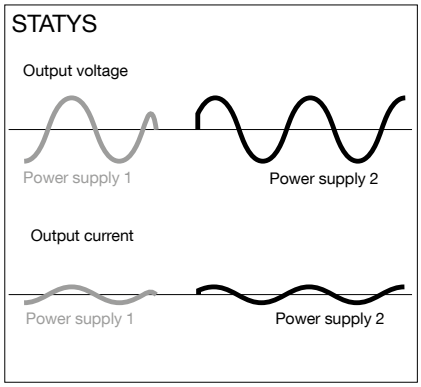
If the upstream network has no distributed neutral cable, two upstream transformers or one downstream transformer can be added to create a neutral reference point at the output. For the downstream solution, STATYS (thanks to ATSM) correctly manages the switching to limit inrush current and avoid the risk of spurious breaks.



STATY_039_A_BW



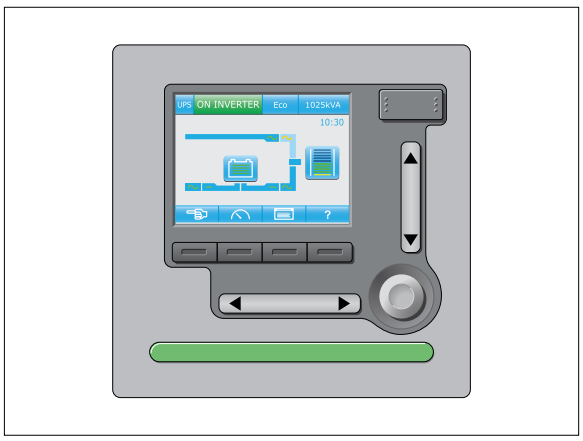
STATY_042_A_BW



STATY_043_A_BW

ADICOM (advanced interface)

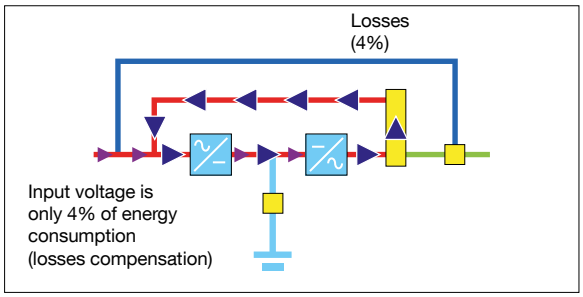
- **User-friendly graphic colour display**: gives a clear view of the UPS subassemblies status and provides the user with a full array of controls for their management.
- **USB connection with front access**: for downloading or uploading of files from a memory key such as reports, custom language, software releases.
- **LED status bar**: gives the UPS status in 3 colours: green, yellow, or red.
- **Easy procedures for start and shutdown of the UPS**: the display gives operators a step-by-step explanation of the procedures.
- **Wide range of network connections**: extensive communication possibilities are on offer, including: HTML page for remote monitoring, SNMP agent sending TRAP to network management station, email sent according to events selection.
- **Shutdown agent**: allows sending a shutdown command to stand-alone or virtual servers.



GREEN_096_A

AUTO-LOAD TEST

Available for ***Green Power 2.0*** range, Auto-Load Test feature allows to perform a full power test to rectifier, inverter, bypass, contactors, chokes, capacitors, cables and fuses for validating the performance of the installed UPS with no customer load or dummy load connnected.



AUTOMATIC RETRANSFER

In case of supply from the alternate sources, when the preferred source is restored, the STS must automatically retransfer the load back after a delay of 3 seconds.

The system must try to retransfer to the preferred source in the best conditions.

For specific operating conditions, the automatic retransfer can be disabled via the user settings. In this case, the transfer has to be performed manually by the operator.

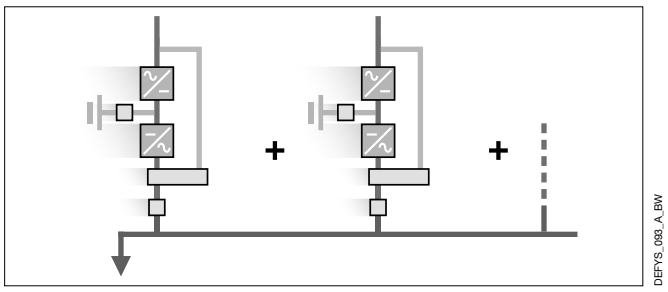
If the alternate source disappears before the manual retransfer, an automatic transfer must switch the load to the preferred source

Automatic retransfer must be activated by default and is configurable by the operator. This function can be delayed by the operator on each device in the case of multiple STS systems.

BYPASS

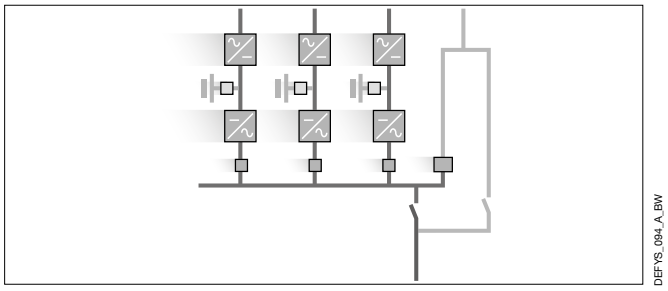
Distributed architecture.

The simplest solution to ensure power supply availability and flexibility in case of unscheduled installation upgrades by means of the parallel configuration of the UPS units, each one incorporating its own bypass. This configuration enables power output to be increased and is suitable for N+1 redundancy. Upgrades can also be performed keeping the load supplied by the system.



Centralised architecture.

The ideal solution for system redundancy and planned power upgrades. The automatic and maintenance bypass functions are centralized. In the event of anomalies inside the UPS or of an overload, the power is automaticaly switched to bypass ensuring the maximum availability. This solution also allows to adapt the bypass size according to the real power and installation short-circuit capability.



EBS

Expert Battery System (EBS) is a system which manages the battery charger. It responds to the working temperature to preserve battery life and reduce operating costs. Battery reliability depends on several variables: the working temperature, the installation environment, the number of charge and discharge cycles. Consequently it is important to introduce systems that can manage these variables in order to limit their impact on the UPS life cycle.

Premature ageing causes:

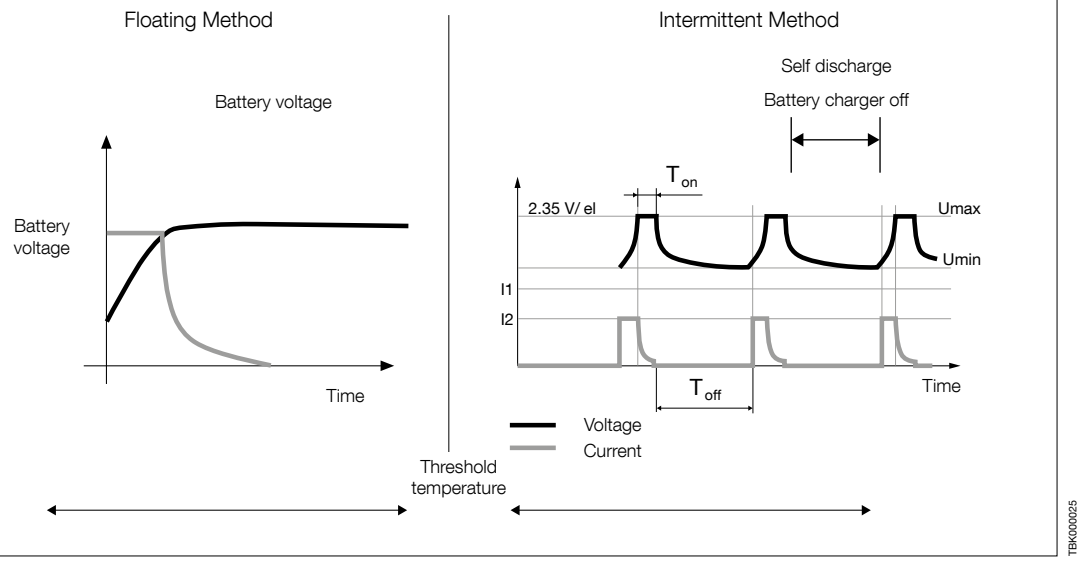
- corrosion: battery overcharge or high working temperature,
- sulfation: low charge voltage or long storage time,
- passivation: frequent charge/discharge cycles (cycling) resulting in capacity loss.

EBS allows for:

- automatic selection of the recharging method according to environmental and battery conditions,
- elimination of overloading due to permanent floating, which accelerates the corrosion of the positive plates,
- isolation of the battery from the DC bus, thanks to the charger function which is separate from the rectifier,
- protection against deep discharge,
- management of different types of batteries (sealed, open lead-acid and nickel-cadmium batteries),
- real-time calculation of the remaining back-up time,
- real-time measurements concerning the battery (voltage, battery current and battery capacity),
- a periodic battery test for monitoring battery efficiency and for programming preventive or corrective maintenance in the case of abnormal situations.

Tests carried out by SOCOMEC on several brands of batteries, together with years of experience, show that battery life can be enhanced by up to 30% with the use of EBS compared to a traditional battery management system.

Method of charging as a function of temperature



ECOMODE

ECOMODE increases efficiency as under normal operating conditions the utility is supplied directly from the emergency supply via the automatic bypass. The static UPS system remains on standby to replace the supply in the event of a failure.

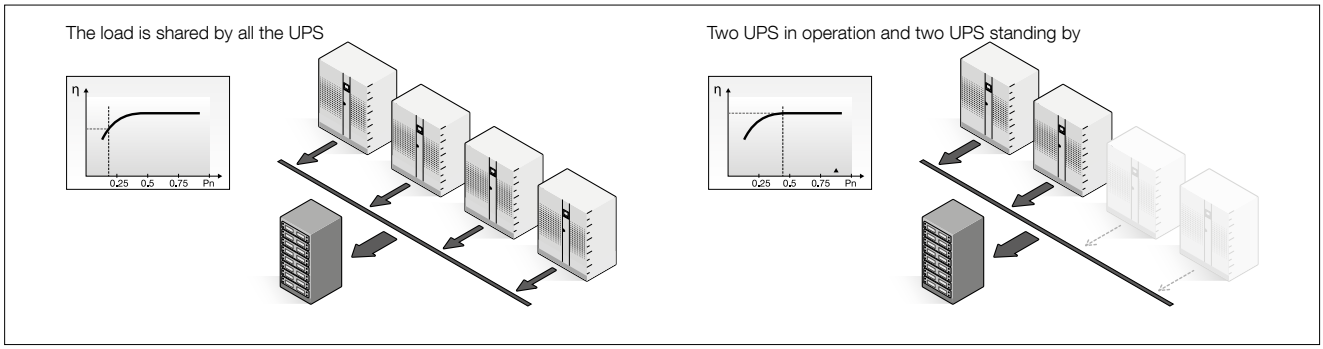
EMD

Environment Module Device (EMD) is a device to be used in conjunction with NET VISION with the following features:

- temperature and humidity measurements + 2 contact alarms,
- can be managed remotely from 2 to 15 metres,
- alarm thresholds configurable via Web browser,
- notification of environmental alarm via e-mail and SNMP traps.

ENERGY SAVER

- This function optimizes the efficiency (η) of your UPS in parallel when operating with a partial load.
- Only the UPS needed to supply the energy required by the applications are in operation.
- Redundancy can be ensured by maintaining an additional unit in operation.
- When the power consumed by the applications increases, the UPS units needed to meet the increased power requirements restart instantly.
- This type of operation is perfectly suited to applications subject to frequent variations in power.
- Energy Saver enables the increased efficiency of the whole system to be maintained.



FAST ECOMODE

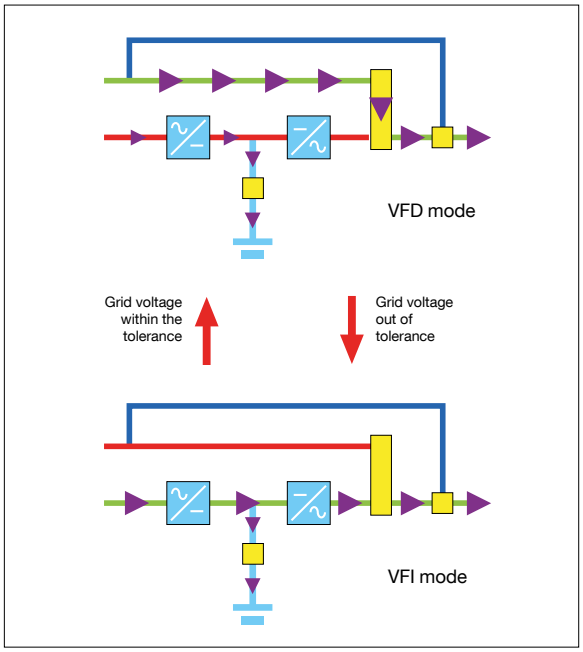
Available as option for GREEN POWER 2.0 160 to 800 kVA/kW, FAST ECOMODE is an automatic operating mode that optimizes the efficiency depending on the quality of the input voltage.

When the input voltage is within the tolerance (value is settable), the load is supplied by the bypss (VFD mode) and the efficiency achived is 99%.

Ultra fast transfer time from bypass to inverter (2 ms) if the input voltage is out of tolerances and automatic transfer back to bypass when the input voltage is restored.

Batteries are permanently maintened under charging, avoiding periodic restarts of the rectifier

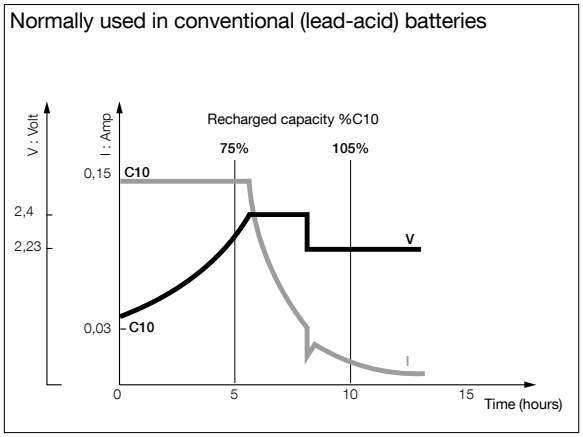
Availble both for single and parallel units.



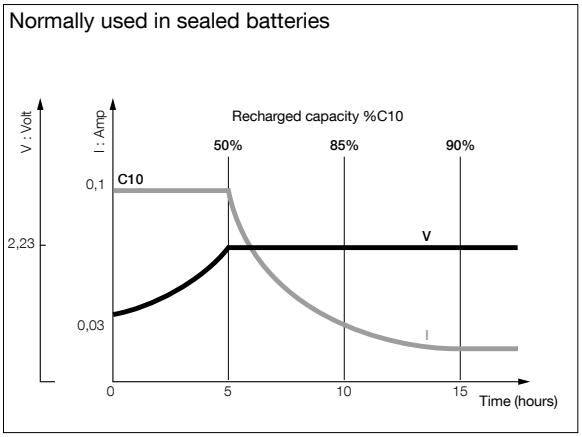
FLOATING AND TWO-LEVEL CHARGE

Lead-acid, sealed and open-vented batteries are extremely sensitive to the temperatures in which they operate. Charge algorithms exist which reduce the effect of these temperatures. In addition to the EBS system, SOCOMEC offers floating and "two-level" mixed charging. Its characteristics are illustrated below.

Normally used in conventional (lead-acid) batteries



Normally used in sealed batteries



FLYWHEEL

FLYWHEEL is a system for storing mechanical energy. It can be used as a replacement or a supplement for conventional batteries connected directly to the DC bus.

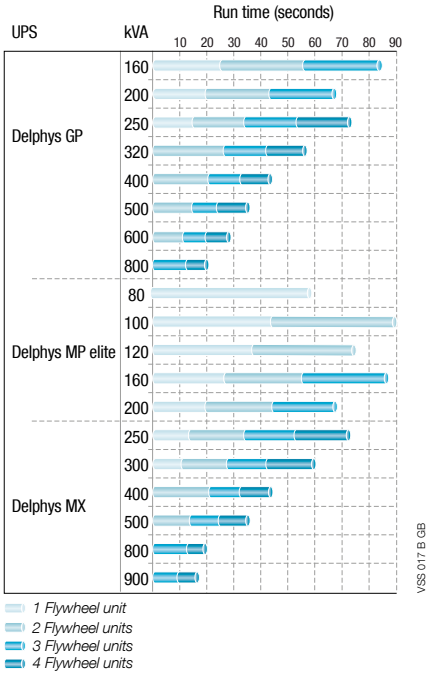
FLYWHEEL stores kinetic energy in a high-speed, carbon/glass fibre composite rotor which rotates in a vacuum levitating on magnetic bearings. It virtually eliminates electricity loss and requires minimal maintenance, so gives greater long-term pay-back.

The FLYWHEEL is driven in rotation by a reluctance motor which, in the event of a mains power failure, changes to generator operating mode. Like a chemical battery bank, it receives recharge and float power from the UPS system's DC bus and returns power whenever the DC bus voltage drops below a programmable threshold level.

FLYWHEEL completely eliminates the need for batteries by providing continuous ride-through power for short duration outages or until a standby generator can come on-line. A single unit can supply loads up to 300 kW.

FLYWHEEL can be paralleled without restriction for increased ride-through and/or power.

Designed for a life in excess of 20 years, it improves the global reliability of the UPS and reduces the global lifecycle cost (savings of 70% over 10 years, with an attractive Return On Investment).



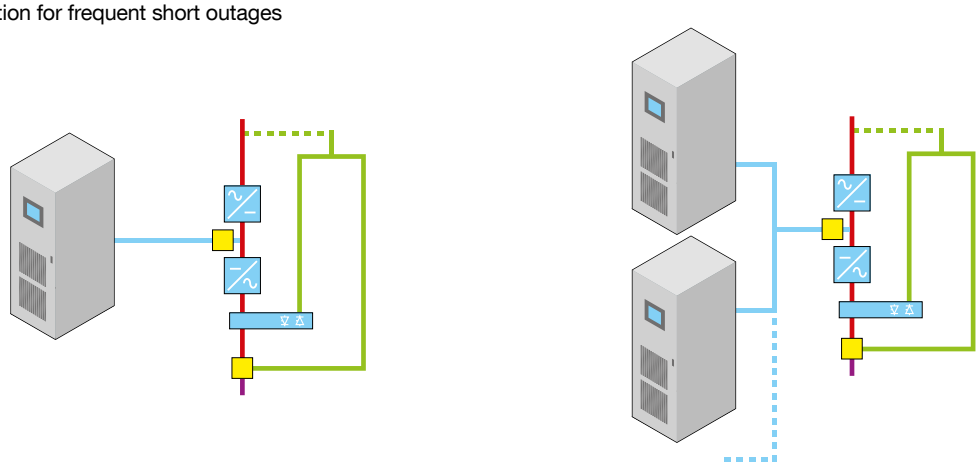
Advantages of using FLYWHEEL include:

- outstanding reliability,
- reduced and simplified maintenance,
- long service life (> 20 years),
- max. power in min. volume,
- less floor space < 0,58 m^2,
- high efficiency 99.4%,
- self-diagnostics,
- rapid recharging (typically 12 minutes),
- adjustable voltage and current parameters,
- silent operation,
- simple operation,
- cabinet on castors for ease of installation,
- no load restrictions on ground,
- installation requiring no structural work,
- cable access via upper section,
- simplified connections,
- units coupled in parallel to increase power and back-up time,
- front access for maintenance,
- environmentally-friendly.

Various configurations.

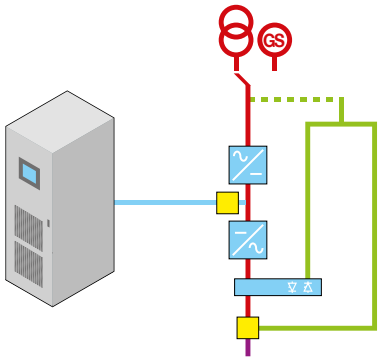
Various solutions or combinations for meeting your requirements for electrical energy availability are possible depending on your operating constraints and technical environment.

Ideal solution for frequent short outages



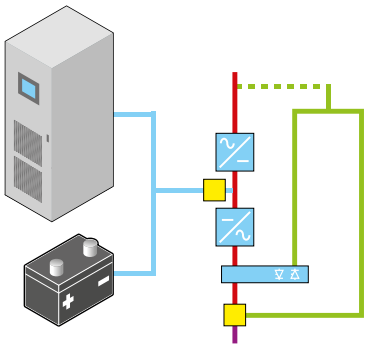
VSS 012 B - VSS 015 B

Load supplied until the GenSet starts.



VSS 013 B

To reduce battery aging in the event of frequent short outages.



VSS 014 B

GRAPHIC TOUCH SCREEN

The colour graphic touch screen, available on request, for DELPHYS MP ELITE and DELPHYS MX, is a user-friendly interface providing both safe operation of the UPS as well as a global system overview. The mimic diagram is interactive and intuitive and provides a quick overview of the whole equipment. Direct access through the mimic panel to the main functions such as the event log, graphic reports and the interactive help menu makes using the controls easier and safer. Remote monitoring is available via LAN connection, and the interface is included in the graphical touch screen.

GREEN POWER 2.0

Energy Saving: high efficiency without compromise.

- Offers the highest efficiency in the market using VFI – Double Conversion Mode, the only UPS working-mode that assures total load protection against all mains quality problems.
- Ultra high efficiency output independently tested and verified by an international certification organization in a wide range of load and voltage operating conditions, to have the value in the real site conditions.
- Ultra high efficiency in VFI mode is provided by an innovative topology (3-Level technology) that has been developed for all the Green Power UPS ranges.

Full-rated power: kW=kVA

- No power downgrading when supplying the latest generation of servers (leading or unity power factor).
- Real full power, according to IEC 62040: kW=kVA (unity power factor design) means 25% more active power available compared to legacy UPS.
- Suitable also for leading power factor loads down to 0.9 without apparent power derating.

Significant cost-saving (TCO)

- Maximum energy saving thanks to 96% efficiency in true double conversion mode: 50% saving on energy losses compared to legacy UPS gives significant savings in energy bill.
- UPS “self-paying” with energy saving.
- Energy Saver mode for global efficiency improvement on parallel systems.
- kW=kVA means maximum power available with the same UPS rating: no overdesign cost and therefore less €/kW.
- Upstream infrastructure cost optimization (sources and distribution), thanks to high performance IGBT rectifier.
- Extended battery life and performance:

- long life battery,
- very wide input voltage and frequency acceptance, without battery use.

- EBS (Expert Battery System) charging management improves battery service life.

HMI (Human Machine Interface)

HMI is a multilanguage Human Machine Interface available on MASTERYS GP which displays information regarding operating status, electrical measurements, allows the access to control functions and configuration parameters and provides a global overview of the system. It includes a colour graphic display and a luminous status bar, and provides access to:

- main functions via the mimic panel,
- measurements, alerts and UPS commands,
- programming battery tests and UPS operating modes,
- assisted startup and switching to maintenance bypass procedures,
- configuration menu,
- event log and alerts.

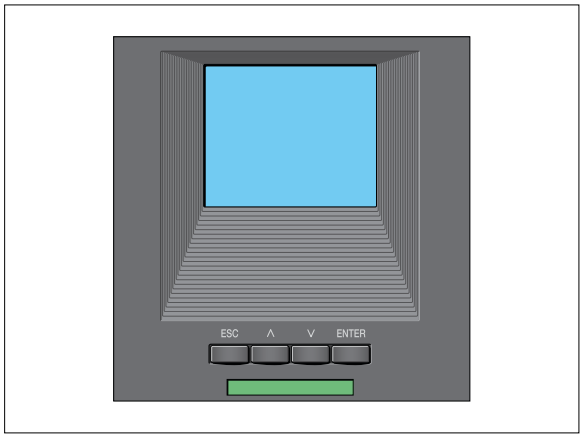
GREEN_055_A

JNC

The UPS back-up time might not always be long enough to cover the whole period of outage. In this case the best way to proceed is to save data and correctly shutdown the machines before the complete absence of the supply. The client is a small software application to be installed in the remote computers. It shows data and executes commands sent by Adicom or NetVision via the LAN network. Clients can be native for every single operating system (OS), or multi-OS and with more advanced features such as "JAVA & .NET Shutdown client" (JNC). The latter has been developed by SOCOMEC on a JRE platform.

LCD SYNOPTIC PANELS

LCD synoptic panels show all items of information relative to operating status, electrical measurements, gives access to control functions and configuration parameters such as input voltage out of tolerance, output voltage present, no mains power, battery circuit broken, battery maintenance voltage fault, battery output operational with mains power present, slow discharge pre-alarm, slow discharge protection alarm, battery charger fault, earth leakage fault (option).



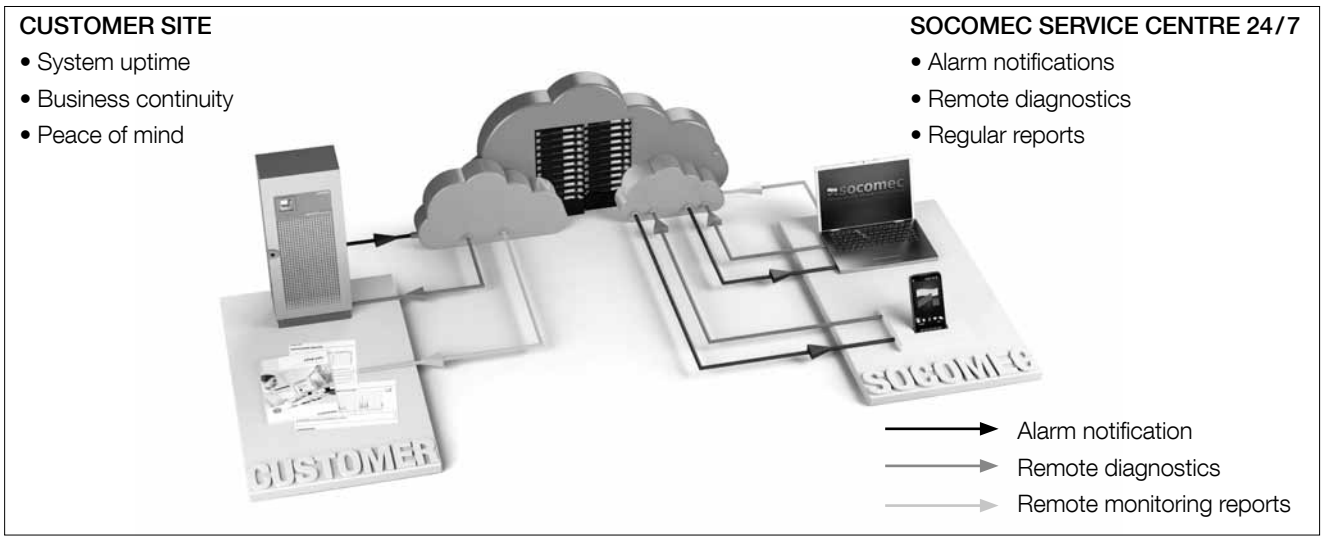
LINK-UPS

LINK-UPS is a remote monitoring solution that provides 24 / 7 connection with your UPS. Using redundant INTERNET / GPRS connection, it allows SOCOMEC engineers to be continuously connected to your UPS without any single point of

failure in communication.

LINK-UPS keeps you updated about the operating status of your UPS, providing you with regular reports and technical recommendations by the SOCOMEC Service Centre for improving the quality of your system.

Combined with a SOCOMEC Maintenance Contract, LINK-UPS allows the SOCOMEC engineers to take care of your UPS by constantly monitoring its parameters and quickly respond to anomalies.



• LINK-UPS increases:
- system availability,
- diagnostic accuracy,
- UPS status updating.

• LINK-UPS reduces:
- MTTR,
- OPEX,
- Downtime.

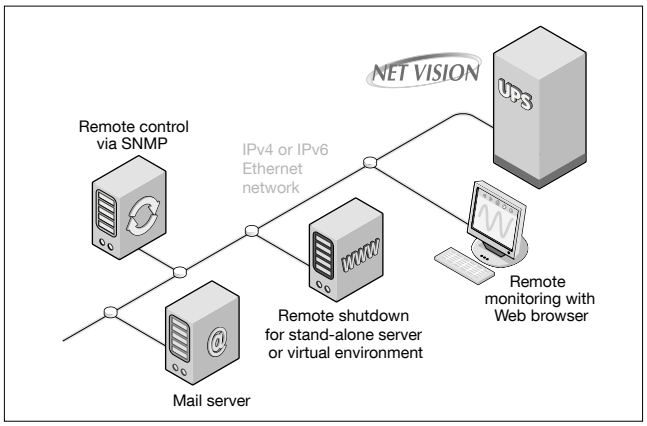
NET VISION

NET VISION is the most common Ethernet interface for use with SOCOMEC products. It is a communication interface designed for business networks. The UPS behaves exactly like a networked peripheral, it can be managed remotely and allows the shutdown of server-based workstations.

NET VISION allows a direct interface between the UPS and Ethernet network avoiding dependence on the server. It is therefore compatible with all networks and multi-OS since it interacts via the Web browser.

The main specifications and functions are as follows:

- 10 / 100 Mb Ethernet connection (RJ 45),
- UPS monitoring screen via a Web browser,
- remote shutdown of stand-alone server (compatible with JNC) or Virtual environnement (compatible with VIRTUAL-JNC),
- notification of faults via email to up to 8 addresses,
- UPS management via SNMP protocol,
- monitoring of the operating environment (optional EMD temperature and humidity sensor). Configurable alarm trigger, notification via email.



“ON-THE-FLY” TRANSFER

In STS systems, the “on-the-fly” transfer mode is necessary to allow the operator to perform a synchronous transfer from the control panel when the two power sources are not permanently synchronous and the respective phases slowly diverge.

The “on-the-fly” transfer function must also be usable during automatic retransfer, to revert to the preferred source as soon as it is in better conditions than the alternative source.

The STS must transfer exactly when the source phase shift is below the preset tolerance window (which is adjustable).

PARALLEL KIT

Parallel kits contain all of the components necessary for installing equipment units in parallel configurations. This can be anything from a cable to a cabinet, depending on the power and model of the UPS.

Contact SOCOMEC for further details on the different solutions offered.

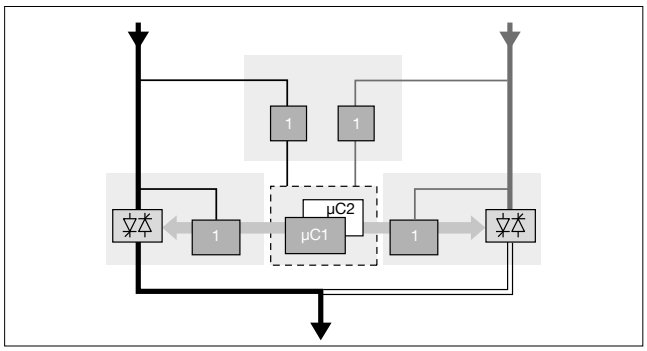
PFC

Power Factor Correction (PFC) is based on IGBT rectifier technology (Pulse Width Modulation). This cutting-edge technology ensures "clean" and perfectly sinusoidal current draw. It does not pollute the upstream power source since the input current has exceptionally low harmonic distortion (THDI < 3%). Moreover, thanks to a power factor close to 1 (FP > 0.99), the absorbed input power (kVA) is reduced by 30% compared to traditional technologies (six-phase or twelve-phase rectifiers) and in any operating condition, with charged or discharged battery. Input current draw is therefore reduced, with resulting benefits in terms of source and connection cable ratings. PFC systems do not require additional options for harmonic compensation or complex correction devices such as harmonic filters, which are essential for the most commonly used technologies. Unlike solutions with passive LC resonant filter, there is no risk of resonance either with harmonic filters or with the power factor correction capacitors that may already exist within the system.

Furthermore, PFC technology makes the UPS system perfectly compatible with generating sets without having to overrate the system.

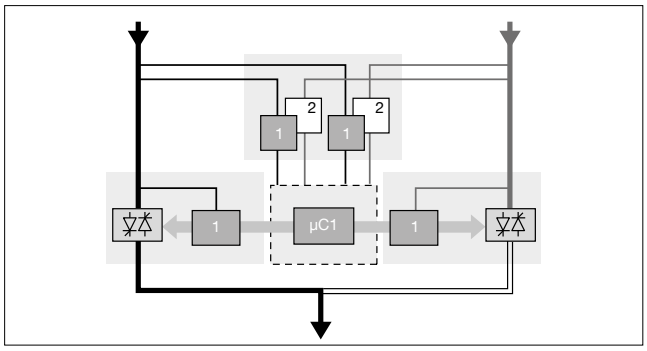
REDUNDANT MICROPROCESSOR

In the case of mission-critical applications where system availability is fundamental, the equipment and all other components must be redundant intelligent. For the highest availability, even in the event of a control failure, the microprocessor can be redundant so that the system will not interrupt the power supply and full communication capacity will be maintained.



REDUNDANT SUPPLY AND DUAL REDUNDANT SUPPLY

A Static Transfer System for "redundant supply" is a redundant electronic power supply connected to each source that powers the control boards. The term "dual redundant supply" indicates the presence of a second redundant power supply in addition to the first one described above. If one power supply control board should fail, it enables internal redundancy to be maintained even with a single power source.



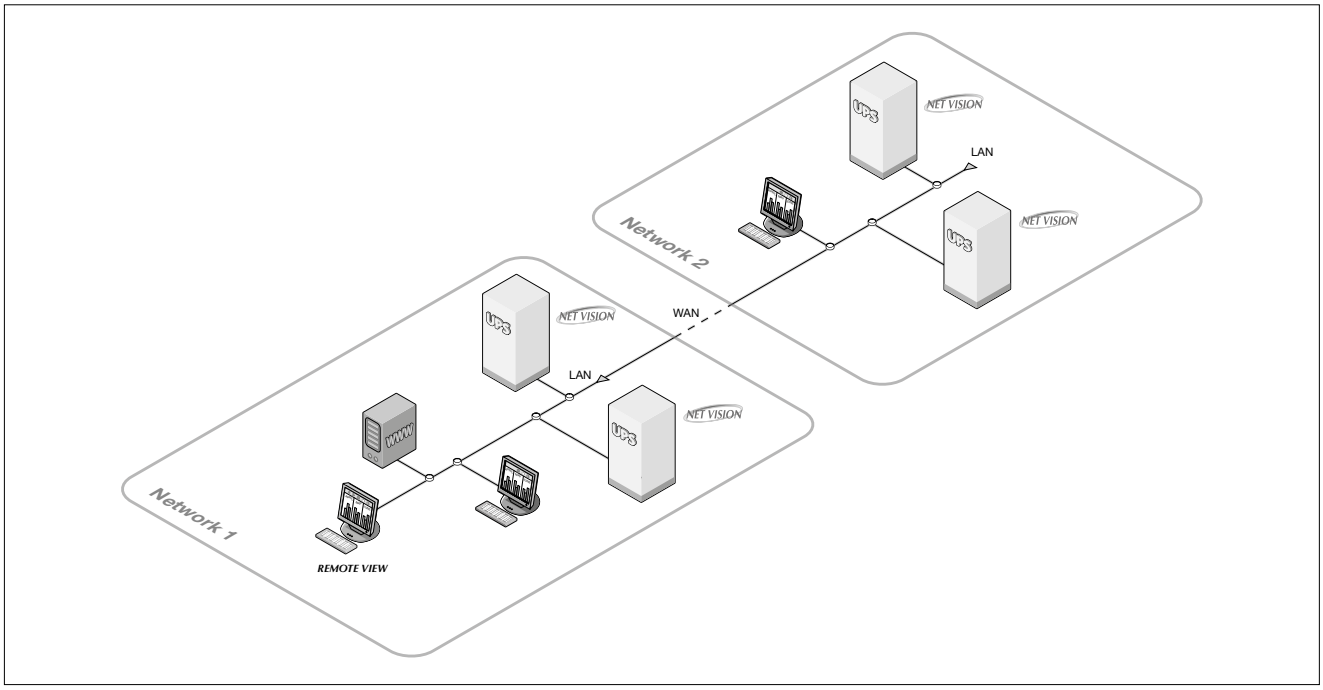
REMOTE VIEW

In addition to these protocols, another SOCOMEC solution is REMOTE VIEW, a central monitoring programme for UPS systems over an Ethernet network, which is simpler and less expensive than the complex NMS platforms.

REMOTE VIEW is an application able to monitor simultaneously up to 1,024 devices equipped with NET VISION card or box through the Ethernet network. Users are provided with tree-view (hierarchy structure can have up to 8 levels) and list-view. When an alarm is triggered in one or other monitored UPS, (trap event), the icon that represents the UPS will change colour according to the severity level, sending an email to several addressees which have been set the programme configuration dialogue window.

If the programme is running in the background, a pop-up message appears. Input and output voltages, battery capacity and load percentage are continuously monitored by the REMOTE VIEW programme. Plant supervisors and technicians can monitor all the UPS in the same programme window.

REMOTE VIEW runs on Windows® 2000/2003/2008 (R2)/XP/VISTA/7 with administrator rights. REMOTE VIEW software is available from the SOCOMEC's website for free download.



SYDIV_013_A_GB_BW

SVM - Digital Space Vector Modulation

The SVM, digital Space Vector Modulation, along with the isolation transformer installed on the inverter output, provides:

- perfectly sinusoidal output voltage THDV < 2 % with linear loads and < 3 % with non-linear loads,
- output voltage precision even when load is completely unbalanced between phases,
- an immediate response to major variations in load, without deviating the output voltage (± 2% in less than 5 ms),
- a very high short-circuit capacity up to 4 In (Ph / N) allows selectivity,
- a complete galvanic isolation between DC circuit and load output.

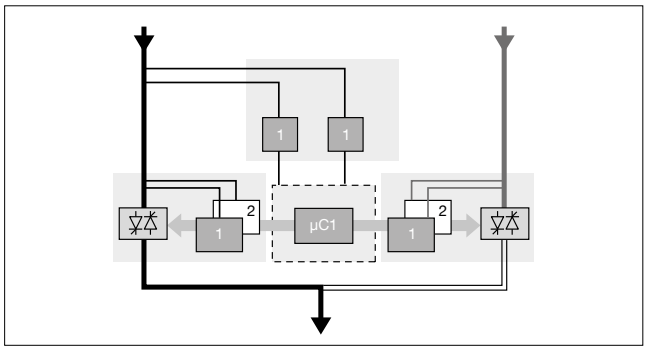
SVM, the latest high performance components and IGBT power bridges enable the supply of:

- non-linear loads with high crest factor up to 3,
- active power without derating, for loads with a lagging power factor and up to 0.9 leading.

SCR - INDEPENDENT CONTROL OF THE SILICON CONTROL RECTIFIER

Technology integrated in the Static Transfer System with individual, separate and autonomous control boards on each SCR path, increasing the redundancy and fault tolerance of each SCR path.

Physical separation between source 1 and source 2 SCRs prevents mutual disturbance.

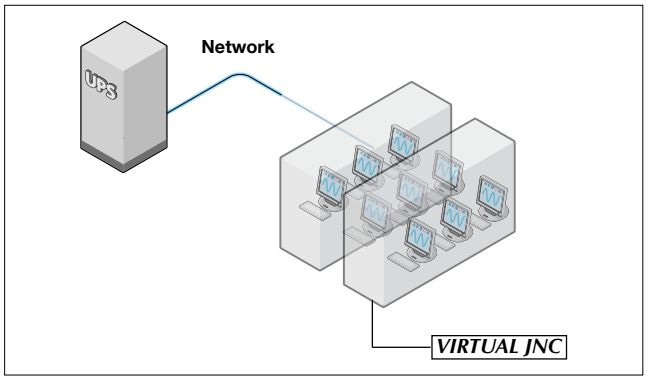


VIRTUAL JNC

Server virtualisation, which makes it possible to exploit the advantages of IT infrastructure consolidation, is becoming increasingly widespread. As a result, the correct management of virtual machines in the event of a fault with the electric power supply system is an increasingly common requirement. VIRTUAL JNC is the SOCOMEC solution especially for virtual systems. It fully supports virtual machine shutdown, by acting on the physical server to correctly shutdown all virtual machines running on that server.

On Virtual Environment systems it is possible to manage the order of virtual machine shutdown (defining the shutdown as sequential or staggered)) and systems with more than one host (also in a cluster configuration), in a simple, efficient manner. VIRTUAL JNC is compatible with all SOCOMEC UPS systems that support shutdown management via LAN. VIRTUAL JNC is compatible with VMware vCenterTM/vSphere, MicrosoftTM HYPER-V and Citrix XenServer.

VIRTUAL-JNC requires to be installed in a Windows® virtual machine. VIRTUAL-JNC software is available in the SOCOMEC's web site for free download.



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