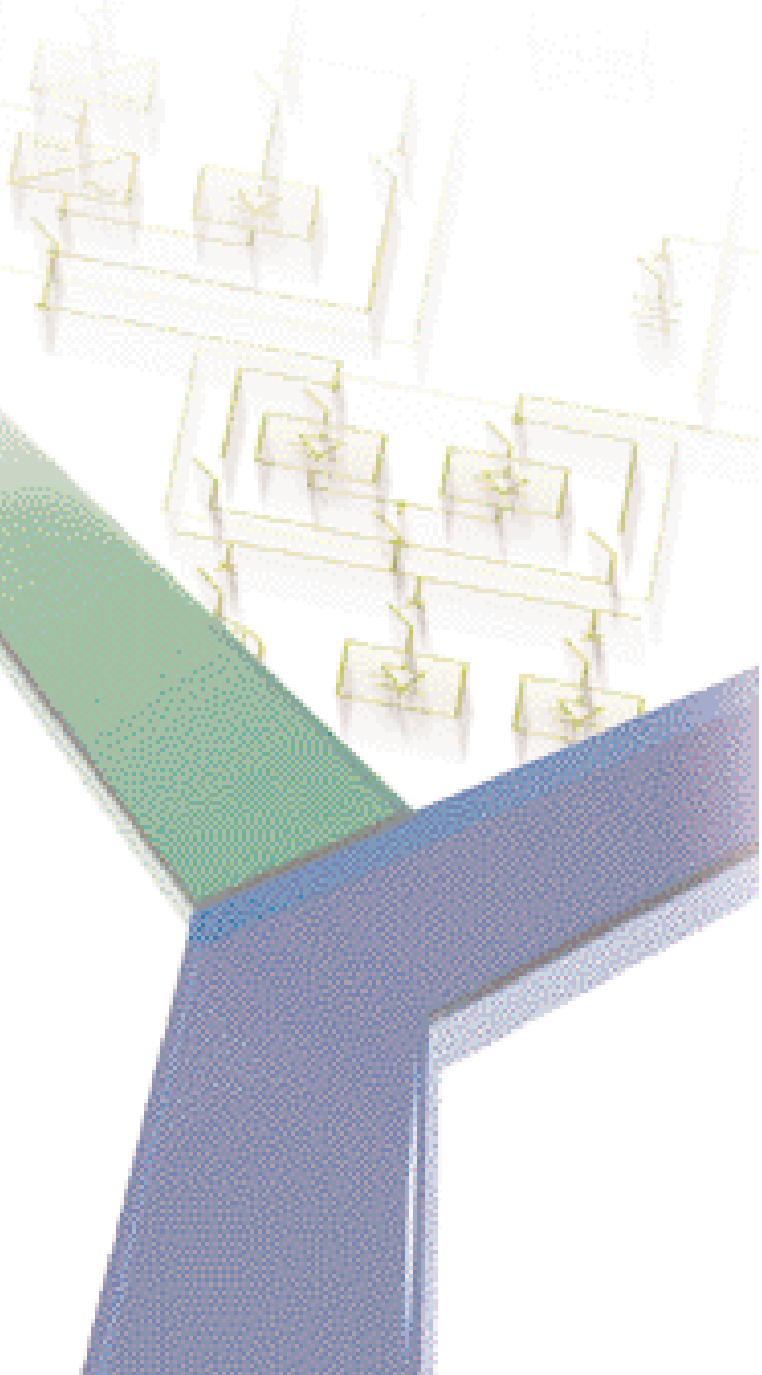
high availability solutions

High-quality power guide



THE UNINTERRUPTIBLE POWER PROVIDER

MGE
UPS SYSTEMS

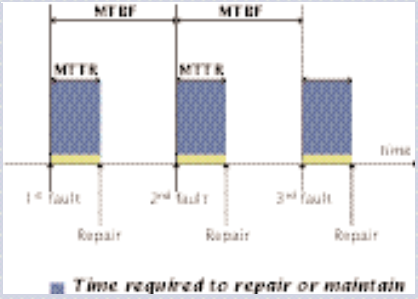
What is availability?

It is the probability that an electrical installation can supply quality power compatible with the equipment.

Availability (%)
= (1 – MTTR / MTBF) x 100

MTTR (mean time to repair) :
MTBF (mean time between failures) :

Secure power is based on three main factors, a clean electrical signal, availability and easy site management.



Everyone is concerned by availability

availab

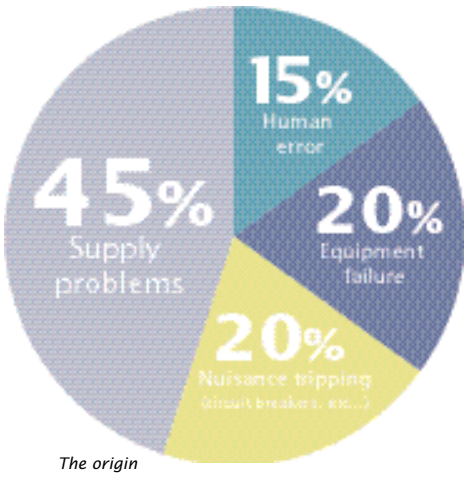
Industry, services, hospitals...
«The deregulation of power distribution markets means a wider selection of electricity suppliers, but at the same time less consistency in terms of power quality.»

Data centers, telecommunications...
«The explosion in internet and telecom applications has resulted in large data-exchange centres where the availability of power is a vital issue.»

Major risks
«For data-exchange applications, the financial cost of disturbances in the supply of power can be very high. In 1999, the corresponding losses represented nine times more than the cost of the power purchased.»

Examples of the cost of one hour of downtime:

- *mobile telephones: 40 000 euros,*
- *airline reservation system: 90 000 euros,*
- *bank-card transactions: 2 500 000 euros,*
- *stock-market transactions: 6 500 000 euros.*

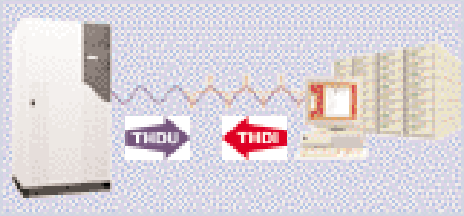


The origin of breakdowns

Toward optimum voltage quality

- **Identify the disturbing elements**

The type of installation and loads determines the disturbances affecting the quality of the electrical signal.
The disturbances are directly related to the system impedance and the harmonic currents drawn by the loads.
The level is characterised by the THDU (voltage distortion) and the THDI (current distortion).

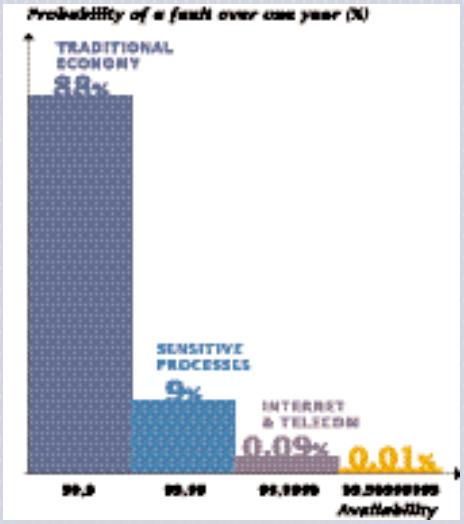


THDU for a source.
THDI for a load.

Harmonic currents

Voltage

Telephone and internet applications have imposed new, six-digit standards called "six nines" (99.9999%) to ensure "very high availability".



High ility

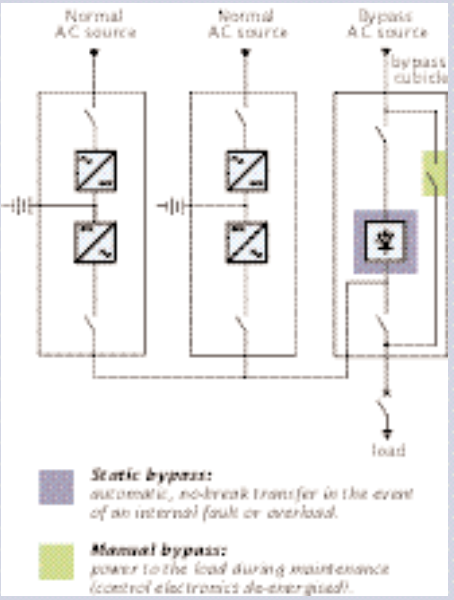
How can the availability of power be improved?

- **First of all by reducing the MTTR** through real-time detection of faults and analysis by experts for accurate diagnosis and fast repair.

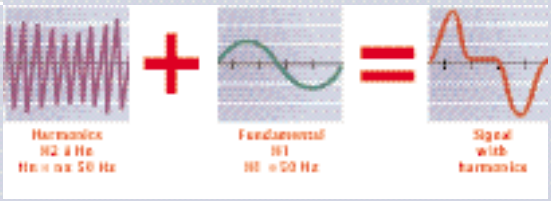
- **MGE PowerServices proposes** comprehensive assistance, training and site audits to provide customers with the information required to operate the installation and carry out diagnostics and basic maintenance.

- **Increase the MTBF as well** by selecting equipment with proven reliability. With 40 years of experience and 350 million kVA of installed power-protection equipment, MGE UPS SYSTEMS solutions have convinced the largest companies in the industrial, commercial and service sectors.

- **Higher MTBF means higher fault tolerance**
The power-system architecture takes into account equipment maintenance requirements and the faults that may occur at all levels in the installation.

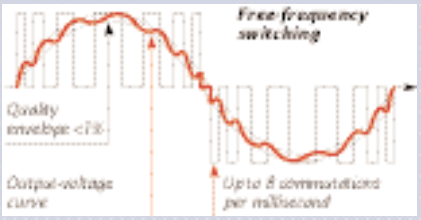


- **Taking into account the full consequences of harmonics**
Harmonics affect the availability of equipment, make it necessary to oversize sources (UPS, engine generator set), capacitors, cables, etc. The financial consequences can be substantial.



Distortion in the voltage signal causes temperature rise in motors, electrical noise, accelerated ageing of equipment and malfunctions of sensitive electrical devices.
Flow of current in the neutral causes temperature rise in transformers and nuisance tripping of circuit breakers.

- **Generate a perfect signal**
The double-conversion and free-frequency technologies built into MGE UPS SYSTEMS solutions ensure the highest quality of voltage, whatever the level of harmonic disturbances in the installation.



- **Eliminate disturbances on the electrical system**
By continuously regenerating the electrical signal, a double-conversion UPS acts as a filter and blocks propagation of harmonic disturbances. pollutions harmoniques.

UPS THDI up to 3 %

THDI of computer loads from 70 % to 100 %

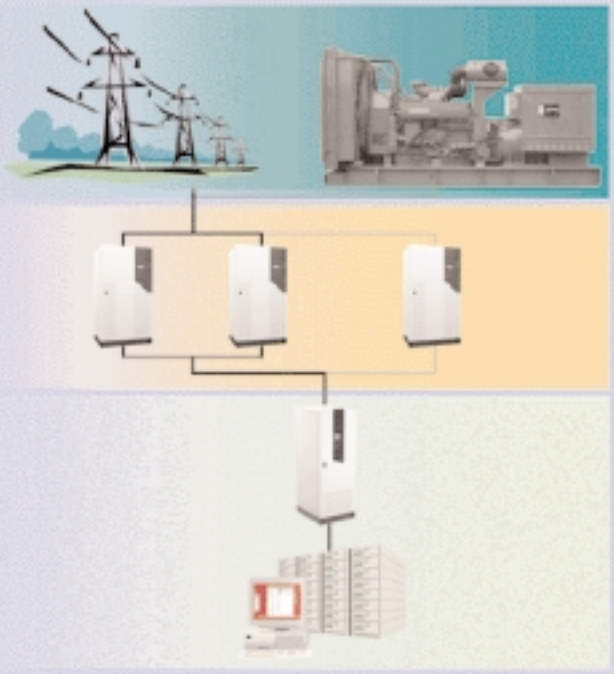
- **Eliminate the harmonics caused by equipment**
An active harmonic conditioner produces the harmonic currents drawn at a given point in the installation, thus avoiding harmonic pollution upstream.

Elimination of harmonic currents

1. *Equipment drawing harmonic currents.*
2. *Current sensors analyse the harmonics required by the loads.*
3. *The conditioner provides the harmonic currents required by the loads.*
4. *The upstream signal is no longer disturbed, the apparent power is reduced.*

Redundancy

Redundancy means connecting a number of devices for a given function in parallel. This ensures a secure supply of power to the loads even if one or more elements fail or require maintenance.



THE RIGHT INST

Key factors for quality power

Reliability, availability
Selection of an architecture means selecting the level of criticality and fault tolerance required by the loads.

Maintainability
Facilitating maintenance means reducing the MTTR and thus improving availability. The architecture must ensure fast and easy maintenance of the equipment, without risk to life and property.

Upgradeability
An installation must be upgradeable at any time, i.e. the architecture must provide the means to increase redundancy, backup time and power without impinging on the daily operation of the power system.

Discrimination and non-propagation of faults
Elimination of fault propagation is essential to ensure the high-availability criteria of the installation. The solution generally consists in segmenting the load to isolate faults.

Operation and management
Measurements, data and planning are indispensable in running a site. These daily operations are made easy by the high-performance and ergonomic human-machine interfaces (HMI) and the supervision systems.

Select the right architecture

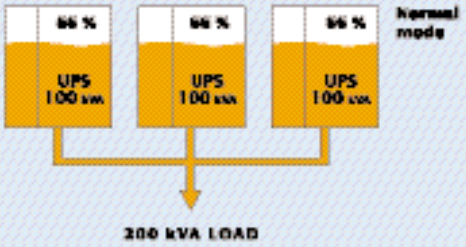
The load can be supplied by one or more sources, including UPSs, engine generator sets, transformers, etc.

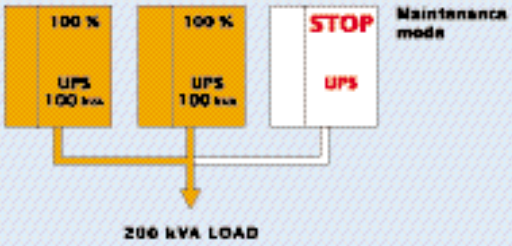
On the following pages, discover the different single or multi-source architectures proposed by the experts at MGE UPS SYSTEMS, as well as the product ranges, software, peripheral equipment and services required to implement "your" solution.

N+1 redundancy means the system can accept the failure of one device.

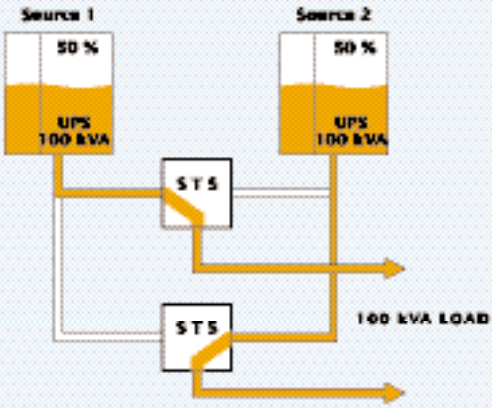
Three levels of redundancy

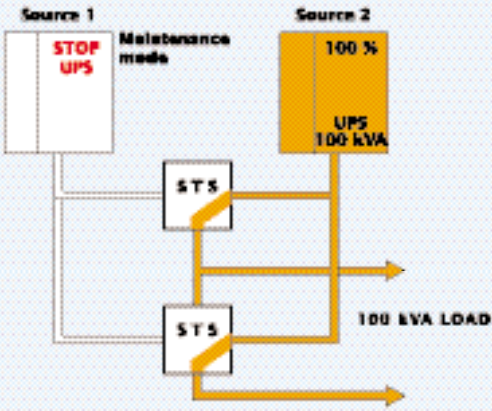
1. ***Source redundancy:*** *availability even during long utility outages.*
2. ***UPS redundancy:*** *reliability, easier and more secure maintenance.*
3. ***Distribution redundancy with STS:*** *optimum availability.*





N+1 redundancy for the UPSs





N+1 redundancy for the distribution

ALLATION

Selection criteria

Two basic systems

Single source

- The entire load is supplied by a single UPS or set of UPSs.

Multiple source

- The load is supplied by more than one UPS or set of UPSs.
- Distribution without a single point of failure.

Single-UPS unit with static bypass

This is the basic system for high-availability installations. Double-conversion UPSs supply high-quality power whatever the level of disturbances.

Availability

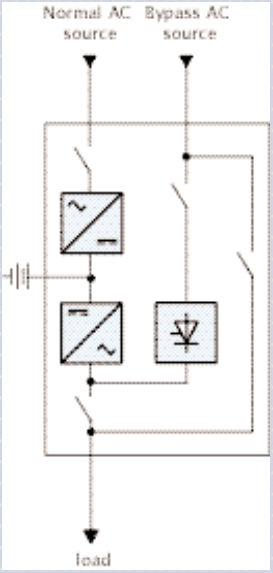
99.99790% and an MTBF of 475 000 hours for a distribution-system MTBF of 96 hours and an MTTR of 10 hours.

UPS maintenance

The manual bypass ensures the supply of power to the load (without backup) even during maintenance.

Possible extensions

Up to four UPS units for Galaxy PW, Modular Galaxy and Galaxy 3000 and six units for Galaxy.0



Availability	Maintainability	Upgradeability
X - - -	X - - -	X - - -

N+1 modular redundancy

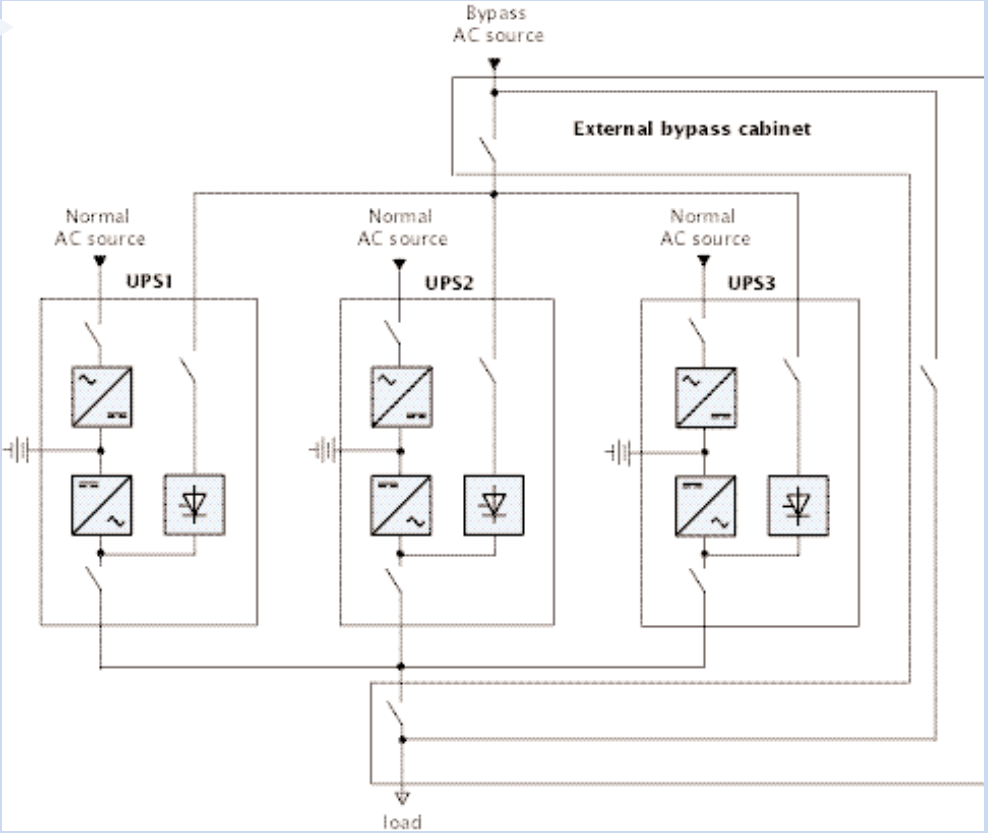
Expandable solution up to 600 kVA in which the UPS units share the load.

- **Availability**
  99.99947% and an MTBF up to 4 times higher than for a single UPS unit.

- **Maintenance of UPS units**
  Maintenance on a unit does not affect the load which remains protected during servicing.

- **Possible extensions**
  Up to four identical UPS units (Galaxy PW, Modular Galaxy or Galaxy 3000) for a small cost and small dimensions.

Availability	Maintainability	Upgradeability
XX - -	XX - -	XX - -



THE RIGHT INSTALLATION

"Single-sour

N+1 modular active redundancy with centralised SSC (Static-Switch Cubicle)

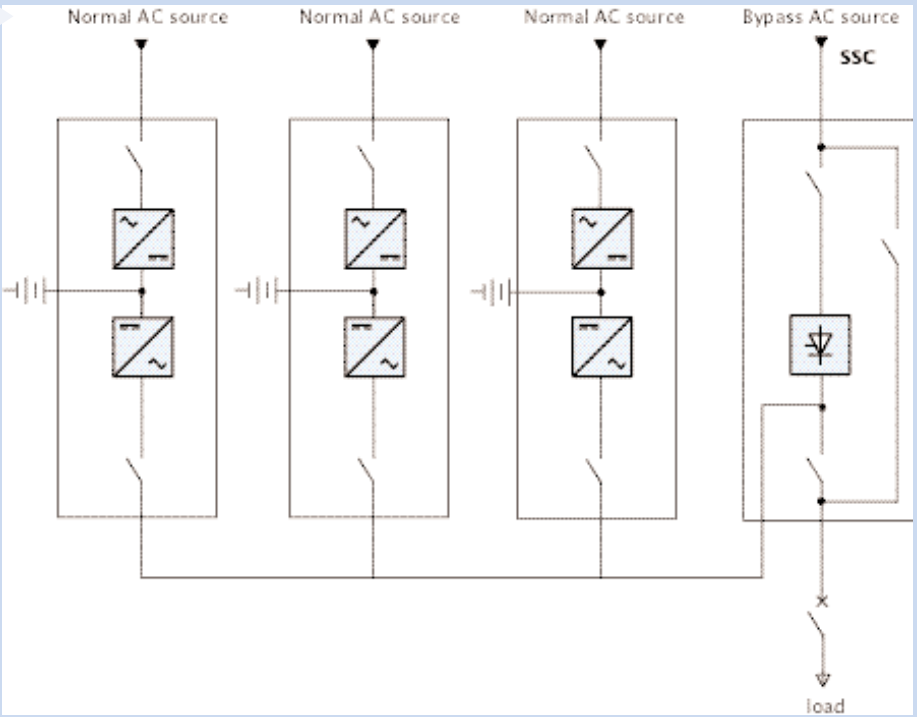
The solution for centralised installations up to 4 MVA. Excellent reliability due to the independent modular units and the autonomous bypass management.

- **Availability**
  99.99968% and an MTBF up to 6.5 times higher than for a single UPS unit.

- **Maintenance of UPS units**
  Maintenance on a UPS unit does not affect the load which remains protected during servicing.
  SSC maintenance does not affect redundancy of the UPS units.

- **Possible extensions**
  Up to six UPS units (Galaxy).

Availability	Maintainability	Upgradeability
XXX -	XX - -	XX - -



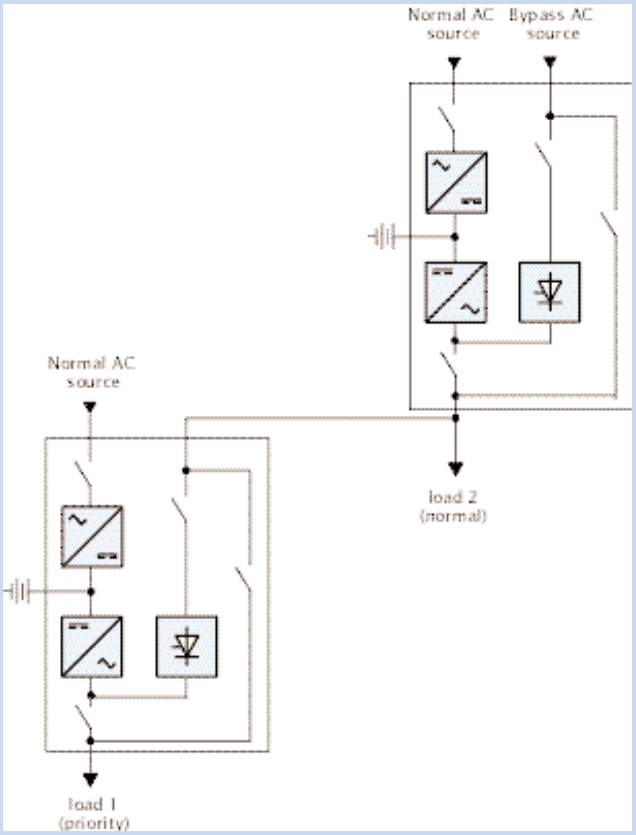
Isolated redundancy

This is an extremely flexible solution used to combine different types of remote UPS units. It also offers greater backup time and is perfectly suited to UPSs from MGE UPS SYSTEMS which can handle large load step changes.

- **Availability**
  99.99970% and an MTBF 6.8 times higher than for a single UPS unit.

- **Maintenance of UPS units**
  Maintenance on a unit does not affect the load which remains protected during servicing.

Availability	Maintainability	Upgradeability
XXX -	XX - -	XX - -



ce" architectures

N+1 modular active redundancy with dual active SSCs

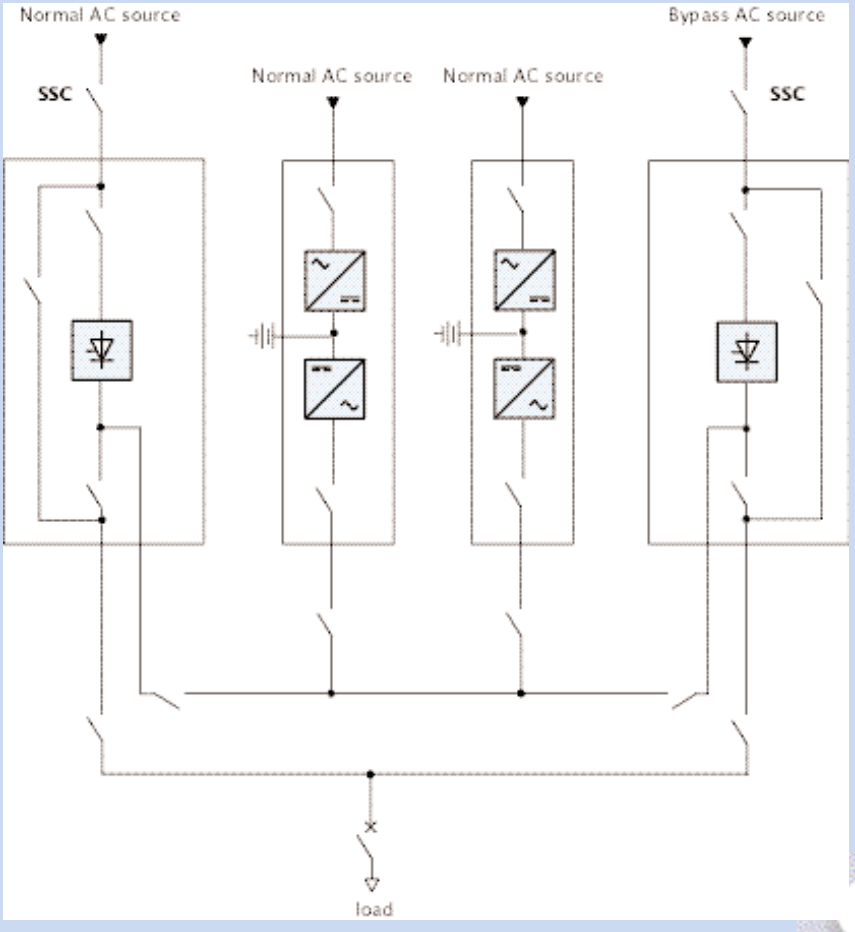
The dual SSCs offer total redundancy for even better maintainability.

- **Availability**
  99.99968% and an MTBF up to 6.5 times higher than for a single UPS unit.

- **Maintenance of UPS units**
  Maintenance on a UPS unit or on one of the centralised static-switch cubicles does not affect the load which remains protected during servicing.

- **Possible extensions**
  Up to six UPS units (Galaxy).

Availability	Maintainability	Upgradeability
XXX -	XXX -	XX - -

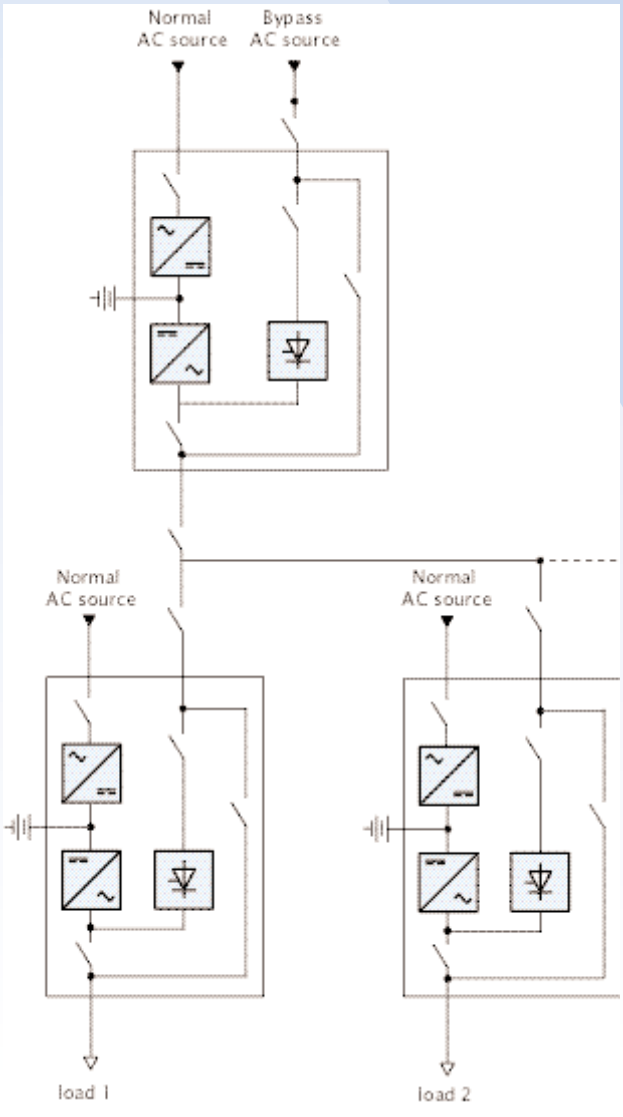


"Multiple-source"

N+1 isolated redundancy

The architecture for different types of UPS units installed at different locations.

- **Availability**
  99.99970% and an MTBF 7 times higher than for a single UPS unit.
- **Maintenance of UPS units**
  Maintenance on a UPS unit does not affect the load which remains protected during servicing.
- **Possible extensions**
  No limitation to the power rating.
- **Short-circuit propagation**
  Impossible between the sources.



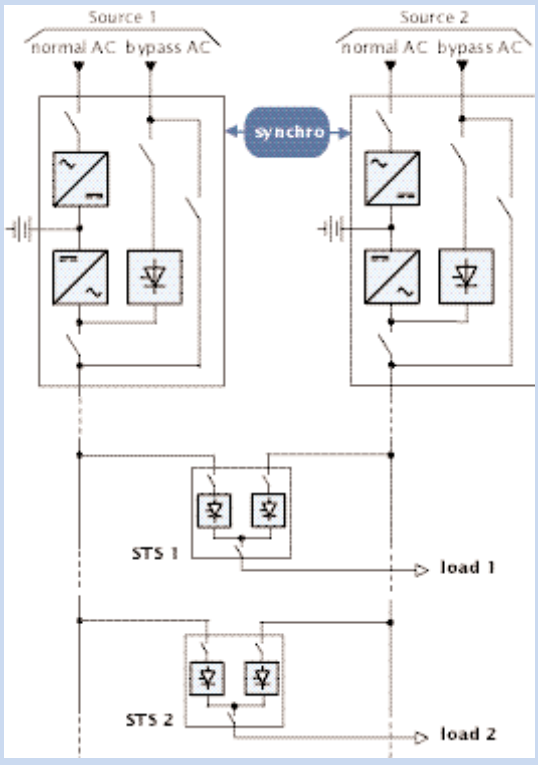
Availability	Maintainability	Upgradeability	Propagation	Operation
XXXX	XX - -	XXX -	XX - -	X - - -

Redundant distribution with Upsilon STS

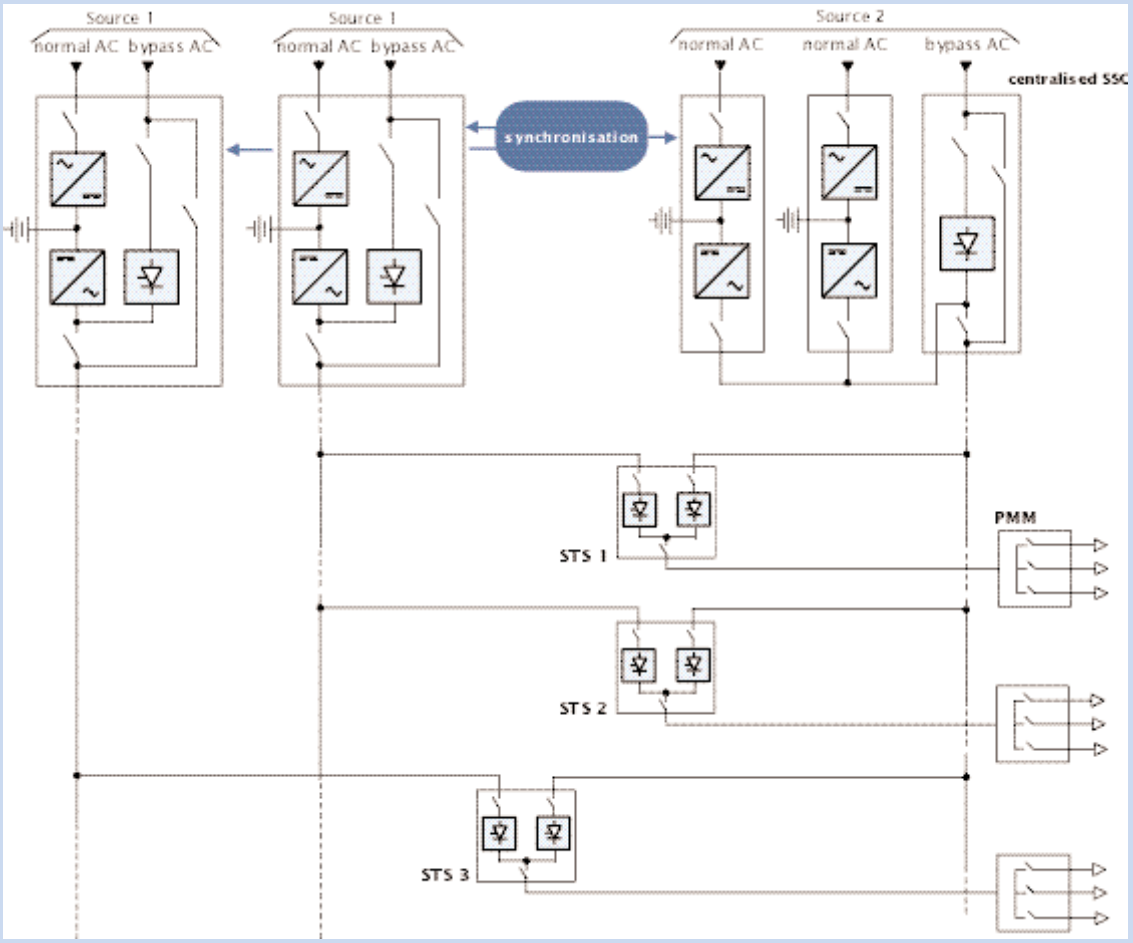
This is the best solution in terms of availability, site operation and safety. It is also the only solution that covers power distribution through to the loads. Upgrade possibilities are particularly numerous and adaptation of the redundancy level to the needs of the loads is simple.

- **Availability**
  99.9999%, the highest level of availability.
- **Maintenance of UPS units**
  The redundant distribution system ensures maximum maintenance safety because there is total redundancy and servicing is carried out under de-energised conditions.
- **Possible extensions**
  Single UPS units may be added with no limitation to the power rating. Installation is greatly facilitated by the capacity to establish partial isolation between the distribution subassemblies.
- **Short-circuit propagation**
  Load segmentation and the technology employed in the Upsilon STS ensure that a faulty load cannot affect the other loads.

Availability	Maintainability	Upgradeability	Propagation	Operation
XXXX	XXXX	XXXX	XXXX	XXXX



architectures

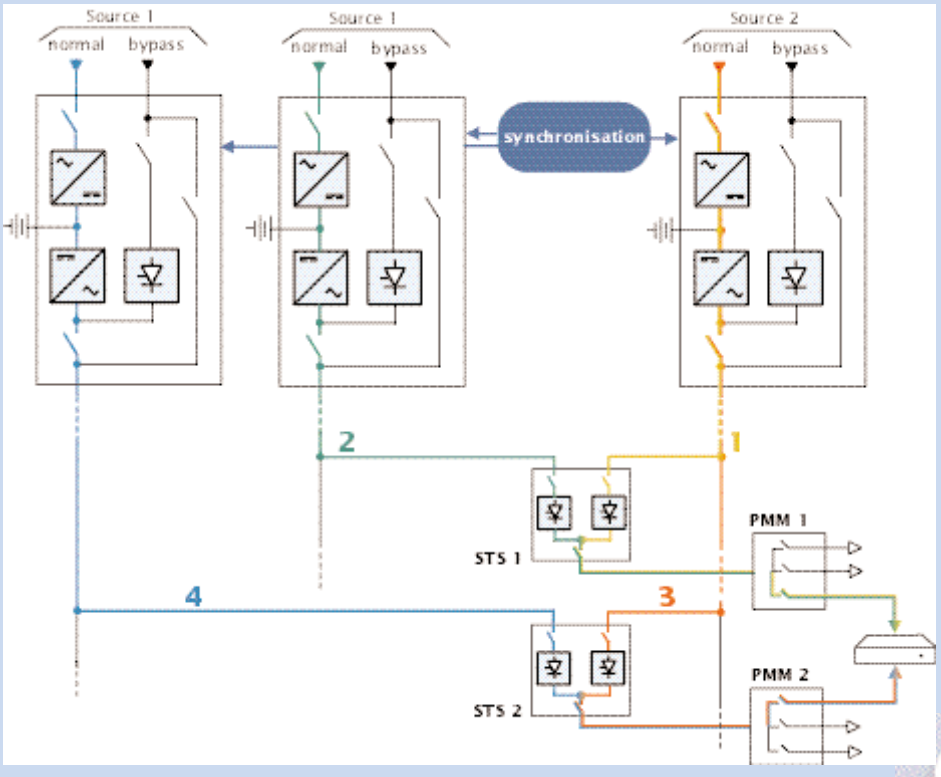


Example of a very high-availability configuration

- Redundancy is built into every level, from the PDUs and the Upsilon STS units on up to the Galaxy UPSs and synchronisation modules.
- A precise point in the installation can be made more reliable.
- There are four different supply channels for a dual-attach server.
  (-> right plan: 1, 2, 3 et 4)

Example of an easy-to-operate configuration

- The loads are segmented to avoid fault propagation.
- Optimum sharing of power by the UPSs.
- Different types of UPSs at different locations can be used.



UPSs

Galaxy 3000

Protection for company networks with 10 to 50 servers.

The first "Clean Power" UPS

- No harmonic pollution upstream.
- Cost savings on equipment (engine generator set, circuit breakers, cables, etc.).
- Output voltage suited to the needs of the most sensitive loads (THDU < 2%).

Three-phase double-conversion UPS.
Four power ratings from 10 to 30 kVA.
Expandable to four parallel-connected units.

Galaxy PW ET 1000 PW

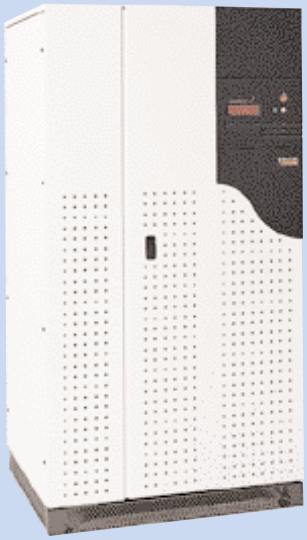
Protection for medium-power applications, computer rooms, internet and telecoms, industrial and commercial processes.

Designed to meet the most demanding requirements

- Harmonic-filtering solutions for all user needs.
- Reduced footprint.
- Exceptionally low voltage distortion (THDU < 2%).
- Designed to meet all supervision and communication needs.

Two heights available.

Galaxy PW from 20 to 200 kVA.
Three-phase double-conversion UPS.
Expandable to four parallel-connected units.



Galaxy 1000 PW from 20 to 80 kVA.
3ph-1ph double-conversion UPS.
Expandable to four parallel-connected units.

Galaxy

Modular protection up to 4.8 MVA. Large sites, data centres, industrial and commercial processes.

The high-performance solution for centralised-protection systems

- High efficiency even at low percent loads.
- Suitable for computer loads.
- Exceptional reliability with a complete range of centralised static switch cubicles from 500 kVA to 4 MVA.

Three-phase double-conversion UPS.
Eight power ratings from 160 to 800 kVA.Expandable to six parallel-connected units.

Synchronisation module

The indispensable component to Upsilon STS.

- Synchronises two independent sources of which at least one must be a UPS.
- Automatic operation.
- Adjustable synchronisation range.
- Operating display on the UPS.
- For Galaxy and Galaxy PW.

Static Transfer Switches and electrical distribution

Upsilon STS

Provides, secures and optimises power redundancy for data centres and sensitive processes.

The heart of high-availability architectures

- No-break transfer (typically 3 ms).
- Blocks all fault propagation.
- Upstream switches automatically open following fault detection, no single point of failure, continuous monitoring of the SCRs.
- Wide selection of communication options for a perfect fit in the environment and notably the supervision system.
- Easy integration, small footprint.

Static transfer switches from 30 to 600 A.
Three or four-pole distribution system.
Accepts all system earthing arrangements.

Power Management Module (PMM)

Secure distribution for data centres.

- Alarms before overloads occur on each outgoing single-phase circuit.
- Elimination of manual current measurements.
- Easy access to information.
- Optimised power density on the circuits.

Distribution and protection of single-phase electronic equipment.
Rated supply 250 A three-phase.
Two versions for 60 outgoing circuits (16 A) with earth-leakage protection or 126 outgoing circuits (16 A) with thermal-magnetic protection.
Optional built-in transformer.

Controlling harmonics

SineWave active harmonic conditioner

The solution to eliminate harmonics in installations.

- Wide power range from 20 to 120 A (three-phase).
- Elimination of up to 480 A of harmonic current at any given point in the installation.
- Compatible with all system earthing arrangements.
- Elimination of harmonic pollution caused by loads.
- Active compensation of harmonics up to order 25.
- Instantaneous adaptation to the load spectrum.
- Installation wherever needed.

Communication accessories and supervision software

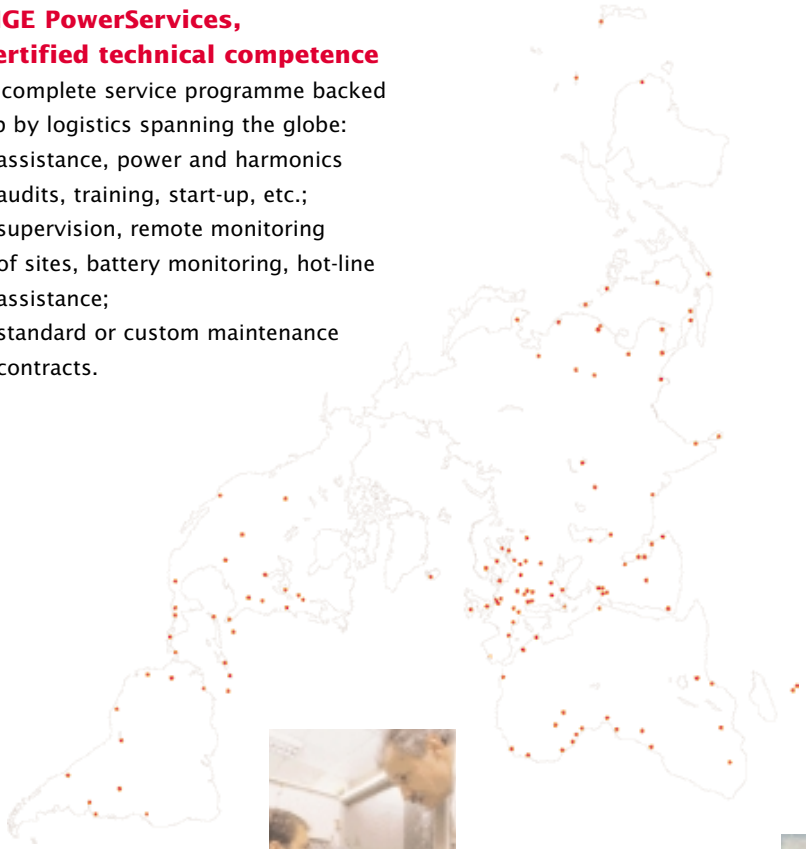
- Solutions offering complete communication with the electrical and computing environments, including MultiSlot, Monitor-Pac, Web-Pac supervision software, etc.
- Communication cards compatible with market standards, including SNMP, RS232 or RS485, USB, XML Web (HTTP), relays (250 V 2 A), etc.

MGE UPS SYSTEMS, for continuity of service

MGE PowerServices, certified technical competence

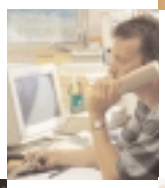
A complete service programme backed up by logistics spanning the globe:

- assistance, power and harmonics audits, training, start-up, etc.;
- supervision, remote monitoring of sites, battery monitoring, hot-line assistance;
- standard or custom maintenance contracts.



Teams on hand around the world for a fast response

- Over 900 MGE UPS SYSTEMS experts based around the world.
- 170 service centres in over 100 countries.
- International personnel on hand 24/365 as well as local technicians and monitoring.
- Emergency spare parts stored on customer sites.
- Management of customer operations.
- Resident personnel on customer sites.



Building the future

40 years of experience in UPS maintenance 350 million kVA of installed power-protection equipment.

Qualified instructors (level 4, AFNOR NFX 60 010) in four certified training centres located in Europe (Grenoble), the United States (Costa Mesa), Asia (Singapore) and Africa (Johannesburg).

Special engineering and consulting competencies include drafting of installation technical specifications, analysis of electrical conformity and customer specifications, installation upgrading to applicable standards and regulations, preventive action plans and guidance for site modifications and extensions.

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