WHITE PAPER

DATA CENTER UPS

THE ESSENTIAL CHARACTERISTICS OF AN OPTIMISED SOLUTION

THE GLOBAL SPECIALIST IN ELECTRICAL AND DIGITAL BUILDING INFRASTRUCTURES

legrand®

Data center technologies and applications evolve quickly and continuously, at the same time as business continuity becomes ever more critical.

This White Paper examines and explains the role that a modern UPS has in meeting the demands of today's digital data centers.

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INTRODUCTION

Compared to a few decades ago, Digital Services are now an indispensable part of daily life in our modern society. Public Administration, Health, Finance, Telecommunications, Commerce, Industry, Entertainment and many other sectors are heavily dependent on and empowered by digital services, devices and infrastructures.

Data Centers are the hidden core behind our daily "digital life" - allowing us to use and receive digital services. Data Center down time means digital services down time, the consequence of which is a major interruption to our daily activities, problems for both individuals and organisations, huge financial losses and, potentially, compromised safety scenarios.

For this reason, in modern Data Centers, dedicated infrastructure is implemented in order to guarantee the continuity of the operation and to provide highly resilient systems. A UPS is one of the essential components in such a critical infrastructure.

All the characteristics and functions required of a modern Data Center UPS can be grouped under three main features:

- Business Continuity
- Limited Total Cost of Ownership (TCO)
- Adaptability

Business continuity is focused on the reliability of the UPS in terms of high quality materials and design. It can be also be achieved with advanced monitoring and diagnostics, and a suitable maintenance plan. In addition, the required level of business continuity can be achieved with redundant configurations and decentralized architectures.

Limited total cost of ownership that can be achieved with a compact footprint, easy servicing and high efficiency to help reduce energy consumption.

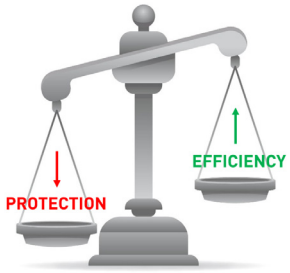
Adaptability is made possible through scalability, modularity, and with flexibility in the installation of the whole system. Adaptability is also related to electrical and broader energy performance, which make the UPS able to operate in optimized conditions - also with load variations or different electrical systems.

CONTINUITY

Investing in a UPS system makes sense whenever the UPS TCO is lower than the overall costs associated with a business interruption. Continuity is paramount in Data Centers, since even the shortest operational breakdown will mean huge losses in terms of unprocessed or "lost" data and permanent damage to hardware. Minor mains disturbances, such as voltage drops and surges, micro-interruptions and flickers, can all cause severe damage to data and servers, not to mention breakdown disruption for infrastructure failures and repairs.

How UPS improves continuity:

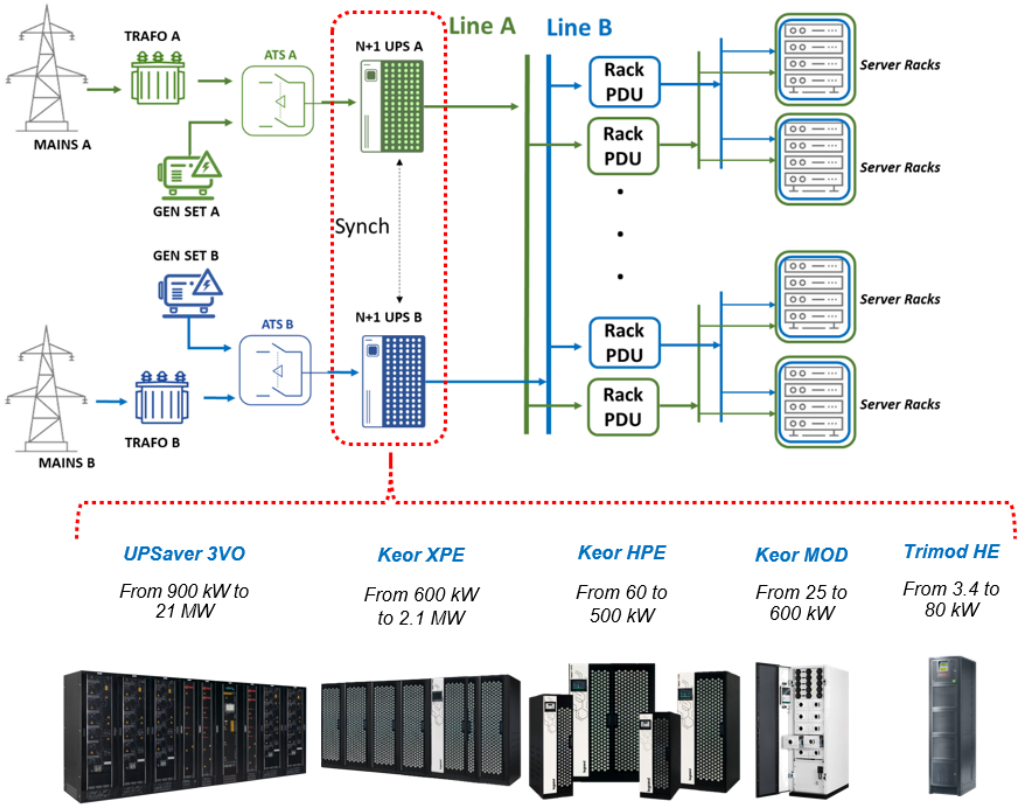
Installing a UPS system in a power supply line greatly assists with business continuity by filtering mains disturbances and outages; it also provides clean power to critical loads such as servers or other critical equipment. Depending on the type of operation, protection can be modulated from total (VFI - online double conversion mode) to moderate (VI - line interactive mode) to light (ECO mode). The choice of which operational mode to use is strictly related to the efficiency of the system and the related energy consumption.



As a general rule, the greater the protection the lesser the efficiency. While VFI total protection is by far the most preferable solution, especially in colocation facilities, lower VI or ECO protection is sometimes acceptable in end on-premise DC's, this trade off providing slightly higher efficiency. In any case, the balance between protection and energy savings needs to be evaluated for any specific situation. For example, ECO mode could be used to reduce unused energy consumption during maintenance periods; and VFI mode could be used when the Servers and other active loads are in full operation.

AVAILABILITY

For the last decade, the concept of design for availability has been enhancing pure MTBF-based reliability analysis, which can be used to define the quality of a single system or piece of equipment. Availability assessment is now preferably carried out at site level, by checking the impact of random failures on the infrastructure's ability to keep supplying the IT loads. This is also referred to as "outcome based" availability. Following this trend, in modern Data Centers a single power feed, even if including multiple UPS units, is no longer considered reliable enough to provide the desired power quality, so multiple layers of redundancy are usually deployed.



Datacenter with line A and B (level of redundancy 1) and N+1 (level of redundancy 2) both with modular and conventional UPS

Availability (continued)

In this scenario "low MTTR (Mean Time To Repair)", "N+1 redundancy" and "hot-swap" have proved to be critical features for any device installed upstream of a critical IT load and contribute to the success of modular UPSs in Data Centers.

TYPE OF DATA CENTERS

Hyperscale Data Center

Very large facility own & operated by the company IT supports

- «Super 8» global players
- Specialist brands & international specs by end-user and SI
- Coordination and global specification required
- Go-to-market: direct, IT-distributor acting as global partner

Colocation (Co-Lo) Data Center

Large facility leasing Data Center space for large and small enterprises

- Wholesale: a cage, hall or suite is leased to large businesses
- Retail: from ½ rack to 100 cabinet are leased to SME
- *Colocator* & Consultant decides for any grey area equipment
- Retail: *Colocator* and –possibly- end-user decide
- Wholesale: end-user decides on white room, *Colocator* influences
- Go-to-market: direct to *Colocator* or via distribution

On Premise Data Center

DC own & operated by public & private organisations

- In house IT teams run white space
- Key Account approach for large Data Centre (IT, Government)
- Large DC: specialist brands preferred, End-user & SI decide
- Small DC: turn-key solution preferred, Consultant & SI are key
- Go-to-market: direct or via local distribution

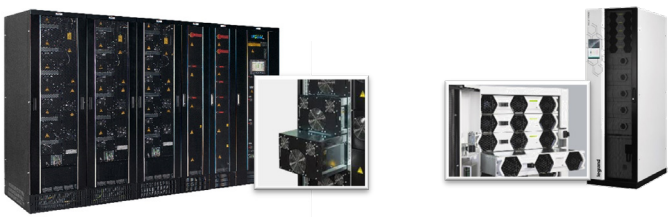
Micro Data Center

Containerized Plug & Play small DC

- Sizes from single rack to container
- For fast deployment in remote locations
- Emerging **edge** market to be assessed
- End-user decides, influenced by SI
- Go-to-market: direct & distribution

MEAN TIME TO REPAIR

MTTR is the average time to recover UPS operation after a failure. In modular UPSs, MTTR is usually as low as 30 minutes since the typical failure fix consists of replacing the whole power module. To have such a low MTTR, power modules should be plug-in, which means no cabling is needed to connect them to the UPS unit. In conventional UPSs, MTTR depends on the power and the size of the system and it is typically from 1 to 4 hours (as the average repair includes longer dismantling procedures for the failed part(s)). Of course, the same MTTR figures can be applied to routine maintenance. Although MTTR is not critical whenever redundancy is deployed, low MTTR is still a nice-to-have feature in Data Centers.

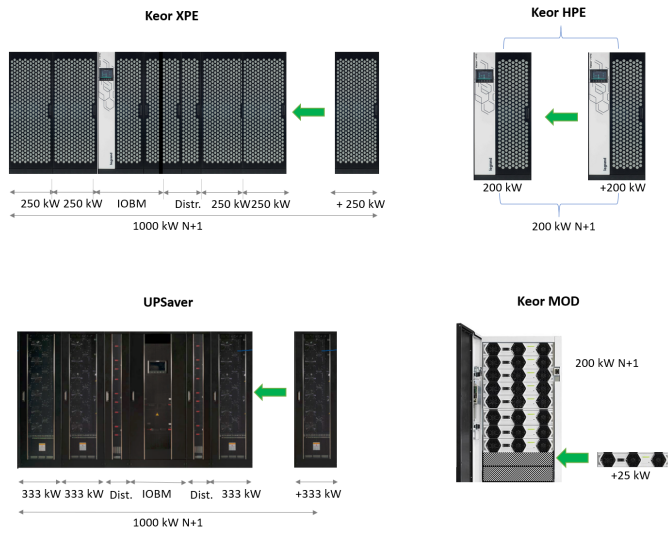


Easy maintenance allows lower MTTR

N+1 REDUNDANCY

"N+1" redundancy implies that there is some spare power available in the UPS system, so that loads can be supplied in VFI double conversion mode after a first failure or during maintenance activities.

It must be noted that if no N+1 redundancy is provided, maintenance can still be performed without load shutdown, by switching the UPS unit under electronic bypass. However, even in dual fed redundant electrical systems, this scenario is not the preferred one. To provide N+1 redundancy in modular UPSs, an additional power module is installed over and above the required UPS rating. So, if a 1000 kW N+1 UPS is needed and the power module's size is 333 kW, the installed UPS size will be 1333 kW. On the other hand, N+1 redundancy in a conventional UPS is achieved by installing an additional UPS unit on top of the required size. So a 1000 kW N+1 system can be composed by of 6 no. 200 kW UPS units in parallel, or 5 no. 250 UPS units, or even 3 no. 500 kW UPS units.



Examples of N+1 redundancy configuration

HOT SWAP

"Hot-swap" allows maintenance and power resizing, or the adding or removing of some UPS power, without switching the whole UPS unit to bypass. This feature must be combined with N+1 sizing to result in a true hot-swappable system.
It should be noted that hot-swappable systems are, by definition, hot- maintainable, whereas the opposite is not always the case. Modular UPS are hot-swappable if a power module (for some UPS also a battery module) can be completely removed or added while the rest of the unit is running and no further software reconfiguration is needed.

In a conventional UPS, hot swappability is usually limited to replacing an inoperative UPS unit, as power resizing would require software reconfiguration of the parallel system, therefore they are to be considered hot-maintainable and not truly hot-swappable.

LEGRAND UPS AND BUSINESS CONTINUITY

Model	Modular	Conventional	VFI	ECO	MTTR	N+1	Hot Scalability	Hot Maintenance
Keor HPE		✓	✓	✓	1-4 h	✓	✗	✓
Keor MOD	✓		✓	✓	0.5 h	✓	✓	✓
Keor XPE	*scalable		✓	✓	3-6 h	✓	option	✓
UPSaver	✓		✓	✓	0.5 h	✓	✓	✓

UPS ARCHITECTURES

Conventional UPS Stand-Alone and in Parallel

Legrand UPS and business continuity (continued)

In the early years of the modern Data Center, UPSs were a unique stand-alone system - generally one cabinet containing all the needed electronics , sized to the nominal power , called Conventional UPS or, sometimes, Monolithic UPS. The availability of the protected load was strictly related to the UPS itself, since a failure of the UPS often corresponded to the breakdown of the load.

One of the solutions for this limit was the introduction of the parallel function: two or more conventional UPS connected in parallel in order to have redundancy (in case one of the UPS fails the other continues to run and protect the load). Keor HPE is the family of conventional UPS from Legrand, offering from 60 to 500 kW, cutting edge technology, high Efficiency and up to 6 units in parallel, for N+X redundancy.

Modular UPSs

In recent years the need for continuity of power supply and ease of maintenance and management has led to the emergence of UPS with modular architecture. Modular UPS are made up of several transformer-less Online Double Conversion UPS (modules) working in parallel within a single system. The total power of the UPS is the sum of the power of the individual modules. In modular systems it is easy to achieve redundancy or increase the power by simply adding one or more modules, without having to connect several UPS in parallel. Furthermore, in modular UPSs, any faults in the power circuits remain confined within the individual module, which is automatically excluded. The lower the power of the individual modules (granularity), the less power is lost in the event of a fault and the easier it is to replace a faulty module. Typically, the granularity brings major benefits and flexibility with Power Modules of 25 kW or less. Legrand offers the Keor MOD UPS as the state of the art Modular Granular System, fully redundant with super compact power modules of 25 kW each, for maximum power of 600 kW.

Salable Systems

At high power levels (from 500 kW up to several MegaWatts), the redundancy and granularity can be obtained connecting in parallel Modular UPS or using a Modular System with large size Power Units in parallel - these systems are also called Scalable. In Scalable systems the Power Units are Conventional UPSs in parallel and connected to a dedicated distribution and control units which manage them as Power Modules, allowing redundancy, hot service and hot scalability.
Keor XPE System is the Legrand solution for Scalable UPS, with Power Units of 250 and 300 kW capable of reaching up to 2.1 MW Power, with the options of redundancy, hot serviceability and hot scalability.

Scalable / Modular Construction

A further option for high power and serviceability is to use Scalable UPS with Power Units designed with internal modular construction.
This type of system combines the high power Flexibility of Scalable UPS with the resilience and serviceability of the Modular granular UPS. Connecting in parallel more of these Scalable Modular System provides the option to achieve a power level of more than 20 MW. Borri UPS (A Legrand Group brand) offers the UPSaver 3vo, a top level Scalable Modular UPS System. UPSaver with Power Units of 333 kW (based on 6 sub functional modules), can reach up to 2.67 MW with a single system and up to 21 MW in parallel system, with maximum availability at high power level.

Synchronized UPS Systems

In modern Data Centers, with highly redundant architecture, it is typical to have dual power line distribution and to provide two independent power sources for the active IT load with redundant power supply.
In this case, each line is protected by one UPS system, often in N+1 redundancy, but, whenever the two lines are separated and independent it could be needed to keep them synchronized. In particular it is important to have a perfect commutation from one line to the other line in case of STS (Static Transfer Switch) systems. (For instance for loads with single power supply stage or in configurations where various UPS lines are distributed through STS to various dual lines part of the Data Center.)
Thanks to cutting edge logic controls, Legrand (and Borri) UPS for Data Centers are capable of running in Synchro for dual power line distributions.

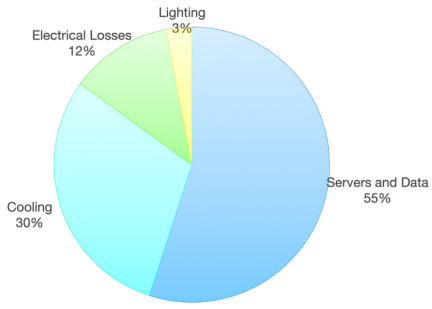
TOTAL COST OF OWNERSHIP

Reducing Total Cost of Ownership (TCO) for all IT critical applications such as the Data Center, is one of the most important objectives for buyers and owners. Today, the Data Center represents a fundamental structure for a company on which the entire organization depends. For this reason, it is important to ensure its correct functioning and efficiency, whilst also ensuring maximum reliability and availability.

DEFINITON:

TCO is the sum of the initial capital expenditure (CAPEX), which includes the cost of equipment and installation expenses, and the ongoing and long-term operational expenditure (OpEx). In addition, predicting and measuring TCO for the physical infrastructure is required for return-on-investment (ROI) analysis and other business decision processes. TCO is a critical metric when designing a new Data Center facility or selecting equipment. Yet, with the explosion of Data Center expansion, identifying and weighing the value of TCO variables when specifying, building and operating a Data Center is far from easy. A simple miscalculation can cost companies millions of dollars every year.

We know that energy is certainly one of those critical TCO variables, as Data Centers are significant consumers of energy. Servers and data equipment account for 55 percent of the energy used by a Data Center, followed by 30 percent for the cooling equipment to keep the facility operational. Electrical power distribution losses, including uninterruptible power supply (UPS) losses, represent a significant 12 percent of energy consumption and the last 3 percent is consumed by lighting.

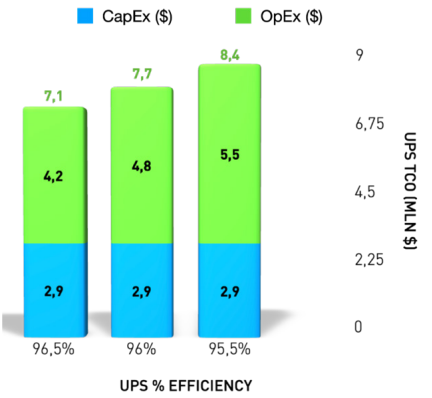


Different component of the energy used

In each of these areas, energy efficiency gains have a significant impact on TCO and annual operating expenses, especially on high power, long life assets. For example, let's look at just a 1 percent efficiency improvement for a UPS deployment for a 10 megawatt (MW) Data Center. As shown in the chart below, while CapEx is fixed, the OpEx costs of a UPS over 10 years shows an operational saving of $1.3 million with an energy efficiency improvement of just one percent - from 95.5 to 96.5 percent.

As we can see in the picture above, lifetime costs can quickly exceed initial investments. When budgeting for a new UPS, it's crucial to account for the ongoing Operating Expenses (OPEX) which usually represent between 60-75 % of the TCO.

Capital Expenses (CAPEX) instead are easily identifiable and comprise the initial purchase price of the UPS, as well as the costs of installing the UPS, where it will be housed (its physical footprint) and cooling requirements. The initial purchase and installation costs account for between 25-40 % of the TCO.



Correlation between TCO and efficiency

Thanks to the long history of building and supplying Data Center solutions, Legrand pays attention to all life cycle costs generated by the UPS, allowing economic savings over time and a TCO reduction.

The latest generation of Legrand UPS systems have a major impact on Operating expenses, such as:

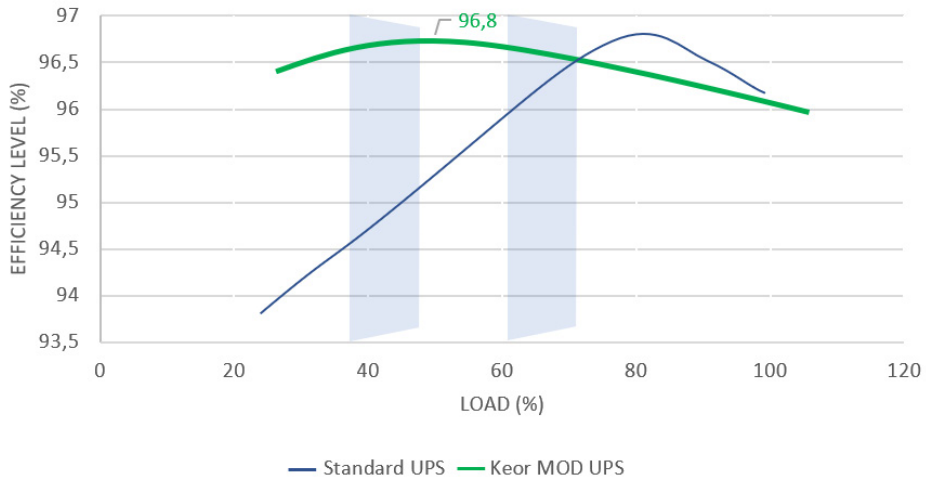
- Energy efficiency
- Maintenance and servicing
- Battery management
- Component lifetime
- Serviceability

ENERGY EFFICIENCY

Increasing energy efficiency is the most important objective for an effective reduction of Operating Expenses for all IT critical applications such as Data Centers - characterized by early years of life with lower and variable load levels, usually less than 50 %.

The Legrand UPS solutions respond to the need for different availability and the evolution of the IT infrastructure, thank s to the careful study and use of the latest generation components, which allow the achievement of high efficiency values from lower power levels.

Indeed, starting from a load from 20 % to 50 %, the efficiency curve reaches its maximum range, up to 96.6 % efficiency. Legrand UPS solutions ensure high energy savings starting from low load percentages, typical for this sector, which results in reduced carbon dioxide emissions, and an operating costs saving - allowing for a faster return on investment.



OPTIMIZED EFFICIENCY CURVE

- Maximum values between 25 % and 50 %
- Normally, in IT applications, load is less than 50 %

Legrand UPS' energy savings at low load percentages

In the market today, it is possible to find many solutions which can increase efficiency to more than 97 %. It is important in TCO evaluation, to check in which operating mode a UPS can achieve these high efficiency levels. As indicated before in the "Continuity" chapter of this document, it is important to also check the protection level and to evaluate when it is acceptable to reduce the protection in order to have higher efficiency or when it is preferred to have less efficiency but higher protection. It is likely that avoiding the cost of down time can justify a little increase in the TCO.

MAINTENANCE AND SERVICING

Maintenance service combines the benefits of preventive maintenance and emergency work in a service entirely tailored to customer needs, considering individual operational constraints, business activity and the unique level of criticality associated with specific applications, minimizing business interruption and the costs of downtime, as well as extending the lifespan of critical power equipment.
Legrand's UPSs are built around the latest developments in power management and proven technologies, in order to make them reliable and resilient and to keep maintenance and servicing costs low.

ADVANCED BATTERY MANAGEMENT

Batteries are the most critical component in the reliability of any UPS. Extending battery life can provide significant savings, while neglect can be costly.

To ensure power supply continuity in the event of a power failure, the batteries must be charged and in good condition. Therefore, a part of the energy absorbed by the UPS must be directed to charging the batteries. This is an additional consumption that cannot be avoided.

Legrand Smart charge battery technology is a unique three-stage charging technique that significantly extends battery service life and optimizes recharge time, compared to traditional trickle charging.
This system is based on the direct measurement of the operating parameters (Voltage and current) of the batteries and their variations in order to monitor the status of the battery in real time. The recharge follows a cycle consisting of several stages, whose duration and intensity depends on the state of the batteries.

This advanced battery charge system has the benefit of having a fast charging time and the batteries are always charged and constantly monitored.

At the same time this system does not stress the batteries, because when they reach their full charge, the charging intensity decreases until it reaches zero.

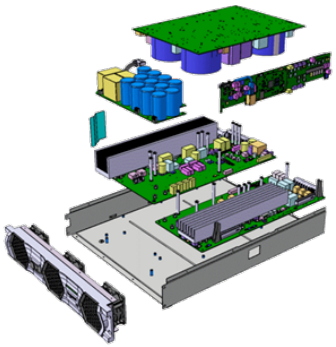
In other words, the smart battery charge system optimizes energy adsorption by limiting it to the amount actually required by the real charging status of the batteries. Moreover, it has the additional effect of extending the batteries' performance and life.

Intelligent Battery Charge System (Smart Battery Charger)
The Smart Charger three-stage intelligent charging system considerably extends batteries' life by as much as 50 %, thereby halving the number of times they need to be replaced and the environmental pollution associated with their disposal.

TOTAL COST OF OWNERSHIP

COMPONENT LIFESTYLE

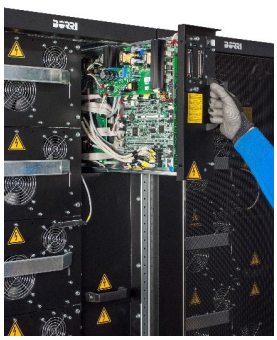
Legrand designs its UPS components to provide a longer lifetime and to enable longer periods between maintenance by increasing their Mean Time Between Failure; for example Keor MOD UPS introduces the new structured energy flow system, that eliminates the connection cables inside the power modules. The connections are achieved by the structure itself, increasing the total MTBF.



Structured Energy Flow:
no connection cables inside the power module

SERVICEABILITY

Legrand provides a complete range of specific solutions and services to meet customer requirements, using the latest technologies to remotely monitor the systems and perform accurate interventions.
Legrand UPSs are also designed to minimize Mean Time to Repair (MTTR), thanks to modular technology.
Modularity also leads to lower installation and maintenance costs of the UPS. As they are lightweight and compact, the modules are easy to transport and replace. So, it is possible to handle and maintain modular UPS systems with minimum personnel and transport requirements and with very little downtime. Moreover, modular machines are "self-configuring" (self-sensing) and do not require programming or hardware or software setting when the modules are installed or replaced. Therefore, no special tools and devices are required to operate with these UPS systems.



Easy service in Legrand and Borri UPS

ADAPTABILITY

The intense, fast and constant evolution of the "Digital World" is reflected in the need for frequent modification, upgrading and renewal of digital infrastructure. In particular, this happens in Data Centers where the upgrade of active IT devices may often also require the upgrade of the electrical system. Furthermore, thanks to technological developments, the performance of IT devices is growing but size and energy consumption levels are decreasing. This brings about space and cost savings, which can only be fully achieved if the surrounding infrastructure is able to follow this evolution at the same speed.

In addition, during the last few years, Data Centers have experienced a huge evolution and diversification of their characteristics. They have develope from private company or public office server rooms to Clouds, Colocation, Hybrid, Edge, and HyperScale Systems: all of which require different power sizes, different services, different management of the IT - which means different energy usage and management.

The UPS is a key part of this evolution since it is the core link between the electrical infrastructure and the IT critical load, which requires full continuity and high-quality energy feed(s).

In a nutshell, latest generation UPSs must be able to adapt themselves and match both with the load, the surrounding infrastructure and in general with the application; this is the meaning of "Adaptability".

ADAPTABILITY WITH LOAD

There are many different reasons and causes which determine variations in the load and energy absorption. For instance, regarding active IT loads:

- In the normal activity of a colocation Data Center, servers may be connected or disconnected according to the leasing contracts and agreements;
- Data Center managers planned future upgrade or deployment steps to the final anticipated size of the infrastructure;
- Ordinary or extraordinary maintenance needs to disconnect part of the load, while keeping operational the rest of the load;
- The IT devices are replaced with new, higher performance models to reduce energy consumption.
- In an initially 'underused' infrastructure, additional IT devices are installed.

There are also scenarios where the UPS provides energy to other critical loads separate from the active devices (Servers, Storages, etc). For instance, the UPS may be used to provide continuity for lighting, surveillance, safety and cooling systems. These loads may have several, variable types of energy absorptions and running conditions.
The UPS must be able to guarantee full functionality with the best performance in all the anticipated load variations and quickly meet any increase, or other changes, of the installed load.
This is possible thanks to high quality electronics and firmware design and equipment, combined with native architecture, which allows easy and reliable power configurations and future upgrades.

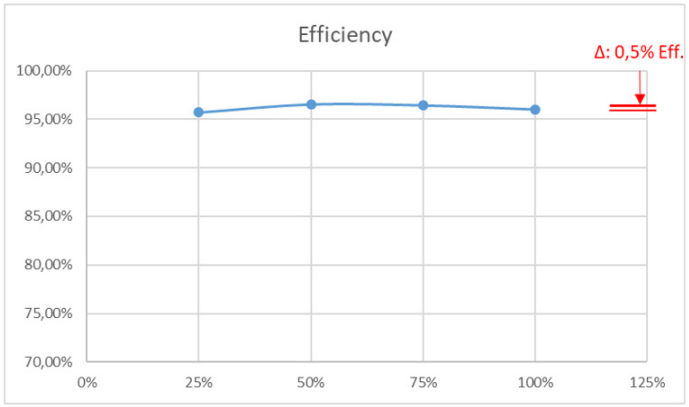
The combination of Modularity, Scalability and the Parallel capability allows energy requirements to be met, making the UPS "Adaptable" to the load.

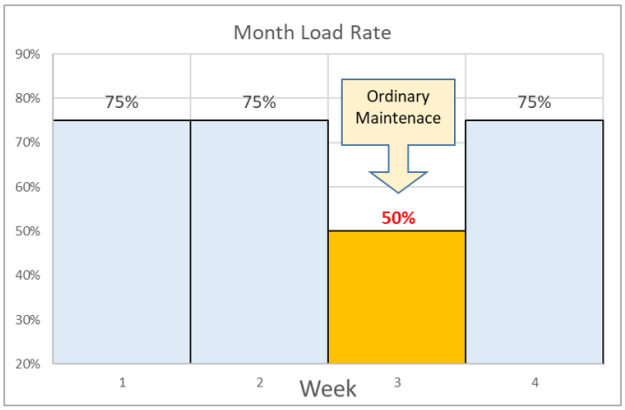
ADAPTABILITY

HIGH AND CONSTANT EFFICIENCY

At various load levels (available in Trimod HE, Keor MOD, Keor HPE, Keor XPE).

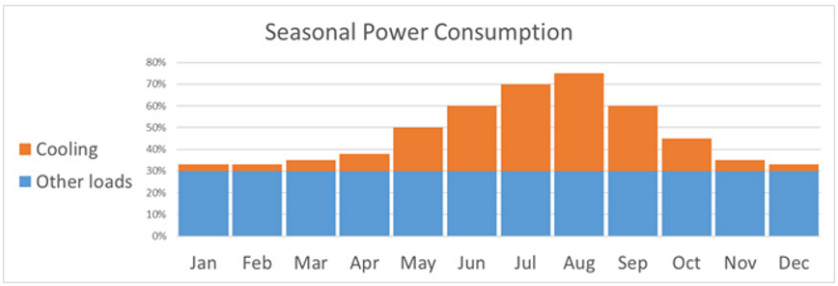
Example 1: In the case of routine maintenance, the load decreases for one week from 75 % to 50 %.





Load decrease in case of maintenance

Example 2: UPS dedicated to the Cooling system and other building critical systems (not active IT Devices).



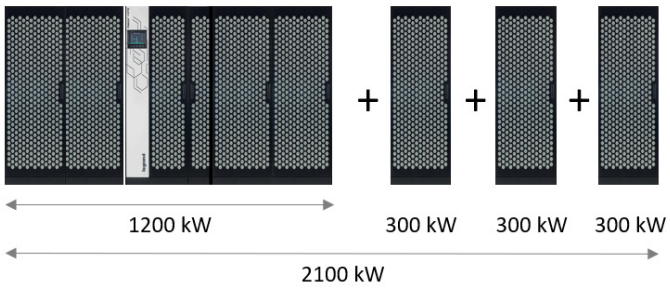
Seasonal power consumption

The "non Active IT load" in the building can be considered constant but the consumption of the cooling system may vary greatly during the year, according to the local climate. In this example the variation is up to 35 % of UPS nominal power.

Thanks to constant high efficiency there is minimum efficiency variation even in the case of important load variation: in the two examples above the difference of efficiency is just 0.5 % against a load variation of 30-35 %.

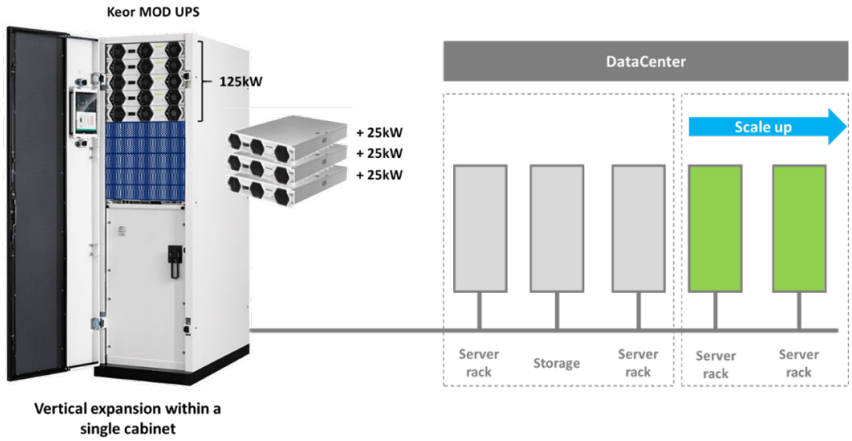
SCALABILITY

Example1: Keor XPE, **Pay as you grow**. Project deployed and realized in several steps of load connection, infrastructure designed for 2.1 MW but starting from 1.2 MW load , increasing 300 kW in 3 steps up to nominal power at the regime.



Example of Keor XPE scalability

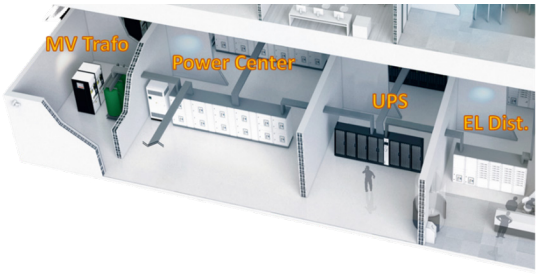
Example2: Keor MOD, **Pay as you need**. Additional servers are installed and activated in server farm Racks, UPS can be easily upgraded without change the infrastructure.



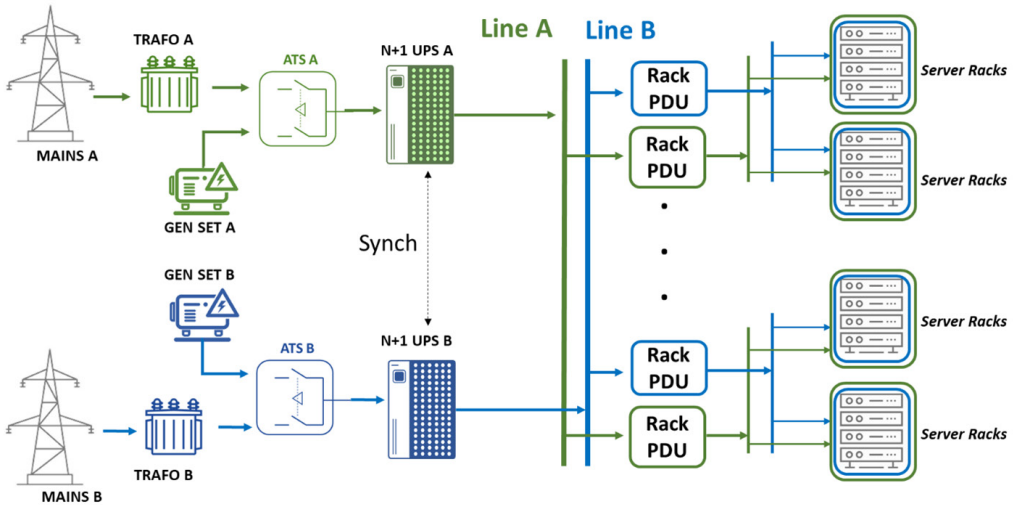
New Servers installed in free Rack Slots – New Power Modules installed in the UPS to feed the new device (Keor MOD)s

ADAPTABILITY WITH ELECTRICAL INFRASTRUCTURES

Electrical infrastructures in Data Centers vary and can be very specific according to the power size, geographical location, local laws, technical/design choices, building typology and a variety of other reasons.
Electrical infrastructure may also change over time, in the case of renewal, reorganization or enlargement of the Data Center. In other cases, the room and the electrical system already exist, but were originally used for other applications - for example, were intended to house a server farm or other IT infrastructures.
A UPS which is designed to be compatible (natively or easily configurable) with various electrical infrastructures is, undoubtedly, a great advantage in terms of both time and cost savings. In particular, it is very useful to have full compatibility with the various grounding systems, easy and comfortable electrical connections, suitability to different electrical connections (cable/busbars), and in/out signal port to coordinate the UPS operations with surrounding distribution and protection devices.



Another important feature of the UPS is the extremely low electrical impact on the electrical network. Minimum harmonics pollution and zero reactive power absorption are, nowadays, a basic requirement in are as where a clean and stable output voltage is essential, But UPSs for Data Centers must be also full compatible with isolation transformers, Genset, ATS, STS and other devices which are typically used in Data Centers electrical systems.
Legrand UPS are designed to be compatible with a wide variety of electrical systems.
They are all compatible with different grounding systems, can work with isolation TRAFO both in input and output. They have dedicated controls for input absorption which makes them compatible with GenSet, ATS and other upstream systems. Input, bypass and output performances make the Legrand UPS fully compatible with all the electrical distribution products in the Legrand portfolio, providing a complete integrated Electrical infrastructure both for the grey and white rooms of the Data Center.

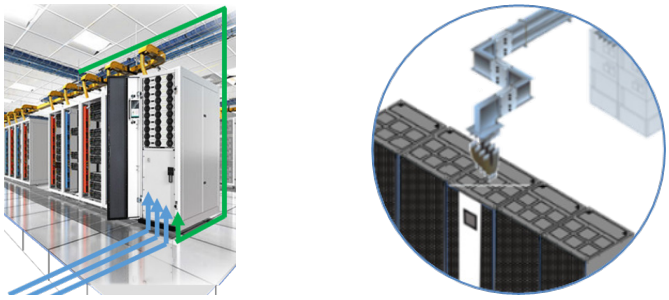


Compatibility with various configurations of the Electrical System

Adaptability with electrical infrastructures (continued)

For small to medium power, Legrand UPS can be easily connected with cables at the bottom of the cabinet front. This is particularly useful in the case of cabling passing under a raised floor. Nonetheless, the UPS can also be easily connected with cable coming from the top cable trays.

For large power Systems UPS can be connected both to cables and busbar power lines.



Connection with cables and busbars is possible

ADAPTABILITY TO THE ROOM AND BUILDING

Data Center managers and designers pay great attention to the room space and footprint. In fact, both the occupied and available space can have a significant impact on costs and potential value of the infrastructure; in order to reduce the first factor and increase the second one, it is vital to dedicate as much space as possible to active devices (racks for servers and storage) and to reduce to a minimum the space used by the rest of the technical infrastructure, including the UPS.

For this reason, the Data Center UPS must have the highest possible power density level and mechanical compactness. The small footprint with compact cabinets, combined with wheels and adjustable feet, makes the UPS adaptable to the building and technical room when in-situ and also during installation, movement or building renovation. Modular systems, with small power modules, are preferable due to the fact that they require very few technicians to move empty cabinets and modules and to install them easily and quickly after final positioning. Even in the case of high-power UPSs (>500 kW), modular architecture helps to simplify the movement, positioning and installation inside the building, as these big UPS systems are made of a combination of several units in smaller cabinets. Furthermore, for a large power UPS it can be helpful to have the option of configuring the cabinets not only in line (side by side), but also along the walls (in L shape or U shape) or at the center of the room (back to back). Similarly, the ability to avoid structural obstacles (e.g. pillars) is another benefit of a modular cabinet system.

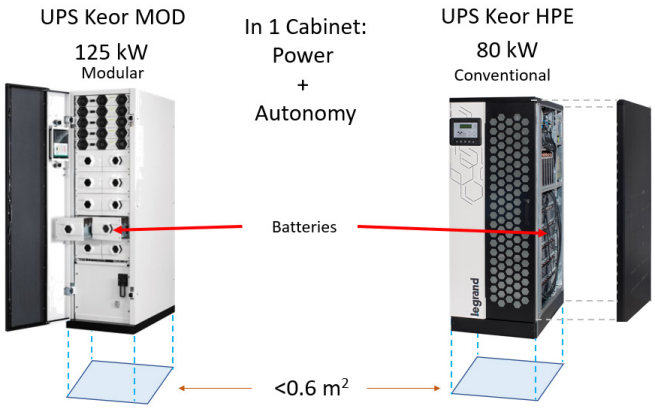
The Adaptability of the UPS to the technical room (whether a Grey Room or White Room), is also related to the environmental specs, proper ventilation system, mechanical compatibility with active load racks, cold corridors and power distribution systems.

ADAPTABILITY

Adaptability to the room and building (continued)

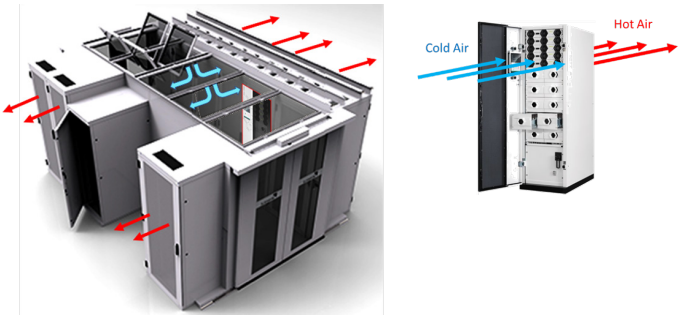
For best use of the available Data Center space, Legrand UPS are designed to have one of the highest levels of power density in the market with an attendant compact footprint.

The ventilation system in the Legrand UPS Keor MOD is designed to match the air flow strategy in the Data Center White Room, compatible with hot and cold aisles and with enclosed cold corridors.

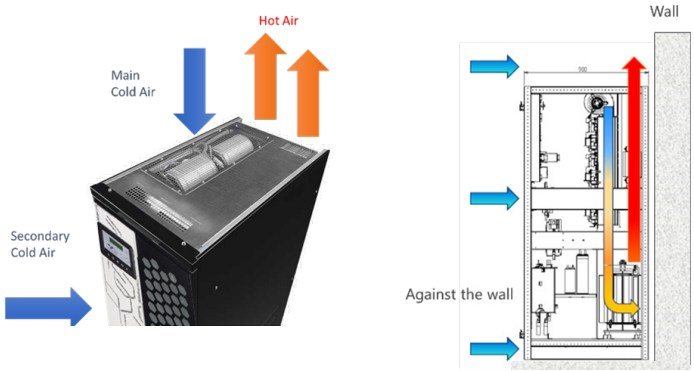


High power density and compact footprint

Ventilation in Legrand UPS Keor HPE is designed to flow from top and front, without the need of free space on the rear side of the cabinet for easy installation against the wall.



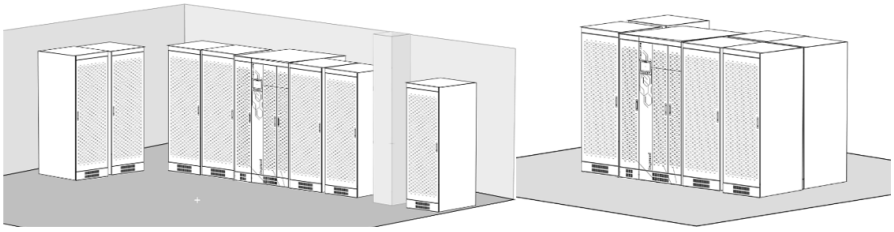
Ventilation compatible with cold corridor systems



Top and front ventilation allow installation against the wall with floor space savings

Adaptability to the room and building (continued)

For large systems like Keor XPE composed of several cabinets, Legrand offers the option of free positioning of the individual cabinets in order to optimize the occupation of room space, for instance following the wall or placing the cabinets in the center of the room and many other layouts. In addition, the free positioning of cabinets, allows the avoidance of structural obstacle like pillars, doors, etc.



Customizable layout for footprint optimization

Example of Keor XPE layout

ADAPTABILITY TO THE APPLICATION AND USER

The last aspect of Adaptability is focused on the application and the user. In Data Centers the core of the application is the treatment and the storage of the data inside the active IT devices. The value of these activities is so high that they must be kept online constantly, protected and controlled.

This means that all the infrastructure which supports and the active IT load must be monitored, controlled and integrated with automatic diagnostic and process management. For this reason, the UPS for Data Center should have a full set of communication interfaces for the most popular protocols and be compatible with all operating systems, which allows the full integration of Data Center data networks.

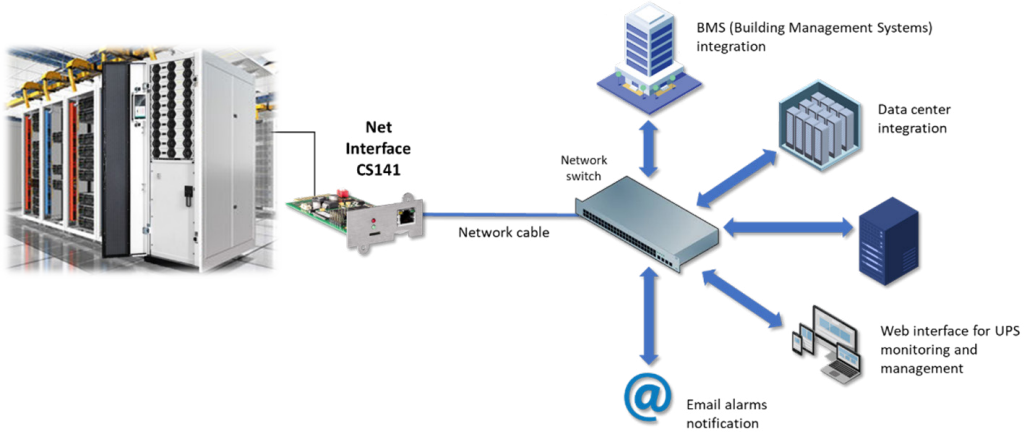
Finally, the UPS for Data Centers should be adaptable to the user, with an intuitive, simple and immediate display and human interface: these elements should clearly show the status of the system and with few button pressings allow complete monitoring, control and, with proper protection, set up and diagnostics actions.

ADAPTABILITY

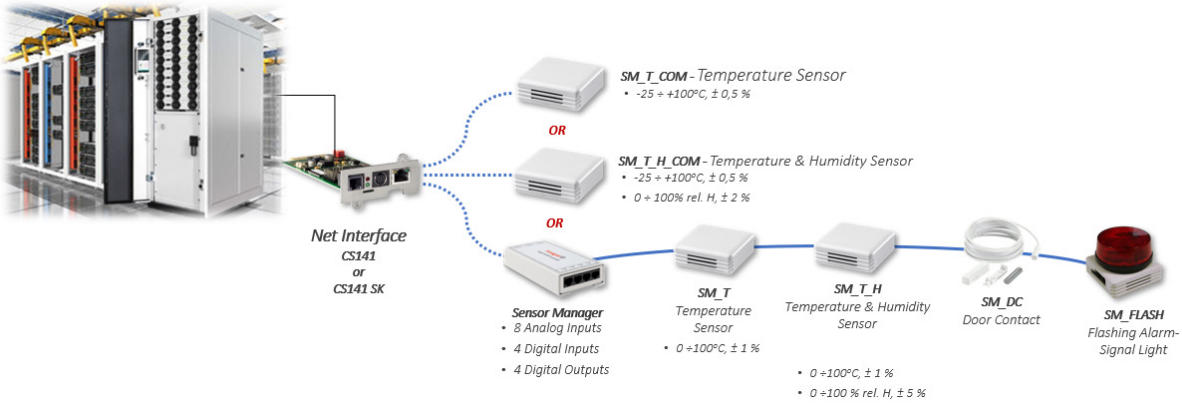
Adaptability to the application and user (continued)

Legrand pays particular attention to the ergonomics of the UPS in terms of both the User and the Application and achieves a high level of usability and integration for the best experience in UPS management. (USB, Dry Contacts, RS232, RS485, ModBUS, Ethernet, Parallel, IN/Out Logic signals, etc.)

Full Communication Ports and Interfaces



Full integration with Data Center Network for remote monitoring, control and management



Many possibilities of environmental and room monitoring

CONCLUSION

In conclusion, today Data Centers need smart solutions which combine agility, effectiveness, and sustainability from every infrastructure component. This includes the UPS, which has the main task of providing a continuous and high quality energy supply; but can give added value if it can contribute to make the system easier to manage, flexible to develop, reliable and affordable.

The added value can be summarized in the three main points:

- Business continuity
- Limited TCO
- Adaptability

Current trends of technology and applications suggest that the future evolution of the Data Center will focus on the improvements of these three main features, additionally, paying more and more attention to the sustainability and environmental impact of the overall system.

Modular, Scalable architecture, attention to design and material, advanced logic controls, innovation and research will be key to developing the next generation of Data Center infrastructure.

Legrand UPS, with its complete UPS portfolio and continuous improvement policy, is fully committed to research and develop cutting edge solutions for the Data Center and other critical applications and environments.

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