01 The ABB Megaflex DPA UPS. Here, a 1.5 MW configuration is shown.

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MEGAFLEX – AN EFFICIENT AND RESILIENT UPS FOR HIGH-POWER DATA CENTERS

ABB's new MegaFlex uninterruptible power supply (UPS) is aimed at applications such as data centers that have high power demands. MegaFlex is simple, compact and resilient – and delivers the excellent availability, reliability and efficiency that is a hallmark of all ABB's power protection products.

The quantity of data added to data centers around the globe each minute of every day is staggering. This deluge of data has to be stored in a safe and rapid way and has to be retrievable just as quickly – 24/7 and 365 days a year – so it can be utilized in one of the many applications uopn which day-to-day life depends. The dawning of this new era is the reason why data centers are proliferating around the world. Growth in the sheer number and size of data centers is accompanied by another trend: a move toward a sophisticated world of cloud-based, hybrid and distributed data centers. The single, standalone data center concept often cannot provide the replication, data traffic, reliability and resiliency capabilities demanded by some customers.

Growth in the number and size of data centers is accompanied by a move to cloud-based, hybrid and distributed data centers.

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Data center requirements

Data center operators have many requirements in common, the most important being:

- Business continuity and zero downtime: All systems have to be always up and running – and whatever happens on the infrastructure side, load-drops are not an option. This is to guarantee safe data transaction, storage and recovery. It is not uncommon for data center outages to cost tens to hundreds of thousands of dollars, and cases that incur costs in the tens of millions of dollars are no rarity.
- Reduction of investment and operating costs through higher energy efficiency: Better efficiency not only reduces energy losses and operational costs but also eliminates the capital investment that would be needed to purchase higher-performance temperature-conditioning systems. Such investments profoundly impact upfront investment.

A data center has to store data in a completely safe and reliable way. For this reason, the ability to provide an unbroken supply of good-quality power to the data center is critical. Indeed, when they do occur, the most common cause of outages in data centers is a power supply problem.

ABB is a market leader in the UPS technology that ensures power keeps flowing no matter what. The company has pioneered many advanced concepts in modern UPS design – for example, distributed parallel architecture (DPA™).

DPA has worked well for ABB: Users whose power requirements increase can simply add modules to reach power capacities of several MW. However, as larger data centers drive UPS power requirements ever higher – to 30 or 40 MW – the need has emerged for a UPS that has a base power level of at least 1 MW and that can be expanded or configured to cater for applications requiring up to 6 MW. Five such installations can cover the energy needs of a 30 MW site.

Further, as data centers evolve into larger facilities that are denser, scalable, more networked and more converged, operational costs can increase. An appropriate choice of UPS and associated power infrastructure helps control these costs.

Customers seek a power distribution solution that is highly efficient, scalable, flexible and easy to install and maintain.

Other considerations involve the move away from the standalone data center toward geographically distributed facilities, global traffic management, critical data replication, virtual storage, cloud computing and other complicating factors. This evolution places new demands on resiliency, provokes new thinking and, most importantly, motivates customers to look for a power distribution solution that is highly efficient, scalable, flexible and easy to install and maintain.

To satisfy these evolving customer demands, ABB has developed the MegaFlex UPS for the UL and IEC markets →01.

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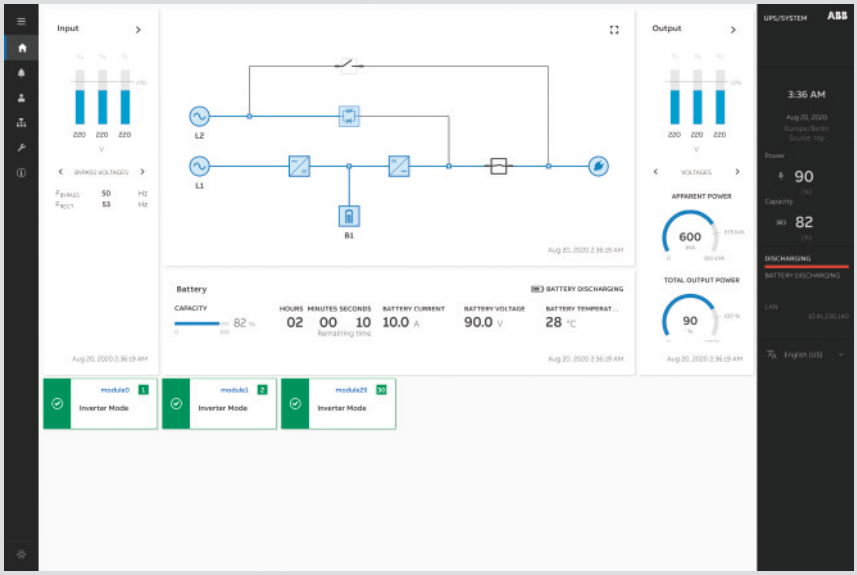

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02 Space in data centers is usually limited, so the flexibility of the Megaflex DPA UPS is valuable when it comes to layout.

02a 1,000 kW, system with four power modules, connection frame on left.

02b 1,000 kW, system with four power modules, connection frame on right.

02c 1,500 kW, six-power-module system with connection frame in center.

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03 Compared to an ABB DPA 500 UPS solution, the Megaflex DPA has a footprint around 45 percent smaller.

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04 The operator has a comprehensive overview via a HMI but can also access the same information via a Web page.

ABB's MegaFlex DPA IEC UPS

The MegaFlex DPA design brief included the following basic tenets:

- Develop, manufacture and sell a high-efficiency UPS with a rated power of 1 MW, 1.25 MW, or 1.5 MW that is suitable for large data center facilities.
- Standardize power distribution architectures in compliance with the Uptime Institute classification system and EN 50600.
- The UPS must be compact, highly energy-efficient, flexible, easy to install and maintenance needs must be predictable.

The result was a transformer-less UPS consisting of 250 kW power blocks, a central static bypass with a rated power of 1,000 kW or 1,500 kW and an I/O connection frame with power ratings of 1 MW and 1.5 MW. The input feed can be single or dual (option). The MegaFlex DPA UPS can use lithium-ion or valve-regulated lead-acid (VRLA) batteries as external storage. Backfeed protection is provided as standard. An option provides redundant power capacity: 1,000 kW N+1 or 1,250 kW N+1. A product variant – which will be released first – features distributed bypass switches, resulting in a smaller footprint.

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An option provides redundant power capacity of 1,000 kW N+1 or 1250 kW N+1.

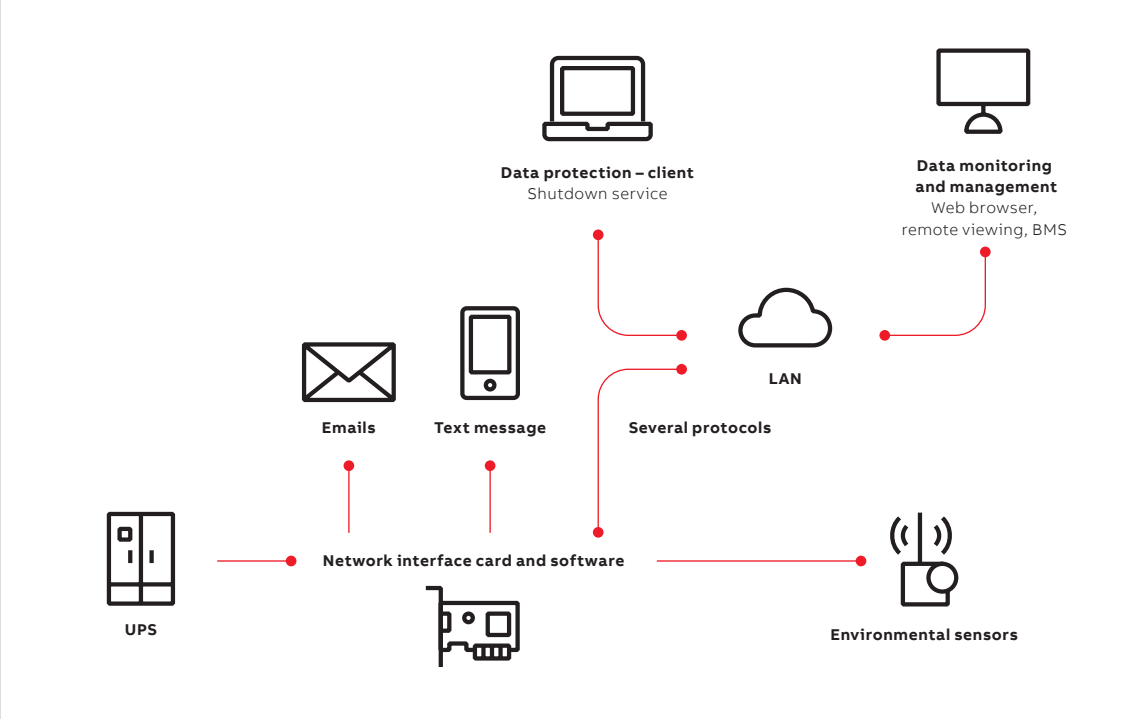
Further salient MegaFlex DPA features include:

- High-efficiency converters – in VFI mode (see below) > 97.4 percent.
- Optimized footprint and flexibility in component layout →02–03.
- Simple, safe and quick installation with high adaptability to the building infrastructure.
- Enhanced power measurement that provides comprehensive information to the data center operator so that energy consumption can be tracked.
- Intelligent predictive maintenance program to plan and reduce maintenance throughout the product life.
- Enhanced self-diagnostics to minimize human intervention during maintenance and start-up.
- Full lifetime service provision via local ABB-trained specialists.

Intelligent energy management

Due to the vast amount of energy large data centers consume, energy efficiency is a particularly important topic. Every percentage point improvement in efficiency brings with it significant cost savings. The default operating mode for the MegaFlex DPA is voltage- and frequency-independent (VFI) double conversion mode, which has an efficiency of up to 97.4 percent. Alternatively, the UPS can operate in its voltage- and frequency-dependent (VFD) ECO mode to attain 99 percent efficiency.

When a UPS is operating significantly under capacity, its energy efficiency can be negatively impacted. ABB's Xtra VFI operating mode is a smart way to minimize losses and improve



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efficiency safely when running in double conversion mode.

When the MegaFlex DPA UPS runs with Xtra VFI mode enabled, the UPS automatically adjusts the number of active modules according to the load power requirements. Modules that are not needed are switched to a standby state of readiness, primed to transfer back to active mode if the load increases. The efficiency improvements

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To increase reliability, extend service life and equalize aging, the system rotates modules between active and standby mode.

achieved by this mode of operation are especially significant when the load is less than 25 percent of full UPS system capacity – an operating regime in which traditional UPS systems fare poorly. The switching scheme parameters can be configured by the user. To increase reliability, extend service life and equalize aging, the system rotates modules between active and standby mode at fixed intervals. Should there be a mains failure or other abnormal situation, all modules revert to active mode within milliseconds.

Control and monitoring

The MegaFlex DPA human-machine interface (HMI) allows the operator to display measurements, events and alarms (primary input failure, battery status, overtemperature, overload, input and output protection status, etc.) as well as the UPS status and primary component status →04. Also measured and displayed are:

- Input, output and battery voltage and currents.
- Output kW/kVA.
- Thermal monitoring for the main converter and critical components.

Connectivity is accomplished via two slots for optional communication boards, eg, SNMP, Modbus TCP/IP or Modbus RS-485. These ports can make measurements and alarms available to the electrical power monitoring system (EPMS), the building management system (BMS) and the data center infrastructure management (DCIM) – all of which integrate with ABB Ability™ Data Center Automation via, for example, the local area network (LAN) →05. The UPS is also equipped with dry inputs for remote shutdown, generator operation and external switchgear; I/O dry ports; a Castell interlock function; and a preconfigured (battery) temperature sensor input.

Resiliency
Resiliency refers to the ability of the entire power structure to prevent failure – and to recover quickly and fully from failure – or to keep running even with a certain level of faulty equipment or software. A system-wide approach becomes essential if resiliency is to be maintained as the concept of the standalone data center is overtaken by new trends – for example, hybrid and distributed architectures and advances in virtualization; strategies that shift data from one geographical location to another to take advantage of cheaper energy tariffs; and real-time data replication in different sites for hyper-critical applications.

ABB's MegaFlex DPA UPS and associated ABB support infrastructure – such as intelligent switchgear, smart sensors, cloud-based predictive maintenance algorithms, enterprise-wide and site-specific monitoring, transformers, smart sensors, short-circuit isolation selectivity, etc. – help deliver the high level of system-wide resilience needed.

Measures taken to improve resiliency can also have other benefits. For example, a good monitoring strategy creates a predictive insight that not only flags a component replacement need (rather than unnecessarily replacing it after a prescribed period) but also increases availability while reducing energy consumption. Here, emergency maintenance is also reduced and customer satisfaction increased. This approach also allows remote monitoring of energy consumption and costs, making the implementation of energy management strategies easier and faster.

— 05 Example of Megaflex DPA connectivity.

— 06 The Megaflex DPA. Power modules slide in on integrated wheels and lock in place using docking connectors.

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Another critical aspect of resilience lies with ease of maintenance and the elimination of human error. The design of the MegaFlex DPA UPS has placed great emphasis on these factors. For example, module cabinets can be easily moved to the UPS location using a palette truck and then slid into place on their integrated wheels →06. Connection is made via docking connectors so cabling faults cannot arise during the procedure.

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A predictive insight flags component replacement need, thus increasing availability while reducing energy consumption.

For mains cabling, there is entry top and bottom and the cabinet is IP20 protected. Further, the fan array is located on a pull-out drawer for easy access. Fan failure detection and speed regulation are provided as standard. Timely indication is given of the need to replace consumables such as fans and AC and DC filters, thus improving reliability. All in all, continuous UPS monitoring, smart design and intelligent diagnostics lengthen the UPS lifetime significantly.

MegaFlex DPA – a UPS for tomorrow's data center
High power, simplicity of use, efficiency, reliability, availability and resiliency are the watchwords that underpin ABB's high-power MegaFlex DPA UPS. MegaFlex DPA is designed to work with the rest of ABB's power infrastructure products to ensure a continuous flow of clean power to a data center and provide the system-wide resiliency needed for modern data storage solutions that implement distributed, cloud or hybrid approaches. By paralleling units, MegaFlex DPA can provide up to 6 MW and the UPS satisfies the "six-nines" requirement of the most demanding data centers.

Most important of all, MegaFlex DPA provides peace of mind for customers with the assurance that their power is guaranteed by the very best power protection technology on the market. •

MNS-UP: LOW-VOLTAGE SWITCHGEAR COMBINED WITH MODULAR UPS

MNS-Up combines ABB's Conceptpower DPA 500 uninterruptible power supply (UPS) and ABB's MNS switchgear with Emax 2 circuit breakers into one product. This flexible, integrated product delivers a host of benefits.

Although the data center market is continuously growing and changing, the demands on site electrification have not altered much. The principal demands are:

- Power availability, as the nature of the data center business means that unplanned outages are unacceptable.
- Reduction of footprint to increase the space available for IT equipment.
- Flexibility to adapt the power supply to continuously changing demand.
- Reduction of installation time to make a "pay as you grow" approach to power expansion fast and easy.

To accommodate these requirements, ABB has introduced MNS-Up. MNS-Up combines ABB's MNS low-voltage switchgear and ABB's Conceptpower DPA 500 modular UPS into a single product, which means a large part of the power infrastructure can be installed as one integrated unit →01.

MNS-Up combines ABB's MNS low-voltage switchgear and ABB's Conceptpower DPA 500 modular UPS into a single product.

At the core of ABB's electrification business is the MNS switchgear platform, which has been evolving for over 40 years. The full breadth of ABB technology – including automation products, breakers, switches, control products, connection technology, protection and wire management – is leveraged in the MNS design.

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01 MNS-Up combines ABB's MNS low-voltage switchgear, with Emax 2 circuit breakers, and ABB's Conceptpower DPA 500 modular UPS into a single integrated product.

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02 DPA 500 UPS modules can be removed or added without powering off.

MNS-Up integrated UPS and switchgear is an MNS variant intended for critical power applications. For a 500 kW installation, MNS-Up can save up to 10 percent of the space needed versus a conventional setup; for 2 MW or more, the saving can be up to 30 percent. MNS-Up provides all the switchgear feeders (eg, network incoming, generator incoming and bus tie) as well as line starters, motor starters and modular capacitor banks.

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With DPA 500, each 100 kW UPS module contains all the hardware and software required for full system operation.

The DPA 500 UPS modules are located in dedicated sections but with the same busbar systems as the switchgear. This direct coupling is a key aspect of creating a single product. Usage of the MNS standard busbar system also guarantees maximum layout flexibility, allowing UPS sections to be placed in the middle or side of the layout.

Connections between the UPS modules and busbars are part of MNS-Up, so they are completed and tested in the factory, eliminating the potential for the trouble that can sometimes accompany the site works required by conventional solutions when connecting switchgear and the UPS using cables or bus ducts.

To maximize scalability and reduce the number of spare parts required, only one size of UPS module (100 kW) is used. Each section can host up to five modules and by paralleling six sections a total power capacity of 3 MWA can be attained.

With DPA 500, each 100 kW UPS module contains all the hardware and software required for full system operation, which eliminates potential single points of failure. Modules can be replaced without powering down, which makes maintenance and replacement straightforward →02.

Even though each UPS module has its own bypass, the switchgear also includes a central bypass that is common to all the UPS sections that might be accessed during maintenance operations. To maximize the integration of the switchgear and UPS, this bypass is in a standard switchgear bus tie, creating a direct connection between the incoming and outgoing busbars of the UPS modules.

The advantages of the MNS-Up single-product approach are evident even in the tendering phase, in which the customer only has one purchase procedure instead of two (switchgear and UPS), and continue right up to the test phase in which the factory acceptance test merges switchgear and UPS testing procedures, saving time and cost.

The advantages of MNS-Up do not end with the delivery and installation of the product: The benefits of a low total cost of ownership for the data center operator last throughout the entire life cycle of the product. Further, conventional solutions have different life expectancies for switchgear and UPS (30 and 12 to 15 years, respectively) and at the UPS end-of-life interconnections also must be checked and possibly renewed. With MNS-Up, these interconnections are an inherent part of the switchgear, so are guaranteed for 30 years. Thus, the UPS replacement at end-of-life is faster and more cost-effective compared to the conventional solution. •

MEDIUM-VOLTAGE UNINTERRUPTIBLE POWER SUPPLY

A large data center needs a power protection scheme that can supply a sizeable amount of power in a very reliable and efficient way. A power protection and distribution approach at the medium-voltage (MV) level provides the perfect solution.

Continuous growth of the data center industry, particularly in the hyperscale space, is resulting in a dramatic increase in data center facility power needs. This trend is driving new strategies to fulfill customer ideals pertaining to higher efficiency, higher availability and minimal maintenance – in parallel with the insatiable need for reduction in capital investments. With all things considered, the natural next step for power protection for large critical power facilities is an MV-based system.

The output voltage is regulated no matter what input supply disturbances are present.

ABB's PCS120 MV uninterruptible power supply (UPS) – based on the revolutionary impedance (Z) isolated static converter (ZISC) architecture – is the most recent addition to ABB's MV product portfolio and represents the next generation of MV UPS intended for multi-MW power protection →01.

The UPS's high-performance inverters – designed using ABB proprietary power electronics technology – combine with the ZISC architecture to ensure that the output voltage is regulated no matter what input supply disturbances are present. The PCS120 MV UPS provides continuously regulated, filtered power.

To maximize scalability and minimize spare parts, the PCS120 MV UPS system is built using UPS blocks, each with a rated power of 2,250 kVA. Up to 10 of these blocks can be paralleled in a so-called hard-parallel configuration to give

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01 The PCS120 MV UPS.

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02 Operating at MV levels allows the PCS120 MV to supply power protection to large data centers – at lower overall cost.

22.5 MVA or 20 can be arranged in a ring-bus configuration to give 45 MVA.

The PCS120 MV UPS was designed to meet the typical requirements of a large data center:

Maximum availability
The PCS120 MV UPS offers a high uptime that is driven by a robust MV design approach that delivers high power levels from single blocks, a lower switchgear count and a modular design

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The PCS120 MV UPS's flexibility allows it to accommodate several common data center architectures.

that allows the loss of up to two converters without automatic transfer to bypass mode. Other internal redundancies for fans and switched-mode power supplies further increase system availability.

For large parallel or ring-bus systems, if the system designer includes a redundant module in the system, module maintenance is possible while keeping the system online and the load fully protected, thus yet further increasing system availability.

High performance
The PCS120 MV UPS delivers a clean output voltage in accordance with IEC62040-3 class 1 and can also supply high fault currents for downstream protection and fault clearing of up to five times nominal current.

Efficiency
The PCS120 MV UPS has a class-leading efficiency of 98 percent for the load spectrum from 50 percent up to full rated load and better than 96 percent for 25 to 50 percent load. Low no-load losses and modular design ensure a near-flat efficiency curve, allowing maximum foreseen capacity to be installed on day one, whilst minimizing energy wastage if the initial loading is low.

Operating cost-effectiveness
Because the power protection is at the MV level, facility build and operation costs are reduced as currents and electrical losses are lower at this higher voltage and cables can be thinner →02. An MV UPS can be placed on less expensive real estate – for example, in an electrical room or substation – distant from the loads. Furthermore, because MV requires less infrastructure, reliability is inherently improved.

Flexibility and scalability in large power applications
The PCS120 MV UPS's flexibility allows it to accommodate several common data center architectures, such as "distributed redundant,"

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03 Power support for the grid.

03a Power flow in normal mode of operation.

03b Power flow with grid support functionality.

or “shared redundant” or “catcher.” These are in addition to the hard-parallel and ring-bus configurations mentioned above. Utilizing groups of 22.5 MVA configurations in hard-parallel mode gives a new perspective on using known architectures – and on a significantly higher power level as large backup systems such as diesel or gas generators are supported by the architecture.

Indoor and outdoor PCS120 MV solutions are possible as are versatile energy storage options with autonomies that range from a few seconds up to several minutes.

Grid support functions
With the rise of renewable energy generation comes a potential for UPS equipment to provide grid support functions in addition to their primary task of load protection.

Large data centers have a significant stranded power generation capacity due to their redundant design and battery systems. This infrastructure can generate an income stream through grid support services such as demand management and frequency regulation, as well as increase engagement in corporate social responsibility by helping out local community power schemes.

In addition to its core purpose as a load protection system, the ABB PCS120 MV UPS ZISC topology is also ideal for injecting real power into – or absorbing it from – the electrical network on request from an external power plant controller when network stability is threatened. On request, the PCS120 MV UPS will step in to supply power to the site critical load, thus reducing the drain on the grid, allowing it to recover. If the power relief requested would leave the critical load short, the UPS will support the full load and inject just any excess capacity into the grid – ie, the maximum available power to be injected into the grid is the PCS120 MV UPS system rating minus the required load power →03.

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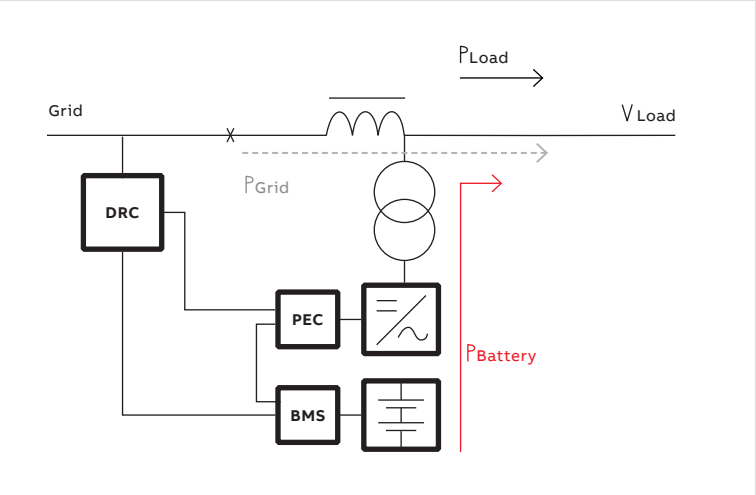
The PCS120 MV UPS is the ideal solution for data centers that need power protection in the multi-MW range.

The PCS120’s modular approach allows unparalleled serviceability and redundancy while maximizing uptime. The PCS120 MV UPS is the ideal solution for large data centers that need power protection in the multi-MW range and the UPS covers every aspect the data center needs over the 20 years’ lifetime of the product with minimized maintenance and maximized efficiency, leading to an optimal total cost of ownership. •



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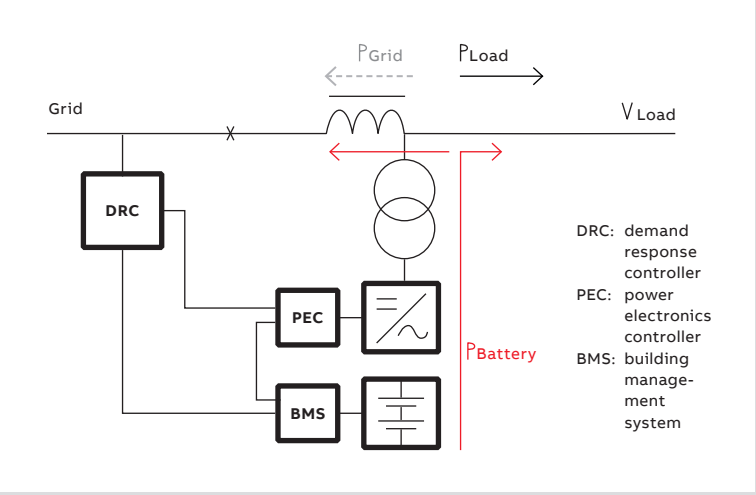

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