



SEPTEMBER 2017

Conceptpower DPA 500

The true modular UPS for high-power applications

ABB Power Protection



Agenda

The concept of modular UPS in data center applications

Product overview and system characteristics

Performance characteristics

Energy storage

Frame cabinet design details

User interface, software and connectivity

Maintenance and service



The concept of a modular UPS

In data center applications

Why UPS is important

What to consider when selecting a UPS?

The ultimate mission of a UPS:

... to secure continuity of a critical process by supplying uninterrupted, clean power to the critical load, **maximizing availability**.

- Identified criticality level of a process dominates the infrastructure design, too:
 - Sets the requirements for electrical power infrastructure around it
 - Defines the levels of reliability and availability that need to be achieved
 - Defines the level of reasonable investment

UPS is the core of power infrastructure

Selecting correct UPS type for the application is the most critical part of site planning

UPS solutions for data centers

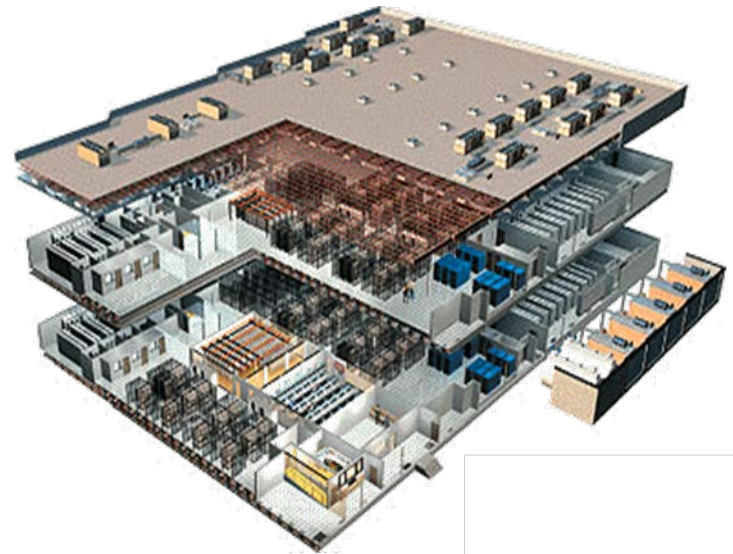
As of today

Every data center has a business running in it – or it is the business

1. The business defines the white space: servers, data storage, network gear, etc
2. The servers (size and number) and the criticality of the processes running on the servers define the powering concept, gray space
3. The powering concept defines the UPS

As of today:

- Central UPS concept is common in large data centers ranging from hundreds of kW to 3-4 MW - defined by available power feed, LV transformer and size of generator set
- Distributed (end-of-row) UPS concept is common in smaller data centers – typically from 1 rack up to 300-400 kW but can be used in larger facilities too
- Other variations increasing their share
- Both centralized and distributed can be built to any Tier rank (1-4)



Modular UPS for medium-power application

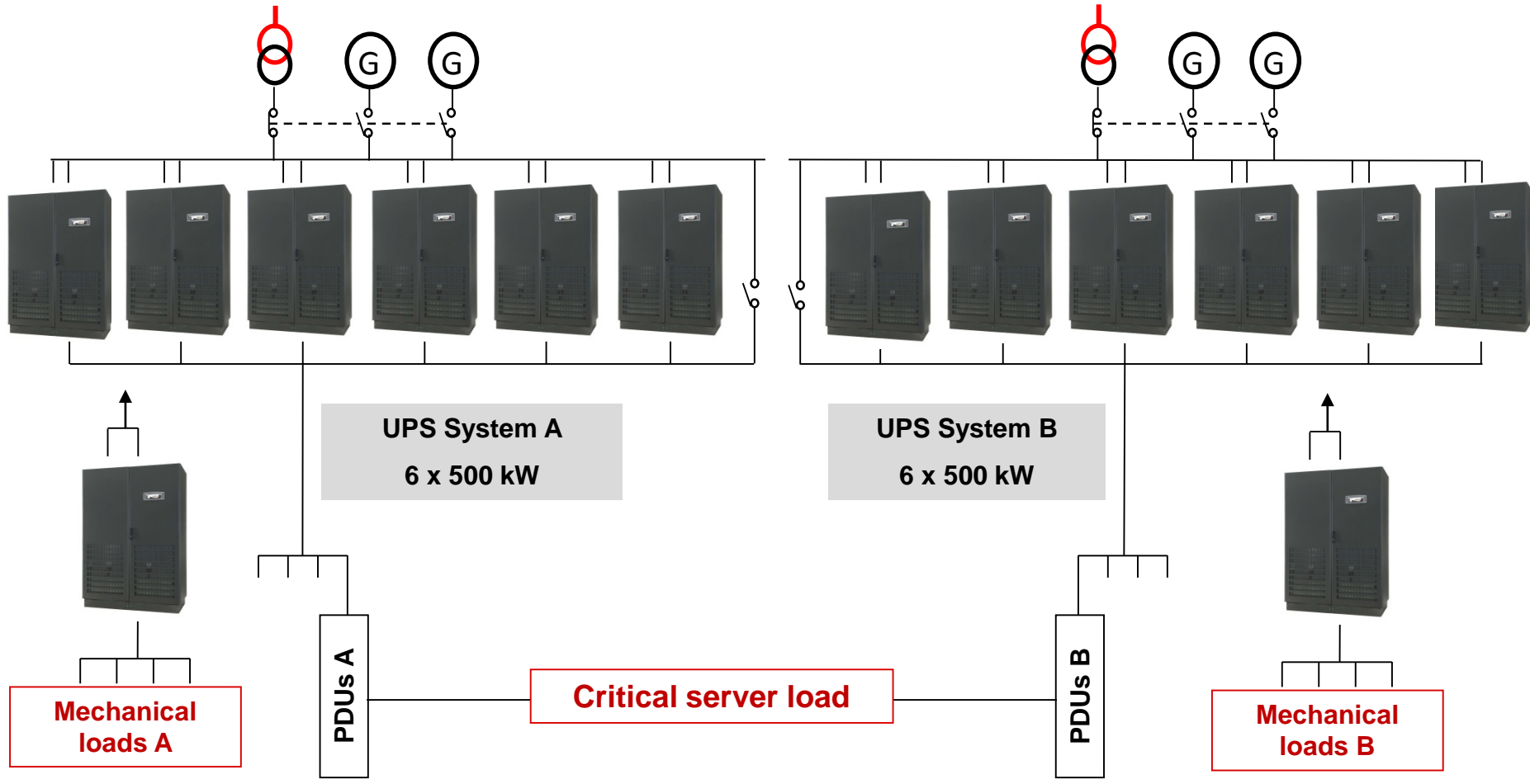
Module rated power 10-50 kW



As UPS power has been scalable up to around 250 kW in a single frame, modular UPS has been typically used only in server room or as “end-of-rack-row solution” when applied in larger data centers

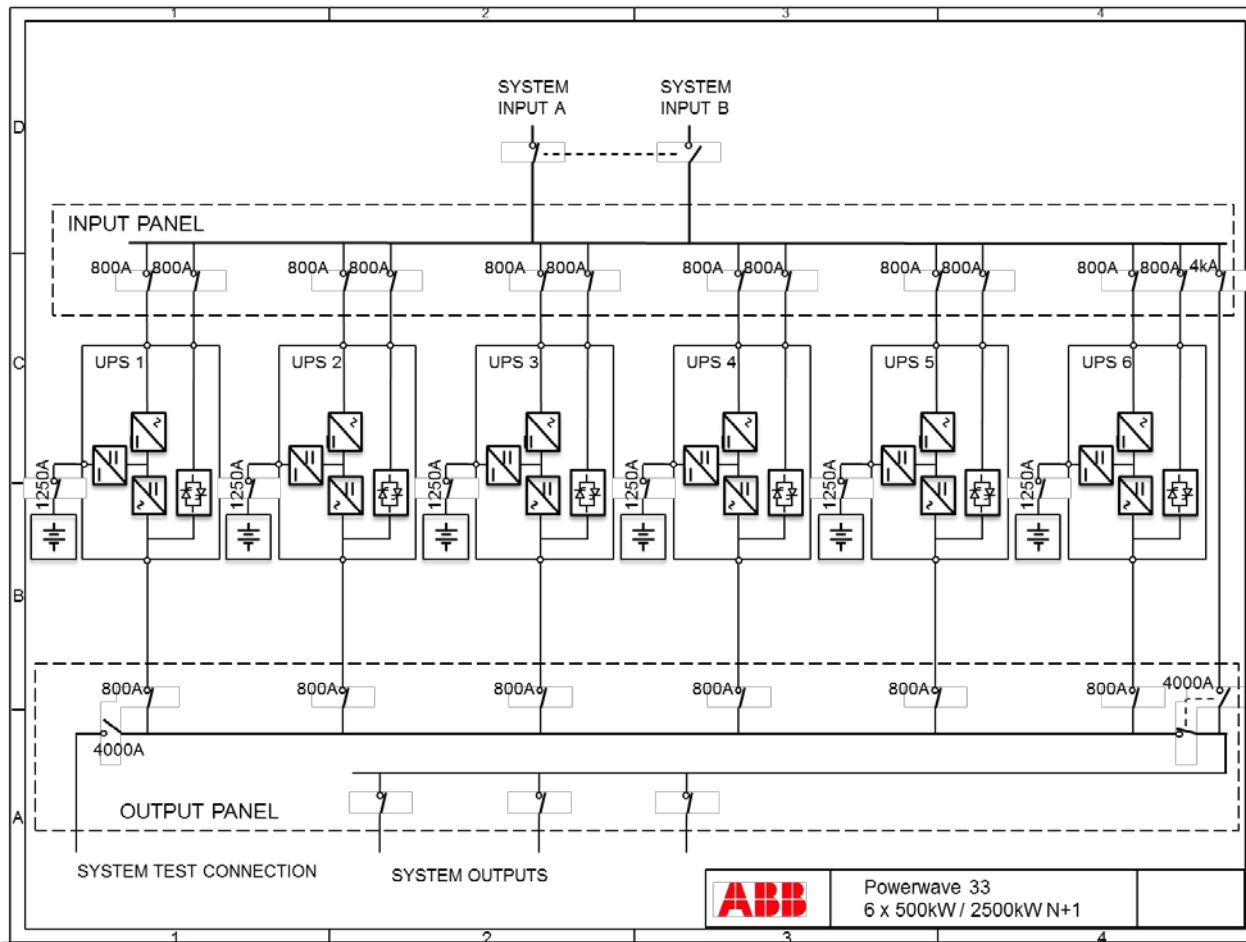
Typical solution for high-power application

Centralized large Tier 4 system using monoblock UPS in parallel



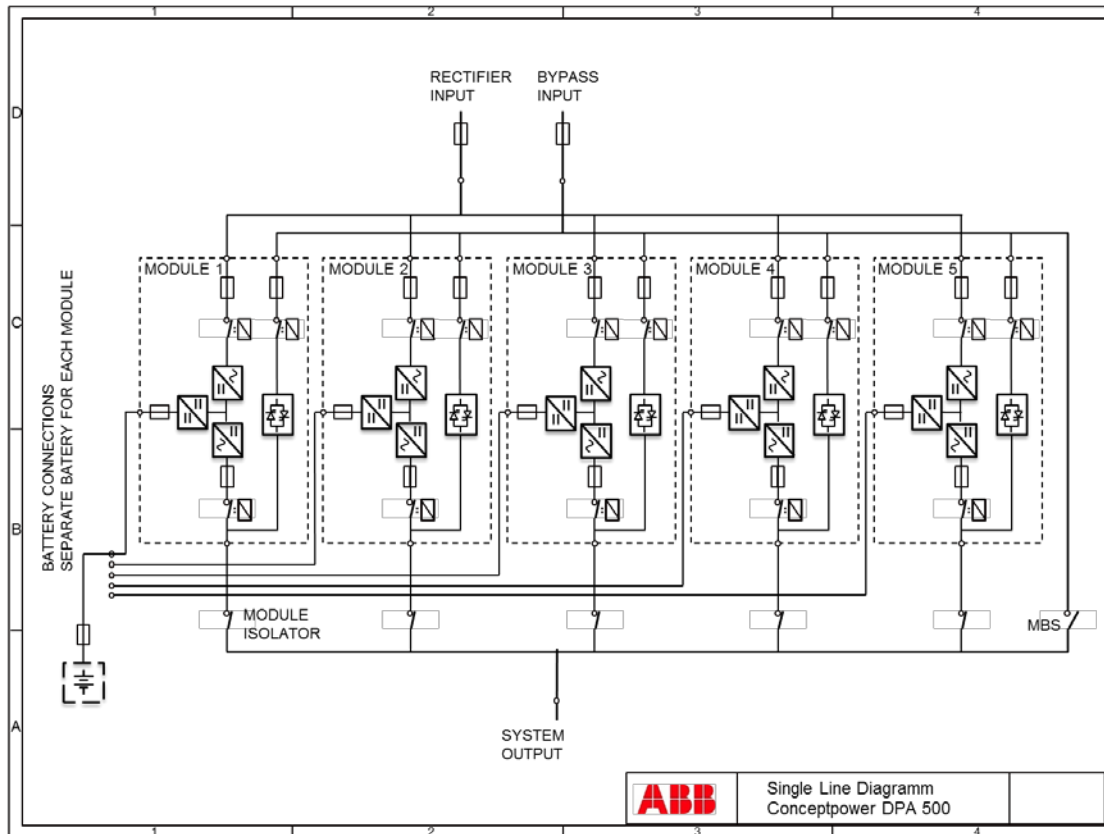
UPS in data center application

The other half of a typical Tier 4 UPS system



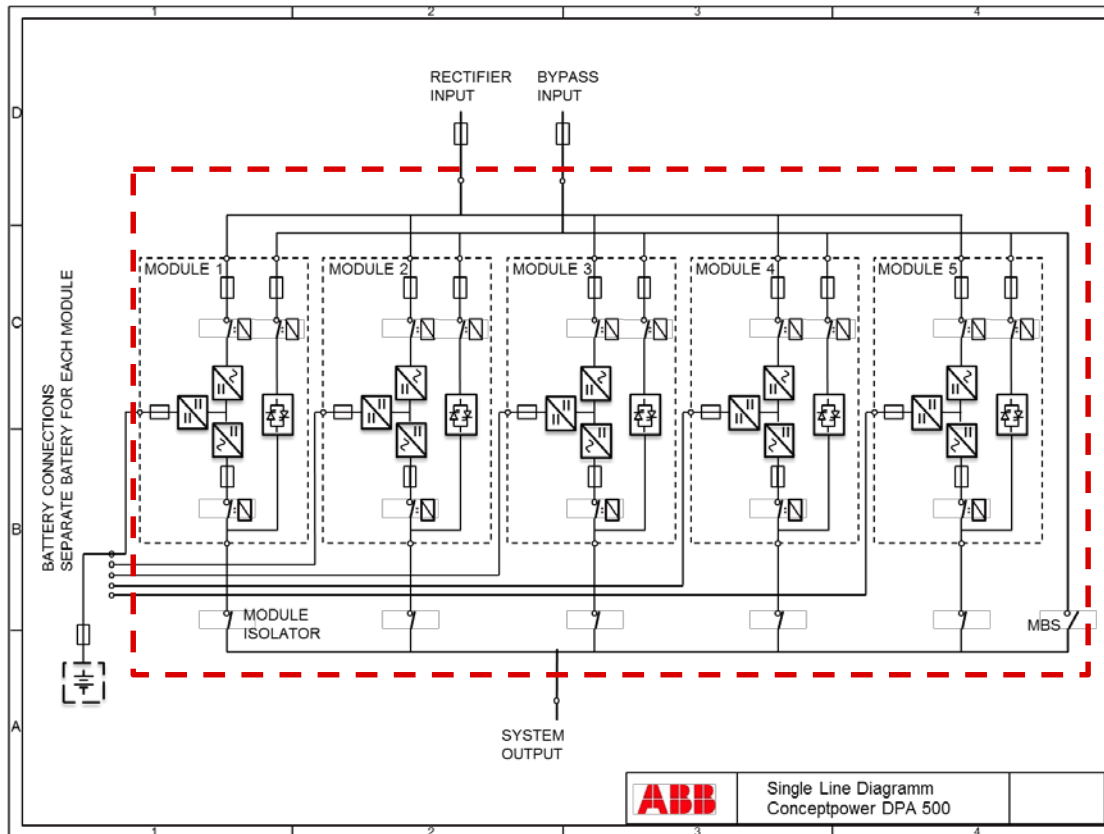
UPS in data center application

Similar arrangement as previous image...



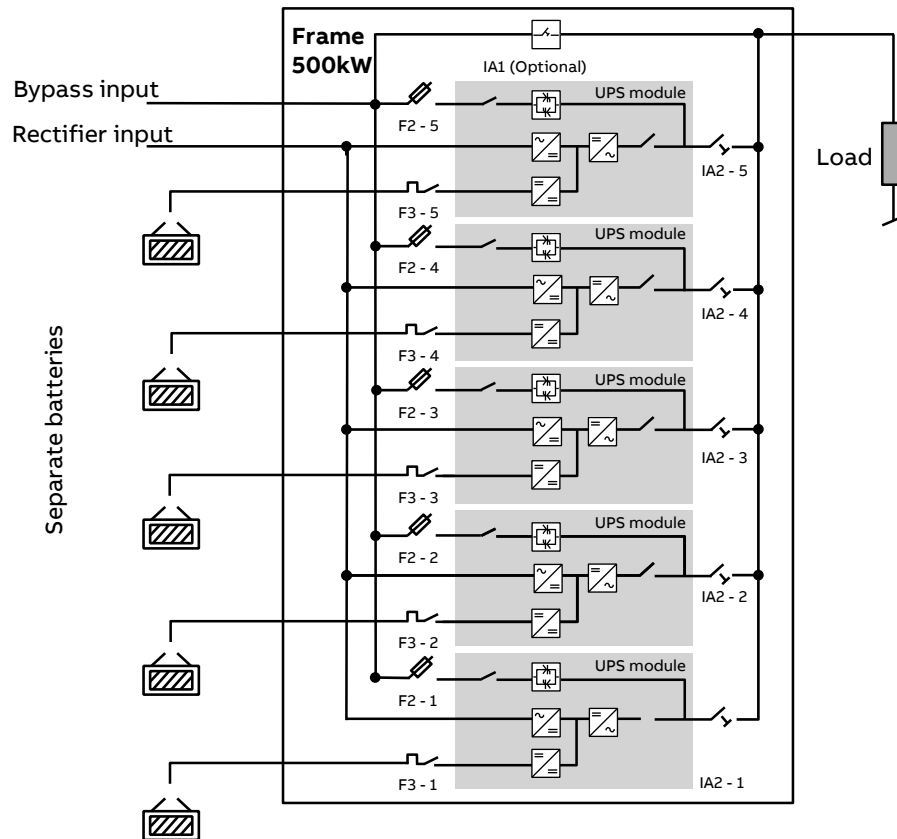
UPS in data center application

Place the equipment inside one frame....



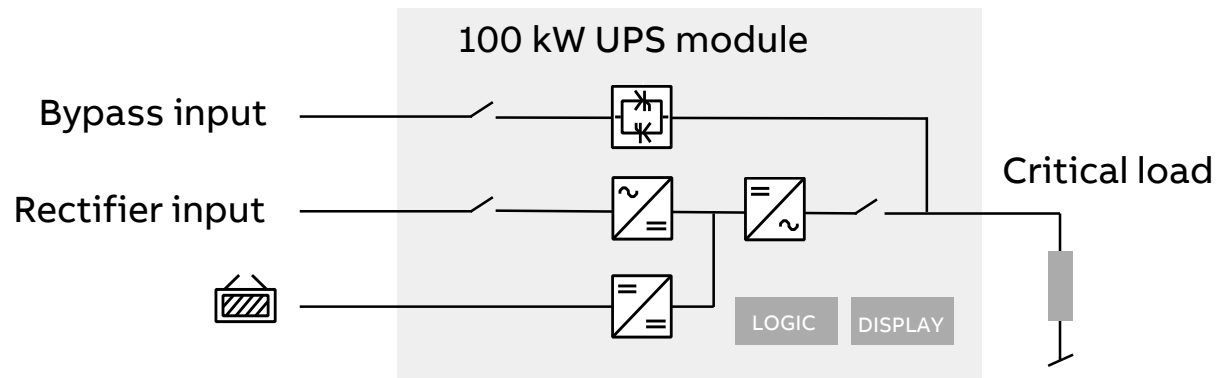
UPS in data center application

... and turn it vertical



UPS in data center application

Evolution of UPS has led to development of higher-power modular solution



100 kW uninterruptible power packed in one UPS module

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Unique, modular UPS solution with superior benefits



Advantages of the modular UPS concept

Maximizing availability

Add redundancy to the system

Modular architecture introduces redundancy to the system automatically.

With **decentralized paralleling architecture** all modules within the system are **truly redundant**. Single points of failure in the UPS system are eliminated.

Minimize chance of human error

Simplicity of service and maintenance of ABB's modular UPS mitigates human error.

Modular architecture allows for implementation of simple and standardized power protection and service concept across installations.

Select high-quality, reliable equipment

Use reliable double conversion UPS technology.

High "Swiss-made" quality with over **20 years experience on modular UPS**.

Typical availability of N+1 modular UPS is 99,9999% (six-nines)

Advantages of the modular UPS concept

Targeting low TCO

Optimize and save on capital investment

- Combines the right-sizing approach with scalability → **pay as you grow**.
 - The same product type can be used in different load segments of different power demand → **standardization helps optimize maintenance and eases operation**.
 - Small footprint saves space.
-

Accelerate speed of deployment

- Product standardization: the same product can be selected to match the needs of each data center and each load segment.
 - Front access and easy wiring allows fast installation.
-

Decrease complexity and costs of service and maintenance

- On-line swappable modules ensures:
- Fast service: one module is swapped/replaced in 15 min!
 - Standardized spare parts.
-

Decrease the operating costs

- With high and flat efficiency in double conversion mode the operating costs can be >40% less compared to UPS of previous generation!
 - Minimize cooling.
-

The concept of modular UPS

What makes it so unique

- Modular design allows power protection capacity to be added when needed to meet the existing demand, instead of total up-front deployment.
- Standardized modular design allows changes to such fundamentals as load criticality, thus needed protection level, installed power quantity and density.
- Modular designs typically include the ability to add redundancy, which increases significantly the system availability.
- Until recently, the advantages of modularity have been available with up to 50 kVA modules for the midrange power sector, only up to 1.2 MW systems.
- Since, ABB has taken a step further.

**ABB (Newave) was the first to offer modular UPS to the market, in 1998
- this delivers a technology advantage and long experience!!**

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Unique solution with superior benefits



Pay as you grow

Scalability and future upgradability guaranteed **with true modular architecture**

Minimize the total cost of ownership

Up to **96% efficiency** ensures OpEx can be minimized as a result of reduced energy losses and lower electricity costs

Increase reliability

Reliable double conversion topology and redundancy across modules makes the system faultproof

Maximize availability

Easy and fast to service; short MTTR thanks to on-line swappable modules

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Product overview and system characteristics

Conceptpower DPA 500

100 – 500 kW uninterruptible power in one frame

Scalability with one to five modules in a frame for 100-500 kW power



Conceptpower DPA 500

100 – 3000 kW uninterruptable power in one system

Six frames can be connected in parallel for amazing 3 MW total system power!

- Multiple benefits follow from the advanced scalability:
- Scaling the UPS capacity to match the load power is simple
- Adding redundancy to increase availability and reliability is easy
- Standardizing UPS system to serve load segments of different sizes is a reality



Conceptpower DPA 500

True modularity with fault tolerant DPA™ architecture

The 100 kW power module

- Each module can operate fully independently, thanks to ABB's Decentralized Paralleling Architecture (DPA™)



The 500 kW UPS frame

- 500 kW secured power in only 1.5 m²
- All modules are fully redundant with each other

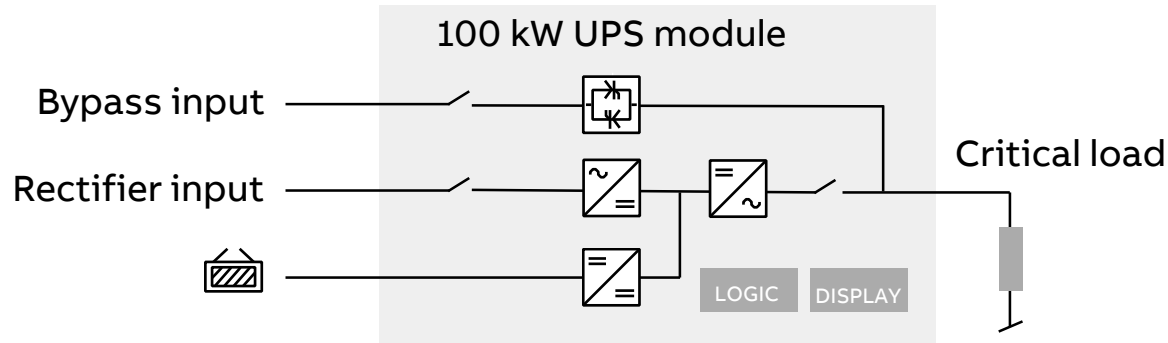
The frame completes the system

- Bypass input breaker, battery fuse and output isolation switch for each module, dedicated
- System maintenance bypass switch as option
- Single and dual input feed supported
- Top and bottom cable entry supported
- The frame supports both separate and common battery arrangement



UPS module

Each 100 kW module is a complete UPS



Proven technology for increased uptime

- **Decentralized paralleling architecture (DPA™)** minimizes central point of failures in the UPS and **maximizes system availability**

Each module embraces

- IGBT rectifier and inverter
- Independent control logic and display
- Battery converter
- Static bypass switch
- Inbuilt back-feed protection

The UPS module

Each 100 kW module is a complete UPS

100 kW module pair is very compact, but easy to service



- Rectifier, booster, inverter
- Battery charger
- Logic control
- User interface (DPA display + mimic diagram)



- Static bypass
- Input and output filters
- Back-feed protection
- Output contactor

The 100 kW module is split into two separate subassemblies, which makes the module handling and service easier as the weight is distributed evenly over both parts.

The UPS module

Each 100 kW module is a complete UPS

Module pair front view



Module pair rear view



- Very robust design
- Strong and practical handles
- Error proof: it is only possible to insert the module pair into the frame in the correct way
- The modules are online swappable thanks to the smart power connectors
- Slide rails are strong and have mechanical stoppers to prevent the module sliding out too far, thus preventing unintentional drop

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All included

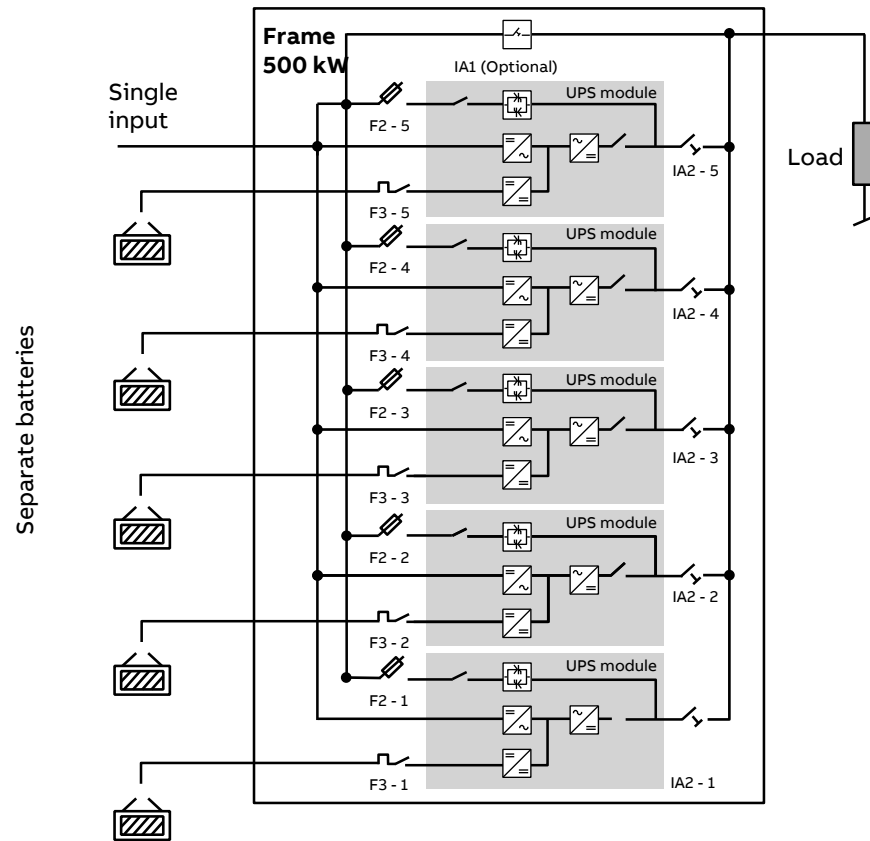
System embraces

1. Up to 5 x 100 kW UPS modules
2. System graphical display (touch screen)
3. Connectivity section for external communication & signaling
4. Module-specific DPA display
5. Maintenance bypass switch (optional)
6. Module isolator (output switch)
7. Module-specific bypass fuses
8. Module-specific battery breaker

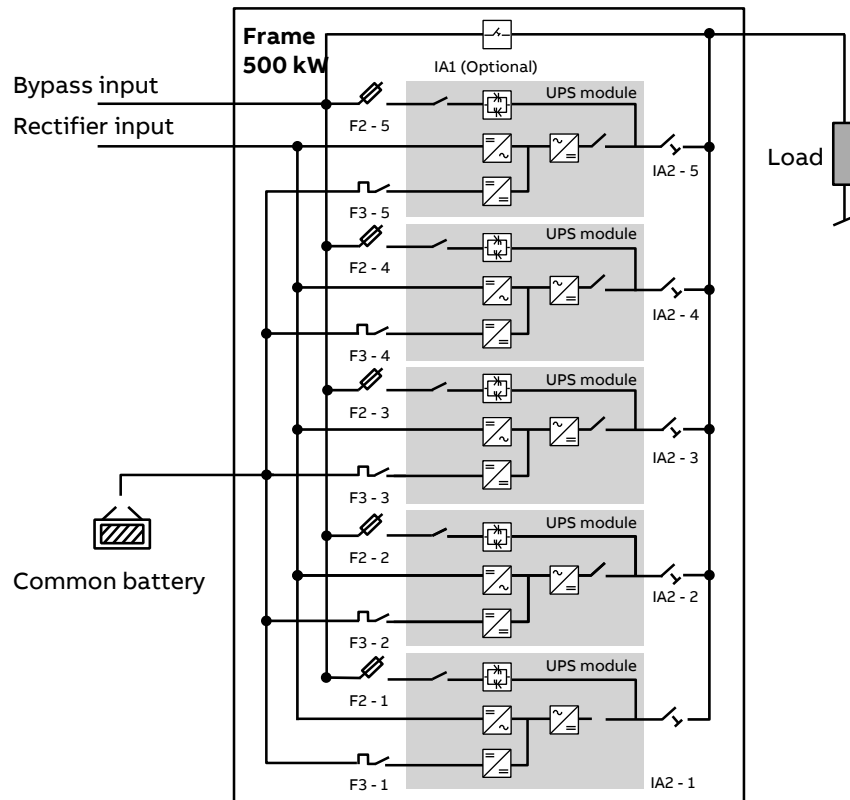
All inclusive!



SLD single input / separate batteries configuration



SLD dual input / common battery configuration

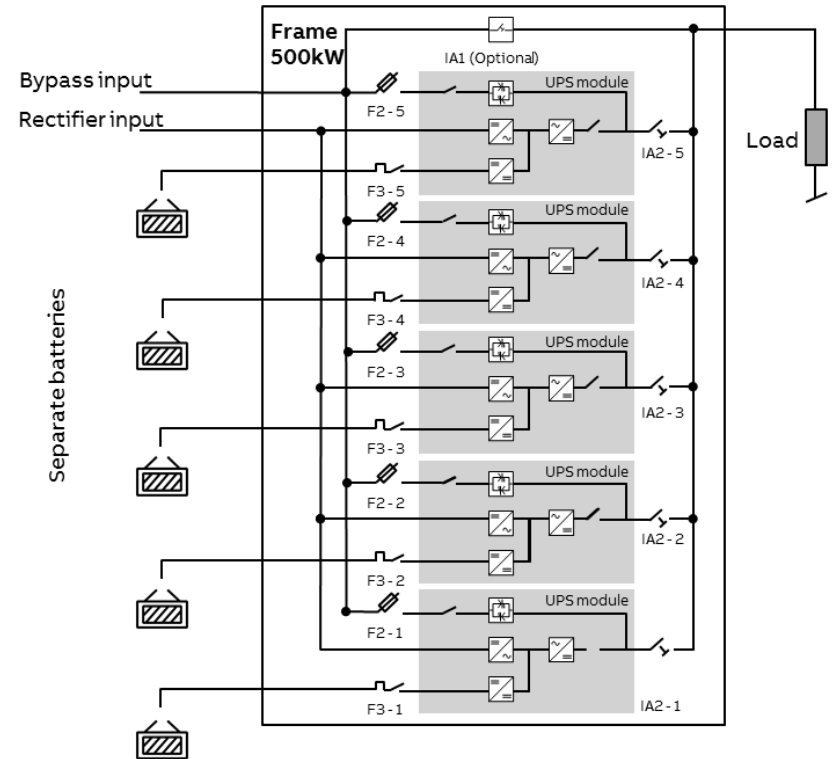


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A complete power protection solution

The DPA system is like a traditional parallel UPS system, except that it is....

- More compact
- Designed to make site planning easier
- Simple to install
- Faster and easier to maintain and operate thanks to sophisticated and reliable modular architecture
- Inherently reliable
- Saving your precious time and money!



Conceptpower DPA 500

Performance characteristics and operating modes

Top-of-the-line performance

Technical specifications

Technical highlights

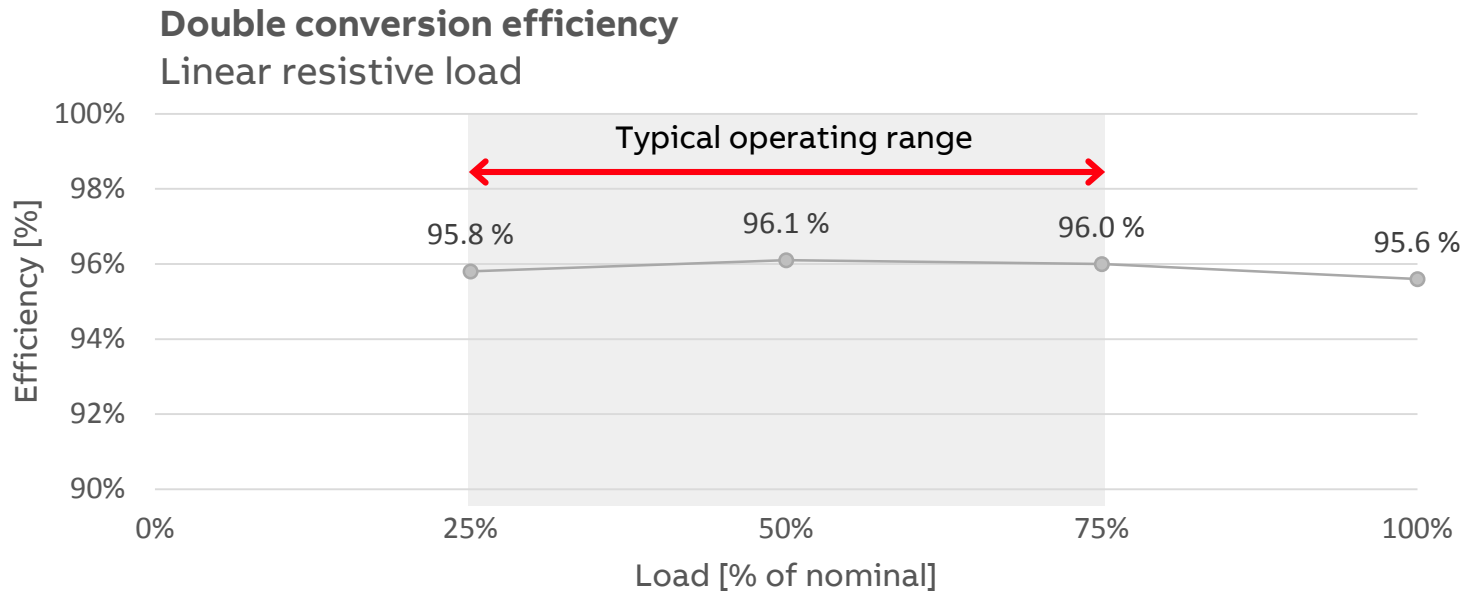
Classification IEC/EN 62040-3	VFI-SS-111
Module power rating	100 kW
Maximum power per frame	500 kW
Paralleling	6 frames (30 modules)
System power range	100 kW – 3 MW
Maximum power (N+1)	2.9 MW
Output power factor	1
Efficiency in double conversion	up to 96%
Efficiency in eco-mode	>99%
Power density per m ²	up to 335 kW/m ²
Input current distortion THDI	< 3.5%
Input power factor (PF)	0.99
Overload on inverter	20 minutes @ 110% load 5 minutes @ 125% load



High double conversion efficiency

Third-party certified, high-performance

- High efficiency **exceeding 96%** minimizes energy losses and costs for operation
- Flat curve: high **efficiency is reached already at low load levels** (eg, 95.8% at 25% load)
- The performance is certified (IEC 62040-3) by Electrosuisse



Xtra VFI – double conversion mode

Intelligent Energy Management

UPS standard modes

VFI – double conversion mode

The default operating mode – efficiency up to 96% (recommended for all critical applications)

VFD – ECO mode

Alternative operating mode – efficiency up to 99% (for ultimate efficiency savings – double conversion on demand)

Bypass mode

Alternative operating mode – efficiency up to 99% (manual selection/automatic transfer in case of eg, overload)

Battery mode

Load supplied from utility through bypass (automatic transfer in case of UPS AC input source not available)

UPS Xtra modes

Xtra VFI – double conversion mode

Double conversion mode with enhanced efficiency when load is low compared to total capacity
(best choice for demanding applications where efficiency is important)

Xtra VFI is a complementary feature to enhance the double conversion efficiency of the UPS when load power is low

Xtra VFI – double conversion mode

Intelligent Energy Management

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UPS Xtra modes

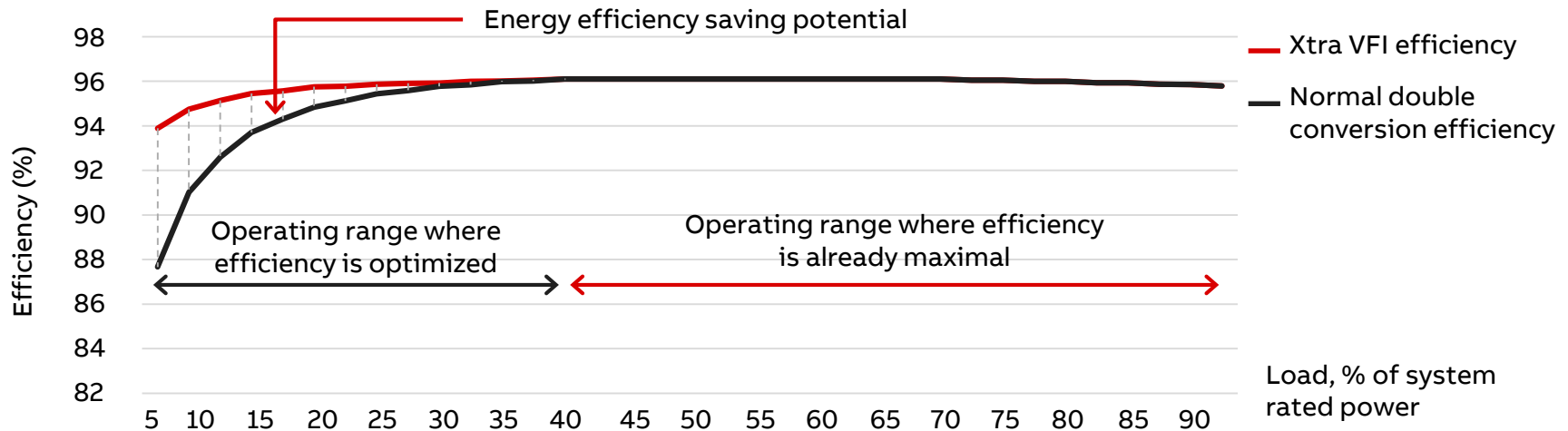
Xtra VFI – double conversion mode

Double conversion mode with enhanced efficiency when load is low compared to total capacity
(best choice for demanding applications where efficiency is important)

Xtra VFI is a complementary feature to enhance the double conversion efficiency of the UPS when load power is low

Xtra VFI – double conversion mode

Enhances efficiency without compromising the critical load



- **UPS maximizes the double conversion efficiency** by engaging UPS modules based on load power
- When load is very low compared to UPS system rated power, the **overcapacity is automatically switched to stand-by mode, in which modules consume much less power and thus help save energy**
- Efficiency improvement is especially significant when load is $\leq 25\%$ of full UPS system capacity

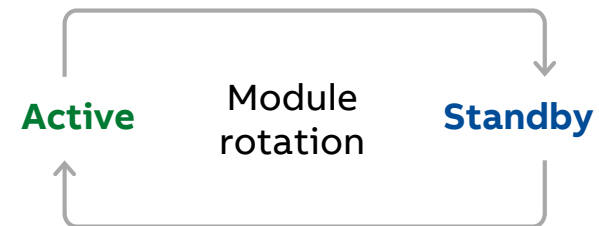
Xtra FVI introduces a secure way to increase significantly the efficiency of systems that do not run on full load from day one!

Xtra VFI – double conversion mode

Set up once, the rest is automatic

Working principle and main features

- Module rotation keeps aging of the modules balanced over time
- The feature scales, automatically and continuously, the UPS system active capacity according to the load power
- Desired redundancy level and the highest expected load step (both set by user) guarantee highest protection level for the load
- Works only if there are no alarms within the system. In case of an alarm, Xtra VFI is deactivated automatically → all modules switch to “Active” status
- Friendly user interface, fast and easy setup
- kWh counter records the total saved energy



Xtra VFI – double conversion mode

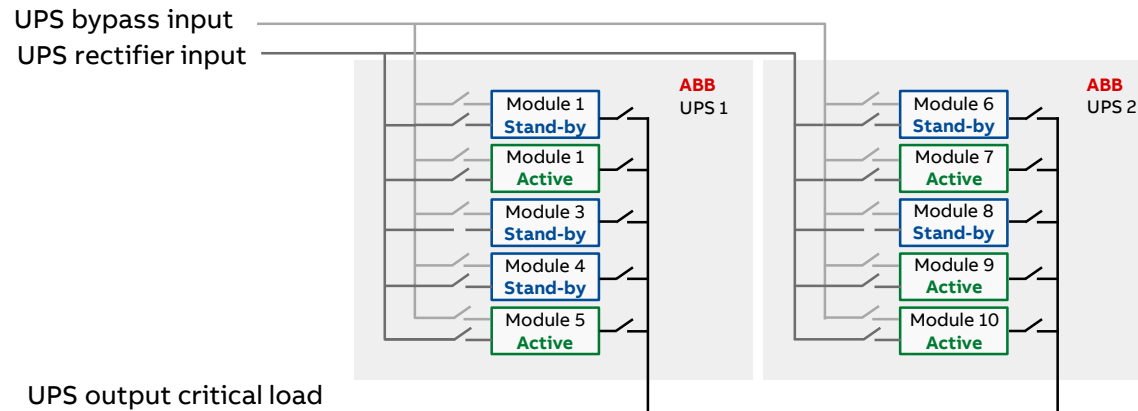
UPS module state of operation

- Active**
- The UPS module is operating in double conversion mode and supplying the load with other active modules.
 - Loading of the module is equal to full load divided by number of active modules.

- Standby**
- The UPS module is on standby mode with the inverter switched off.
 - Ready to transfer to active double conversion mode in case needed.

- Alarm**
- The UPS module has detected an abnormal condition. Depending on the alarm status, the module may disconnect itself from the system to prevent further malfunction or damage. The remaining UPS modules are all activated until the alarm is cleared.

- Off**
- The UPS module is manually turned off and isolated from the system.



Xtra VFI – double conversion mode

Calculation example

System setup

Number of modules in system	15	modules
Minimum redundancy	1	module
Module rating	100	kW
Load	150	kW
Electricity cost	0.1	EUR/kWh

Case 1: Xtra VFI disabled

Number of active modules	15	modules
Active module operating point	10%	of nominal load/ module
Active modules efficiency	92.80%	
System efficiency	92.50%	(approximate)

Case 2: Xtra VFI enabled

Number of active modules	3	modules
Active module operating point	50%	of nominal load/ module
Active modules efficiency	96.00%	
System efficiency	94.50%	(approximate)

Savings

Efficiency gain	1.90%	
Power losses reduction	4.65	kW
Annual savings	4,077	EUR
Savings over 3 years	12,230	EUR

Small things make a big difference

- Xtra VFI helps adapt UPS capacity to load changes without manual interference
- In the example on the left, module operating point is forced to most optimal 50% loading - this **increases the active module efficiency to 96.1%**
- Stand-by modules consume significantly less power than when supporting load actively



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Energy storage

Conceptpower DPA 500 – energy storage

The choice is yours

Variety of different energy storage solutions can be applied

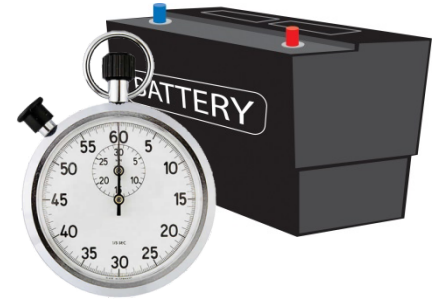
- VRLA batteries
- Nickel cadmium batteries
- Lithium-ion batteries ¹
- Flywheel solutions
- Etc.



¹ Please consult with your local ABB sales support or reselling partner for details and validated configurations

Conceptpower DPA 500 – energy storage

Flexible runtimes with VRLA batteries



Flexible battery configuration

Number of battery blocks (12 V) selectable from 40-50

- Batteries can be sized for exact match
- Straightforward re-use of batteries of old, replaced UPS

Most common battery runtimes with standard configuration

- The line-and-match battery cabinet supports
 - 2 x 50 x 28 Ah → 5-6 min @ 100 kW load
 - 3 x 40 x 28 Ah → 8-9 min @ 100 kW load
- Longer autonomies supported thanks to the powerful battery charger (up to 60 A charging capacity at full 100% nominal load)

Separate and common battery arrangements supported

- Separate battery arrangement allows full redundancy thanks to module-dedicated batteries
- Common battery arrangement for cost optimization and maximized runtime relative to capacity

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Frame cabinet design details

Conceptpower DPA 500 – frame cabinet design

Compact and requires front access only for service

Front



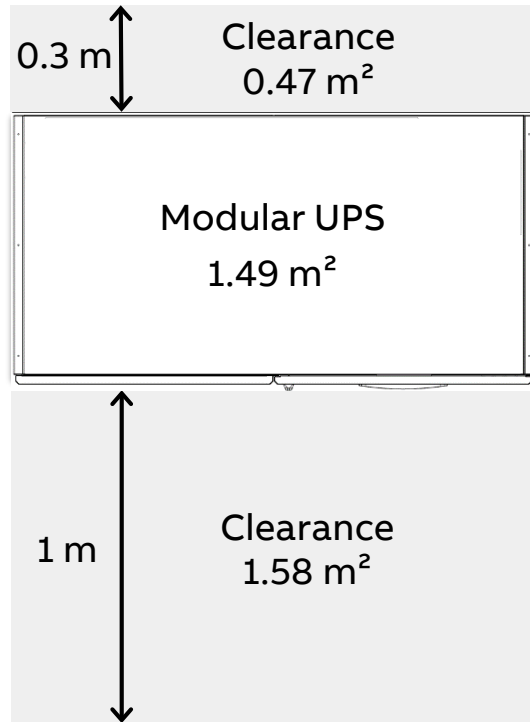
Back



Compact and space-saving cabinet occupies only 1.5 m² footprint
Only front access needed for installation and service!

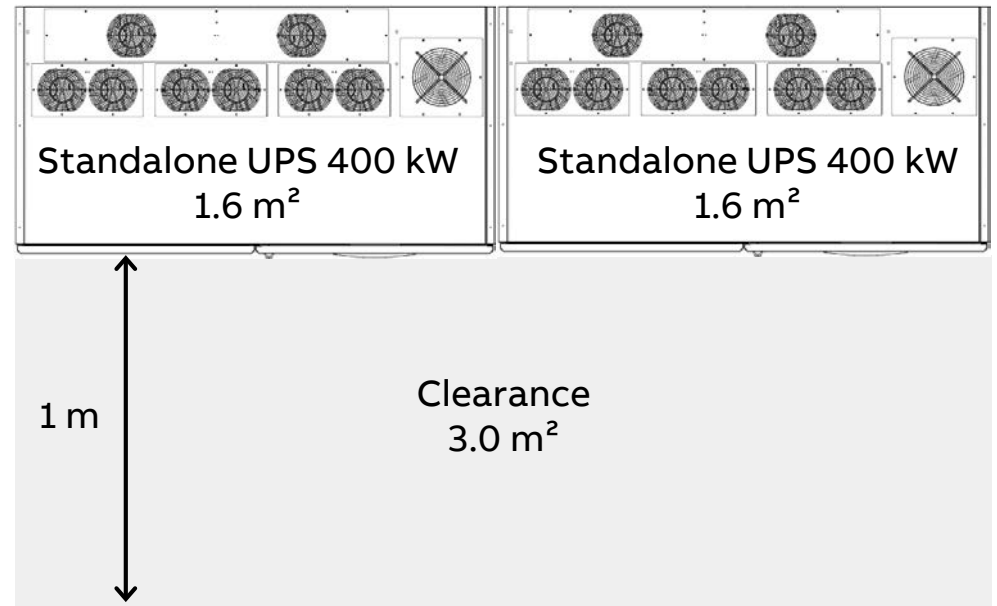
Footprint modular vs standalone UPS

Comparison example for 400 kW N+1 redundant



Total footprint 3.53 m²

>3 m² saved!



Total footprint 6.84 m²

Conceptpower DPA 500

Mechanical design highlights

Small details make all the difference

- Very compact design occupying less space
 - Footprint = 1.49 m²; power density (500 kW) = 335 kW/m²
- Light weight
 - Empty frame = 430 kg; fully equipped (500 kW) = 975 kg
- Top / bottom cable entry and front serviceable (no extra cost!)
- Single and dual feed supported (no extra cost!)
- Per module separate and common battery configuration supported (no extra cost!)
- Terminal bus-bars with a lot of space around them
- Smart module mechanical design allows easy servicing
- Split module makes sure the weight of each part is reasonable: active module = 55 kg, passive module = 54 kg

Conceptpower DPA 500

All included

System embraces

1. Up to 5 x 100 kW UPS modules
2. System graphical display (touch screen)
3. Connectivity section for external communication & signaling
4. Module-specific DPA display
5. Maintenance bypass switch (optional)
6. Module isolator (output switch)
7. Module-specific bypass fuses
8. Module-specific battery breaker

All inclusive!



Conceptpower DPA 500

User interface, software and connectivity

User interface

Graphical, touch screen system display

Intuitive graphical display is easy to navigate

- 7" touch screen interface
- Interactive mimic diagram
- Colored and graphical display
- Integrated buzzer for alarms
- **18 languages** selection
- Extended events log (1,000 events)



Clear system overview, measurements and system status.

Navigation into module level, module level measurements and status.

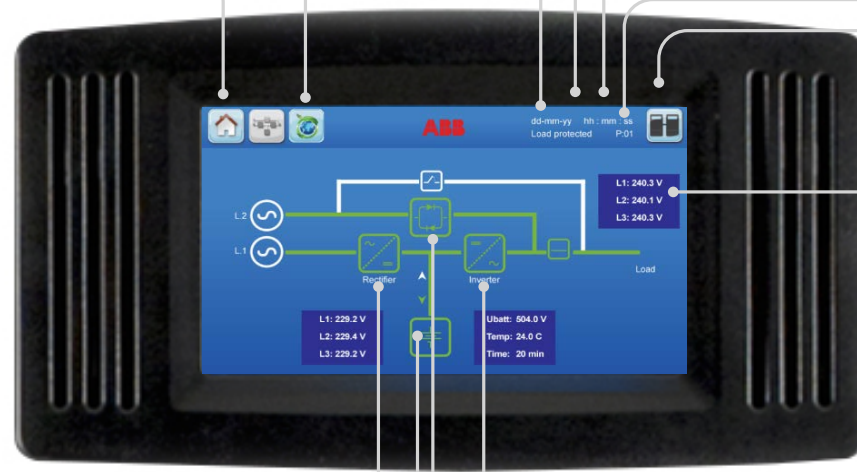
System level commands.

User interface

Graphical, touch screen system display

Quick access to Xtra VFI status
Quick access to service, operation and information menus

System status
Time
Date
Parallel/single
Access to module level

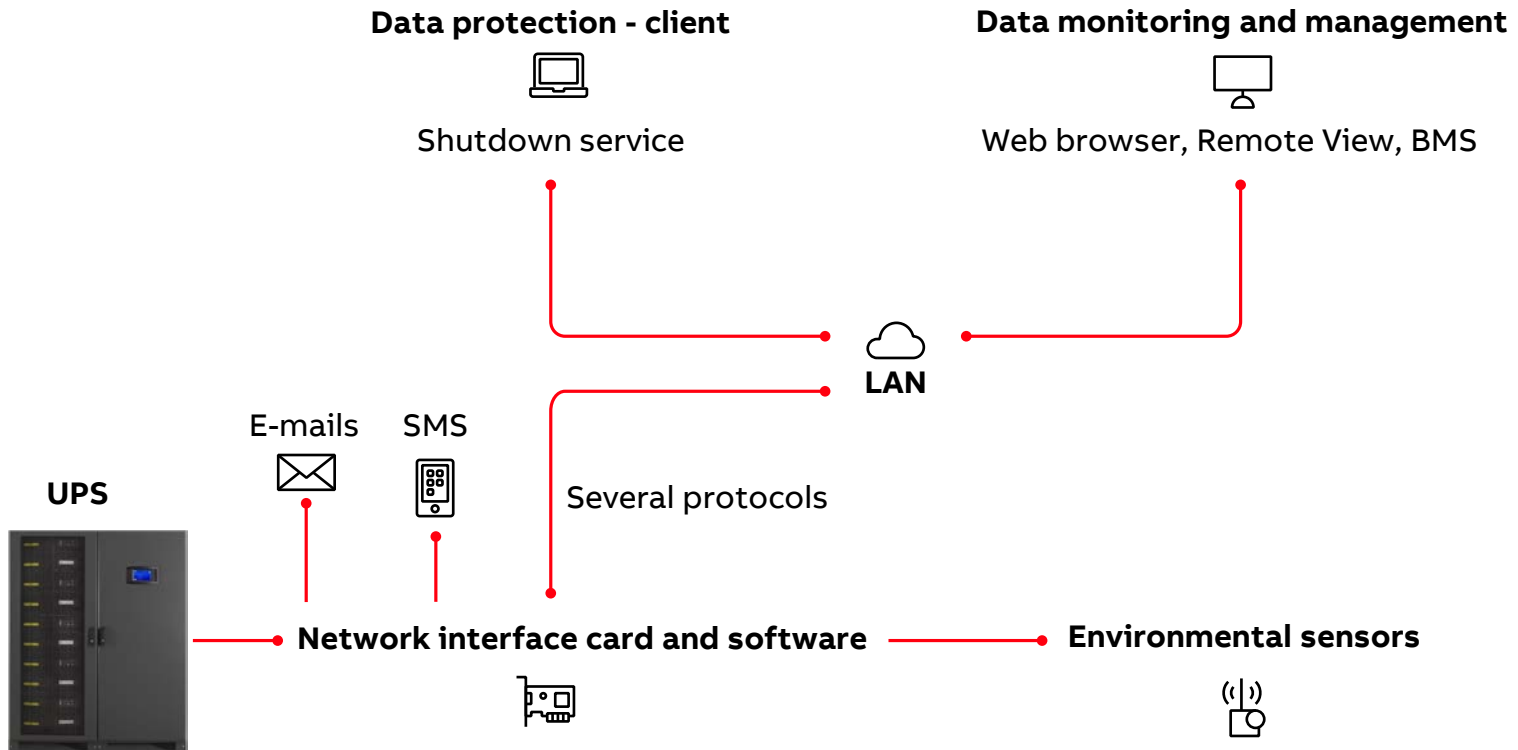


System status

Direct access zones to specific menus

Connectivity

Options and possibilities



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Maintenance & service

Conceptpower DPA 500

Straightforward service concept

Benefits of modularity for maintenance and service

- Simplified spare parts inventory and minimized total value means **minimized investment**.
- Standardized service practices means **minimized risk of human errors!**
- Fast and easy service: **one module is swapped/replaced in 15 min while the rest of the system remains in online mode!**
- Concurrent repair possible simply by swapping a module.
- Front access and easy wiring allows fast and safe installation.



Operator training can be standardized and simplified since the UPS system is a standard solution.

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Applications

Conceptpower DPA 500

Designed to secure continuity of critical operations

Applications

- Mid-size, large and containerized data centers
- Server rooms, office floors and other IT applications
- Industry process automation
- Other critical applications



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Allows for standardization of power protection concept

Modular architecture allows the end user to:

- Optimize the solution according to the needs of each data center or each load segment.
- Increase the system availability and make savings due to simple and standardized power protection concept.
- Streamline and simplify service concept, which minimizes chances for error, is cost-efficient and maximizes availability.



Small or big



...growing



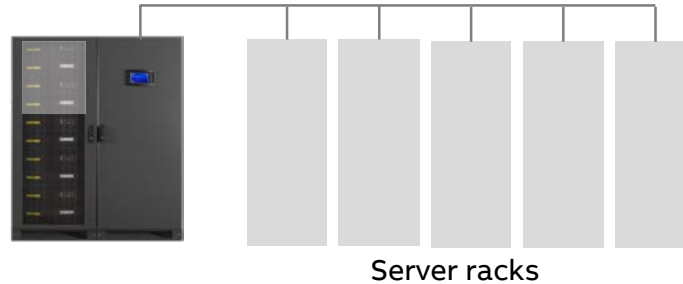
...modular

Data center application

Scalability example – distributed end-of-row concept

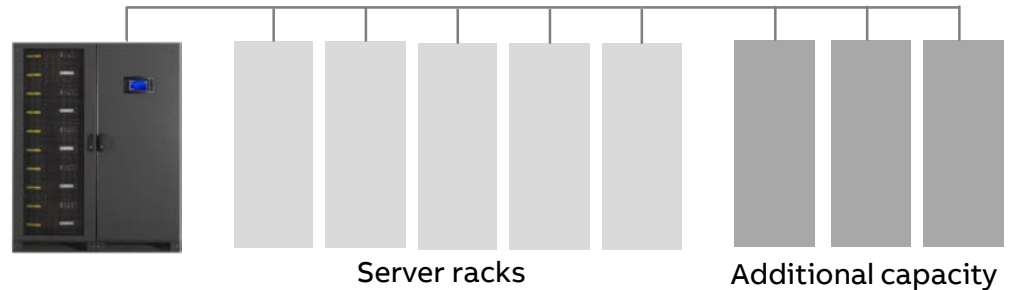
Conceptpower DPA 500 200 kW (N+1)

Starting with small server load



Conceptpower DPA 500 400 kW (N+1)

With increased number of modules for capacity



Typical one-rack-row power demand can vary from 20 kW to hundreds of kilowatts. Only a modular UPS is capable of adapting to changes of power demand in a growing infrastructure.

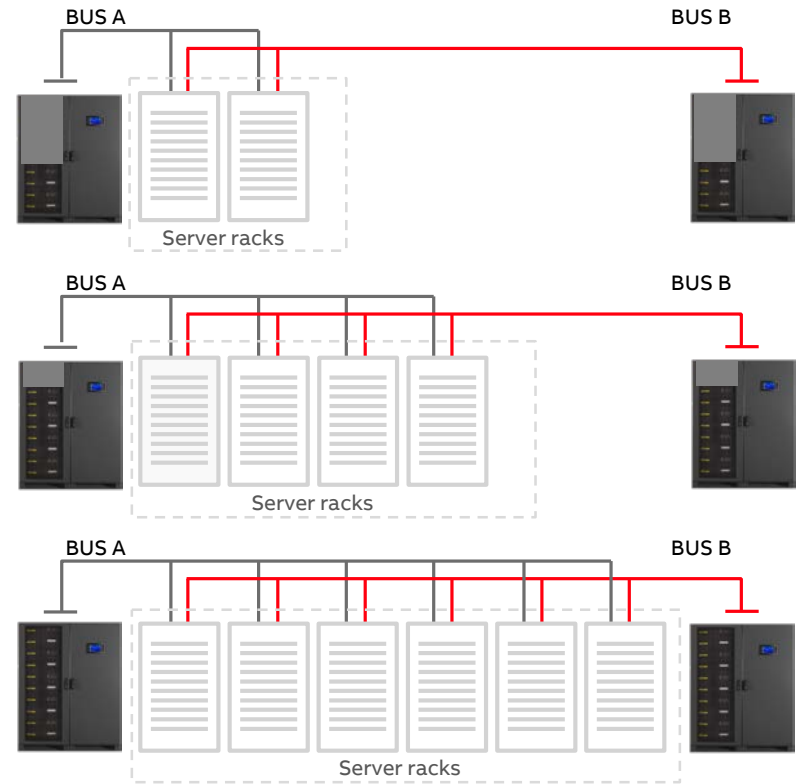
Conceptpower DPA 500

Scalability example – distributed end-of-row Tier IV

Typical Tier 4 arrangement:

Typical Tier 4 one-rack-row built using decentralized power protection concept.

Only a modular UPS is able to adapt to changes of power demand in a growing infrastructure!

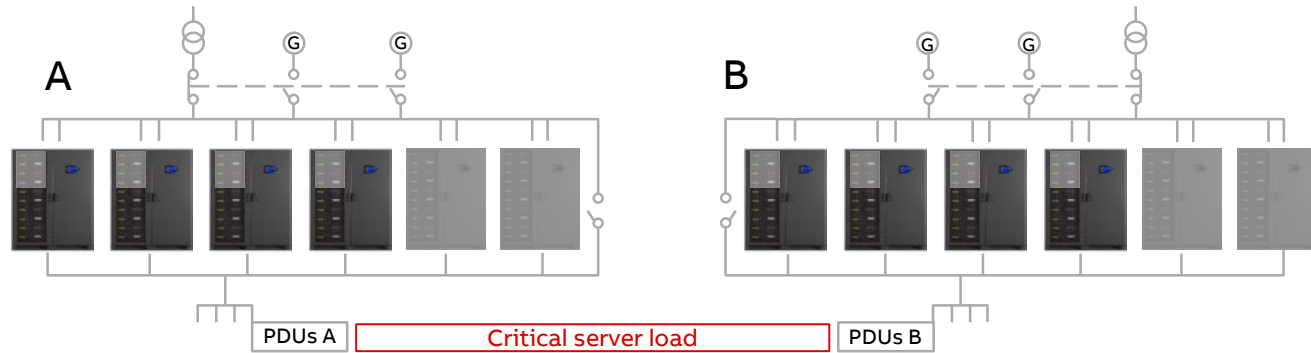


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Scalability example – centralized Tier 4

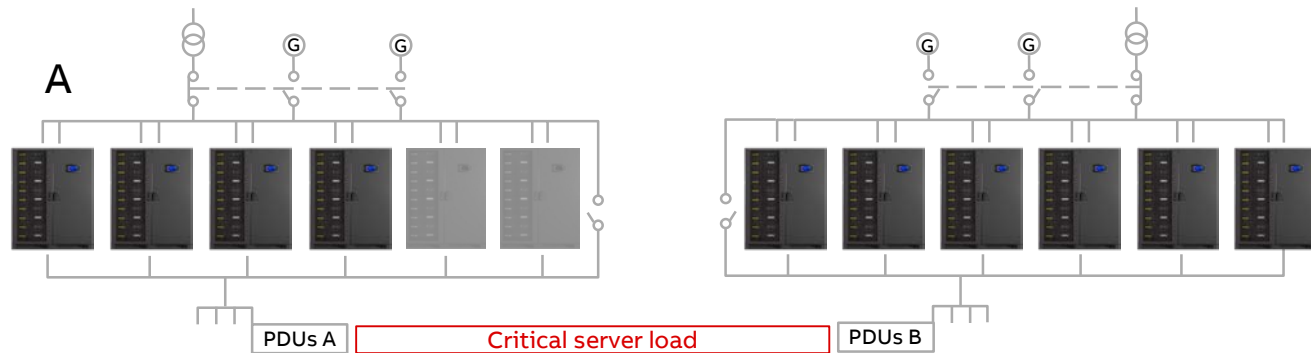
Stage 1

4 x 300 kW
(A and B feed)



Stage 2

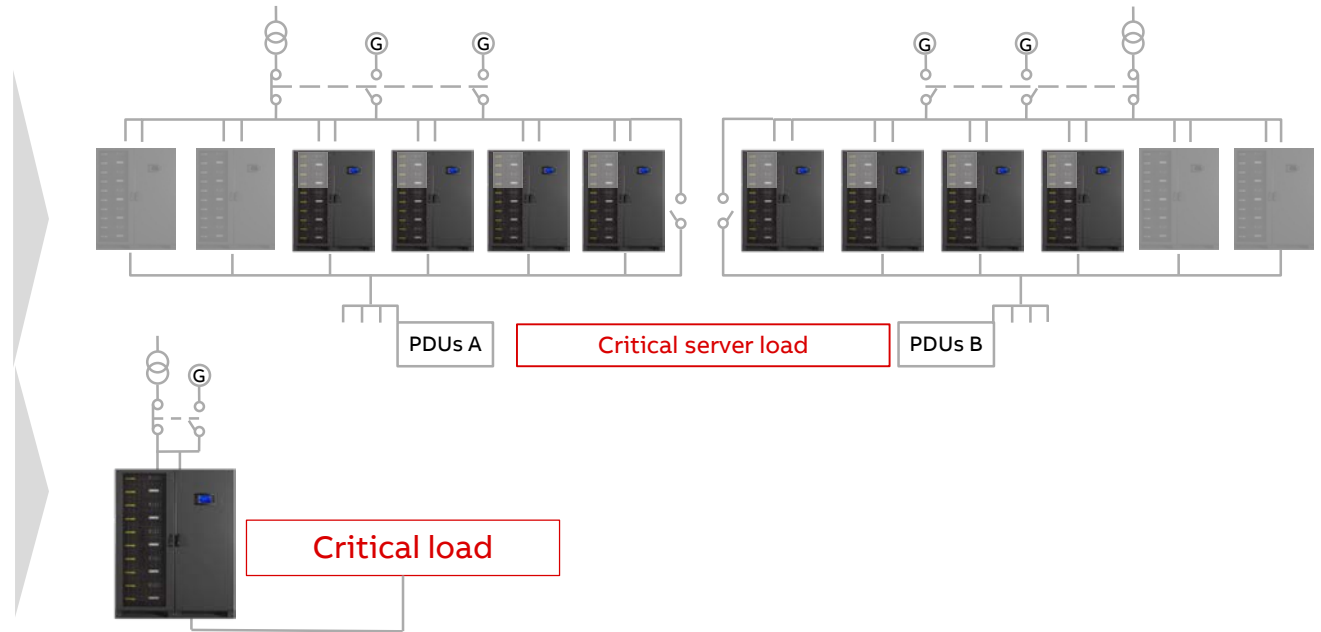
6 x 500 kW
(A and B feed)



**Power demand can vary greatly, from 500 kW up to 3 MW and above.
Only a modular UPS is able to adapt to changes in power demand in a changing infrastructure!**

Conceptpower DPA 500

Allows for standardization of power protection concept



The same UPS module is the basic building block for a large variety of applications.

Conceptpower DPA 500

Reliable, uninterrupted power for critical applications

Up to five 100 kW modules in one single cabinet for up to 500 kW power



Up to six 500 kW cabinets in parallel configuration for up to 3 MW power

Highest availability – zero downtime

- True redundancy with fault-tolerant DPA architecture
- Fast and easy maintenance without downtime with online swappable modules (OSMs)
- True scalability: flexible power upgrades and downgrades (100 kW steps)

Lowest total cost of ownership (TCO)

- Modular architecture: optimized initial investment – pay as you grow
- Compact size and small footprint
- Reduced energy cost with high double conversion efficiency, 96% (Eco-Mode >99%)
- Concurrent, fast maintenance

ABB