APPLICATION NOTE

Continuous Power solutions for Containerized power distribution in Data Centers

1750kW N+1 IT Loads | IEC Solution

Are you searching for perfect coordinated UPS and power distribution solutions for IT loads? Take a look at the pre-designed ABB solution.
UPSs play a vital role in providing power continuity for IT loads in a data center, but a perfect continuous power solution must include a resilient power distribution system coordinated with the UPS.

What is continuous power distribution with UPS?
It is the capability of coordinating Uninterruptible Power Supply apparatuses with upstream and downstream protection devices. If you need a reliable power distribution system to supply your IT loads, ABB pre-designed solutions are the right choice.

Why you need an UPS solution for distribution selectivity
Uninterruptible Power Supply apparatuses ensure continuous power is supplied to critical loads under specific installation conditions, while if a feeder fails, continuous operation is ensured through proper coordination with the protection devices, provided that only the breaker of the feeder affected by the fault cleans the overcurrent.

Main benefits

Secure Uptime & Reliability
N+1 redundancy and pre-designed selectivity.

Sustainability
Improves reliability while minimizing environmental impact, reducing energy losses, operating costs and use of resources.

Modular design
Compact solution suitable for containers.

Battery Lifetime
10-year performance warranty, lower total cost of ownership.

Typical containerized power distribution solution for IT Loads in Data Centers

The typical containerized architecture of a power distribution solution for IT loads in data centers includes incomings for supplies from the utility and an alternative power source, typically a generator to safeguard against the risk of downtime. Distribution then passes through an Uninterruptible Power Supply (UPS) system, which provides short-term power when the input power source fails while protecting critical components against voltage spikes, harmonic distortion and other common power problems.

To ensure good operating conditions for the UPSs and batteries, a suitable cooling system must be provided inside the container.

Key characteristics of AC power distribution for IT loads in data centers:

- Connection to the utility and to back-up generator
- UPS and batteries sized to sustain IT loads
- Supply to Remote Power Panels (RPPs) typically at 400V.

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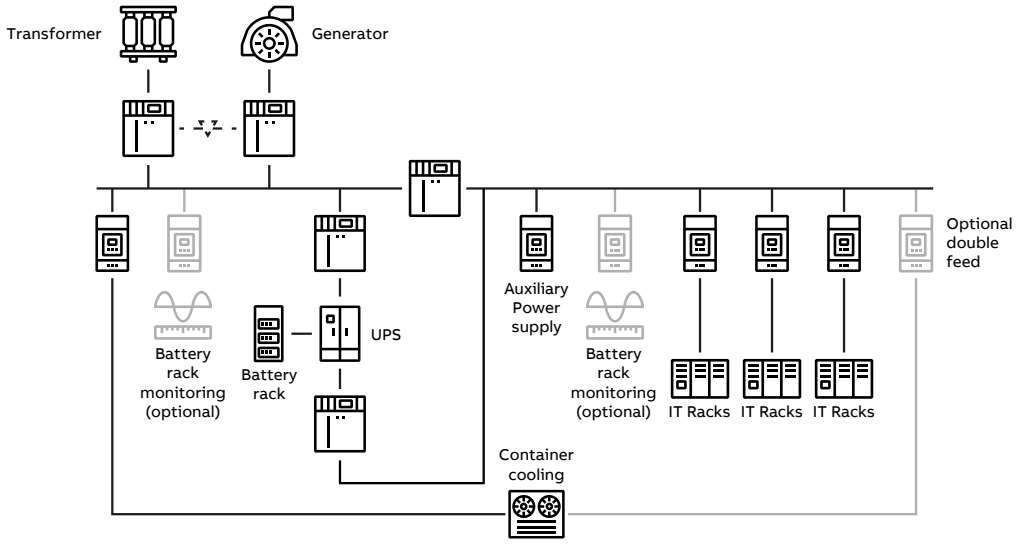
Fig.1
Containerized power distribution system for IT Loads



Continuous Power solutions for Containerized power distribution in 1750kW N+1 IT Loads in Data Centers

Our architecture solution for IT load power distribution is fed fed by the utility in the normal operating mode, while a transfer switching mechanism between the transformer breaker and a second incoming breaker enables the supply to be provided by backup power generation.
1750kW IT loads with N+1 redundancy are fed by two modular UPS connected in parallel. ABB MegaFlex DPA is a 3ph transformerless Uninterruptible Power System (UPS). It is a true modular online double conversion UPS with performance qualification code VFI-SS-111, which provides quality power for sensitive equipment. Each UPS features 1000kVA power capacity and consists of 2 UPS frames with up to 4 DPA Modules with 250kW rated power.
A lithium-ion battery type has been chosen for the battery rack solution. The battery monitoring system is available as an option.
Suitable direct current protection devices and feeders to supply the battery monitoring system are also included. A system for cooling the UPSs and batteries is also required if the solution is to be installed in a container; this cooling system can be redundant as an option.

Since the reliability of electrical distribution infrastructure in data centers is one of the key design factors and to ensure high availability, given the sensitive nature of IT loads which need clean and continuous power supplied through a UPS, selectivity coordination of different protection devices (upstream and downstream of the UPS) during faults plays a vital role in increasing the availability of the electrical network. To speed up the design stage, ABB has created standard building blocks for data centers by taking into consideration parameters such as breaker sizing, selectivity based on the UPS and bypass characteristics, including maximum input current, overload capability, short circuit and selectivity, as defined by IEC 60947-2 “Low voltage Equipment – part 2: Circuit breakers”.
There are generally two types of selectivity: “Total selectivity”, where selectivity is achieved for all the short circuit current values up to the maximum capacity of the downstream breaker, and “Partial selectivity”, achieved only up to a certain level before the upstream breaker trips. In this application, all the protection devices upstream and downstream of the UPSs have been dimensioned to obtain “Total selectivity” using the Site Planning Tool, which allows you to select protection devices upstream & downstream according to any ABB UPS used.

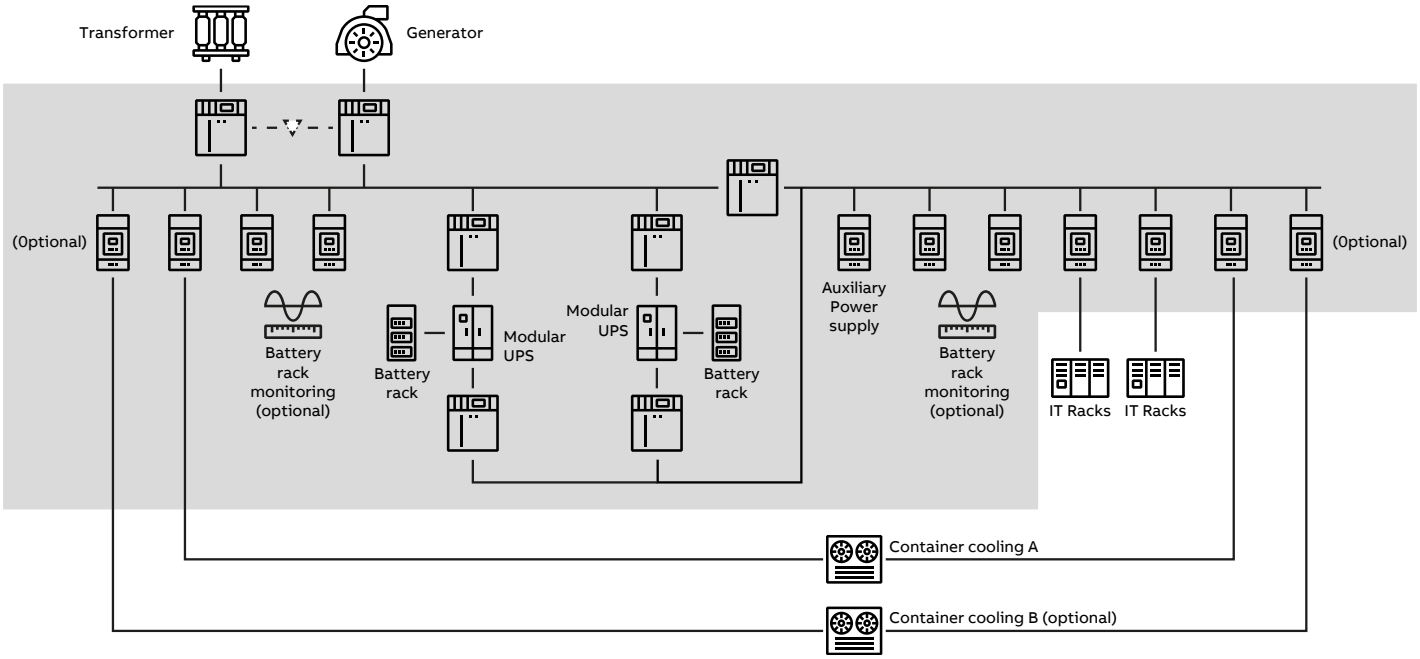


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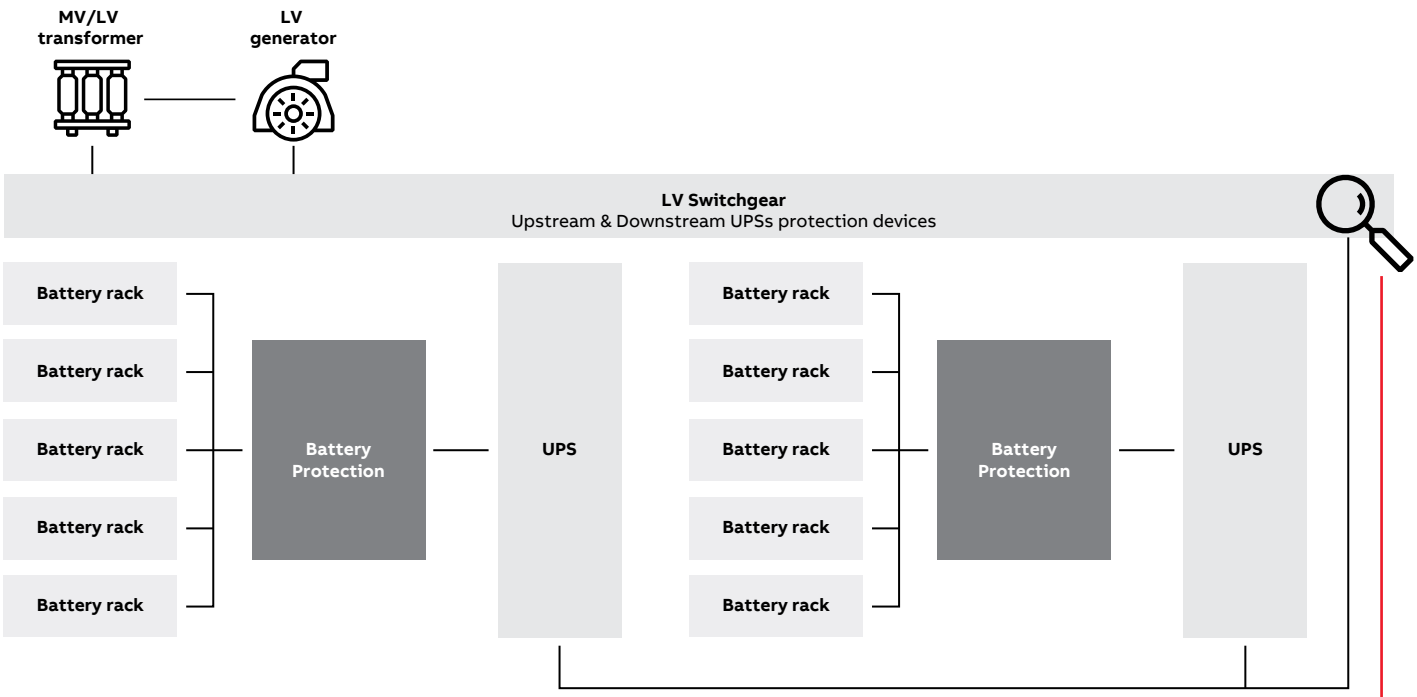
Fig.2
Containerized continuous power distribution solution for 1750kW IT Loads with N+1 redundancy

Input Data		
Rated AC Voltage	[V]	400
Total IT Loads	[kW]	1750
UPS rated power	[kW]	1000
Number of UPS cabinets in parallel		2
UPS redundancy		N+1
Number of modules per UPS		4
Rated power of UPS Module	[kW]	250
Rated AC Voltage	[V]	400
Transformer rated power	[kVA]	2500
Generator rated power	[kVA]	2500
Type of battery		Lithium-ion
Battery Nominal Capacity	[kWh]	34.6
Battery number of modules per rack		17
Number of battery racks		5 per UPS
UPS & Battery rack cooling rated power	[kW]	70
Operating DC Voltage	[V]	From 435 V to 571.2 V

Single-Line Diagram:

ABB offering (IEC)

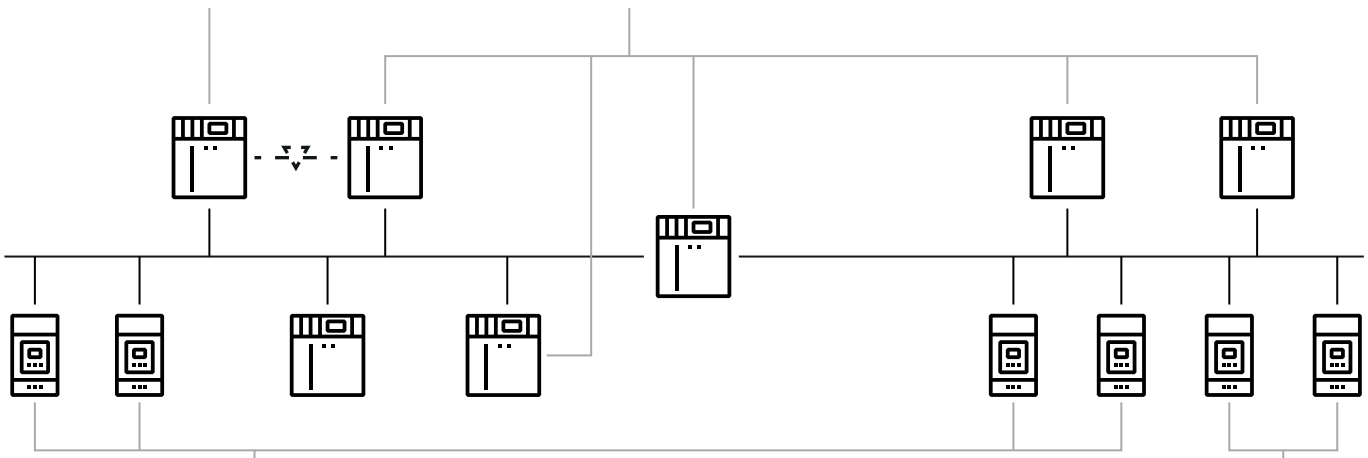


Automatic transfer switch controller

Air Circuit Breakers

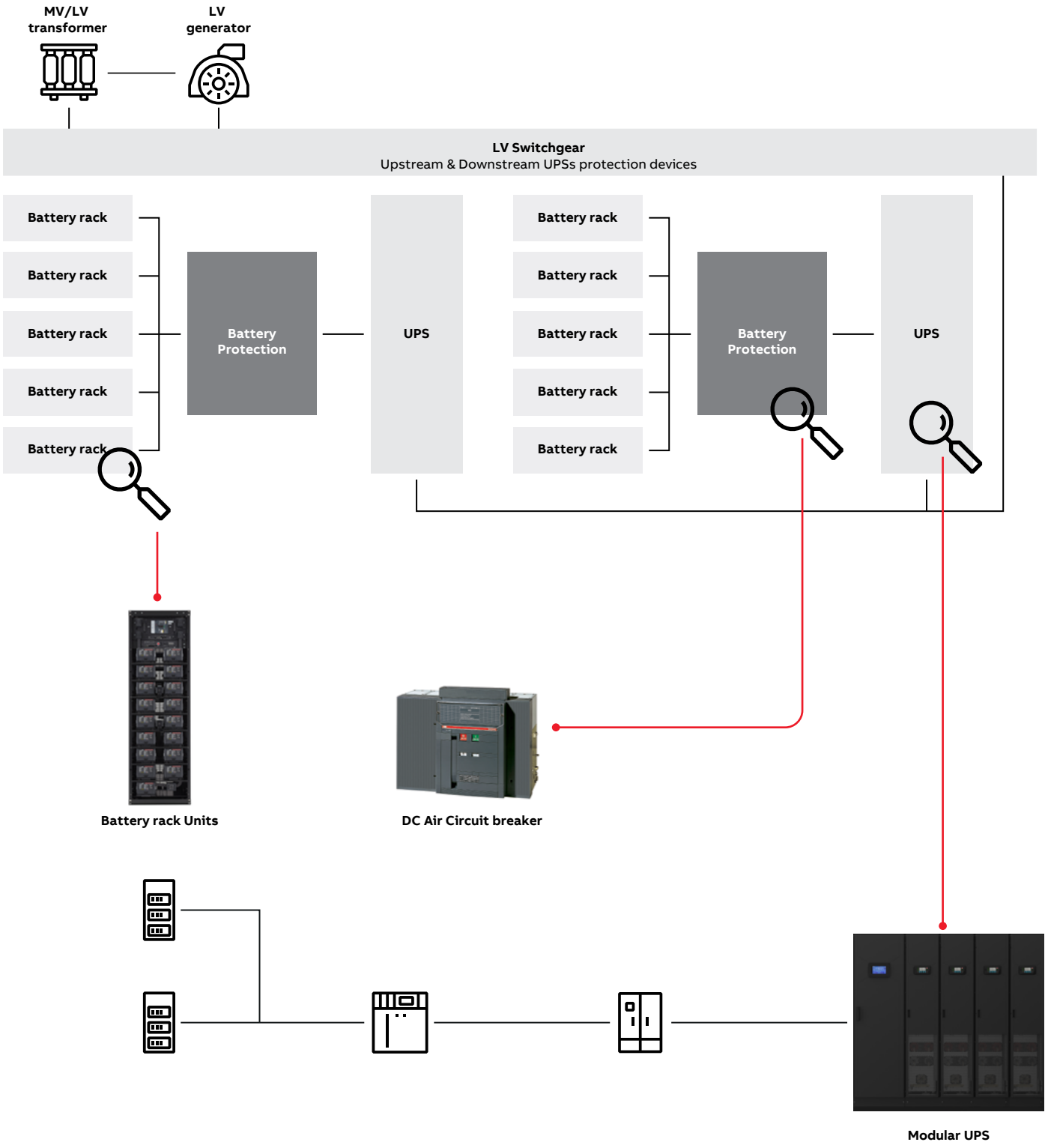
Main LV Switchboard components
Incoming breakers: ACB Emax 2 (E4.2)
Bus Tie breaker: ACB Emax 2 (E2.2)
UPS incoming breaker: ACB Emax 2 (2.2)
UPS outgoing switch disconnector: Emax 2/MS switch (E1.2/MS)
Feeder for IT loads: MCCB Tmax XT (XT5)
Other feeders: MCCB Tmax XT (XT2-XT1)

Note: breakers have been selected to ensure total selectivity



Thermomagnetic
Molded-case circuit breaker

Electronic
Molded-case circuit breaker



UPS & Battery Rack components
MegaFlex DPA 1000kW frame with UPS modules.
ABB Network card for remote monitoring of the UPS
Battery Rack Unit provided with BMS for monitoring. Each rack cabinet is supplied with an individual protection device.
Emax E4S 3200PR123/DC In=3200A 3p (installed inside Main LV switchgear). Protects DC distribution to 5 battery rack units

MegaFlex DPA Modular UPS

The UPS is the main component of the system that supplies IT loads. Not only does it ensure continuity of supply but also power quality, by eliminating all voltage and frequency disturbances.
A certain redundancy of the UPS must be provided, depending on the desired tier level. Since the power of IT loads is extremely fluctuating, use of a system with monobloc UPSs in parallel would have a high impact on project costs as well as on the energy efficiency of the data center. To reduce the footprint and increase energy efficiency we offer a modular UPS with 250 kW modules since in this solution, the modules are activated according to load power thanks to the XTRA-VFI, thereby maintaining a high-efficiency level in every working condition. In the Xtra-VFI Mode, the UPS system adapts power capacity to the partial AC load by setting the unused UPS module to the standby mode. The remaining UPS modules operate in the double conversion mode. The UPS system decides autonomously which UPS module must set to the standby mode. The system rotates/swaps the UPS modules between the double conversion mode and standby mode, thereby extending their lifespan and equalizing the aging process.

MegaFlex DPA - The best in power protection

From 250 kW to 1,000 or 750 kW N+1

- Connection frame 1,000 kW
- Power frame with four slots
- Up to four power modules

ABB MegaFlex DPA 750kW N+1 or 1,000kW at first glance

EcoSolutions Label

The MegaFlex DPA™ Uninterruptible Power Supply (UPS) has become the first Smart Power product to earn ABB's new EcoSolutions label, reflecting the focus on circularity and sustainability that guides our product development process.
To earn an EcoSolution label, a product must first obtain an independently verified Type III ISO:14025 Environmental Product Declaration. It must then meet a minimum of four ABB sustainability targets, one from each of the key stages in its lifecycle.
The MegaFlex DPA UPS was designed to close resource loops with a strong 75% recyclability rate and clear end-of-life instructions for the 0user. The Quartino production facility in Switzerland produces MegaFlex DPA with 'zero waste to landfill' and packaging that uses 80% recycled cardboard.
Use of MegaFlex DPA has been highly optimized, providing customers with 97.4% system level efficiency and 15-year extended lifetime, thanks to a modular design and services that prolong its working life. According to calculations, MegaFlex customers can save more than 400 tonnes of CO2 equivalent emissions over the lifetime of the UPS. Our MegaFlex DPA UPS solution combines the highest efficiency ratings available with our commitment to the circular economy.
This not only helps reduce energy losses and operating costs, but also provides a product that uses minimal resources and materials that can be easily recycled.
Learn more at MegaFlex DPA - UPS and power conditioning | ABB

ABB EcoSolutions™
Coming full circle.

Together with customers and partners, ABB is innovating to make circular, increasingly sustainable solutions and operations a reality.
ABB's new EcoSolutions label provides full transparency to environmental impacts across the entire product lifecycle.
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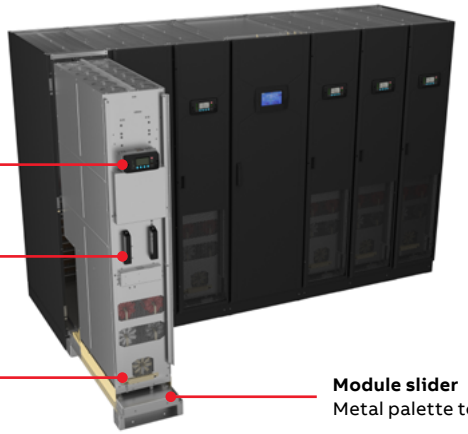
UPS Power Module 250kW



LCD control panel
with mimic diagram, LED indication, measurements, module status

Module handles
To insert/remove the module into/ from the frame

Power handle
Mechanical handle to connect/ disconnect the module to/from the main busbars in the frame

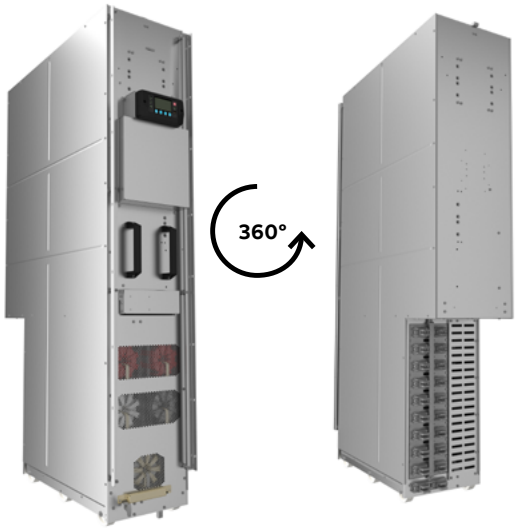
Module slider
Metal palette to slide the module

250kW Rated power

Equipped with

- Rectifier
- Inverter
- Battery charger
- Back feed protection
- Static bypass
- Control logic
- Control panel

UPS Power Module M250



DPA™ (decentralized parallel architecture) technology
The 250 kW power modules include all the necessary functional parts, such as rectifier, inverter, battery converter, static bypass and back-feed protection. The UPS architecture provides fully redundant critical components and shares the load equally among the power modules.

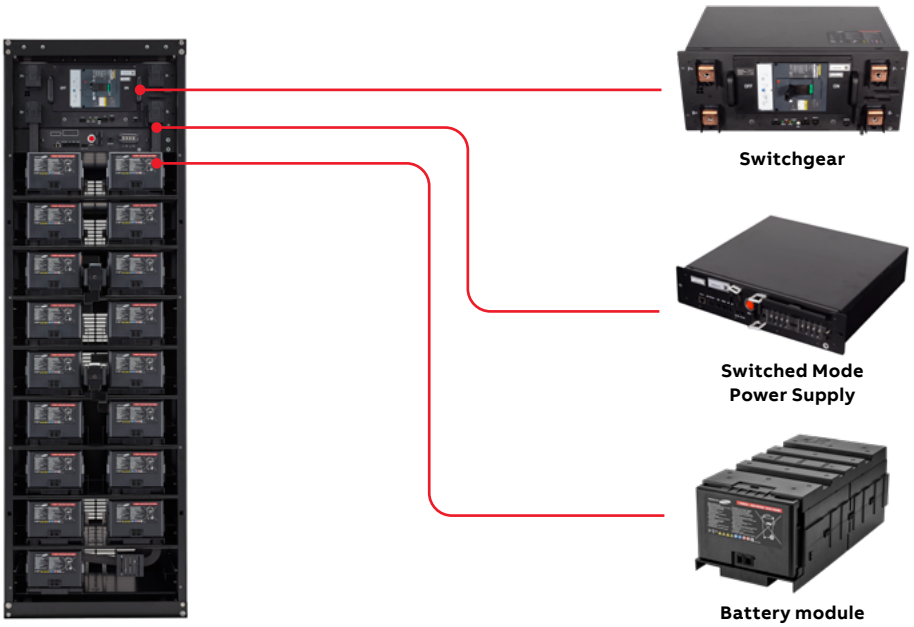
Concurrently maintainable power modules for continuous uptime
The power module is online-swappable while the load is secured in the double conversion mode. Insertion or withdrawal of the power core are smooth and simple thanks to wheels and guide rails. In addition, the power module plug-in concept supports easy and safe power connection, thus eliminating electrical hazards.

Fail-safe start-up of the system without human intervention by auto-calibration and testing of power modules before applying to the critical load.

Battery Rack Units

The batteries used with the UPS provide power during unexpected lack of supply from the primary power source.
Among the several types of batteries available on the market, we selected Lithium-ion batteries for this solution since they do not contain mercury, lead, cadmium or other hazardous materials.

In addition, despite the fact that the majority of batteries require temperatures in the range of 20-25°C for high performance and lifetime, Lithium-ion batteries are much more tolerant to changes in environmental temperature and can operate over a broader temperature range of 18-28°C. Finally, when it comes to operating expenses, Lithium-ion batteries offer a lower total cost of ownership.



Each battery cabinet has various battery management systems for single modules, single strings and for complete systems (multiple racks in parallel), plus fuses and circuit breaker protection.

A single 34.6kWh cabinet configuration comprises one Switchgear, one Switched Mode Power Supply (SMPS) and 17 Battery Modules.

Bill of materials

Id	Product Code	Description	Quantity per side
1	1SDA072545R1	E4.2N 4000 Ekip Touch LSI 4000	1
2	1SDA073915R1	Fixed Part	1
3	1SDA074098R1	Terminals	1
4	1SDA068165R1	XT2H 160 Ekip Touch LSI 160	4
5	1SDA068187R1	Fixed Part *	4
6	1SDA066278R1	Cb2 Mobile Part *	4
7	1SDA100103R1	Trip Unit *	4
8	1SDA067613R1	XT2H 160 TMD 10-100 **	20
9	1SDA072385R1	E2.2N 2000 Ekip Touch LSI 2000	2
10	1SDA073909R1	FixedPart	2
11	1SDA074092R1	Terminals	2
12	1SDA062061R1	E1.2 N/MS 1600	2
13	1SDA063123R1	Terminals	2
14	1SDA100561R1	XT5H 630 Ekip Touch LSI 630	5
15	1SDA104693R1	FixedPart	5
16	1SDA104714R1	Cb2 Mobile Part	5
17	1SDA100674R1	Trip Unit	5
18	1SDA104872R1	Cb Sliding Contact	5
19	1SDA080850R1	XT1H 160 TMF 16-450	1
20	1SDA072547R1	E4.2N 4000 Ekip G Touch LSIG 4000	1
21	1SDA073915R1	FixedPart	1
22	1SDA072492R1	E4.2N 3200 Ekip Dip LSI 3200	1
23	1SDA073913R1	FixedPart	1
24	1SDA074098R1	Terminals	1
25	1SDA073674R1	YO E1.2..E6.2-XT7-XT7M 220-240 VAC/DC	2
26	1SDA073687R1	YC E1.2..E6.2-XT7M 220-240 VAC/DC	2
27	1SDA073711R1	M E1.2 220-250 VAC/DC	2
28	1SDA073881R1	Cable interlock A - HR E1.2..E6.2-XT7/M	1
29	1SDA073890R1	Lever interlock E4.2	2
30	1SDA073895R1	Support F/FP Type A,B,D E2.2...E6.2	2
31	1SDA073858R1	PBC Prot. Pushbuttons AP/CH E2.2...E6.2	2
32	1SDA073778R1	S51 250V E2.2...E6.2	2
33	1SDA073767R1	AUP 5 suppl.cont. 24Vdc DX E2.2...E6.2	2
34	1SDA065523R1	ATS021 Auto.tran.switch Multi Voltage	1
35	4NWP106348R0001	UPS MF DPA 1000kW frame DSB SIF LSF	1
36	4NWP106348R0002	UPS MF DPA 1000kW frame DSB SIF RSF	1
37	4NWP106740R0001	UPS-OPT Power Module Slider	2
38	4NWP105933R0001	UPS-OPT MF DPA Common Battery 1000KW	2
39	4NWP105924R0001	UPS MF DPA M250 DSB	8
40	4NWP106901R0001	Parallel cable L=10m LC41_0034A	2
41	4NWP104024R3602	LIB_1Rack_17x8_SMPS with BMS_CE9540_136S1P	10
42	4NWA7000368206A	Interface Kit for SDI CE9540 Lithium-ion batteries	10
43	4NWP107574R0001	Datalogger for SDI CE9540 Lithium-ion batteries **	2
44	1SDA064727R1	E4S 3200PR123/DC In=3200A 3p F VR **	2
45	4NWP106924R0001	ANC-ABB Network Card-Slot **	2

* Optional item if container cooling redundancy is required
** Optional item if monitoring of the UPS & battery racks is required

APPLICATION FINDER

We've made it simpler for you to set up your project!
Click here to find the reference architecture that best fits your needs and download the Bill of Materials.

Product offering

Emax 2:

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Tmax XT:

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MageFlex DPA:

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CATALOG

Lithium-ion Battery:

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9AKK108467A1155 - 2023.01