Pierre-Alain Gubelmann, ABB Power Protection, Giornadas Tecnicas, Santiago de Chile, 11-12 Abril 2017

Zero downtime for mission critical applications? Absolutely.

The Benefits of Modular UPS Systems within Datacentres space
Agenda

- What is Modularity?
- The ABB UPS Modular Portfolio
- The ABB Modular way
  - The different and unique approach to Modularity
  - Optimizing the different dimensions

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The Benefits of Modular UPS Systems within Datacentres space
The Modularity Concept

1. “Module” = “component” (of various complexity levels) = integral part of a much bigger system
2. “Modules” are characterized by well defined “interfaces” and a specific “implementation”:
3. Modules typically work independently from the conditions of the other “components”, even though parts of a much bigger system
4. **Any failure affecting one of the modules will not affect the overall system operation!**

The Benefits of Modular UPS Systems within Datacentres space
What is Modularity

Modularity (Modular systems) aims to optimize 3 main dimensions:

- **Construction**
- **Functionality of Components and Systems**
- **Operations of the Systems**

”Cost optimization” and “Faster Business Growth”

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The Benefits of Modular UPS Systems within Datacentres space
The ABB UPS Modular Portfolio

DPA USPCALE (10 – 400kW)

Basic Characteristics:

- Modular ST and RI UPS solutions for Small to Medium Size Datacenters applications
- Based on Upscale Modular UPS technology 10/20kW
- Suited to IEC Market 220/230/240V, 3ph+ N configuration
- Power Levels available from 10kW to 200kW per frame
- Highest Power density in the market: 400kW/m2
- Hot Swappable technology

The Benefits of Modular UPS Systems within Datacentres space
The ABB UPS Modular Portfolio

DPA 250 and DPA 500 (IEC, 30 – 3000kW)

Basic Characteristics:

- Modular DPA250 and DPA500 IEC solutions for Medium to Large Size Datacenters applications
- Based on DPA Modular UPS 30/40/50/100kW modular technology
- Suited to IEC Market 220/230/240V, 3ph+ N configuration
- Power Levels available from 50kW to 500kW per frame and from 150kW to 3000kW per system
- Highest Power density in the market: up to 350kW/m2
- Hot Swappable technology

The Benefits of Modular UPS Systems within Datacentres space
The ABB UPS Modular Portfolio

CP 120 and DPA 500 (UL, 20 – 3000kW)

Basic Characteristics:

- Modular DPA120 and DPA500 UL solutions for small to Medium to Large Size Datacenters applications
- Based on DPA Modular UPS 20/100 kW modular technology
- Suited to UL Market 208V/480V, in both three and four wires configuration (w or w/o N)
- Power Levels available from 20kW to 500kW per frame and from 120kW to 3000kW per system
- Highest Power density in the market: up to 320kW/m2
- Hot Swappable technology

The Benefits of Modular UPS Systems within Datacentres space
The ABB UPS Modular Portfolio

MNS-UP Integrated Solution

Distribution and DPA 500 (IEC, 100 – 3000kW)

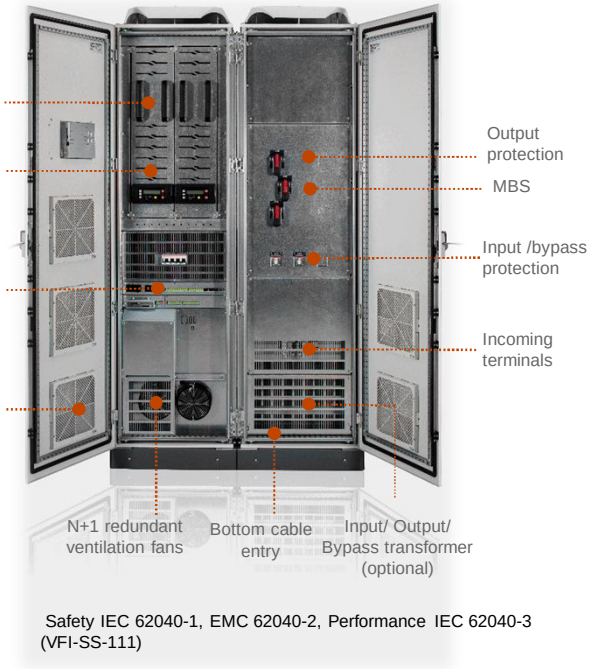
Basic Characteristics:

- Modular MNSUp Integrated solutions for Medium to Large Size Datacenters applications
- Integrated solution of Upstream/Downstream distribution protecting breakers and Modular DPA UPS technology (100kW per module)
- Suited to IEC Market 220/230/240V in both three and four wires configuration (w or w/o N)
- Power Levels available from 100kW to 500kW per frame and from 500kW to 3000kW per system
- Unique Integrated Values Proposition in the world
- Hot Swappable technology

The Benefits of Modular UPS Systems within Datacentres space
The ABB UPS Modular Portfolio

Powerline: Light Industrial UPS

UPS modules



Technical Highlights	
Topology	3 phase on-line double conversion UPS
System power rating	20 kVA– 120 kVA
Overall efficiency	Up to 96%
Power Factor/ ITHD	0.99 / < 3%
Internal transformers	Galvanic Isolation or step up/down transformers (optional)
Operating temperature	-5°C up to +45°C
Input protection	IP 31, IP42(optional)
Cable entry	Bottom, Top(optional)
Ventilation	Forced with monitored fans
Internal wiring	Halogen free cable
Battery compatibility	VLRA, Ni-Cd
Autonomies	Up to 8h
Battery charging current	Up to 30% In
Friendly user interface	Graphical display for control and metering, 8 programmable alarm indications
Easy integration to industrial networks	SNMP, Modbus TCP/IP, Profibus (optional)
MTTR	< 0.5h
Product design life	15 years

Standard	Safety IEC 62040-1, EMC 62040-2, Performance IEC 62040-3 (VFI-SS-111)

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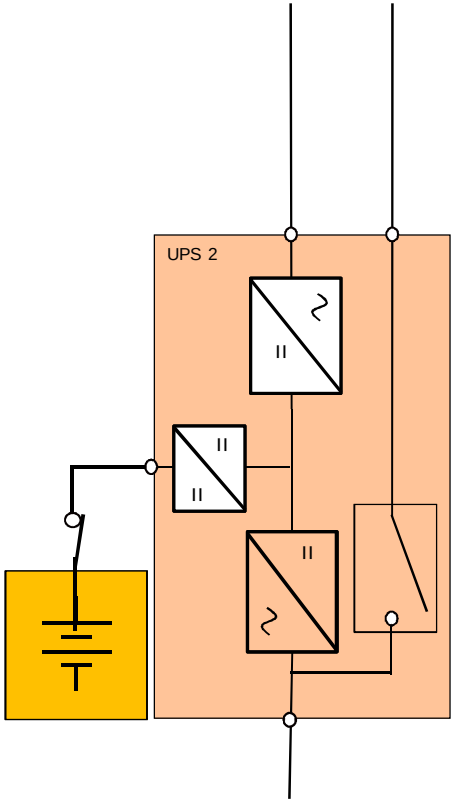
ABB Modular Way
Traditional UPS



A traditional UPS consist of:

Main and Bypass Inputs

Rectifier

Battery Charger

Inverter

Static Bypas

CPU

Display

Batteries

ABB Modular Way
Traditional UPS

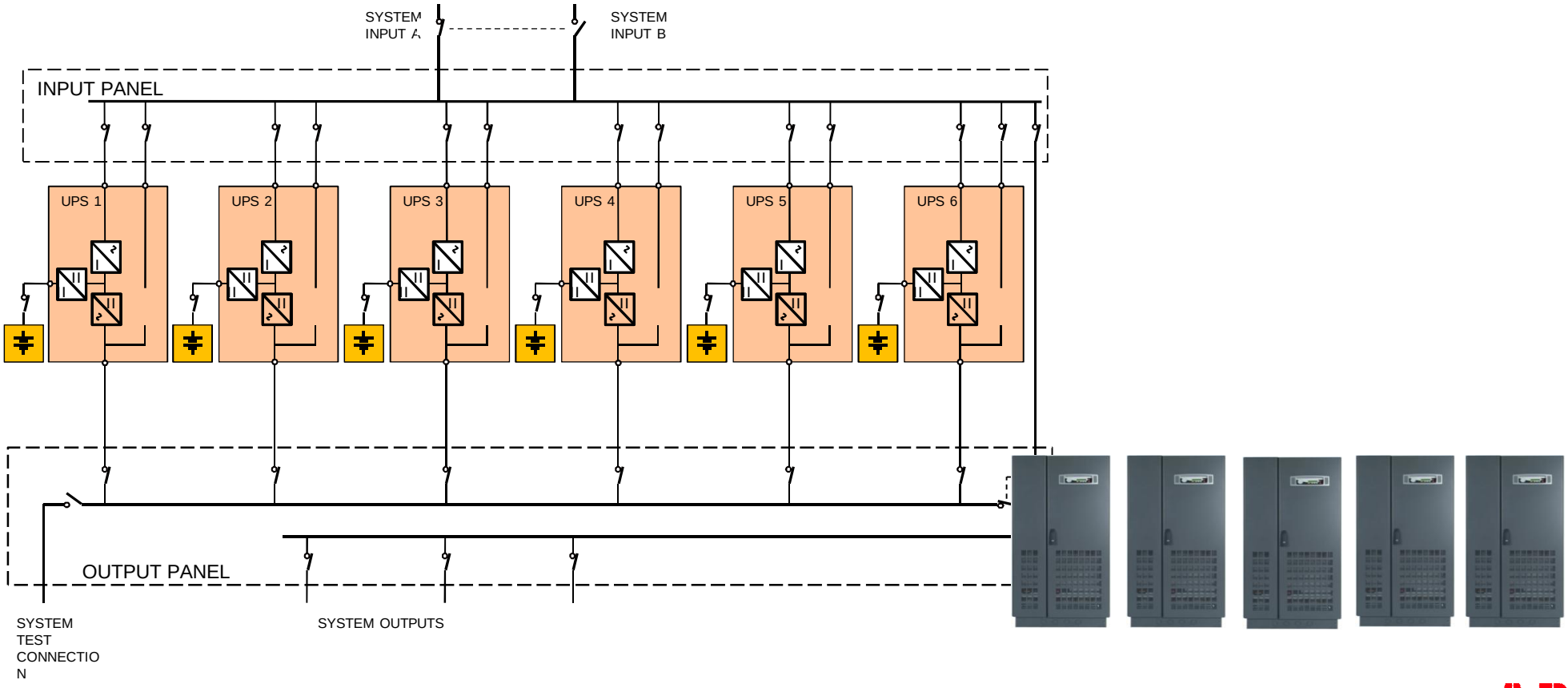
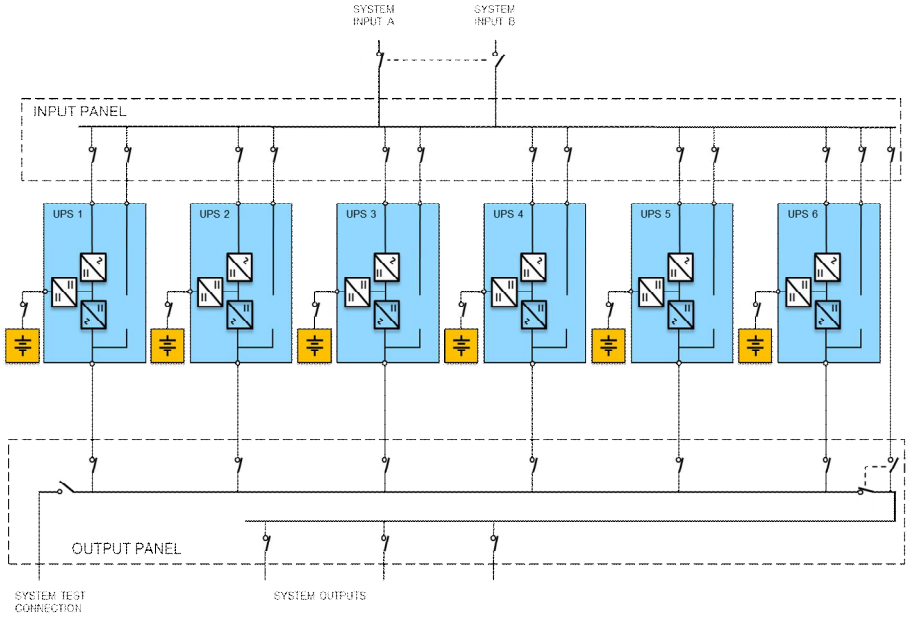


ABB Modular Way
Make it Small and flip it 90°



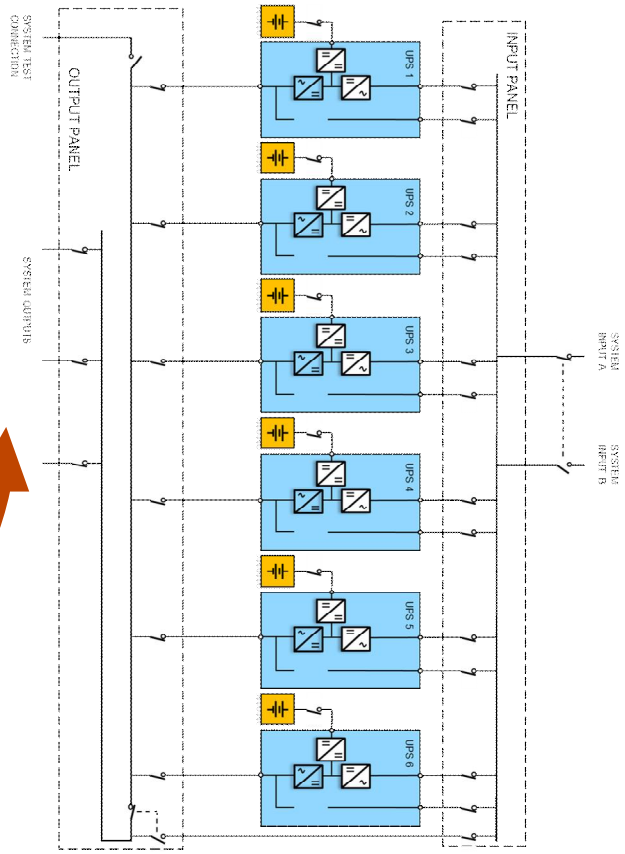


ABB Modular Way
Make it “Rackable“ and “swappable”

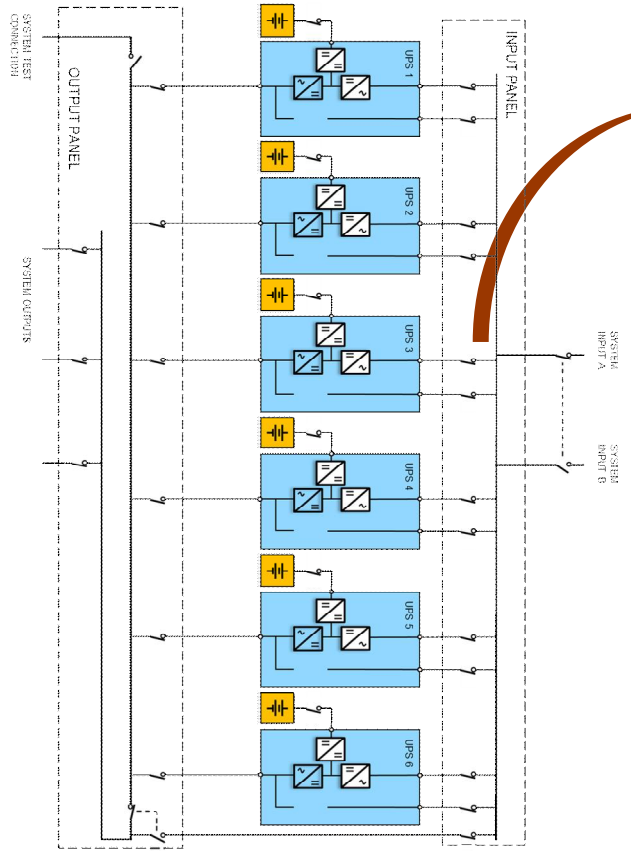


ABB Modular Way
The different Approaches to Modularity

ABB Way is “DPA”
Decentralized Parallel Architecture

No common components to the system.
= De-centralized system

All essential functions are independent
- System logic
- Control Panel (Display)
- Static Bypass
- Power Units
- Separate Battery Charger/Connection

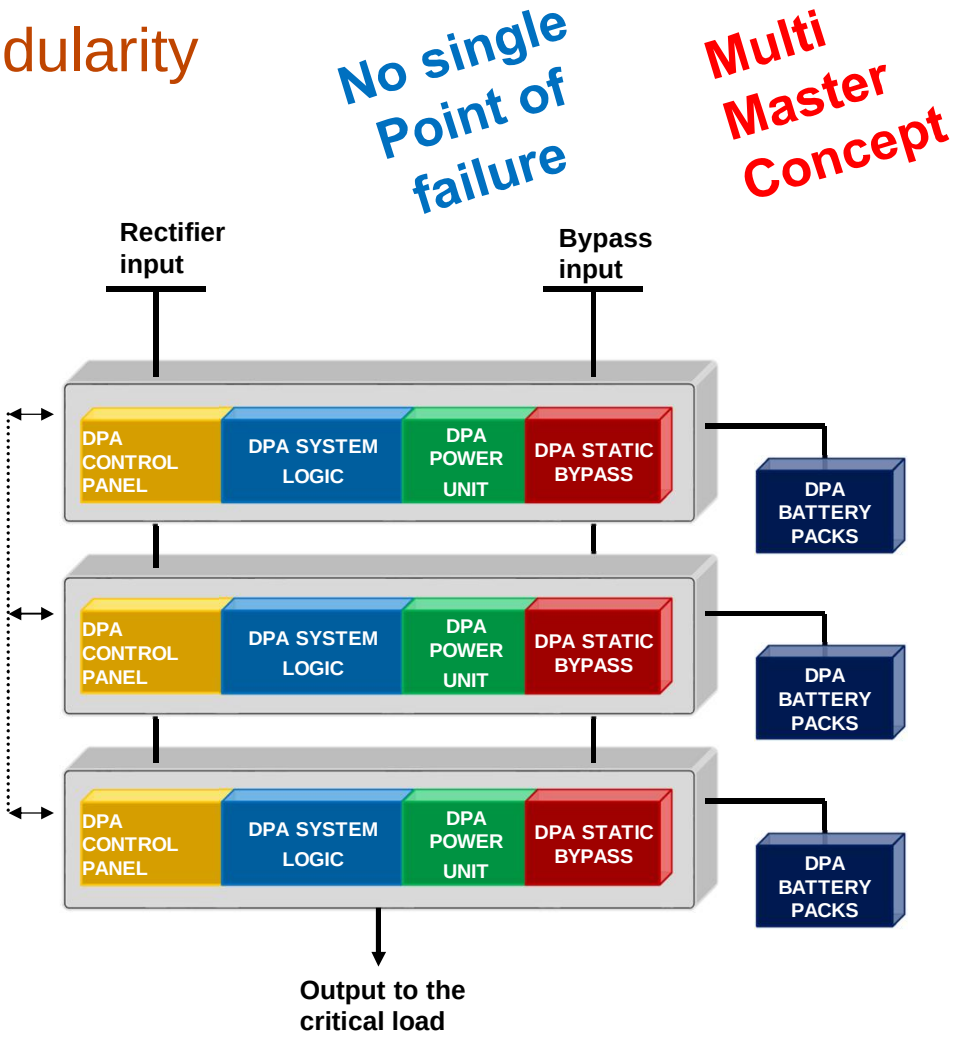
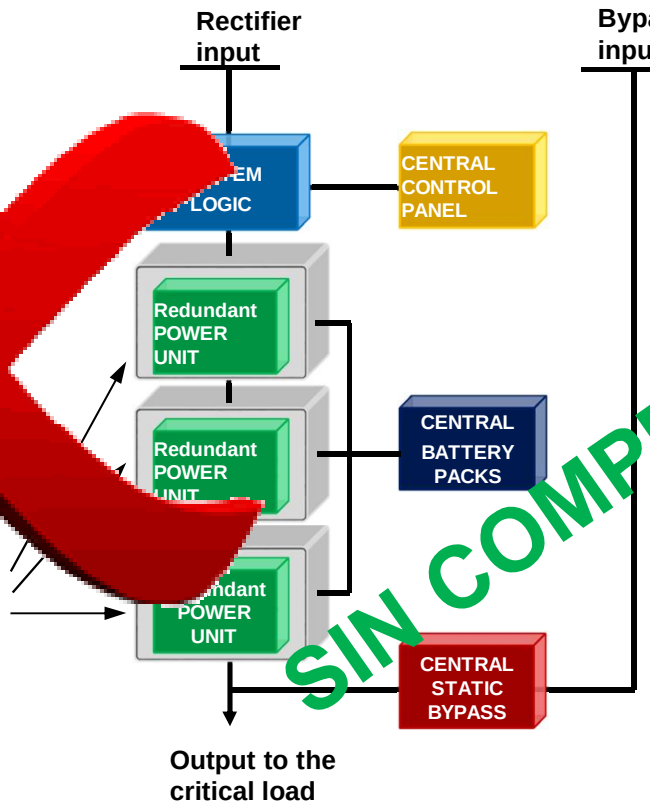


ABB Modular Way
The different Approaches to Modularity

THIS IS NOT ABB's WAY

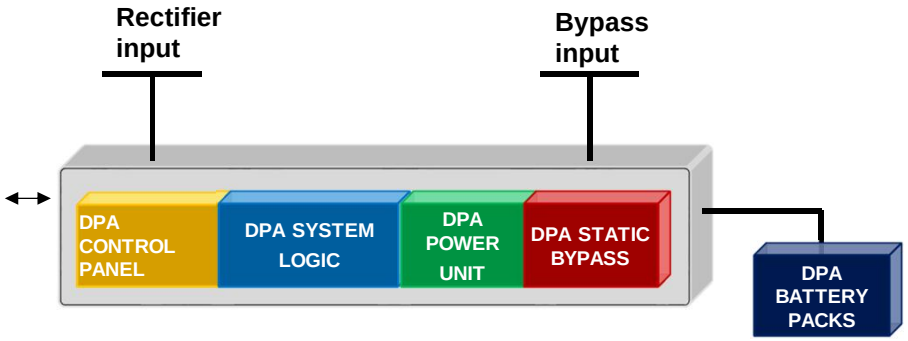
- The most common modular approach to UPS design in the competitive landscape is represented by the Centralized ... oach
- In ***Centralized Parallel Arch... s*** some components are common to t... n:
  - Central system logic
  - Control Panel (Display)
  - Static Bypass
  - Battery

Only the power modules ... ized and can be redundant with each ...
→ System has single points of failure that compromise system reliability – and availability!



SIN COMPROMISO

ABB Modular Way
Summary



- Each module is a complete UPS
- All critical parts are redundant (no critical single point of failure)
- Modular are rackable
- Modulare a SAFE-swappable (no need to swith the UPS on maintenance bypass)
- Each modular can be the MASTER module (regulation of output current, synchronization)
- All modules are «intelligent»
- All «intelligences» are connected to each other.

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Optimizing the different Dimensions
Modularity in Functionality

Zero Downtime

- Modular Decentralized architectures enable true **99.9999%** system level availability
- **No Single Point of Failure** within the System

DPA architecture minimize the failure risk during system operation

- Thanks to a real **Multi Master Protocol**, each one of the UPS system module is ready to real time take over the control of the entire system in case a failure is detected
- Failed Modules **self isolate** from the whole system without affecting the system level operation
- Thanks to a **democratic protection** procedure approach, it is possible to effectively reduce the risk of false-failures

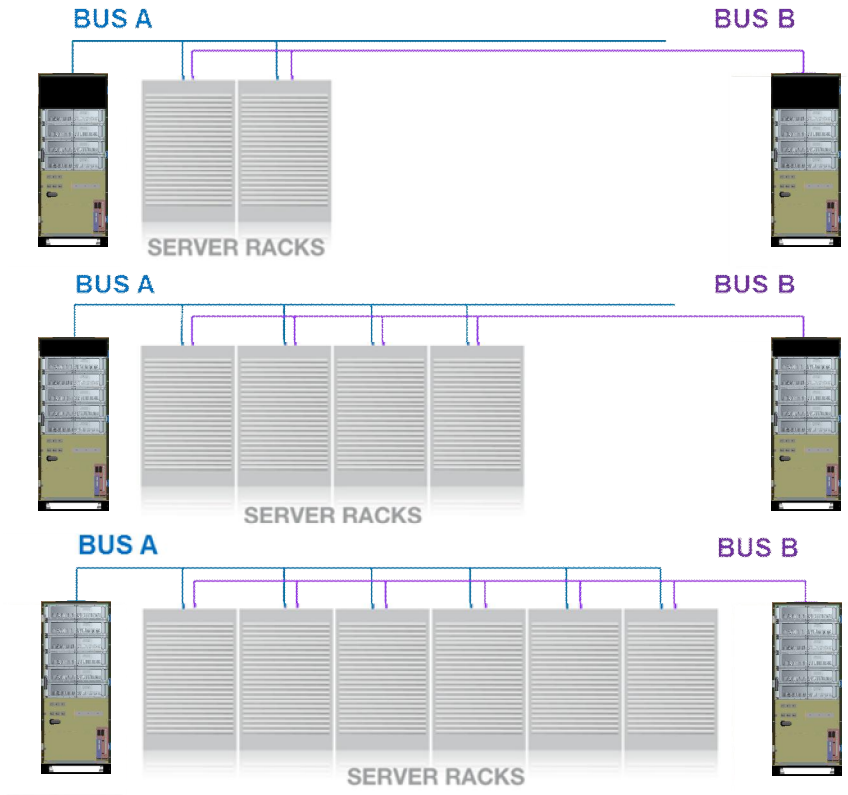
Elastic Operation

- Thanks to the latest introduced Energy Management Mode – **XTRA VFI** – the UPS Modular system dynamically adapts to the actual loading conditions, the number of UPS in on line mode.
- Thanks to an easy system level upgradability with no need to move the IT loads to Bypass operation, the ABB modular DPA architecture **enables on line System scalability (vertical and horizontal)**

Optimizing the different Dimensions
Modularity in Construction

Optimize and save on capital investment	➢ R**ight-sizing approach** and **scalability**, ➢ **Pay-as-you-grow** solution ➢ **Maximal power density** > **more space** for equipment.
Accelerate speed of deployment	➢ R**apid installation with minimal engineering**. ➢ **Same product and technology** > Interchangeable modules
Allows for Dynamic capacity Planning	➢ Sites-capacity can be dynamically adapted > **quick ramp up and ramp down** of facilities

Optimizing the different Dimensions
Modularity in Construction – PAY as you GROW



Power demand can vary greatly, from 20kW/40 kW to 600kW/1200kW
Only a modular UPS is capable to adapt changes in power demand in a changing infrastructure

ABB ’s Xtra VFI – double conversion mode

Targeting to save energy in demanding applications

Xtra VFI increases efficiency securely in double conversion mode

- UPS maximizes the double conversion efficiency by engaging UPS modules based on load power.
- When load is very low, the over capacity is switched to stand-by mode where modules consume much less power and thus help save energy.
- Efficiency improvement is especially significant when load is ≤ 25 % of full UPS system capacity

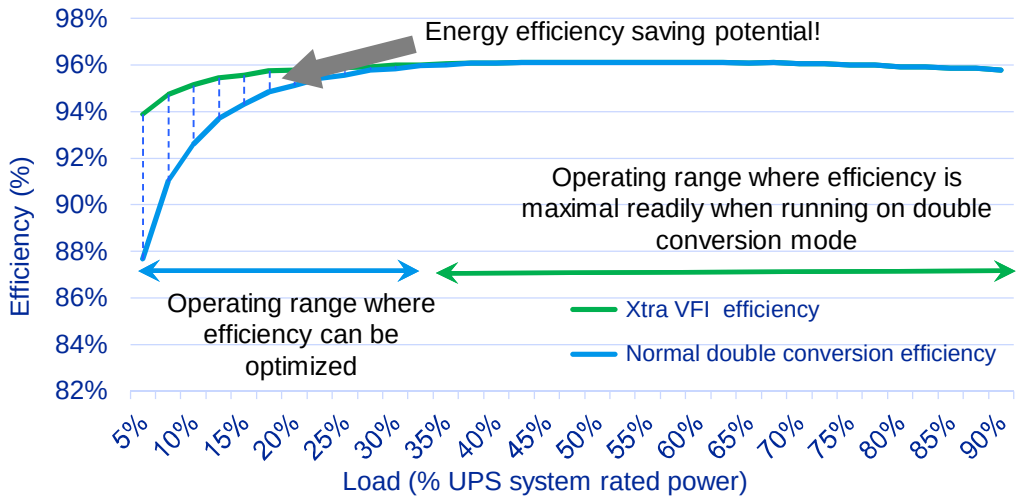


ABB ’s Xtra VFI – double conversion mode

Targeting to save energy in demanding applications

EXAMPLE: Conceptpower DPA 500 3000 kW (30x 100 kW modules / 5x 500 kW frames)

Configuration:	30 x 100 kW
System total capacity:	3000 kW
Specified redundancy:	N+2
Load power	980 kW
N:o of active mode:	12 pcs
UPS active capacity:	1200 kW

Enhanced double conversion efficiency:

- UPS active capacity scaled according to the load power to maximize efficiency.
- The system calculates the optimal load % value for maximal efficiency, keeping redundancy.

Fault tolerant and sustainable

- In case of mains failure or other abnormal situation all modules turn to active mode.
- The system rotates the modules (active and stand-by modes) based on selected intervals > extends the system service life

ABB ’s Xtra VFI – double conversion mode

UPS module operation states

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 kick in and transfer to active double conversion mode in case needed.

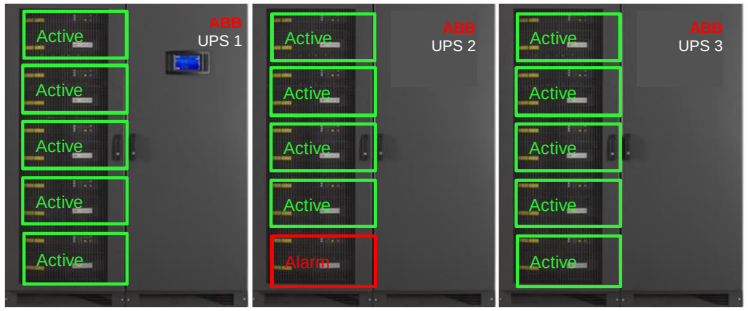
Off

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

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.

Status 1: Module operating modes in Xtra VFI mode



Status 2: Module operating modes when a fault with module has been detected

Optimizing the different Dimensions
Modularity in Operational Benefits

Benefiting through Local Regulations and third party certifications	➢ Modular DPA enables **UPTIME Tier III** level certifications ➢ Modular DPA enables for **eco-bonuses** (high efficiency and advanced energy management modes)
Decrease complexity and costs of service and maintenance	➢ Simple and standardized **protection** and **service concept** ➢ Quick **modules replacement** without affecting the loads ➢ **MTTR** reduced to 15 min (service technician is on site)
Decrease the operating costs	➢ Operating costs up to 40% less compared to UPS of previous generation (energy saving, serviceability) ➢ Increased availability > **increased utilization** ➢ **Minimized Inventories** of spares parts

Optimizing the different Dimensions
Modularity in Operational Benefits – Easy Serviceability

Modular concept benefits for maintenance and service

- Limited spare parts inventory in quantities, different articles and total value
- Standardized service practices
- Minimized risk for human errors

UPS service with ABB's online swappable modules:

- Concurrent preventative maintenance by swapping modules
- Concurrent repair by swapping a module

DPA 500 frame mechanical design allows for efficient and safe servicing

- Front access only needed for maintenance and service
- Smart connectors allow for safe handling of modules

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

Power and productivity
for a better world™