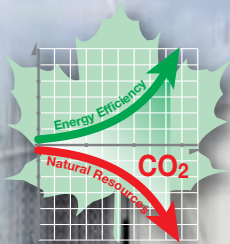


Excellent Technology, Efficiency and Quality

## Increase the Availability of your Power System Achieve considerable Cost Savings

ENERTRONIC *modular* UPS Systems  
ensure:

- Maximum Power Availability
- High Power Quality
- Premium Energy Efficiency



### ENERTRONIC modular

Three phase modular UPS system  
for your mission-critical Business Applications



## **ENERTRONIC modular** *Optimised Efficiency and Continuous Availability*

**Are UPS systems always safe and cost effective?**

### **Comments from the market:**

- Low UPS reliability due to cost driven design limitations
- Insufficient availability due to complex service and maintenance processes
- Limited application and cost flexibility
- High operating costs  
(System, maintenance, cooling system)

### **Our Solution:**

**ENERTRONIC modular UPS Systems**  
**Reliable and cost-effective power protection for mission critical business applications**

- High availability
  - Real system-redundancy
  - High quality components
  - Premium design
- Efficient maintenance and cost-effective Service
  - Short MTTR (Meantime To Repair)
  - Hot swappable key components and modules
- Financial flexibility
  - Excellent modularity – pay as you need
- Optimised cost of operation
  - Floor space saving rack design (minimum footprint)
  - High efficiency with energy and CO<sub>2</sub> emission savings
  - Flexible power upgrade and simple replacement of power modules

### **Continuous power protection availability and strong advantages**

The modular and flexible scalability allows the addition or replacement of power modules at any time.

Competent Personnel can add or replace power modules without removing UPS power from the load.

The ENERTRONIC *modular* software provides seamless integration of new power modules (Auto-configuration).

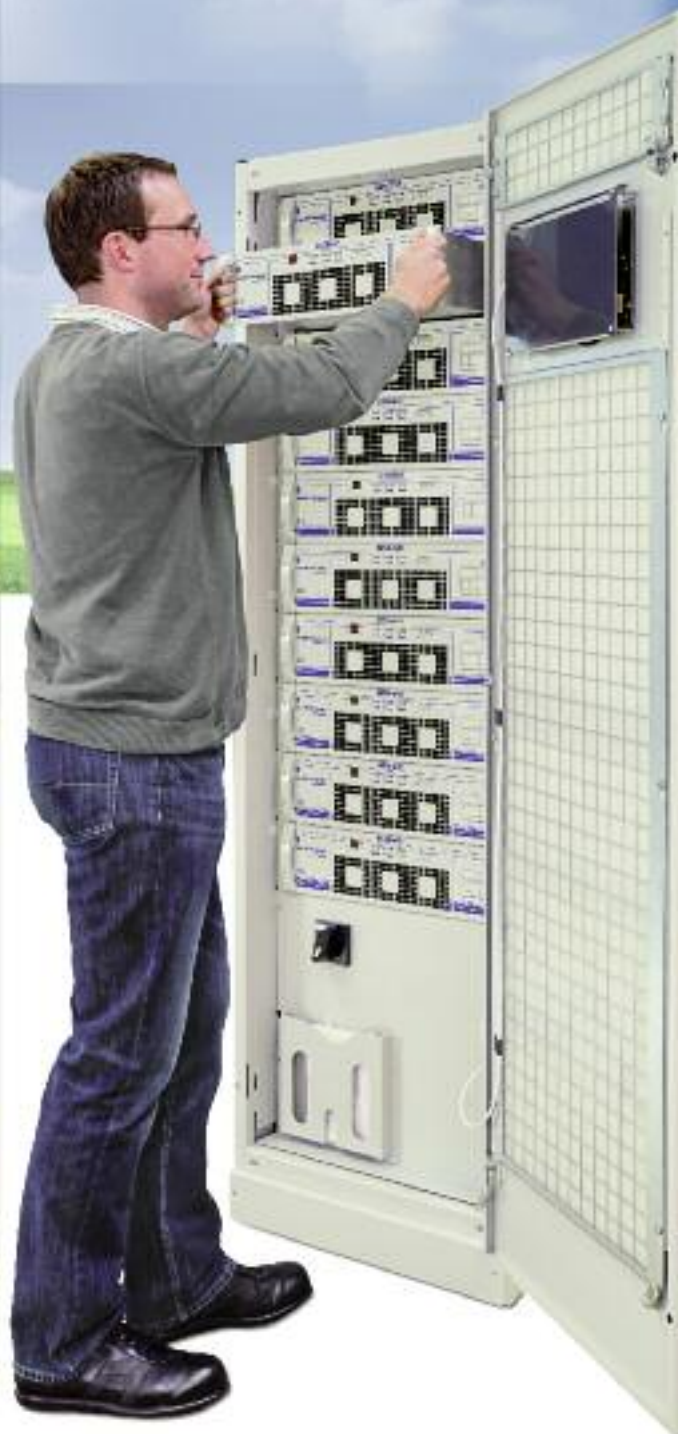


Fig. 1: With little training Personnel can change modules within 30 minutes.  
Such replacement can be performed without any interruption to the load.



# ENERTRONIC modular

## Parallel, Modular and Redundant

### Parallel and redundant

Very often traditional UPS systems operate as stand-alone systems without any redundancy. System component faults can cause downtime of mission critical loads with very costly consequences (single point of failure).

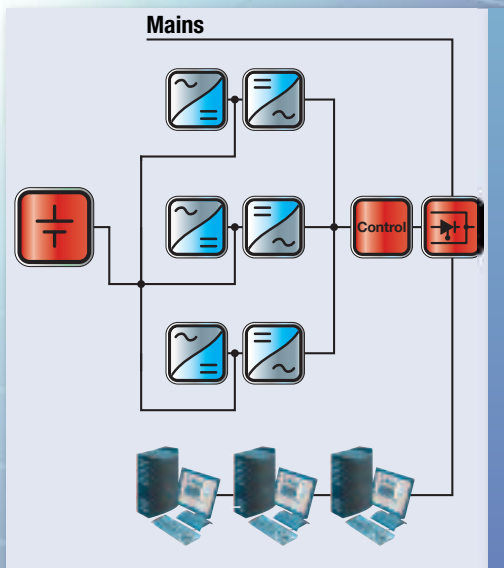


Fig. 2: Traditional modular UPS system  
with single point of failure (No redundancy)

### Real parallel redundant

ENERTRONIC *modular* UPS systems are based on parallel operating hot-plug power modules. Each module represents a complete double conversion UPS system with three phase input three phase output and static by-pass.

Maximum availability is achieved by combining the parallel operating modules with  $n+1$  redundant design.

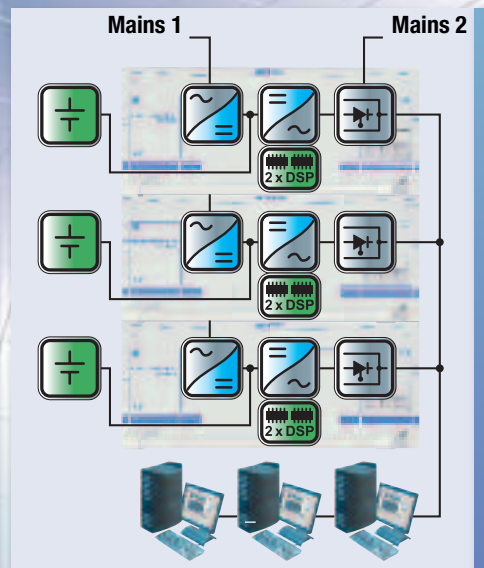


Fig. 3: „True redundant“ modular UPS system  
No single point of failure

### Pay as you need

In comparison with single bloc UPS systems with high initial costs the advanced ENERTRONIC *modular* concept allows the user to scale the output power in steps and to adapt the UPS system to changing power requirements. With power modules of 10 kVA, 20 kVA and 40 kVA a wide range of UPS system solutions can be designed.

### Flexible output power scalability

The addition or replacement of power modules can be achieved without additional work on site.

The load continues to be supplied by safe UPS power. No load transfer to mains is required.

The software within the ENERTRONIC *modular* UPS system integrates the new modules automatically.

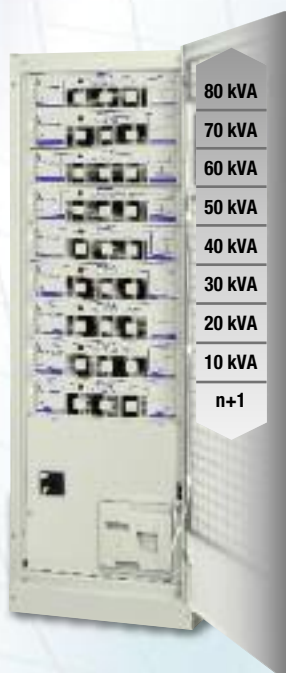


Fig. 4: UPS system with 10 kVA power modules  
Output power 80 kVA ( $n+1$ )

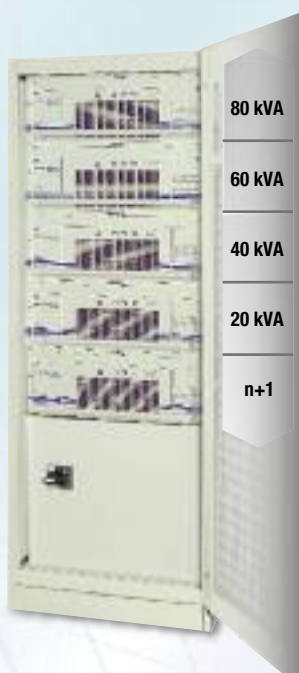


Fig. 5: UPS system with 20 kVA power modules  
Output power 80 kVA ( $n+1$ )

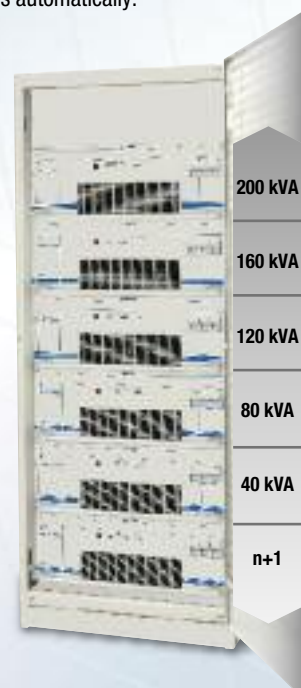


Fig. 6: UPS system with 40 kVA power modules  
Output power 200 kVA ( $n+1$ )

## Flexible battery configurations

The ENERTRONIC modular UPS can be supplied with common battery, group battery or single battery configurations.

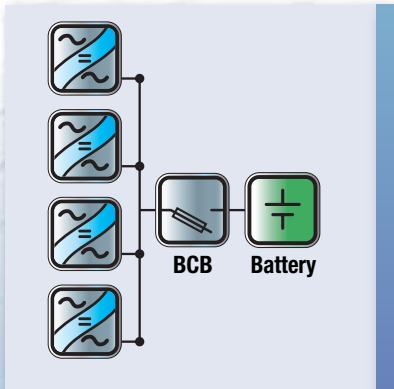


Fig. 7: Common battery

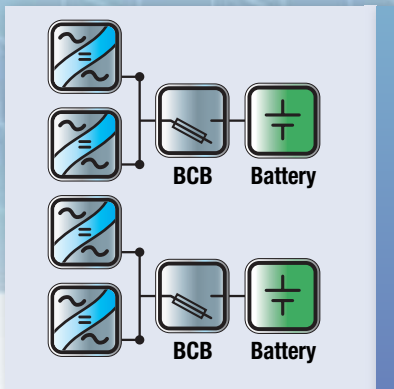


Fig. 8: Group battery

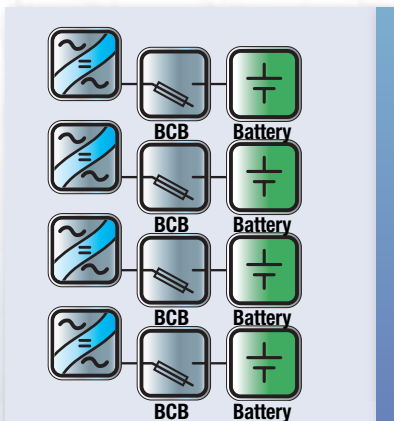


Fig. 9: Single battery

Maximum system availability is achieved by group or single battery solutions. Depending on UPS output power and autonomy, batteries can be installed in cabinets or separate battery racks.

# Serviceability

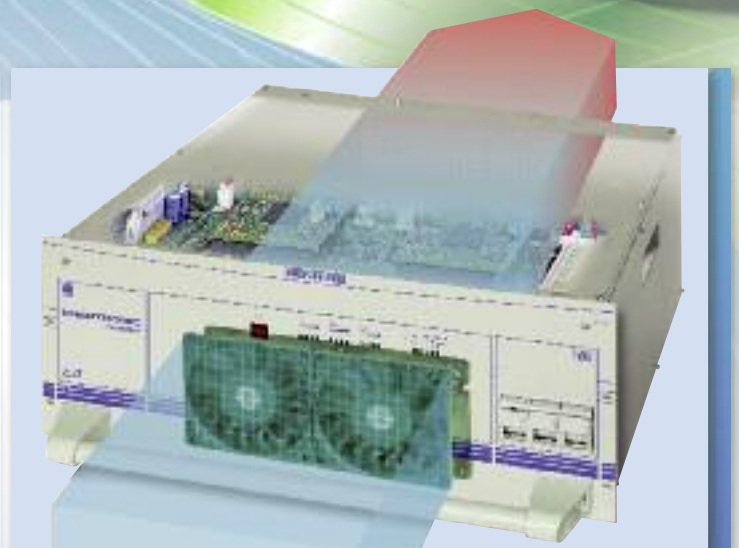
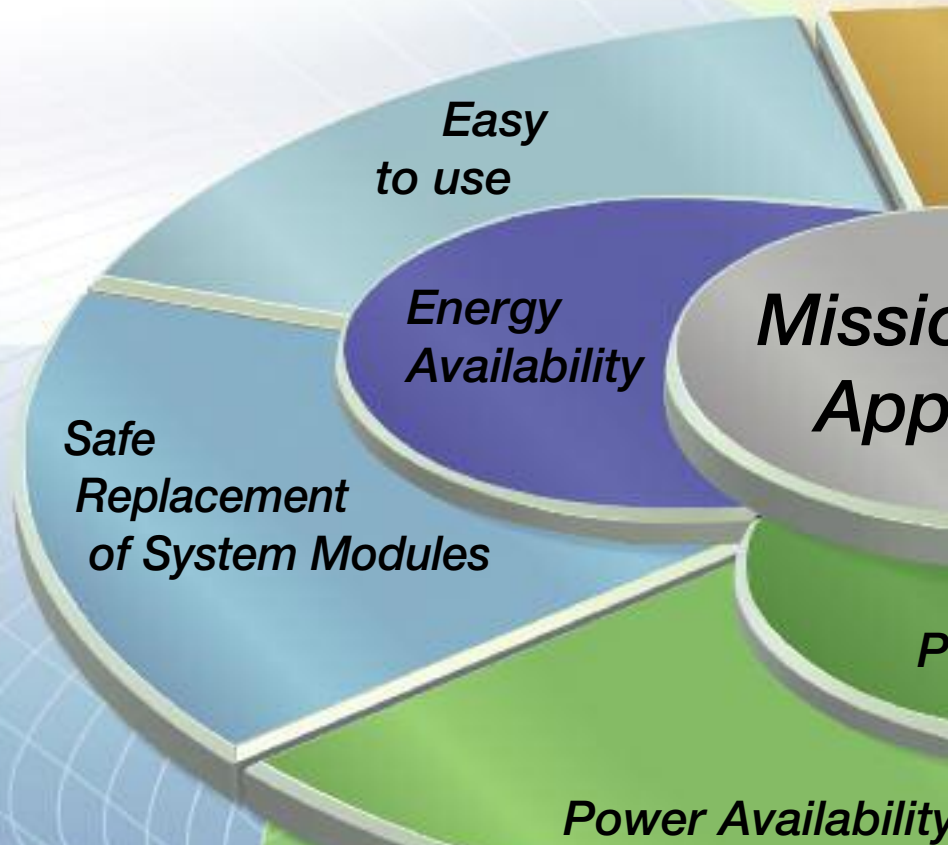


Fig. 10: Front fans optimise fan life expectancy

## Optimised fan life expectancy and simple maintenance

ENERTRONIC power modules are equipped with front access fans which can be easily replaced during normal UPS operation. These fans are mounted in the „cold“ air inlet behind the front plate. The „hot“ air leaves the power module at the rear. (Fig. 10)

Fig. 11: Fan mounted in the „hot“ air outlet

The expected life time of fans which are mounted in the „cold“ air zone is much better than for fans positioned in the „hot“ air zone at the rear of the cabinet. (Fig. 11)





# ENERTRONIC modular - the advanced UPS technology

When making a decision to invest in UPS systems for mission critical applications availability and total cost of ownership (TCO) have to be considered.

However, as you can see from the chart below further product characteristics must be considered to make the right decision for the best possible UPS solution.

Invest as you need

on critical  
lication

Power  
Quality

Optimised  
Life-Cycle  
Costs

Cost

Power Efficiency

Lower Energy  
and Floor Space  
Costs



Fig. 12: ENERTRONIC modular vs. traditional redundant mono bloc UPS systems  
Floor space requirement

## Floor space (footprint) requirement of parallel redundant UPS systems

The single, space saving cabinets of ENERTRONIC modular UPS systems need less than one third of the floor space when compared to traditional redundant two cabinet UPS systems.

Traditional UPS systems often require access for service and repair at the sides and the rear. ENERTRONIC modular UPS systems only require front access.

With the parallel architecture, only one cabinet is required for ENERTRONIC modular UPS systems. This cabinet can be upgraded by simply inserting additional power modules. No extra space or cabling is required.

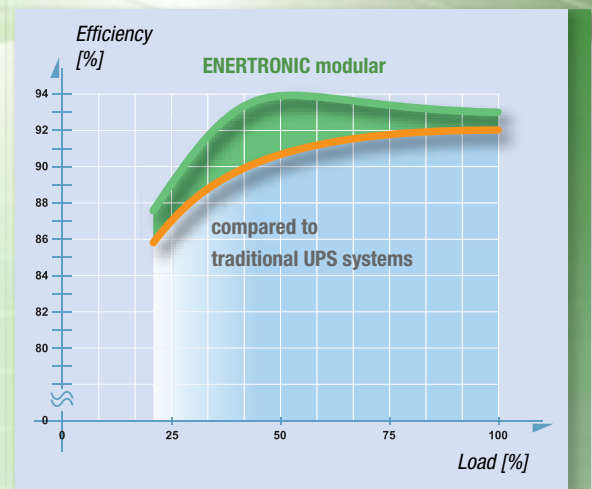


Fig. 13: Efficiency as a function of load  
High Efficiency under partial load conditions

## High Efficiency under partial load conditions

Energy costs, the major part of UPS life-cycle costs, are directly related to the efficiency characteristic of the UPS system.

In contrast to traditional UPS systems with „poor“, efficiency under partial load conditions, ENERTRONIC modular UPS systems have been designed to provide their highest efficiency between 30 % and 100 % load.

Higher efficiency at partial and rated loads results in considerable energy and CO<sub>2</sub> emission savings.

# ENERTRONIC modular

## Power Upgrade, Lower Operating Costs

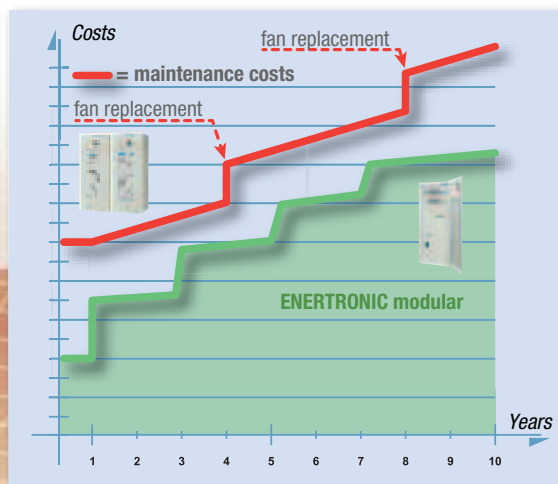


Fig. 14: life cycle costs (total cost of ownership)

### Total cost of ownership (TCO)

Total cost of ownership depends on capital and operating costs as well as installation, footprint and maintenance costs. In comparison to traditional UPS systems the advanced modular hot-plug design of ENERTRONIC modular UPS systems results in lower operation, installation, upgrade and maintenance costs.

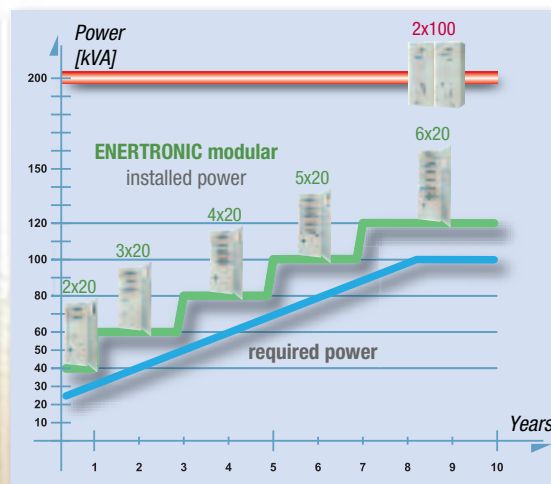


Fig. 16: High financial flexibility - pay as you grow

### Power upgrade

Compared with traditional UPS systems the scalability of ENERTRONIC modular UPS systems allows the output power to grow in-line with increasing demand. This eliminates the high initial capital cost of purchasing power capacity that is not required at the earlier stage of installation.

During the entire life-cycle, power capacity upgrading keeps the cost of ownership low. Operating costs can be optimised if each of the parallel redundant power modules delivers between 50 % and 100 % of their nominal output power. It is therefore important to pay attention to the UPS system efficiency under partial load conditions.

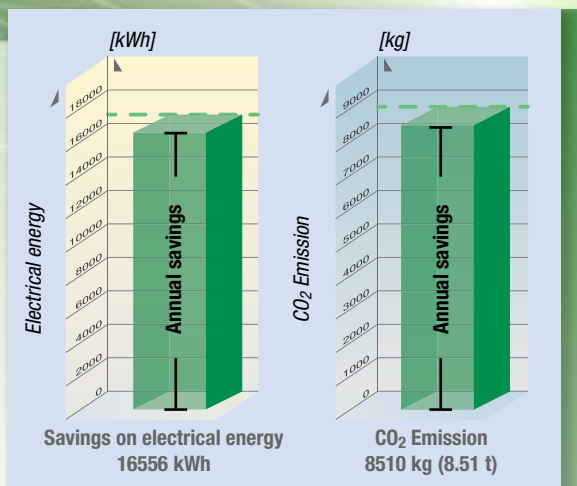


Fig. 15: Annual savings on electrical energy and CO<sub>2</sub> emissions  
Using a 60 kVA redundant ENERTRONIC modular UPS system

### Less consumption in electrical energy and savings in CO<sub>2</sub> emissions

Fig. 15 shows annual savings on electrical energy and CO<sub>2</sub> emissions of a redundant (n+1) 60 kVA ENERTRONIC modular UPS system compared with a traditional redundant monoblock UPS (2 x 60 kVA). The identical load for both systems is 50 kVA (0.8 power factor).

Annual savings on electrical energy are 16560 kWh and 8.51 t of CO<sub>2</sub> emissions.

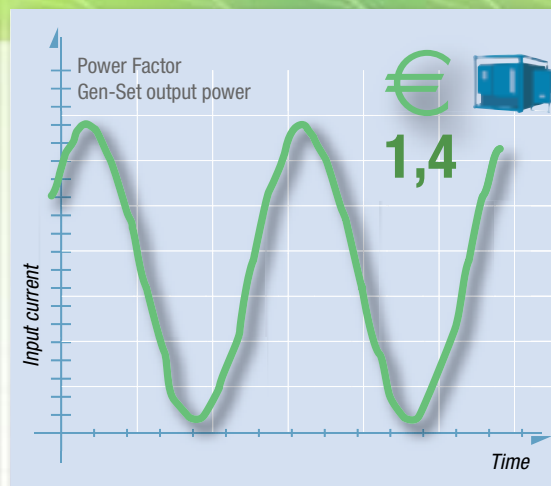


Fig. 17: ENERTRONIC modular with near unity power factor and 5 % THDi avoids expensive oversizing of Gen-sets

### Unity power factor and low THDi

The harmonic pollution (THDi) on the input current of a traditional UPS with 6-pulse thyristor rectifiers is about 33 %. If Gen-sets are used, they have to be oversized by 2.5 times the UPS output power. With 12-pulse thyristor rectifiers Gen-sets need 2.0 times higher output power. ENERTRONIC modular UPS systems with their „clean input“ (THDi 5 %) require Gen-sets with only 1.4 times the rating of the UPS output power.

# ENERTRONIC modular Three Phase UPS System with Modular, Hot-Plug Design

## Classification of the ENERTRONIC modular UPS in accordance with EN/IEC 62040-3

Beside high availability, UPS systems have to guarantee high power quality.

ENERTRONIC modular UPS systems with true online double-conversion technology are classified as level VFI-SS-111 in accordance with EN/IEC 62040-3.

**VFI:** The output voltage is independent of all mains voltage and frequency variations.

**SS:** The output waveform is sinusoidal with all linear and non-linear loads.

**111:** The dynamic deviation of the output voltage will not exceed the three tolerance curves of the standard EN/IEC 62040-3 if :

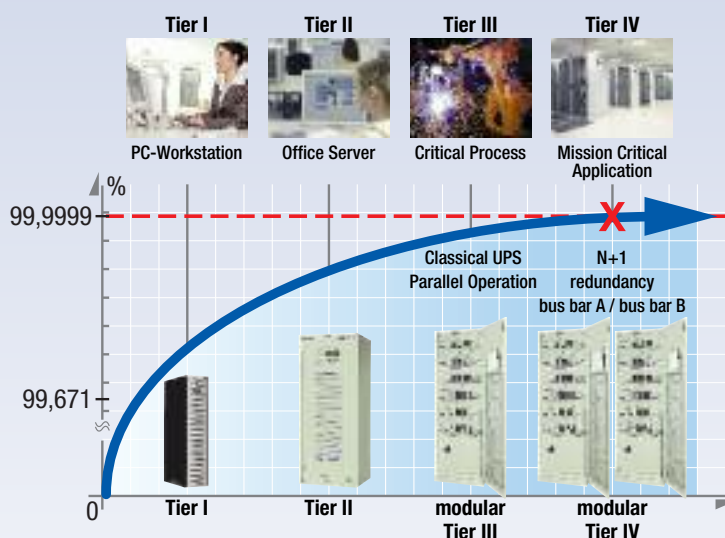
- the operating mode changes
- during linear load steps
- during non-linear loadsteps

## Mains Disturbances and UPS Solutions

Voltage Phenomenon	Time	e.g.	EN/IEC 62040-3	UPS-Solution
1. Outage - blackouts	> 10 ms		<b>VFD</b> Voltage- and Frequency dependent	<b>Classification 3</b> Offline  <b>Classification 2</b> Line Interactive
2. Sags/brownouts	< 16 ms			
3. Dynamic overvoltage	4...16 ms			
4. Undervoltage	continuous		<b>VI</b> Voltage independent	
5. Overvoltage	continuous			<b>Classification 1</b> Real double Conversion
6. Transients (Surge)	< 4 ms			
7. Lightning	sporadic		<b>VFI</b> Voltage- and Frequency independent	
8. Voltage distortion HF (Burst)	periodically			
9. Voltage harmonics	continuous			
10. Frequency variations	sporadic			

published by ZVEI: UPS Guide

## Tier Classification Tier I – Tier IV



## Tier Classification System

Uptime Institute New York has created the international Tier classification system for the infrastructure of data centers.

According to this topology four Tier levels (I-IV) are used:

- Tier I: Non-redundant
- Tier II: Basic redundant
- Tier III: Concurrently maintainable (No shutdowns for equipment replacement and maintenance)
- Tier IV: Fault tolerant (Withstands a single unplanned event).

ENERTRONIC modular UPS systems with n+1 redundant parallel architecture are Tier III classified and two separate redundant ENERTRONIC modular UPS systems with two different input sources (bus bar A and bus bar B) are Tier IV solutions.

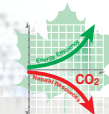


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9001

ISO  
14001

SCC



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