

BENNING

World Class Power Solutions



ENERTRONIC modular

Three Phase UPS System
with Modular, Hot-Plug Design



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

Introduction

BENNING has been supplying modular DC power solutions for IT, telecom and industrial applications for more than 20 years. These DC systems are very reliable as they consist of parallel operating hot-plug DC power modules with n+1 redundant configuration. This design allows easy and rapid replacement as well as upgrade or downgrade of the power capacity following any change in the load requirements.

The modules can be replaced without any interruption of the load.

Following this trend in the standby DC market, more and more customers are now demanding a similar modular, N+1 redundant solution for their UPS requirements.

Features of the ENERTRONIC modular UPS Systems:

- Scaleable UPS systems with hot-plug power modules
- N+1 redundancy ensures highest availability
- Advanced UPS design with IGBT and MOSFET semiconductors and DSP processors
- UPS classification VFI-SS-111 following EN/IEC 62040-3
- High efficiency also at partial load, reduces energy losses
- Sinewave input current (powerfactor 0.99)
- Input current with low harmonic distortion (THDi < 5 %)
- Short MTTR (Mean Time To Repair)
Replacement of modules without any load interruption
- Online diagnosis and monitoring

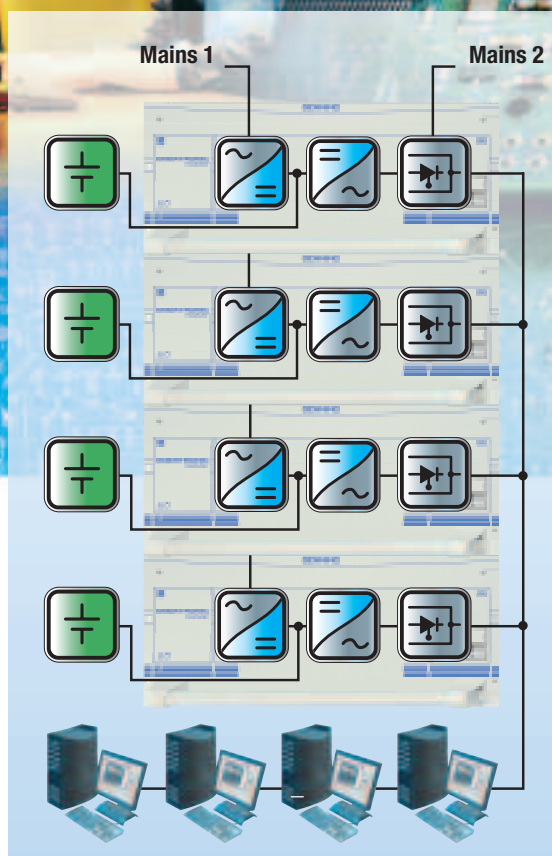


Fig. 1: Decentralized parallel configuration

ENERTRONIC modular – the new UPS Standard with DSP Processor Technology

BENNING followed the request of many customers and has developed the ENERTRONIC modular UPS range as a system with parallel operating three phase hot-plug UPS modules.

Each module represents a complete double conversion UPS system with three phase input, rectifier, inverter, static-bypass, DSP processor regulation, three phase output and batteries.

The 20 kVA rated output power of each module allows the scalability of systems in small steps.

The modular design makes any system upgrade or downgrade very flexible and avoids high investment costs for power which is not needed at the first stage of installation.

ENERTRONIC modular

Reliable, Cost Saving, Scaleable

DSP Processor Technology

In each ENERTRONIC module two DSP processors are responsible for regulation and monitoring. Thanks to this advanced design the quantity of electronic components has been reduced compared to conventional UPS systems which results in better MTBF figures.

The power section of the ENERTRONIC modules is based on MOSFET and IGBT technology which results in less module weight and size (1.5 to 2 times), compared to conventional UPS systems.

High Efficiency also at partial Loads, means less TCO (Total Cost of Ownership)

High efficiency of UPS systems is essential to reduce operation costs. The ENERTRONIC modular UPS has been designed to provide high efficiency at rated loads and also at partial loads. (Fig. 2) This excellent efficiency lowers the energy consumption as well as the investment and operation costs for the airconditioning equipment.

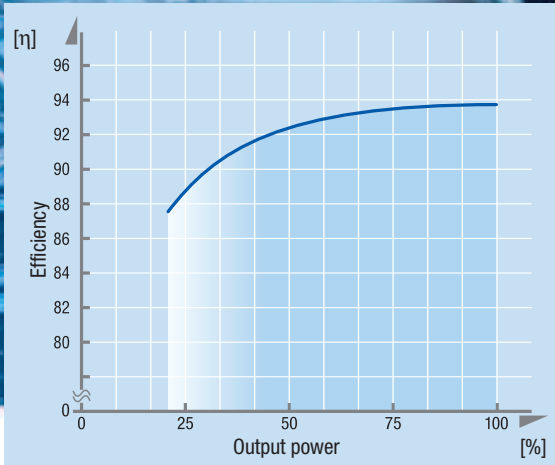


Fig. 2: Efficiency as a function of output power

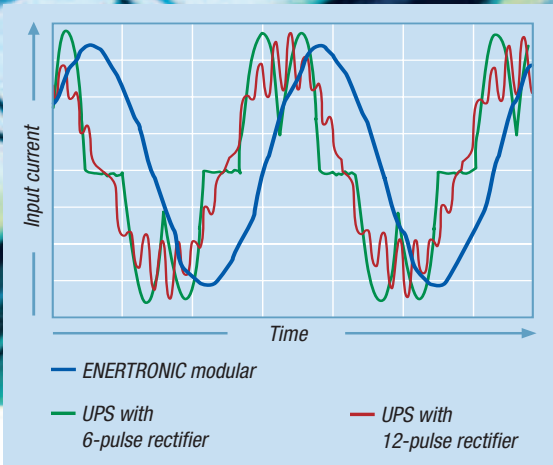


Fig. 3: The near unity power factor of the ENERTRONIC modular, results in very low harmonic distortion on the mains.

Sinewave Input Current and less than 5 % THDI results in Investment and Energy Savings. (Fig. 3)

The level of harmonic pollution on the input current of conventional UPS systems is about 33 %. Input cables and fuses as well as generator sets have to be oversized to operate these UPS systems as they take additional reactive power from the mains. In some cases, especially for bigger UPS systems, 12-pulse rectifiers or filter systems are needed to compensate this reactive power value. Investment and operating costs have to be considered.

The THDI value of ENERTRONIC modular UPS systems is less than 5 %. Thanks to the built in active power factor correction, the cos phi of the sinewave input current is 0.99. As a result of these advantages ENERTRONIC modular UPS systems do not need any filter systems or oversized gensets.

Classification of the ENERTRONIC modular UPS in accordance with EN/IEC 62040-3. (Fig. 5)

The ENERTRONIC modular UPS is classified as level VFI-SS-111 in accordance with EN/IEC 62040-3.

Part 1 (s. Fig. 5) (VFI, VI, VFD) defines the dependency of the UPS output in regard of the mains input	Part 2 (SS, XX, YY) defines the output waveform sinusoidal, non-sinusoidal	Part 3 (111, 222, 333) Defines the output voltage limits under dynamic deviations
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Part :1 **VFI** • The output voltage is independent of all mains voltage and frequency variations.

Part 2: **SS** • The output waveform is sinusoidal with all linear and non-linear loads.

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

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



ENERTRONIC modular Availability without any Compromise

Hot-plug Modular Redundant Design means highest Availability and short MTTR (MEAN Time To Repair)

The modular n+1 redundant concept of the ENERTRONIC modular UPS, together with real hot-plug design provides the highest availability of the power protection.

The redundant design is still providing 100 % power to the load even if one module fails.

The replacement of the faulty module can be done in less than 10 minutes if the module is available on site. After the replacement the UPS is back to redundant operation.

Redundancy with conventional UPS systems needs to have a second complete system for parallel operation (Fig. 4).



Fig. 4: Comparison of redundant parallel UPS configurations. ENERTRONIC modular compared to traditional standalone UPS systems.

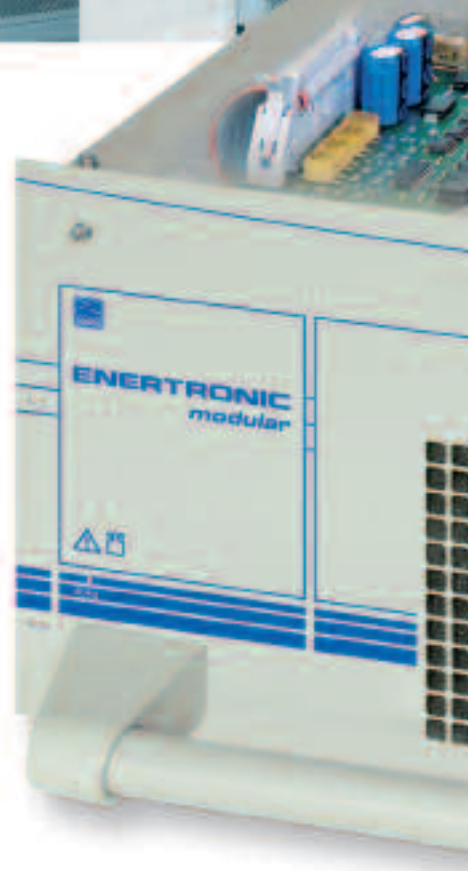


Fig. 6: Power module of the ENERTRONIC modular UPS
Output power 20 kVA

Fig. 5: Mains Disturbances and UPS-Solutions

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

ENERTRONIC modular

Simple Operation, rapid Diagnosis

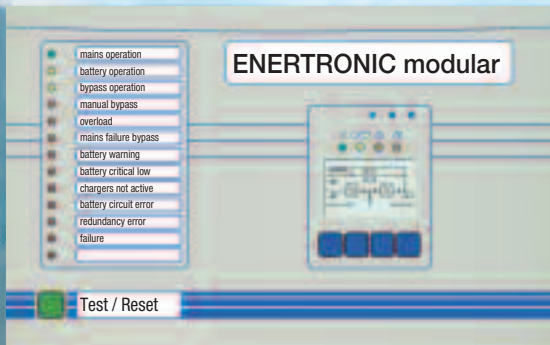
Operation and Monitoring Front Display

The operation and monitoring of the ENERTRONIC modular UPS, is made via the front door keyboard.

The operating and fault signals are indicated by 17 LED's and the system status is displayed and controlled via the built in LCD mimic diagram.

An event recorder stores each occurring event (max. 250 entries) date and time (Fig. 7).

Fig. 7: Display and control unit



The System and Battery Cabinets of the ENERTRONIC modular UPS are very compact in Size and Weight.

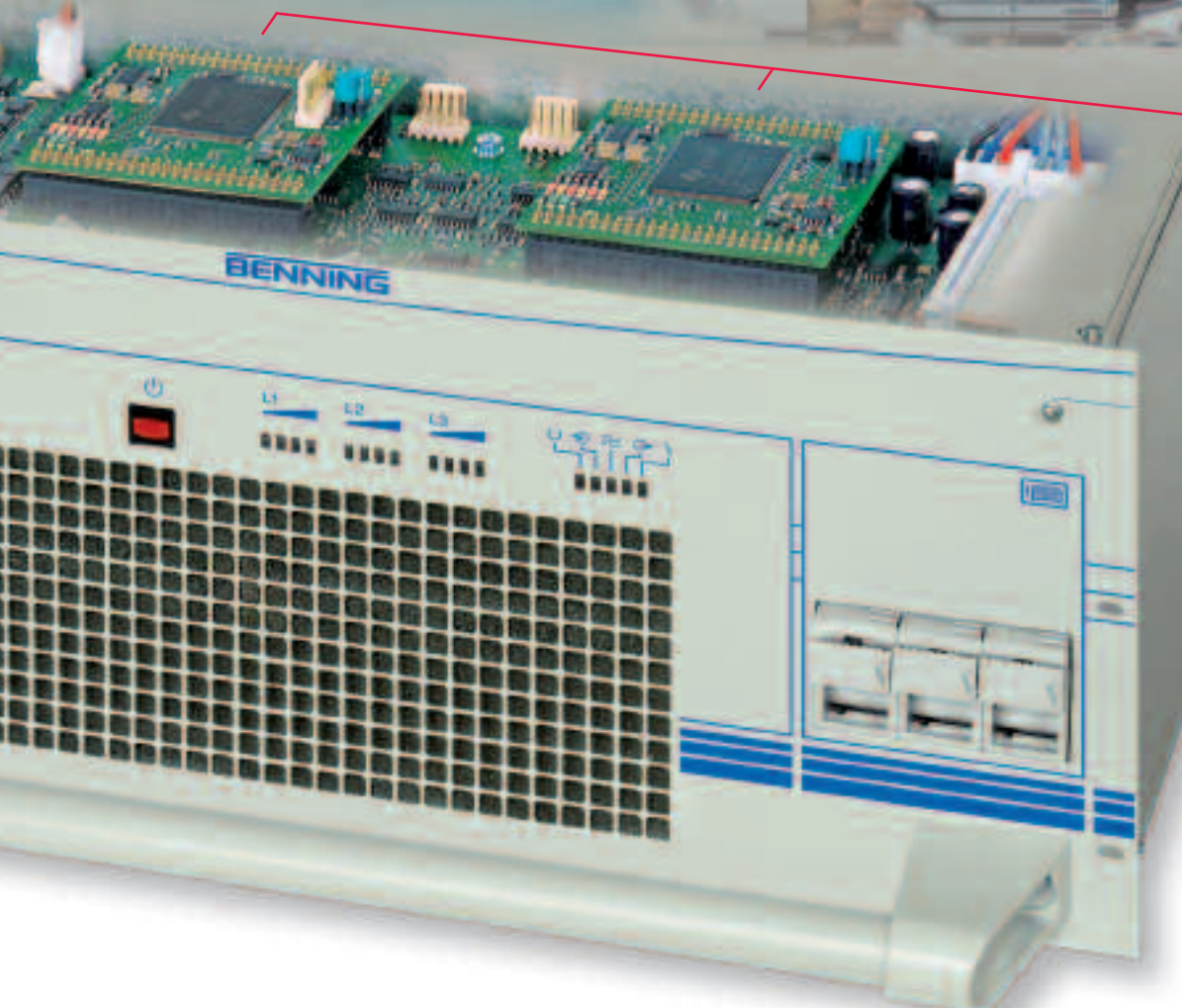
The light-weight system cabinets of the UPS line ENERTRONIC modular can be handled very easily compared to the heavy cabinets of conventional UPS systems. There are also reduced costs for packing and transport using the ENERTRONIC modular UPS.

Each ENERTRONIC modular system cabinet can accommodate max. 5 or 6 modules (depending on height) with 20 kVA output power each which results in 80 kVA or 100 kVA system power for the n+1 configuration.

For this configuration a battery cabinet the same size as the system cabinet is available to accommodate a battery with max. 10 minutes runtime.

Bigger batteries with higher capacities have to be accommodated on battery racks.

The built-in battery management software automatically checks the condition of the battery daily to maintain the best possible power protection availability.



Two DSP processors are responsible for all regulation and monitoring functions.

ENERTRONIC modular Local and Remote Monitoring System

Diagnostics and Monitoring

The expert system of the ENERTRONIC modular UPS enables remote diagnostics and monitoring with complete access to the system for fault finding and repair.

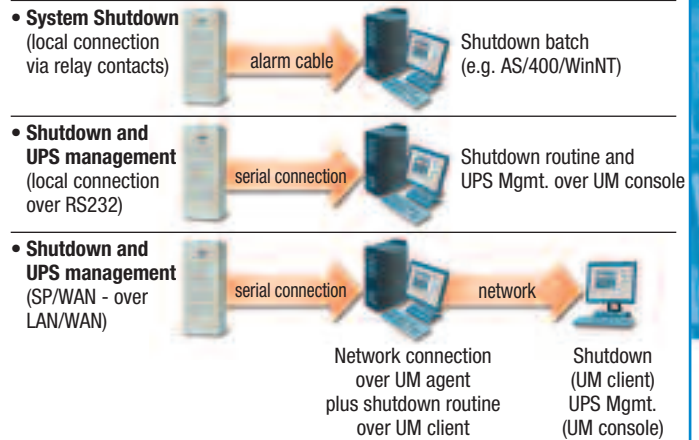
The event recorder allows access to the system status event logs and real time data such as voltage, current, power and frequencies.

The UPS can be configured to call automatically for service based on certain events.



Fig. 8: ENERTRONIC modular (80 kVA, n+1)
with battery cabinet

UPS communication – 3 possibilities:



SNMP – Network Management Integration

The internationally recognised, simple network management protocol, (SNMP) is standard and allows simple monitoring of the UPS.

The ENERTRONIC modular UPS can be integrated into Network systems like HP-Openview, IBM-Netview, Novell NMS and other compatible systems.

UPSMAN – The Automation of different Actions, permitting Shutdown and Monitoring

UPSMAN allows the automation of different actions based on certain events. E. g. arranged shut down of individual PC's over the network or broadcasting messages or e-mails e.g. battery under-voltage.

UPSMAN is available for all standard operating systems.

UPSMON – Factory Data Capture and Monitoring

UPSMON is a complete information software package for monitoring and controlling of the ENERTRONIC modular UPS via serial interface, network or modem.

It is able to monitor realtime processing information and past events. The information can be represented in the form of individual building plans, electrical mimic diagrams or control elements of the devices.

The DDE interface enables compatibility with standard applications such as data bases or spread-sheets for further processing. Simple and clear commands make the software an efficient tool even for non-experts.

Remote Control

For remote control the following functions are contained ex factory

- Emergency Power Off (EPO)
- Generator operation (blocks the bypass)
- External battery disconnecting switch open

Technical Specifications

ENERTRONIC modular 40, 60, 80, 100, 120 kVA

Technical Specifications

UPS design:

online double conversion modular

Rated output:	[kVA] [KW]	40 32	60 48	80 64	100 80	120 96
No. of modules		2	3	4	5	6
Input						
Input current	[A]	54	81	108	135	162
Nominal voltage	[V]	3 x 400 / 230 ± 15 %, 50 Hz ± 5 %				
Distortion	[THDi]	≤ 5 %				
Power factor	cos phi	≥ 0,99				
Output						
Output voltage	[V]	3 x 400 / 230 + N (± 5 % programmable)				
Tolerance static	[%]	≤ 1 static				
Tolerance dynamic	[%]	≤ 5 with 100 % load step				
Tolerance asymmetric load	[%]	≤ 2 with 100 % asymmetric load				
Regulation time	[ms]	≤ 20				
Nominal frequency	[Hz]	50 ± 0,1 %				
Distortion factor	[%]	≤ 2 with linear load				
Distortion factor	[%]	≤ 5 with non linear load EN 50091-1-1				
Crest factor	[%]	≥ 3 : 1				
Overload		150 % for 60 sec., 125 % for 10 min. with three phase load				
Electronic by-pass						
Overload		150 for 10 min, 500 % for 100 ms				
Service		installed				
General data						
Efficiency	[%]	94				
EMC		IEC 62040 - C3				
Permitted ambient temp.	[C°]	0 to 40				
Storage temp.	[C°]	-25 to +70				
Relative humidity	[%]	5 to 95 non condensing				
Installation height	[m]	< 1000 m over absolute altitude without derating				
Cabinet protection		IP 20				
Painting		RAL 7035 textured				
Weight*	[kg]	280	320	360	400	440
Battery						
No. of cells		2 x 108 – 144				

Standards

EN 60801, EN 60950, EN 61000, EN 62040-1, EN 62040-2, EN 62040-3, EN 62040-1-1, VGB 4

* without battery

Specifications are subject to change without notice.

Dimensions UPS Plant [mm]

Type	Height	Width	Depth
PSJ 1868 (5 modules)	1800	600	800
PSJ 2068 (6 modules)	2000	600	800

Dimensions Battery Cabinet [mm]

Type	Height	Width	Depth
Battery cabinet	1800	600	800
Battery cabinet	2000	600	800

With the scaleable UPS system ENERTRONIC modular it is easy to add or reduce the output power.

High initial investment costs can be eliminated. Up or down grading is possible without removing the power or transferring the load to the mains.



Fig. 9: Scalability of the ENERTRONIC modular range 40 kVA up to 120 kVA with one system cabinet and 40 kVA up to 240 kVA with two system cabinets.


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