BENNING

World Class Power Solutions

Excellent Technology, Efficiency and Quality



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## UPS ENERTRONIC I

- For industrial applications
- Single-phase and three-phase output

# UPS ENERTRONIC I – designed to meet the needs of the industry

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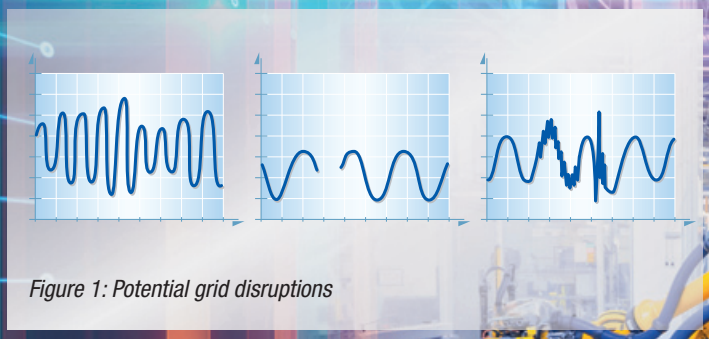


*Figure 1: Potential grid disruptions*

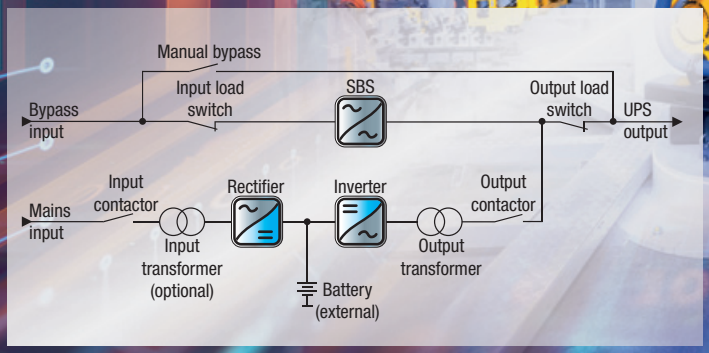



*Figure 2: Single line diagram*



*Figure 3: ENERTRONIC I 40 kVA*

## Maintaining operations safely – even in the event of grid disturbances or failures

Information and data technologies as well as increasingly automated production processes with complex data networking (Industry 4.0) require a reliable and trouble-free power supply.

Due to the high load on the public power supply system caused by feedback from large consumers, switching on during peak consumption periods or lightning strikes, irregularities cannot be prevented. This results in voltage dips, overshoots and transients of the public grid voltage.

For the supply of critical consumers, which require a voltage independent of disturbances of the public network, such as

- **Petrochemical plants**
- **Refineries**
- **Power plants and substations**
- **Process computers**
- **Control rooms**
- **SCADA systems**

should therefore use robust, uninterruptible power supplies (UPSs).

The static UPS system not only has the task of supplying the connected loads continuously and without interruption, but also achieves a significant improvement in voltage and frequency quality compared to the normal network.

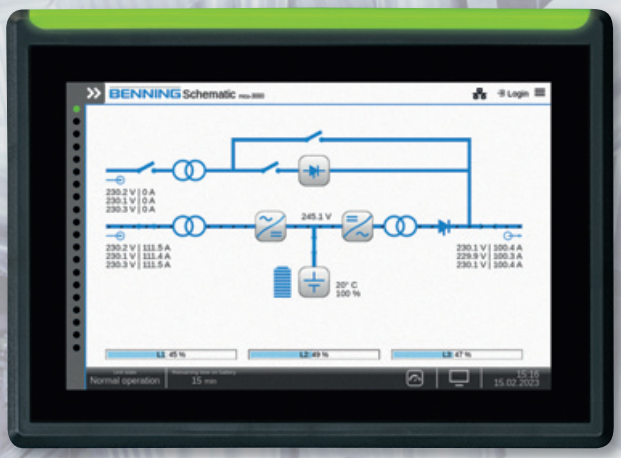
In normal operation, the consumer is supplied by the functional chain transformer, rectifier, inverter and output transformer.

The UPS ENERTRONIC I complies with the highest UPS classification VFI SS 111 according to IEC / EN 62040-3 and stands for maximum safety and economic efficiency, based on the following features:

- **IGBT power semiconductors in the rectifier and inverter**
- **Input power factor of ≥ 0.99**
- **Mains feedback (THDi) < 5 %**
- **Excellent control characteristics for high voltage stability, even with large load changes**
- **Electronic changeover unit (EUE) and internal service bypass**
- **Extensive reporting and monitoring functions**

# ENERTRONIC I – technical details for enhanced safety

**Touch panel**
- Graphical interface with display of energy flow and plant status
- Support of all common written languages
- Event monitor for the last 8000 events. Complete documentation of date, time and message in plain text
- Customisable
- Function setting of the remote control and adjustment of the operating parameters




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## Rectifier

The rectifier consists of an IGBT semiconductor rectifier bridge with power factor correction (power factor = 1), which converts the three-phase supply voltage into a regulated DC voltage to feed the inverter. At the same time, the connected battery is charged or always kept at the optimum state of charge in float charge mode.

The rectifier is dimensioned in such a way that it can simultaneously supply the fully loaded inverter and, after a mains failure, recharge the discharged battery to approx. 95 % of the battery capacity in a time of approx. 12 hours. The rectifier has a start-up delay with soft start to ramp up the starting current after a mains failure.

When parallel systems are switched on again, a series switch-on delay is automatically activated to limit the switch-on current to that of a single rectifier. The rectifier has a charging current and voltage limitation according to the battery supplier's specifications. A temperature-compensated charging characteristic can be integrated as an option.
Instead of the IGBT rectifier, a thyristor rectifier (SCR) can optionally be installed. This may require additional input filters depending on the targeted THDi.

## Inverter

In the inverter, the DC voltage is converted into a single-phase voltage (ENERTRONIC I 3-1) or three-phase voltage (ENERTRONIC I 3-3) by means of sinusoidally optimised pulse width control via the IGBT semiconductors and the output isolating transformer.
Due to the high switching frequency in relation to the fundamental frequency as well as the optimal control of the pulse width, a very good efficiency and a very low distortion factor with non-linear load is achieved even in the partial load range. This also favours the excellent dynamic behaviour if the load changes.

In the event of mains dips or failures, the battery connected to the DC input is automatically used to supply power without interruption. The discharge of the battery is reported. If the discharge threshold of the battery is not reached, the inverter switches off automatically and a message is displayed shortly before the end-of-discharge voltage is reached.

An automatic switchover of the loads to the bypass grid or a corresponding replacement system takes place when the supply by the inverter is no longer guaranteed within the specified tolerances.

## Technical data

| ENERTRONIC I | |
|---|---|
| Operating temperature range | 0 … 40 °C (power reduction if exceeded) |
| Relative humidity | 5 … 95 % (non-condensing) |
| Volume | approx. 65 dBA (depending on performance) |
| Degree of protection | IP20 (others available on request) |
| Installation altitude | 1000 m (without power reduction) |
| Cable entry | below (above on request) |
| Colour | RAL 7035 (others on request) |
| Ventilation | redundant forced ventilation |
| Classification | VFI-SS-111 (in accordance with IEC / EN 62040-3) |
| **Standards** | |
| Safety | IEC / EN 62040-1, IEC / EN 62477-1 |
| EMV | IEC / EN 62040-2 |
| Power | IEC / EN 62040-3 |
| **Input** | |
| Voltage | 3/N 400 V ± 10 % (others on request) |
| Frequency | 50 Hz ± 10 % / 60 Hz ± 10 % |
| Total harmonics distortion THDi (100 % load) | ≤ 5 |
| Input power factor | ≥ 0,99 |
| Transformer | Isolation transformer*1 |
| **Output (inverter operation)** | |
| Voltage tolerance (static) | ± 1 % |
| Frequency tolerance | ± 0,1 % |
| Total harmonics distortion THDu | linear load: ≤ 2 % |
| Inverter overload operation | 200 % for 1 s, 150 % for 60 s, 125 % for 10 min |
| Transformer | Isolation transformer |
| **Battery** | |
| Battery technologies | Lead, Nickel Cadmium, Lithium Ion |

(*1 as an option for systems with 384 V nominal battery voltage)

Subject to technical changes.

## Can be connected in parallel with Group-Connector

Up to 8 units of the ENERTRONIC I series can be connected in parallel for redundancy purposes or to increase power. It works with an active load sharing function in active and passive master mode.

The Group Connector makes it possible to operate two UPS systems individually or in parallel. If half-load parallel operation is implemented with the aid of a coupling switch on two busbars, it is possible to read in the switch position during operation via an auxiliary contact.

When the tie breaker is closed, the load is distributed to both UPS systems – when the tie breaker is open, the UPS systems supply the respective connected rail. A secure supply to the load is thus ensured at all times.

## High short-circuit current

It is optionally possible to design the inverter for a three-phase short-circuit current of up to 4 x I-Nominal (ENERTRONIC I 3-3: 1ph 7 x IN, 3ph 4 x IN or ENERTRONIC I 3-1: 1ph 6 x IN). Depending on the power, a larger cabinet may be necessary.

## Ensuring reliability long-term – thanks to our proactive 360° services

By placing your trust in a BENNING UPS system, you are choosing a high-quality product from one of the world's leading manufacturers of AC and DC power supplies.

You will benefit from our reliable, globally oriented service structure that optimally supports your requirements.
You gain access to high-quality support, spare parts and expert knowledge – how, where and when you want.

BENNING 360° services include reliable maintenance and spare parts management and contribute to safeguarding your operation and preventing possible failures with individual service contracts.

With these proactive services, BENNING helps you to ensure the maximum availability of your power supply in the future.

The transmitter station is thus ideally equipped for the challenges of today and the opportunities of tomorrow.

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360°
proactive service

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# UPS ENERTRONIC I – the most important technical data at a glance

## Technical data

| ENERTRONIC I 3-3 (three-phase input and three-phase output) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power*² (cosφ = 0.8) | [kVA] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 | 200 | 240 |
| Power*² (cosφ = 1.0) | [kW] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 | 200 | 240 |
| **Dimension at battery voltage** | | | | | | | | | | | | | |
| 110 V (H 2000/D 800 mm) | W [mm] | 800 | | | 1200 | | | 1600 | 2000 | 2400 | | | |
| 220 V (H 2000/D 800 mm) | W [mm] | 600 | 800 | | | 1200 | | | 1600 | | | 2000 | 2400 |
| **Output (inverter operation)** | | | | | | | | | | | | | |
| Voltage | | 380 V / 400 V / 415 V (others on request) | | | | | | | | | | | |
| Efficiency | | up to 94 % (depending on configuration) | | | | | | | | | | | |
| Overload operation Bypass | | 1000 % for 100 ms, 150 % for 10 min | | | | | | | | | | | |
| Short-circuit behaviour of inverter | | up to 350 % for 1 s (higher on request) | | | | | | | | | | | |
| Short-circuit behaviour of bypass | | 1000 % for 100 ms | | | | | | | | | | | |

(*² higher performance on request)

| ENERTRONIC I 3-3 (three-phase input and three-phase output) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (cosφ = 0.8) | [kVA] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 | 200 | 300 | 400 | 500 |
| Power (cosφ = 1.0) | [kW] | 8 | 16 | 24 | 32 | 40 | 48 | 64 | 80 | 96 | 128 | 160 | 240 | 320 | 400 |
| **Dimension at battery voltage** | | | | | | | | | | | | | | | |
| 384 V (H 2000 mm) | W [mm] | 600 | | | | | 800 | 1200 | | | | | 1600 | 2100 | |
| | D [mm] | 800 | | | | | 800 | 800 | | | | | 1000 | 1000 | |
| **Output (inverter operation)** | | | | | | | | | | | | | | | |
| Voltage | | 380 V / 400 V / 415 V (others on request) | | | | | | | | | | | | | |
| Efficiency | | up to 95 % (depending on configuration) | | | | | | | | | | | | | |
| Overload operation Bypass | | 1000 % for 100 ms, 150 % for 10 min | | | | | | | | | | | | | |
| Short-circuit behaviour of inverter | | up to 350 % for 1 s (higher on request) | | | | | | | | | | | | | |
| Short-circuit behaviour of bypass | | 1000 % for 100 ms | | | | | | | | | | | | | |

| ENERTRONIC I 3-1 (three-phase input and single-phase output) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (cosφ = 0.8) | [kVA] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 | 200 |
| Power (cosφ = 1.0) | [kW] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 | 200 |
| **Dimension at battery voltage** | | | | | | | | | | | | |
| 110 V (H 2000/D 800 mm) | W [mm] | 800 | | | 1200 | | | 1600 | 2400 | | | |
| 220 V (H 2000/D 800 mm) | W [mm] | 800 | | | | 1200 | | | 1600 | | 2400 | 3000 |
| **Output (inverter operation)** | | | | | | | | | | | | |
| Voltage | | 220 V / 230 V / 240 V (others on request) | | | | | | | | | | |
| Efficiency | | up to 92 % (depending on configuration) | | | | | | | | | | |
| Overload operation Bypass | | 1000 % for 100 ms, 150 % for 10 min | | | | | | | | | | |
| Short-circuit behaviour of inverter | | up to 300 % for 1 s (higher on request) | | | | | | | | | | |
| Short-circuit behaviour of bypass | | 1000 % for 100 ms | | | | | | | | | | |

| ENERTRONIC I 3-1 (three-phase input and single-phase output) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (cosφ = 0.8) | [kVA] | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 | 120 | 160 |
| Power (cosφ = 1.0) | [kW] | 8 | 16 | 24 | 32 | 40 | 48 | 64 | 80 | 96 | 128 |
| **Dimension at battery voltage** | | | | | | | | | | | |
| 384 V (H 2000/D 800 mm) | W [mm] | 800 | | | | 1200 | | | | | |
| **Output (inverter operation)** | | | | | | | | | | | |
| Voltage | | 220 V / 230 V / 240 V (others on request) | | | | | | | | | |
| Efficiency | | up to 93 % (depending on configuration) | | | | | | | | | |
| Overload operation Bypass | | 1000 % for 100 ms, 150 % for 10 min | | | | | | | | | |
| Short-circuit behaviour of inverter | | up to 300 % for 1 s (higher on request) | | | | | | | | | |
| Short-circuit behaviour of bypass | | 1000 % for 100 ms | | | | | | | | | |

We reserve the right to make technical changes.

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# Modern power electronics for economical operation



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*Figure 4: ENERTRONIC I 120 kVA*

## Static bypass switch (SBS)

The EUE enables the loads to be switched to mains supply (bypass mains) without interruption – in compliance with the specified tolerances. The changeover can be triggered automatically by a control signal or manually by means of a button.

The monitoring is autonomous and prevents faulty operation of the system as well as any illogical switching functions of the EUE. For example, any uninterruptible switching, whether automatic or manual, is only possible if the voltage, frequency and phase position of the inverter are synchronised with the bypass grid. Mains frequency deviations that lie outside the specified tolerances cause a changeover block or, in the event of inverter failure, a changeover with interruption.
The EUE consists of a static, microprocessor-controlled and anti-parallel thyristor set in the mains bypass. automatically switches the connected loads to the mains without interruption in the event of a corresponding deviation of the output voltage from the set values.
It automatically switches the load back to the inverter when an overload or short circuit has occurred and normal operation is available again.

## Internal manual bypass

The UPS system is equipped with an internal maintenance bypass (manual bypass) with a manually operated switch. The consumers are then supplied directly from the grid. With the option of an external manual bypass cabinet, the entire UPS can be de-energised, e.g. for recurring tests.

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BENNING
Benning Elektrotechnik und Elektronik GmbH & Co. KG
Münsterstr. 135-137 • 46397 BOCHOLT / Germany
Tel.: +49 (0) 28 71 / 93-0 • E-Mail: info@benning.de
www.benning.de