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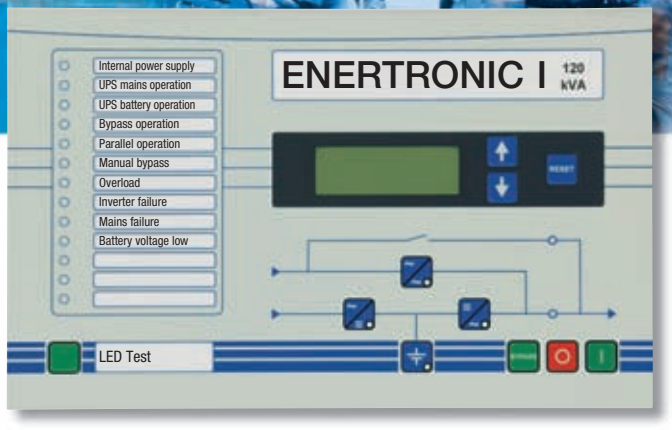
World Class Power Solutions



Industrial UPS, single and three phase output

ENERTRONIC I Range

ENERTRONIC I
disposed for highest security

General

The requirement for power supply reliability is growing, due to the increasing application of information and data carrier systems, text processing, automated production processes and complex data networks.

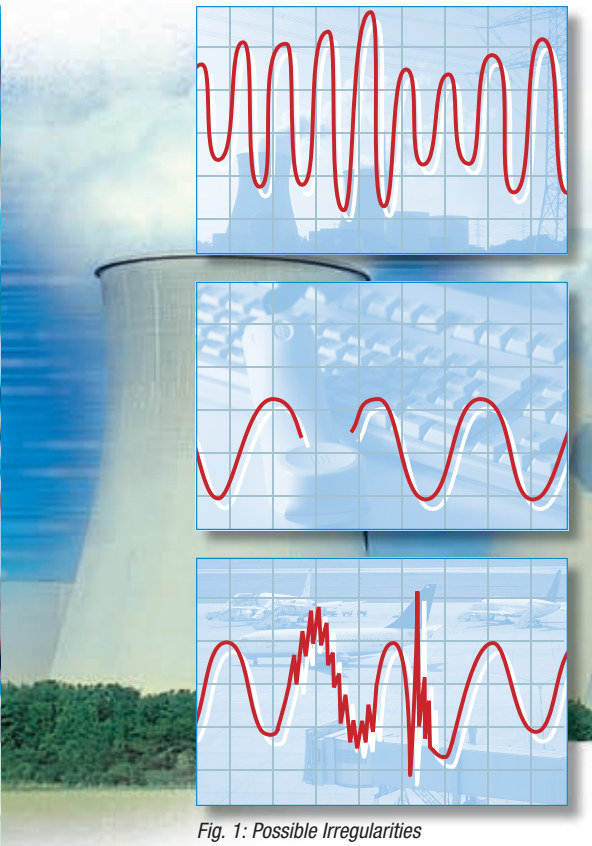


Fig. 1: Possible Irregularities

Fig. 2: ENERTRONIC I UPS

Irregularities due to loading of the public power supply by major users, peak-time use or by lightning strikes cannot be avoided.
The result is:
Mains voltage breaks, spikes and transients. (Fig. 1)

Static UPS's are being installed increasingly for loads that require AC voltages unaffected by interference on the mains e.g.

- **Data processing installations**
- **Process control computers**
- **Air safety installations**
- **Signalling, alarm systems**
- **Telecommunication systems**
- **Power- and Substations**

Design

Due to the use of IGBT transistors of the newest technology in the rectifier and in the inverter, the new ENERTRONIC I range fulfills the highest reliabilty for power supplies and is very economical.
This results in an input power factor of ≥ 0,99 and an input distortion factor of < 5 %.

The exceptional characteristics of this inverter in the ENERTRONIC I series results in very small dynamic voltage deviations even in the case of one hundred percent load changes.

A combination of a 16-bit micro-controller and the latest power electronics is responsible for controlling and monitoring of all rectifier, inverter and static switch functions with highest reliability. A static switch and a manual bypass switch are integrated in the unit.

In the front of the cabinet there is a plastic foil keyboard with 6 keys, 4 three coloured and 2 single coloured LED's and a mimic diagram.

ENERTRONIC I
an uninterrupptible power supply

Function

The static UPS not only has the task of supplying the connected consumers continuously and without interruption, but beyond that to also provide a clear improvement of the voltage and frequency quality in relation to the normal system. In normal operation the load is supplied by the input autotransformer, rectifier, inverter and output transformer route.
The ENERTRONIC I is designed to meet the highest UPS classification VFI SS 111 in accordance with EN 62040-2.

Fig. 3: Interior view

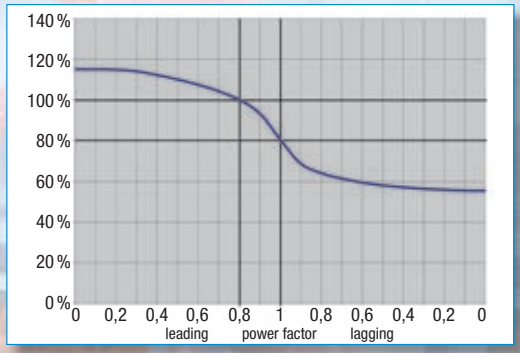


Fig. 4: Available inverter apparent output power depending on power factor

Rectifier

The rectifier consists of an IGBT bridge with power factor correction (power factor = 1), converting the three phase mains voltage via an autotransformer (optional isolated transformer) into a controlled DC voltage to supply the inverter and to recharge the connected battery or to keep the battery in optimum capacity in float charge condition.

The rectifier is able to supply the fully loaded inverter and to recharge the discharged battery to 95 % of its capacity within 12 hours.

The rectifier is equipped with a software controlled soft start to start the rectifier on a ramp after mains failure.

The restart of parallel systems is done in steps so that not all UPS's are starting at the same time.

The rectifier is also equipped with an IU charging characteristic in accordance with the information of the battery manufacturer, with the option of battery temperature compensation.

Inverter

The inverter power block changes DC voltage into a single or three phase sinusoidal AC voltage with constant amplitude and stable frequency. The output voltage is independent of line disturbances or power failures.
The unit works with an IGBT inverter bridge with pulse width modulation having a high efficiency in the partial load range as well as achieving a low distortion factor at non linear load.

In the event of mains interruption or failure, the battery connected to the DC input is brought in automatically and without interruption to supply current. If the battery becomes discharged this is reported. If the battery discharge limit is exceeded, the inverter automatically turns off and a warning is given shortly before the discharged voltage limit is reached.

Automatic change-over of the load to the bypass mains or a suitable spare supply occurs if the supply from the inverter falls outside the preset tolerances.

ENERTRONIC I
multi utilities

Static Bypass

The static bypass of the UPS facilitates uninterrupted change-over to direct mains supply (bypass mains), keeping within the specified tolerances. The change-over can be initiated manually or automatically by a control signal. The µP monitoring is autonomous and prevents incorrect operation of the UPS and any illogical switching functions of the static bypass.

Thus, for example, an uninterrupted change-over, whether automatic or manual, is only possible when the voltage, frequency and phase conditions of the inverter are synchronised with the bypass mains. Mains frequency deviations, which lie outside the preset tolerances cause blocking of the change-over, or if the inverter fails, a change-over with an interruption.

A change back can only occur to a functioning inverter, and is in everycase uninterrupted even if the mains should fail on a test change-over.

The static bypass consists of a microprocessor-controlled anti parallel thyristor block. It can be activated manually with a push button, in order to test the change-over. The change-over from inverter to the mains and back takes place in a synchronised operation without a break.

The static bypass has an overload capability of 150 % for 10 min. and 500 % (single phase output) and 1000 % (three phase output) for 100 ms.
After the presence of an overload or a short-circuit, it automatically resets the load to the inverter, if normal operation is possible.

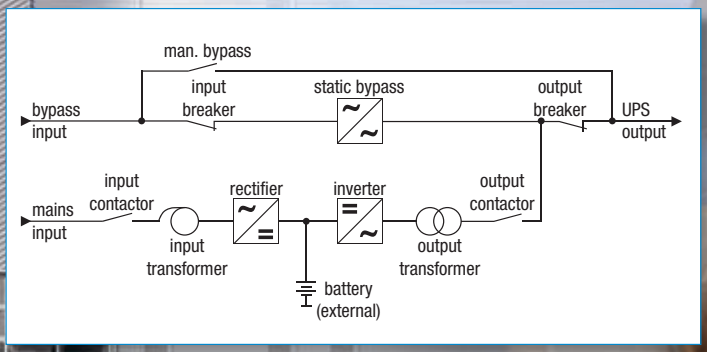


Fig. 5: Block diagram

Internal manual bypass

Each UPS is equipped with a maintenance bypass with manually operated switch. When operated, the ENERTRONIC I is completely disconnected from the load. The supply to the load is now directly from the mains via the manual bypass. (Fig. 5)

Parallel Operation

For redundancy or increased output power, up to eight ENERTRONIC I units can be connected in parallel, operating in an active load-sharing mode with active and passive master.

Half load parallel operation is achieved using two separate bus bars, connected with a coupling switch. The state of the coupling switch is relayed to the microprocessor, via an auxiliary contact.

Option

For power plant applications where higher than normal fault three phase clearing current is required, it is possible to specify an option for 4 x I nominal system output. Depending on the output power, a bigger cabinet may be required.

ENERTRONIC I
all-purpose

Technical Data

ENERTRONIC I 3-1 with three phase input and single phase output - DIN Type: D400 E230/...../2 rfg-UEG....
Nominal power cos. φ 0,8: [kVA] 30, 40, 50, 60, 80, 100, 120

Type ENERTRONIC I

UPS Nominal output power (cos. φ=0,8 ind.):	[kVA]	30	40	50	60	80	100	120

Inverter data
ENERTRONIC I 3-1

Inverter input voltage:	[V]	187 - 264						
Nominal input real power (with load cos. φ=0,8 ind.):	[kW]	25,5	34,4	42,5	51,1	68,1	-	-
Nominal output real power (cos. φ=1):	[kW]	24	32	40	48	64	-	-
Nominal output current (cos. φ=0,8):	[A]	130	173	217	260	347	-	-
Nominal output current (cos. φ=1):	[A]	104	139	173	208	278	-	-
Nominal output voltage:	[V]	230 V (adjustable ± 5%)						
Nominal output frequency:	[Hz]	50						
Transformer:		galvanically isolated						
Voltage tolerance:								
- static	[%]	± 1						
- dynamic with 100% load change	[%]	< 5						
Regulation time:	[msec]	< 10						
Angle deviation:		< 1°						
Frequency tolerance:								
- mains synchronised	[%]	± 1 (synchronisation range ± 4)						
- self synchronised	[%]	± 0,1						
Distortion factor (acc. EN 62040-1):								
- linear load	[%]	< 1						
- non linear load	[%]	< 5						
Crest factor:		≥ 3						
Overload:	[%]	150% 60 sec., 125% 10 min.						
Short-circuit behaviour:	[%]	300% 3 sec. Inverter itself is short circuit proof, switch OFF after max. 3 seconds if bypass mains is not available (EN 62040)						
Inverter efficiency with nominal load (cos. φ 0,8):	[%]	≥ 92				≥ 94		

Front Panel

The operation of the UPS is made by a plastic foil keyboard with 6 keys, 4 three coloured and 2 single coloured LED's. There is a mimic diagram on the operating section. The operating condition and any operational disturbances are represented by the multi colour LED's. (Fig. 6)

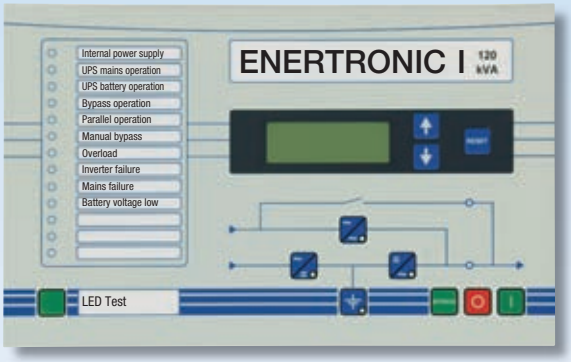


Fig. 6: Front Panel

There is a 4-line, 80-digit LC display in the operating section for reading information and/or for clear guidance by the menu. Control of the operating section takes place via the display controller, which communicates over the CAN bus with the controller board.
In addition, the most important operating and fault signals are indicated by 13 single LED's.

Rectifier:

- input voltage (each phase/phase or phase/neutral conductor)
- input current of each phase
- frequency

Inverter:

- output voltage (with three phase output phase/phase or phase/neutral conductor)
- output current (with three phase output of each phase)
- frequency
- apparent power
- real power

ENERTRONIC I
all-purpose

Technical Data

ENERTRONIC I 3-3 with three phase input and three phase output - DIN Type: D400 D400/...../2 rfg-UDG....
Nominal power cos. φ 0,8: [kVA] 30, 40, 50, 60, 80, 100, 120

Type ENERTRONIC I

UPS Nominal output power (cos. φ=0,8 ind.):	[kVA]	30	40	50	60	80	100	120

Inverter data
ENERTRONIC I 3-3

Inverter input voltage:	[V]	187 - 264						
Nominal input real power (with load cos. φ=0,8 ind.):	[kW]	25,5	34,4	42,5	51,1	68,1	85,1	102
Nominal output real power (cos. φ=1):	[kW]	24	32	40	48	64	80	96
Nominal output current (cos. φ=0,8):	[A]	43,3	57,7	72,1	86,6	115	144	173
Nominal output current (cos. φ=1):	[A]	34,6	46,2	57,7	69,3	92,4	115	138
Nominal output voltage:	[V]	3/N 400 V (adjustable ± 5 %)						
Nominal output frequency:	[Hz]	50						
Transformer:		galvanically isolated						
Voltage tolerance:								
- static	[%]	± 1						
- 50 % asymmetric load	[%]	± 1						
- 100 % asymmetric load	[%]	± 3						
- dynamic with 100 % load change	[%]	< 5						
Regulation time:	[msec]	< 10						
Angle deviation:								
- symmetric load		< 1 °						
- 50 % asymmetric load		< 2 °						
- 100 % asymmetric load		< 3 °						
Frequency tolerance: - mains synchronised	[%]	± 1 (synchronisation range ± 4)						
- self synchronised	[%]	± 0,1						
Distortion factor (acc. EN 62040-1): - linear load	[%]	< 1						
- non linear load	[%]	< 5						
Crest factor:		≥ 3						
Overload: - 3ph	[%]	150 % 60 sec., 125 % 10 min.						
- 1ph / N	[%]	220 % 60 sec., 180 % 10 min.						
Short-circuit behaviour: - 3ph	[%]	200 % 3 sec.						
- 1ph / N	[%]	350 % 3 sec.						
		Inverter itself is short circuit proof, switch OFF after max. 3 seconds if bypass mains is not available (EN 62040)						
Inverter efficiency with nominal load (cos. φ 0,8):	[%]	≥ 92				≥ 94		

Battery:

- voltage
- charge/discharge current
- remaining back up time
- remaining capacity

Bypass:

- input voltage (with three phase output phase/phase or phase/neutral conductor)
- input current (with three phase output of each phase)
- frequency

An event recorder stores each occurring event (push button operation, switching events and error) with date and time. Up to 1200 entries can be stored.

The following information is indicated via 6 volt free change over contacts:

- mains operation (mains OK)
- battery operation
- bypass operation
- manual bypass activated
- low battery voltage
- common alarm

As serial interfaces a RS232 and RS485 each with MODBus protocol is provided as standard, additionally an analogue output with 0 or 4 to 20 mA is included which can be programmed with an internal value, e.g. output power.

Digital inputs:

- EMERGENCY POWER OFF (EPO)
- remote ON/OFF
- inhibit battery charging
- generator operation
- inhibit bypass operation

As an option an additional relay card with 6 relays and an additional interface card with a RS232 and RS485 can be build in, also a Profibus interface and network interface (TCP/IP) can be added.

ENERTRONIC I
General data

Technical Data

Type ENERTRONIC I

UPS Nominal output power (cos. φ=0,8 ind.):	[kVA]	30	40	50	60	80	100	120

Rectifier data
ENERTRONIC I 3-1 and 3-3

Max. input power:	[kVA]	32,7	43,5	54,4	65,2	78,1	108	129
Nominal input power without battery charging:	[kVA]	27,2	36,2	45,3	54,3	72,2	90,2	108
Nominal input current without battery charging (at 400 V):	[A]	39,2	52,3	65,4	78,4	104	130	155
Max. input current with high rate charging (at 400 V):	[A]	47,2	62,8	78,5	94,1	112	155	186
Transformer:		autotransformer (optional galvanically isolated)						
Input power factor:	[cos. φ]	≥ 0,99 (0,97 already at 25 % load)						
Nominal input voltage:	[V]	3/N 400 V ± 15 %						
Nominal input frequency:	[Hz]	50 Hz ± 5 %						
Mains distortion (at 100 % load):	[%]	≤ 5						
Current ripple:		< 5 A / 100 Ah						

Battery data

Recommended number of battery cells:		106 - 116						
Max. charging current:	[A]	20	27	34	41	55	69	83

General data

Over all efficiency (AC to AC) without battery charging:								
- 100 % load		88,4	88,4	88,4	88,4	88,7	88,5	88,5
- 75 % load		88,7	88,7	88,7	88,7	89,1	88,9	88,9
- 50 % load		89,0	89,0	89,0	89,0	89,5	89,1	89,1
Heat dissipation: - 100 % load	[kW]	3,2	4,2	5,2	6,3	8,4	10,4	12,6
Noise level with 1 m distance:	[dB(A)]	63		65			67	
Permitted ambient temp.:	[°C]	0 to +40 (daily average ≤ 35)						
Relative humidity:	[%]	5 - 95 without condensing						
Permitted installation height:	[m]	< 1000 m above sea level without derating						
Humidity class:		DIN/IEC 721 2-1-09/86						
Protection degree:		IP 20 (DIN/VDE 0470 part 11/92 IEC 529) / others optional						
Radio interference:		EN 50091-2 standard class A (optional class B)						
Dimensions (Width x Depth x Height):	[mm]	800 x 800 x 2000 (optional 2200 height)						
		(max. 30 kVA single phase and 60 kVA three phase output)						
	[mm]	1600 x 800 x 2000 (optional 2200 height)						
		(max. 80 kVA single phase and 120 kVA three phase output)						
Cooling: forced cooled with speed controlled, redundant and monitored fans, build in the air inlet, equipped with air flaps, which close in case of fan failure, fans can be changed from front, power blocks and transformers are temperature monitored, prewarning will be sent out, after temperature increase switch OFF, air inlet from front, air outlet from top								
Cable entry:		from bottom (optional from top with cable cabinet, width 200 mm)						
Painting:		RAL 7035, structured power coating						

Static bypass

Nominal voltage:	[V]	230 / 400
Nominal frequency:	[Hz]	50
Over load: - 10 min.	[%]	150
- 100 msec.	[%]	ENERTRONIC I 3-1: 500, ENERTRONIC I 3-3: 1000
Transfer limits:	[%]	U ± 10; F ± 5
Inverter/Bypass transfer time:		
- inverter failure	[msec]	< 1
- overload or manual transfer	[msec]	< 1
		interlock when transfer was activated 5 times within a minute
Bypass/inverter transfer time:	[msec]	< 1

Other options, e.g. bypass transformer on request.

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ISO 9001

ISO 14001

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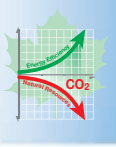

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