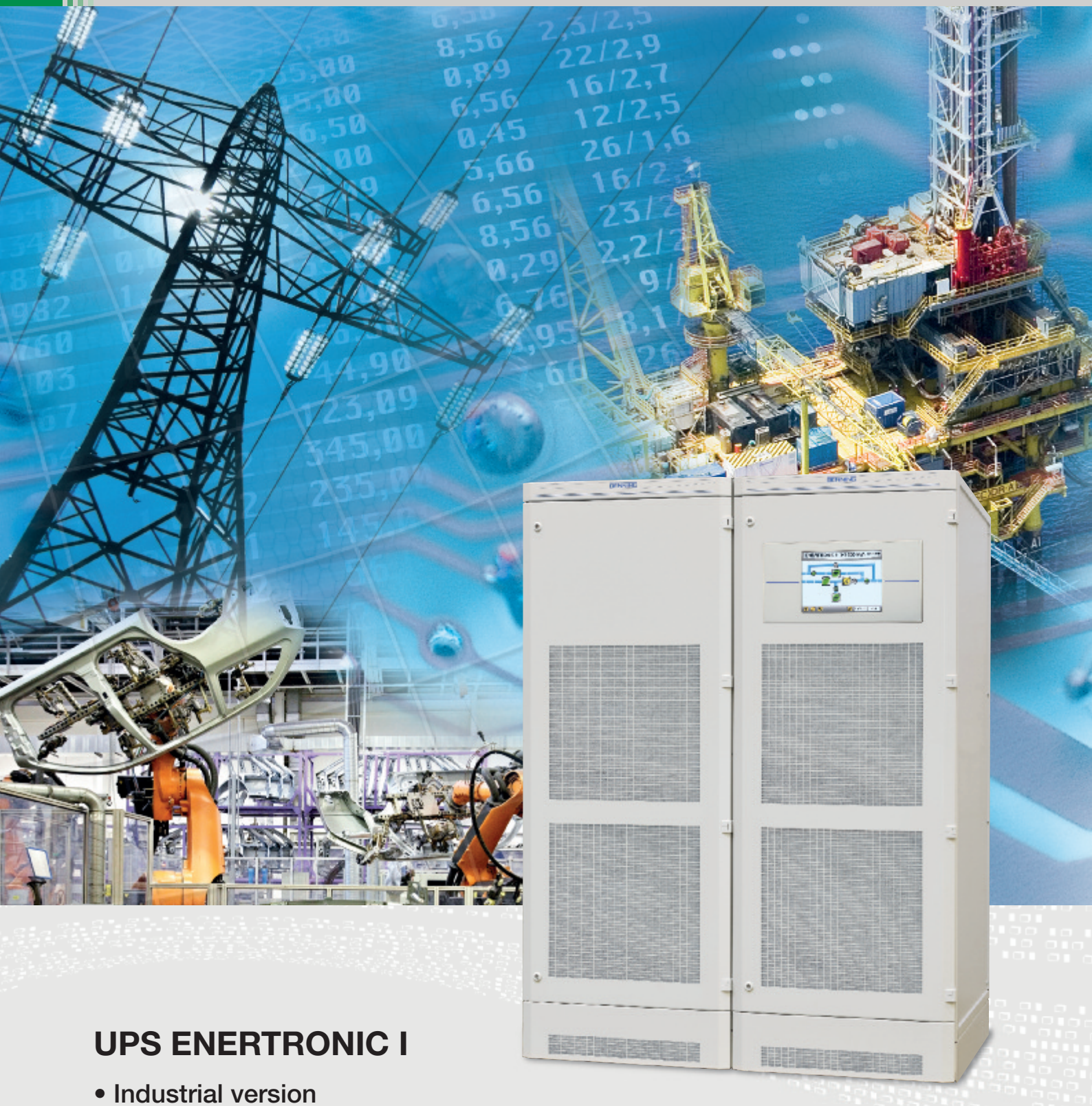
BENNING
World Class Power Solutions

Excellent Technology, Efficiency and Quality



UPS ENERTRONIC I

- Industrial version
- Single-phase and three-phase output

ENERTRONIC I UPS – developed to meet industrial demands

Figure 1: Possible grid disturbances

Maintaining safe operation – even during grid disturbances or power cuts

The ever-increasing requirement for data, as well as the rise in automated production processes that include complex data networking (Industry 4.0), necessitate a reliable and trouble-free current supply.
However, power irregularities caused by high loading of the public power supply cannot be avoided. This can be caused by grand scale energy consumers, on grid switching in periods of maximum consumption or lightning strikes. The results are voltage dips, overshooting and transients in the public power supply.

To maintain crucial tasks and minimise downtime some critical consumers require power, which is independent of public grid disturbances. Those critical customers are for example:

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

All of which require robust, uniterruptible power supplies (UPSs) to meet this criteria.

The static UPS installation doesn't only supply connected consumers with continuously and free of interruption power, but furthermore also achieves a significant improvement in voltage and frequency quality in comparison with the normal grid.

In normal operation the function chain (rectifier, inverter and output transformer) supplies the consumer. The ENERTRONIC I UPS corresponds to the maximum UPS classification VFI SS 111 in accordance with EN 62040-3 and provides maximum safety and economy on the basis of the following features:

- **IGBT power semiconductor in the rectifier and inverter**
- **Input power factor ≥ 0.99**
- **Input current THD (THDi) < 5%**
- **Excellent control properties for high voltage stability, even with large load changes**
- **Electronic switchgear (EUE) and internal service bypass**
- **Extensive reporting and monitoring functions**

ENERTRONIC I – technical details for your extra safety

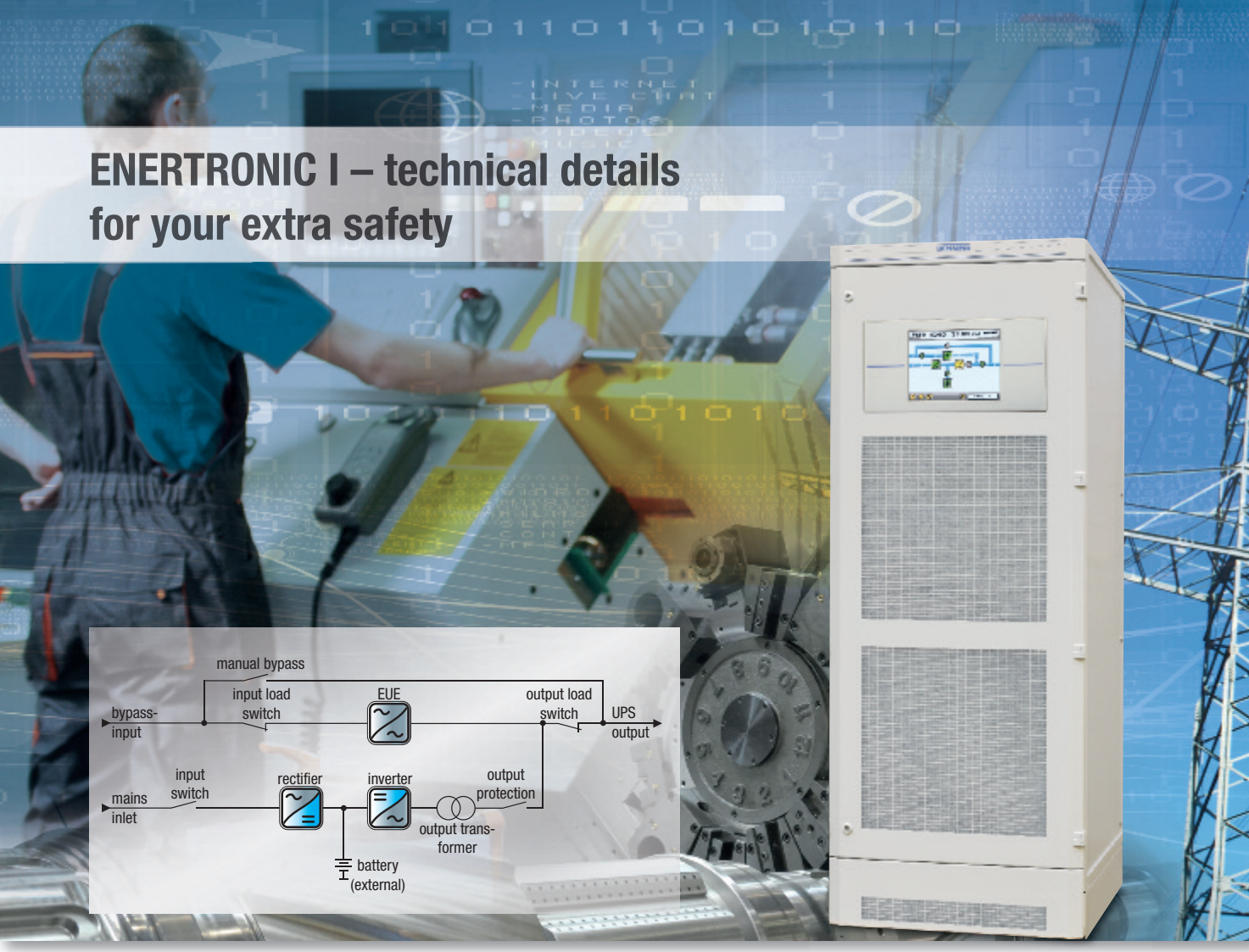


Figure 2: Overview of circuit diagram

Figure 3: ENERTRONIC I 40 KVA

Electronic switching facility (EUE)

The electronic switchgear facilitates the switch to bypass supply (bypass-grid) without any interruption and whilst maintaining the specified tolerances. The switch over can be achieved automatically by the control signal or manually by the user.

System monitoring and control circuitry prevents operating errors, as well as any illogical switching function of the EUE. Thus, any uninterrupted switch over (whether automatic or manual) is only possible when voltage, frequency and phasing of the inverter are synchronised with the bypass-grid.

Grid frequency deviations outside the specified tolerances will inhibit the EUE operations.

The electronic switching facility (EUE) consists of a static, micro-processor-controlled and antiparallel thyristor set in the grid bypass. It switches over the connected loads to the grid automatically and free of interruption if the UPS output voltage deviates from prescribed tollerances for any reason.

The EUE has an overload capability of 150% for 10 minutes and 500% (ENERTRONIC I 3-I) or 1000% (ENERTRONIC I 3-3) for 100 ms. It automatically switches the load back to the inverter when there has been an overload or short circuit and operation is normal again.

Internal manual-bypass

The UPS is fitted with an internal service bypass (manual bypass) with a manually operated switch. This facilitates complete disconnection of the ENERTRONIC I from the consumer supply. The consumer is then supplied directly from the grid (Figure 2).

Figure 4: ENERTRONIC I with standard control unit

Figure 5: Extensive reporting and monitoring functions

Parallel switching capability with Group-Connector

Up to 8 ENERTRONIC I series UPS can be connected in parallel for redundancy (N+1) purposes or to increase load capacity. It operates with an active load-sharing function in active and passive master operation modes.

The Group Connector makes it possible to operate two UPS installations in parallel. If semi-load parallel operation is undertaken by means of a section switch on two bus bars, it becomes possible to read the switch setting during operation by means of an auxiliary contactor. When the section switch is closed, the load is distributed to both UPS-installations and when the section switch is open, the UPS-installations supply the respective connected bar. This therefore results in secure supply of the load at at all times.

High short-circuit current

As an option, the inverter output-short-circuit current capability can be increased to 700% for 3 seconds (ENERTRONIC I 3-3) or 400% for 3 seconds (ENERTRONIC I 3-1). Depending on the UPS power rating it may be necessary to increase the cabinet size if this option is taken.

Maintaining long-term reliability – by pro-active 360° services

By placing your trust in a BENNING UPS installation you have decided on a high-quality product from a world leader in the production of AC and DC power supplies. Benning UPS offers a reliable, globally orientated service structure that provides the best possible support for your requirements. You have access to high-quality support, spare parts and expert knowledge – wherever and whenever you require them.

With a Benning service contract you can rely on a high standard of service with reliable delivery dates and rapid delivery of spare parts.

With its pro-active services BENNING can help you secure the maximum availability of your current supply – helping you meet the challenges of today and the opportunities of tomorrow.

360°
pro-active services

www.benning-services.com

Touch Panel (optional)

- Graphic interface with display of the energy flow and the system status
- Support for all common standard languages
- Event monitor for the last 1200 events. Complete documentation of data, time and report in clear text
- Customized configuration possible
- Function setting of the remote control as well as adjustment of the operating parameters

Technical Data

ENERTRONIC I 3-3 (three-phase input and three-phase output)														
Power*[1] ($\cos\varphi = 0.8$)	[kVA]	10	20	30	40	50	60	80	100	120	140	160	200	240
Power*[1] ($\cos\varphi = 1.0$)	[kW]	8	16	24	32	40	48	64	80	96	112	128	160	192
Operating temperature range		0 ... 40 °C (reduction in power beyond this)												
Relative air humidity		5 ... 95% (non-condensing)												
Volume		< 65 dBA (as a function of power)												
Protection class		IP20 (further classes on request)												
Installation height		1000 m (without reduction in power)												
Cable entry point		below (above on request)												
Colour		RAL 7035 (other colours on request)												
Ventilation		redundant forced-air ventilated												
Classification		VFI-SS-111 (according to IEC / EN 62040-3)												
Standards														
Safety		IEC / EN 62040-1, IEC / EN 60950-1												
EMC		IEC / EN 62040-2												
Power		IEC / EN 62040-3												
Input														
Voltage		3 / N 400 V ± 15% (further voltages on request)												
Frequency		50 Hz ± 5% / 60 Hz ± 5%												
THDi (100% load)		≤ 5												
Input power factor		≥ 0.99												
Transformer		Isolation transformer as an option												
Output (inverter mode)														
Voltage		380 V / 400 V / 415 V (further voltages on request)												
Voltage tolerance (static)		± 1%												
Frequency tolerance		± 0.1%												
Total harmonics distortion THDu		Linear Load ≤ 1%												
Efficiency		up to 94% (as a function of the configuration)												
Overload operation - inverter		200% for 3 s, 150% for 60 s, 125% for 10 min												
Overload operation - bypass		1000% for 100 ms, 150% for 10 min												
Short-circuit behaviour - inverter		up to 350% for 3 s (up to 700% as an option)												
Short-circuit behaviour - bypass		1000% for 100 ms												
Transformer		isolation transformer												
Battery														
Nominal voltage		110 V												
		220 V												
		400 V												
Battery technologies		Lead, nickel cadmium, lithium Ion (optional)												

(*[1]higher power ratings on request)

Specifications are subject to change without notice.

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

Technical Data

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	140	160	200
Power (cosφ = 1.0)	[kW]	8	16	24	32	40	48	64	80	96	112	128	160
Operating temperature range		0 ... 40 °C (reduction in power beyond that)											
Relative air humidity		5 ... 95% (non-condensing)											
Volume		< 65 dBA (as a function of power)											
Protection class		IP20 (further classes on request)											
Installation height		1000 m (without reduction in power)											
Cable entry point		below (above on request)											
Colour		RAL 7035 (other colours on request)											
Ventilation		redundant forced-air ventilated											
Classification		VFI-SS-111 (according to IEC / EN 62040-3)											
Standards													
Safety		IEC / EN 62040-1, IEC / EN 60950-1											
EMC		IEC / EN 62040-2											
Power		IEC / EN 62040-3											
Input													
Voltage		3 / N 400 V ±15% (further voltages on request)											
Frequency		50 Hz ± 5% / 60 Hz ± 5%											
THDi (100% load)		≤ 5											
Input power factor		≥ 0.99											
Transformer		Isolation transformer as an option											
Output (inverter mode)													
Voltage		220 V / 230 V / 240 V (further voltages on request)											
Voltage tolerance (static)		± 1%											
Frequency tolerance		± 0.1%											
Total harmonics distortion THDu		Linear load: < 1%											
Efficiency		up to 91% (as a function of configuration)											
Overload operation - inverter		200% for 3 s, 150% for 60 s, 125% for 10 min											
Overload operation - bypass		500% for 100 ms, 150% for 10 min											
Short-circuit behaviour - inverter		300% for 3 s (up to 400% as an option)											
Short-circuit behaviour - bypass		500% for 100 ms											
Transformer		Isolation transformer											
Battery													
Nominal voltage		110 V											
		220 V											
Battery technologies		Lead, nickel cadmium, lithium ion (optional)											

Specifications are subject to change without notice.

Modern power electronics for efficient operation

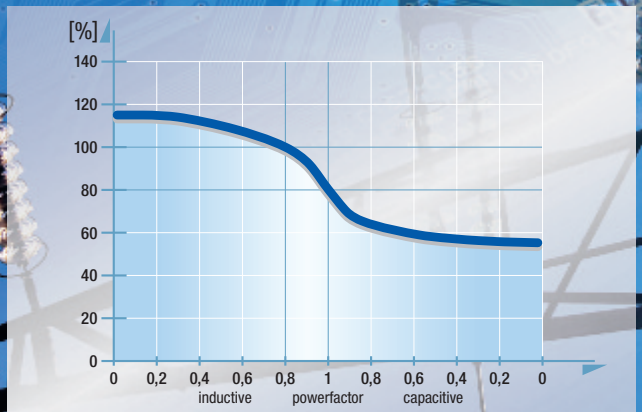


Figure 6: Output power as a function of the power factor of the connected load

Figure 7: ENERTRONIC I 120 kVA with optional IP21 cabinet

Rectifier

The rectifier consists of an IGBT semi-conductor rectifier bridge with power factor correction (power factor = 1), which converts the three-phase supply current into a controlled direct current in order to feed the inverter. At the same time the connected battery is charged and/or always kept in its optimum charge state by a trickle charging operation.

The rectifier is designed to simultaneously supply the fully loaded inverter and after a power failure, recharge the discharged battery. The rectifier has a start-up delay with soft start in order to ramp up the start-up current after a power failure. In the course of the reconnection of parallel installations, a series switching delay is automatically activated in order to limit the in-rush current to that of an individual rectifier.

The rectifier has a charge current and voltage limit in accordance with the data supplied by the battery supplier. A temperature-compensated charging characteristic line can also be integrated if required.

Inverter

The inverter converts the direct current into single-phase voltage (ENERTRONIC I 3-1) or three-phase voltage (ENERTRONIC I 3-3) by means of sine-optimized pulse-width control in the IGBT semi-conductor and the output isolation transformer. As a consequence of the high switching frequency relative to the base frequency and optimum control of the pulse width, a very high level of efficiency is achieved, even with partial loads and a very small distortion factor with a non-linear load. Furthermore, this promotes an excellent dynamic response with load step changes.

In the event of voltage dips or black-outs, the battery connected to the DC bus bar is used automatically and free-of-interruption for the delivery of current. The battery discharging alarm is activated and if the battery reaches its end of discharge limit, the inverter switches off automatically and an alarm is activated.

Automatic switching of the load to the bypass supply occurs when the inverter supply can no longer be guaranteed within the prescribed tolerances.

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