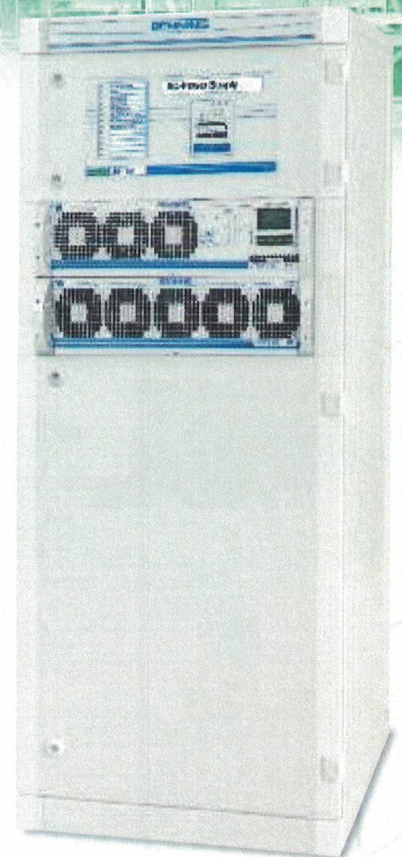
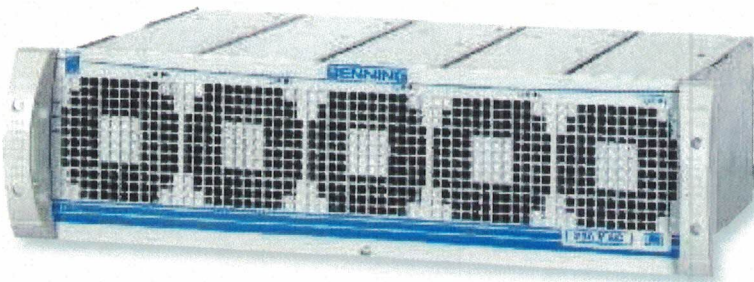


# BENNING

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## Industry

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INVERTRONIC compact  
Modular, Single Phase Inverters

# INVERTRONIC compact

## Cost Saving Power Protection Availability

### Mains failure and mains disturbances may cause serious problems

More and more mission critical loads for industrial and commercial applications require a smooth and uninterrupted supply of electricity.

On the public network, major loads as well as lightning strikes, generate dynamic over voltages, under voltages, sags/brownouts and transients.

### Invertronic compact inverter systems ensure continuous power protection availability

Benning's new advanced INVERTRONIC compact single phase inverter systems provide continuous and high quality AC power for mission critical loads in the industrial and commercial market place.

The INVERTRONIC compact inverter modules offer a very flexible platform to design compact AC/AC power solutions in combination with the modular rectifier range 3000I and 12000I.

(see pages 5 & 6 for examples)

Voltage Phenomenon	Time	e.g.
1. Outage - blackouts	> 10 ms	
2. Sags/brownouts	< 16 ms	
3. Dynamic overvoltage	4...16 ms	
4. Undervoltage	continuous	
5. Overvoltage	continuous	
6. Transients (Surge)	< 4 ms	
7. Lightning	sporadic	
8. Voltage distortion HF (Burst)	periodically	
9. Voltage harmonics	continuous	
10. Frequency variations	sporadic	

published by ZVel: UPS Guide

Table of main disturbances

Malfunctions in the public network (see table of mains disturbances above) may cause hardware failure, disruption of critical loads, unplanned production downtime or loss of communication.

Inverter systems are often the perfect choice to supply reliable and conditioned AC power to mission critical applications.



Fig. 1: 19" Sub-rack with 3 INVERTRONIC compact inverters, static and manual bypass



Fig. 2: 19" Sub-rack with 5 INVERTRONIC compact inverters

### The INVERTRONIC compact range consists of the following system components:

#### 1. 19" sub-rack

The 19" sub-rack is designed to accommodate the INVERTRONIC modules and can be integrated into 19" floor standing or wall mounted cabinets.

The following sub-rack versions are available:

1. Sub-rack with back plane connections for up to 3 inverter modules, one static bypass module and a manual bypass. (fig. 1)
2. Sub-rack with back plane connections for up to 5 inverter modules. (fig. 2)

# INVERTRONIC compact

## Modular Design, Multiple System Integration

### 2. Parallel operating Inverter modules

INVERTRONIC inverter modules are available for use with DC input voltages of 24, 48-60, 110V or 220V. The standard AC output voltage is 230V, but 220V and 240V are selectable. Each inverter module can supply 1-2.5kVA rated output power.

The hot-plug design of the inverter modules together with the dimensions of 1/5 19 inch width and 3U height allows the accommodation into 19 inch 3U sub-racks.

### 3. Static bypass switch

The static bypass switch increases the availability of the inverter system and provides security during overload or short circuit.

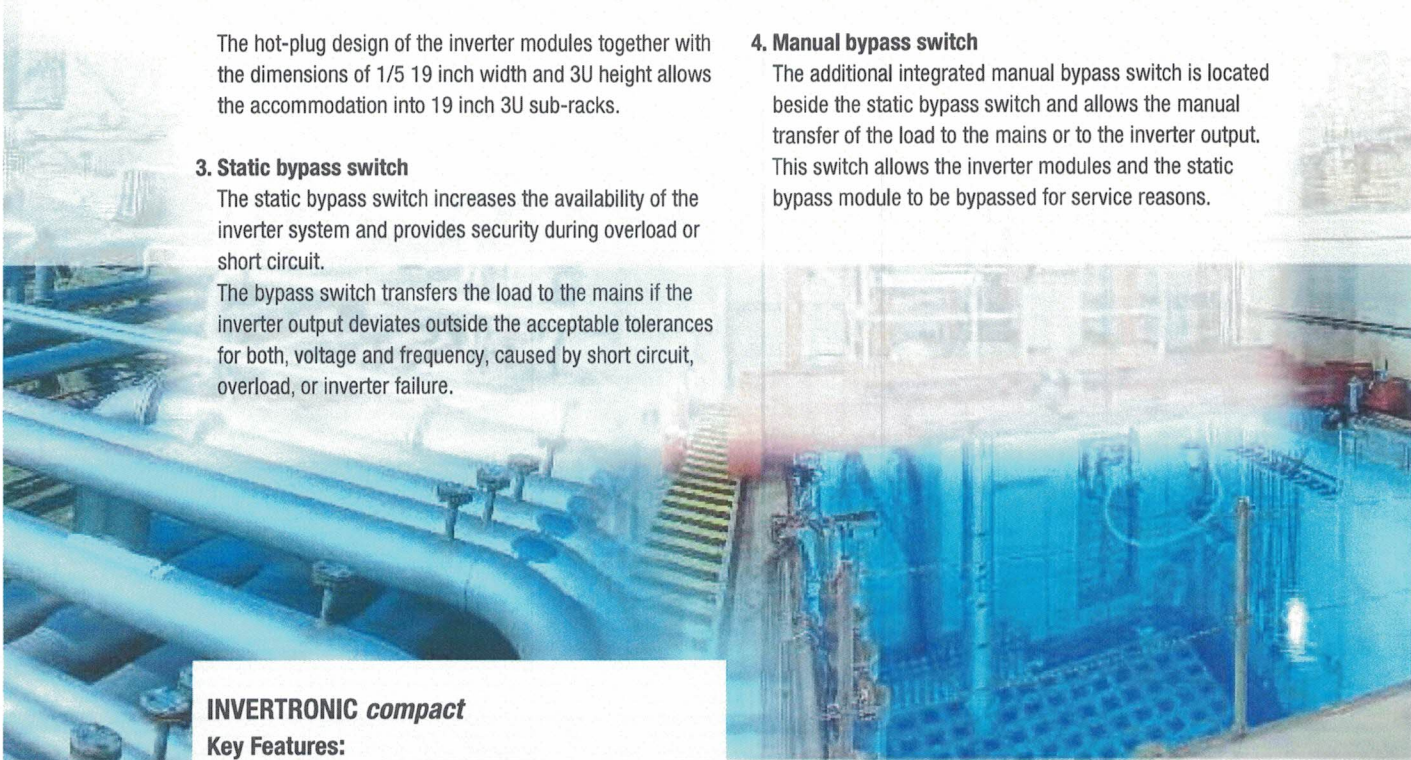
The bypass switch transfers the load to the mains if the inverter output deviates outside the acceptable tolerances for both, voltage and frequency, caused by short circuit, overload, or inverter failure.

Automatic transfer of the load back to the inverter is made after the inverter output has returned to within tolerance. The transfer time is less than 2ms.

The static bypass has the same dimensions as the inverter modules and can be integrated into the 19 inch sub-rack. (Fig.5).

### 4. Manual bypass switch

The additional integrated manual bypass switch is located beside the static bypass switch and allows the manual transfer of the load to the mains or to the inverter output. This switch allows the inverter modules and the static bypass module to be bypassed for service reasons.



### INVERTRONIC compact

#### Key Features:

- Advanced inverter technology with DSP (digital signal processing) and IGBT/MOSFET semiconductors
- Scalable and flexible single phase inverter system with hot -plug inverter modules for parallel operation
- Short MTTR (Mean Time To Repair) Replacement of modules without any load break
- The combination with Benning's modular rectifier range, allows the realisation of very compact AC-AC systems
- High efficiency even at partial loads, means low operating costs
- N+1 redundant configuration ensures continuous availability
- Excellent dynamic response
- High power density with low volume and weight

### Block diagram of the modular construction of INVERTRONIC compact inverter systems

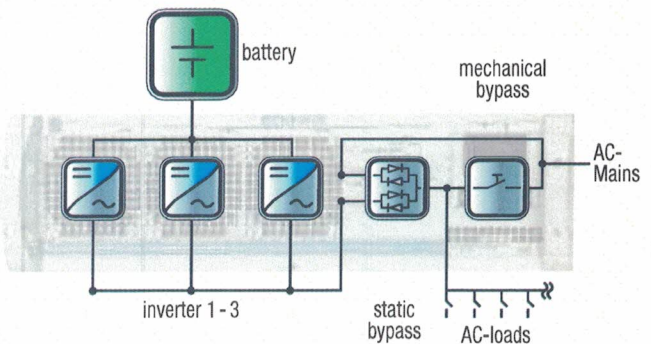


Fig. 3 (above): Sub-rack with 3 inverters, static bypass switch and manual bypass switch

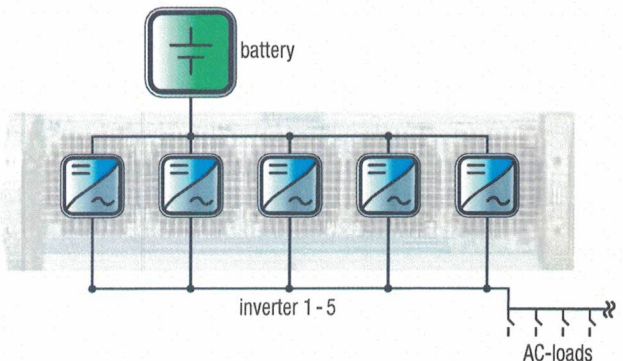


Fig. 4: Sub-rack with 5 inverters, without bypass switch

**INVERTRONIC compact**

Plug and Play Means Lower Operating Costs

**INVERTRONIC compact**

Redundancy Ensures Higher Availability

**Multiple system integration**

The modular design of the INVERTRONIC compact inverters allows flexible configurations of custom designed DC/AC or AC/AC (UPS) power supply solutions.

Fig. 5: 19" Sub-rack with 3 inverters, static bypass and manual bypass, output voltage 230 V AC

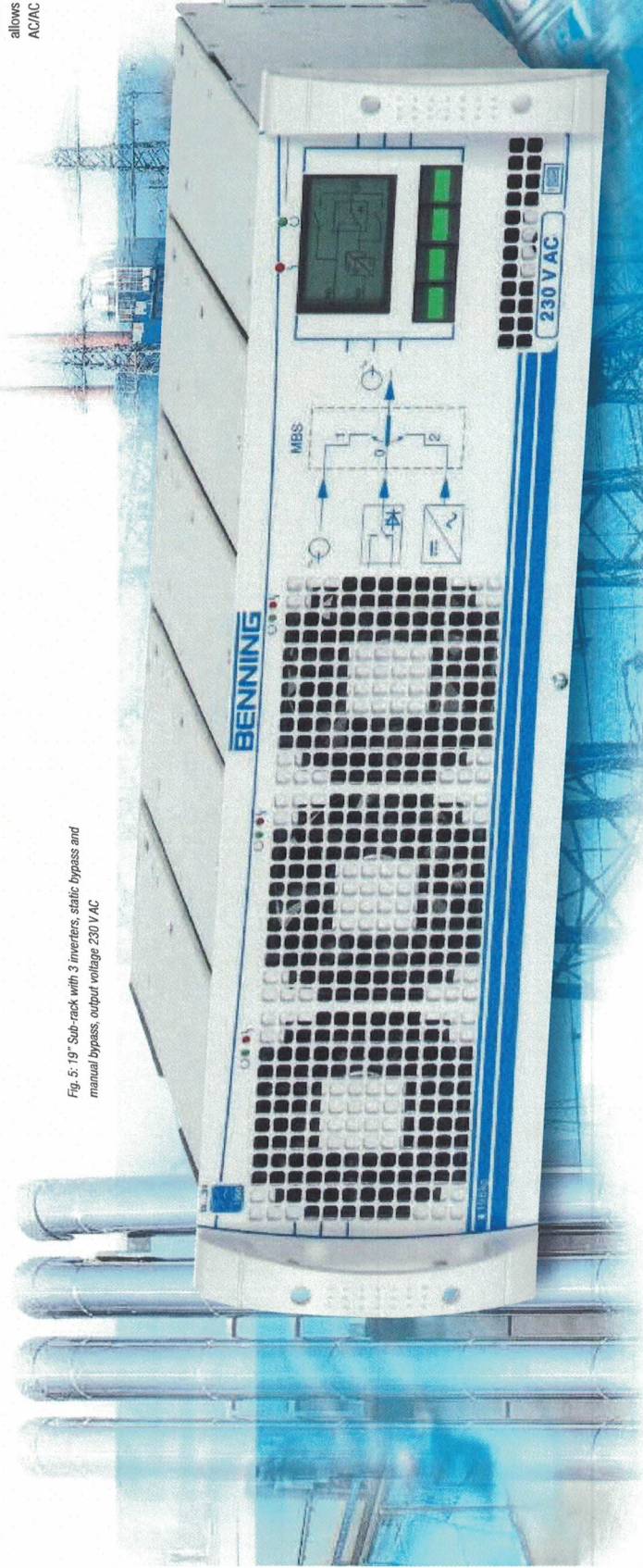


Fig. 6: 19" Sub-rack with 5 inverters, output voltage 230 V AC, output power 7.5 kVA at 110V and 220V, 12.5kVA at 46-60V, 5.5kVA at 24V

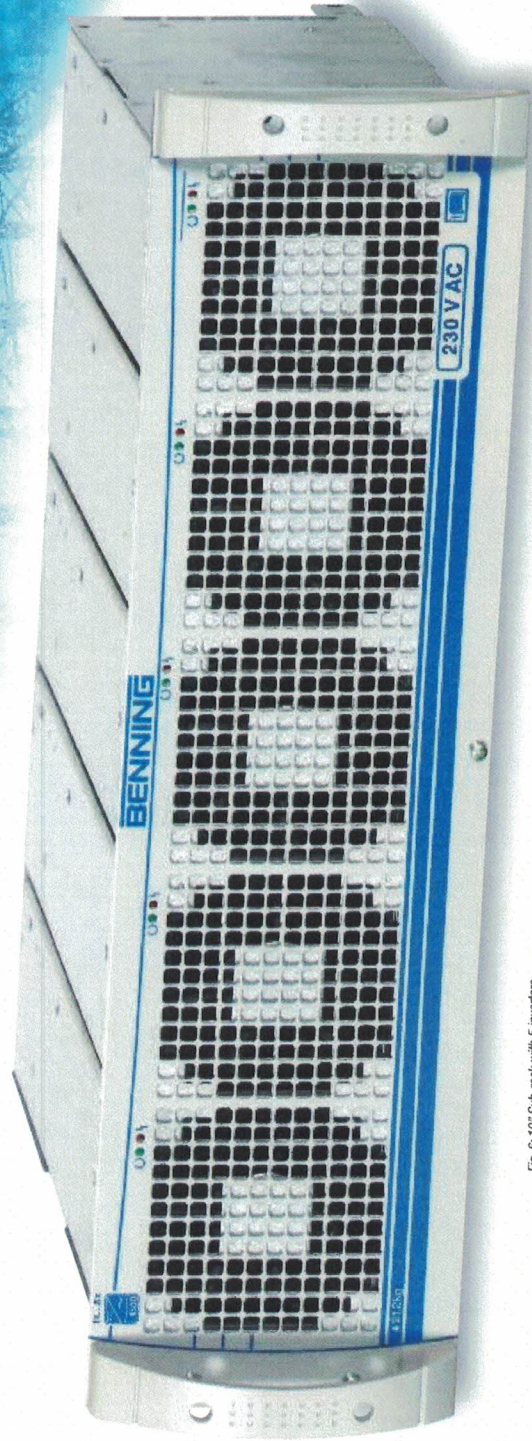
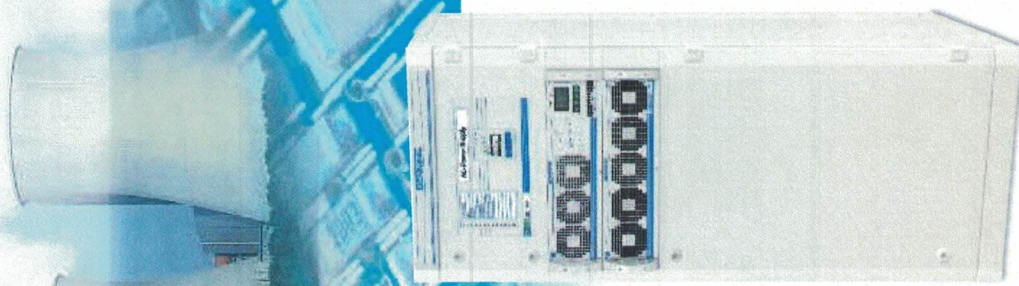


Fig. 7: Inverter cabinet with 8 inverter modules, static and manual bypass



# INVERTRONIC compact Monitoring & Remote Management with MCU 2500

Figs 7 & 8, show different sizes of cabinets with sub-racks for inverters only and a combination of inverters and rectifiers.

The integration of battery and load fuses/breakers is also possible.

## Monitoring system MCU 2500

The Monitoring system MCU 2500 allows local or remote operation of the INVERTRONIC compact systems.

The display and operation unit mounted on the front door of the system cabinet consists of liquid crystal display, 17 LED's and 4 push buttons and allows local operation of the power system.

Remote control and monitoring is possible using modem, Ethernet, Web, SNMP, MODbus or Profibus. (Fig10)

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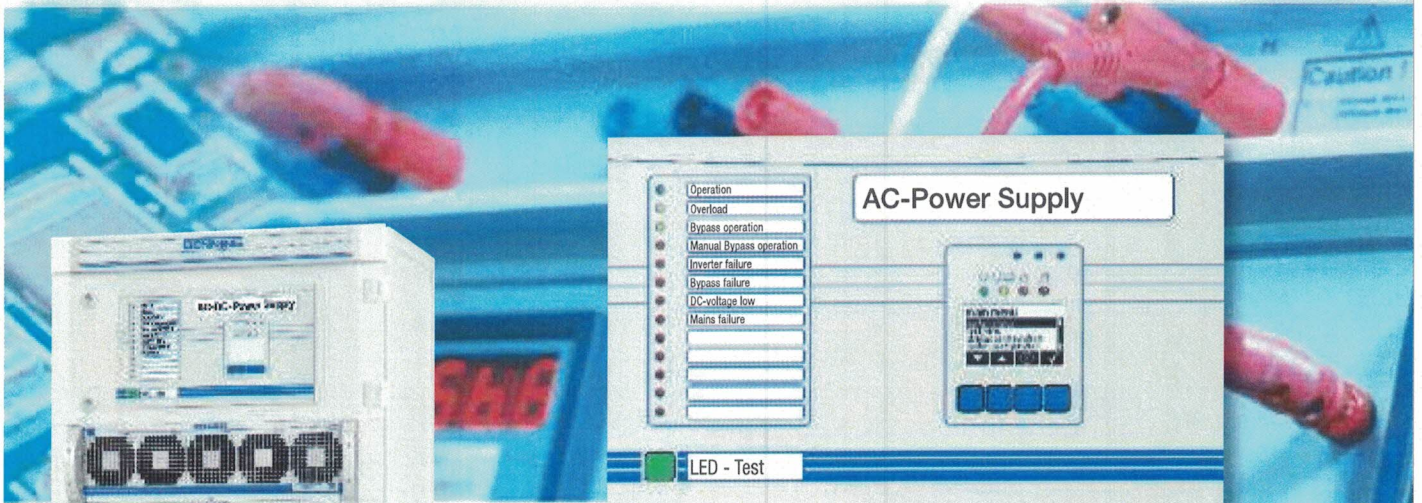
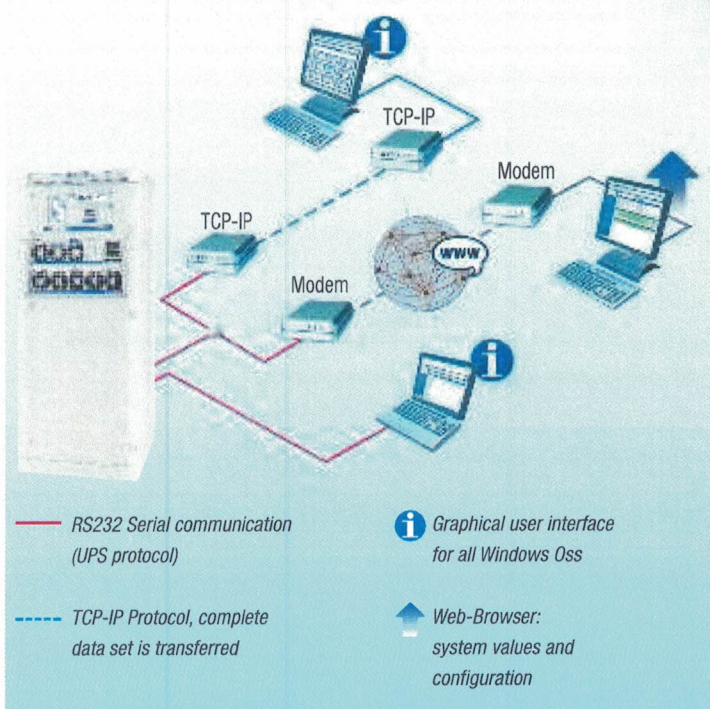


Fig. 9: Monitoring and control unit



Fig. 8: Inverter- rectifier cabinet with:  
3 inverter modules, static and manual bypass  
Total AC output power 4.5kVA  
5 rectifier modules output voltage 220V DC, output current 50A DC

Fig. 10: Monitoring concept of the MCU 2500



# Technical Specification

## INVERTRONIC compact

### Technical Specification

#### Inverter

Rated output power at*1 (cos φ = 0.8)						
DC-Input 24 V	[kVA]	1.1	2.2	3.3	4.4	5.5
48 V/60 V	[kVA]	2.5	5	7.5	10	12.5
110 V/220 V	[kVA]	1.5	3.0	4.5	6.0	7.5
No. of modules		1	2	3	4	5

#### Inverter input

Input voltage range	[%]	-15 to +20
Permitted ripple Voltage	[%]	< 5 eff.

#### Inverter output

Output voltage	[V]	220/230/240 1-ph., N, PE (selectable)
Voltage tolerance	static	± 1
	dynamic	≤ 10 at 100 % load step
Regulation time	[msec]	≤ 25
Motorload		100 % permitted (beware of starting current)
Overload behaviour 24 V - 60 V	[%]	1.35 x I - nom for approx 60 sec.
Overload behaviour 110 V - 220 V	[%]	2.0 x I - nom for 4 sec., after that 1.2 x I - nom for 60 sec., then switch off
Short-circuit current	[A]	2.5 x I - nom for 4 sec.
Output frequency	[Hz]	50 (60) ± 0.1 % oscillator or mains synchronised
Synchronisation range	[Hz]	50 (60) ± 5 % (selectable)
Wave form		sinusoidal
Distortion factor	[%]	≤ 2 with linear load, ≤ 5 with non linear load according to EN 50091-1-1
Efficiency at nominal output power and input voltage		
24 V DC	[%]	≥ 88
48/60 V DC	[%]	≥ 91
110/220 V DC	[%]	≥ 91.5

#### Static bypass

Rated output power	[kVA]	23 (at 230 V AC)
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#### Input

DC voltage	[V]	18 to 80 V and 90 to 275 V
*2 Mains voltage	[V]	220/230/240
Tolerance	[%]	±15
*2 Mains frequency	[Hz]	50/60
Permitted frequency range	[%]	max. ±5; Inverter synchronisation range
*2 Inverter output voltage	[V]	220/230/240 AC

#### Output

Max. output current	[A]	100
*2 Nominal output voltage	[V]	220/230/240 AC
Voltage tolerance/static	[%]	max. ±15 mains operation, max. ±1 inverter operation
*2 Nominal output frequency	[Hz]	50/60
Max. frequency tolerance	[%]	±5 (±0.1 oscillator controlled)
Power factor	[cos φ]	0.7 ind. to 0.8 cap.
Overload	[%]	120 for 10 min.
Transfer time	[msec]	typ. 2 in accordance with DIN VDE 0558 Part 5, IEC 146-4
Supply priority*2		Inverter / mains priority

(\*2: These adjustments can be made directly on the unit.)

#### Others

EMC		in accordance with class B (24-60 V) class A (110+220 V) EN 55022
Noise level at 75 – 100 % load	[dB (A)]	approx 65
Cooling		forced cooling with speed controlled fans at air inlet
Permitted ambient temperature	[°C]	-33 to +55
Permitted storage temperature	[°C]	-25 to +70
Relative humidity	[%]	5 – 95 without condensation
Installation altitude at nom. load	[m]	to 1000 m above sea level without power reduction
Protection		IP 20 in accordance with DIN 40050
Painting		RAL 7035, structured paint finish (frontplate)
Dimensions, Sub-rack		3 U x 19" x 300 mm (H x W x D)
Weight: Sub-rack		
- with 3 inverters, bypass and manual bypass	[kg]	21.5
- with 5 inverters	[kg]	23.2

(\*1: Up to 25 °C)

Specifications are subject to change without notice.