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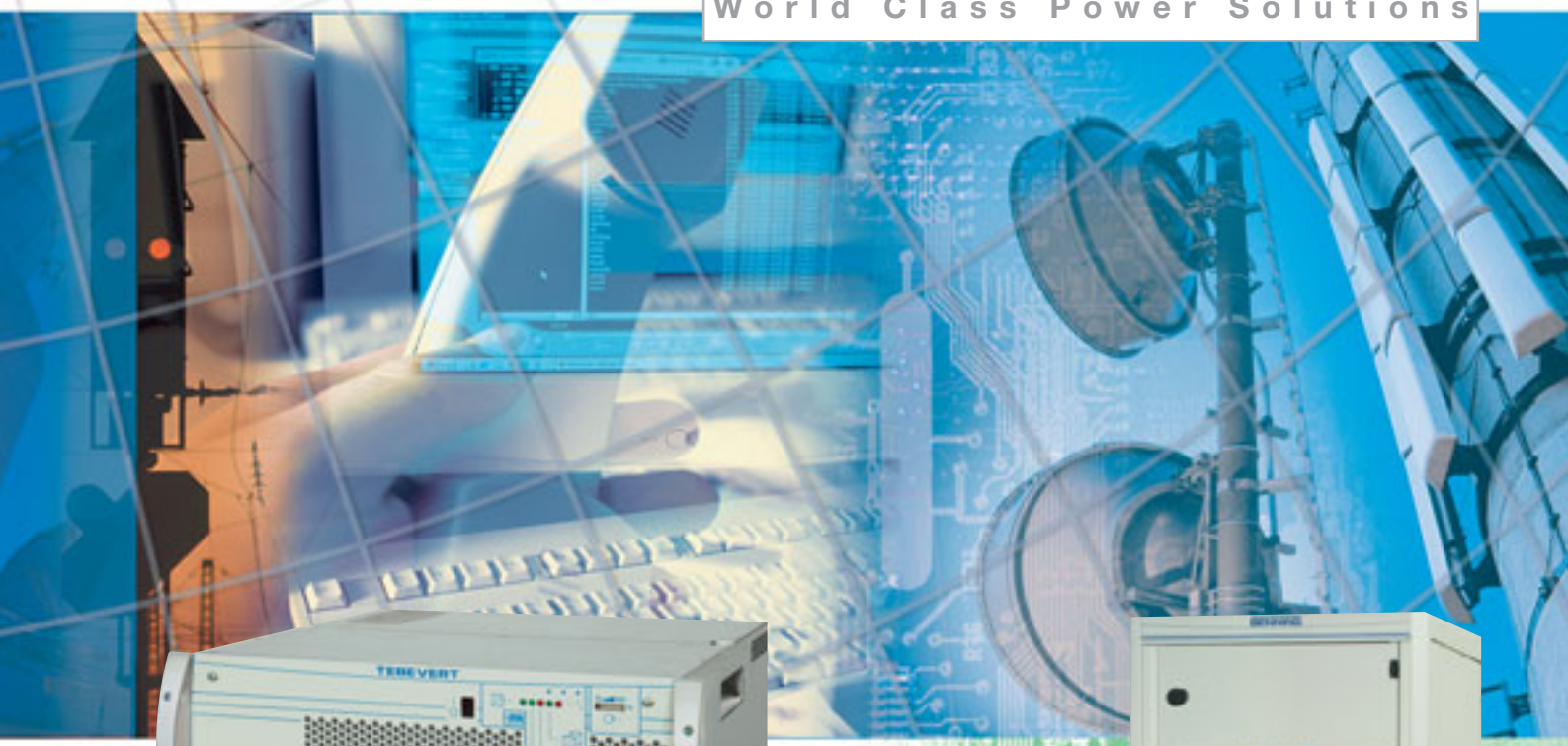
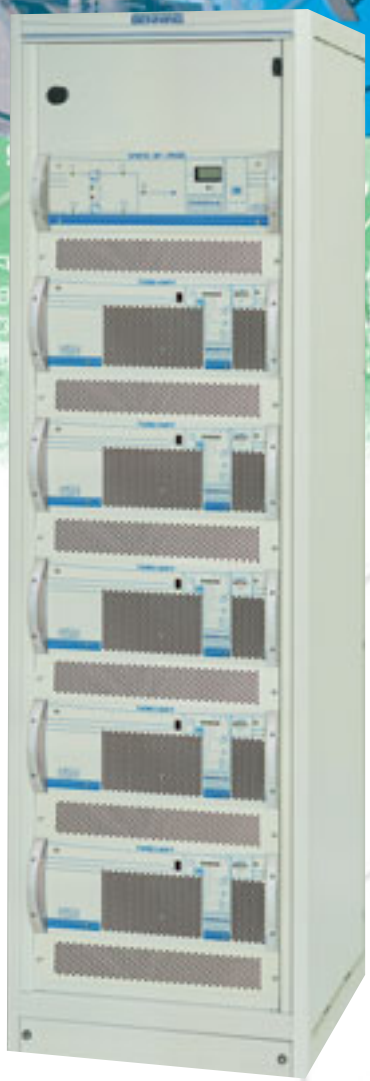
World Class Power Solutions





TEBEVERT

Switch-mode inverters

General

The TEBEVERT III is a new generation of inverter.

Sophisticated production methods and high-quality electronic components are utilized on this range of equipment.

The use of modern semiconductors with high switching frequencies provides compact construction, low weight and a very high efficiency.

The inverters can be connected in parallel by special technology. So, systems in N or N + 1 redundancy can be realised. Parallel connection can be used for increasing the power and thus system extension on site is possible for increased power demand.

Systems with upto 5 inverters connected in parallel are possible.

All monitoring and control units are designed to be intrinsically safe so that an uninterrupted supply of the connected load is ensured.

These products have a very good dynamic range. At load peaks of 0 % – 100 % – 0 %, fluctuations and voltage surges are corrected within a very short time.

In order to increase the availability of the system a mechanical by-pass can be provided. In case of inverter failure the system can be manually switched to mains supply (Fig. 2).

The EUE (electronic by-pass) is another component for increasing the system security. Using of the EUE loads are directly switched to the mains in case of overload or faults in the inverter (Fig. 3).

This switch-over is made almost without interruption.

Fig. 1: Inverter 2500 VA

Operation modes

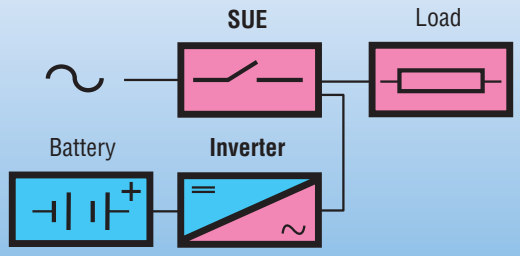


Fig. 2: Inverter with mechanical by-pass (SUE), voltage gap approx. 100 ms

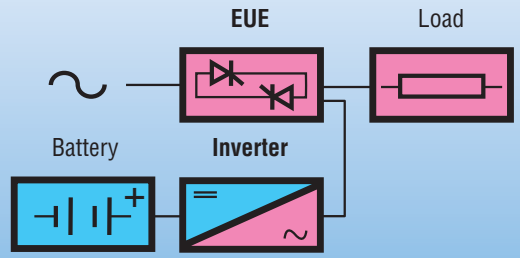


Fig. 3: Inverter with static by-pass (EUE) for the uninterrupted supply of the loads.

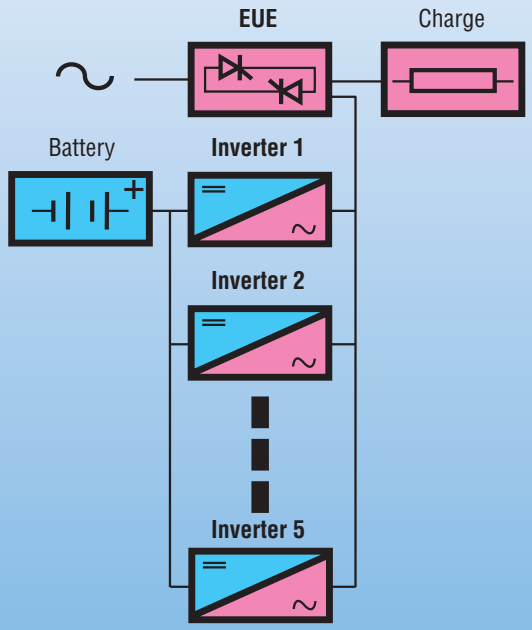


Fig.4: Inverters connected in parallel with static by-pass (EUE) for increasing the system safety.

Typeseries Tebevert III

Technical data: 1000 VA, 1500 VA, 2500 VA, 5000 VA,

Input DC voltage:	see type table
Permissible deviation:	+ 20 %, - 15 %
Disconnection value:	1,7 V/C +/- 1V 2,4 V/C +/- 1 V
Connection value:	2,05 to 2,1 V/C
Ripple of the input voltage:	max. 5 % rms. (2 mV reverse smoothing for 48 V and 60 V)
Nominal power:	see type table
Output voltage:	230 V
Efficiency:	approx. 85 %
Static deviation:	+/- 5 % at total loading -, nominal voltage - and power factor range
Frequency:	50 Hz
Constance of frequency:	+/- 0,1 % (at self-step)
Mains control of frequency:	+/- 3 %
Power factor range:	0,7 ind. to 0,8 cap.
Voltage form:	sine- wave
Distortion factor:	< 3 % (at linear load)
Overload capacity:	2 x I nom. For 1,3 sec., cut-off after 40 sec.
Crest factor load:	(max. peak current 2,8 I nom. at higher crest factor permissible nominal current will reduce).
Radio interference:	limiting class B ac. to EN 55022 B
Noise level:	< 55 dB (A) at fan operation
Ambient temperature:	+ 5 °C to + 40 °C (option: + 55 °C)
Installation height:	up to 1000 m above sea level
Climatic environment Conditions:	IEC 721-3-3 (3K3)

Humidity class:	F
Cooling:	temperature controlled forced ventilation
Protection class:	1 to VDE and IEC 950 (EN 60950)
Mechanical design:	19", rack
Dimensions:	see type table
Protection class:	IP 20 (without terminals)
Painting:	RAL 7032 for front panel
Instruments:	Output current, bargraph
Indications:	- Output voltage present - Fault - Overload - Mains synchronisation - Parallel operation
Pot.-free contact:	- Fault (delay approx. 10 sec.) Connections at the rear
Connections:	- AC-side: Plug - DC-side: * 1 D-Sub-Plug * 2 screw-bolts * 3 Plug
Indications and remote control by D-Sub-plug (* 2 terminal strip, * 3 plug).	
Earthing bolts:	M 6 bolts
EUE/Parallel operation:	Plug connector
Options:	- SUE Operation - EUE Operation - Parallel operation

***1** 1000 VA
***2** 1500 VA, 2500 VA,
***3** 5000 VA

Type

Type	Input voltage	Input current at cos phi 0,8 and nominal input voltage	Output power	Dimensions H x W x D	Weight [kg]
G 48 E 230/ 4,4/2rfg-PWE1,0	48 V	18,7 A	1000 VA	134 x 483 x 300	11
G 60 E 230/ 4,4/2rfg-PWE1,0	60 V	15,0 A	1000 VA	134 x 483 x 300	11
G 24 E 230/ 6,5/2rfg-PWE1,5	24 V	56,5 A	1500 VA	177 x 483 x 400	19
G 48 E 230/10,9/2rfg-PWE2,5	48 V	46,3 A	2500 VA	177 x 483 x 400	19
G 60 E 230/10,9/2rfg-PWE2,5	60 V	37,0 A	2500 VA	177 x 483 x 400	19
G 110 E 230/10,9/2rfg-PWE2,5	110 V	20,2 A	2500 VA	177 x 483 x 400	19
G 220 E 230/10,9/2rfg-PWE2,5	220 V	10,0 A	2500 VA	177 x 483 x 400	19
G 48 E 230/21,7/2rfg-PWE5,0	48 V	92,0 A	5000 VA	177 x 483 x 450	28
G 60 E 230/21,7/2rfg-PWE5,0	60 V	74,0 A	5000 VA	177 x 483 x 450	28
G 110 E 230/21,7/2rfg-PWE5,0	110 V	40,4 A	5000 VA	177 x 483 x 450	28
G 220 E 230/21,7/2rfg-PWE5,0	220 V	20,0 A	5000 VA	177 x 483 x 450	28

Type table Inverter with integrated mechanical by-pass

Type	Input voltage	Input current at cos phi 0,8 and nominal input voltage	Output power	Dimensions H x W x D	Weight [kg]
G 48 E 230/ 4,4/2rfg-PWE1,0	48 V	18,7 A	1000 VA	177 x 483 x 300	17
G 60 E 230/ 4,4/2rfg-PWE1,0	60 V	15,0 A	1000 VA	177 x 483 x 300	17
G 24 E 230/ 6,5/2rfg-PWE1,5	24 V	56,5 A	1500 VA	223 x 483 x 400	21

Parallel operation of inverters

Conventional inverter systems operate with a "passive redundancy" i.e. the mains does not supply the loads directly but will be connected in a fault situation.

In contrast to this, parallel operating inverters, that are actively supplying the load (N or N+1 operation) offer an "active redundancy".

This operation mode requires a reliable exchange of information by the inverters via control signals.

Furthermore a faulty unit has to be identified and switched off before the common busbar is affected. The Tebevert III inverters fulfil the above conditions.

Parallel connection is controlled via a master-slave operation. In case of a faulty master a new master will be selected automatically and the loads are uninterrupted.

The compact construction of the inverters offers redundant systems in one housing. Apart from the inverters, rectifiers, electronic by-pass and the distribution can be installed here. (Fig. 5).

The location of the wiring permits a safe exchange of items during operation.

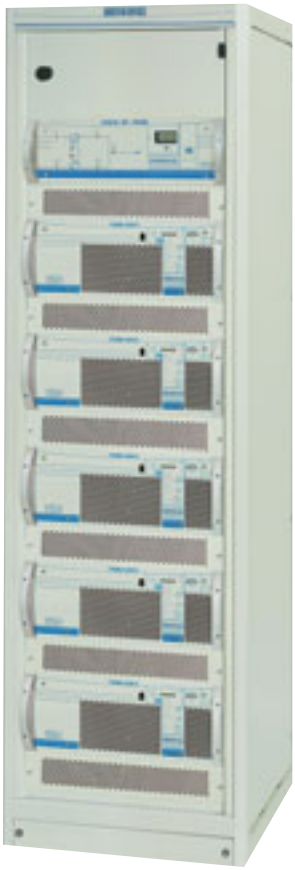


Fig. 5: Inverter system 5 x 2,5 kVA with EUE

Mechanical by-pass SUE

Fig 6: Inverter with SUE

By means of a switch, the SUE enables the operation modes "inverter priority" and "mains priority" to be selected.

In case of mains priority operation, the loads are directly fed from the mains and in case of mains failure, they are switched to the standby inverter.

The voltage gap is approx. 100 ms. In case of inverter priority operation, the loads are permanently supplied via the inverter.

In the event of failure in the inverter or overload, they are switched to the present mains.
The voltage gap also is approx. 100 ms.

For all 1 and 1.5kVA inverters, the SUE can be installed into a standard inverter cabinet, this will increase the overall size by 2U.

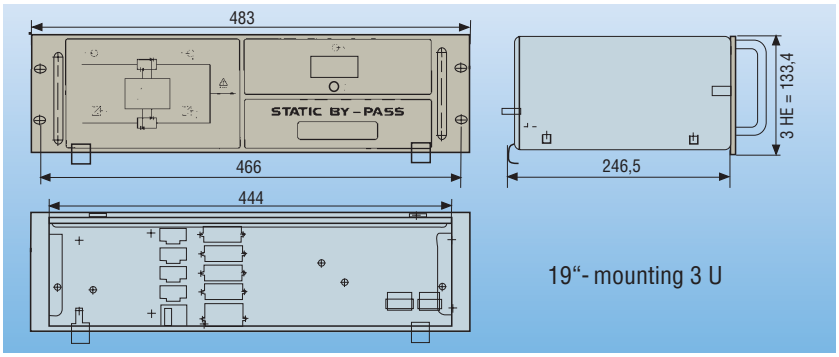
For the 2.5kVA inverter, the SUE is installed into a separate 19" rack mounted cabinet and measures 3U hight and 260mm deep.

Static by-pass EUE

Loads of systems with EUE are permanently supplied via the inverter.

The voltage gap, arising in the event of failure in the inverter or overload, is < 1,5 ms. So, even sensitive electronic loads can be supplied without any problems. The overload behaviour is approx.

5 x I rated for 100 ms, so loads with high inrush currents can also be connected.



Output diagrams

The control of parallel connected inverters ensures a uniform power distribution among the modules. The currents and bus voltage at a load of 1,11 kW is shown in fig. 7. Both inverters are actively supplying the load.

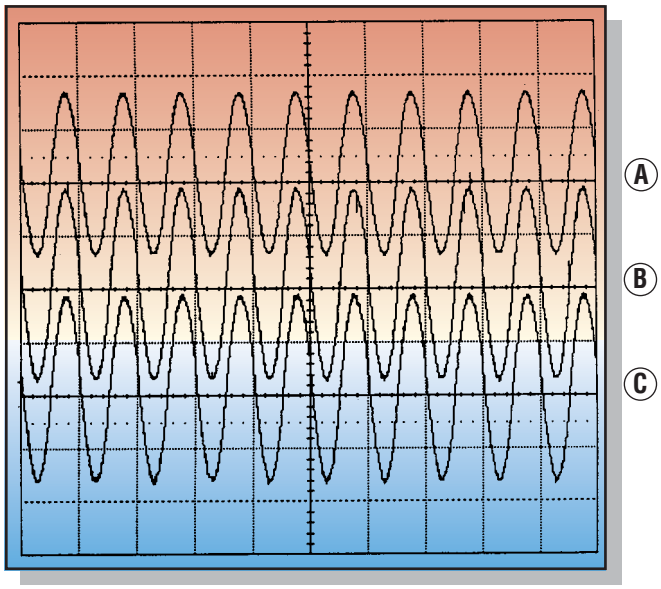


Fig. 7: Two inverter parallel

Ⓐ Output current inverter 1
Ⓑ Output current inverter 2
Ⓒ Bus voltage

On failure of inverter A inverter B takes the full current load without a interference of the voltage. (Fig. 8).

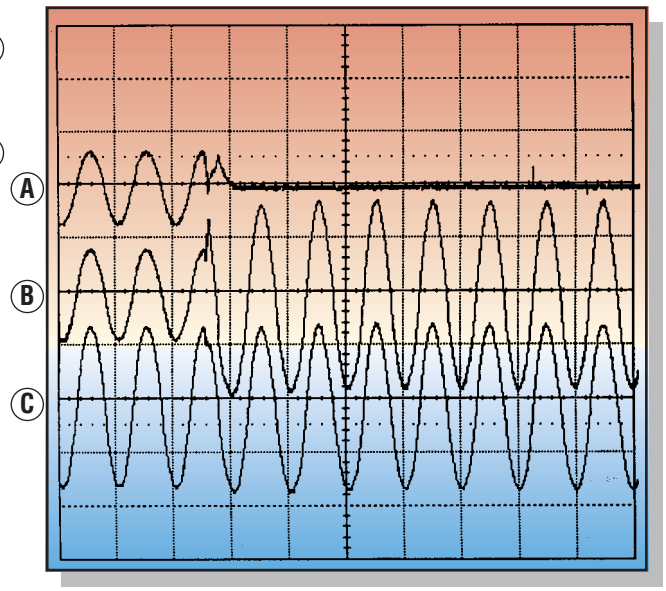


Fig. 8: Failure of one inverter

After fault clearance the inverter is connected in parallel again. In Fig. 9 (see unit A) bringing up the current on the inverter can be critical. The bus voltage is not affected.

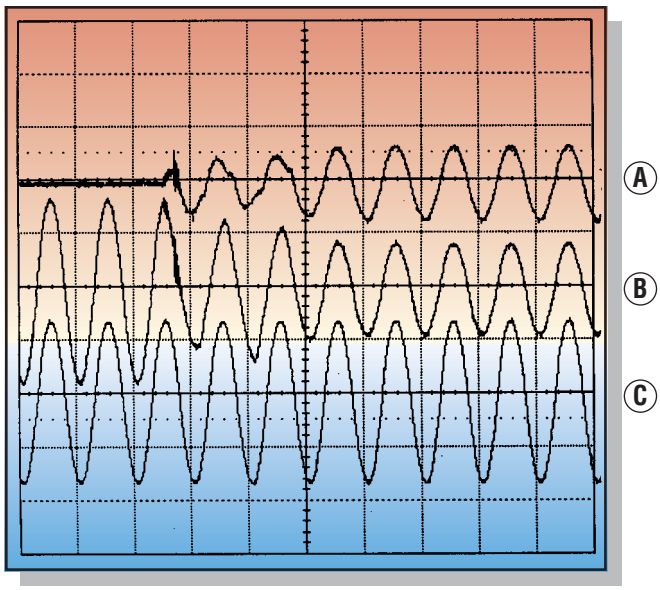


Fig. 9: Connection of one inverter.

The Tebevert III inverter range can supply linear and non-linear loads. Fig. 10 shows currents at combinational circuit part-load of 600 VA. A crest factor load of max. 2,5 : 1 is permissible. Parallel connected units will enlarge this result accordingly.

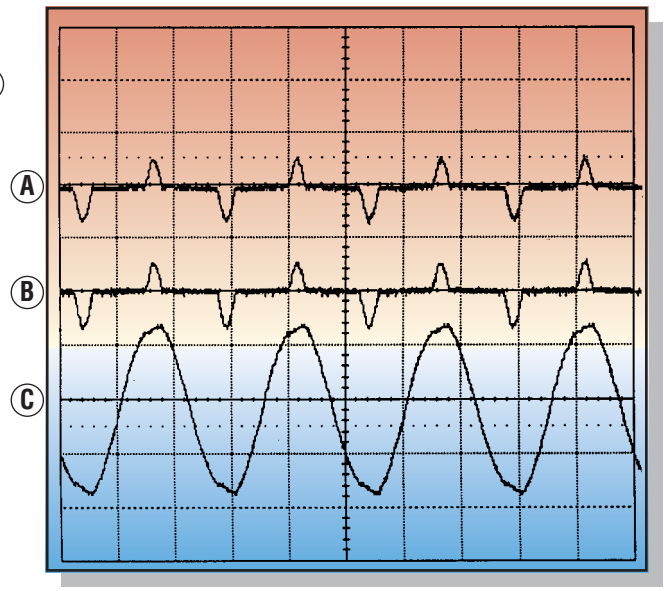


Fig. 10: Supply of a non-linear load.

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