BENNING Invertronic modular 3 Phase Inverter System User Manual

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BENNING Invertronic modular 3 Phase Inverter System

Product Information: INVERTRONIC modular Three Phase Inverter System

The INVERTRONIC modular is a high-tech, efficient and high-quality three-phase inverter system designed to provide continuous power protection and availability for mission critical loads in information, telecommunication and industrial applications. It is capable of ensuring cost-effective system scalability with the highest power availability.

Features:

- Modular, hot-plug design
- Scale able redundant systems
- High power protection
- Continuous power availability
- Static bypass transfer switch
- Adaptable output power

Benefits:

- Cost-effective system scalability
- Continuous power protection and availability
- High-quality power protection of mission critical loads
- Flexible output power adaptation

- Easy maintenance with hot-plug design

Mains Disturbances:

The INVERTRONIC modular inverter system is designed to protect against various mains disturbances that can affect microprocessor-based equipment in production or communication systems. Some examples of mains disturbances are:

Voltage Phenomenon	Time
Outage – blackouts	> 10 ms
Sags/brownouts	< 16 ms
Dynamic overvoltage	4…16 ms
Undervoltage	continuous
Overvoltage	continuous
Transients (Surge)	< 4 ms
Lightning	sporadic
Voltage distortion HF (Burst)	periodically
Voltage harmonics	continuous
Frequency variations	sporadic

Product Usage Instructions:

The INVERTRONIC modular should be installed and operated by qualified personnel. Follow these instructions for proper usage:

1. Connect the DC mains and AC mains to the inverter system according to the installation manual.
2. Switch on the inverter system.
3. The system will automatically detect the AC mains voltage and frequency, and start to convert DC voltage to AC voltage.
4. The inverter system will continue to supply power until the AC mains voltage or frequency deviates outside the acceptable tolerances. In this case, the static bypass switch will automatically transfer the load to the mains.
5. If any module of the inverter system fails, it can be easily replaced without shutting down the entire system due to its hot-plug design.
6. To upgrade or downgrade the output power, add or remove the necessary number of inverter modules according to the installation manual.
7. The system can be monitored and controlled through the communication interface provided.
8. Refer to the user manual for additional instructions and safety precautions.

High Power Protection with INVERTRONIC modular

More and more mission critical loads in information, telecommunication and industrial applications demand continuous power protection and availability in the event of mains failure and reasonable power quality in the

event of critical mains conditions. On the public network, major loads as well as lightning strikes ,generate dynamic over voltages, under voltages, sags / brownouts and transients.
Fig.1 illustrates some examples of mains disturbances which can influence microprocessor-based equipment in production or communication systems
For power protection in these business-critical environments inverter systems provide continuous power with high availability and ensure continuous and high quality power protection of mission critical loads in the industrial and commercial marketplace. BENNING´s new advanced inverter system

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	

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INVERTRONIC modular is a hot-plug modular three phase system which operates from a central (battery based) 48V, 110V or 220V DC source.

INVERTRONIC modular ensures cost-effective System Scalability and continuous Power Protection and Availability

Todays traditional three phase inverter systems are heavy and bulky and are not scale able. The output power is fixed and cannot be adapted to changing load demands. The new INVERTRONIC modular inverter system consists of rack mounted, parallel operating inverter modules. This design allows scale able redundant systems with the highest power availability.

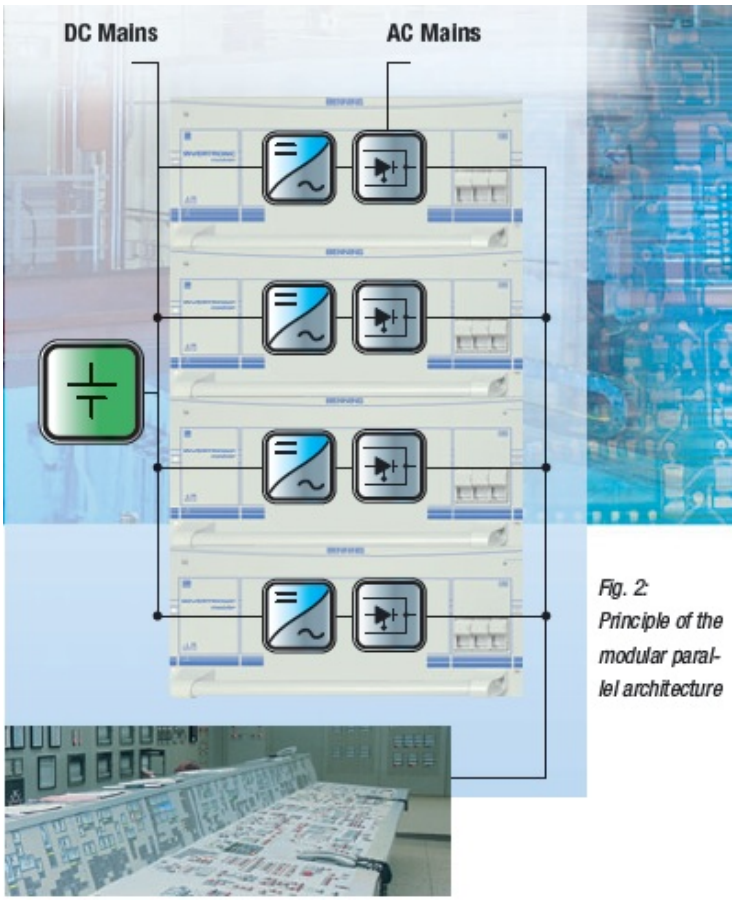


Fig. 2: Principle of the modular parallel architecture

With the modular hot-plug design of the INVERTRONIC modular, any up or downgrading of the system output power is possible. Each INVERTRONIC modular inverter module has its own static by-pass to transfer the load to the mains if the output of the inverter deviates outside the acceptable tolerances for both voltage and frequency, caused by short circuit, overload or inverter failure. The static by-pass will transfer the load back to the inverter without any break after the inverter output has returned within tolerance.

Availability without any Compromise

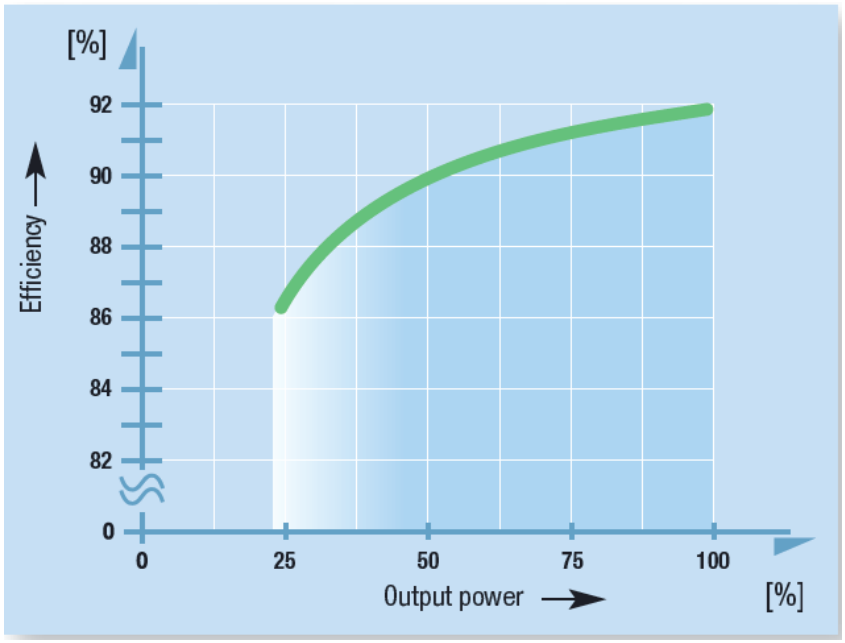
Hot-plug modular redundant Design means highest Availability and short MTTR (MEAN TIME TO REPAIR)
The modular redundant concept of the INVERTRONIC modular system together with real hot plug design provides the highest level of continuous power protection availability and minimizes service and maintenance costs.

INVERTRONIC modular Features

- Scale able three phase inverter system with hot-plug power modules
- Each Inverter module with its own electronic by-pass
- Short MTTR (Mean TIME To Repair) Replacement of modules without any load interruption
- N+1 redundancy ensures highest availability
- High energy efficiency also at partial load saves energy costs
- Advanced inverter technology with DSP processors and IGBT /MOSFET semiconductors
- Less volume and weight of the INVERTRONIC modular inverter systems results in reduced floor space and lower transport and installation costs

The redundant design (n+1) is still providing 100% power tothe load even if one module fails. The replacement of the faulty module can be done in less than 15 minutes, if the module is available on site. After the replacement the INVERTRONIC modular system is back to redundant operation.
The modular hot-plug design means system redundancy as well as reduction of service and maintenance costs.

High Efficiency at rated as well as partial Loads, means less TCO (Total Cost of Ownership)
The INVERTRONIC modular inverter system has been designed to provide ≥ 90% efficiency even at 50% partial load (systems with 110V and 220V DC input voltage).



Efficiency as function of output power
Systems with 48V DC input, have appr.3% less. efficiency.

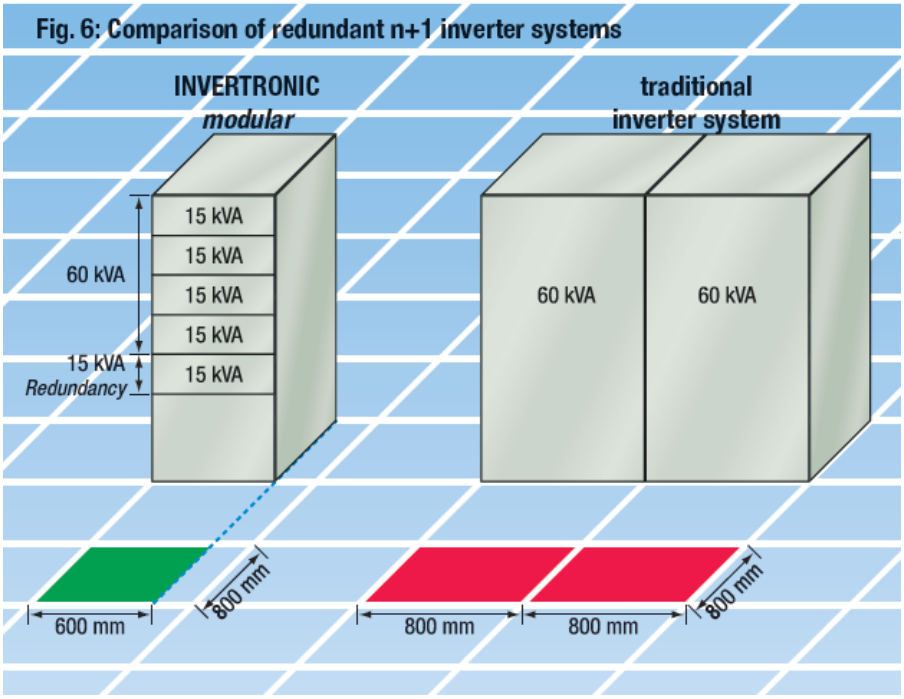
INVERTRONIC modular 90 kVA DC input 220 V
High efficiency is essential to reduce the energy consumption of the inverter system as well as the investment and operational costs for the cooling system.

- The light and compact System Cabinets of the INVERTRONIC modular Inverters save Packing and Transport Costs.

The light weight system cabinets of the INVERTRONIC modular line are easily handled compared to the heavy cabinets of conventional (one bloc) inverter systems.

Cost Saving High Efficiency

- Redundant INVERTRONIC modular Systems have less Energy Consumption and require less Floor Space, compared with traditional redundant Inverter Configurations.

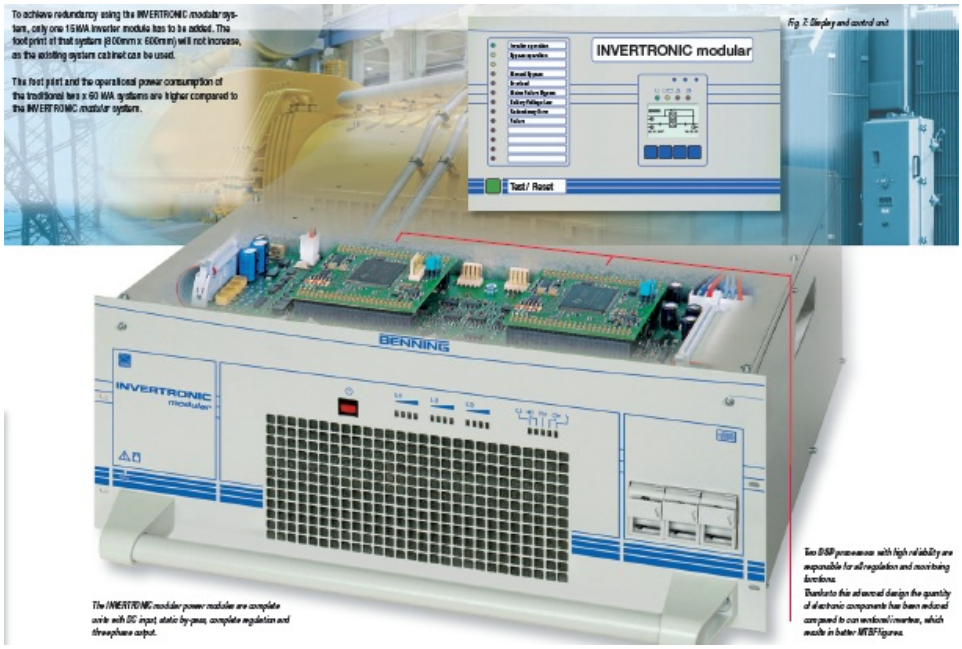


show the comparison of traditional and modular n+1 redundant 60 kVA inverter systems. To achieve redundancy using traditional inverter systems, you need to have a second complete 60kVA system for parallel operation. The

total foot print of the two systems will be two times 800mm x 800mm. To achieve redundancy using the INVERTRONIC modular system, only one 15kVA inverter module has to be added. The foot print of that system (800mm x 600mm) will not increase, as the existing system cabinet can be used. The foot print and the operational power consumption of the traditional two x 60 kVA systems are higher compared to the INVERTRONIC modular system.

Simple Operation, Rapid Diagnosis

Operation and Monitoring Front Panel



The operation and monitoring of the INVERTRONIC modular is made via the front door panel. The operating and fault signals are indicated by 17 LED`s and the system status is displayed and controlled via the built in LCD mimic diagram. An event recorder stores each occurring event (max.250 entries) date and time.

Customer interfaces:

- RS 232 or RS 485 with MOD bus protocol
- 6 voltage free relay contacts

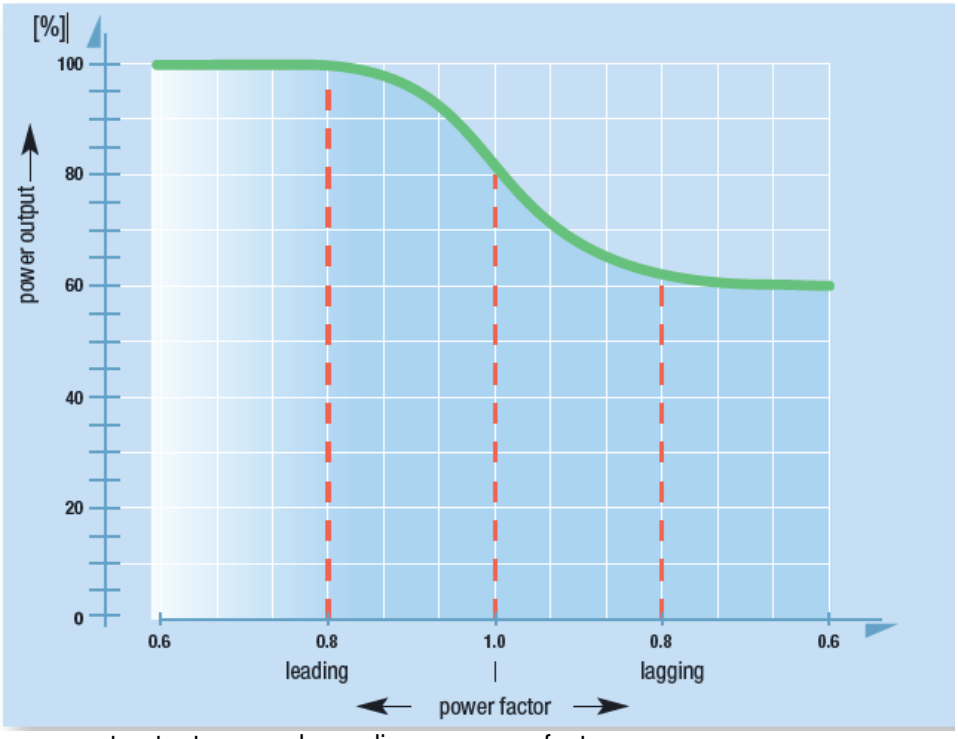
Options:

- Interface profibus
- Network adapter

Scale able Power Capacity

Scale able Power Capacity with INVERTRONIC modular Inverter modules
INVERTRONIC modular inverter modules are available for 48V, 110V and 220V DC input. Each inverter power module with DC input 48V can supply 10kVA output power and the modules with DC input 110V or 220V can supply 15kVA output power.

Available Inverter Output Power depending on Load Power Factor
The output power of the INVERTRONIC modular inverter depends on the load power factor.



Available inverter apparent output power depending on power factor
The Invertronic modular inverter can supply 100% output power if the leading cos phi of the load is 0,8. or less.

- INVERTRONIC modular 30 kVA

- INVERTRONIC modular 45 kVA

- INVERTRONIC modular 90 kVA

These inverter modules allow the design of scale able three phase inverter systems, and it is easy to add or remove output power. This eliminates high initial investment costs of purchasing power capacity that is not required at the stage of installation. Each 2000 mm high INVERTRONIC modular system cabinet is able to accommodate 6 inverter modules, and the 1800 mm high cabinet 5 inverter modules. The total output power of one system cabinet with 48V DC input can be 50kVA and the total output power of one system cabinet with 110V or 220V DC input, can be 90kVA or 75kVA. Two INVERTRONIC modular system cabinets can be paralleled, to increase the output power capacity.

Technical Data

Three Phase Inverter Range INVERTRONIC modular
Rated output power at (each system cabinet*2)

Rated output power at (each system cabinet*2)							
DC-Input 48 V	[kVA]	10	20	30	40	50	-
DC-Input 110 V/ 220 V	[kVA]	15	30	45	60	75	90
No. of modules		1	2	3	4	5	6
Inverter Input							
Input voltage range	[%]	-15 to +20					
Permitted overlaid AC	[%]	< 5 eff.					
Current input at 48 V DC	[A]	195	390	585	780	975	-
Current input at 110 V DC	[A]	116	232	348	464	580	716
Current input at 220 V DC	[A]	58	116	174	232	290	348
DC Power at battery operation	[kW]	13*)	26*)	39*)	52*)	65*)	78*)
*) Input voltage DC 110 V / 220 V							
Inverter output							
Output voltage	[V]	400/230 3-ph., N, PE					
Adjustment range of output voltage	[%]	± 5					
Voltage tolerance							
static	[%]	± 1					
dynamic	[%]	≤ 5 for 100 % load step					
unbalanced load	[%]	≤ 2 at 100 % unbalanced load					
Regulation time	[msec]	≤ 25					
Motor load		100 % permitted (note inrush current)					
Overload behaviour	[%]	150 for 60 sec.					
	[%]	125 for 10 min.					
Short-circuit behaviour		short circuit proof					
Short-circuit current	[A]	2 x I-nom for 3 sec.					
Output frequency	[Hz]	50 (60) ± 0,1 % quarz or mains synchronised					
Synchronisation range	[Hz]	50 (60) ± 3 %					
Wave form		Sinewave					
Distortion factor	[%]	≤ 2 with linear load					
	[%]	≤ 6 with non linear load according to EN 60091- 1-1					
Efficiency							
Input voltage DC 48 V	[%]	≥ 89					
Input voltage DC 110 V/ 220 V	[%]	≥ 92					
General Data							
Radio interference (EMC)		In accordance with IEC 62040-2 C3					
Noise level (at 75 - 100 % load)	[dB (A)]	approx 65					
Cooling		forced cooling with speed controlled fans at air inlet					
Permitted ambient temperature	[°C]	0 to +40					
Permitted storage temperature	[°C]	-25 to +70					
Relative humidity	[%]	5 – 95 non condensing					
Per. installation altitude at nom. load	[m]	1000 m over absolute altitude without derating					
Protection		IP 20 in accordance with DIN 40050					
Painting		RAL 7035, structured paint finish					
Dimensions							
Cabinet UC 1868 (5 modules)	[mm]	1800 (H) x 600 (W) x 800 (D)					
Cabinet UC 2068 (6 modules)	[mm]	2000 (H) x 600 (W) x 800 (D)					

- 2: Two system cabinets with maximum 12 modules can be paralleled, to increase the output power capacity.

  Specifications are subject to change without notice.

With the scale able INVERTRONIC modular inverter system it is easy to change the output power capacity. Up or down-grading is possible without removing the power or transferring the load to the mains. High initial investment costs can be eliminated.

Scalability of the INVERTRONIC modular inverter systems

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Documents / Resources

	**BENNING Invertronic modular 3 Phase Inverter System** [pdf] User Manual Invertronic modular 3 Phase Inverter System, Invertronic modular, 3 Phase Inverter System, Inverter System

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