BENNING
World Class Power Solutions

Excellent Technology, Efficiency and Quality

INVERTRONIC

- single and three phase IGBT inverters
- robust and reliable
- more than a match for tough industrial applications

INVERTRONIC – for maximum uptime for process-critical consumers in industry

- **outstanding availability**
- **high cost-effectiveness**
- **maximum power supply quality**

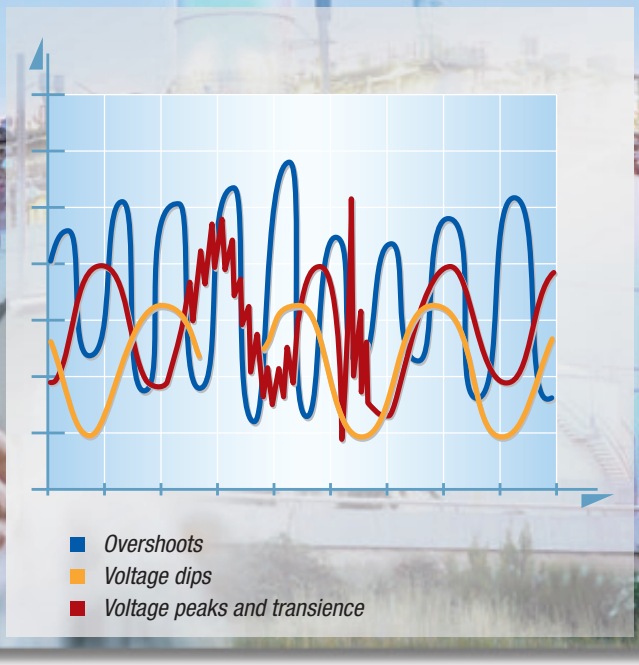


Fig. 1: Possible Irregularities

- **high quality of output voltage**
  - ideal sinewave output
  - low output ripple
  - good control dynamics even during rapid load cycles, thus no overshoot/undershoot with consumer voltage
  - marked improvement in quality of voltage and frequency – by comparison with standard grade, – and this results in a reduction of stress on consumers

- **digitally regulated switching concept**
  - can be configured rapidly
  - low parts count
  - straightforward optical and digital interfaces

- **extensive reporting and monitoring functions**
  - internal controllers
  - all currently used interfaces are available, e.g. remote monitoring/modem control, HTML or SNMP, MODBus or Profibus etc

- **Output expansion or redundancy configuration**
  - by parallel switching of up to 8 individual systems with smart bus connection

- **straightforward coupling of A and B rails**
  - via coupling switch with no interim changeover to bypass mode

- **Using any battery and rectifier infrastructure that's already in place**

Dependable, cost-effective solutions

Far-reaching budgeting and financial repercussions can arise as the result of faults in the area of power supply. Due to loads on public power supply system caused by repercussions from large-scale consumers, and due to energization events during peak consumption periods – or in the event of lightning strike – it's impossible to prevent irregularities from arising. These will result in voltage dips, overshoots and transients in the public grid voltage (Fig. 1).
These may exert a considerable influence on the availability of connected loads, giving rise to process faults or production failures.

For the supply of power to loads that are independent of faults arising on the public grid, BENNING offers very robust, single-phase and three-phase inverter systems – in the form of the INVERTRONIC power inverter – for the tough applications that come up in industry, typically for:

- **the power stations sector**
- **the oil, gas and petrochemical industry**
- **the processing industry**

These are connected up to AC power grids that are supported (e.g. by batteries) and provide a reliable source of superior quality electrical power to critical loads.

INVERTRONIC power inverters…
for the most demanding requirements

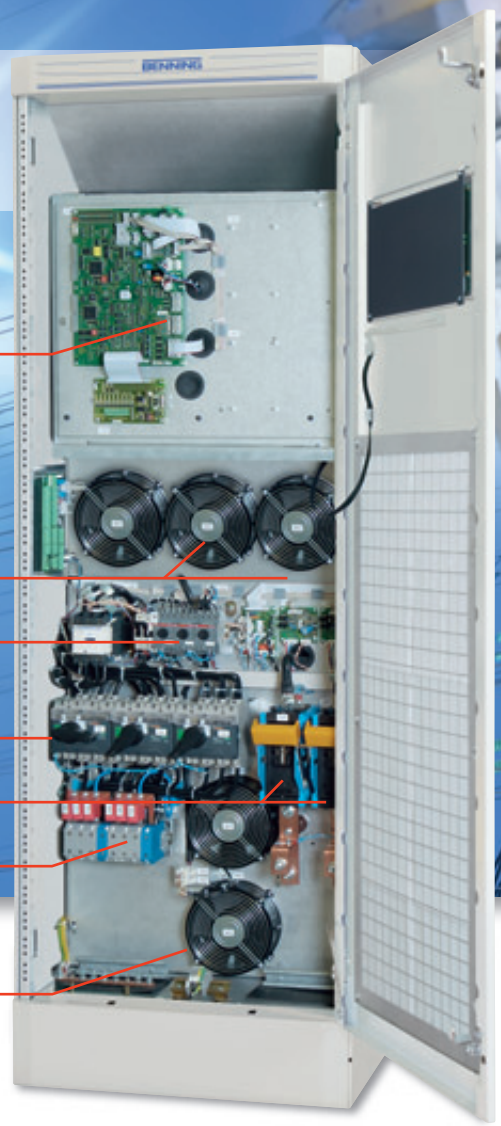


Fig. 2: INVERTRONIC 50 kVA, internal view

Static Bypass

The static bypass consists of a semiconductor switch in the bypass circuit. In the case of an appropriate deviation of the output voltage from the desired values, it switches the connected load automatically and without interruption to the mains.

The change-over can be initiated manually or automatically by a control signal. The µP monitoring is autonomous and prevents incorrect operation of the installation 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 synchronized 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 has an overload capability of 150 % for 10 min. and 1000 % 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.

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 synchronized operation without a break.

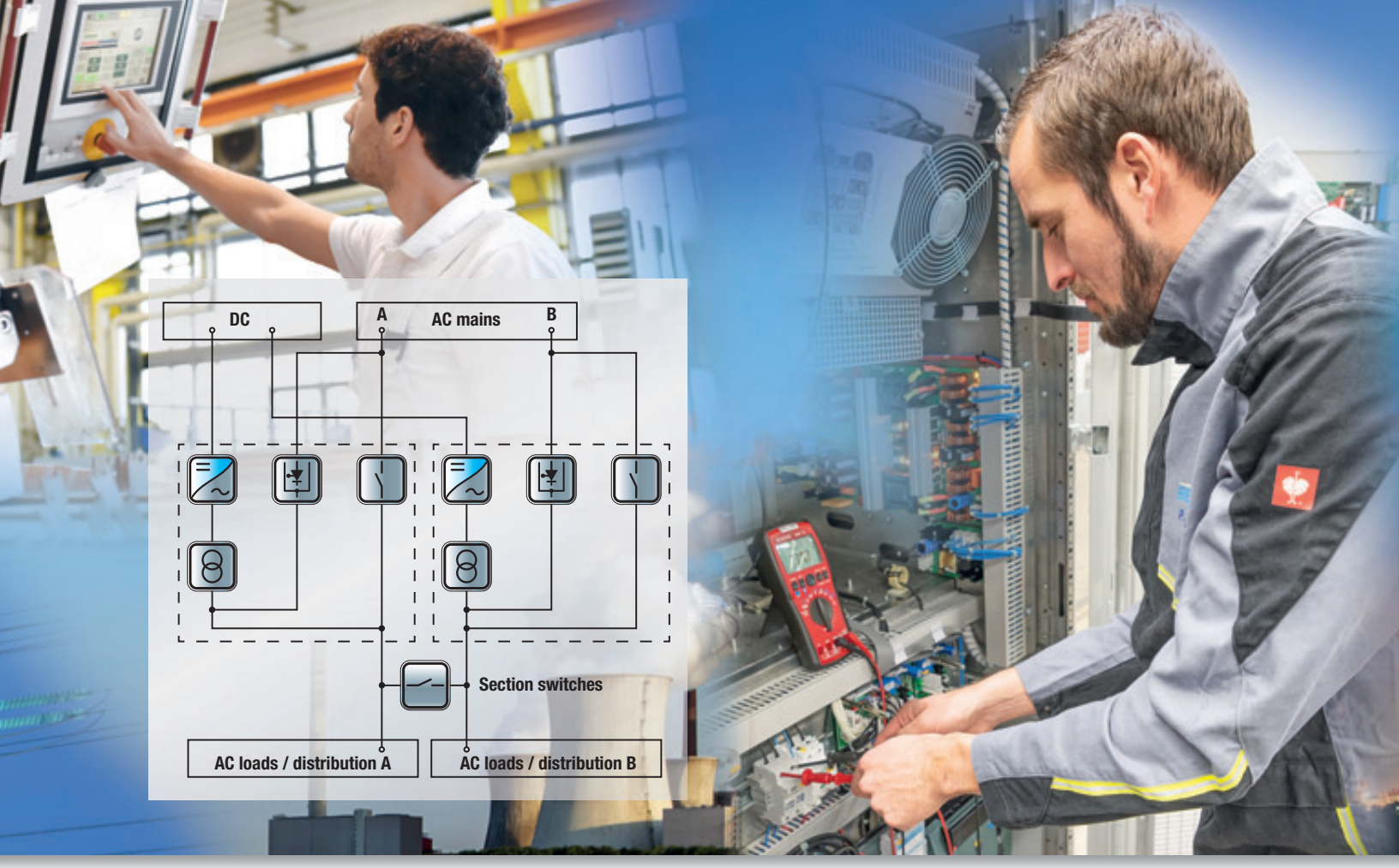


Fig. 3: Supply of power to two bus bars (A+B). Coupling can be brought about without having to switch over to bypass mode.

Flexible, safe and scalable – for the toughest industrial demands

Internal manual bypass
Each inverter is equipped with a maintenance bypass with manually operated switch. When operated, the Inverter is completely disconnected from the load. The supply to the load is now directly from the mains via the manual bypass.

Parallel Operation
For redundancy or increased output power, up to eight INVERTRONIC units can be connected in parallel, operating in an active load-sharing mode.

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.

Straightforward coupling without using bypass mode
INVERTRONIC power inverters use section switches directly and without having to switch over to bypass mode. The switching process is controlled by corresponding logic, thus dispensing with the need for complex switching routines. All loads remain isolated from the public grid and receive a continuous supply of the superior quality of power.

Option
For power plant applications where higher than normal fault clearing current is required, it is possible to specify an option for 7 x I nominal system output. Depending on the output power, a bigger cabinet may be required.

Reliability is sustained continuously – thanks to proactive 360° services

Because you can rely on a BENNING power inverter, you can consequently opt for a high-quality product from a worldwide leader in AC and DC power supply manufacturers. This means that you can expect a reliable, globally aligned service structure which provides the optimum support for your requirements.

That's the best way for you to gear up for the challenges of today and the opportunities of tomorrow.

www.benning-services.com

360°
pro-active Service

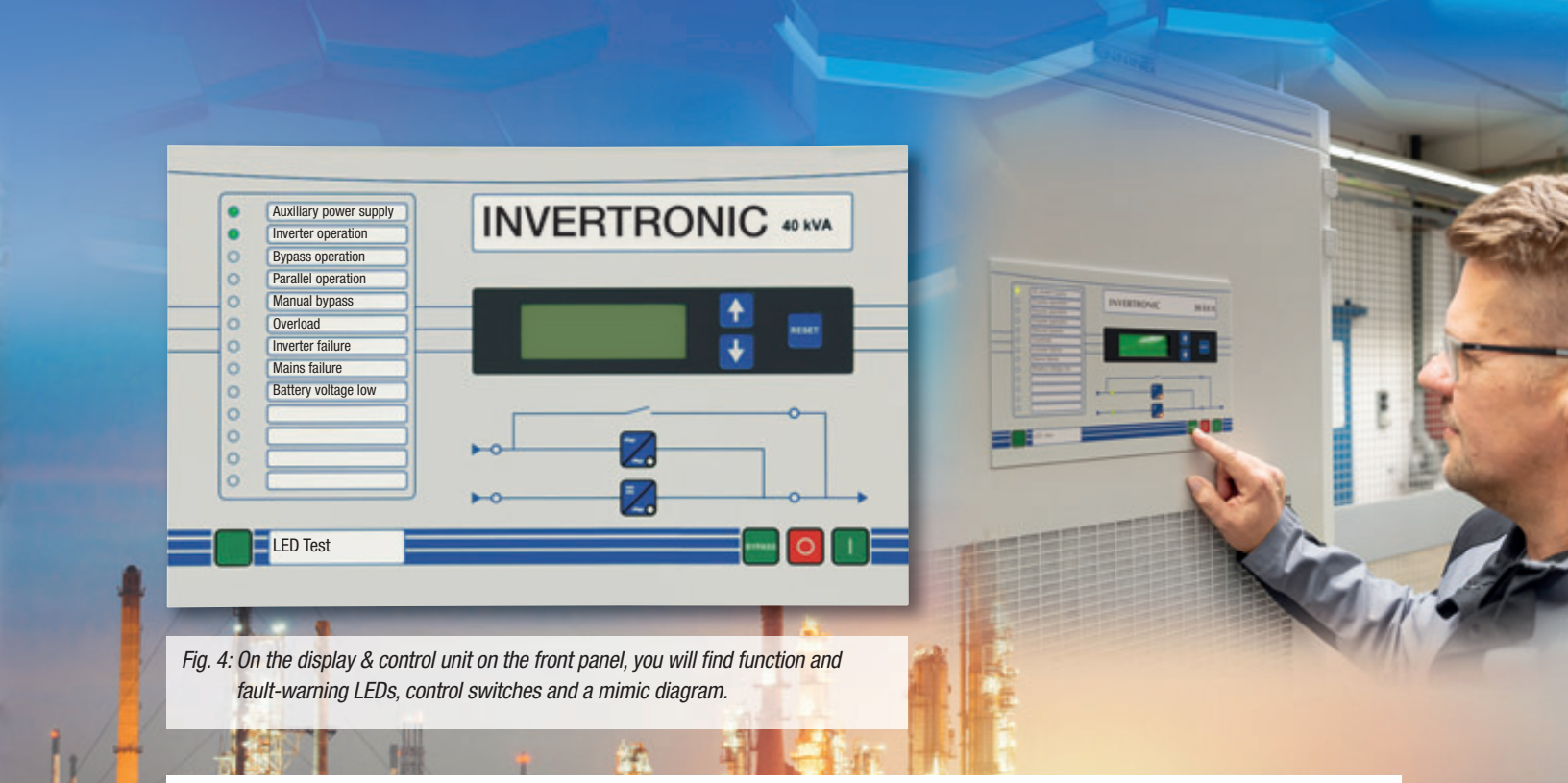


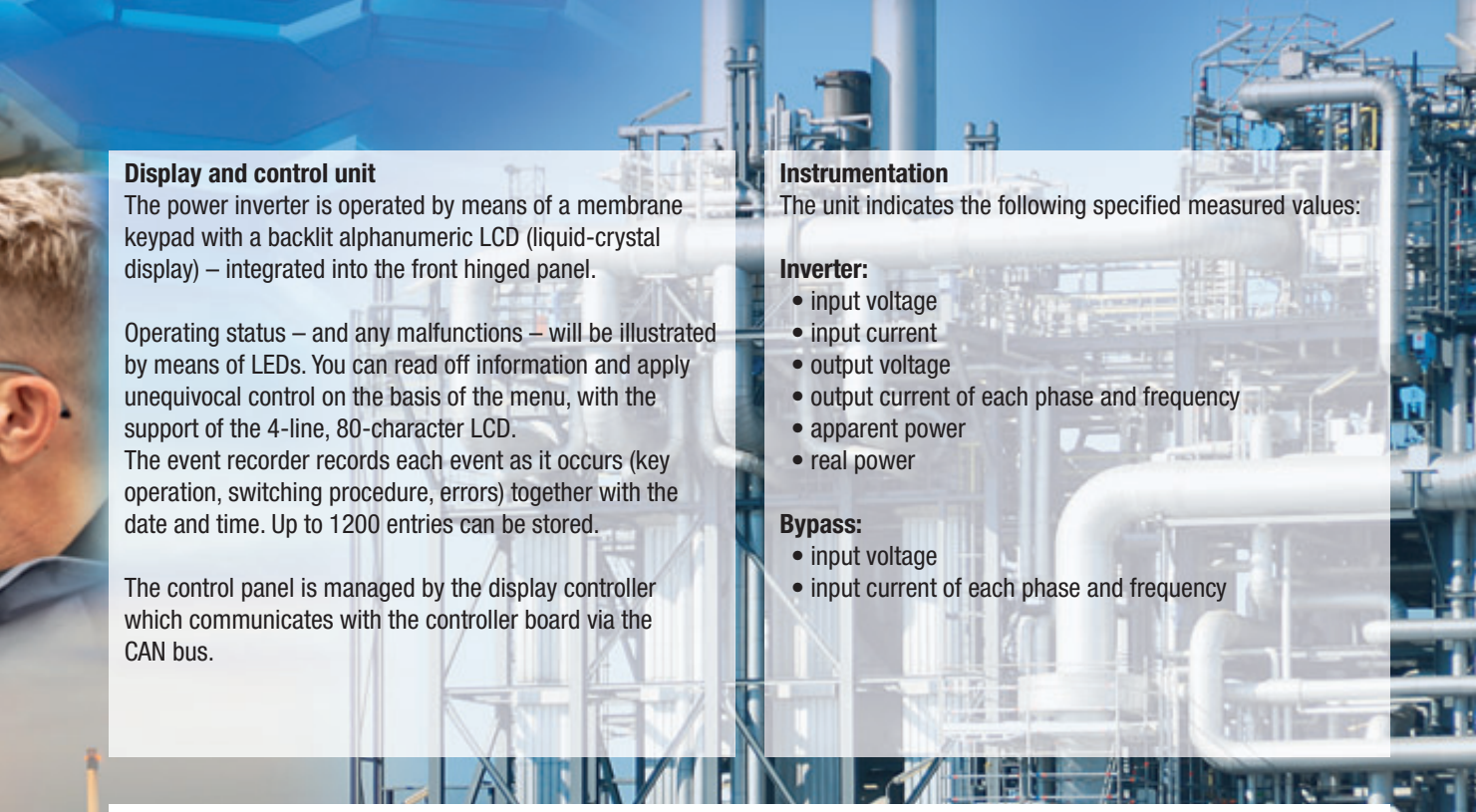
Fig. 4: On the display & control unit on the front panel, you will find function and fault-warning LEDs, control switches and a mimic diagram.

Technical Data

INVERTRONIC 3ph													
Ratings*[1] (cosφ = 0.8)	[kVA]	10	20	30	40	50	60	80	100	120	140	160	200
Ratings*[1] (cosφ = 1.0)	[kW]	8	16	24	32	40	48	64	80	96	112	128	160
Operating temperature		0 … 40 °C, 32 ... 104 °F (derating at higher temp.)											
Relative humidity		5 … 95 % (non condensing)											
Noise level		< 65 dBA (depending on rating)											
Protection kind		NEMA 1 (others on request)											
Altitude above sea level		1000 m, 3280 ft (without derating)											
Cable entry		bottom (top on request)											
Color		RAL 7035 (others on request)											
Cooling		redundant forced ventilated											
Classification		VFI-SS-111 (as per IEC / EN 62040-3)											
Standards													
Safety		IEC / EN 62040-1, IEC / EN 60950-1, UL, CSA											
EMC		IEC / EN 62040-2											
Performance		IEC / EN 62040-3											
Input													
Voltage		110 V / 125 V / 220 V / 240 V											
Voltage tolerance		-15 % … +25 % (depending on configuration)											
Inrush current		< I Nom											
Output (power inverter mode)													
Voltage		208 V / 380 V / 400 V / 415 V / 480 V (others on request)											
Voltage tolerance (static)		± 1 %											
Frequency tolerance		± 0.1 %											
Distortion THDu		linear load: ≤ 1 %											
Efficiency		up to 96 % (depending on configuration)											
Overload inverter		200 % for 3 s, 150 % for 60 s, 125 % for 10 min											
Overload bypass		1000 % for 100 ms, 150 % for 10 min											
Short circuit behavior inverter		up to 350 % for 3 sec											
Short circuit behavior bypass		1000 % for 100 ms											
Transformer		isolation transformer											
Battery													
Nominal voltage		110 V / 125 V											
		220 V / 240 V											

(*[1] higher ratings on request)

Specifications are subject to change without notice.



Display and control unit
The power inverter is operated by means of a membrane keypad with a backlit alphanumeric LCD (liquid-crystal display) – integrated into the front hinged panel.

Operating status – and any malfunctions – will be illustrated by means of LEDs. You can read off information and apply unequivocal control on the basis of the menu, with the support of the 4-line, 80-character LCD.
The event recorder records each event as it occurs (key operation, switching procedure, errors) together with the date and time. Up to 1200 entries can be stored.

The control panel is managed by the display controller which communicates with the controller board via the CAN bus.

Instrumentation
The unit indicates the following specified measured values:

Inverter:
- input voltage
- input current
- output voltage
- output current of each phase and frequency
- apparent power
- real power

Bypass:
- input voltage
- input current of each phase and frequency

Technical Data

INVERTRONIC 1ph													
Ratings (cosφ = 0.8)	[kVA]	10	20	30	40	50	60	80	100	120	140	160	200
Ratings (cosφ = 1.0)	[kW]	8	16	24	32	40	48	64	80	96	112	128	160
Operating temperature		0 … 40 °C, 32 ... 104 °F (derating at higher temp.)											
Relative humidity		5 … 95 % (non condensing)											
Noise level		< 65 dBA (depending on rating)											
Protection kind		NEMA1 (others on request)											
Altitude above sea level		1000 m, 3280 ft (without derating)											
Cable entry		bottom (top on request)											
Color		RAL 7035 (others on request)											
Cooling		redundant forced ventilated											
Classification		VFI-SS-111 (as per IEC / EN 62040-3)											
Standards													
Safety		IEC / EN 62040-1, IEC / EN 60950-1											
EMC		IEC / EN 62040-2											
Performance		IEC / EN 62040-3											
Input													
Input voltage		110 V / 125 V / 220 V / 240 V											
Voltage tolerance		-15 % … +25 % (depending on configuration)											
Inrush current		< I Nom											
Output (power inverter mode)													
Voltage		120 V / 220 V / 230 V / 240 V (others on request)											
Voltage tolerance (static)		± 1 %											
Frequency tolerance		± 0.1 %											
Distortion THDu		linear load: ≤ 1 %											
Efficiency		up to 95 % (depending on configuration)											
Overload inverter		200 % for 3 s, 150 % for 60 s, 125 % for 10 min											
Overload bypass		500 % for 100 ms, 150 % for 10 min											
Short circuit behavior inverter		up to 300 % for 3 sec											
Short circuit behavior bypass		500 % for 100 ms											
Transformer		isolation transformer											
Battery													
Nominal voltage		110 V / 125 V											
		220 V / 240 V											

Specifications are subject to change without notice.

INVERTRONIC:
Flexible, safe and scalable

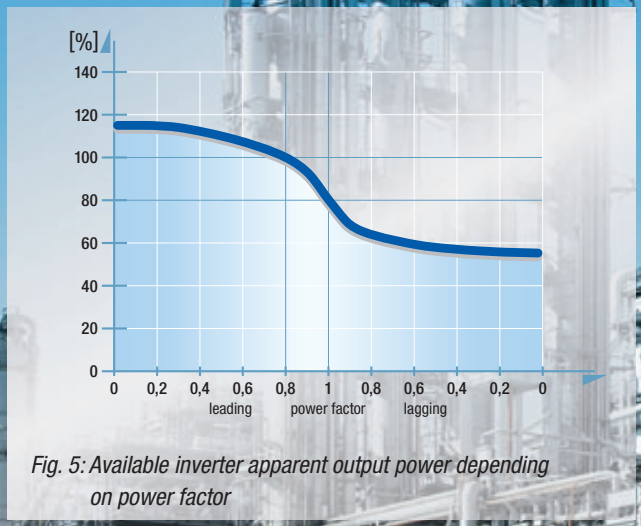


Fig. 5: Available inverter apparent output power depending on power factor

Fig. 6: INVERTRONIC Inverter, 1 x 120 V - 40 kVA

Function & Design

In normal operation the load is supplied by the inverter through the output transformer.

The static inverter not only has the task of supplying the connected loads 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.

Thanks to the control characteristics of the INVERTRONIC power inverter range, any dynamic deviations in voltage are very low, even in the event of major variations in load.

Thanks to the use of the latest technology in IGBT output semiconductors, the INVERTRONIC range is more than a match for the highest requirements in terms of power supply reliability, with the added bonus of being cost-effective.

All of the inverter and static switch functions are controlled, regulated and monitored with the highest reliability, due to a combination of 16-bit microcontrollers and leading-edge power output electronics.

A static switch and a service bypass switch are provided.

Inverter

The inverter power block changes DC voltage into a 1-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 with 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. During battery discharge, the inverter signals battery on discharge and reports status. Shortly before the low limit of the battery is reached, the system warns of discharge limit and then checks the alternate source availability before switching.

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ISO 9001 ISO 14001 ISO 50001 SCC[P]

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