

# DC/AC INVERTER

## INV216

# USER MANUAL



## Notes to this manual

ATTENTION! Read this manual very carefully before installing and commissioning the specified module. This manual is a part of the delivered module. Familiarity with the contents of this manual is required for installing and operating the specified module. The rules for prevention of accidents for the specific country and the general safety rules in accordance with IEC 364 must be observed.

The function description in this manual corresponds to the date of publishing. Technical changes and changes in form and content can be made at any time by the manufacturer without notice. There are no obligations to update the manual continually.

The module is manufactured in accordance with applicable DIN and VDE standards such as VDE 0106 (part 100) and VDE 0100 (part 410). The CE marking on the module confirms compliance with EU standards 2006/95/EG (low voltage) and 2004/108/EG (electromagnetic compatibility) if the installation and operation instructions are followed.

### Supplier:

	ELTEK VALERE DEUTSCHLAND GmbH GB Industrial Schillerstraße 16 D-32052 Herford
	+ 49 (0) 5221 1708-210
FAX	+ 49 (0) 5221 1708-222
Email	<a href="mailto:Info.industrial@eltekvalere.com">Info.industrial@eltekvalere.com</a>
Internet	<a href="http://www.eltekvalere.com">http://www.eltekvalere.com</a>

©2009. ELTEK VALERE DEUTSCHLAND GmbH. All rights reserved.

**The current revision status of this user manual is the following:**

Revision: 1.0

Date: 2009-06-26

Revision	Description of change	Writer	Date
01-04	Minor text modifications	RTH	
05	ELTEK VALERE layout inserted	RTH	23.01.2008
06	View of the rear side connector corrected	RTH	2009-04-08
1.0	New revision status numbering (X.X) introduced, data of the input and output current corrected (section 3), minor text modifications.	RTH	2009-06-26

## Table of Contents

1. SAFETY INSTRUCTIONS/WASTE DISPOSAL RULES .....	5
2. GENERAL INFORMATION.....	6
2.1 TYPICAL APPLICATIONS.....	6
3. TYPE RANGE/MAIN DATA.....	7
3.1 MAIN OUTPUT DATA.....	7
3.2 OPTIONAL EQUIPMENT FOR INVERTER ASSEMBLY: .....	7
3.3 FRONT SIDE LED PANEL .....	7
3.4 REAR SIDE CONNECTION .....	8
3.5 COOLING/AIR FLOW DIRECTION.....	9
3.6 COMMUNICATION INTERFACE.....	9
4. HANDLING.....	10
4.1 STORAGE.....	10
4.2 COMMISSIONING.....	10
4.3 LED INDICATIONS.....	10
4.4 MONITORING .....	11
5. MAINTENANCE .....	11
6. TROUBLE SHOOTING.....	12
7. TECHNICAL SPECIFICATIONS.....	13
7.1 DIMENSIONAL DRAWING: .....	15

## 1. Safety Instructions/Waste Disposal Rules



### Warning!

---

Because several components of operating electrical modules are charged by dangerous voltage, the improper handling of electrical modules may be the cause of accidents involving electrocution, injury, or material damages.

- Operation and maintenance of electrical modules must be performed by qualified skilled personnel such as electricians in accordance with EN 50110-1 or IEC 60950.
  - Install the module only in areas with limited access to unskilled personnel.
  - Before starting work, the electrical module must be disconnected from mains. Make sure that the module is earthed.
  - Do not touch connector pins as they can be charged with dangerous voltage up to 30 seconds after disconnection.
  - Only spare parts approved by the manufacturer must be used.
- 

All electric modules must be disposed of separate from domestic waste at collecting points that have been set up by the government or municipal authority.

“Separate collection is the precondition to ensure specific treatment and recycling of WEEE and is necessary to achieve the chosen level of protection of human health and the environment in the Community.”

The above statement from EU directive 2002/96/EC applies to all electric modules installed within EU countries.

In countries outside the EU, different rules may apply regarding waste disposal of electric modules.

For more information about waste disposal of your discarded equipment, contact your ELTEK VALERE DEUTSCHLAND partner.

---

## 2. General Information

The inverter INV216 converts input side DC voltage to a stable sine-wave output voltage.

The INV216 is a module with rear side connectors and is designed to be mounted in an assembly set sub rack (see section 3.2).

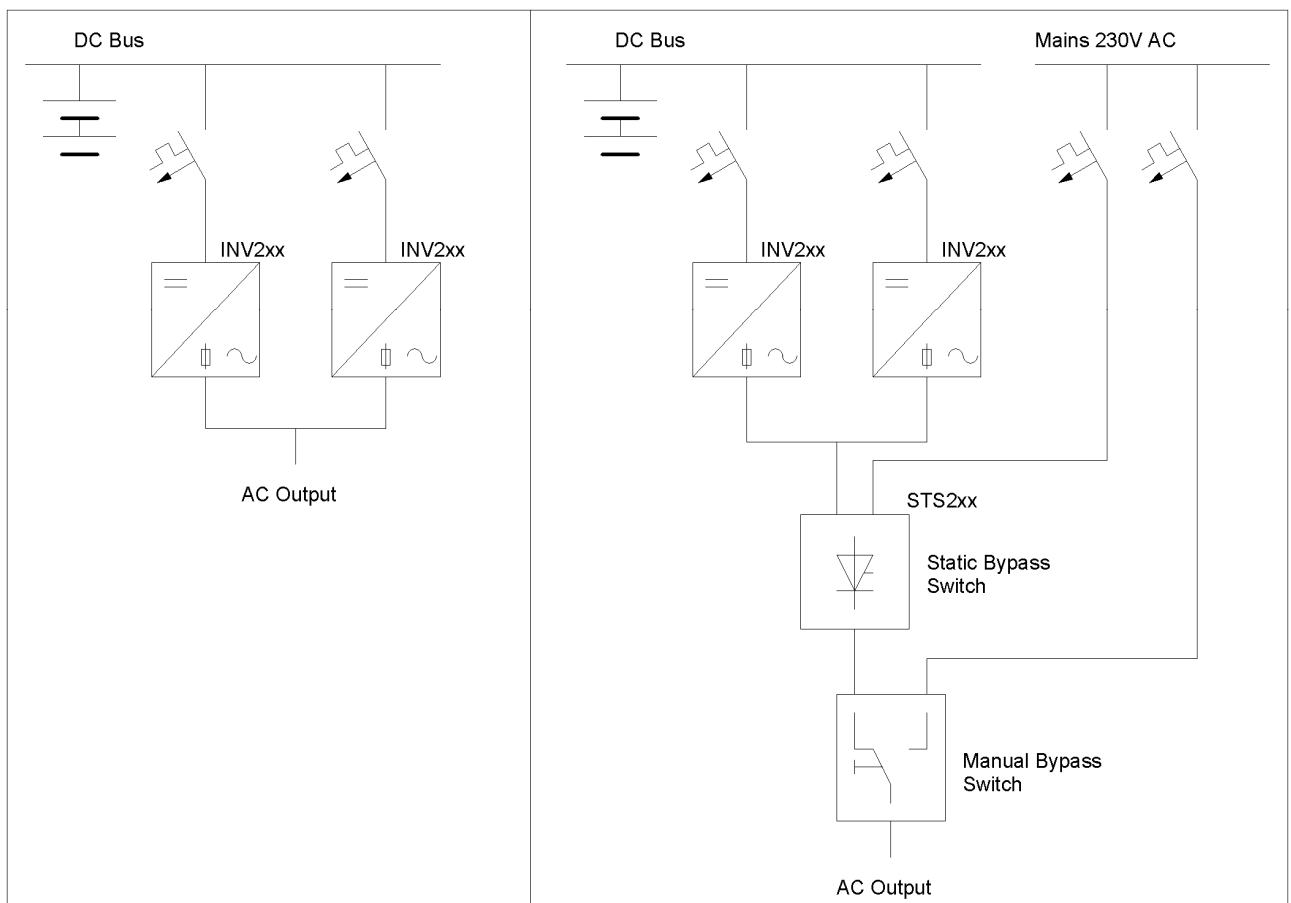
The inverter is controlled and monitored by internal microprocessors. Due to its state-of-the-art circuitry design, the unit has very low losses and therefore very compact dimensions, low weight and a very high power density.

To increase the reliability the inverter is designed to operate in combination with a static transfer switch of series STS207. The static transfer switch monitors the connected bypass mains and synchronizes the inverter output with mains frequency. At inverter priority mode the STS transfers the load supply to bypass mains in case of inverter faults, high overload or battery low voltage. The transfer is nearly without voltage interruption (<4ms). The unit automatically switches back to inverter operation if the reason for the transfer is gone. In case of mains priority mode the inverter will take over the load if the mains voltage is not present, out of limits or heavy disturbed. The priority source is programmable at the STS unit (see the specific manual).

The nominal output power per unit is 1.6kW. Several modules can be switched in parallel to increase the system output power or to build redundant power supply systems (n + 1 principle).

### 2.1 Typical Applications

(a) Inverter in parallel operation without STS      b) Inverter in parallel operation with STS



### 3. Type Range/Main Data

Type Designation	Material Code	Nominal Input Voltage	Nominal Input Current	Input Voltage Range
INV216-48/230-50	501-016-515.A0B	48V <sub>DC</sub>	37.1A <sub>DC</sub>	40.8 - 60V <sub>DC</sub>
INV216-108/230-50	501-016-715.A0B	108V <sub>DC</sub>	16.6A <sub>DC</sub>	91.8 - 135V <sub>DC</sub>
INV216-216/230-50	501-016-815.A0B	216V <sub>DC</sub>	8.3A <sub>DC</sub>	183.6 - 270V <sub>DC</sub>

#### 3.1 Main output data

Output Voltage: 230V<sub>AC</sub>  
Output Current: 7.4A<sub>AC</sub>  
Output Frequency: 50/60Hz

For more specific data, see section 7.

#### 3.2 Optional equipment for inverter assembly:

- 19" rack 2U with 3 slots for INV216-48 and 1 slot for static transfer switch STS207 including wired backplane (Mat. Code 502-216-315.LV)
- 19" expansion rack 2U with 4 slots for INV216-48 including wired backplane (Mat. Code 502-216-405.LV)
- 19" rack 2U with 3 slots for INV216-108 or INV216-216 and 1 slot for static transfer switch STS207 including wired backplane (Mat. Code 502-216-315.HV)
- 19" expansion rack 2U with 4 slots for INV216-108 or INV216-216 including wired backplane (Mat. Code 502-216-405.HV)
- Cover plate to cover not used slots, 2U, colour RAL 7035 (Mat. Code 881-MEC-BPL.02.21.B)

#### 3.3 Front side LED panel

The device is equipped with 4 LED indications for:

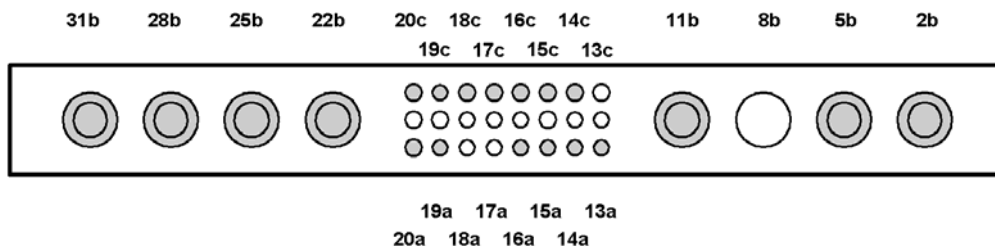
- OPERATION
- OUTPUT OK
- THRESHOLD REACHED
- ALARM

For more information about the LED panel, see section 4.3.

### 3.4 Rear side connection

Male connector (DC input voltage, AC output voltage and signalling):

Pin	Designation
22b, 25b	DC input, plus pole
28b, 31b	DC input, minus pole
11b	PE
5b	AC output, Neutral
2b	AC output, Phase L1
15a	Alarm NO (OC)
16c	Alarm COM
19c	SYNC-STAT1 (synchronization bus 1, state lines)
20a	SYNC-SIG1 (synchronization bus 1, 50Hz-signal)
18c	SYNC-STAT2 (synchronization bus 2, state lines)
19a	SYNC-SIG2 (synchronization bus 2, 50Hz-signal)
20c	SYNC-GND (synchronization bus, ground)
14a	CAN-H
14c	CAN-L
13a	CAN-VSS
15c	CAN-VCC
17c	Address coding
16a	AGND

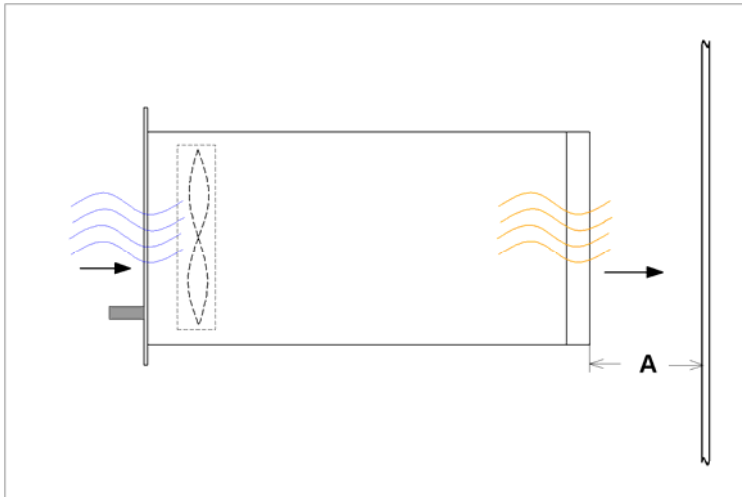


Male connector, shown from the rear side of the module.



### 3.5 Cooling/Air flow direction

The unit is cooled with an internal fan. The airflow is from the front to rear side. The fan is monitored and speed controlled dependent on module temperature. To provide sufficient air flow, a minimum space (see item "A" in the figure below) of 50 mm is required between the unit and the rear cabinet wall as well as an unobstructed supply of air to the front of the module.



### 3.6 Communication interface

The inverter is equipped with a serial data interface according to CAN (= controlled area network) –specification. Via CAN-Bus, several inverters in a system or parallel connection can be controlled and monitored by a central unit which is integrated in the static switch unit STS.

Following parameters of a specific inverter unit can be controlled or monitored:

- Inverter status (OK/failure)
- Output voltage (measurement value)
- Output current (TRMS measurement value)
- Input voltage (measurement value)\*
- Input current (measurement value)\*
- Output frequency (measurement value)\*
- Internal temperature (measurement value)\*

\*with separate software tool

The CAN-Bus connection is integrated in the rear side connector.

## 4. Handling

### 4.1 Storage

The modules must be stored in a dry, dust free environment with a storage temperature in accordance with the specific technical data (see section 7).

### 4.2 Commissioning

**Note:** Before commissioning the module, make sure that the input voltage corresponds to the nominal input voltage of the unit as specified on the type plate.


1. Carefully unpack the unit
2. Fill the rack beginning with the left slot.
3. Put the unit into an empty slot.
4. Carefully slide in the unit until the module connector touched the backplane connector.
5. Increase the force until the unit fits in completely. Avoid using too much force. If the unit does not fit in, begin again at Step 3.
6. Secure the unit using the captive screw (M4x12) provided with the module.

**Note:** Before **removal** of a module it must be **switched off** by the external input fuse!

**WARNING:** After switching off the module the internal capacitors are still fully charged. Do not touch connector pins as they can still be charged with dangerous voltage after disconnection.

### 4.3 LED Indications

Following functions are indicated with front side LEDs:

LED		Colour	Function
OPERATION		green	Inverter operation; DC input voltage monitoring
OUTPUT OK		green	Output voltage monitoring
THRESHOLD		red	Output current/overload monitoring
ALARM		red	General alarm; temperature/fan monitoring

For a detailed description of the fault status, see section 6.

## 4.4 Monitoring

Monitored values	Criteria	Function
DC input voltage	Input voltage out of the range of adjustable thresholds $U_{i<}$ * and $U_{i>}$ *	Unit automatically switches off and on with delay and hysteresis
AC output voltage	Output voltage out of specified range $U_{o>}$ * and $U_{o<}$ *	Unit automatically switches off (has to be manually restarted)
Short circuit	*	Unit automatically switches off after 2.5sec; the module automatically tries three times to restart. If this fails, the module switches off and must be manually restarted.
Overload	*	Unit automatically switches off after 30sec* (has to be manually restarted)
Temperature	Internal temperature higher than specified value*	Automatically switch-off at high over temperature and switch-on with hysteresis*

\* see specific technical data section (section 7)

## 5. Maintenance

In general, the module is maintenance free.  
A yearly inspection with following checks is recommended:

- Mechanical inspection
- Removal of dust and dirt, especially on radiator surfaces
- Check for internal dust or humidity

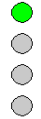
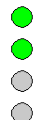
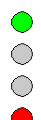


**WARNING!** Dust combined with moisture or water may influence or destroy the internal electronic circuits.

Dust inside the unit can be blown out with dry compressed air.  
The interval between the checks depends on ambient conditions of the installed module.

## 6. Trouble Shooting

The following table shows all possible combinations of LED signals at the inverter unit.

LED symbols means: grey - LED off; green/red – LED permanently on; green/red with rays – LED is flashing

LED signal	Reason	What to do
	1. No DC input voltage 2. Internal fault on circuitry	1. - Check input DC voltage - Check incoming distribution fuses - Check mounting position of device 2. Exchange the unit
	Inverter was switched of remotely via CAN-bus	Check the STS controller about the reason of the switch-off command
	DC input voltage to low or to high	Check DC input voltage level
	Normal operation mode	
	Device switched off during internal start-up procedure	1. Restart the unit by incoming DC fuse 2. If the fault remains, exchange the unit
	Output voltage to high	Internal fault in circuitry; exchange the unit
	1. Slow flashing: fan fault 2. Quick flashing: device shut-off due to over temperature	1. Exchange the unit or the internal fan (service personnel only) 2. Check all air ventilations; remove dirt and dust; check the room temperature (see the limits under section 7)
	Currently output side overload or short circuit	Reduce the load to nominal value (see section 7) or check the load circuitry for short circuit
	Unit switched off due to output side overload or short circuit	Reduce the load to nominal value (see section 7) or check the load circuitry for short circuit and restart the unit by input DC distribution

If the module still does not work even though all checks have been done, contact your sales agent or the ELTEK VALERE DEUTSCHLAND service department.

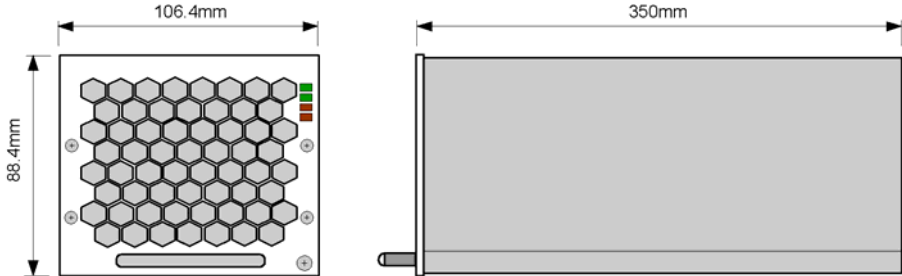
## 7. Technical Specifications

<b>Type designation</b>	<b>see section 3</b>
<b>Article code</b>	<b>see section 3</b>
<b>DC input:</b>	
Nominal input voltage	see section 3
Input voltage range	see section 3
Nominal input current	see section 3
Inrush current	≤ nominal input current
Reflected input voltage ripple	≤ 1,8mV psophometric (CCITT-A-filter)
Overall efficiency	≥90% for 50...100% load
Internal input fuse	there is no internal fuse, external fusing required (63A)
<b>AC output:</b>	
Nominal output voltage	230V <sub>AC</sub> ±0.5%, factory adjustment range: 200...252V <sub>AC</sub> , parallel mode: 230V <sub>AC</sub> ±5%
Nominal output current	7.4A <sub>AC</sub>
Output frequency	50Hz ±0,05%, at factory settable to 60Hz, synchronization range with external static transfer switch unit: 45-65Hz
Nominal output power	1600W
Output power factor range	0.7 ind. – 1 – 0.7 cap.
Overload capability	150% for 5 sec.; 110% for 1 min
Overload current	Switch-off at ≥7.8A <sub>AC</sub> (short circuit detection at 10.1A <sub>AC</sub> )
Total harmonic distortion	<2% for linear load
Crest factor	≤ 3
Dynamic behaviour	≤ 3 % for load transients between 10 % - 100 % -10 % of nominal output current (recovery time ≤ 0.3 ms)
Short circuit protection	sustained short circuit proof, short circuit current 2-2,5x I <sub>nom</sub> for approx. 2.5sec (with delayed restart)
Internal output fuse	16A
<b>Other specifications:</b>	
Monitoring	DC-input voltage, (U <sub>IN&lt;</sub> , U <sub>IN&gt;</sub> ) with automatic switch ON/OFF function, AC-output voltage(U <sub>OUT</sub> ), over temperature and overload with automatic switch off function
LED-indications	OPERATION, OUTPUT OK, THRESHOLD, ALARM

---

Electronic protection	input under voltage, input over voltage, over temperature, overload and short circuit protection
External synchronization	External synchronization over static transfer switch.
Parallel operation	Parallel operation without any additional equipment and without fixed master possible; max. eight modules, load sharing approx. 5% Inom due to decreasing output line characteristic
Communication	CAN-BUS interface to communicate with a static transfer switch STS
Isolated signalling contacts	“General fault”, isolated optocoupler output COM/NC
Cooling principle	forced cooling by internal fan (temperature-regulated, monitored)
Max. installation altitude	≤1500m
Ambient temperature	operation: -20°C...+55°C, storage: -40°C...+85°C
Noise emission	< 50dB(A) at 1m distance
Surfaces	powder coating RAL 7035 (front panel only), constructive parts: anodized metal
Weight	approx. 4.0 kg
Dimensions (W/H/D)	106.4/88.4/350mm (¼ x 19”, 2U)
Electrical connectors	DC-Input , AC-Output and signals: DIN 41612-M-connector
<b>Applicable standards:</b>	
Mechanical construction	acc. to VDE 0160 edition 5.88 chapter 7.2.2
Protection class	IP20
Climatic conditions	acc. to IEC 721-3-3 class 3K3/3Z1/3B1/3C2/3S2/3M2
RFI suppression / immunity	CE-label, (EN50081-1, EN55011/55022 class „B“, EN50082-2, EN61000-4 part 2/3/4/5)
Compliance to safety standards	acc. to EN60950-1, VDE0100 T410, VDE0110, EN60146

**7.1 Dimensional Drawing:**





**Supplier:**

	ELTEK VALERE DEUTSCHLAND GmbH GB Industrial Schillerstraße 16 D-32052 Herford
	+ 49 (0) 5221 1708-210
FAX	+ 49 (0) 5221 1708-222
Email	<a href="mailto:Info.industrial@eltekvalere.com">Info.industrial@eltekvalere.com</a>
Internet	<a href="http://www.eltekvalere.com">http://www.eltekvalere.com</a>