

Wiring and installation must follow the corresponding regulations! Check the voltage / power rating and polarity of each equipment (battery, solar modules, DC and AC loads) which is to be connected to the inverter, **before** you start with the actual connection! Their voltage / power rating have to correspond to one another! If you have any doubts – ask your local dealer. Please follow this exact order during installation:

1. Check whether the connected battery is already earthed. In that case the minus connector must be earthed since the solar-station is internally connected to earth. If that is not the case, connect the earth of the unit to the earthing point of your house. If you have no suitable earth connection available, the earthing must be done according to the corresponding regulations (e.g. earthing spear). Under no circumstances can the unit be operated without earthing because faulty units of Protection Class I may represent serious hazard to human health and life (life danger). Earthing of the neutral connection is not allowed and will destroy your unit!
2. Switch your unit off before connecting it (AUS position). The connecting symbols can be found on the unit itself.
3. Connect the battery with the appropriate cables while making sure of the right polarity. Always install a fuse directly at the battery plus terminal, according to the corresponding regulations. The external temperature sensor should be attached directly on the battery case (with a strip of tape, etc).
4. Connect the solar modules to the screw terminals with the right polarity.
5. Connect the DC loads (if any) to the screw terminals with the right polarity.
6. Switch the unit on (EIN position). The green LED should light. If not, please check fuses and the presence of voltage from the battery.
7. Now AC loads can be connected to the output socket.
8. If you do not wish to operate AC loads at the moment, please switch the unit off again.

Technical data:

Type	PC1000
Battery connections	
Nominal voltage U_{nom}	12 V
Input voltage range U_{in}	10...15 V
Max. input current / Fuse	120A / 4x30 A
Typical standby consumption with inverter ON	0.4A
Typical standby consumption with inverter OFF	4mA
Recommended battery Ah_{min}	120 Ah
230V Output	
Output voltage	225V +/- 5%
Output frequency	50Hz +/-1%
Output current continuous / peak	4,5 / 12 A
Max. continuous power at $\cos \varphi > 0,8$	1000VA
Max. peak power at $\cos \varphi > 0,8$	2500VA
Typ. Efficiency (at nom. load power 1000W, $U_{in} = U_{nom}$)	94 %
Deep Discharge Protection - AC Load	
Advance warning indication	<11,0 V
Switch-off threshold of DDP	9,8V
Reset threshold	12,0 V
Solar charge controller - solar module input	
Typ. standby consumption	4mA
Nominal current	20A
Charging limit, float charge at $T_u = 25^\circ C$	13,8V
Charging limit, gas control at $T_u = 25^\circ C$	14,4V
Gas control activation at $T_u = 25^\circ C$	12,3V
Temperature compensation	-4mV
Deep Discharge Protection - DC Load	
Nominal current	20A
DDP Load disconnection	10,5V
Reset threshold	12V
Other data	
Operating temperature	0...+40 °C
Dimensions (mm)	283x350x115
Weight	6 kg
MC Directive	EN55011-03.91; EN50082-1:01.92
Low Voltage Directive	EN60335-1:09.94+A11:05.95
Communication port:	RS232, Pin 2=TXD 3=RXD 5=GND
LCD display:	1x16 digit, alphanumeric
Voltage range:	8,00V ... 32,00V +/- 2Digit +/-2% from max. value
Current range:	- 30,0A ...+ 30,0A +/- 2Digit +/-5% from max. value
Temperature range:	- 40 °C ...+ 50°C +/- 2Digit +/- 5% from max. value

Subject to alteration

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Panelectron Ltd., Rózsa u. 3, 9/52, H-1045 Budapest, Hungary
Tel/Fax: +36 1 370 8007, E-mail: info@panelectron.hu; URL: http://www.panelectron.hu



INSTRUCTION MANUAL



PC1000-LCD – 12/24V COMBI INVERTER with LCD and RS232 port

- Built-in 20A solar charge controller with DC load output
- Battery deep discharge protection
- Gas regulation and temperature compensated charging

Dear Customer,

Thank you for buying our product. You have bought one of the most powerful, most compact and most reliable sinewave Inverter of its class. Please make sure to read this manual carefully before putting the unit into operation.

WARNING!!! Important security advice!

- Only solar modules can be used as power source.
- Please follow the correct order when connecting your unit! Disconnection should be done in a reversed order (see installation).
- The unit contains an internal fuse for the positive battery connection and another one for the AC output connection. In order to avoid high current if short-circuit occurs between the unit and the battery, the positive cable must be fused (e.g. built-in fuse in the battery cable).
- Equipment which, due to its function must not be switched off by means of load disconnection, (e.g. navigation lights) **must be connected directly** to the battery and fused.
- This unit produces 230V alternating current on the output side, which is dangerous for human life and health if touched!
- This unit must be kept away from children! Should a supervised operation in a household with children not be possible, all corresponding security measures related to the mains socket are to be taken!
- The operation of an alternating current load of protection class I (unit with protection plug containing PE connection) is dependent on the earthing of the PE connection at the sinewave inverter output or the earthing of the battery minus connector. Please note that according to the regulations the cover and the PE connector are internally connected to the minus connector of the battery. Under no circumstances should the output neutral-connector be earthed!
- Please note that even when the inverter is switched off, there could be dangerous voltage on the output stored in the capacitors!
- Operation under extreme conditions must be avoided, such as: in temperatures above 40°C, inflammable gas, solvents, vapour, dust, humidity over 80% non cond., etc.)
- The unit must be kept and operated in closed, dry area.
- As soon as you assume that safe operation of the unit is no longer possible, unplug it immediately and make sure that it cannot be switched back by somebody else. Operation has become unsafe when the unit does not show any signs of working or has been visibly damaged under transportation of after storing the unit in unfavourable conditions. Under adverse circumstances (e.g. lack of charge regulation, extremely high temperature) lead acid batteries can produce hydrogen – danger of explosion! Batteries must be stored and installed in well-ventilated areas only!
- Due to the power consumption of the unit, it is only allowed to use lead acid batteries with a minimum Ah capacity, as required in the technical specifications.
- Batteries are able to deliver high currents, which can, despite the corresponding protecting measures taken, damage equipment and cause injuries to persons. In adverse conditions short-circuit could result in heat development and consequent fire. Please observe technical specification on voltages and polarity!
- Servicing and repair can be conducted by authorised personnel only. Only fuses with the same rating and characteristics can be used as replacement. It is forbidden to mend the burned fuse or short-circuit the fuse-holder. Before service or fuse replacement, all equipment must be disconnected from the inverter and the inverter itself from the batteries. It is necessary to wait for an additional 3 minutes in order to avoid dangerous voltage shock from the internal capacitors.

Operation description

The PC1000-LCD combi inverter joins an integrated solar load regulator (type PSCD-20) and a 230 V AC sinewave inverter (type P1000-12) in one unit. The unit provides the DC loads with a nominal voltage of 12V and a max. current of 20A as well as AC loads (230V AC @ 50 Hz, $\cos \varphi > 0,8$) up to a max. power of 1000VA. The 12V lead acid battery which is used as power supply will be protected against hazardous deep discharge / overcharging. The unit is designed for usage in dry room and should be installed wall-mounted. When the necessary conditions for usage are not present, it is the responsibility of the user to provide them. Generally lead-acid batteries are used in photovoltaic systems for storing energy. They must be protected from deep discharging and overcharging. This built-in solar charge controller complies with both requirements.

Battery deep discharge protection (DDP) – AC and DC load disconnection

Lead acid batteries must be protected against deep discharging; otherwise the cells will be irreversibly damaged. All loads (both AC and DC) will be switched off automatically when battery discharge voltage is reached. A new automatic load re-connection is possible only after charging the battery to an appropriate level. This is to make sure that the battery leaves the discharged status as soon as possible.

Protection against overcharge

Exceeding the final charging voltage leads to the formation of gas. Gassing leads to the loss of electrolyte inside the battery and can also cause the formation of detonating gas through creating hydrogen. Due to the loss of electrolyte, the plates inside the battery are not covered completely which can lead to battery damage. In case you experience gas formation, eliminate the cause of the problem (please check chart for faults) and check the electrolyte level. The amount of gas depends on the temperature. The inbuilt temperature-sensor automatically regulates the final charging voltage in accordance with the temperature in the area of use/operation. The battery is not fully charged when the final charging voltage is reached. The charging current is then reduced just to the level that the final charging voltage is not exceeded. The charging process - „IU-charging” recharges the batteries evenly and quickly. The PSC charge controller uses PWM (Pulse Width Modulation) series regulation, e.g. the charging limit is regulated by modulating the charging current coming from the solar module. Therefore other charger types can also be connected additionally to the PV input terminal.

Gas control

An over-extended use of lead-batteries without a controlled gas-formation can lead to the development of damaging lead-sulphate layers. The Solar Charger Unit controls the gas-formation and therefore prevents the development of lead-sulphate. This process depends upon the temperature and is regulated by the external temperature-sensor.

Temperature compensation

The external temperature sensor adjusts and regulates the final charging voltage and gas-formation of the batteries to the temperature in the area of battery storage. For that reason the combi inverter should be mounted in the same room as the batteries.

Sinewave inverter

The unit produces real sinewave at its output from which all alternating current loads (230V AC 50 Hz $\cos \phi > 0,8$) within the corresponding power range can be operated. Nevertheless please note that some load devices require more power at start-up than their nominal power. Light bulbs can require 5 times more current at start-up than their nominal value. Drills and refrigerators take a much higher current at start-up than their rated power given in their manuals. There are also 230V appliances, which require a 16A fusing to get them started. Starting drills, refrigerators (with compressor), PC monitors or TVs (demagnetising coil) also requires 10 times more power than their nominal power consumption. Should disconnection due to overload repeatedly occur, please use a more powerful model with the corresponding power reserve for difficult start-ups.

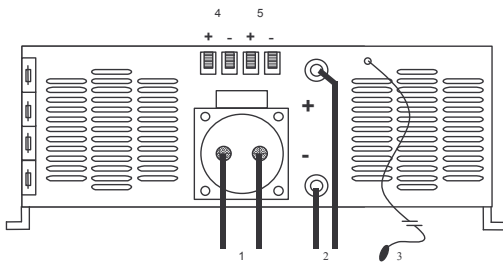
Main switch

The inverter can be started by the main switch, which is located on the side of the unit. If there is no load connected to the unit for a longer period, it is recommended to switch the unit off. This will save the batteries from discharging (self-consumption is approx. 5W).

Connections

At the front panel the following connections can be found:

- 1) Earthed socket for 230VAC loads
- 2) +/- Battery cable
- 3) Temperature sensor
- 4) +/- Solar module terminals (Modul)
- 5) +/- DC load terminals (Last)



LED Indications

On the top of the unit the following LED indicators can be found:

Inverter

- **“Betrieb”** (operating): the green LED shows that the inverter is switched on.
- **“Fehler”** (fault): red LED shows Warning or faulty operation of the inverter (see details in table)

Solar charge controller

- **“Laden”** (charging): green LED shows that the module input receives charging current
- **“STATUS”** (DC load off): red LED shows DC load disconnection. When the battery is recharged, the red LED switches off again.



After the charge controller is connected to the battery, the initializing takes about 1 sec.

During this time the name of the manufacturer (or local distributor) appears in the display.

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After the initializing process the display will show the following:

12.34V 0.0A I

The left value shows the battery voltage, the right value shows the battery current. The letter in the right corner indicates the status: L = Charging; E = Discharging.

During the initializing process the null point of the current indicator is balanced. Should there be larger offset values with the time, the null point of the current indicator can be balanced by pressing „Set“ and „Next“ button at the same time. Both the PV module and the DC load will be disconnected for a short time and the null point will be newly calibrated.

Pressing the „Next“ button will bring out further measured values. The next menu shows the current value:

10.0a >> - 10.0A

The left value shows the maximum charging current; the right value shows minimum charging current. The negative sign indicates discharging. To erase the max./min. values press the „Set“ and „Next“ button simultaneously. Then the actual values will be stored in the max./min. memory.

The next menu shows the voltage value:

13.45V >> 11.89V

The left value shows the maximum battery voltage; the right value shows minimum battery voltage. To erase the max./min. values press the „Set“ and „Next“ button simultaneously. Then the actual values will be stored in the max./min. memory.

The next menu shows the actual temperature:

25°C

By pressing the „Next“ button the display will jump back to the original starting point.

Serial port

The system data can also be accessed via the serial port with the help of a 9-pin RS232 cable. Further details can be found in the “read me” file provided with the software. Minimum PC requirements: processor: Pentium, min. 100MHz; min. 16MB RAM memory, operating system: Windows 9X/NT/XP/ME/2000; serial port. For installing the software there should be approx. 4 MB free disc space on the computer. Recommended screen resolution is 1024x768.

The solar charge controller has an internal 20A fuse. **Warning:** Should the terminals be reverse polarity connected to the load output, can even <20A fused units be completely damaged. Each system component must be individually fused.

Troubleshooting table

The solar system fails to function - possible reasons

Battery terminals are reverse connected: The fuse has blown, replace with a same type. (see „changing the internal fuse“ section).

Module terminals are reverse connected: Avoid at all costs!!!

Load terminals are reverse connected: The equipment can be seriously damaged before the fuse blows. Batteries contain considerable amounts of electrical energy. A short-circuit can result in a large build-up of heat leading to FIRE!

The LEDs indicate the operating status under different conditions and possible mal-functions in the Combi inverter unit.

Charge controller LED indications

Green LED (Laden)	Red LED (STATUS)	Fault	Observations
1 OFF	OFF	Internal fuse is blown. Battery fuse is blown.	Check fuses. Find the cause of the problem (why blown).
		Load is not supplied although the fuse is OK.	The charge controller is faulty.
2 ON	OFF	Battery is being charged. Battery is not fully charged.	Operating status OK.
3 OFF	ON	Battery became deep-discharged.	Load-disconnection is active, load is disconnected.
		Deep-discharged battery was connected to the charger.	Automatic system voltage detection; charger switches over to 12V system when battery voltage is less than 18V.
		The solar panel charges over the allowed voltage.	There is no battery connected, only solar panel. The battery fuse is blown. The battery cables are somewhere disconnected. The charge controller is faulty.
4 ON	ON	The Battery is fully charged.	Advanced warning: load will be disconnected upon reaching the DDP threshold.
		Little or no charging current at all.	The solar module is somewhere disconnected, the module is faulty, dirty or partly/fully covered.
		Load requires more power than the solar module can deliver.	Reduce power requirement or increase the charging capacity.

Inverter LED indications

Green LED (Betrieb)	Red LED (Fehler)	Status
ON	OFF	Unit in operation. Everything is O.K.
ON	Flashing	The unit is temporarily overloaded. This operating status is limited in time.
OFF	Flashing	The unit has switched off due to impermissible overload. The unit will automatically switch back to ready status after a certain waiting time.
ON	ON	Advance warning to deep discharging. The battery voltage has dropped below the deep discharge threshold but the discharge end voltage not yet reached.
OFF	Flashing	The battery voltage has dropped below the discharge end voltage. The unit will switch back only after the battery voltage reaches the switch-back threshold.
OFF	OFF	The unit is off. If the main switch is in ON position, either there is no voltage connected or the fuse is blown.

Installation

Corresponding to its protection class, the unit must be mounted not far from the battery. Battery area must be ventilated according to the regulations. The unit must not be mounted directly above any heat source or on inflammable material. The free space must be > 100 mm above and below the unit.

Wiring

Attention: Make sure of the right polarity! Follow the security advice!