

# **DC/AC Inverter with AVR system**

## **User's Manual**

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Pure Sine Wave Inverter with  
Optional AVR System for By-Pass Mode

**Sine Wave Inverter series (EV version)**

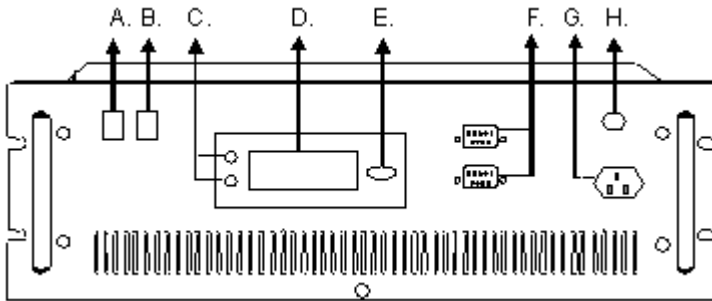
1000VA ~ 4000VA

Rack & Tower

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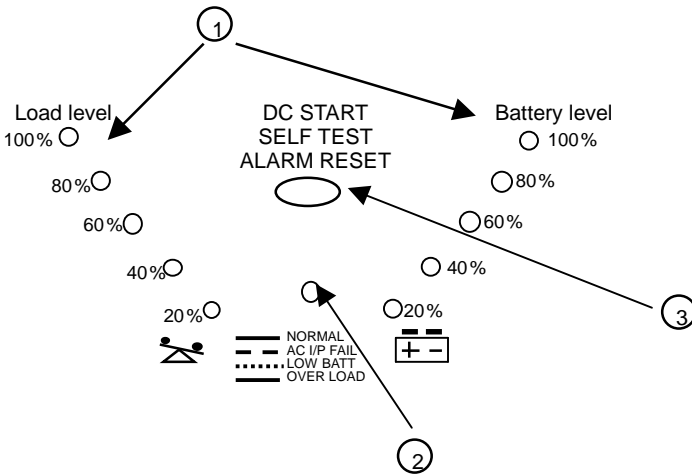
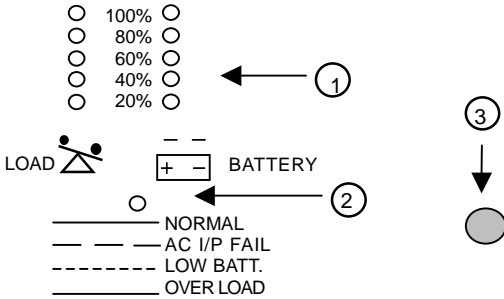
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## Front panel A (Rack Mount, LCD only)



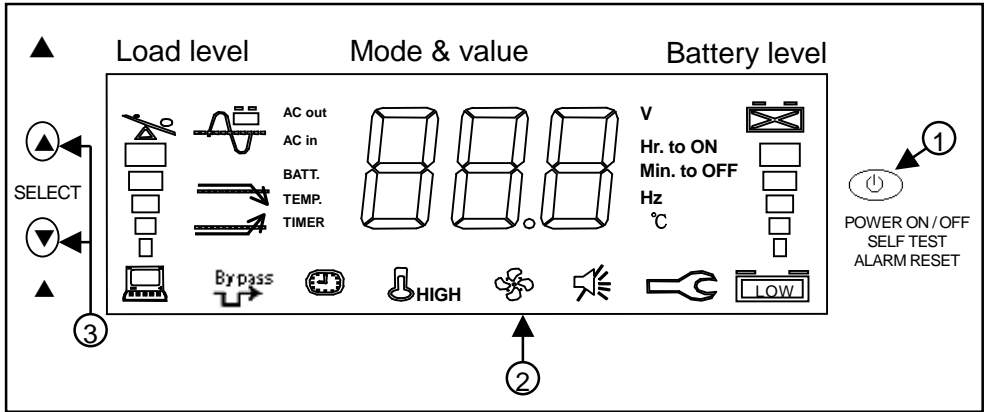
- A. DC input switch (optional).
- B. AC input switch.
- C. Selection button for mode & value.
- D. LCD screen. (Please Ref. 5.1)
- E. Main control button.
- F. RS-232 (DB-9) interface (optional).
- G. AC output (10A, max)
- H. Circuit breaker of AC output.

# Front panel B (Tower, LED)



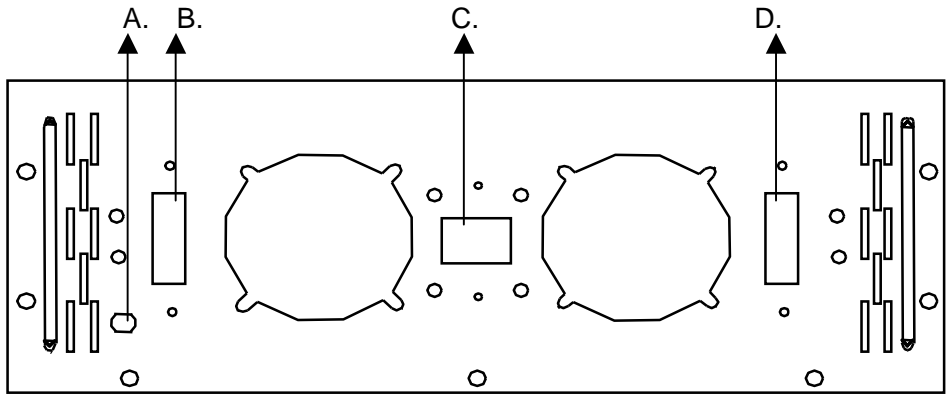
- ① LEDs of battery voltage level and load level.
- ② LED of operation status.
- ③ Control button.

## Front panel B (Tower, LCD)



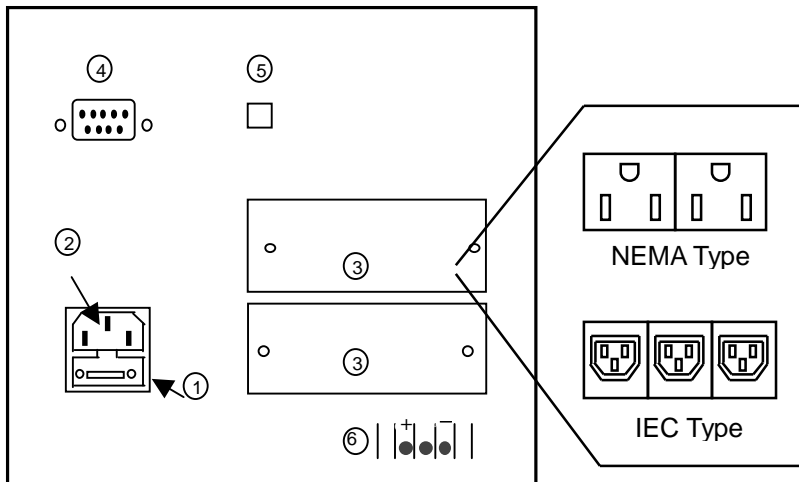
- 1) Main control button.
- 2) LCD screen.
- 3) Selection button for mode & value.

## Rear Panel A (Rack Mount)



- A. AC input circuit breaker.
- B. AC input connector.
- C. DC input connector.
- D. AC output connector.

## Rear Panel B (Tower)



- ① Fuse.
- ② Inlet of city power.
- ③ Outlet(s) (NEMA/IEC).
- ④ RS-232 Interface.
- ⑤ USB Interface; or DIP switch (for EV-4000 only)
- ⑥ Battery connector (screw type or Anderson's).

# 1. INTRODUCTION

## 1.1 Overview:

The inverter uses the microprocessor based design to provide tight regulation, Low THD, quick dynamic response and high accuracy output frequency. Through the LCD button you can adjust the inverter with different output voltages and frequencies in different areas.

## 1.2 Communication interface (optional)

RS-232 communication interface ports for sensing input voltage, output voltage, battery voltage, output power level and inverter status are provided; through the RS-232 interface, you can read the status of inverter through PC, or connect SNMP card to control the inverter through internet.

## FOR ALL MODELS

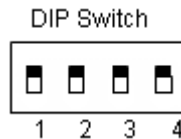
### 2. MAIN FEATURES :

- ◆ Wide DC input range
- ◆ Output short circuit protection
- ◆ DC input polarity protection
- ◆ Sine Wave output
- ◆ Designed for any kind of load
- ◆ Adjustable low battery shutdown level
- ◆ Automatic restart of load after overload shutdown
- ◆ Audible alarm
- ◆ Thermal control cooling fan
- ◆ Generator compatible(models with AC input)
- ◆ Smart Bypass function (models with AC input)
- ◆ Full function of LED display (LCD display optional)

### 3. INSTALLATION:

- 3.1 Inspecting the packing carton for damage that may have occurred while in transit. Immediately notify the carrier and place of purchase if any damage is found. Retain the package for future use.
- 3.2 Do not allow water or any foreign object to get inside the inverter. And do not put objects containing liquid on or near the unit.
- 3.3 Connecting the DC input power cord with the correct battery voltage and correct polarity, use only original DC cable for the connection. Any extension for the DC power cord must be checked and connected carefully. Either a slow-speed circuit breaker or slow-blow fuse (EX. in 48V DC I/P, use 130A for 4000VA, 100A for 3500VA, 70A for 2500VA, & 50A for 1700VA) is suggested to use at the end of the DC power cord if an extension cord is used.
- 3.4 Connecting your equipment to the inverter: To ensure that the output voltage distortion is within the limit of the specification, it is important to make sure that the maximum power needed by the equipment is not over the rated capacity of the inverter.
- 3.5 DIP Switch Setting

(for EV-4000 only)



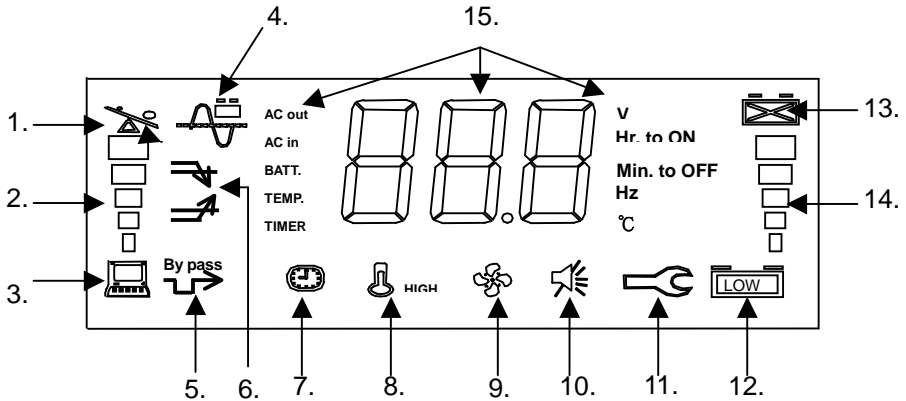
DIP 1	DIP 2	220V System	110V System
Down	Up	200V	100V
Up	Up	220V	110V
Up	Down	230V	115V
Down	Down	240V	120V
DIP 3 Up = 50Hz ; Down = 60Hz			
DIP 4 Not in use			

## 4. Operation









- 4.1 After installation with normal battery power, you may need to check if inverter is running correctly under the supplied battery power. One push at the control button to power on the inverter (for the model with DC switch, please turn on the DC switch). If inverter does not turn on, please check the battery voltage and polarity.
- 4.2 When DC input voltage is too low, the inverter will emit quick beeping alarm; at the same time, inverter will shutdown (or transfer to by-pass mode). The inverter will turn on the power automatically when DC input voltage is back to normal in two minutes or the inverter will shutdown the power completely (or keep in by-pass mode).
- 4.3 When DC input voltage is too high, the inverter will emit urgent beeping alarm, the inverter will shutdown (or transfer to by-pass mode), if the high voltage maintained for more than 3 seconds.
- 4.4 When overload happen, the inverter will emit continuous beeping alarm. If overload is serious, the inverter will shutdown (or transfer to by-pass mode) in two seconds. If overload is not serious, the inverter will shutdown after 1 minute.
- 4.5 If your inverter provides by-pass mode function (optional), please connect the AC I/P at the utility power, and turn on the AC switch after finishing the connection.
- 4.6 When your DC input power is not stable or for some purpose, you want to save the DC battery power, please set the inverter to by-pass mode. To enable running in by-pass mode, please push the control button for 3 seconds. Under by-pass mode, the inverter works like an UPS, it can transfer to inverter mode at blackout (for the models 1000VA~3500VA).
- 4.7 For the 4000VA model, the inverter will transfer to by-pass mode when the inverter is turned off. To push button for 3 seconds will turn off inverter, and to push it again will turn it on. While to turn off the DC switch will turn off the inverter completely, including the control circuit.
- 4.8 To replace battery, please enable by-pass mode before disconnecting DC I/P and disable by-pass mode when DC I/P is O.K. To disable running in by-pass mode, please push the control button for 3 seconds again. When the inverter is emitting alarm (only for low battery or over temperature), to push the control button for 1 second will enable silence mode.

# 5. INDICATION AND SETTING

## 5.1 LCD display operation



No.	Symbol	Indication	Description
1.		Over load	The loading exceeds the rating of inverter.
2.		Load level	The higher the loading, the more bars will illuminate.
3.		Inverter is loaded	This symbol will display if the loading is over 30W (approximately), and disappears when it is under 25W (approximately).
4.		Inverter mode, AC input is fail	The sine wave symbol and battery symbol will blink when the Inverter is loss of normal AC input.
		Inverter mode, AC input is normal	The sine wave symbol will display steadily when the inverter is connect with normal AC input.
5.		By pass mode	The sine wave symbol and by pass symbol will display when the inverter by pass the AC input to the output.
6.		Buck mode	Under by-pass mode, the AVR is reducing the output voltage from AC input.
		Boost mode	Under by-pass mode, the AVR is increasing the output voltage from AC input.
7.		Timer is enabled	This symbol will show up when a turn-on / turn-off schedule has been set using the monitoring software. Refer to the "Readme" file or "Help" function of the monitoring software.

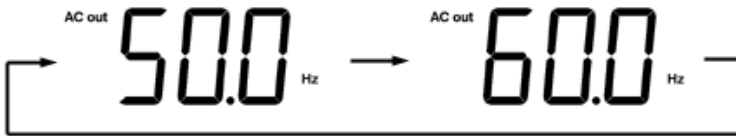
No.	Symbol	Indication	Description
8.	 <b>HIGH</b>	Thermal alarm	The temperature inside the inverter is over 60°C. If the user does not reduce the load, the temperature will continue to rise and the inverter will shut down automatically at 70°C.
9.		Fan is in "High speed"	The symbol will display whenever the cooling fan is running at high speed, and will disappear at low speed.
10.		Silence mode	The audible alarm has been silenced. To reset the alarm, push the control button.
11.		inverter fault	The inverter has failed and must be repaired. Contact a qualified service person.
12.		Battery normal	In normal operation, this symbol will show up.
		Battery low	When the DC input voltage level is low, the word "LOW" will be added to the symbol.
13.		Battery high	The DC input voltage is too high for the inverter.
14.		Battery voltage level	The higher the battery voltage, the more bars will illuminate.
15.	<b>Mode</b>	<b>Value</b>	<b>Description</b>
	AC out	V	AC output voltage.
	AC in	V	AC input voltage.
	AC out	Hz	AC output frequency.
	BATT.	V	DC battery voltage.
	TEMP.	°C	Inverter internal temperature.
	TIMER	Min. to off	The inverter will turn off and run by pass mode when the displayed value reaches zero. For example, if the timer shows 0.5 Min to off, the inverter will turn off in 30 seconds.
TIMER	Hr. to on	The inverter will turn on when the displayed value reaches zero. For example, if the timer shows 48.0 Hr to on, the inverter will turn on in 2 days.	
<p>Selection Button for mode &amp; value.</p> <p>All the operation data will be displayed on LCD screen. By selecting the required mode (upward or downward), the related value will be displayed.</p>			

## 5.2 Change the inverter settings:

5.2.1 To push the two selection buttons,  $\triangle$  and  $\nabla$ , at the same time for 3 seconds until the LCD display begins to blink.

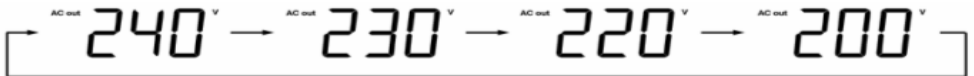
5.2.2 To change the O/P frequency at DC start

When the frequency value is blinking, push any selection button,  $\triangle$  or  $\nabla$ , for 1 second to change the frequency setting! The setting will keep changing every 2 seconds if you keep pushing the button. Push two selection buttons at the same time for next setting, or leave the LCD blinking without pushing any button for 30 seconds to end the setting.

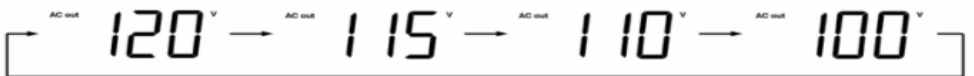


5.2.3 To change the rated voltage

When the voltage value is blinking, push any selection button for 1 second to change the rated voltage. Keep pushing the button until the required voltage blinking. Then, push two selection buttons at the same time to end the setting, or leave the LCD blinking for 30 seconds to end the setting.



220V Series



110V Series

### 5.3 LED display

#### 5.3.1 Battery level and load level LEDs

The battery level LEDs show the voltage level of DC input. When the LED indicates 20%, it means that the DC input voltage is in low level. While when all five LEDs are lighted in normal mode, it means that the DC input voltage is in high level.

The load level LEDs show the percentage of added load by the rated capacity. When all five LEDs are lighted, the Inverter is over loaded.

#### 5.3.2 Operation status LED

The status LED shows the UPS status. It shows Green when the AC I/P is normal; and shows Orange in the event of AC I/P fail; while if the inverter is under fault operation, it shows Red.

### 5.4 Audible alarm

During fault operation, the inverter emits beep for warning, the alarm can be silenced by pushing the control button. However, the warning of inverter fail or short circuit will still sound.

Fault condition	ALARM	LED STATUS
DC input is too low.	4 beeps every second.	Status LED show Orange, quick flashing
DC input is too high.	8 beeps every second.	Status LED show Red, urgent flashing
Over load	Continuous alarm	Status LED show Red.
Thermal alarm	32 beeps every 2 seconds followed by 2 seconds silence.	32 flashed every 2 seconds followed by 2 second off.
Inverter Fail or O/P start ci	32 beeps every 2 seconds followed by 2 seconds silence.	32 flashed every 2 seconds followed by 2 second off.

## 6. COMMUNICATION INTERFACE (Optional):

The inverter provides both computer interfaces, smart software (RS-232) and dry contact (DB-9); by using different software and cable, the inverter shows different monitoring function.

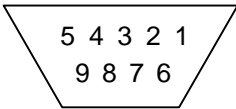
6.1 The definition and setup for RS-232 is as following:

Baud Rate : 2400 dps

Data Length : 8 bits

Stop Bit : 1 bit

Parity : None



Pin #6 : RS-232 data Tx out.

Pin #7 : Common of Pin #6 and Pin #9

Pin #9 : RS-232 data Rx In

6.2 The definition and setup for DB9 is as following:

Tower	Rack	Definition
Pin #2	Pin #8	Common GND
Pin #4	Pin #9	NO (Normal Open)
Pin #5	Pin #3	NC (Normal Closed)

The NO pin to Common pin will become closed at error signal, and NC pin will become open. The error signal indicates battery voltage too low/high, over load, over temperature, or failure of the inverter.

## 7. TROUBLE SHOOTING

Problem	Possible Cause	Action to Take
Inverter no reaction while AC is connected	<ol style="list-style-type: none"> <li>1. Line cord plug is loose.</li> <li>2. Fuse open.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the line cord plug.</li> <li>2. Push to reset the fuse.</li> <li>3. Check wall socket with a table lamp.</li> </ol>
Power output is normal, inverter emits continuous beep LCD display, shows "overload".	Inverter is over loaded.	Reduce the loading.
No power on outlets.	<ol style="list-style-type: none"> <li>1. Inverter disconnects the outlets.</li> <li>2. Relay damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn off power &amp; on again.</li> <li>2. Call for service.</li> </ol>
Power output is normal, LCD display shows thermal alarm	Temperature inside inverter is too high.	Check the inverter fan.
Button on front panel doesn't work	<ol style="list-style-type: none"> <li>1. The CPU inside inverter is not running correctly.</li> <li>2. Button damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn off power &amp; on again.</li> <li>2. Call for service.</li> </ol>
Inverter can not be turned on, and LCD display shows "Err".	Inverter fault.	Call for service.

## 8. SPECIFICATIONS:

### ☐ AC Output

	115V Models	230V Models
Power Levels crated at nominal inputs	1000VA/ 700W ; 1500VA/ 900W ; 1700VA/ 1200W ; 2500VA/ 1800W ; 3500VA/ 2400W ; 4000VA/ 3300W	
Output Voltage	100V/110V/115V/120V Selectable	200V/220V/230V/240V Selectable
Voltage Waveform	Sine wave	
Crest Factor	5 : 1	
Output Frequency	50/60Hz(selectable by using the remote set-up software)	
Regulation	±3% (output voltage adjustable by using the remote set-up software)	
Transfer time (Models with AC input)	2ms typical (Bypass to inverter mode) Zero (Inverter mode to bypass mode)	
Over current protection	Over load alarm level 100% ~ 120% Over load shutdown level 120% ~ 190% (Adjustable by using the remote set-up software)	

### ☐ AC Input (optional input)

	115V Models	230V Models
Nominal Voltage	100V/110V/115V/120V Selectable	200V/220V/230V/240V Selectable
Input Frequency	47Hz ~ 65Hz, 50/60Hz auto-sensing	
Efficiency (Normal mode)	97%	
Noise Filtering	Full time EMI/RFI filtering	
Over current protection	By re-settable over current protector	
Voltage Range	-30% ~ +33% for selected nominal voltage.	

AVR Range (2 Bucks/Boosts) 1000VA~3500VA	Enhanced Buck: +24% of selected nominal voltage Buck mode: +8% of selected nominal voltage Boost mode: -8% of selected nominal voltage Enhanced Boost: -20% of selected nominal voltage	
Surge Protection (Only available when AC Input included)	1000VA : 216 Joules 1500VA ~ 4000VA : 324 Joules	1000VA : 220 Joules 1500VA ~ 2500VA : 440 Joules 3500VA / 4000VA : 660 Joules

## DC Input

Voltage	12Vdc(10Vdc ~ 16Vdc) : 1000VA / 1500VA 24Vdc(20Vdc ~ 32Vdc) : 1000VA / 1700VA / 2500VA 48Vdc(40Vdc ~ 64Vdc) : 1000VA ~ 4000VA 72Vdc(60Vdc ~ 96Vdc) : 1700VA / 2500VA / 3500VA / 4000VA 96Vdc(80Vdc ~128Vdc) : 1700VA / 2500VA / 3500VA / 4000VA 108Vdc(90Vdc ~ 144Vdc) : 1700VA / 2500VA / 3500VA / 4000VA
Typical run time	Load <100%, No Limit 100%<Load<120%, 30 minutes typical 120%<Load<190%, 1 minute maximum 190%<Load, 0.25 second typical
Protection	Input polarity protection (by DC relay) DC fuse protection (60A or 120A, depends on DC voltage and VA rating) Over current protection (2KHz Switching, real time protection) Under voltage protection (adjustable by using the remote set-up software) Over voltage protection (CPU control)
Monitoring	Smart monitoring & warning for failed battery

## Communications & Management

Standard Interface port	UPSilon2000 compatible; optional for RS232 and/or USB
Control panel	LCD or LED Selectable (Rack units with LCD only)
Audible alarm	Alarm on battery : Low battery & Battery over voltage Alarm on abnormal operation : Over load, Short-circuit, & Over heat

Green mode function (for models with AC input)	1% to 14% of full load (adjustable by using the remote set-up software) The default setting is OFF.
Cooling fan control	Auto on / off, controlled by temperature & operation mode

## Environmental and Safety

Operating Temperature	Up to 1500 meters : 0°C to 40°C (32°F to 104°F)
Transit/storage Temperature	-15°C to 55°C (5°F to 131°F)
Relative Humidity	5 - 95% non condensing
Operating Altitude	0 ~ 3000 meters
Audible noise	≤ 50 dBA (at 1M from surface of unit)
Safety Markings	CE
EMC	Class B, EN50091-2, FCC part15, IEC1000-2-2
Isolation	3KVac for 1 minute between DC input and AC output
Quality control system	ISO 9001

## Physical

Dimensions:	Tower (EVT)	Rack (EVR)
Unit / Shipping DxHxW (cm)	1000VA ~ 2500VA : 45x20x18 cm / 54x33x30 cm 3500VA/ 4000VA : 51x20x18 / 61x33x30 cm	1000VA ~ 3500VA : 3ux45 cm / 59x33x59 cm 4000VA : 4ux45 cm / 59x38x59 cm
Weight: Net / Gross (kg)	1000VA : 16/17kg 1500VA : 18/19kg 1700VA : 19/20kg 2500VA : 23/24kg 3500VA : 30/32kg 4000VA : 39/41kg	1000VA : 20 / 24 (kg) 1500VA/1700VA : 26 / 30 (kg) 2500VA/3500VA : 34 / 38 (kg) 4000VA : 48 / 52 (kg)
Packing	Export carton for each unit, 16 - 30 units per pallet	