ULTIMATE POWER LLC
202 N.W. St.
Coudersport, PA 16915
TEL: 610 317 8513 FAX: 610 317 8514

Smart Power Series
Pure Sine Wave Inverter/Charger
User's Manual

For Model

UP/12600PEC

Table of Contents

1. Important Safety Information

⚠ **WARNING!** Before using the Inverter, you need to read and save the safety instructions.

1.1. General Safety Precautions

1-1-1.Do not expose the Inverter to rain, snow, spray, bilge or dust. To reduce risk of hazard, do not cover or obstruct the ventilation openings. Do not install the Inverter in a zero-clearance compartment. Overheating may result. Allow at least 30CM(11.81 inches) of clearance around the inverter for air flow. Make sure that the air can circulate freely around the unit. A minimum air flow of 145CFM is required.
1-1-2. To avoid a risk of fire and electronic shock. Make sure that existing wiring is in good electrical condition; and that wire size is not undersized. Do not operate the Inverter with damaged or substandard wiring.
1-1-3. This equipment contains components which can produce arcs or sparks. To prevent fire or explosion do not install in compartments containing batteries or flammable materials or in locations which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.
See Warranty for instructions on obtaining service.
1-1-4. Do not disassemble the Inverter/Charger. It contains no user serviceable parts. Attempting to service the Inverter/Charger yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
1-1-5. To reduce the risk of electrical shock, disconnect both AC and DC power from the Inverter/Charger before attempting any maintenance or cleaning. Turning off controls will not reduce this risk
CAUTION: Equipment damage
The output side of the inverter's AC wiring should at no time be connected to public power or a generator. This condition is far worse than a short circuit. If the unit survives this condition, it will shut down until corrections are made.
Installation should ensure that the inverter's AC output is, at no time, connected to its AC input.
Warning: Limitations On Use
SPECIFICALLY, PLEASE NOTE THAT THE SMART POWER SERIES INVERTER/CHARGER SHOULD NOT BE USED IN CONNECTION WITH LIFE SUPPORT SYSTEMS OR OTHER MEDICAL EQUIPMENT OR DEVICES.

1.2. Precautions When Working with Batteries

1-2-1. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 20 minutes and get medical attention immediately.
1-2-2. Never smoke or allow a spark or flame in vicinity of battery or engine.
1-2-3. Do not drop a metal tool on the battery. The resulting spark or short-circuit on the battery of other electrical part may cause an explosion.
1-2-4. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery produces a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.
1-2-5. To reduce the risk of injury, charge only rechargeable batteries such as deep-cycle lead acid, lead antimony, lead calcium gel cell, absorbed mat, NiCad/NiFe or Lithium battery. Other types of batteries may burst, causing personal injury and damage.

2. Introduction

2.1 General Information

Smart Power Series Pure Sine Wave Inverter is a combination of an inverter, battery charger and AC auto-transfer switch into one complete system with a peak conversion efficiency of 80%.
It features sophisticated multi-stage charging and pure sine wave output with unprecedentedly high surge capability to meet demanding power needs of inductive loads without endangering the equipment.

The Smart Power Series Inverter is equipped with a charger of up to 25Amp.

Thus, the Smart Power Series Pure Sine Wave Inverter is suitable for Renewable energy system,Utility, RV, Emergency appliances.

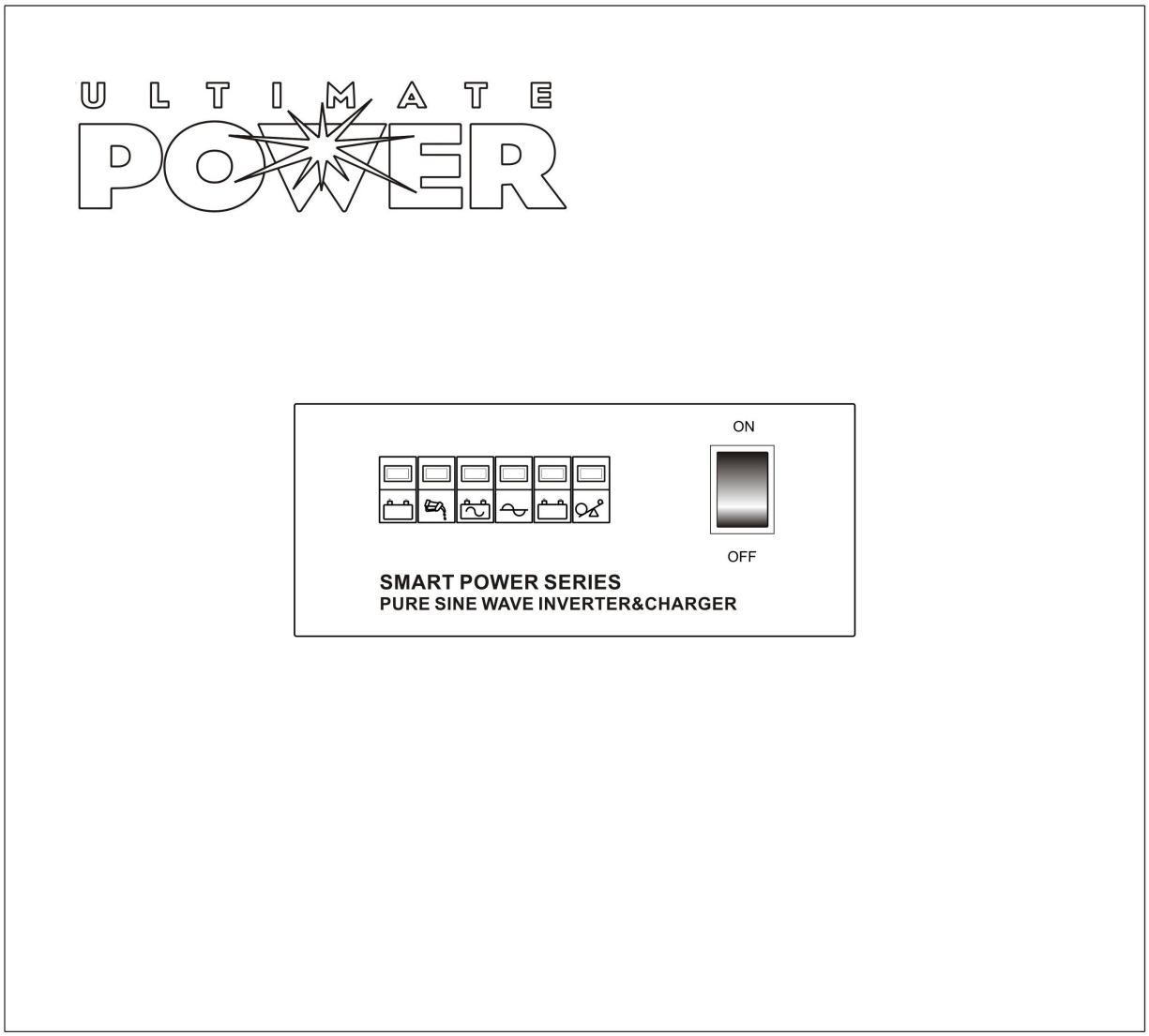
To get the most out of the power inverter, it must be installed, used and maintained properly. Please read the instructions in this manual before installing and operating.

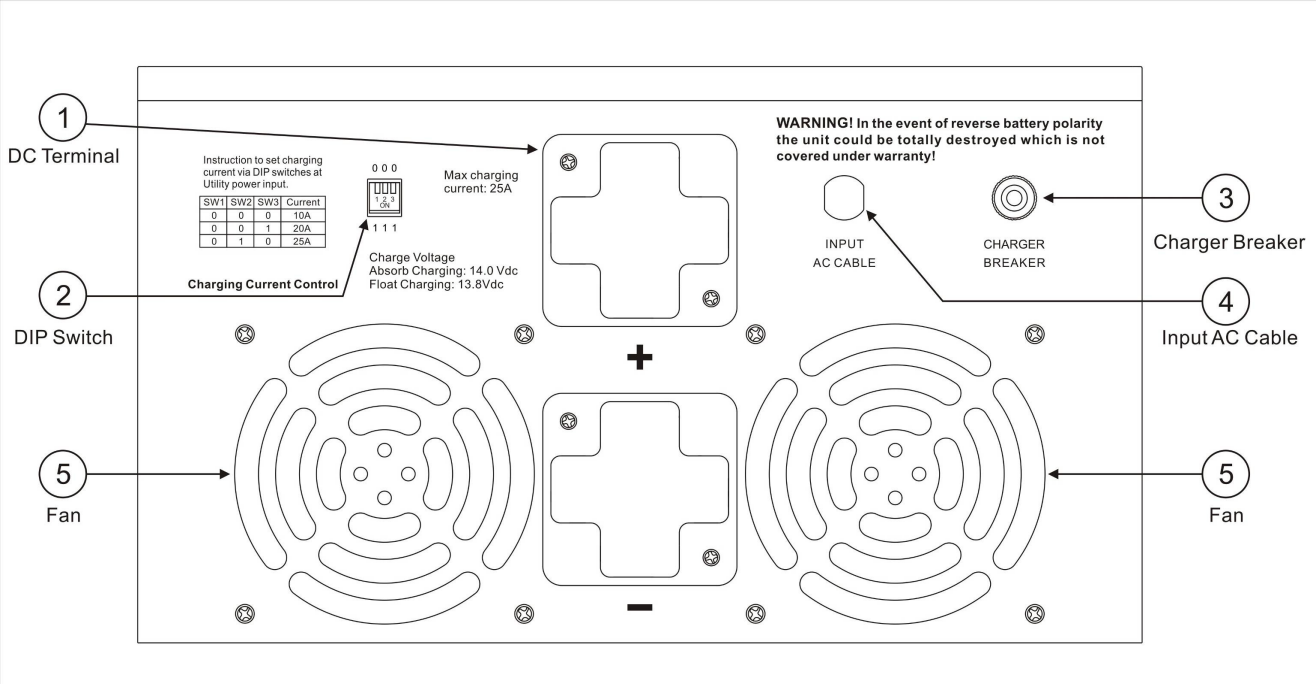
2.2 Application

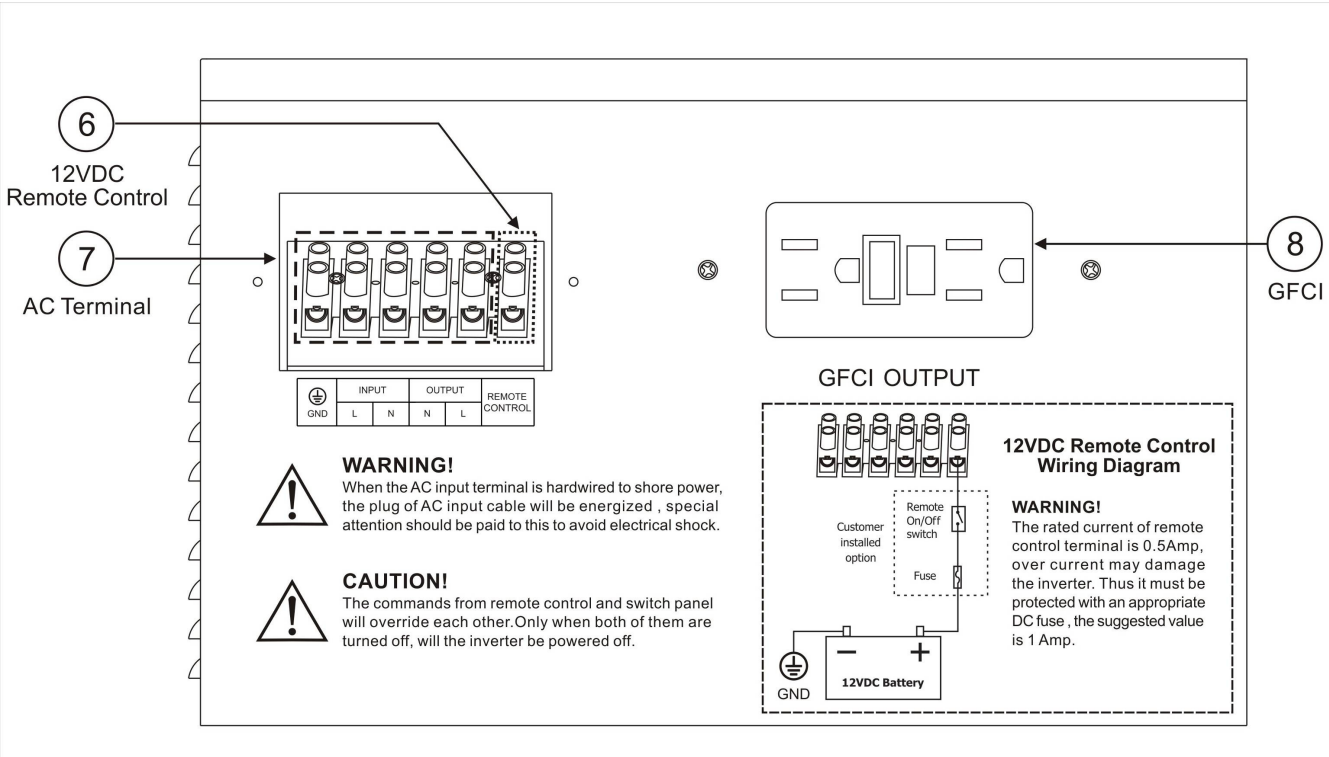
Power tools–circular saws, drills, grinders, sanders, buffers, weed and hedge trimmers, air compressors.
Office equipment – computers, printers, monitors, facsimile machines, scanners.
Household items – vacuum cleaners, fans, fluorescent and incandescent lights, shavers, sewing machines.
Kitchen appliances – coffee makers, blenders, ice markers, toasters.
Industrial equipment – metal halide lamp, high – pressure sodium lamp.
Home entertainment electronics – television, VCRs, video games, stereos, musical instruments, satellite equipment.

2.3 Mechanical Drawing

Smart Power 600W Model
Inverter Dimensions(L*W*H) 295*267*150 mm/11.61*10.51*5.9 Inches




1
DC Terminal
Instruction to set charging current via DIP switches at Utility power input.
SW1 SW2 SW3 Current
0 0 0 10A
0 0 1 20A
0 1 0 25A
0 0 0
1 1 1
Max charging current: 25A
Charge Voltage
Absorb Charging: 14.0 Vdc
Float Charging: 13.8Vdc
Charging Current Control
2
DIP Switch
WARNING! In the event of reverse battery polarity the unit could be totally destroyed which is not covered under warranty!
INPUT AC CABLE
CHARGER BREAKER
3
Charger Breaker
4
Input AC Cable
5
Fan
5
Fan


6
12VDC Remote Control
7
AC Terminal
GND
INPUT
L N
OUTPUT
N L
REMOTE CONTROL
WARNING!
When the AC input terminal is hardwired to shore power, the plug of AC input cable will be energized , special attention should be paid to this to avoid electrical shock.
CAUTION!
The commands from remote control and switch panel will override each other.Only when both of them are turned off, will the inverter be powered off.
8
GFCI
GFCI OUTPUT
12VDC Remote Control Wiring Diagram
Customer installed option
Remote On/Off switch
Fuse
WARNING!
The rated current of remote control terminal is 0.5Amp, over current may damage the inverter. Thus it must be protected with an appropriate DC fuse , the suggested value is 1 Amp.
GND
12VDC Battery

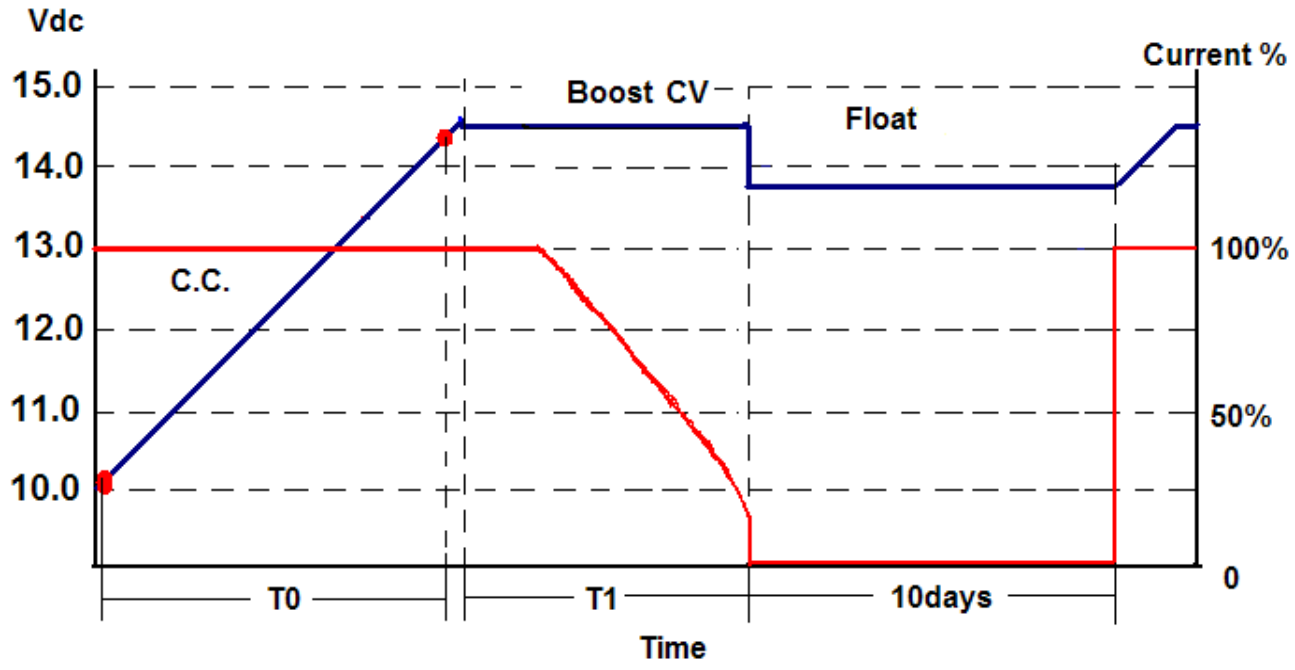
2-4. Features

High overload ability up to 300% rated power
Low quiescent current
Intelligent battery charging
Powerful charge rate up to 25Amp, selectable from 10A-25A
10 ms typical transfer time between battery and AC, guarantees power continuity
Smart 12Vdc remote control
Multiple controlled cooling fan

2.5 Electrical Performance

Smart Power Series is equipped with a multistage battery charger.
The Smart Power Series inverter has a very rapid charge current available, and the max charge current can be adjusted from 10A-25A via DIP switches on the left of the DC terminal. This will be helpful if you are using our powerful charger on a small capacity battery bank.

There are 3 main stages:
Bulk Charging: This is the initial stage of charging. While Bulk Charging, the charger supplies the battery with controlled constant current. The charger will remain in Bulk charge until the Absorption charge voltage (determined by the Battery Type selection) is achieved.
Software timer will measure the time from A/C start until the battery charger reaches 0.3V below the boost voltage, then take this time asT0 and T0×10 = T1.
Absorb Charging: This is the second charging stage and begins after the absorb voltage has been reached. Absorb Charging provides the batteries with a constant voltage and reduces the DC charging current in order to maintain the absorb voltage setting.
In this period, the inverter will start a T1 timer; the charger will keep the boost voltage in Boost CV mode until the T1 timer has run out. Then drop the voltage down to the float voltage. The timer has a minimum time of 1 hour and a maximum time of 12 hours.
Float Charging: The third charging stage occurs at the end of the Absorb Charging time. While Float charging, the charge voltage is reduced to the float charge voltage . In this stage, the batteries are kept fully charged and ready if needed by the inverter.
If the A/C is reconnected or the battery voltage drops below 12Vdc, the charger will reset the cycle above.



Charge Voltage

Absorb Charging: 14.0 Vdc	Float Charging: 13.8Vdc

*Charging voltages can be customized in factory.

While in the Standby Mode, the AC input is continually monitored. Whenever AC power falls below the AC Trip voltage , the inverter automatically transfers back to the Invert Mode with minimum interruption to your appliances - as long as the inverter is turned on. The transfer from Standby mode to Inverter mode occurs in approximately 10 milliseconds. And it is the same time from Inverter mode to Standby mode. Though it is not designed as a computer UPS system, this transfer time is usually fast enough to hold them up.

Note: The inverter is able to charge over discharged batteries. As long as the battery voltage remains above 8Vdc, the charger will start to work once qualified AC power inputs.

2.6 Charging Current Control

The max charging current of the inverter is settable via the DIP switches.
It is important to choose an appropriate charging current for battery banks with different capacities.
The following is the instruction table on charging current configuration.
The default factory set value is 25A (Utility mode).

SW1	SW2	SW3	Charging Current	AC mode
0	0	0	10A	Utility
0	0	1	20A	Utility
0	1	0	25A	Utility
1	0	0	10A	Generator
1	0	1	20A	Generator
1	1	0	25A	Generator

Note: When the input power is from a generator, it is suggested to configure the DIP switches according to "Generator mode" to guarantee best performance of AC charger.

2.7 Auto frequency adjust

The inverter is designed with Auto Frequency adjust function.
The factory default configuration for 220/230/240VAC inverter is 50Hz, and 60Hz for 100/110/120VAC inverter.
While the output freq can be easily changed once a qualified freq is applied to the inverter.
If you want to get 60Hz from a 50Hz inverter, just input 60Hz power, and the inverter will automatically adjust the output freq to 60Hz and vice versa.

2.8 Power Saver

There are 2 different working statuses for this inverter: “Power On” and “Power Off”.
When power switch is in “Unit Off” position, the inverter is powered off.
When power switch is turned to either “Power on” position or the remote control terminal is connected to a positive 12Vdc source, the inverter will be powered on.
Power saver function is to dedicated to conserve battery power when AC power is not or little required by the loads.
In this mode, the inverter pulses the AC output looking for an AC load (i.e., electrical appliance). Whenever an AC load (greater than 12 watts) is turned on, the inverter recognizes the need for power and automatically starts inverting and output goes from 0Vac to full voltage, 120Vac. When there is no load (or less than 12 watts) detected, the inverter automatically goes back into search mode to minimize energy consumption from the battery bank.

CAUTION

The commands from remote control and switch panel will override each other.
The inverter will remain in standby mode(reduce output voltage to 0Vac) if only one of them is turned off, the idle consumption is 60W.
Only when both of them are turned off, will the inverter be powered off.

2. 9 Protections

The Smart Power Series inverter is equipped with extensive protections against various harsh situations/faults.
These protections include:
AC Input over voltage protection/AC Input low voltage protection
Low battery alarm/High battery alarm
Over temperature protection/Over load protection
Short Circuit protection

2. 10 Remote Control

Apart from the switch on the front of the inverter, the remote control terminal on AC terminal will also enable users to start the inverter.
If the remote control terminal is connected to a positive 12Vdc source, together with the power switch, the two will be connected and operated in parallel.

Whichever first switches from “Off” to “Power on”, will it power the inverter on.
If the commands from the two conflict, the inverter will accept commands according to the following priority:
Power on> Power off
Only when both are turned to “Unit Off” position, the inverter will be powered off.

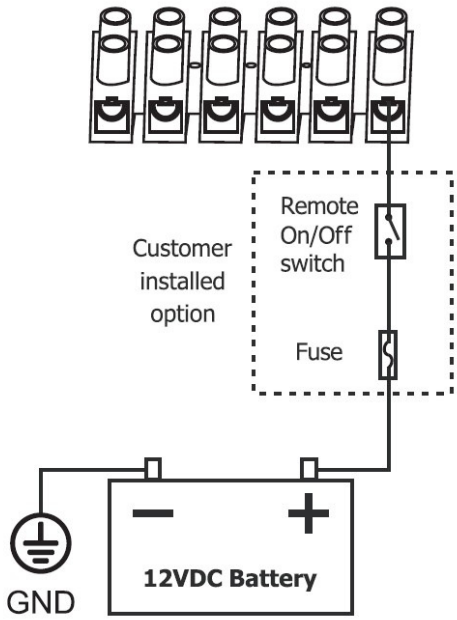
12Vdc Remote Control Wiring Diagram

WARNING

The rated current of remote control terminal is 0.5Amp, over current may damage the inverter. Thus it must be protected with an appropriate DC fuse , the suggested value is 1 Amp.

WARNING

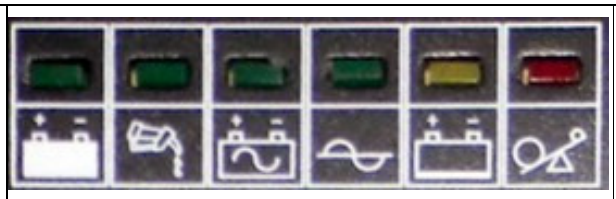
Connecting this wire to chassis ground will cause damage not covered under warranty!



The remote switch should be single pole, single throw with at least a 1 Amp rating. The wire used should be at least 18 gauge.

2. 11 LED Indicator& Audible Alarm

Picture below is the front panel of LED display of inverter, information of battery mode and AC mode will be shown on it.

								
Working Status	LED1	LED2	LED3	LED4	LED5	LED6	Alarm	Notes
AC Mode	off	off	off	on	off	off	Buzz once after switched on	
Bulk Charging (AC Mode)	off	Blink 0.5 sec	off	on	off	off	Off	
Absorb Charging (AC Mode)	off	on	off	on	off	off	Off	
Float Charging (AC Mode)	on	off	off	on	off	off	Off	
Generator Model	off	off	off	Blink 0.5sec	off	off	Off	
Bulk Charging (Generator Model)	off	Blink 0.5sec	off	Blink 0.5sec	off	off	Off	
Absorb Charging (Generator Model)	off	on	off	Blink 0.5sec	off	off	Off	
Float Charging (Generator Model)	on	off	off	Blink 0.5sec	off	off	Off	
Self-diagnosing condition	off	off	Blink 0.5sec	Blink 0.5sec	off	off	Off	Starting up
Battery Mode	off	off	on	off	off	off	buzz once after switched on	
Low DC voltage (Battery Mode)	off	off	on	off	on	off	Blink 0.5sec	
Over DC voltage (Battery Mode)	Blink 0.5sec	off	on	off	off	on	Blink 0.5sec	
Output short circuit (Battery Mode)	off	off	on	off	Off	Blink 0.5sec	Long time buzz	Cut off output at once
Over temperature (Battery Mode)	off	Off	on	off	Blink 0.5sec	off	Long time buzz	Cut off output 1 minute later
Overload 110%	off	off	on	off	off	on	Blink 0.5sec	Cut off output 15minutes later
Overload 120%	off	off	on on	off	off	on	Long time buzz	Cut off output 1 minute later
Overload 150%	off	off	on	off	off	on	Long time buzz	Cut off output at once

Over temperature (AC Mode)	off	Blink 0.5sec	off	on	Blink 0.5sec	off	Long time buzz	Stop charging
Over charging current	off	Blink 0.5sec	off	on	off	on	Long time buzz	Cut off output and charge at once
Inverter fault	off	off	off	off	off	on	Long time buzz	Cut off output at once

2.12 FAN Operation

There are two multiple controlled DC fans which start to work according to the following logics.

Condition	Enter Condition	Leave Condition	Speed
HEAT SINK TEMPERATURE	T ≤60 ℃	T > 60℃	OFF
	65 ℃≤T < 85 ℃	T <60 ℃ or T ≥ 85℃	50%
	T>85℃	T ≥ 80℃	100%
CHARGER CURRENT	I <25%	I≥25%	OFF
	25%<I < 50%	I <15% or I ≥50%	50%
	I > 50%	I ≤ 40%	100%
LOAD Percentage (INV MODE)	Load < 30%	Load ≥ 30%	OFF
	30%≤ Load < 50%	Load ≤20% or Load ≥ 50%	50%
	Load ≥ 50%	Load ≤ 40%	100%

Allow at least 30CM of clearance around the inverter for air flow. Make sure that the air can circulate freely around the unit.

Fan noise level <60db at a distance of 1m

3 Installation

3.1 Location

Follow all the local regulations to install the inverter.
Please install the equipment in a location of Dry, Clean, Cool with good ventilation.
Working temperature: －10℃ to 40℃(-14℉to 104℉)
Storage temperature: －40℃ to 70℃(-40℉to 158℉)
Relative Humidity: 0% to 95%，non-condensing
Cooling: Forced air

3.2 DC Wiring

It is suggested the battery bank be kept as close as possible to the inverter.
In case of DC cable longer than 1m, please increase the cross section of cable to compensate for a drop in voltage and DC ripple.

WARNING

The torque rating range for DC terminal is 18-24NM(13-18 pound-foot), and the suggested torque rating is 20NM(14.8 pound-foot).
Over torquing may cause break of bolt.

WARNING

In the event of reverse battery polarity the unit could be totally destroyed which is not covered under warranty!

WARNING

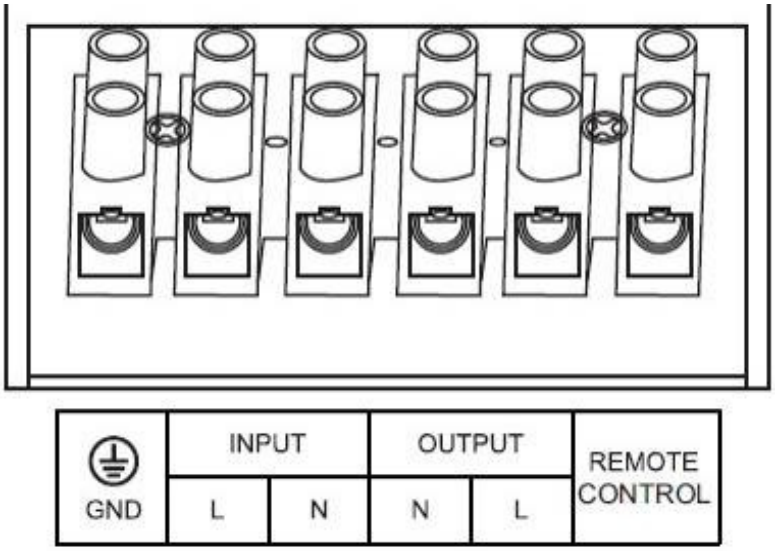
The inverter contains capacitors that may produce a spark when first connected to battery. Do not mount in a confined a battery or gas compartment.

3.3 AC Wiring

When in AC mode the AC input power will supply both the loads and AC charger, a thicker wire gauge for AC Input is required. Pls consult a qualified electrician about the specific wire gauge required in terms of wire material and inverter power.

NOTE: All wiring must follow the National Electric Code, Provincial or other codes in effect at the time of installation, regardless of suggestions in this manual. All wires should be copper conductors.

All the wiring are CE compliant, Call our tech support if you are not sure about how to wire any part of your inverter.

Wiring Instruction	

WARNING

The output voltage of this unit must never be connected in its input AC terminal, overload or damage may result.

Always switch on the inverter before plugging in any appliance.

WARNING

The AC input terminal and AC input cable are interconnected.

When the AC input terminal is hardwired to shore power, the plug of AC input cable will be energized , special attention should be paid to this to avoid electrical shock.

3.4 Grounding

Connect an AWG 8 gauge or greater copper wire between the grounding terminal on the inverter and the earth grounding system or the vehicle chassis.

4 Troubleshooting Guide

Troubleshooting contains information about how to troubleshoot possible error conditions while using the Smart Power Inverter & Charger.

The following chart is designed to help you quickly pinpoint the most common inverter failures.

Indicator and Buzzer

Symptom	Possible Cause	Recommended Solution
Inverter will not turn on during initial power up.	Batteries are not connected, loose battery-side connections. Low battery voltage.	Check the batteries and cable connections. Check DC fuse and breaker. Charge the battery.
No AC output voltage and no indicator lights ON.	Inverter has been manually transitioned to OFF mode.	Press the switch to Power on position.
AC output voltage is low and the inverter turns loads OFF in a short time.	Low battery.	Check the condition of the batteries and recharge if possible.
Charger is inoperative and unit will not accept AC.	AC voltage has dropped out-of-tolerance	Check the AC voltage for proper voltage and frequency.
Charger is supplying a lower charge rate.	Charger controls are improperly set. Low AC input voltage. Loose battery or AC input connections.	Refer to the section on adjusting the “Charging current”. Source qualified AC power.. Check all DC /AC connections.
Charger turns OFF while charging from a generator.	High AC input voltages from the generator.	Load the generator down with a heavy load. Turn the generator output voltage down.
Sensitive loads turn off temporarily when transferring between grid and inverting.	Inverter's Low voltage trip voltage may be too low to sustain certain loads.	Choose qualified AC input, or Install a UPS if possible.

5 Warranty

We offer 2 years limited warranty.
But the following cases are not covered under warranty.

1 DC polarity reverse.
The inverter is designed without DC polarity reverse protection. A polarity reverse may severely damage the inverter.
2 Wrong AC wiring
3 Operation in a condensing environment.

Appendix 1

Smart Power Series Inverter&Charger Spec Sheet		
Electrical Specifications		
	Model	UP/12600PEC
Inverter Output	Continuous Output Power	600W
	Surge Rating	1800W
	Output Waveform	Pure Sine wave/Same as input(Bypass mode)
	Nominal Efficiency	>80%(Peak)
	Power Factor	0.8-1.0
	Nominal Output Voltage rms	120Vac
	Output Voltage Regulation	±4% RMS
	Output Frequency	50/60Hz ± 0.3Hz
	Typical transfer Time	10±4ms
	AC Output Protection	GFCI
DC Input	Nominal Input Voltage	12.0Vdc
	Low Battery Trip	10.5Vdc
	High Voltage Alarm & Fault	16.0Vdc
	Idle Consumption	60W
Charge	Input AC Voltage Range	85-132Vac
	Max Charging current	25Amp
	Charge Voltage(Absorb Charging)	14Vdc
	Charge Voltage(Float Charging)	13.8Vdc
Remote Control	12Vdc Remote Control Function	Yes
Bypass & Protection	Input Voltage Waveform	Sine wave (Grid or Generator)
	Nominal Voltage	120Vac
	Nominal Input Frequency	50Hz or 60Hz (Auto detect)
	Output Short circuit protection	Circuit breaker
Mechanical Specification		
	Working temp	- 10℃ to 40℃(-14℉to 104℉)
	Working Humidity	5%-95%RH
	Cooling	Fan
	Mounting	Wall mount
	Inverter Dimensions(L*W*H)	295*267*150 mm/11.61*10.51*5.9 Inches
	Inverter Weight	13KG/28.66 lbs
	Display & Alarm	Status LEDs +Buzzer
	Standard Limited Warranty	2 Years

※Specifications in this manual are subject to change without prior notice.