AP Series
Pure Sine Wave Inverter/Charger
User's Manual

Version 1.0

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.
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 userserviceable 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 RV Series 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 APC 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 deep-cycle lead acid, lead antimony, lead calcium gel cell, absorbed mat, or NiCad/NiFe type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.

2. Introduction

2-1. General Information

APC 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 88%.
It is packed with unique features and it is one of the most advanced inverter/chargers in the market today. It features power factor corrected, 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.

For the regular model, when utility AC power cuts off(or falls out of acceptable range), the transfer relay is de-energized and the load is automatically transferred to the Inverter output. Once the qualified AC utility is restored, the relay is energized and the load is automatically reconnected to AC utility.
The APC Series Inverter is equipped with a powerful charger of up to 90Amp(depending on model).
The overload capacity is 300% of continuous output for up to 20 seconds to reliably support tools and equipment longer

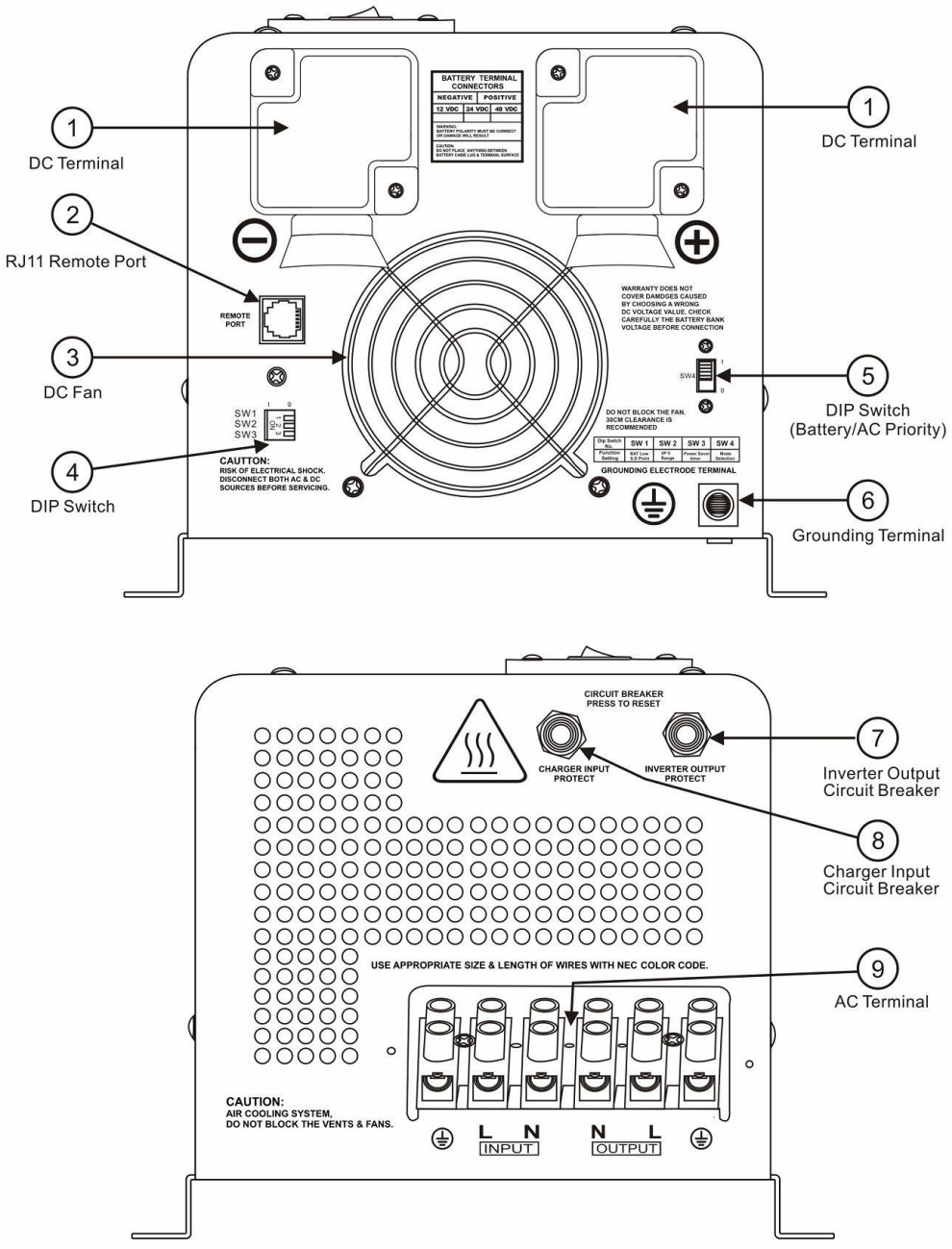
Another important feature is that the inverter can be easily customized to Battery priority via a DIP switch, this helps to extract maximum power from battery in renewable energy systems.
Thus, the APC Series Pure Sine Wave Inverter is suitable for Renewable energy system,Utility, RV, Marin and Emergency 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



APC 1-3KW APS 1-3KW Side View

2-4. Features

High overload ability up to 300% rated power(20 sec)

Low quiescent current, low power “ Power Saving Mode “ to conserve energy

3-step intelligent battery charging, PFC(Power Factor Correction) for charger

8 pre set battery type selector plus de-sulphation for totally flat batteries

Powerful charge rate up to 90Amp, selectable from 0%-100%

10 ms typical transfer time between battery and AC, guarantees power continuity

Smart remote control

15s delay before transfer when AC resumes, extra protection for loads when used with generator

Allows start up and through power with depleted batteries

30A/40A through current ability

Multiple controlled cooling fan

Extensive protections against various harsh situations

13VDC battery recover point, dedicated for renewable energy systems

2.5 Electrical Performance

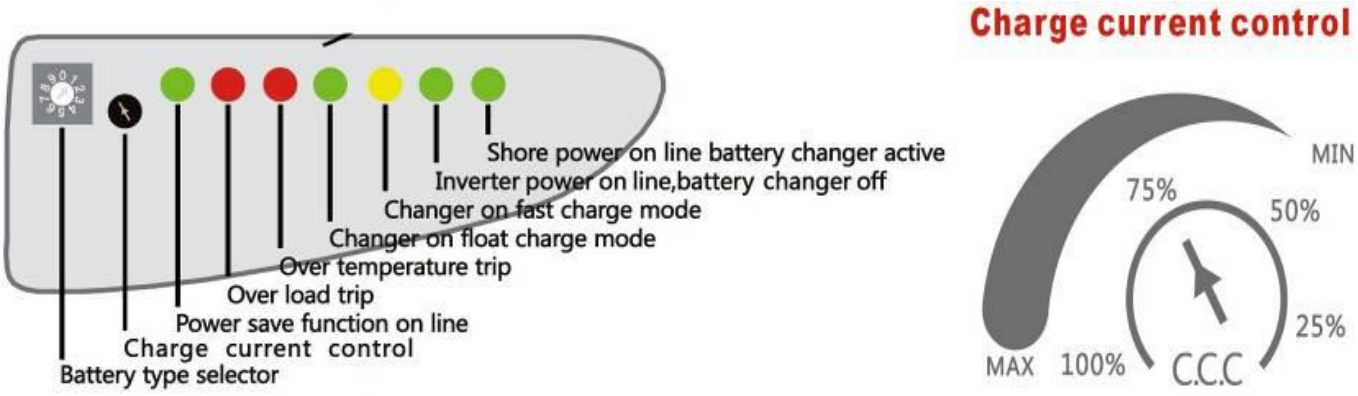
2.5.1 Invert

Topology
The APC inverter/charger is built according to the following topology.
Invert: Full Bridge Topology.
Charge: Isolate Boost Topology
The peak efficiency of APC series is 88%.

Overload Capacity
The APC series inverters have different overload capacities, making it ideal to handle demanding loads.
1 For 110%<Load<125%(±10%), no audible alarm in 14 minutes, beeps 0.5s every 1s in the 15th minute, and Fault(Turn off) after the 15th minute.
2 For 125%<Load<150%(±10%), beeps 0.5s every 1s and Fault(Turn off) after the 1 minute.
3 For 300%≧Load>150%(±10%), beeps 0.5s every 1s and Fault(Turn off) after 20s.

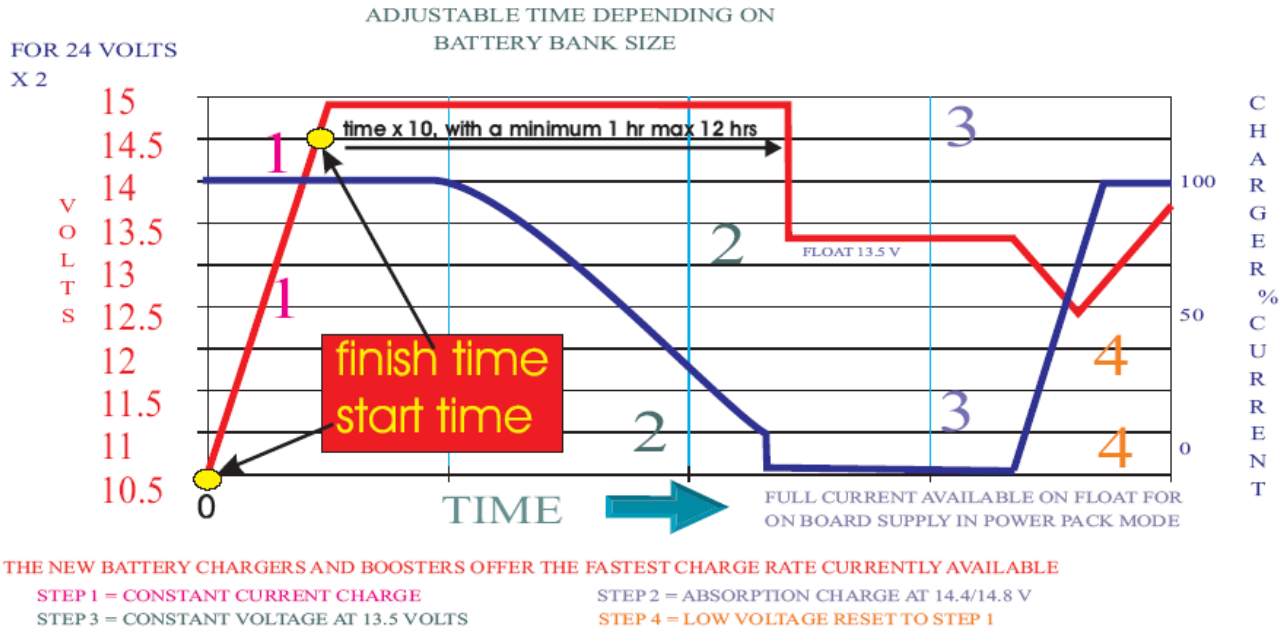
2.5.2 AC Charger

APC Series is equipped with an active multistage battery charger.
The APC series inverter is with a strong charging current of 90Amp(for 3KW,12V), and the max charge current can be adjusted from 0%-100% via a liner switch at the right of the battery type selector. The liner switch can effectively reduce the max charging current to 20% of its peak.
Choosing “0” in the battery type selector will disable charging function.



There are mainly 3 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 fl oat charge voltage (determined by the Battery Type

selection*). 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/24Vdc, the charger will reset the cycle above.
If the charge maintains the float state for 10 days, the charger will deliberately reset the cycle to protect the battery.



Battery type selector

Switch setting	Description	Boost / Vdc	Float / Vdc
0	Charger Off		
1	Gel USA	14.0	13.7
2	AGM 1	14.1	13.4
3	AGM 2	14.6	13.7
4	Sealed lead acid	14.4	13.6
5	Gel EURO	14.4	13.8
6	Open lead acid	14.8	13.3
7	Calcium	15.1	13.6
8	De sulphation	15.5 (4 Hours then Off)	
9	Not used		

12Vdc Mode (*2 for 24Vdc ; *4 for 48Vdc)

De-sulphation

The de-sulphation cycle on switch position 8 is marked in red because this is a very dangerous setting if you do not know what you are doing. Before ever attempting to use this cycle you must clearly understand what it does and when and how you would use it.
What causes sulphation? This can occur with infrequent use of the batteries, or if the batteries have been left discharged so low that they will not accept a charge. This cycle is a very high voltage charge cycle designed to try to break down the sulphated crust that is preventing the plates taking a charge and thus allow the plates to clean up and so accept charge once again.

Charging depleted batteries

The APC series inverter allows start up and through power with depleted batteries.

Charging current for each model

Model	Current
1012E	35+/-5A
1024E	20+/-5A
1512E	45+/-5A
1524E	25+/-5A
2012E	65+/-5A
2024E	30+/-5A
2048E	20+/-5A
3012E	85+/-5A
3024E	45+/-5A
3048E	30+/-5A
4024E	65+/-5A
4048E	35+/-5A
5024E	70+/-5A
5048E	40+/-5A
6024E	85+/-5A
6048E	55+/-5A

2.5.3 Solar Charger*

For APV series, there is a solar charger built in.

Table 1 Electrical Specifications **@ 25℃**

Rated Voltage	12V	24V
Rated Charge Current	40A	
Rated Output Current	15A	
Self Consumption	At idle < 10mA	
Bulk Charge	14.5V(default)	29.0V(default)
Floating Charge①	13.5V(default)	27.0V(default)
Equalization Charge①	14.0V(default)	28.0V(default)
Over Charge Disconnection	14.8V	29.6V
Over Charge Recovery	13.6V	27.2V
Over Discharge Disconnection①	10.8 V(default)	21.6V(default)
Over Discharge Reconnection	12.3V	24.6V
Temperature Compensation①	-13.2mV/℃	-26.4mV/℃
Ambient Temperature	0-40℃(full load) 40－60℃(derating)	
Terminal Size (fine/single wire)	#8AWG	

NOTE:

① The optional battery temperature sensor automatically adjusts the charging process of the controller according to the type of the battery is selected by user through battery type selector. With the battery temperature sensor installed, the controller will increase or decrease the battery charging voltage depending on the temperature of the battery to optimize the charge to the battery and maintain optional performance of

the battery.

Maximum Power Point Tracking (MPPT) Function

Maximum Power Point Tracking, frequently referred to as MPPT, is an electronic system that operates the Photovoltaic (PV) modules in a manner that allows the modules to produce all the power they are capable of.

The PV-seeker Charge controller is a microprocessor-based system designed to implement the MPPT.

And it can increase charge current up to 30% or more compared to traditional charge controllers (see figure 1).

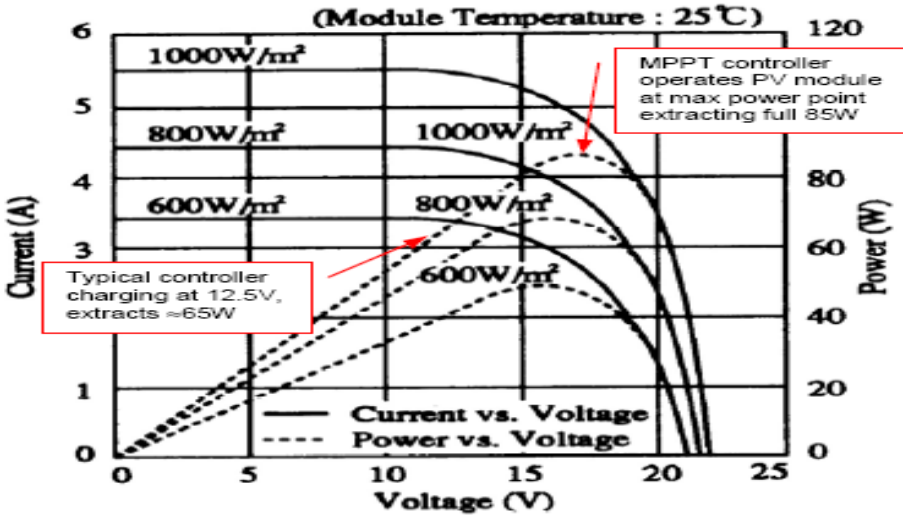


Figure 1 Current, Power vs. Voltage Characteristics

2.5.4 Power Saver

There are 2 different working status for APC inverter: “Power On” and “Power Off”.

When power switch is in “Unit Off” position, the inverter is powered off.

When power switch is in either of “Power Saver Auto” or “Power Saver Off”, the inverter is 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 25 watts) is turned on, the inverter recognizes the need for power and automatically starts inverting and output goes to full voltage. When there is no load (or less than 25 watts) detected, the inverter automatically goes back into search mode to minimize energy consumption from the battery bank.

In “Power saver on” mode, the inverter will draw power mainly in sensing moments, thus the idle consumption is significantly reduced.

The inverter is factory defaulted to detect load for 250ms in every 30 seconds. This cycle can be customized to 3 seconds thru the SW3 on DIP switch.

Note: The minimum power of load to take inverter out of sleep mode (Power Saver On) is 25 Watts.

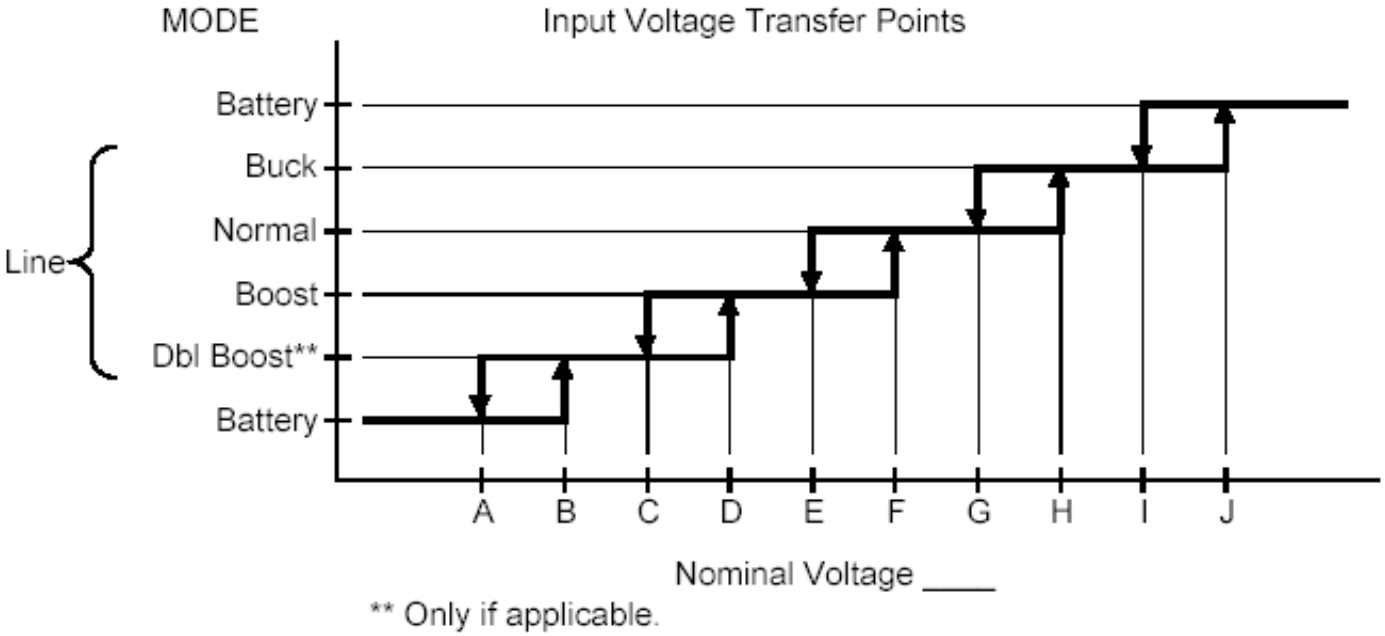
AnyPower Combi Series Idle Power Consumption			
Model	**Power Saver Off**	**Power Saver Auto**	
	Idle	**3Secs(Max)**	**30Secs(MAX)**
1000W	42W	16W	10W
1500W	48W	20W	10W
2000W	60W	25W	10W
3000W	72W	28W	12W
4000W	120W	45W	15W
5000W	135W	50W	18W
6000W	145W	55W	18W

2.5.5 Transfer

While in the Standby Mode, the AC input is continually monitored. Whenever AC power falls below the VAC Trip voltage (154 VAC, default setting), 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.
There is a 15-second delay from DC to AC.

2.5.6 Automatic Voltage Regulation*

The automatic voltage regulation function is only for APS Pure Sine Wave Inverter/ Charger which is a combination of APC inverter and Automatic Voltage Regulator.
Instead of simply bypassing the input AC to power the loads, the APS series inverter stabilizes the input AC voltage to a range of 230V/120V±10%.
Connected with batteries, the APS inverter will function as a UPS with max transfer time of 10 ms.
With all the unique features from the inverter and AVR, it brings you long-term trouble free operation beyond your expectation.
APS Series AVR Function Introduction



Any-Power Solution AVR Function	Any-Power Solution Series					
	LV (NA/JPN)			HV (INTL)		
Acceptable Input Voltage Range (Vac)	**0-160**			**0-300**		
Nominal Input Voltages (Vac)	**100**	**110**	**120**	**220**	**230**	**240**
(A) Line low loss N/W (On battery)	75/65	84/72	92/78	168/143	176/150	183/156
(B) Line Low comeback N/W (On Boost)	80/70	89/77	97/83	178/153	186/160	193/166
(C) Line 2nd boost threshold (On Boost)	**	**	**	**	**	**
(D) Line 2nd boost comeback (On normal)	**	**	**	**	**	**
(E) Line 1st boost threshold (On Boost)	90	99	108	198	207	216
(F) Line 1st boost comeback (On normal)	93	103	112	205	215	225
(G) Line buck comeback (On Normal)	106	118	128	235	246	256
(H) Line buck threshold (On Buck)	110	121	132	242	253	264
(I) Line high comeback (On Buck)	115	127	139	253	266	278
(J) Line high loss (On Battery)	120	132	144	263	276	288

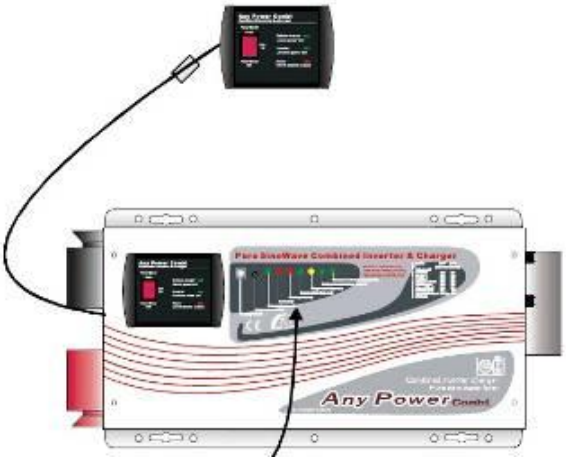
2.5.7 Protections

The APC 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 (1s after fault)
Back feeding protection

When Over temperature /Over load occur, after the fault is cleared, the master switch has to be reset to restart the inverter.

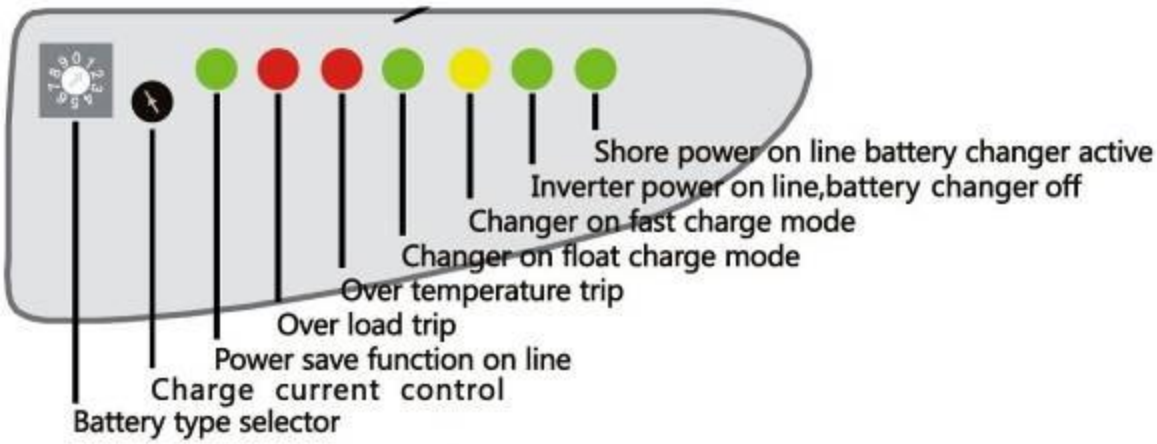
The Low batter voltage trip point can be customized from defaulted value 10VDC to 10.5VDC thru the SW1 on DIP switch.
The inverter will go to Over temp protection when heat sink temp. ≥105℃, and go to Fault (shutdown Output) after 30 seconds. The switch has to be reset to activate the inverter.
The APC series Inverter is with back feeding protection which avoids presenting an AC voltage on the AC input terminal in Invert mode.
After the reason for fault is cleared, the inverter has to be reset to start working.

2.5.8 Remote control



Apart from the switch panel on the front of the inverter, an extra switch panel connected to the RJ11 port at the DC side of the inverter thru a standard telephone cable can also control the operation of the inverter.
If an extra switch panel is connected to the inverter via "remote control port", together with the panel on the inverter case, the two panels will be connected and operated in parallel.
Whichever first switches from "Off" to "Power saver off" or "Power saver on", it will power the inverter on.
If the commands from the two panels conflict, the inverter will accept command according to the following priority:
Power saver on> Power saver off> Power off
Only when both panels are turned to "Unit Off" position, the inverter will be powered off.

2.5.9 LED Indicator & LCD



SHORE POWER ON	GREEN LED lighting on AC Mode
INVERTER ON	GREEN LED lighting on Inverter Mode
FAST CHARGE	Yellow LED lighting on Fast Charging Mode
FLOAT CHARGE	GREEN LED lighting on Float Charging Mode
OVER TEMP TRIP	RED LED lighting on Over Temperature
OVER LOAD TRIP	RED LED lighting on Over Load
POWER SAVER ON	GREEN LED lighting on Power Saver Mode (Power Saver Load ≦25W)

The Inverter can be customized into LCD type. The LCD will display the following content:

1 Greeting message of "Welcome to EYEN"  	2 AC Status & Input Voltage  "AC: abnormal" will be displayed when AC input is not qualified.
3 Output Voltage/Frequency and Battery voltage  	4 Output Current(in percentage) 

2.5.10 Audible Alarm

Battery Voltage Low	Inverter green LED Lighting, and the buzzer beep 0.5s every 5s.
Battery Voltage High	Inverter green LED Lighting, and the buzzer beep 0.5s every 1s, and Fault after 60s.
Invert Mode Over-Load	(1)110%<load<125%(±10%), No audible alarm in 14 minutes, Beeps 0.5s every 1s in 15th minute and Fault after 15 minutes; (2)125% <load<150%(±10%), Beeps 0.5s every 1s and Fault after 60s; (3)Load>150%(±10%), Beeps 0.5s every 1s and Fault after 20s;
Over Temperature	Heat sink temp. ≥105ºC, Over temp red LED Lighting, beeps 0.5s every 1s;

2.5.11 FAN Operation

For 1-3KW, there is one multiple controlled DC fan which starts to work according to the following logics.
For 4-6KW, there is one multiple controlled DC fan and one AC fan. The DC fan will work in the same way as the one on 1-3KW, while the AC fan will work once there is AC output from the inverter.
So when the inverter is in power saver mode, the AC fan will work from time to time in response to the pulse sent by the inverter in power saver mode.

The Operation of DC fan at the DC terminal side is controlled in the following logic:

Condition	Enter Condition	Leave condition	Speed

HEAT SINK TEMPERATURE	T < 85 ℃	T ≥ 85℃	50%
	T ≥ 85℃	T < 80℃	100%
CHARGER CURRENT	I ≤ 50%Max	I > 50%Max	50%
	I > 50%Max	I ≤ 40%Max	100%
LOAD Percentage (INV MODE)	Load < 50%	Load ≥ 50%	50%
	Load ≥ 50%	Load ≤ 40%	100%

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

2.5.12 DIP Switches

On the DC end of inverter, there are 4 DIP switches which enable users to customize the performance of the device.

Switch NO	Switch Function	Position: 0	Position: 1
SW1	Low Battery Trip Volt	10.0VDC	10.5VDC
SW2	AC Input Range	184-253VAC	154-253VAC
SW3	Load Sensing Cycle	30 seconds	3 seconds
SW4	Battery/AC Priority	Utility Priority	Battery Priority

Low Battery Trip Volt:
The Low Battery Trip Volt is set at 10.0VDC by default. It can be customized to 10.5VDC..

AC Input Range:
There are different acceptable AC input ranges for different kinds of loads.
It can be customized from 184-253VAC to 154-253VAC.

Load Sensing Cycle:
The inverter is factory defaulted to detect load for 250ms in every 30 seconds. This cycle can be customized to 3 seconds thru the SW3 on DIP switch.

AC/Battery Priority:
Our inverter is designed AC priority by default. This means, when AC input is present, the battery will be charged first, and the inverter will transfer the input AC to power the load.
The AC Priority and Battery Priority switch is available upon request. When you choose battery priority, the inverter will inverting from battery despite the AC input.

2.5.13 Other features

Battery voltage recover start
After low battery voltage shut off(10V for 12V model), the inverter is able to restore to work after the battery voltage recovers to 13V.

 **WARNING**

Never leave the loads unattended, some loads (like a Heater) may cause accident in such cases.

It is better to shut everything down after low voltage trip than to leave your load in the risk of fire. Nobody wants to return home, finding house surrounded by fire trucks, and naughty neighborhood kids toasting hot dogs against his house.

3 Installation

3.1 Location

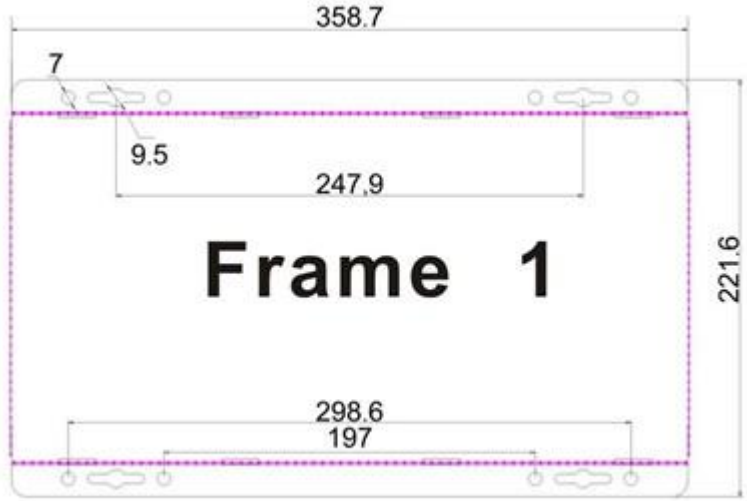
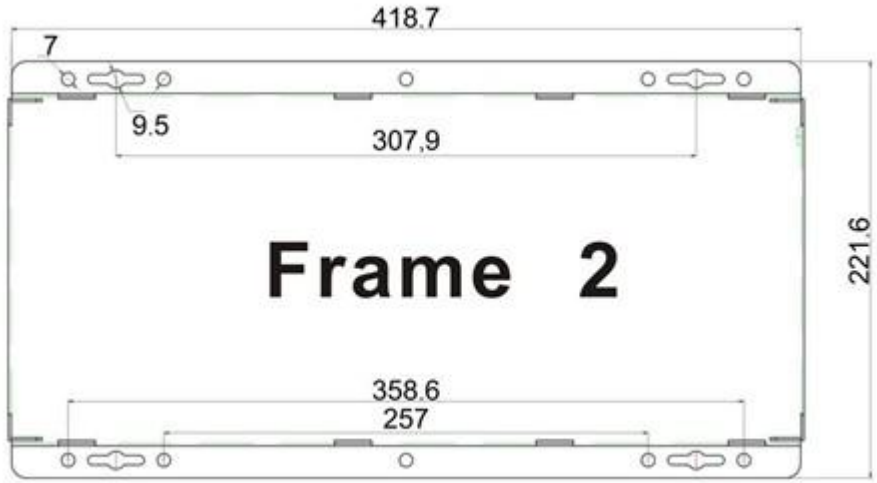
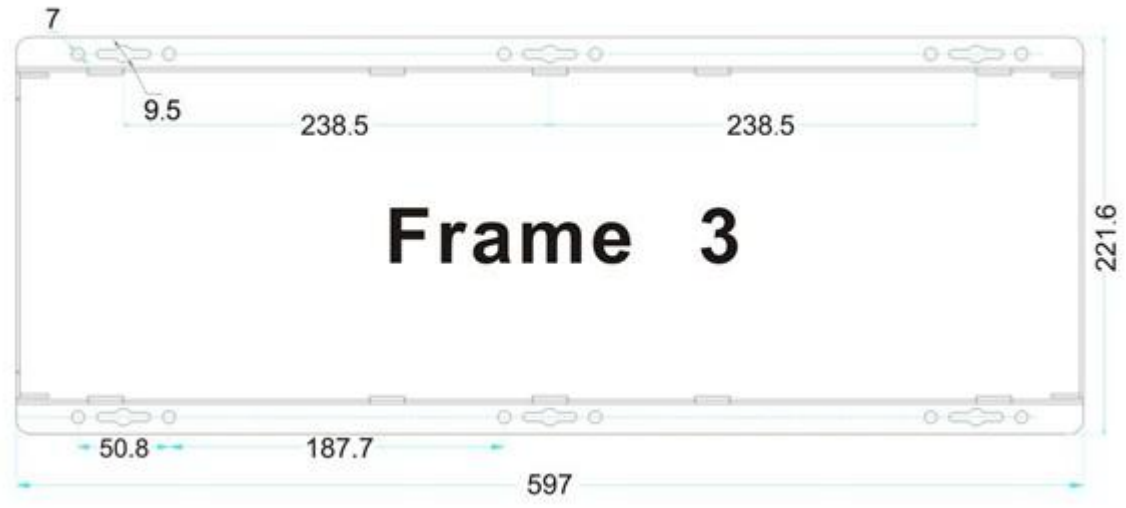
Follow all the local regulations to install the inverter.
Please install the equipment in a location of Dry, Clean, Cool with good ventilation.
Working temperature ： －10℃－40℃
Storage temperature ： －40－70℃
Relative Humidity ： 0%－95%，non-condensing
Cooling ： Forced air

3.2 Wiring recommendation

It is suggested the battery bank be kept as close as possible to the inverter. The following able is a suggested wiring option for 1 meter DC cable.
Please find the following minimum wire size. In case of DC cable longer than 1m, please increase the cross section of cable to reduce the loss.

Power	DC Input voltage	Wire Gage	Strings
1KW	12V	AWG 8	3
1KW	24V	AWG 8	2
1.5KW	12V	AWG 8	3
1.5KW	24V	AWG 8	2
2KW	12V	AWG 8	5
2KW	24V	AWG 8	3
2KW	48V	AWG 8	2
3KW	12V	AWG 8	7
3KW	24V	AWG 8	4
3KW	48V	AWG 8	2
4KW	24V	AWG 8	5
4KW	48V	AWG 8	2
5KW	24V	AWG 8	6
5KW	48V	AWG 8	3
6KW	24V	AWG 8	7
6KW	48V	AWG 8	4

3.3 Install Flange

	APC1-1.5KW APS1-1.5KW
	APC2-3KW APS2-3KW
	APC4-6KW APS4-6KW APS1-3KW

4 Troubleshooting Guide

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

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

Indicator and Buzzer

		Indicator on top cover							LED on Remote Swit			
Status	**Item**	SHORE POWER ON	INVERTER ON	FAST CHG	FLOAT CHG	OVER TEMP TRIP	OVER LOAD TRIP	POWER SAVER ON	BATT CHG	INVERTER	Alarm	Buzzer
Line Mode	CC	√	×	√	×	×	×	×	√	×	×	×
	CV	√	×	√, blink	×	×	×	×	√	×	×	×
	Float	√	×	×	√	×	×	×	√	×	×	×
	Standby	√	×	×	×	×	×	×	×	×	×	×
Inverter Mode	Inverter On	×	√	×	×	×	×	×	×	√	×	×
	Power Saver	×	×	×	×	×	×	√	×	×	×	×
Inverter Mode	Battery Low	×	√	×	×	×	×	×	×	√	√	Beep 0.5s every 5s
	Battery High	×	√	×	×	×	×	×	×	√	√	Beep 0.5s every 1s
	Overload On Invert Mode	×	√	×	×	×	√	×	×	√	√	Refer to “Audible alarm”
	Over-Temp On Invert Mode	×	√	×	×	√	×	×	×	√	√	Beep 0.5s every 1s
	Over-Temp On Line Mode	√	×	√	×	√	×	×	√	×	√	Beep 0.5s every 1s
	Over Charge	√	×	√	×	×	×	×	√	×	√	Beep 0.5s every 1s
Fault Mode	Fan Lock	×	×	×	×	×	×	×	×	×	×	Beep continuous
	Battery High	×	√	×	×	×	×	×	×	√	×	Beep continuous
	Inverter Mode Overload	×	×	×	×	×	√	×	×	×	×	Beep continuous
	Output Short	×	×	×	×	×	√	×	×	×	√	Beep continuous
	Over-Temp	×	×	×	×	√	×	×	×	×	×	Beep continuous
	Over	×	×	√	×	×	×	×	√	×	×	Beep

	Charge											continuous
	Back Feed Short	×	×	×	×	×	×	×	×	×	×	Beep continuous

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. 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 saver on or Power saver off 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 “Charger Rate”. 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 narrow AC voltage in the DIP switch, or Install a UPS if possible.
Noise from Transformer/case	Applying specific loads such as hair drier	Remove the loads

5 Warranty

We offer 1 year limited warranty.