



# ST Series

## ***Pure Sine Wave Power Inverter User's Manual***



**CE FC e13**

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# 1. Important Safety Instructions



## **WARNING !**

Before using the Inverter, 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.

### **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 or 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.

## **2. Functional Characteristics**

### **2-1. General Information**

ST-series completes with stand –alone power inverter with AC transfer switch and is suitable for RV, Marine and Emergency appliances. When utility AC power cutoff, the transfer relay is de-energized and the load is automatically transferred to the Inverter output. Once the AC utility is restored, the relay is energized and the load is automatically reconnected to AC utility.

This power inverter series is a member of the most advanced line of mobile AC power systems available.

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

### **2-2. Application**

- 2-2-1 Power tools—circular saws, drills, grinders, sanders, buffers, weed and hedge trimmers, air compressors.
- 2-2-2. Office equipment – computers, printers, monitors, facsimile machines, scanners.
- 2-2-3. Household items – vacuum cleaners, fans, fluorescent and incandescent lights, shavers, sewing machines.
- 2-2-4. Kitchen appliances – coffee makers, blenders, ice makers, toasters.
- 2-2-5 Industrial equipment – metal halide lamp, high – pressure sodium lamp.
- 2-2-6. Home entertainment electronics – television, VCRs, video games, stereos, musical instruments, satellite equipment.

### **2-3. Features**

- 2-3-1. Pure sine wave output (THD < 3%) to operate higher-end electronic Equipments.
- 2-3-2. Output frequency : 50 / 60Hz switch selectable
- 2-3-3. Built in 16A or 25A rating transfer switch.

- 2-3-4. Speed up transfer time and synchronized operation with the AC source at all times that allows the transfer to be interruption-free for sensitive equipment.
- 2-3-5. Built in advanced microprocessor to make friendly interface with user
- 2-3-6. Low power “ Power Saving Mode “ to conserve energy
- 2-3-7. Capable of driving highly reactive & capacitive loads at start moment.
- 2-3-8. Options of dual AC outlets or hardwire AC connection for the model.
- 2-3-9. Loading controlled cooling fan
- 2-3-10. Smart remote controller
- 2-3-11. 3 LED indicators with tri-color display for all operation status
- 2-3-12. High efficiency 88 ~ 93%.
- 2-3-13. Protection:
  - Input over voltage and Input low voltage protection
  - Low battery alarm
  - Over temperature protection
  - Over load protection
  - Short Circuit protection
  - Reverse polarity protection
  - AC circuit breaker (6Amp to 30Amp)

## 2-4. Electrical Performance

Specification	Model No.					
Item	ST1000-112	ST1000-124	ST1000-148	ST1000-212	ST1000-224	ST1000-248
Continuous Output Power	1000W					
Maximum Output Power (3Min.)	1150W					
Surge Rating	2000W					
Input Voltage	12V	24V	48V	12V	24V	48V
Output Voltage	100 / 110 / 120V $\pm$ 3%			220 / 230 / 240V $\pm$ 3%		
Frequency (Switch Selectable)	50 / 60Hz +/- 0.05%					
Output Waveform	Pure Sine Wave (THD < 3%)					
Efficiency (full load)	88%	91%	92%	90%	93%	94%
No Load Current Draw	1.43A	0.75A	0.38A	1.25A	0.65A	0.35A
Stand-By Current Draw	0.25A	0.15A	0.09A	0.25A	0.15A	0.09A
Input Voltage Regulation	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC
Input Level Indicator	Red / Orange / Green LED					
Load Level Indicator						
Failure Indicator	Red LED					
Protection	Overload, Short Circuit, Reverse Polarity (Fuse), Over Temperature Over/Under Input Voltage, AC Input Circuit Breaker					
Circuit Breaker	12 Amp			6 Amp		
Remote Control Unit	CR6 / CR7 / CR8 Optional					
Synchronous AC transfer	YES					
Transfer switch	16 Amp					
Transfer Time	4~8 msec.					
Safety	Meet UL458			Meet EN60950-1		
EMC	FCC Class A			EN55022: 1997 EN55024: 1997 EN61000-3-2: 1998 EN61000-3-3: 1995		e-Mark 022967
Operating Temperature Range	0 - 40					
Storage Temperature Range	-30 to 70					
Cooling	Loading controlled cooling fan					
Dimensions	373(L)*236(W)*115(H) mm / 14.7(L)*9.29(W)*4.53(H) Inch					
Weight	6.2 kgs. / 13.6 Lbs.					

Note: The specifications are subject to change without notice.

## 2-4. Electrical Performance

Specification	Model No.					
Item	ST1500-112	ST1500-124	ST1500-148	ST1500-212	ST1500-224	ST1500-248
Continuous Output Power	1500W					
Maximum Output Power (3Min.)	1725W					
Surge Rating	3000W					
Input Voltage	12V	24V	48V	12V	24V	48V
Output Voltage	100 / 110 / 120V $\pm$ 3%			220 / 230 / 240V $\pm$ 3%		
Frequency (Switch Selectable)	50 / 60Hz +/- 0.05%					
Output Waveform	Pure Sine Wave (THD < 3%)					
Efficiency (full load)	88%	91%	92%	90%	93%	94%
No Load Current Draw	1.45A	0.75A	0.40A	1.40A	0.70A	0.40A
Stand-By Current Draw	0.28A	0.15A	0.09A	0.28A	0.15A	0.09A
Input Voltage Regulation	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC
Input Level Indicator	Red / Orange / Green LED					
Load Level Indicator						
Failure Indicator	Red LED					
Protection	Overload, Short Circuit, Reverse Polarity (Fuse), Over Temperature Over/Under Input Voltage, AC Input Circuit Breaker					
Circuit Breaker	16 Amp			10 Amp		
Remote Control Unit	CR6 / CR7 / CR8 Optional					
Synchronous AC transfer	YES					
Transfer switch	25 Amp			16 Amp		
Transfer Time	4~8 msec.					
Safety	Meet UL458			Meet EN60950-1		
EMC	FCC Class A			EN55022: 1997 EN55024: 1997 EN61000-3-2: 1998 EN61000-3-3: 1995		Meet e-Mark
Operating Temperature Range	0 - 40					
Storage Temperature Range	-30 to 70					
Cooling	Loading controlled cooling fan					
Dimensions	403(L)*236(W)*115(H) mm / 15.9(L)*9.29(W)*4.53(H) Inch					
Weight	7.0 kgs. / 15.4 Lbs.					

Note: The specifications are subject to change without notice.

## 2-4. Electrical Performance

Specification	Model No.					
Item	ST2000-112	ST2000-124	ST2000-148	ST2000-212	ST2000-224	ST2000-248
Continuous Output Power	2000W					
Maximum Output Power (3Min.)	2300W					
Surge Rating	4000W					
Input Voltage	12V	24V	48V	12V	24V	48V
Output Voltage	100 / 110 / 120V $\pm$ 3%			220 / 230 / 240V $\pm$ 3%		
Frequency (Switch Selectable)	50 / 60Hz +/- 0.05%					
Output Waveform	Pure Sine Wave (THD < 3%)					
Efficiency (full load)	88%	91%	92%	90%	93%	94%
No Load Current Draw	2.6A	1.50A	0.70A	2.3A	1.1A	0.65A
Stand-By Current Draw	0.60A	0.30A	0.2A	0.60A	0.3A	0.15A
Input Voltage Regulation	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC
Input Level Indicator	Red / Orange / Green LED					
Load Level Indicator						
Failure Indicator	Red LED					
Protection	Overload, Short Circuit, Reverse Polarity (Fuse), Over Temperature Over/Under Input Voltage, AC Input Circuit Breaker					
Circuit Breaker	25 Amp			12 Amp		
Remote Control Unit	CR6 / CR7 / CR8 Optional					
Synchronous AC transfer	YES					
Transfer switch	25 Amp			16 Amp		
Transfer Time	4~8 msec.					
Safety Certification	Meet UL458			Meet EN60950-1		
EMC	FCC Class A			EN55022: 1997 EN55024: 1997 EN61000-3-2: 1998 EN61000-3-3: 1995		Meet e-Mark
Operating Temperature Range	0 - 40					
Storage Temperature Range	-30 to 70					
Cooling	Loading controlled cooling fan					
Dimensions	433(L)*332(W)*115(H) mm / 17(L)*13(W)*4.53(H) Inch					
Weight	11.2 kgs. / 24.6 Lbs.					

Note: The specifications are subject to change without notice.

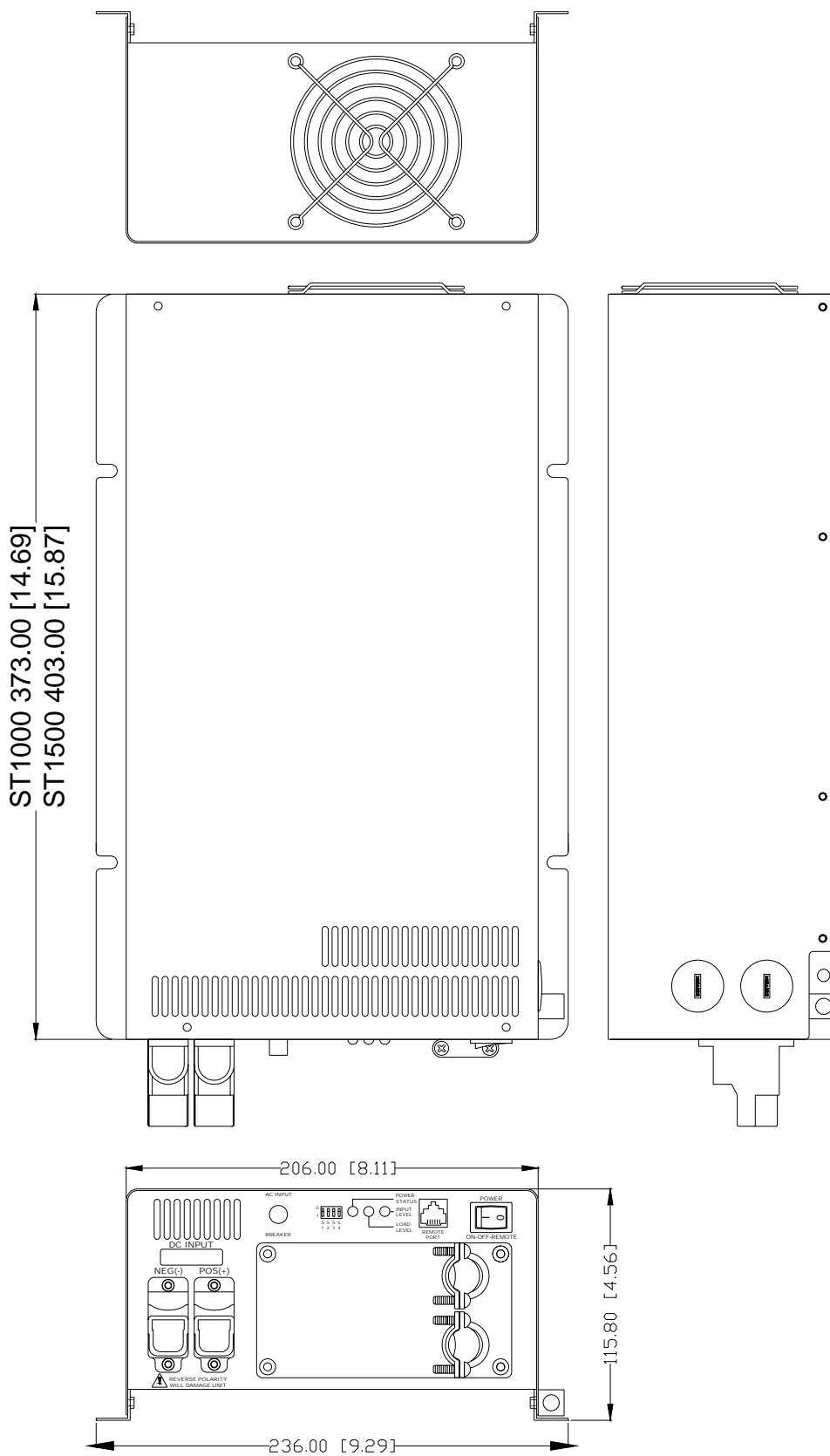


## 2-4. Electrical Performance

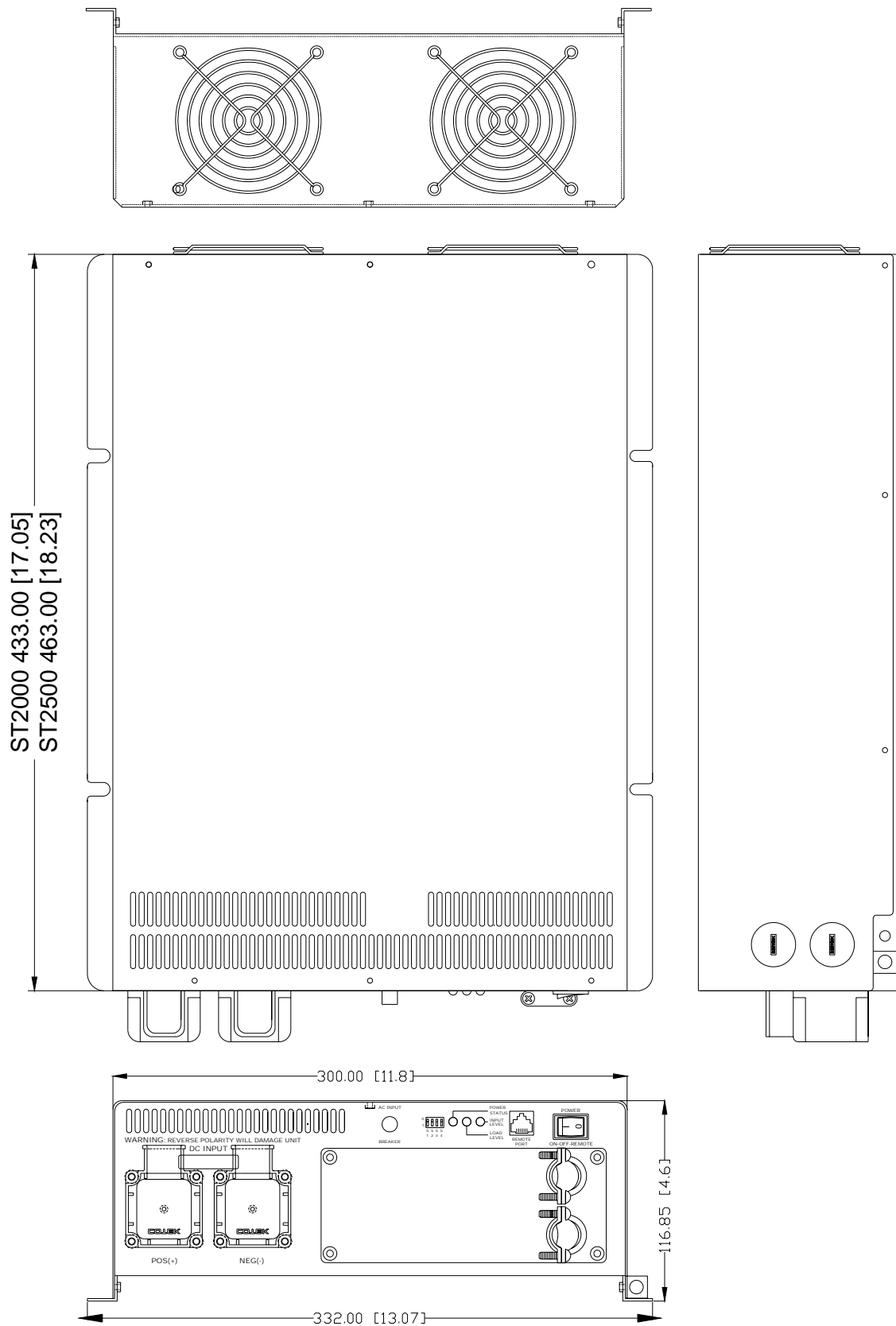
Specification	Model No.					
Item	ST2500-112	ST2500-124	ST2500-148	ST2500-212	ST2500-224	ST2500-248
Continuous Output Power	2500W					
Maximum Output Power (3Min.)	2875W					
Surge Rating	5000W					
Input Voltage	12V	24V	48V	12V	24V	48V
Output Voltage	100 / 110 / 120V $\pm$ 3%			220 / 230 / 240V $\pm$ 3%		
Frequency (Switch Selectable)	50 / 60Hz +/- 0.05%					
Output Waveform	Pure Sine Wave (THD < 3%)					
Efficiency (full load)	88%	91%	92%	90%	93%	94%
No Load Current Draw	2.35A	1.3A	0.7A	2.4A	1.5A	0.65A
Stand-By Current Draw	0.5A	0.35A	0.19A	0.6A	0.35A	0.19A
Input Voltage Regulation	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC	10.5-15 VDC	21.0-30 VDC	42.0-60 VDC
Input Level Indicator	Red / Orange / Green LED					
Load Level Indicator						
Failure Indicator	Red LED					
Protection	Overload, Short Circuit, Reverse Polarity (Fuse), Over Temperature Over/Under Input Voltage, AC Input Circuit Breaker					
Circuit Breaker	30 Amp			16 Amp		
Remote Control Unit	CR6 / CR7 / CR8 Optional					
Synchronous AC transfer	YES					
Transfer switch	25 Amp					
Transfer Time	4~8 msec.					
Safety Certification	Meet UL458			Meet EN60950-1		
EMC	FCC Class A			EN55022: 1997 EN55024: 1997 EN61000-3-2: 1998 EN61000-3-3: 1995		Meet e-Mark
Operating Temperature Range	0 - 40					
Storage Temperature Range	-30 to 70					
Cooling	Loading controlled cooling fan					
Dimensions	463(L)*332(W)*115(H) mm / 18.2(L)*13(W)*4.53(H) Inch					
Weight	12 kgs. / 26.4 Lbs.					

Note: The specifications are subject to change without notice.

## 2-5. Mechanical drawings



## 2-5. Mechanical drawings



## 3. Installation

### 3-1. Where to install

The power inverter should be installed in a location that meets the following requirements:

- 3-1-1. Dry – Do not allow water to drip or splash on the inverter.
- 3-1-2. Cool – Ambient air temperature should be between 0 and 40 , the cooler the better.
- 3-1-3. Safety – Do not install batteries in compartment or other areas where flammable fumes existence such as fuel storage areas or engine compartments.
- 3-1-4. Ventilated – Allow at least one inch of clearance around the inverter for air flow. Ensure the ventilation shafts on the rear and bottom of the unit are not obstructed.
- 3-1-5. Dust-free – Do not install the Inverter in a dusty environments where dust, wood particles or other filings/shavings are present. The dust can be pulled into the unit when the cooling fan is operation.
- 3-1-6. Close to batteries – Avoid excessive cable lengths but do not install the inverter in the same compartment as batteries. Use the recommended wire lengths and sizes (see section 4-3). Do not mount the inverter at the place where it is exposed to the gases produced by the battery. These gases are very corrosive and prolonged exposure will damage the inverter.



#### **WARNING!**

Shock Hazard. Before proceeding further, carefully check that the inverter is NOT connected to any batteries, and that all the wiring is disconnected from any electrical sources . Do not connect the output terminals of the inverter to an incoming AC source.

## 3-2 Hard-wire Installation

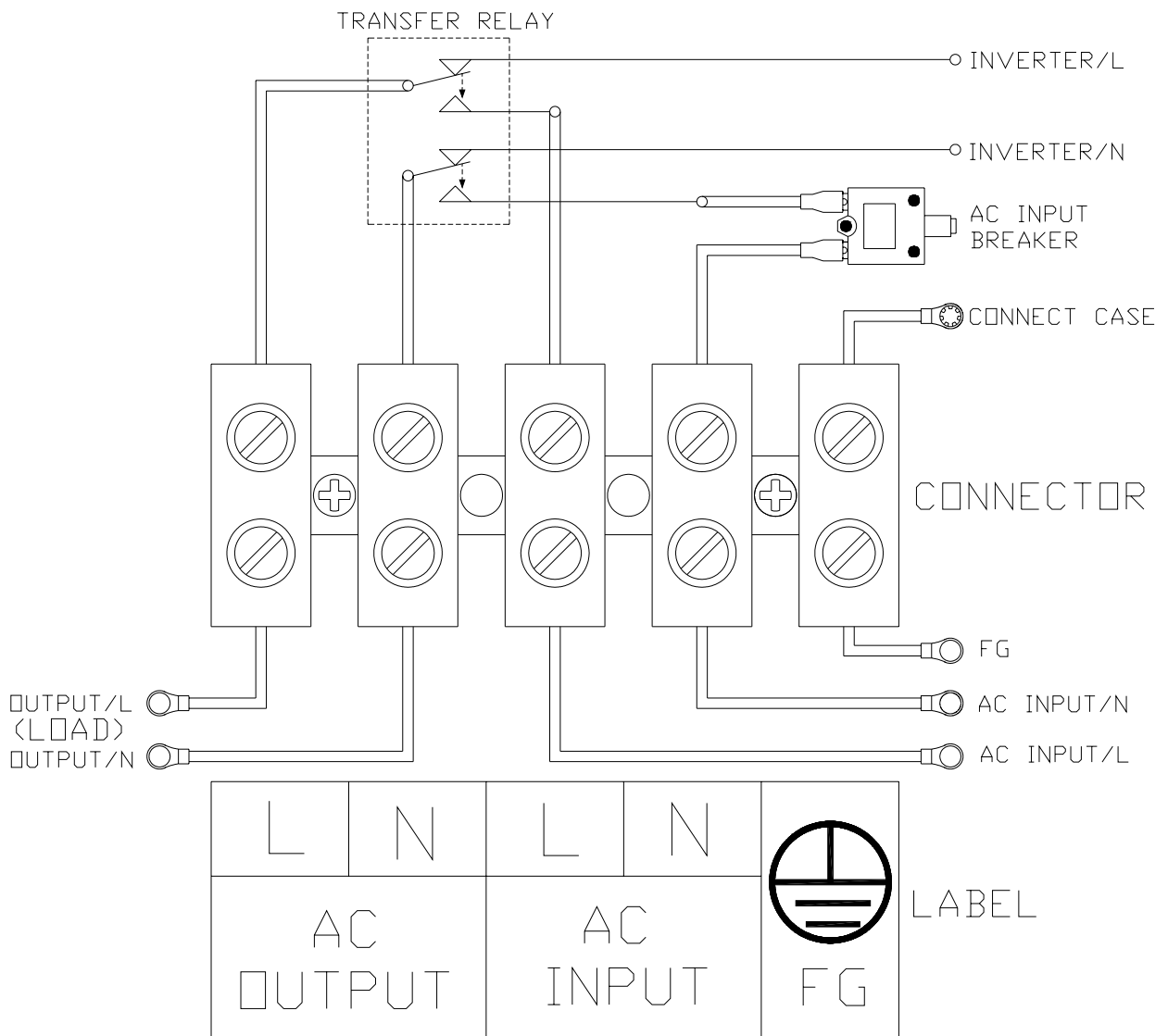
### AC wiring connections:

3-2-1. The AC wiring compartment is located on the front panel of the ST series. Remove the AC wiring compartment cover to gain access to the AC terminal.



#### WARNING!

Before you connect AC wiring to the terminals of compartment cover, ensure to check the label in the compartment for correct connections. Wrong connection will damage the inverter.

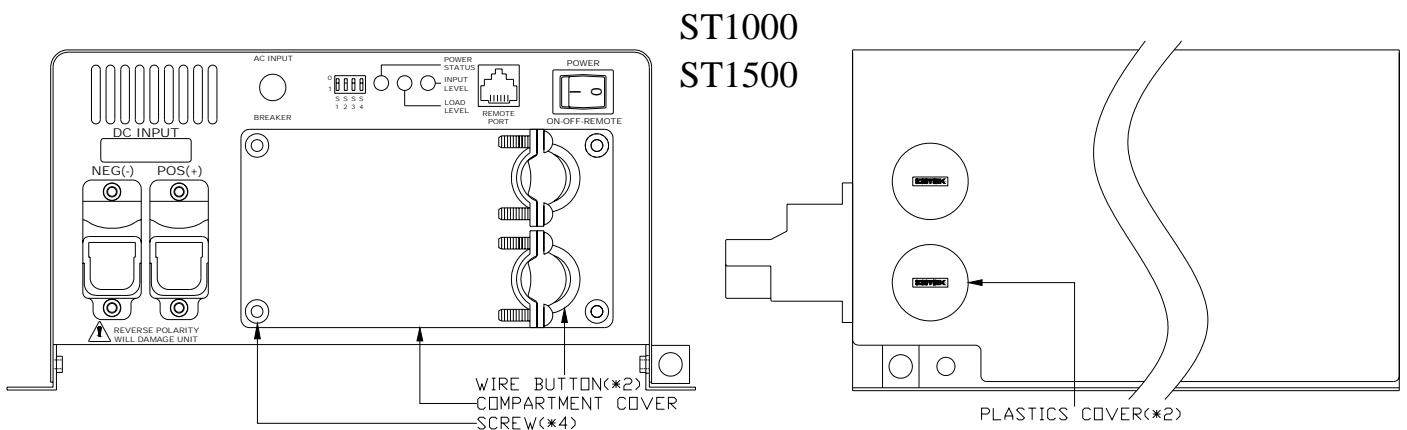


3-2-2. Connect AC output and AC input wiring to the ST series terminals. Please take the following information as your reference.

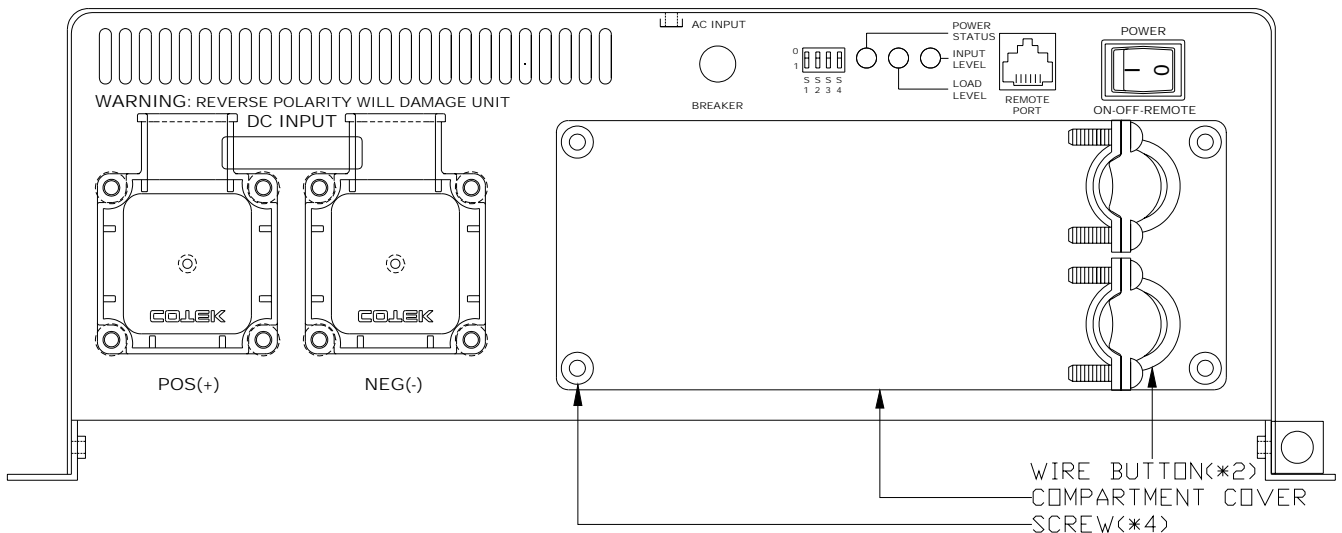
Terminal		Wire color	Wire length / gauge	
			ST1000&ST1500	ST2000&ST2500
AC OUTPUT	Line (L)	Black	Within 16 feet / AWG# 14~16 26~32 feet / AWG# 12~14	Within 16 feet / AWG# 10 ~12 26~32 feet / AWG# 8 ~10
	Neutral (N)	White		
AC INPUT	Line (L)	Brown		
	Neutral (N)	Blue		
Ground		Green / Yellow or Bare copper		

3-2-3. Please double check and review all connections to ensure the wires are in correct terminals and the connections are tight.

3-2-4. Before connecting AC output and AC input terminals of the ST series, you can either use front compartment cover or a side hole to coil out. Both AC input and AC output are coiled out from the front compartment cover when in production. If you want to change the position, you should open the top cover first, and then switch the wire of the front compartment cover and the plastic cover of the side of top cover.



ST2000  
ST2500



### 3-3 DC Wiring Connections

Follow the instructions to connect the battery cables to DC input terminals of the Inverter. The cable should be as short as possible (less than 6 feet / 1.8 meters ideally) so that it can handle the required current in accordance with the electrical codes or regulations application. Inappropriate length of cables will deteriorate the inverter performance such as poor surge capability, frequent low-input voltage warnings, and shutdown. UVP warning occurs when DC voltage drops across the cables from the inverter to the batteries. The longer or narrower the cables, the more the voltage drop. Increasing your DC cable size will help improve the situation. The following recommended cables are for the best performance of the inverter. (Apply both 120V and 230V versions)

Model No	Wire AWG	Inline Fuse
ST1000-112 / 212	# 2	150 A
ST1000-124 / 224	# 4	80 A
ST1000-148 / 248	# 6	40 A
ST1500-112 / 212	# 2	200 A
ST1500-124 / 224	# 4	100 A
ST1500-148 / 248	# 6	50 A
ST2000-112 / 212	# 2/0	250 A
ST2000-124 / 224	# 1/0	125 A
ST2000-148 / 248	# 2	70A
ST2500-112 / 212	# 4/0	400 A
ST2500-124 / 224	# 2/0	200 A
ST2500-148 / 248	# 1/0	100 A

3-3-1. Connect the cables to the power input terminals on the front panel of the inverter. The red terminal is positive (+) and black terminal is negative (-). Insert the cables into the terminals and tighten screw to clamp the wires securely.



**WARNING!**

Make sure all the DC connections are tight (torque to 9 – 10 ft-lbs, 11.7 – 13 Nm). Loose connections could result overheat in a potential hazard.

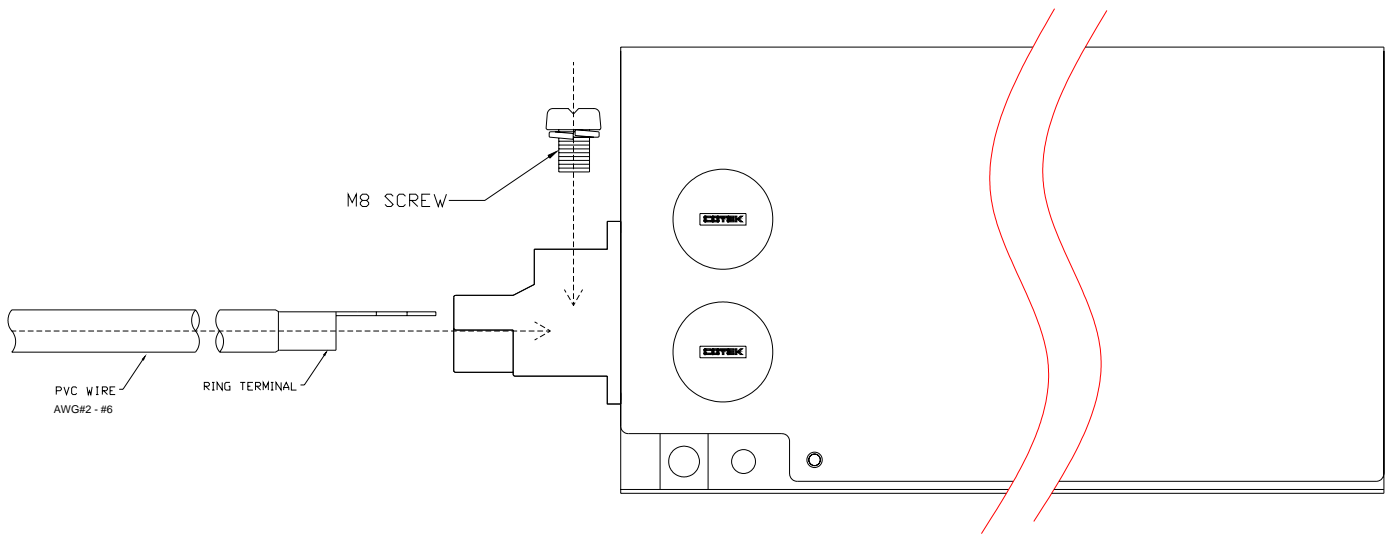


**WARNING!**

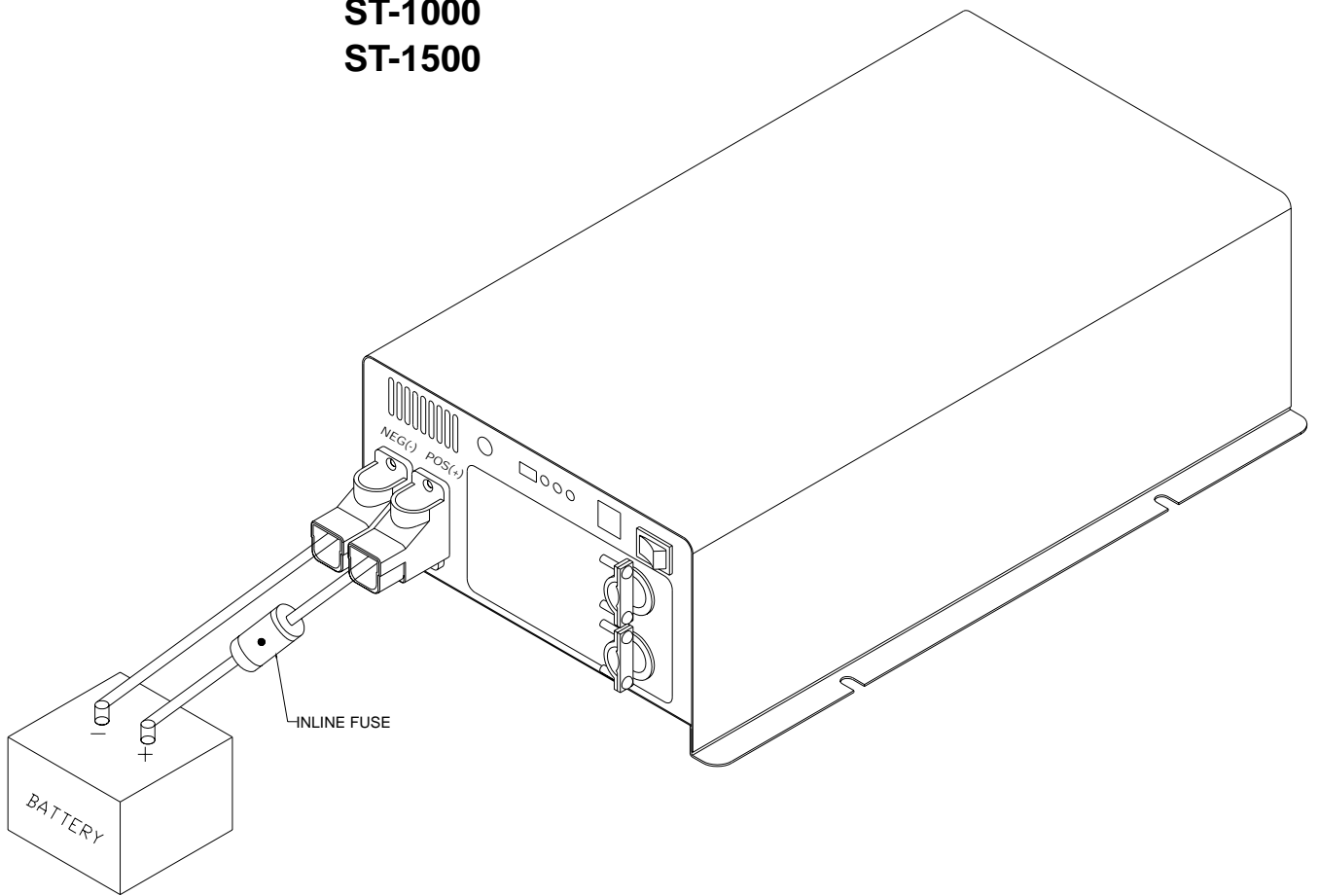
The installation of a fuse must be on positive cable. Failure to place a fuse on “+” cables running between the inverter and battery may cause damage to the inverter and will void warranty.

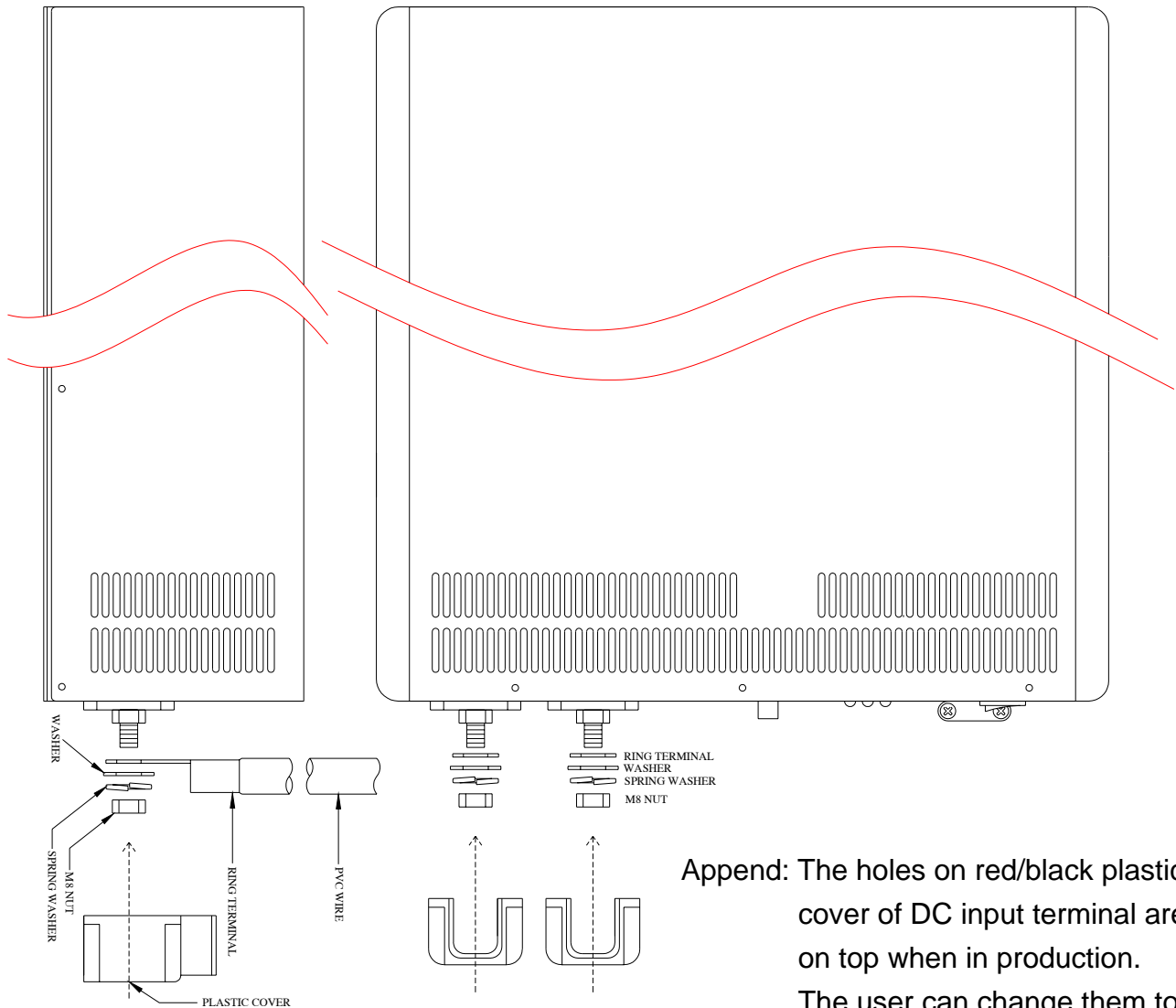
Also, only use high quality copper wire and keep the cable length short which is a maximum of 3 - 6 feet.





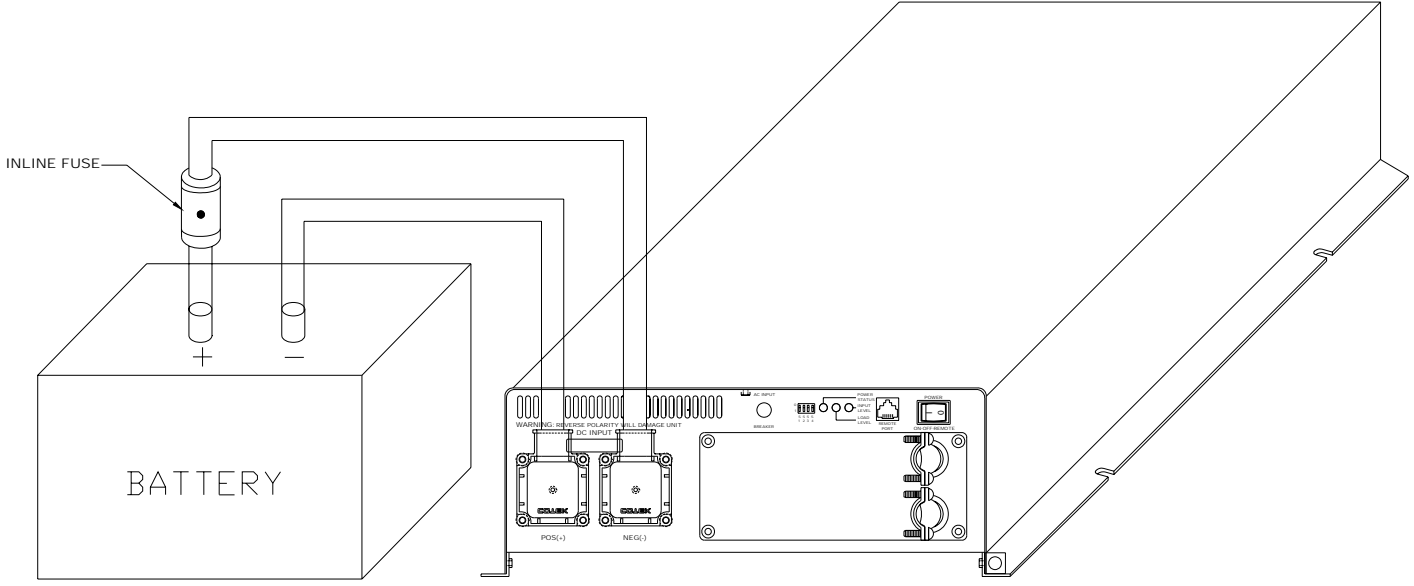
**ST-1000**  
**ST-1500**





Append: The holes on red/black plastic cover of DC input terminal are on top when in production. The user can change them to the bottom if necessary.

**ST2000  
ST2500**



## 4. Introduction:

### 4-1. Inverter Operation

Switch the power ON, then the power inverter is ready to supply AC power to the loads. Turn on the loads separately after the inverter is ON to prevent OVP status caused by the surge power.

4-1-1. Switch the power ON, then the buzzer will send out beep sound. At the moment, the inverter is doing self-diagnosis. Then the LED's indicators will also show various colors.

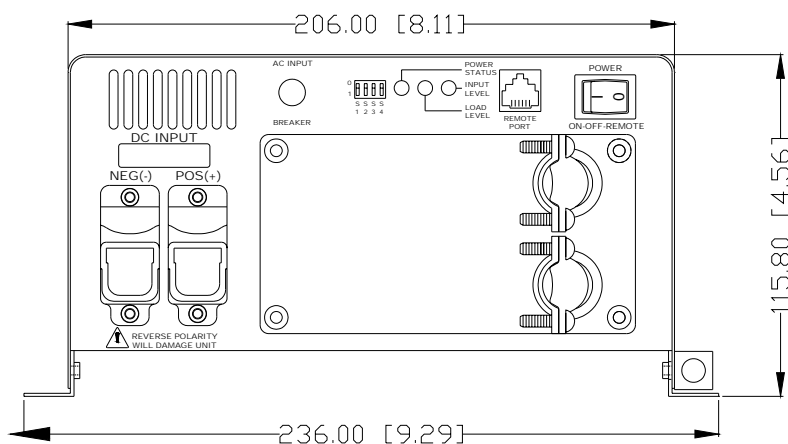
Finally, the buzzer will send out another beep, and the Input Level and Status LED indicators will turn green. Then the inverter will start to work.

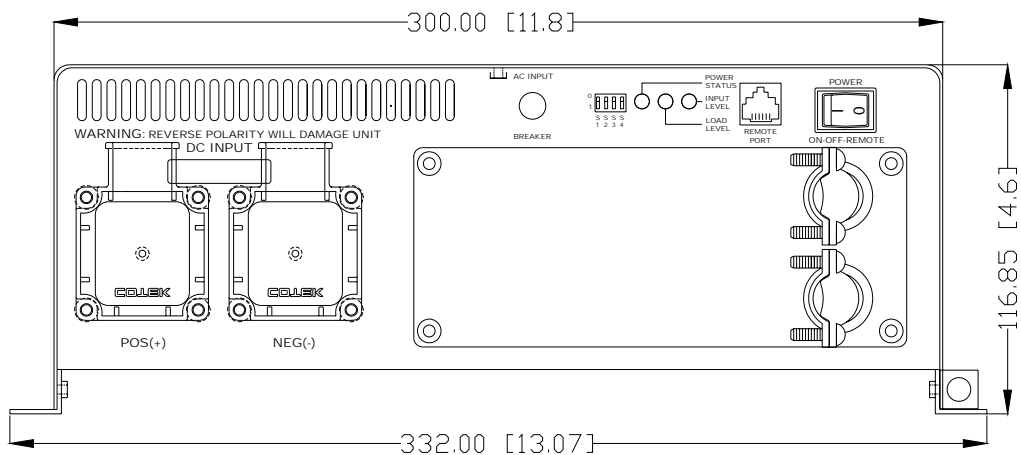
4-1-2. Switch the power OFF, then the inverter stops and all the lights that are On will go Off.

4-1-3. Switch the power inverter and the test load ON, then the inverter will supply the power to the load. If you want to measure true RMS voltage output of the inverter, a meter such as FLUKE 45 BECKMAN 4410 or TRIPLETT 4200 must be used.

### 4-2. Front Panel Operation

4-2-1. Front view :





**4-2-2. Power ON / OFF / REMOTE (Main) switch:**

- a. Before installing the inverter, you need to ensure the main switch is in the OFF position.
- b. Before using the remote unit, you need to ensure the main switch is in the REMOTE position.

**4-2-3. AC input Circuit Breaker:**

The AC input circuit breaker protects the model from overload. When an overload condition exists, the circuit breaker stops to supply output AC grid power. To reset it, push the circuit breaker switch then the model will be back in normal operation. The source fault should be corrected before you reset it.

**4-2-4. Remote Port:**

The ST Series Inverter is compatible with any of these remote controllers: CR-6, CR-7 or CR-8.


**4-2-5. DC Input Terminals:**

Connect DC input terminals to 12V / 24V / 48V battery or other power sources.

[ + ] represents positive, [ - ] represents negative. Reverse polarity connection can blow the internal fuse and may damage the inverter permanently.

Model	DC Input Voltage	
	Minimum	Maximum
12V	10.5V	15.0V
24V	21.0V	30.0V
48V	42.0V	60.0V

4-2-6. Chassis Ground: Connect the wire # 8 AWG to vehicle chassis.

	<p><b>WARNING!</b></p> <p>Operating the inverter without a proper ground connection may cause electrical safety hazard.</p>
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4-2-7. DC Input Level : Display Input Voltages

LED Status	DC 12V	DC 24V	DC 48V
RED Blink (slow)	10.5~10.9	21.0~21.8	42.0~43.6
RED	10.9~11.3	21.8~22.6	43.6~45.2
ORANGE	11.3~12.0	22.6~24.0	45.2~48.0
GREEN	12.0~14.0	24.0~28.0	48.0~56.0
ORANGE Blink	14.0~14.7	28.0~29.4	56.0~58.8
OVER RED BLINK	14.7↑	29.4↑	58.8↑

4-2-8. AC Input Level : Display Input Status

LED Status	AC Input
GREEN	OFF
ORANGE	ON

4-2-9. Load Level : Display AC Loads (Watts)

LED Status	DARK	GREEN	ORANGE	RED	BLINKING RED
ST1000	0 ~ 50W	50 ~ 330W	330 ~ 750W	750 ~ 960W	Over 960W
ST1500	0 ~ 75W	75 ~ 495W	495 ~ 1125W	1125 ~ 1450W	Over 1450W
ST2000	0 ~ 100W	100 ~ 660W	660 ~ 1500W	1500 ~ 1920W	Over 1920W
ST2500	0 ~ 125W	125 ~ 825W	825 ~ 1875W	1875 ~ 2390W	Over 2390W

#### 4-2-10. AC Frequency : Selected by “S4” Dip Switch

Frequency	S4
50 HZ	OFF
60 HZ	ON

#### 4-2-11. Status : Display Power & Fault Status

Green LED	LED Signal	Status
Solid	—————	Power OK
Slow Blink	- - - -	Power Saving
Red LED	LED Signal	Status
Fast Blink	- - - - - .	OVP
Slow Blink	- - - -	UVP
Intermittent Blink	.. ..	OTP
Solid	—————	OLP

4-2-12. Power Saving Mode: Power Saving Mode is adjustable and set by the Dip Switches, S1, S2 and S3 on the front panel.

Example: The load should be set above 15W. If the load is below 15W, the power saving mode will be activated.

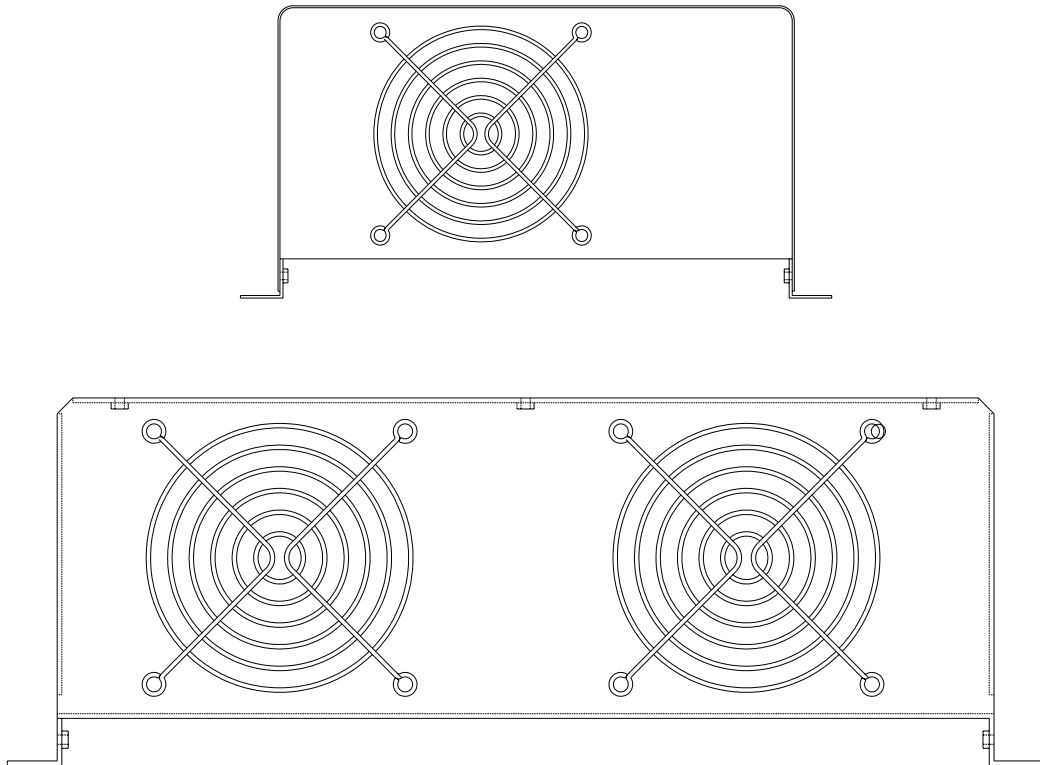
ST1000 ST1500	ST2000 ST2500	S1	S2	S3
DISABLE	DISABLE	OFF	OFF	OFF
20W	40W	ON	OFF	OFF
40W	80W	OFF	ON	OFF
50W	100W	ON	ON	OFF
60W	120W	OFF	OFF	ON
80W	160W	ON	OFF	ON
90W	180W	OFF	ON	ON
110W	220W	ON	ON	ON

### 4-3. Protections Features

Model	DC Input (VDC)					Over Temperature Protection			
	Over Voltage		Under Voltage Alarm	Under Voltage		INTERIOR		HEAT SINK	
	Shut-down	Restart		Shut-down	Restart	Shut-down	Restart	Shut-down	Restart
12V	15.3	14.2	11.0	10.5	12.5	70	45	90	60
24V	30.6	28.4	22.0	21.0	25.0				
48V	61.2	56.8	44.0	42.0	50.0				

## 4-4. Rear Panel Operation

### 4-4-1. Rear view :



### 4-4-2. Fan Ventilation:

Be sure to keep it a distance (at least 1 inch) form surrounding things.

## 5. Information

### 5-1. Troubleshooting



#### **WARNING**

Do not open or disassemble the ST series Inverter. Attempting to service the unit may cause the risk of electrical shock or fire.



<b>Problems and Symptoms</b>	<b>Possible Cause</b>	<b>Solutions</b>
<i>No AC Power "Output"</i> <b>STATUS illuminates the LED</b>		
a. Power status light is blinking fast.	Over input voltage. (OVP)	Check input voltage Reduce input voltage.
b. Power status light is Blinking slowly.	Low input voltage. (UVP)	Recharge battery. Check connections and cables.
c. Power status light is blinking Intermittently.	Thermal shutdown. (OTP)	Improve ventilation. Make sure ventilation, shafts of the inverter are not obstructed. Lower ambient temperature.
d. Power status light is glowed steadily.	Short circuit. Wiring error. Over Loading (OLP)	Check AC wiring for short circuit. Reduce load.

## **5-2. Maintenance**

Very little maintenance is required to keep your inverter operating properly. You should clean the exterior of the unit periodically with a damp cloth to prevent accumulation of dust and dirt. At the same time, tighten the screws on the DC input terminals.

## **5-3. Warranty**

We guarantee this product against defects in materials and workmanship for a period of 24 months from the date of purchase and will repair or replace any defective power inverters if you directly returned them to us with postage paid.

Please note that Cotek is only responsible for ensuring our products are operational before delivering. This warranty will be considered void if the unit has been misused, altered, or accidentally damaged. Cotek is not liable for anything that occurs as a result of the user's fault.

