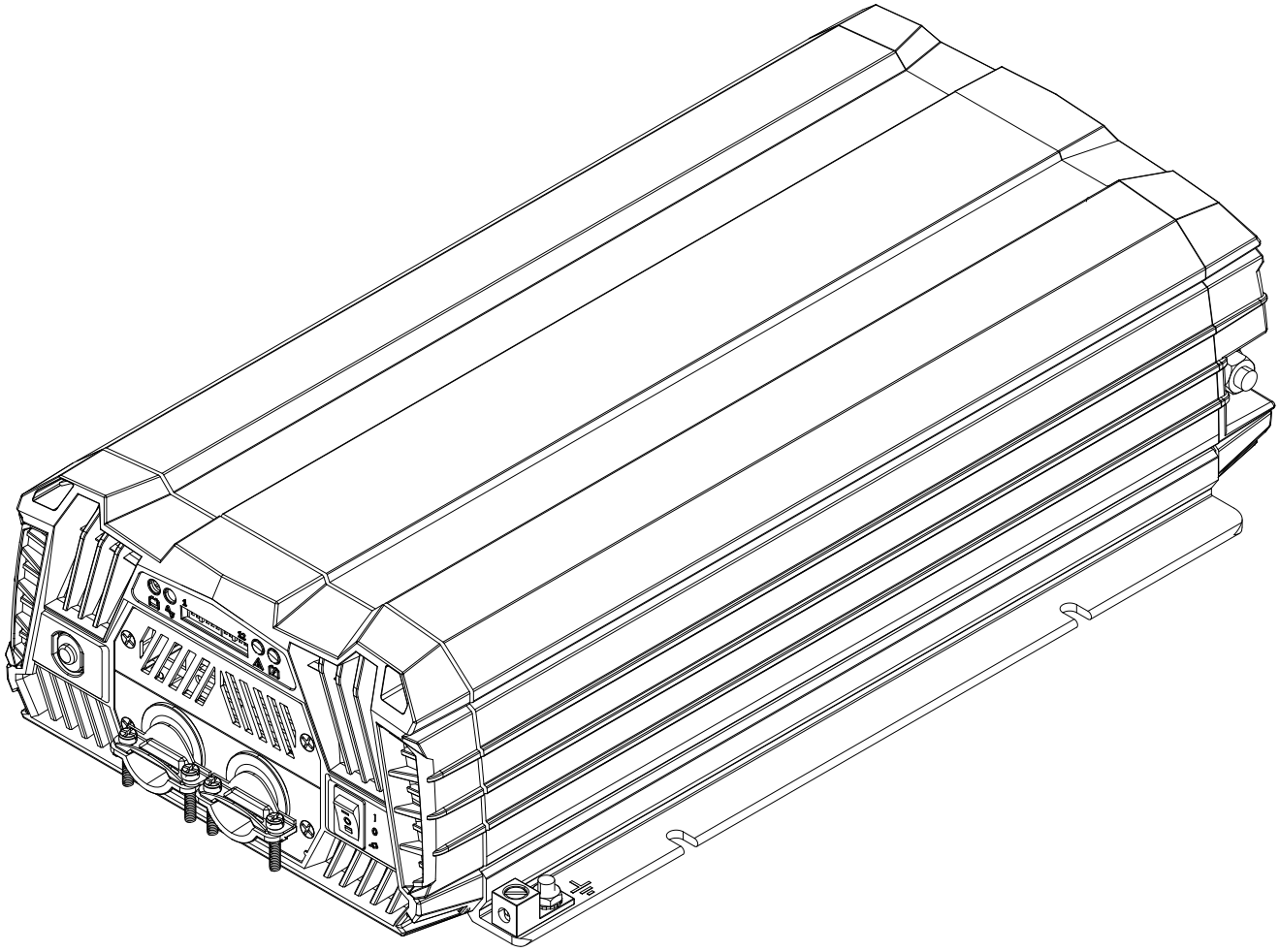
Pure Sinewave Inverter/Charger



Model LSC12-2000

Table of Content

1. Safety Instructions

1-1. Warnings and symbols

Safety instructions and warnings are marked in this manual by the following pictograms：

Supplementary information on operating the device.

CAUTION
Safety instruction: Failure to observe this instruction can cause material damage and impair the function of the device.

CAUTION
Safety instruction relating to a danger from an electrical current or voltage. Failure to observe this instruction can cause material damage and personal injury and impair the function of the device.

WARNING!
SAVE THESE INSTRUCTIONS – This manual contains important instructions that should be followed during installation and maintenance of the unit.

1-2. Use for intended purpose general safety precautions

The unit is constructed as per the applicable safety-technical guidelines.

- For the charging of lead acid batteries and the supply of user attached to these batteries, in permanent systems.
- For the conversion of a DC voltage from a battery to and AC voltage.
- Do not expose the unit to rain, snow, spray or dust. To reduce the risk of fire hazard, do not cover or obstruct the ventilation openings and. do not install the unit in a zero-clearance compartment.
- To avoid the risk of fire and electric shock, make sure that the existing wiring is in good electrical condition; and that the wire size is not undersized.
  Do not operate the unit with damaged or substandard wiring.
- Depending on the use, the AC output of the unit may require user installed breaker or fusing. The unit incorporates standard AC short circuit protection.
- The following precautions should be taken when working on the Inverter Charger：
  - Remove watches, rings, or other metal objects.
  - Use tools with insulated handles.
  - Wear rubber gloves and boots.

1-3. Other safety notes and installation precautions

- Upon receipt, examine the shipment box for damage. Notify the carrier immediately, before opening, if damage is evident.
- Do not operate near water or in excessive humidity.

- Do not open or disassemble the unit, warranty may be voided.
- The DC and AC side connections should be firm and tight.
- Grounding：Reliable grounding of rack-mounted equipment should be maintained.
- Do not drop a metal tool on the battery. The resulting sparks or short-circuit on the battery or on the other electrical part may cause an explosion.
- Wiring：Adequate input power must be supplied to the unit for proper use; correct wiring sizes must be ensured.
- Do not operate the unit close to combustible gas or open fire.
- Temperature：The unit should be operated in an ambient temperature range of -20 to 40°C or else the output efficiency may be affected. Air flow to the unit must not be restricted.
- In case of fire, you must use the fire extinguisher which is appropriate for electrical equipment.
- Short circuiting or reversing polarity will lead to serious damage to batteries, unit and the wiring. Fuses between the batteries and the unit cannot prevent damage caused by reversed polarity and the warranty will be void.
- Do not work on unit or system if it is still connected to a power source. Only allow changes in your electrical system to be carried out by qualified electricians.
- Check the wiring and connections at least once a year. Defects such as loose connections, burned cables etc. must be corrected immediately.
- Do not touch the equipment when wet or if your hands are clammy.

CAUTION
The cabinet of the unit must not be opened. There are no serviceable parts inside the cabinet. Only qualified, authorized and trained electrician installers are authorized to open the connection compartment.

1-4. Warning regarding the use of batteries

Excessive battery discharge and / or high charging voltage can cause serious damage to batteries. Do not exceed the recommended limits of discharge level of your batteries. Avoid short circuiting batteries, as this may result in explosion and fire hazard. Installation of the batteries and adjustments of the unit should only be undertaken by authorized personnel!

2. Function Characteristics Introduction

2-1. System overview

The LSC12-2000 is an inverter / charger system, designed with advanced power electronic and digital signal processor technology offering the following features：

- Bi-directional All-in-One Design.
- Certified by UL (UL458 Vehicle & Supplement SA).
- Compact Size - Highly Integration = Installation hassle-free.
- Battery charger current as below table.

Model No.	MAX	Battery voltage
LSC12-2000	100A	12V

Table 1 ：LSC12-2000 battery charger current

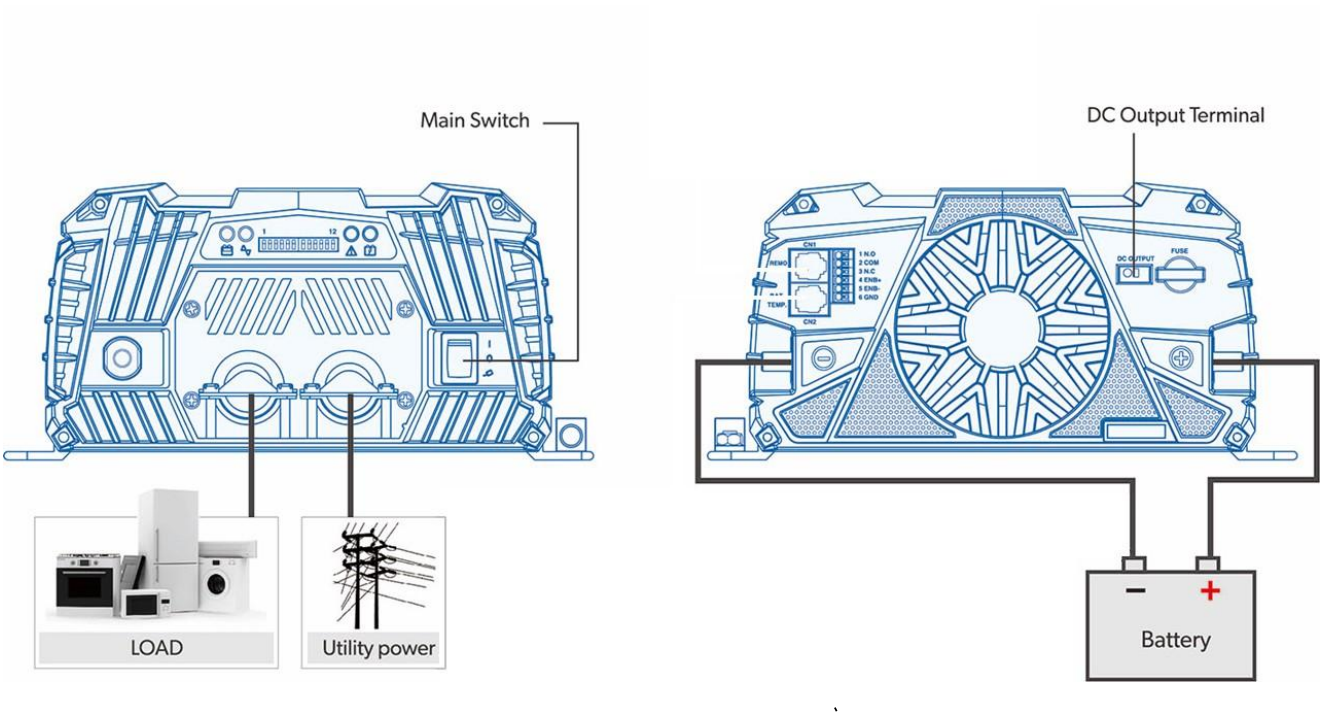


Fig. 1 ：LSC12-2000 System Overview

2-2. Electrical specification

Electrical		Specification	Model No.
		Item	LSC12-2000
Inverter Mode	Input Characteristics	Nominal Voltage	12 VDC
		Input Voltage Range (±0.5V)	10.5 ~ 16.5 VDC
		Input Over-Voltage Protection (±0.5V)	16.5 VDC
		Input Over-Voltage Warning (±0.5V)	15.5 VDC
		Input Under-Voltage Protection (±0.5V)	10.5 VDC
		Input Under-Voltage Warning (±0.5V)	11.0 VDC
		Input Current (Max)	260 A
		No Load Current	< 4.0 A @12.5V
		Stand-By Current	< 0.4 A
	Output Characteristics	Continuous Output Power	2000 VA ± 3%
		Surge Power	Load 101%~115% (1 Min)
			4000 VA (2 Sec)
		Frequency	50/60 Hz ± 0.3 Hz (User-selectable)
		Output Voltage	100 / 110 / 115 / 120VAC ±3%
		Max. Efficiency (Full Load)	89%
		Output Waveform	Pure Sine Wave (THD < 5% @ 12.5V/25V/115VAC, linear load)
		INV. AC Output*	20A MAX
		AC Output*	20A MAX
	Protection	Input Protection	Over / Under Voltage, Reverse Polarity (Internal Fuse)
		AC Output Protection	Short-Circuit, Overload
		AC Input Protection	30 Amp Circuit Breaker
		Temperature protection	Shutdown
Charger Mode	AC input Characteristics	Nominal Voltage / Frequency	110 VAC, 50 / 60Hz (User-selectable)
		Input Voltage Range	90 ~ 132 VAC
		Input Frequency Range	50Hz:47 ~ 53 Hz / 60Hz:57 ~ 63 Hz
		Nominal Current	16.5A (@110VAC)
		Efficiency (Max.)	>88%

Electrical		Specification	Model No.
		Item	LSC12-2000
		AC Input*	30 A MAX
		Power Factor Correction(PFC)	>0.95 (Max.)
	Auxiliary DC Output	Output Voltage	Battery Voltage
		Output Current	20A Max
	DC Output Characteristics	Charging Current Range	25 / 50 / 75 / 100A
		Max. Output Voltage	14.4 VDC
		Battery Control (3-stage Battery Chargers)	Bulk / Absorption / Float
	Signal and Control		
		Remote Control Terminal	Controls the inverter ON / OFF operation
		Dry Contact Terminal	By a relay
	Bypass Relay	Relay Specification	30 Amp / 250 VAC
		Transfer Time	0 sec
Operating Temperature Range		Full Load	-20 ℃ ~ 40 ℃
		Power de-rating	60 W / ℃, 41~60 ℃
		Storage	-30 ℃~70 ℃
Operating Humidity Range		Max 93%, Non-condensing	
Cooling		Temperature & Load Controlled Cooling Fan	
Mechanical Specification		Dimension (W x H x D)	251 x 116 x 453mm
		Net Weight	6 Kg
Safety and EMS		Safety Standards	UL458 Vehicle & Supplement SA
		EMC Standards	Certified FCC Class A*

Table 3. LSC Series Specification

Note ：

1. Max Inverter output define inverter 100% load output at Vac =100V / 200V
2. Max AC input current Limit by the Breaker
3. LSC12-2000 is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

De-rating Curve

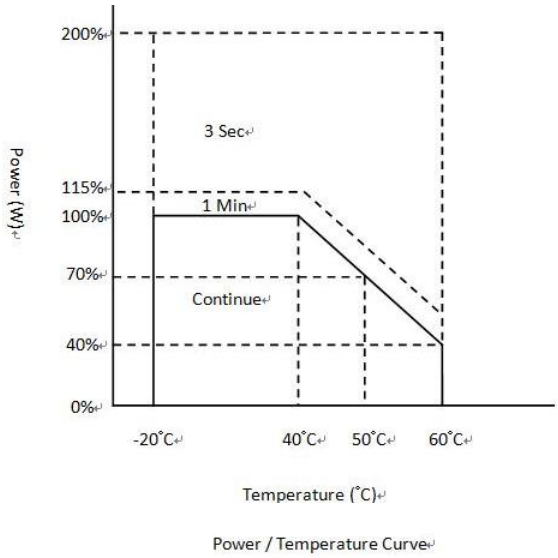
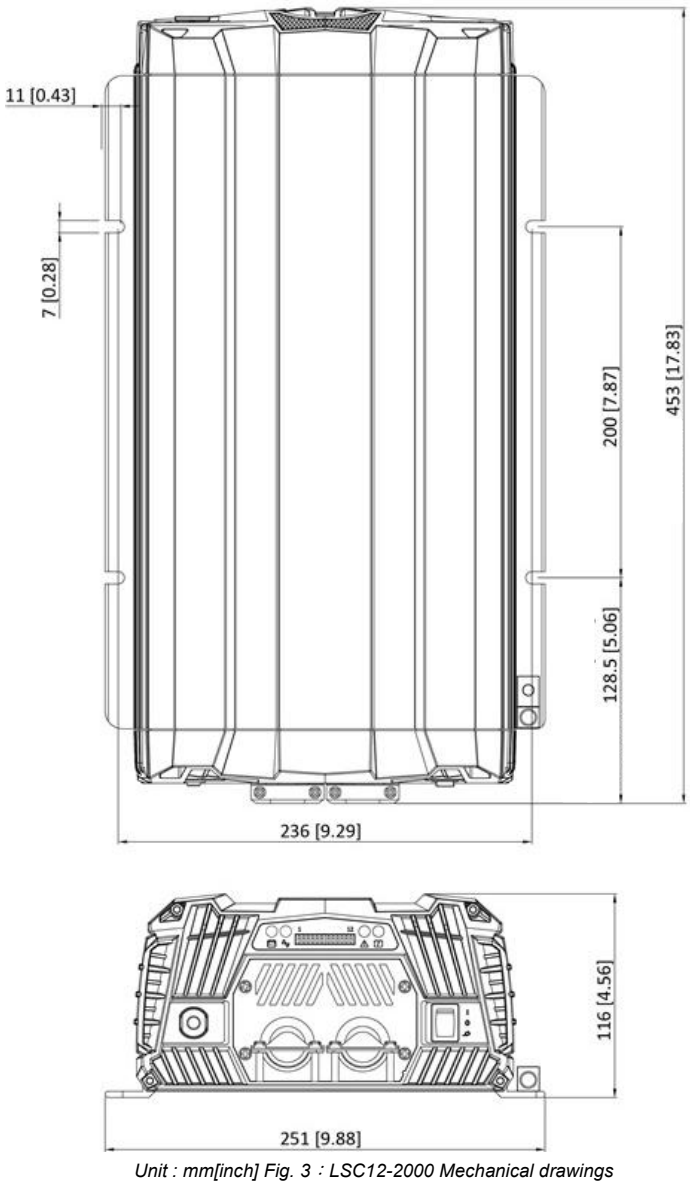


Fig. 2 : LSC12-2000 De-rating Curve

2-3. Mechanical drawings



Unit : mm[inch] Fig. 3 : LSC12-2000 Mechanical drawings

3. Installation and Maintenance

During installation and commissioning of the unit, the Safety Guidelines & Measures are applicable at all times. See chapter 1 of this manual.

3-1. Unpacking the product

In addition to the unit the delivery includes：

- Owner's Manual

After unpacking, check the contents for possible damage. Do not use the product if it is damaged. In case of the contents damaged, please contact your supplier.

Check from the identification label whether the battery voltage is the same as the DC-input voltage of the unit (e.g. 12V battery set for a 12V input voltage). Also check that the AC output voltage and output power of the unit satisfies loading requirements.

3-2. Front Panel

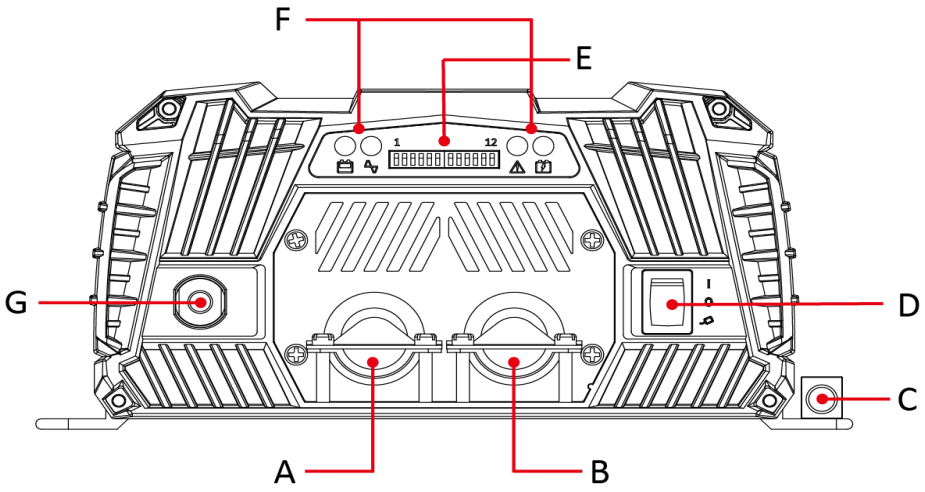
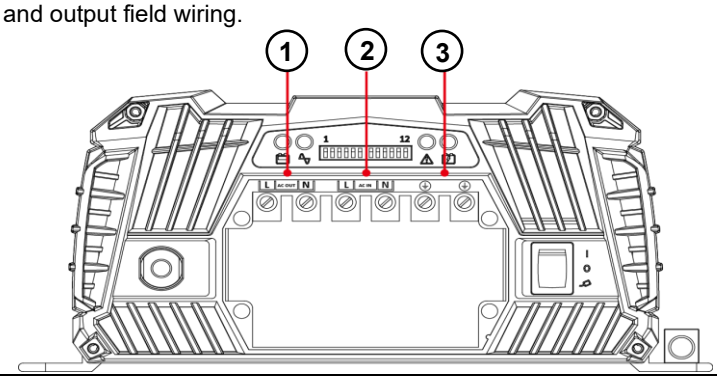


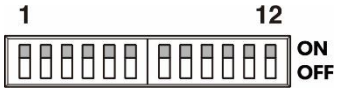
Fig. 4 : LSC12-2000 front panel introduction

<table>
<tr><th colspan="3">Front panel</th></tr>
<tr><td>A</td><td>AC Output</td><td rowspan="2">Two 3/4 inch knockouts provided with cable-clamp strain reliefs to allow and hold the AC input and output field wiring.
 

<table>
<tr><th colspan="2">Front panel</th></tr>
<tr><td>1</td><td>AC Output terminal (L/N)</td></tr>
<tr><td>2</td><td>AC Input terminal (L/N)*</td></tr>
<tr><td>3</td><td>AC Input / Output ground terminal</td></tr>
</table>
*If the grid power use GFCI or RCD socket, please set up the input current limit following</td></tr>
<tr><td>B</td><td>AC Input</td></tr>
</table>

<table>
<tr><td></td><td></td><td>their max current limitation for avoiding the risk of socket damage.
<table>
<tr><th>Model No.</th><th>AC IN AWG</th><th>AC OUT AWG</th><th>GROUNDING AWG</th></tr>
<tr><td>LSC12-2000</td><td>30A/10AWG</td><td>30A/10AWG</td><td>30A/10AWG</td></tr>
</table></td></tr>
<tr><td>C</td><td>Chassis ground</td><td>This connection is used to tie the exposed chassis of the inverter to the DC grounding system. This terminal accepts CU/AL conductors from #14 to #2 AWG (2.1 to 33.6 mm2).
 
WARNING!
The ground wire offers protection only if the cabinet of the unit is connected to the safety ground. Connect the chassis ground. Terminal to the hull or the chassis.
Refer to local regulations on these issues!
For safety purposes the neutral conductor (N) of the AC output must be connected to the earth (PE / GND) when the unit is in inverter operation. When utility power is available on the AC input, and the unit is in charger mode, this connection must be disabled again.
In some applications automatic connection between the neutral conductor (N) and earth (PE / GND) is not required or acceptable. Therefore the automatic connection between the neutral conductor (N) and earth (PE / GND) is enabled by default.</td></tr>
<tr><td>D</td><td>Main switch</td><td>The switch for 1.Power ON 2.Power Off 3.Remote Mode.</td></tr>
<tr><td>E</td><td>DIP switch</td><td>
<table>
<tr><th>Dip Switch</th><th>Function</th></tr>
<tr><td>S1</td><td rowspan="2">Output Voltage Select (refer to 3-2-1-1)</td></tr>
<tr><td>S2</td></tr>
<tr><td>S3</td><td>Frequency Select (refer to 3-2-1-2)</td></tr>
<tr><td>S4</td><td rowspan="3">AC Input Current Limit Select
(refer to 3-2-1-3)</td></tr>
<tr><td>S5</td></tr>
<tr><td>S6</td></tr>
<tr><td>S7</td><td rowspan="2">Battery Type Select (refer to 3-2-1-4)</td></tr>
<tr><td>S8</td></tr>
<tr><td>S9</td><td rowspan="2">Charger Current Select (refer to 3-2-1-5)</td></tr>
<tr><td>S10</td></tr>
<tr><td>S11</td><td>DC Source on/off (refer to 3-2-1-6)</td></tr>
<tr><td>S12</td><td>Saving Function on/off (refer to 3-2-1-7)</td></tr>
</table>
</td></tr>
<tr><td>F</td><td>Function LED</td><td>From left to right is “Battery voltage”’, ”AC output load”, “Charger stage”, “System status”
*For details, refer to 3-2-2</td></tr>
<tr><td>G</td><td>AC input breaker</td><td></td></tr>
</table>

3-2-1. DIP(Function) switch：



3-2-1-1 Output Voltage switch Function (S1,S2)：Default : 120VAC

Output Voltage	S1	S2
100V	OFF	OFF
110V	ON	OFF
115V	OFF	ON
120V	ON	ON

Table 5 ：Output voltage function definition

3-2-1-2 Output Frequency switch Function (S3)：Default : 60HZ

Frequency	S3
50HZ	OFF
60HZ	ON

Table 6 ：Output frequency function definition

3-2-1-3 AC Input Current Limit Select (S4,S5,S6)：Default : 15A

AC Input Current 100~120V	S4	S5	S6
3A	OFF	OFF	OFF
6A	ON	OFF	OFF
9A	OFF	ON	OFF
12A	ON	ON	OFF
15A	OFF	OFF	ON
20A	ON	OFF	ON
25A	OFF	ON	ON
30A	ON	ON	ON

Table 7 ：LSC12-20000 Input current limit select function definition

3-2-1-4 Battery Type Select Function(S7,S8)：Default : Flooded

Battery Type	S7	S8
LiFePO4	OFF	OFF
Flooded	ON	OFF
AGM	OFF	ON

Table 8 ：Battery types select function definition

3-2-1-5 Charger current Select Function(S9,S10)：Default : 100%

Charger Current (%)	S9	S10
25%	OFF	OFF
50%	ON	OFF
75%	OFF	ON
100%	ON	ON

Table 9：Charger current select function definition

3-2-1-6 DC Source Output On/Off Function (S11)：Default : ON

ESB function	S11
OFF	OFF
ON	ON

Table 10：DC source output On/Off function definition

3-2-1-7 Saving Function Switch On/Off Function (S12)：Default : OFF

The saving mode will be triggered if the output load <20W @10seconds.

Saving function	S12
OFF	OFF
ON	ON

Table 11：Saving function switch On/Off function definition

3-2-2 Status LED indicator:

Icon	Description	Icon	Description
	Battery Input voltage indicator		Output Load indicator
⚠	Alarm indicator		Charger Stage indicator

Table 12： LED indicator

Status	LED Indicator				
Green	Off				Inverter mode
	Solid ON	Normal (12V: 11.5 ~ 15.0V) (24V: 23.0 ~ 30.0V)	Normal (0~100%)	Normal status	Float mode
	Slow Blink			Over Temperature Protection	Equalization mode
	Fast Blink			Under Temperature Protection	Active mode
Orange	Off				Inverter mode
		Battery Low voltage	Over load (100%-	Phase or Frequency	Absorption mode

Status	LED Indicator				
	Solid ON	(12V:11.0 ~ 11.5V) (24V:22.0 ~ 23.0V) Battery High voltage (12V:15.0 ~ 15.5V) (24V:30.0 ~ 31.0V)	115%)	Failure	
	Slow Blink			Grid Over / Under Voltage Protection	Bulk mode
	Fast Blink			Grid Over Current Protect	
Red	Off				Inverter mode
	Solid ON	Battery Under voltage (12V: < 11.0V) (24V: < 22.0V) Battery Over voltage (12V: >15.5V) (24V: >31.0V)	Over load (>115%)	Over Load / Short Circuit Protection	
	Slow Blink			Battery Under Voltage Protection (12V: < 10.5V) (24V: < 21.0V)	
	Fast Blink			Battery Over Voltage Protection (12V: >16.5V) (24V: >33.0V)	

Table 13 : Status LED indicator

3-3. Rear panel

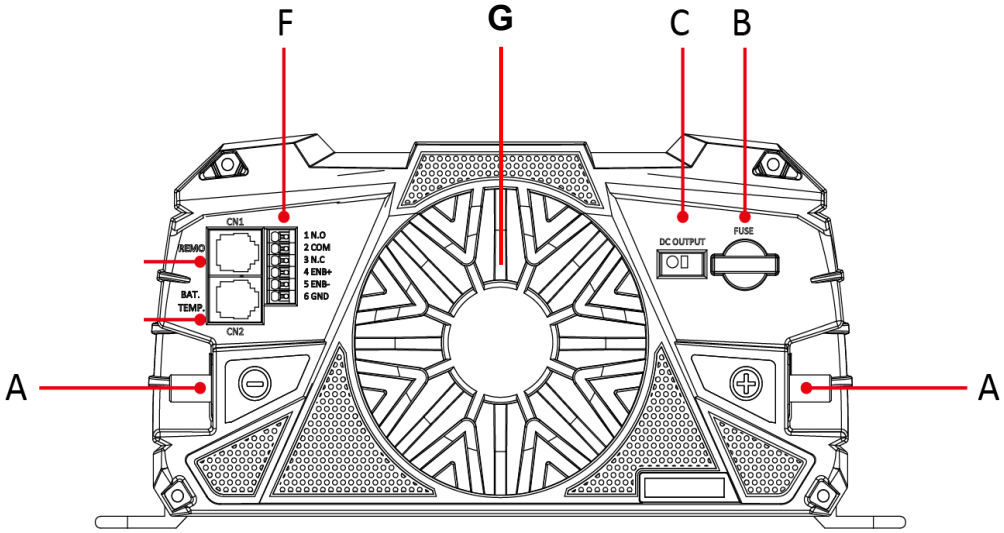


Fig. 5 : LSC12-2000 Rear panel introduction

<table>
<tr>
<td>A</td>
<td>DC input connector</td>
<td>Follow the instructions to connect the battery cables to the DC input terminals of the unit. The cables should be as short as possible (less than 6 feet / 1.8 meters ideally) so that they can handle the required current in accordance with the Electrical Codes and Regulations. The size of the cable should be thick enough to limit the voltage drop to less than 2% when carrying the maximum input current to prevent frequent low-input voltage warnings, and shutdown. UVP (Under Voltage Protection) warning may result if there is excessive voltage drop across the DC cables between the batteries and the unit. Increasing your DC cable size will help improve the situation.
Batteries are capable of providing very large currents in case of short circuit. In case there is a short circuit in the cable run between the batteries and the input terminals of the unit, it will result in overheating / melting of the cables and consequent risk of fire and injury, to prevent possibility of this hazard, use Very Fast Acting DC Fuse in line with the positive cable. The fuse should be as close to the positive battery terminal as possible.
The following sizes of cables and fuses are recommended for up to 6 ft. distance between the batteries and the unit.
MAX torque 100in-lb
<table>
<tr><th>Model No.</th><th>Wire AWG</th><th>Inline Fuse</th><th>External Fuse</th></tr>
<tr><td>LSC12-2000</td><td>#2/0</td><td>400A</td><td>>400A</td></tr>
</table>
</td>
</tr>
<tr>
<td>B</td>
<td>Auxiliary DC output Fuse</td>
<td>Second charger limit current protection.</td>
</tr>
<tr>
<td>C</td>
<td>Auxiliary DC output</td>
<td>LSC12-2000 has a second charger output connector can be used to give a maintenance of a small battery. Maximum current is 20A.</td>
</tr>
</table>

F

Remote control terminal and Dry terminal

Remote control terminal may be connected to a Form C relay for “FAULT” indication. When “FAULT” occurs, the relay switches.

conditions include Input under/over voltage, Output Short Circuit, Over Temperature, Over load and, Fan Failure.

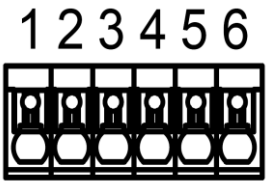


Fig. 7 : Remote control terminal

Item	Description	Item	Description
1	Dry contact (Normal Open)	4	Enable+ (ENB)
2	Common	5	Enable- (ENB)
3	Dry contact (Normal Closed)	6	Ground

RS-232 / Remote control port

Use 20 ~ 24 #AWG wire to connect the remote control terminals.

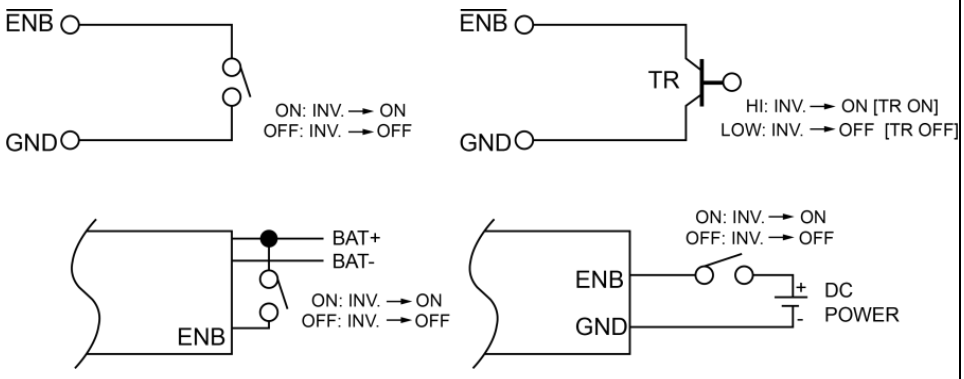
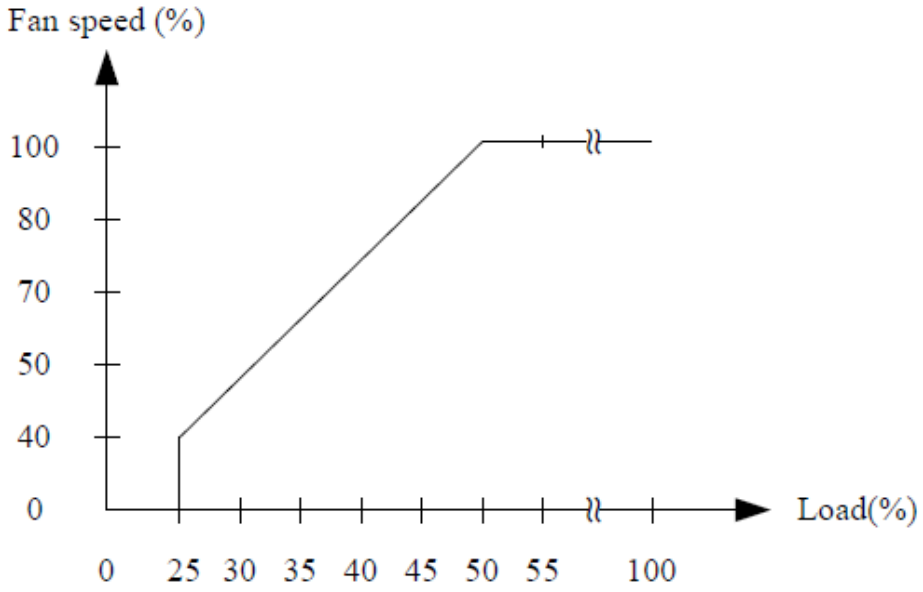
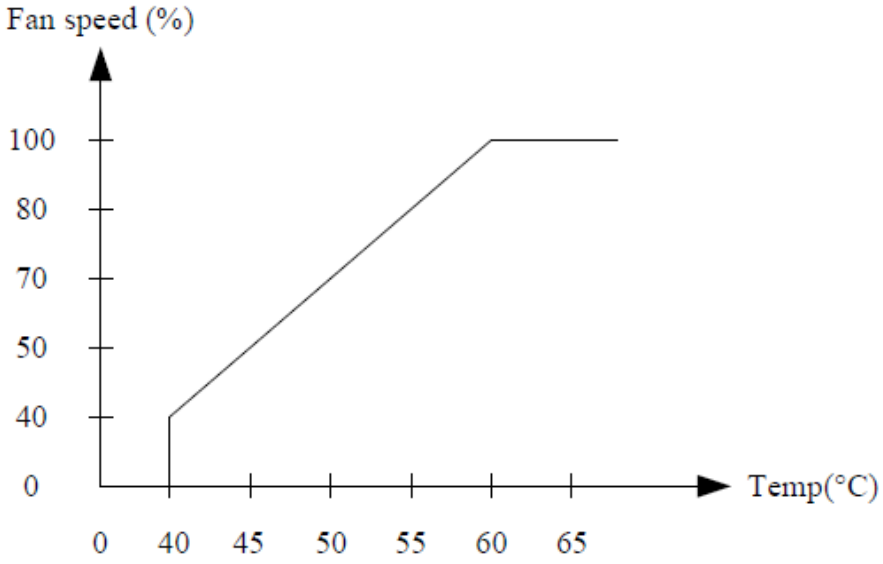


Fig. 8 : Wiring for remote control

Specifications of the Relay					
Maximum Voltage	Load	Contact Rating		Number of operations	Operating/Storage Temperature
		N.O.	N.C.		
250 VAC	Resistive	1 A	—	100,000	-30℃~75℃
250 VAC	Resistive	—	1 A	—	
24 VDC	Resistive	1 A	—	—	
24 VDC	Resistive	—	1 A	—	

G	**Fan speed control**	The fan turned on by Load(%) or Temp(°C) as below chart:   Note: the fan full speed(100%) turned when the status of over temperature, the circuit short, and the over load occur

4. System Function Introduction

The LSC12-2000 is a battery charger, a pure sine wave inverter and an AC transfer system in one compact enclosure. 1. The three-step charging function guarantees that the batteries are always charged 100% (User-selectable). 2. The pure sine wave inverter assures that the AC output voltage is perfectly reliable even when limited external AC power is available. 3. External AC power can be supplied by a public grid or a generator. 4. DC power can be delivered by charged batteries.

4-1. Battery charger introduction

The LSC12-2000 can connect to three types of batteries (default setting is Flooded), and user can adjust the parameters by dip switch to meet battery charging characteristics.
The following table shows some battery type charging setting.

Battery Type Stage	LiFePO4	AGM	Flooded
	@12VDC	@12VDC	@12VDC
Bulk Voltage	14.4VDC	14.4VDC	14.2VDC
Absorption Voltage	14.4VDC	14.3VDC	14.1VDC
Float Voltage	14.0VDC	13.6VDC	13.2VDC

Table 14：Battery type charging setting I

4-1-1. Battery charging function description

The LSC12-2000 is equipped with a PFC (Power Factor Corrected) and PI (Proportional-Integral) multistage battery charger. The PFC feature controls the amount of power used to charge the batteries to obtain a power factor as close as possible to 1 (or unity). This causes the battery charger to look like a resistor to the line (forces the charge current wave shape to mirror the voltage wave shape). The PI feature allows the charger voltage and current to change independently. These two features maximize the real power available from the AC power source (i.e., utility or generator), which translates into less power wasted and greater charging capabilities than most chargers today. When an AC source is connected to the AC input, the inverter begins monitoring for acceptable AC voltage. Once the AC voltage is accepted, the AC transfer relay closes the charge mode begins. After the charge mode begins, the inverter's battery voltage is monitored to determine the charging stage. The charger will skip the Bulk and Absorb charge stages and go directly to Final charging. However, if the incoming AC power is lost and returns within 2 minutes the charge mode returns to the charge stage it was in prior to losing AC input—regardless of the battery voltage.
The LSC12-2000 three stages include an automatic 3-stage charging process: Bulk, Absorb, and Float Charge. The automatic 3-stage charge process provides complete recharging and monitoring of the batteries without damage due to overcharging. If the AC input voltage falls below 90 VAC the charger will stop charging to help stabilize the incoming AC voltage. The Charge mode provides up to three separate charging stages: Bulk Charging, Absorb charging and Float Charge.

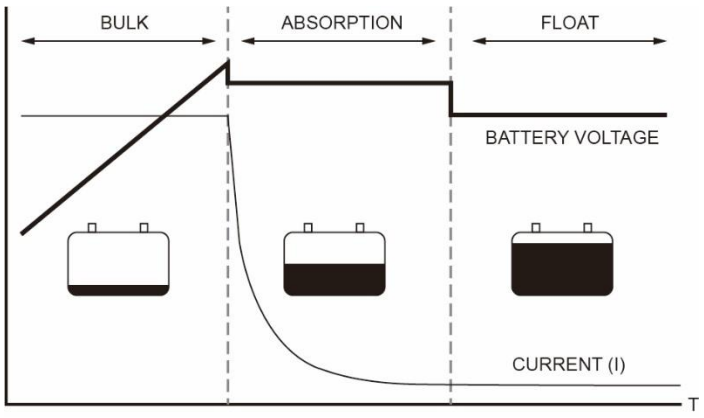


Fig. 9：Three step charge system

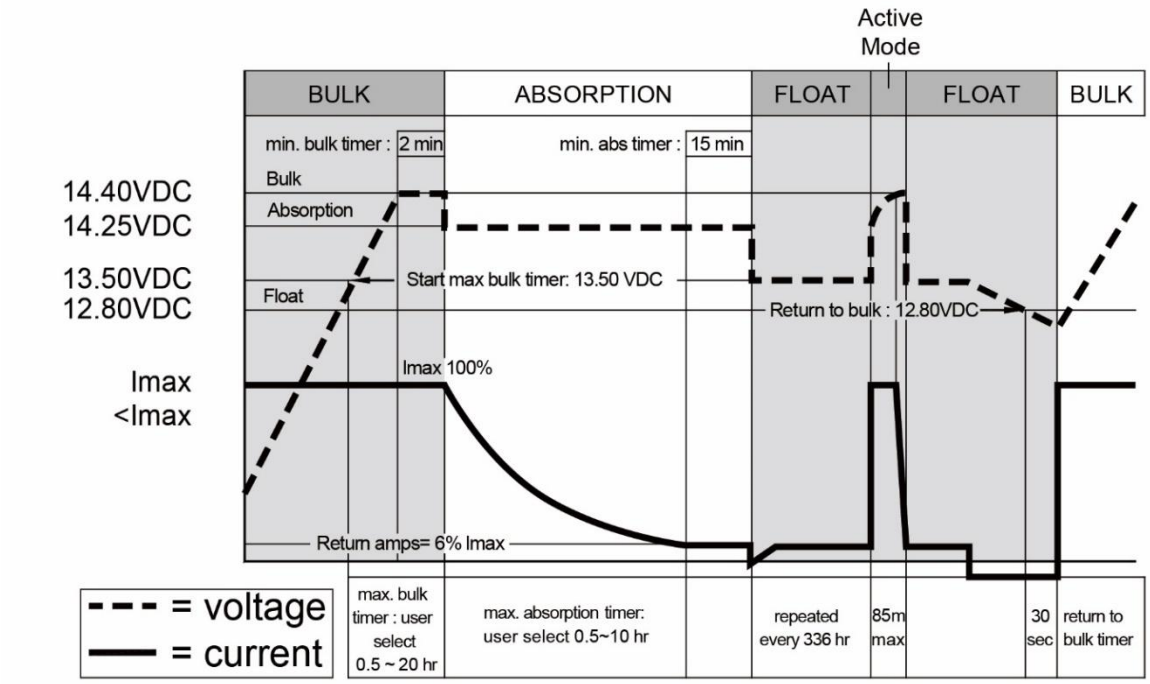


Fig. 10 : Charge characteristic of three-step plus charging method

4-1-2. 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) then switches to absorption charging.

4-1-3. 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 then switches to final charging.

4-1-4. Float charging

The third charging stage occurs at the end of the absorb charging time. While final charging, the charge voltage is reduced to the final charge voltage (determined by the Battery Type selection*). In this stage, the batteries are kept fully charged and ready if needed by the inverter. The Float Charging stage reduces battery gassing, minimizes watering requirements (for flooded batteries), and ensures the batteries are maintained at optimum capacity.

4-2. Operation mode introduction

The LSC12-2000 is not just a combination of an inverter and a battery charger. There are many additional features which can be used to increase the total available AC power, even when external AC power is limited.

4-2-1. Basic operation description

When there is no external “AC input” power available, the inverter of the unit provides AC power output load from the batteries.

When external AC power comes available, the transfer relay switches on. Both outputs as well as the

battery charger are supplied by the external AC power. The batteries are recharged now.

4-2-2. Power Support function

With the adjustable AC input current limit function, Power Support function of the LSC12-2000 inverter will trigger OLP (over-load protection) when the output power is over loaded. It can protect the input AC power device such as the utility or generator power system.

CAUTION

For safety unit the transfer relay is immediately switched off when incoming AC power fails in operation so that there will never be a high voltage on the shore cable inlet when it is not connected.

5. Trouble Shooting

Status	LED Indicator	Buzzer states	Status	Solution
Green	Slow Blink	Two Short	Over Temperature Protection (OTP)	1. Improve ventilation. Make sure ventilation openings in inverter are not obstructed. 2. Reduce ambient temperature.
	Fast Blink	One Short	Under Temperature Protection (UTP)	1. Increase ambient temperature.
Orange	Slow Blink	N/A	Grid Over / Under Voltage Protection	1. Make sure AC input is within 90Vac ~ 132Vac (110V system) or 180Vac~264Vac (220V system).
	Fast Blink	N/A	Grid Over Current Protect	1. Turn off the load and make sure there is no short circuit inside the load circuit. 2. Check the setup value of AC input current limit (Dip Switch S4,S5,S6). 3. Re-turn on the unit manually.
	Solid	N/A	Phase or Frequency Failure	1. Make sure AC input frequency matches the Unit output frequency.
Red	Slow Blink	Four Short	Battery Under Voltage Protection	1. Check DC input voltage. Increase DC input voltage. 2. Check DC input connection and wring cable. 3. Recharge battery.
	Fast Blink	Three Short	Battery Over Voltage Protection	1. Check DC input voltage. Reduce DC input voltage.
	Solid	Five Short	Over Load (101%~115%) Protection	1. Reduce load in case of restart failed. 2. Re-turn on the unit manually.
		N/A	Over Load (>115%) / Short Circuit Protection	

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