

# Multistage Battery Charger

User Manual

## Design Features:

1. PFC function.  
– except C-15L-12 / C-7L-24.
2. Sleeping mode function.
3. Wide input voltage (universal) range operation.  
– except C-15L-12 / C-7L-24.
4. LCD remote control.
5. Battery temperature sensor function.
6. Tri-LED color indicator for different charge stage.
7. With power supply function.
8. Prevent the battery overcharging, and extend the battery life.
9. For recovery of the aging (sulfated) battery.



C-15L-12 / C-7L-24



C-30-12 / C-15-24



C-60-12 / C-30-24



ISO: TS16949

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# 1. Important Safety Instructions



## **Warning!**

Before installing and using the charger, read all instructions and cautionary markings on the charger, the batteries, and all appropriate sections of this guide.

### **General Safety Precaution:**

- A. Do not expose the charger to rain, snow, spray, or bilge water. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the charger in a zero-clearance compartment. Overheating may result.
- B. The charger is designed to be permanently connected to your AC and DC electrical systems.
- C. Before using the charger, read all instructions and cautionary markings on the charger, the batteries, and all appropriate sections of this guide.
- D. Use only attachments recommended or sold by the manufacturer. Doing otherwise may result in a risk of fire, electric shock, or injury to persons.
- E. Do not disassemble the charger. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
- F. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- G. Children should be supervised to ensure that they do not play with the appliance.
- H. The charger must be provided with an equipment-grounding conductor connected to the AC input ground.
- I. To reduce the risk of electrical shock, disconnect both AC and DC power from the charger before attempting any maintenance or cleaning or working on any circuits connected to the charger. Turning off controls will not reduce this risk.
- J. Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged in any way.
- K. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the charger with damaged or substandard wiring.

## 2. Installation Location: Physical requirements for installation

### IMPORTANT

This product is best mounted in a Horizontal position.

If the unit is mounted in a vertical position,

The cooling fan must be at the bottom of the unit.

Condition	Description
Clean	Do not expose the charger to metal filings or any other form of conductive contamination. The presence of conductive contamination can cause damage and void your warranty.
Cool	For best performance, the ambient air temperature should be between 5°F (-15°C) and 113°F (45°C)- the cooler the better. At higher ambient temperatures, the output current will be automatically reduced to protect the charger from high internal temperatures.
Dry	The unit is intended for use in a dry location. Do not allow water or other fluids to drip or splash on the charger. Do not mount the charger in an area subject to rain, spray or splashing bilge water.
Maintenance	You should clean the exterior of the unit periodically with a dry cloth to prevent accumulation of dust and dirt. At the same time, tighten the screws on the DC input terminals.
Safe	Working in the vicinity of lead-acid batteries is dangerous. Batteries generate explosive gases during normal operation. It is safest not to install electrical equipment in these areas.
Ventilated	Allow at least 4 inches (10 cm) of clearance around all sides of the charger for air flow. Ensure that the ventilation openings on the unit are not obstructed. If mounting in a compartment, ventilate the compartment with louvres or cut-outs to prevent overheating.
Close to AC junction box	Avoid the use of extended wire lengths if possible.
Close to batteries	Avoid excessive cable lengths and use the recommended wire lengths and sizes. Undersized or overly long cables may affect charging accuracy.

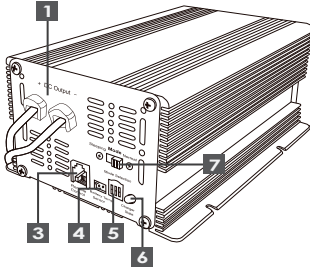
# 3. Overview

## A. Product Introduction

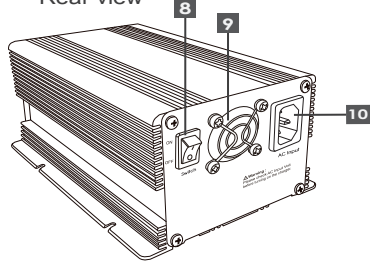
**⚠ Warning: Damage caused by wrong positive (+) and negative (-) connection is not covered by the warranty.**

**C-15L-12 ; C-7L-24**

Front view

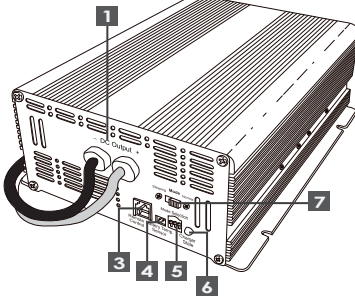


Rear view

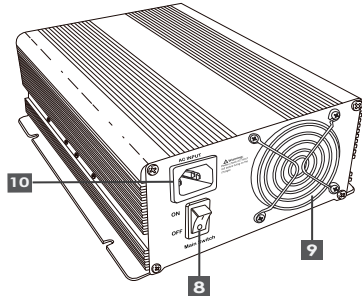


**C-30-12 ; C-15-24**

Front view

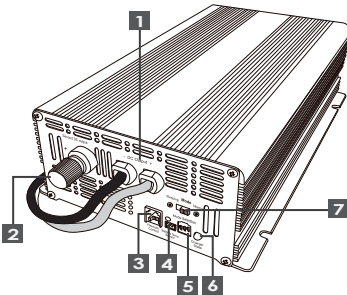


Rear view

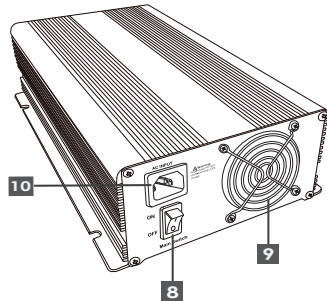


**C-60-12 ; C-30-24**

Front view



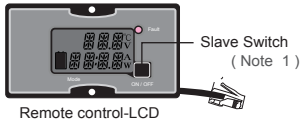
Rear view



1. DC OUTPUT : +Red / -Black

2. Second DC output

3. Remote control-LCD



4. Battery Temp. Sensor

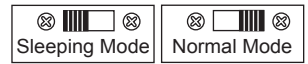


Battery Temp. Sensor

5. Charging Mode Selection  
(Please refer to page 9)

6. Charging Status

7. Sleeping / Normal Mode



( Note 3 / Note 4 )

8. Main Switch

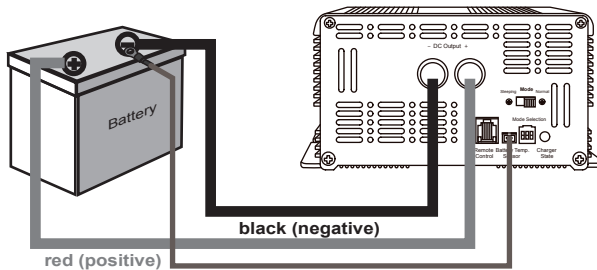
9. Fan

10. AC Input

**Note 1:**

The slave switch of the remote control just cuts out the output. If you want to turn off the charger completely, please switch off main switch of charger body.

**Note 2:**



**Battery Temp. Sensor:** To detect the battery temp. While charging, please connect the wire sensor to the battery Negative (-) terminal.

When the battery (-) pole temp. reaches  $65^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{C}$ ) /  $149^{\circ}\text{F}$  ( $\pm 41^{\circ}\text{F}$ ), the charger would stop output.



**DON'T** connect the sensor to the battery Positive (+) terminal. It may damage the sensor & charger.



**Warning: Damage caused by wrong sensor cable connection is not covered by the warranty.**

**Note 3:**

**Sleeping Mode:** The fan would stop, and the charger working sound would be smaller, so the output current would be 5A (12V spec.) and 2.5A (24V spec.) only.

**Note 4:**

**Normal Mode:** The charger would work as its max. capacity according to its spec., the fan would run if it's necessary.

## B. Accessory

**bracket - 2 parts : rear and frame.**

How to instal?



FRONT VIEW



Rear Frame

① With the frame only, if there's the hole on the wall for phone jack.



or ② With the frame and rear both, if the user just can screw the bracket on the wall, no hole for phone jack.

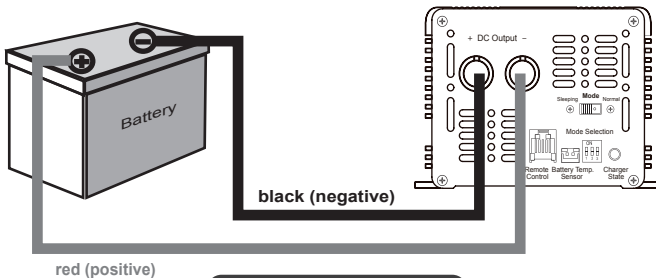


## C . Isolated Design

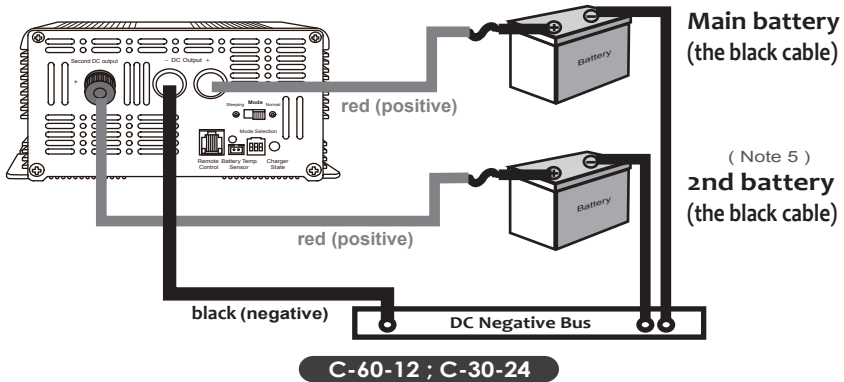
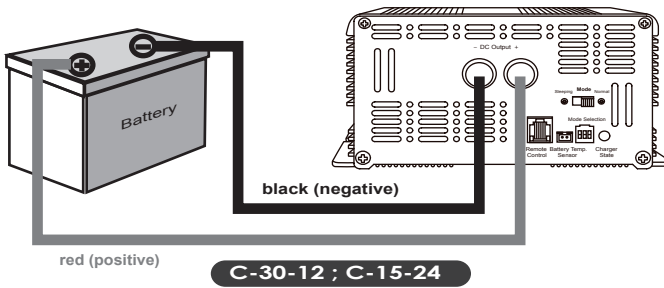
The DC battery charging circuits of this charger are galvanically isolated by a transformer from the AC power circuits. This feature reduces the risk of electric shock .

## 4. Installation Illustration

Before charging, read the instructions; for indoor use only. Disconnect the supply before making or breaking the connections to the battery.



**C-15L-12 ; C-7L-24**



**Note 5:**

Please connect the main battery cable prior to 2nd battery terminal if you just have 1 battery.

**⚠ WARNING**


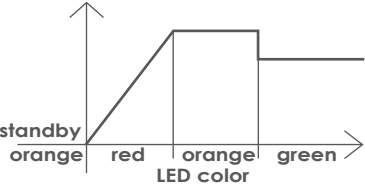

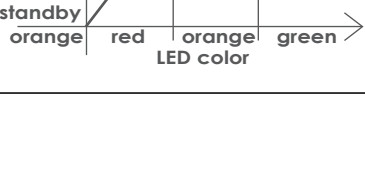

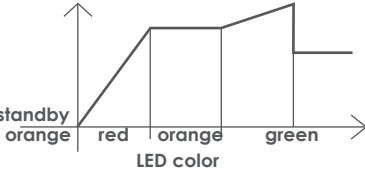

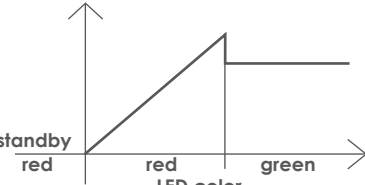






Explosive gases; Prevent flames and sparks; Provide adequate ventilation during charging. Include a warning against recharging non-rechargeable batteries. If the supply cord is damaged, it must be replaced by a special cord or assembly available from the manufacturer or its service agent.

**⚠ Explosive gas precautions**

- (1). The chargers have been approved as Ignition Protected. They may be installed in areas containing gasoline tanks and fittings which require Ignition Protected equipment. It is safest not to install electrical equipment in these areas.
- (2). To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of the equipment in which the battery is installed.
- (3). Working in the vicinity of lead-acid batteries is dangerous. Batteries generate explosive gases during normal operation. Therefore you must read this guide and follow the instructions exactly before installing or using your charger.

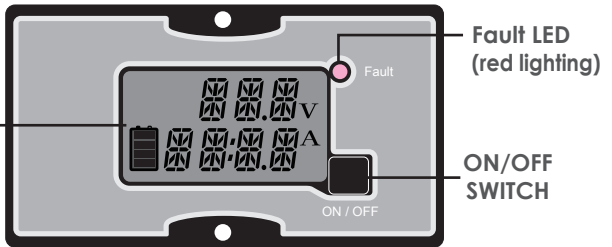
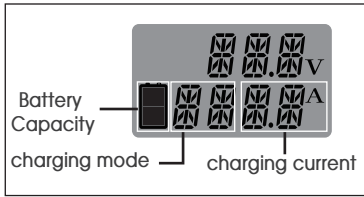


## 5. Charging volt graph (0:OFF ■ )

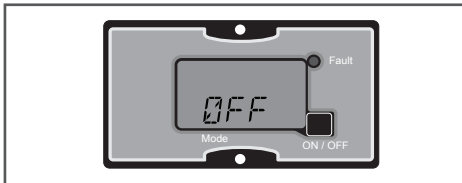
	<b>Mode 1</b> (100)	Suitable for re-charging lead storage battery.	
	<b>Mode 2</b> (120)	Suitable for re-charging gel battery.	
	<b>Mode 3</b> (003)	Suitable for re-charging lead storage battery, <u>which is in good condition battery (no any sulfated situation), and completely disconnected from the devices it runs</u> , because this mode has the additional stage, the battery may reach voltage too high for them, and the limited current delivered by the battery charger. This is not able to provide power for the devices, and simultaneously charge the battery.	
	<b>Mode 4</b> (020)	Suitable for recovery of sulfated gel battery, i.e. discharged batteries unused for long periods or the battery that never re-charges completely. This mode should be applied with the battery completely disconnected from the devices it runs.	
	<b>Mode 5</b> (023)	Suitable for recovery sulfated lead storage battery, i.e. discharged batteries unused for long periods or the battery that never re-charges completely. This mode should be applied with the battery completely disconnected from the devices it runs.	
	<b>Mode 6</b> (123)	DC power supply. [12.2V (for 12V spec.) / 24.5V (for 24V spec.) ]	
	<b>Mode 7</b> (000)	DC power supply. [13.5V (for 12V spec.) / 27V (for 24V spec.) ]	

## 6. Charger LCD Remote Control :

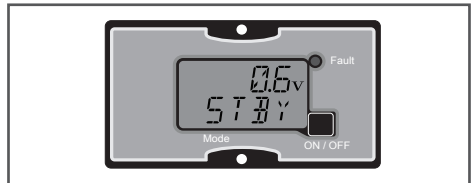
### Graph



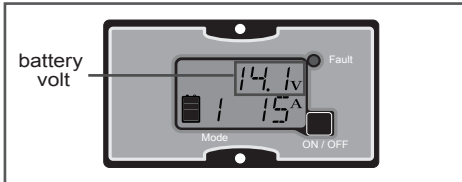
### Display Content :



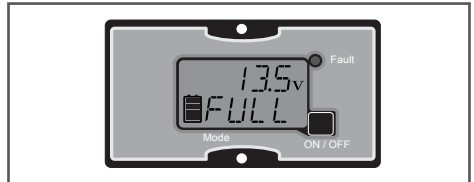
1. OFF



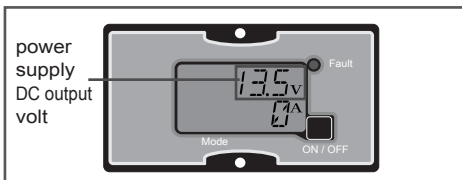
2. Mode 1: no battery connected.



3. Mode 1: while charging.

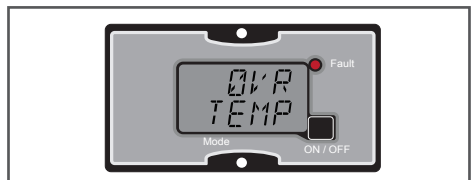


4. Mode 1: battery full.



5. Mode 2: power supply mode.

**\*\* If overload, the output volt would go down gradually, according to the load current. \*\***



6. Over temperature protection.



7. High battery volt protection.



Do not dispose this product as unsorted municipal waste. Collection of such waste separately for special treatment is necessary.

This product must not be disposed together with the domestic waste.

This product has to be disposed at an authorized place for recycling of electrical and electronic appliances.

By collecting and recycling waste, you help save natural resources, and make sure the product is disposed in an environmental friendly and healthy way.

# C-15L-12 / C-7L-24 specification

Model	C-15L-12							C-7L-24						
<b>INPUT</b>														
Voltage range	120Vac (100~130Vac) / 230Vac (180~240Vac).													
Frequency range	50/60Hz													
Efficiency	≥85%													
Power factor	0.5 at full load (±5%)													
Input socket	IEC plug													
<b>OUTPUT</b>														
<b>Mode Selection</b>	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7
Bulk Stage	14.7V, 15A			14.1V, 1A	14.7V, 1A	12.2V, 15A	13.5V, 15A	29.4V, 7A			28.2V, 0.5A	29.4V, 0.5A	24.5V, 7A	27V, 7A
Absorption stage (I)	14.7V, 15A max	14.1V, 15A max	14.1V, 15A max	14.1V, 1A max	14.7V, 1A max	12.2V, 15A	13.5V, 15A	29.4V, 7A max	28.2V, 7A max	28.2V, 7A max	28.2V, 0.5A max	29.4V, 0.5A max	24.5V, 7A	27V, 7A
Absorption stage (II)	/	/	14.7V, 1A max	/	/	/	/	/	/	29.4V, 0.5A max	/	/	/	/
Float stage	13.5V, 1A max					12.2V, 15A	13.5V, 15A	27V, 0.5A max					24.5V, 7A	27V, 7A
Max. current output	15A							7A						
Continuous current output	15A							7A						
Recommended battery capacity	45 ~ 150Ah (12V)						/	30 ~ 90Ah (24V)						/
Leakage current from battery	<1mA						/	<1mA						/
Sleeping Mode Function	YES ( 5A current output only)						/	YES ( 2.5A current output only)						/
<b>PROTECTION</b>														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
<b>ENVIRONMENT</b>														
Working temp.	-15°C ~ +45°C (5°F ~ 113°F)													
Working humidity	20 ~ 90% RH non-condensing													
Storage temp., humidity	-30°C ~ +70°C (-22°F ~ +158°F) , 10 ~ 95% RH													
Temp. coefficient	±0.05%/°C (0°C ~ 50°C/32°F ~122°F)													
<b>OTHER</b>														
Remote Control	YES													
Dimension (L x W x H)	195 x 126 x 82.5 mm													
Weight	2.1 kgs													

\*\*The above spec. ±0.5V for 12V spec.; ±1.0V for 24V spec.; Amp. ±10% is acceptable.

△ Note: Specifications subject to change without notice.

# C-30-12 / C-15-24 specification

Model	C-30-12							C-15-24						
<b>INPUT</b>														
Voltage range	100 ~ 240VAC													
Frequency range	45 ~ 65Hz													
Efficiency	≥85%													
Power factor	1.0 at full load (+/-5%)													
Input socket	IEC plug													
<b>OUTPUT</b>														
<b>Mode Selection</b>	<b>Mode 1</b>	<b>Mode 2</b>	<b>Mode 3</b>	<b>Mode 4</b>	<b>Mode 5</b>	<b>Mode 6</b>	<b>Mode 7</b>	<b>Mode 1</b>	<b>Mode 2</b>	<b>Mode 3</b>	<b>Mode 4</b>	<b>Mode 5</b>	<b>Mode 6</b>	<b>Mode 7</b>
Bulk Stage	14.7V, 30A			14.1V, 2A	14.7, 2A	12.2V, 30A	13.5V, 30A	29.4V, 15A			28.2V, 1A	29.4V, 1A	24.5V, 15A	27V, 15A
Absorption stage (I)	14.7V, 30A max	14.1V, 30A max	14.1V, 30A max	14.1V, 2A max	14.7V, 2A max	12.2V, 30A	13.5V, 30A	29.4V, 15A max	28.2V, 15A max	28.2V, 1A max	28.2V, 1A max	29.4V, 1A max	24.5V, 15A	27V, 15A
Absorption stage (II)	/	/	14.7V, 2A max	/	/	/	/	/	/	29.4V, 1A max	/	/	/	/
Float stage	13.5V, 2A max					12.2V, 30A	13.5V, 30A	27V, 1A max					24.5V, 15A	27V, 15A
Max. current output	30A							15A						
Continuous current output	30A							15A						
Recommended battery capacity	75 ~ 250Ah (12V)						/	45 ~ 150Ah (24V)					/	
Leakage current from battery	<1mA						/	<1mA					/	
Sleeping Mode Function	YES ( 5A current output only)						/	YES ( 2.5A current output only)					/	
<b>PROTECTION</b>														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
<b>ENVIRONMENT</b>														
WORKING TEMP.	-15°C ~ +45°C (5°F ~ 113°F)													
WORKING HUMIDITY	20 ~ 90% RH non-condensing													
STORAGE TEMP., HUMIDITY	-30°C ~ +70°C (-22°F ~ +158°F) , 10 ~ 95% RH													
TEMP. COEFFICIENT	±0.05%/°C (0°C ~ 50°C/32°F ~122°F)													
<b>OTHER</b>														
Remote Control	YES													
Dimension (L x W x H)	235 x 179 x 90 mm													
Weight	3.0 kgs													

\*\*The above spec. ±0.5V for 12V spec.; ±1.0V for 24V spec.; Amp. ±10% is acceptable.

△ Note: Specifications subject to change without notice.

# C-60-12 / C-30-24 specification

Model	C-60-12								C-30-24							
<b>INPUT</b>																
Voltage range	100 ~ 240VAC															
Frequency range	45 ~ 65Hz															
Efficiency	>=85%															
Power factor	1.0 at full load (+/-5%)															
Input socket	IEC plug															
<b>OUTPUT</b>																
<b>Mode Selection</b>	<b>Mode 1</b>	<b>Mode 2</b>	<b>Mode 3</b>	<b>Mode 4</b>	<b>Mode 5</b>	<b>Mode 6</b>	<b>Mode 7</b>	<b>Mode 1</b>	<b>Mode 2</b>	<b>Mode 3</b>	<b>Mode 4</b>	<b>Mode 5</b>	<b>Mode 6</b>	<b>Mode 7</b>		
Bulk Stage	14.7V, 60A			14.1V, 2A	14.7V, 2A	12.2V, 60A	13.5V, 60A	29.4V, 30A			28.2V, 1A	29.4V, 1A	24.5V, 30A	27V, 30A		
Absorption stage (I)	14.7V, 60A max	14.1V, 60A max	14.1V, 60A max	14.1V, 2A max	14.7V, 2A max	12.2V, 60A	13.5V, 60A	29.4V, 30A max	28.2V, 30A max	28.2V, 30A max	28.2V, 1A max	29.4V, 1A max	24.5V, 30A	27V, 30A		
Absorption stage (II)	/	/	14.7V, 2A max	/	/	/	/	/	/	29.4V, 1A max	/	/	/	/		
Float stage	13.5V, 2A max					12.2V, 60A	13.5V, 60A	27V, 1A max					24.5V, 30A	27V, 30A		
Max. current output	60A							30A								
Continuous current output	60A							30A								
Recommended battery capacity	180 ~ 600Ah (12V)					/		90 ~ 300Ah (24V)					/			
Leakage current from battery	<1mA					/		<1mA					/			
Sleeping Mode Function	YES ( 5A current output only)					/		YES ( 2.5A current output only)					/			
<b>PROTECTION</b>																
Over temperature	55°C±5°C (131°F±41°F)															
Overload	YES															
Output short circuit	YES															
Microprocessor check	YES															
<b>ENVIRONMENT</b>																
WORKING TEMP.	-15°C ~ +45°C (5°F ~ 113°F)															
WORKING HUMIDITY	20 ~ 90% RH non-condensing															
STORAGE TEMP., HUMIDITY	-30°C ~ +70°C (-22°F ~ +158°F) , 10 ~ 95% RH															
TEMP. COEFFICIENT	±0.05%/°C (0°C ~ 50°C/32°F ~122°F)															
<b>SIZE</b>																
Dimension (L x W x H)	328 x 179 x 90 mm															
Weight	4.0 kgs															

\*\*The above spec. ±0.5V for 12V spec.; ±1.0V for 24V spec.; Amp. ±10% is acceptable.

△ Note: Specifications subject to change without notice.

## 7.Charging Formula

### ( A ) . Charging Time

Formula      Charging time will depend on the capacity of your battery and on how deeply it is discharged. The following equation calculates an approximate charging time.

$$\text{Charging time} = \frac{\text{CAP} \times \text{DOD}}{\text{CC} \times 80\%}$$

where:

Charging Time:      Battery recharge time in hours

CAP:                  Battery capacity in amp-hours

DOD:                  Battery depth of discharge in per cent. A fully discharged battery has 100% DOD

CC:                    Charge current, the rated current output of the charger in amperes

80%:                  Typical charging efficiency for lead-acid batteries

Example      A Group size battery rated at 100 amp-hours is 40% discharged, that is, it has a DOD = 40. Charging time with a C-15L-12 unit is calculated as follows:

$$\text{Charging time} = \frac{100\text{Ah} \times 40\%}{15\text{A} \times 80\%} = 3.3 \text{ hours}$$

### ( B ) . Discharging Time

To achieve 50% cycling you should calculate your Amp-hour consumption between charging cycles and use a battery bank with twice that capacity. To calculate Amp hour consumption, first look at the rating plate on your AC appliance or tools.

Each appliance or tool will be rated in either AC Amps or AC watts or AC VA(Volts-Amps) apparent power.

Use one of the following to calculate the DC Amp-hour draw for a 12 Volt system:

(AC Amps x 10) x 1.1 x hours of operation = DC Amp-hours

(AC watts/12) x 1.1 x hours of operation = DC Amp-hours

(AC VA/12) x 1.1 x hours of operation = DC Amp-hours

In all formulas, 1.1 is the factor for inverter/charger efficiency.

Calculate the above for every AC appliance or tool you intend to use on your inverter. This will give you the total number of Amp-hours used between recharges. Size your battery bank using this number as a guideline. A good rule to follow is to size the battery bank about 2 times larger than your total Amp-hour load requirement. Plan on recharging when 50% discharged. Many electric motors have momentary starting requirements well above their operational rating. Start up watts are listed where appropriate. Individual styles and brands of appliances may vary.

NOTICE: Lead-acid battery is recommended for inverter/charger models, also the LiFePO4 battery.