

Multistage Battery Charger

User Manual



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



C-30-12 / C-15-24



C-60-12 / C-30-24



C-90-12 / C-45-24

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.
10. Suitable for lead acid and Lithium batteries.

MERCL01(N)



ISO: TS16949



List of contents

Important Safety Instructions	3
Installation Location	4
Overview	5
A. Product Introduction	5
B. Accessory	9
C . Isolated Design	10
Installation Illustration	10
Charging mode Selection & Volt Graph	13
Charger LCD Remote Control	14
C-15L-12 / C-7L-24 specification	15
C-30-12 / C-15-24 specification	16
C-60-12 / C-30-24 specification	17
C-90-12 / C-45-24 specification	18
Charging Formula	19
Charger troubleshooting guide	20

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

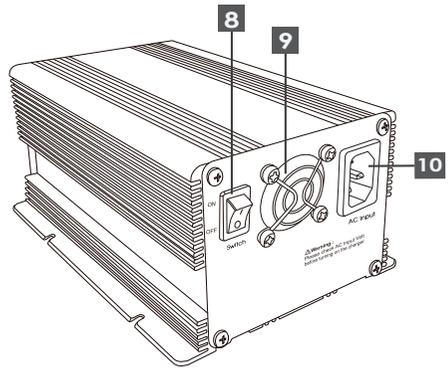
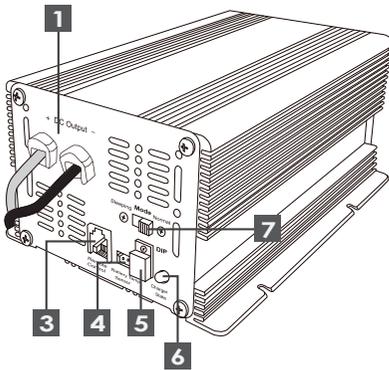
⚠ Warning: Damage caused by wrong positive (+) and negative (-) connection is not covered by the warranty.

⚠ Warning: DO NOT charge the frozen battery, may result in the serious injury or death.

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

Front view

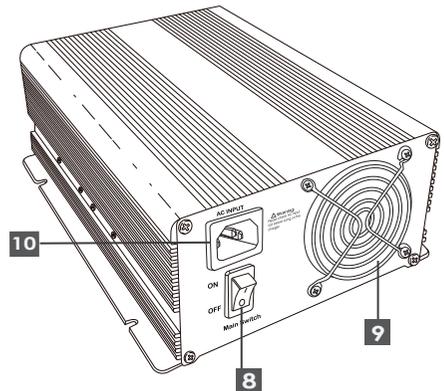
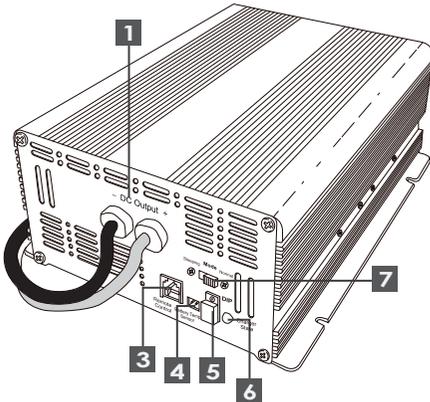
Rear view



C-30-12 ; C-15-24

Front view

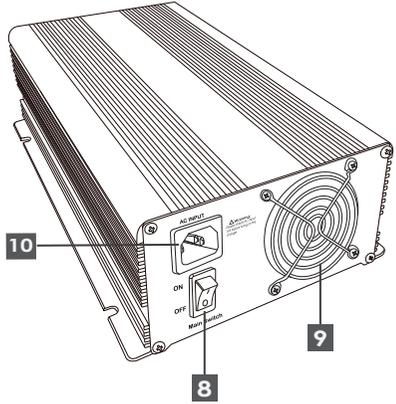
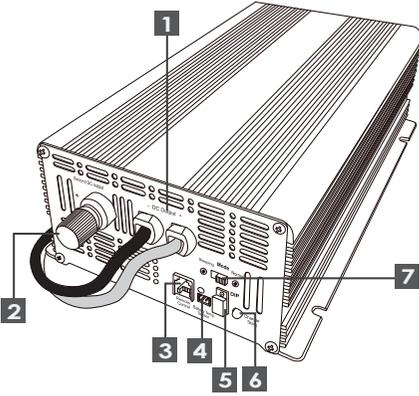
Rear view



C-60-12 ; C-30-24

Front view

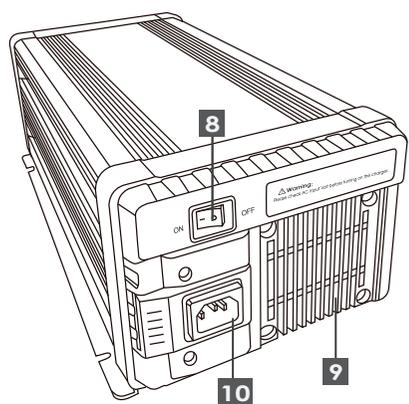
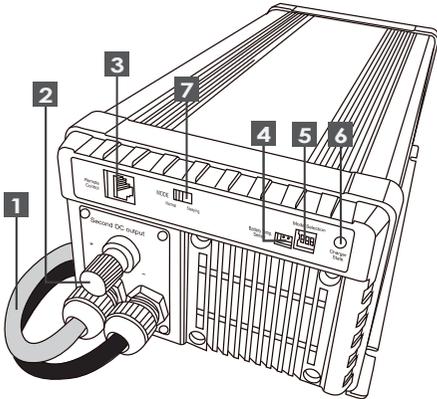
Rear view



C-90-12 ; C-45-24

Front view

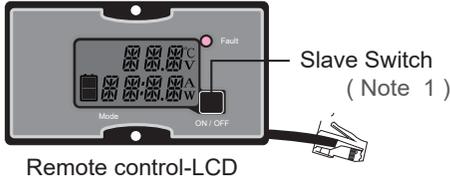
Rear view



1 DC OUTPUT : +Red / -Black

2 Second DC output

3 Remote control-LCD



Remote control-LCD

4 Battery Temp. Sensor



Battery Temp. Sensor

5 Charging Mode Selection

(Please refer to page 13)

6 Charging Status

7 Sleeping / Normal Mode



(Note 3 / Note 4)

8 Main Switch

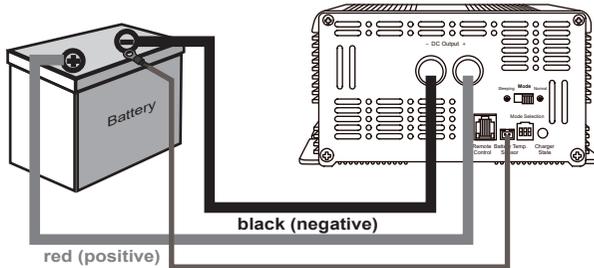
9 Fan

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°C (+/-5°C) / 149°F (+/-41°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.



Charging a Lithium battery in ambient temperatures below 0°C / 32°F must be avoided. The reason for this is it may potentially damage the battery and / or reduce its lifespan.

This range of chargers have no low temperature protection so please be cautious when using lithium batteries in cold environments.

Some lithium batteries will have inbuilt low temperature charge protection.

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.



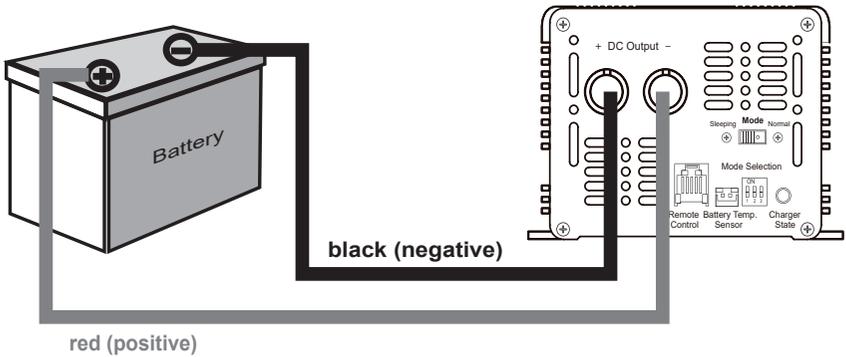
C . Isolated Design

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 .

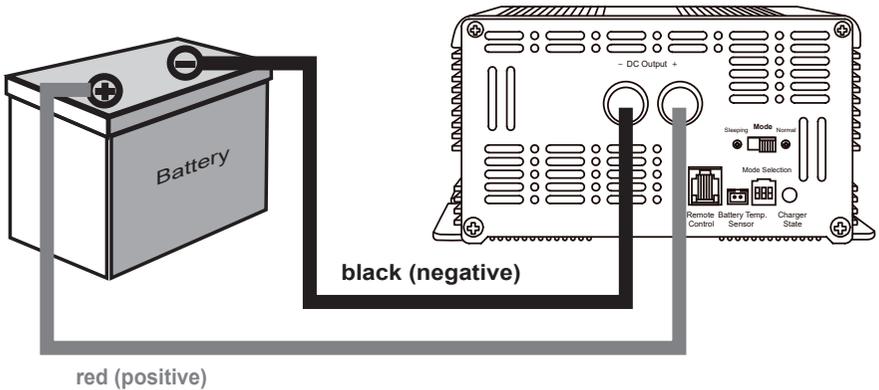
4. Installation Illustration

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

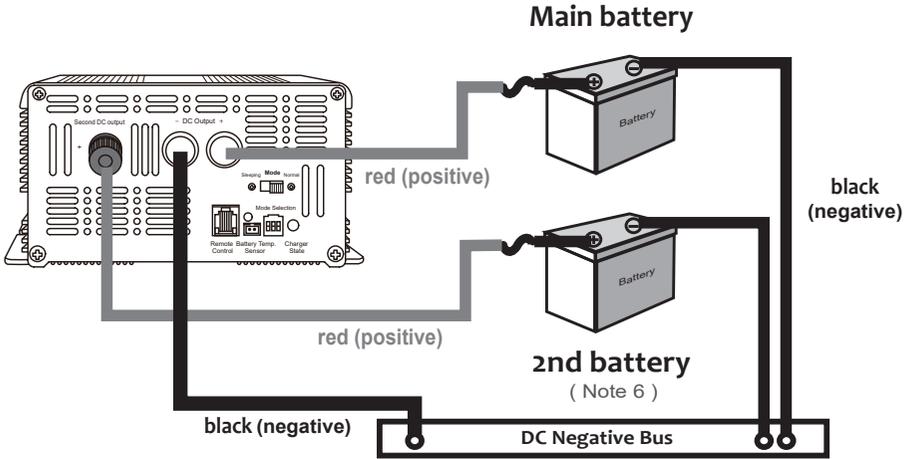
C-15L-12 ; C-7L-24



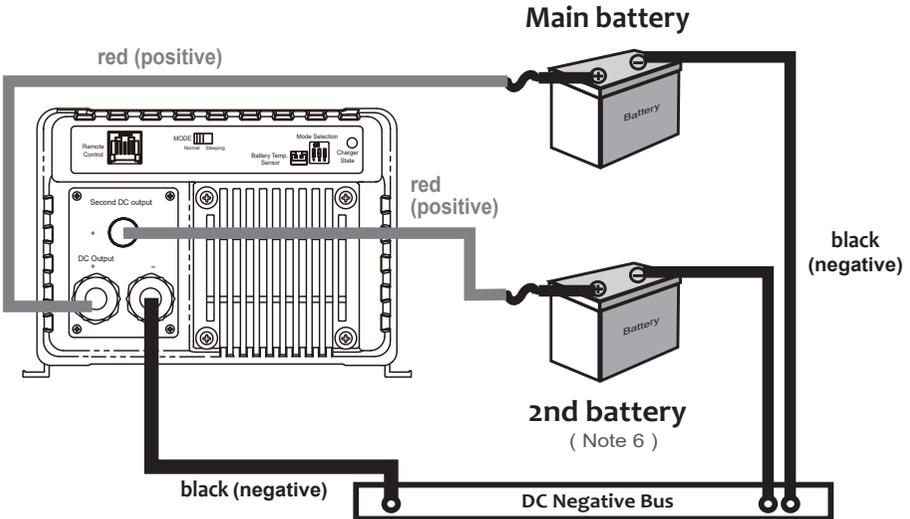
C-30-12 ; C-15-24



C-60-12 ; C-30-24



C-90-12 ; C-45-24



Note 5:

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

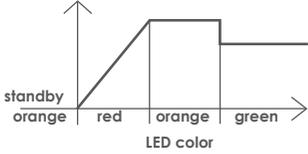
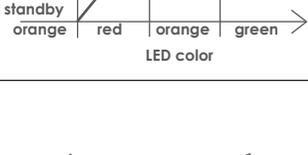
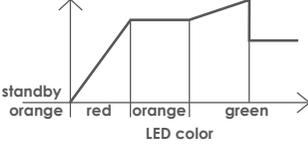
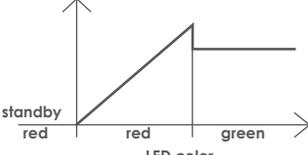
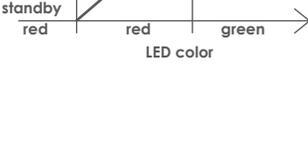
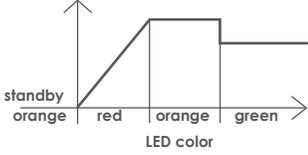
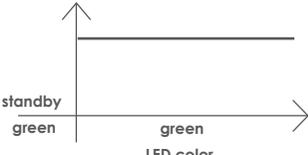
WARNING

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

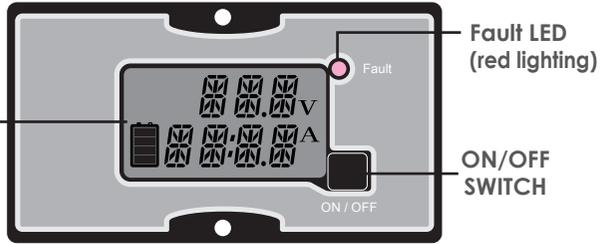
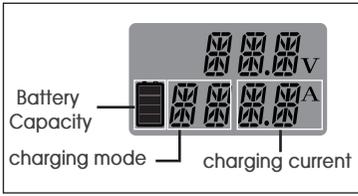
- (1). The chargers have been approved as Ignition Protected. They may be installed in areas containing gasoline tanks and fittings which require Ignition Protected equipment. It is safest not to install electrical equipment in these areas.**
- (2). To reduce the risk of battery explosion, follow these 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 mode Selection & Volt Graph (0:OFF □)

	Mode 1 (100)	Suitable for re-charging lead storage battery including AGM.	
	Mode 2 (120)	Suitable for re-charging gel battery.	
	Mode 3 (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.	
	Mode 4 (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.	
	Mode 5 (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.	
	Mode 6 (123)	Suitable for re-charging lithium battery.	
	Mode 7 (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. / the battery is broken.

3. Mode 1: while charging.

4. Mode 1: battery full.

5. Mode 7: 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						
INPUT														
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													
OUTPUT														
Mode Selection	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	14.4V, 15A	13.5V, 15A	29.4V, 7A			28.2V, 0.5A	29.4V, 0.5A	28.8V, 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	14.1V, 15A max	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	28.2V, 7A max	27V, 7A
Absorption stage (II)	/	/	14.7V, 1A max	/	/	/	/	/	/	29.4V, 0.5A max	/	/	/	/
Float stage	13.5V, 1A max						13.5V, 15A	27V, 0.5A max						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)						/
PROTECTION														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
ENVIRONMENT														
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)													
OTHER														
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						
INPUT														
Voltage range	100 ~ 240VAC													
Frequency range	50/60Hz													
Efficiency	>=85%													
Power factor	1.0 at full load (+/-5%)													
Input socket	IEC plug													
OUTPUT														
Mode Selection	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, 30A			14.1V, 2A	14.7, 2A	14.4V, 30A	13.5V, 30A	29.4V, 15A			28.2V, 1A	29.4V, 1A	28.8V, 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	14.1V, 30Amax	13.5V, 30A	29.4V, 15A max	28.2V, 15A max	28.2V, 15A max	28.2V, 1A max	29.4V, 1A max	28.2V, 15Amax	27V, 15A
Absorption stage (II)	/	/	14.7V, 2A max	/	/	/	/	/	/	29.4V, 1A max	/	/	/	/
Float stage	13.5V, 2A max						13.5V, 30A	27V, 1A max						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)						/
PROTECTION														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
ENVIRONMENT														
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)													
OTHER														
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												
INPUT														
Voltage range	100 ~ 240VAC													
Frequency range	50/60Hz													
Efficiency	>=85%													
Power factor	1.0 at full load (+/-5%)													
Input socket	IEC plug													
OUTPUT														
Mode Selection	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, 60A			14.1V, 2A	14.7V, 2A	14.4V, 60A	13.5V, 60A	29.4V, 30A			28.2V, 1A	29.4V, 1A	28.8V, 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	14.1V, 60A max	13.5V, 60A	29.4V, 30A max	28.2V, 30A max	28.2V, 30A max	28.2V, 1A max	29.4V, 1A max	28.2V, 30A max	27V, 30A
Absorption stage (II)	/	/	14.7V, 2A max	/	/	/	/	/	/	29.4V, 1A max	/	/	/	/
Float stage	13.5V, 2A max						13.5V, 60A	27V, 1A max						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)						/
PROTECTION														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
ENVIRONMENT														
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)													
SIZE														
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.

C-90-12 / C-45-24 specification

Model	C-90-12							C-45-24						
INPUT														
Voltage range	100 ~ 240VAC													
Frequency range	50/60Hz													
Efficiency	>=85%													
Power factor	1.0 at full load (+/-5%)													
Input socket	IEC plug													
OUTPUT														
Mode Selection	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, 90A			14.1V, 5A	14.7V, 5A	14.4V, 90A	13.5V, 90A	29.4V, 45A			28.2V, 2.5A	29.4V, 2.5A	28.8V, 45A	27V, 45A
Absorption stage (I)	14.7V, 90A max	14.1V, 90A max	14.1V, 90A max	14.1V, 5A max	14.7V, 5A max	14.1V, 90A max	13.5V, 90A	29.4V, 45A max	28.2V, 45A max	28.2V, 45A max	28.2V, 2.5A max	29.4V, 2.5A max	28.2V, 45A max	27V, 45A
Absorption stage (II)	/	/	14.7V, 5A max	/	/	/	/	/	/	29.4V, 2.5A max	/	/	/	/
Float stage	13.5V, 5A max					13.5V, 90A	27V, 2.5A max					27V, 45A		
Max. current output	90A							45A						
Continuous current output	90A							45A						
Recommended battery capacity	400 ~ 1000Ah (12V)					/	200 ~ 500Ah (24V)					/		
Leakage current from battery	<1mA					/	<1mA					/		
Sleeping Mode Function	YES (5A current output only)					/	YES (2.5A current output only)					/		
PROTECTION														
Over temperature	55°C±5°C (131°F±41°F)													
Overload	YES													
Output short circuit	YES													
Microprocessor check	YES													
ENVIRONMENT														
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)													
SIZE														
Dimension (L x W x H)	435 x 200 x 135 mm													
Weight	7.8kgs													

**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.

8.Charger troubleshooting guide

Problem	Possible cause	Solution
No AC input	AC input volt is not correct	Ensure AC input volt is at charger AC volt acceptable range.
	AC input frequency isn't correct	Ensure AC frequency is at charger AC frequency acceptable range.
	Poor connection	Check and improve the AC wiring connection.
	Defective AC source switch or breaker	Replace the switch or breaker.
Charger can't detect the battery load	The switch of remote control isn't ON.	Please set the switch of remote control to ON.
	Poor connection	Check and manage the correct connection.
	Reverse polarity	Correct the polarity. The fuse may blown. Damage caused by the reverse polarity is not covered by the warranty.
	Battery volt : < 2V(12V spec.) / <4V (24V spec.)	Replace the battery. You can charge the battery with power supply mode until the battery volt >2v (12v spec.) / >4v (24v spec.), then change it to charger mode to trigger the charger function.
	Wrong battery spec.	Check and change to the right spec. battery. Damage caused by the wrong battery connection is not covered by the warranty.
Battery temp. is too hot	Defective battery (short circuit)	Replace the battery.
	Battery temp. is high	Use the battery temp. sensor, or allow the battery cool.
	Charge volt is too high	Check setting.
Battery discharge is too fast	Battery capacity is too small for the load	Change the bigger capacity battery.
	Battery is aging or sulfated	Recharge the battery a few times after discharge, it may be help. Or replace the battery.
No display	Display switch is off	Turn on the display switch.
	Wiring error	Improve the wiring.