

DC-DC ON-BOARD BATTERY CHARGER WITH MPPT

Installation and Operation Manual

DCC50S



Version 1.0



Important Safety Instructions

Please save these instructions.

This manual contains important safety, installation, and operating instructions for the DCC50S Battery Charger. Do not operate the Battery Charger unless you have read and understood this manual and the charger is installed as per these installation instructions. Renogy recommends that the charger be installed by a qualified professional. Store it in a safe place. The following symbols are used throughout the manual to indicate potentially dangerous conditions or important safety information.

DANGER

Safety instruction: Failure to observe this instruction will result in fatal or serious injury.

WARNING

Safety instruction: Failure to observe this instruction can result in fatal or serious injury.

CAUTION

Safety instruction: Failure to observe this instruction can lead to injury.

NOTICE

Failure to observe this instruction can cause material damage and impair the function of the product.

NOTE

Supplementary information for operating the product.

The manufacturer accepts no liability for damage in the following cases:

- Faulty assembly or connection.
- Damage to the product resulting from mechanical influences and excess voltage.
- Alterations to the product without express permission from the manufacturer.
- Use for purposes other than those described in the operating manual.

For protection, pay close attention to the following basic safety information when using electrical devices:

- Electric shock
- Fire hazards
- Injury

■ General Safety

⚠ DANGER

- In the event of fire, use a fire extinguisher that is suitable for electrical devices.

⚠ WARNING

- Only use the product as intended.
- Make sure all connections going into and from the product are tight
- Disconnect the product from the battery
 - each time before cleaning and maintenance
 - before a fuse change (only by specialists)
- Do NOT allow water to enter the product
 - Detach all connections.
 - Make sure that no voltage is present on any of the inputs and outputs.
- The product may not be used if the product itself or the connection cable is visibly damaged.
- If the power cable for this product is damaged, it must be replaced by the manufacturer, customer service, or a similarly qualified person in order to prevent safety hazards.
- This product may only be repaired by qualified personnel. DO NOT disassemble or attempt to repair the unit. Inadequate repairs may cause serious hazards.
- This product can be used by children ages 8 years or over, as well as by persons with diminished physical, sensory, or mental capacities, or those who lack experience and knowledge, providing they are supervised or have been taught how to use the product safely and are aware of the resulting risks.
- **Electrical devices are not toys.**
Always keep and use the product out of the reach of children.
- Children must be supervised to ensure that they do not play with the product.

NOTE

- Before start-up, check that the voltage specification on the type plate is the same as that of the power supply.
- Ensure that other objects **cannot** cause a short circuit to the contacts of the product.
- Store the product in a dry and cool place.

■ Safety when connecting the product electronically

⚠ DANGER

Danger of fatal electric shock!

- For installation on boats:
If electrical devices are incorrectly installed on boats, this can lead to corrosion damage on the boat. Have the product installed by a qualified (boat) electrician.
- If you are working on electrical systems, ensure that there is somebody close at hand who can help you in emergencies.

⚠ WARNING

- Make sure that the lead has a sufficient cross-section.
- Lay the cables so that they cannot be damaged by the doors or the bonnet. Crushed cables can lead to serious injury.

⚠ CAUTION

- Lay the cables so that they cannot be tripped over or damaged.

⚠ NOTICE

- Use ductwork or cable ducts if it is necessary to lay cables through metal panels or other panels with sharp edges.
- Do not lay the AC cable and DC cable in the same conduit (empty pipe).
- Do not lay the cables so that they are loose or heavily kinked.
- Firmly secure the cables, contact with each other.
- Do not pull on the cables

■ Charger Safety

⚠ NOTICE

- **NEVER** connect the solar panel to the charger without a service battery connection. The Battery must be connected first.
- Ensure the PV input voltage does not exceed 25 Vdc to prevent permanent damage. Use the Open Circuit Voltage (Voc) at the lowest temperature to make sure the voltage does not exceed this value when connecting panels together.

Battery Safety

WARNING

- Batteries may contain aggressive and corrosive acids. Avoid battery fluid coming into contact with your body. If your skin does come into contact with battery fluid, thoroughly wash that part of your body with water. If you sustain any injuries from the acids, contact a doctor immediately.

CAUTION

- When working on batteries, do not wear any metal objects such as watches or rings. Lead acid batteries can cause short circuits which can cause serious injuries.
- **Danger of explosions!**
Never attempt to charge a frozen or defective battery.
In this situation, place the battery in a frost-free area and wait until the battery has adjusted to the ambient temperature. Then start the charging process.
- Wear goggles and protective clothing when you work on batteries. Do not touch your eyes when working with batteries.
- Do not smoke and ensure that no sparks can arise in the vicinity of the engine or battery.

NOTICE

- Only use rechargeable batteries.
- Use sufficient cable cross sections.
- Protect the positive conduit with a fuse.
- Prevent any metal parts from falling on the battery. This can cause sparks or short circuit the battery and other electrical parts.
- Make sure the polarity is correct when connecting.
- Follow the instructions of the battery manufacturer and those of the manufacturer of the system or vehicle in which the battery is used.
- If you need to remove the battery, disconnect it first from the ground connection. Disconnect all connections from the battery before removing it.

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General Information

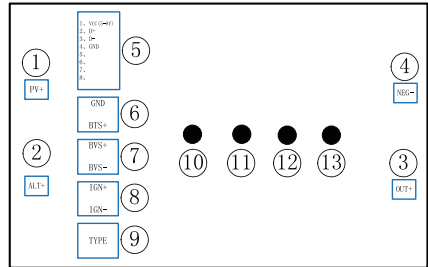
The Renogy DCC50S is a DC to DC on-board battery charger for dual battery system. This multi-stage and multi-input unit is designed to charge a service battery to 100%, either from an alternator or from solar panels, or from a combination of both. While your vehicle's alternator prioritizes your starting battery, this smart charger will allow your solar system to charge your service battery first. It's the smart way to keep yourself fully charged and off-grid longer.

Key Features





- Designed to charge service batteries from two DC inputs—solar panels and alternator
- Built-in Maximum Power Point Tracking (MPPT) to maximize the solar power
- 3-phase charging profile (Bulk, Boost, and Float) ensures your service battery will be accurately charged at the correct voltage levels to 100%
- Built-in Voltage Sensitive Relay (VSR) for easy setup with traditional alternators
- Compatible with smart alternators (with variable output voltage)
- Trickle charges the starting battery via solar panels if the service battery is fully charged
- Isolation of the starting battery and the service battery
- Temperature and voltage compensation features prolong battery life and improve system performance
- Smart Protection Features: battery isolation, over-voltage protection, battery temperature protection, over-current protection, overheat protection, reverse current protection, solar panel and alternator reverse polarity protection
- Compatible with multiple battery types: Sealed, AGM, GEL, Flooded, and Lithium
- Compact with a sturdy design, it was built tough for all conditions

Product Overview

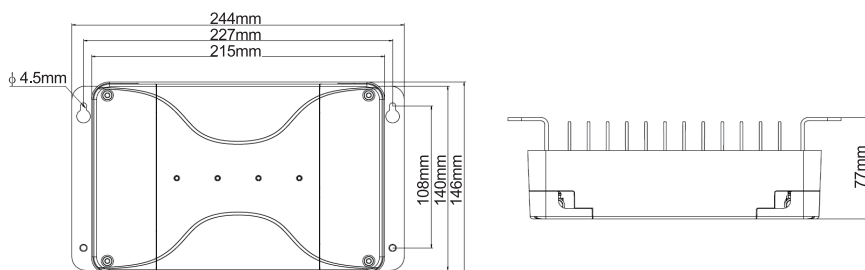
Identification of Parts



Key Parts

#	Labeling	Description
1	PV+	Solar Panel Positive
2	ALT+	Alternator/Starting Battery Positive
3	OUT+	Service battery Positive
4	NEG-	Common Negative Service battery Negative Alternator/Starting Battery Negative Solar Panel Negative
5	RS485	Communication port for data transmission
6	BTS	Battery Temperature Sampling
7	BVS	Battery Voltage Sampling
8	IGN	Ignition Signal Input Smart Alternator: Connect the IGN signal wire to vehicle ignition Traditional Alternator: Not connected
9	TYPE	Battery Type Selection Button
10		Alternator/Charging Indicator
11		Solar Charging Indicator
12		Service Battery Indicator
13		Battery Type Indicator

■ Dimensions



■ Additional Components

Additional components included in the package:



Battery Temperature Sensor

The proper battery charging voltage is important for optimum battery performance and longevity. This Remote Temperature Sensor measures temperature at the battery, allowing the DC-DC charger to use this data for accurate temperature compensation and charge voltage adjustment.

NOTE

No temperature compensation when charging lithium battery.



IGN Signal Wire for Smart Alternator

Connected to the vehicle ignition to trigger the battery charger with on-board voltage.

NOTE

Not connected if using traditional alternator.



RS485 Communication Cable

Data transmission for monitoring and control.

Installation

■ Mount the Battery Charger

⚠ DANGER

- Never mount the product in areas where there is a risk of gas or dust explosion.

⚠ CAUTION

- Ensure a secure stand!
The product must be set up and fastened in such a way that it cannot tip over or fall down.

⚠ NOTICE

- Do not expose the product to any heat source (such as direct sunlight or heating).
Avoid additional heating of the product.
- Set up the product in a dry location protected from splashing water.
- Before drilling any holes, make sure that no electrical cables or other parts of the vehicle can be damaged by drilling, sawing, and filing.

When selecting the installation location, pay attention to the following instructions:

- The battery charger can be installed horizontally as well as vertically.
- The battery charger must be installed in a place that is protected from moisture.
- The battery charger may not be installed in the presence of flammable materials.
- The battery charger may not be installed in a dusty environment.
- The place of installation must be well ventilated. A ventilation system must be available for installations in small, enclosed spaces. The minimum clearance around the battery charger must be at least 5cm.
- The device must be installed on a level and sufficiently sturdy surface.

■ Connect the Battery Charger

WARNING

- Do not reverse the polarity. Reverse polarity of the battery connections can cause injury and damage the device.

CAUTION

- Avoid coming into contact with the battery fluid under any circumstances.
- Batteries with a cell short circuit should not be charged as explosive gases may form due to the battery overheating.

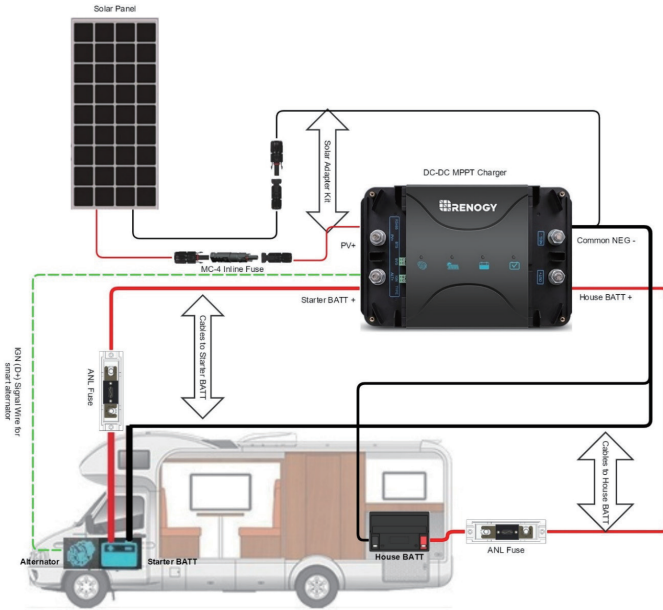
NOTE

- Make sure the battery poles are clean when connecting the terminals.
- Select a sufficient cross-section for the connection cable.
- Use the following cable colors:
 - Red: positive connection
 - Black: negative connection
- Tighten the nuts and bolts with proper torque. Loose connections may cause overheating.

For safety, please always connect ground (NEG.-) first and then connect the service battery positive, starting battery positive and PV positive respectively.

1. Connect a negative power cable to (NEG. -) terminal on the DCC50S, and connect the other end to the negative pole of service battery or directly to the chassis.
2. Connect a positive power cable between (OUT+) terminal on the DCC50S, and the positive pole of service battery.
3. Connect a positive power cable between (ALT+) terminal on the DCC50S, and the positive pole of starting battery.
Optional: Only for system setup with Smart Alternator
Connect the IGN Signal Wire between Ignition Signal Input port on the DCC50S, and the vehicle ignition
4. Connect a cable between terminals marked PV+ on the DCC50S to the PV positive.

■ Typical Setup



■ Cable and Fuse Sizing

Fusing

Product	Rated Current	Vehicle Input Fuse Rating	Charger Output Fuse Rating
DCC50S	50A	75A	65A

Cable sizing

Product	Cable Length (m)	Cable Length (ft)	Recommended Cable Size
DCC50S	1-5	3-16	6 AWG
	5-9	16-30	4 AWG

Operation

LED Indicators

Solar Charging Indicator

Color	Status	Description
Red	ON	Bulk charge (MPPT)
	Slow Flashing	Boost charge
	Single Flashing	Float charge
	Fast Flashing	Equalizing charge
	Double Flashing	Current-limit charge
	OFF	Not charging

Service Battery Indicator

Color	Status	Description
Green	ON	Battery Full
Yellow	ON	Battery voltage normal
Red	ON	Battery undervoltage
	Slow Flashing	Battery over discharged
	Fast Flashing	Battery over voltage/ over temperature

Alternator/Charging Indicator

Color	Status	Description
Red	ON	Alternator is charging the service battery
	Slow Flashing	PV is charging the starting battery
	OFF	Not charging

Battery Type Indicator

Color	Status	Description
Green	ON	SLA (Default)
Yellow	ON	GEL
Red	ON	FLD
Blue	ON	LI
White	ON	DEBUG

■ Charging Logic

1. Connect alternator with starting battery and service battery (No solar panel, or night time)

- 1.1 The DCC50S battery charger will connect or disconnect the service battery according to the starting battery voltage.

Alternator Type	Starting Battery Voltage	
	Cut-in	Cut-off
Traditional Alternator	> 13.2V, for 15 seconds	< 12.7V
Smart Alternator	> 12.0V, for 15 seconds	< 11.5V

- 1.2 The DCC50S will stop charging if the alternator input voltage is higher than 16.5V, and recover to charge when the voltage is lower than 15.5V.

- 1.3 The maximum alternator charging current is 50A, with overcurrent protection.

2. Connect solar panel, starting battery and service battery (Engine not running).

- 2.1 The solar input charges the service battery as priority. If the service battery voltage is lower than the boost voltage setting, solar panel will only charge the service battery.

- 2.2 If the service battery is in float charge stage, the starting battery will be charged at the same time. The charging voltage is limited at 13.8V. The charging amperage is limited at 25A.

- 2.3 After charging the starting battery for 1 minute, it will disconnect for 30 seconds and check the starting battery voltage. It will continue to charge starting battery if the voltage is lower than 12.7V and will stop charging if the voltage is higher than 13.2V.

- 2.4 Solar charging will be triggered if the PV input voltage is higher than 15V for 10 seconds.

- 2.5 The DCC50S will stop charging if the PV input voltage is higher than 25.5V, and recover to charge when the voltage is lower than 24.5V.

- 2.6 The maximum solar charging current is 50A, with overcurrent protection.

3. Connect solar panel, alternator with starting battery and service battery.

- 3.1 The DCC50S will always take as much power from the solar panel as it can before supplementing that power from alternator input, up to the rated charging current.

- 3.2 If the solar input power is able to keep the service battery at constant voltage charge stage, alternator wouldn't charge the service battery.

- 3.3 If the MPPT charging current from solar input is not able to keep the service battery at constant voltage charge stage, alternator will cut in to charge the service battery. In this case, the maximum charging current from either side is limited at 25A, while the maximum combined charging current is still 50A.

4. Operating Temperature

- 4.1 The DCC50S will lower the output power when its internal temperature is in the range from 65 °C to 80 °C. It will stop charging when the temperature is higher than 80 °C, and recover to charge when the temperature is lower than 60 °C.
- 4.2 If the service battery type is set to lead-acid, the DCC50S will stop charging the service battery when its temperature is lower than -36 °C, and recover to charge when it's higher than -34 °C.
- 4.3 If the service battery type is set to lithium, the DCC50S will stop charging the service battery when its temperature is lower than 1 °C, and recover to charge when it's higher than 3 °C.

■ Solar Charge Algorithm

MPPT Technology

The DCC50S utilizes Maximum Power Point Tracking technology to extract maximum power from the solar module(s). The tracking algorithm is fully automatic and does not require user adjustment. MPPT technology will track the array's maximum power point voltage (V_{mp}) as it varies with weather conditions, ensuring that the maximum power is harvested from the array throughout the course of the day.

Current Boost

In many cases, the MPPT charger will "boost" up the current in the solar system. The current does not come out of thin air. Instead, the power generated in the solar panels is the same power that is transmitted into the battery bank. Power is the product of Voltage (V) x Amperage (A). Therefore, assuming 100% efficiency:

Power In = Power Out

Volts In • Amps In = Volts out • Amps out

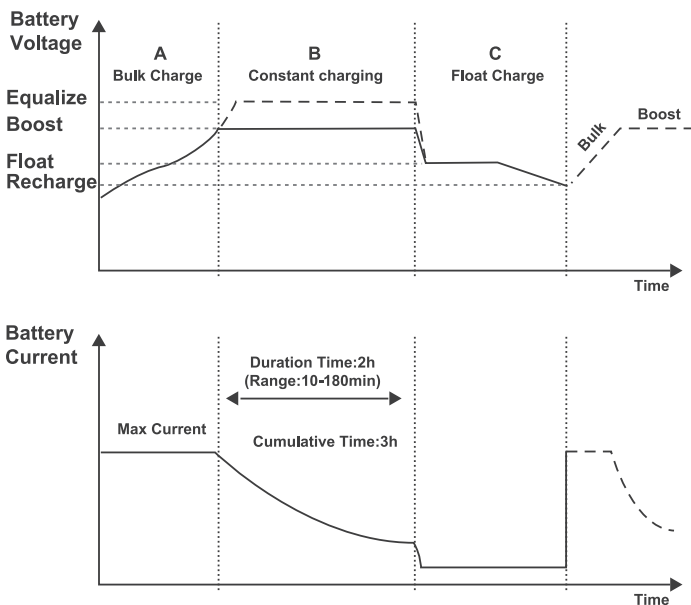
Although MPPT chargers are not 100% efficient, they are very close at about 92-95% efficient. Therefore, when the user has a solar system whose V_{mp} is greater than the battery bank voltage, then that potential difference is proportional to the current boost. The voltage generated at the solar module needs to be stepped down to a rate that could charge the battery in a stable fashion by which the amperage is boosted accordingly to the drop. It is entirely possible to have a solar module generate 8 amps going into the charger and likewise have the charger send 10 amps to the battery bank. This is the essence of the MPPT chargers and their advantage over traditional chargers. In traditional chargers, that stepped down voltage amount is wasted because the charger algorithm can only dissipate it as heat. The following demonstrates a graphical point regarding the output of MPPT technology.

Limiting Effectiveness

Temperature is a huge enemy of solar modules. As the environmental temperature increases, the operating voltage (V_{mp}) is reduced and limits the power generation of the solar module. Despite the effectiveness of MPPT technology, the charging algorithm will possibly not have much to work with and therefore there is an inevitable decrease in performance. In this scenario, it would be preferred to have modules with higher nominal voltage, so that despite the drop in performance of the panel, the battery is still receiving a current boost because of the proportional drop in module voltage.

Four Charging Stages

The Rover MPPT charge controller has a 4-stage battery charging algorithm for a rapid, efficient, and safe battery charging. They include: Bulk Charge, Boost Charge, Float Charge, and Equalization.



Bulk Charge: This algorithm is used for day to day charging. It uses 100% of available solar power to recharge the battery and is equivalent to constant current. In this stage the battery voltage has not yet reached constant voltage (Equalize or Boost), the charger operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging).

Constant Charging: When the battery reaches the constant voltage set point, the charger will start to operate in constant charging mode, where it is no longer MPPT charging. The current will drop gradually. This has two stages, equalize and boost, and they are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

➤ **Boost Charge:** Boost stage maintains a charge for 2 hours by default.

Float Charge: After the constant voltage stage, the charger will reduce the battery voltage to a float voltage set point. Once the battery is fully charged, there will be no more chemical reactions and all the charge current would turn into heat or gas. Because of this, the charger will reduce the voltage charge to smaller quantity, while lightly charging the battery. The purpose for this is to offset the power consumption while maintaining a full battery storage capacity. In the event that a load drawn from the battery exceeds the charge current, the charger will no longer be able to maintain the battery to a Float set point and the charger will end the float charge stage and refer back to bulk charging.

⚠ **Equalization:** Is carried out every 28 days of the month. It is intentional overcharging of the battery for a controlled period of time. Certain types of batteries benefit from periodic equalizing charge, which can stir the electrolyte, balance battery voltage and complete chemical reaction. Equalizing charge increases the battery voltage, higher than the standard complement voltage, which gasifies the battery electrolyte.

WARNING

Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high of equalizing charge or for too long may cause damage. Please carefully review the specific requirements of the battery used in the system.

Troubleshooting

CAUTION

Do not open the device. You risk exposing yourself to an electric shock by doing this.

NOTE

If you have detailed questions about the battery charger, please contact our customer support (addresses on the back of the instruction manual).

Solar Charging Indicator	Troubleshoot
OFF	Ensure that the Solar Panel is not being shaded (by a tree etc.) Verify the Solar Panel voltage is higher than 15V threshold with a multi-meter and check the electric connections.
Service Battery Indicator	
Solid Red	Turn off any loads connected to the battery and recharge battery to a good SOC
Fast Flashing Red	<p>Verify the service battery being used is a 12V unit.</p> <p>Ensure the place for battery installation is well ventilated. Avoid additional heating of the battery.</p> <p>Disconnect all loads and chargers from the battery and allow battery temperature to decrease to operational specifications</p>
Slow Flashing Red	<p>Check fuses are intact and properly connected.</p> <p>Check the cable connections.</p> <p>Turn off any loads connected to the battery and recharge battery to a good SOC.</p>
Alternator Indicator	
OFF	<p>Ensure the engine is running.</p> <p>If using a traditional alternator, verify the alternator input voltage is higher than 13.2V threshold with a multi-meter.</p> <p>If using a smart alternator, verify the alternator input voltage is higher than 12V threshold with a multi-meter. Also verify the IGN Signal Wire is connected.</p> <p>Check fuses are intact and properly connected.</p> <p>Check the cable connections.</p>





Technical Specification

Product	DCC50S
System Voltage	12VDC
Battery Voltage Range	9~16VDC
Maximum Charging Current	50A
Battery Type	SLA, GEL, FLD, LI
Service Battery Charging Mode	MPPT
Charging Efficiency	Up to 97%
Max. Solar Input Voltage	25V
Max. Solar Input Power	660W
Alternator Input Voltage	Traditional Alternator: 13.2-16VDC Smart Alternator (Euro 6): 12-16VDC
Max. Alternator Input Power	660W
Temp. Compensation Coefficient	-3mV/°C/2V
Self-consumption	60mA
Operating Temperature Range	-35°C~65°C / -31°F~149°F
Storage Temperature Range	-40°C~80°C / -40°F~176°F
Humidity Range	0%~95% (NC)
Dimensions	234*146*77 mm / 9.2 x 5.8 x 3.0 in
Weight	1.42 Kg / 3.13 lbs
Terminal Size	M8
Communication Protocol	RS485
Grounding	Common Negative

Battery Charging Parameters

Battery Type	SLA	GEL	FLD	LI
Over voltage disconnect	16V	16V	16V	16.4V
Over voltage recover	15V	15V	15V	15V
Boost charge voltage	14.4V	14.2V	14.6V	14.4V
Float charge voltage	13.8V	13.8V	13.8V	--
Equalization Voltage	14.6V	--	14.8V	--
Boost return voltage	13.2V	13.2V	13.2V	13.2V
Under voltage warning	12V	12V	12V	12.1V
Under voltage recover	12.2V	12.2V	12.2V	12.3V
Low voltage disconnect	11.1V	11.1V	11.1V	11.1V
Low voltage recover	12.6V	12.6V	12.6V	12.6V
Boost duration	2 hours	2 hours	2 hours	--
Equalization interval	30 days	--	30 days	--
Equalization duration	2 hours	--	2 hours	--

Renogy reserves the right to change
the contents of this manual without notice.

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