RENOGY

ROVER ELITE

Maximum Power Point Tracking Solar Charge Controller

20A │ 40A

Version 1.1

⚠ Important Safety Instructions ⚠

Please save these instructions.

This manual contains important safety, installation, and operating instructions for the charge controller. The following symbols are used throughout the manual to indicate potentially dangerous conditions or important safety information.

WARNING	Indicates a potentially dangerous condition. Use extreme caution when performing this task
CAUTION	Indicates a critical procedure for safe and proper operation of the controller
NOTE	Indicates a procedure or function that is important to the safe and proper operation of the controller

■ General Safety Information

- Read all of the instructions and cautions in the manual before beginning the installation.

- There are no serviceable parts for this controller. Do **NOT** disassemble or attempt to repair the controller.

- Do **NOT** allow water to enter the controller.

- Make sure all connections going into and from the controller are tight.

■ Charge Controller Safety

- **NEVER** connect the solar panel array to the controller without a battery. Battery must be connected first.

- Ensure input voltage does not exceed 100 VDC to prevent permanent damage. Use the Open Circuit Voltage (Voc) to make sure the voltage does not exceed this value when connecting panels together.

■ Battery Safety

- Use only sealed lead-acid, flooded, gel or lithium batteries which **must be deep cycle.**

- Explosive battery gases may be present while charging. Be certain there is enough ventilation to release the gases.

- Be careful when working with large lead acid batteries. Wear eye protection and have fresh water available in case there is contact with the battery acid.

- Carefully read battery manuals before operation.

- Do **NOT** let the positive (+) and negative (-) terminals of the battery touch each other.

- Recycle battery when it is replaced.

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

- Equalization is carried out only for non-sealed / vented/ flooded / wet cell lead acid batteries.

- Do **NOT** equalize VRLA type AGM / Gel / Lithium cell batteries UNLESS permitted by battery manufacturer.

- Default charging parameters in Li mode are programmed for 12.8V Lithium Iron Phosphate (LFP) Battery only. Before using Rover Elite to charge other types of lithium battery, set the parameters according to the suggestions from battery manufacturer.

| WARNING | Connect battery terminals to the charge controller BEFORE connecting the solar panel(s) to the charge controller. NEVER connect solar panels to charge controller until the battery is connected.

Once equalization is active in the battery charging, it will not exit this stage unless there is adequate charging current from the solar panel. There should be NO load on the batteries when in equalization charging stage. |

# Table of Contents

General Information

The Rover Elite series MPPT charge controllers give you the best charging efficiency for countless 12V or 24V off-grid solar applications. Compatible with an assortment of batteries, including Lithium, the Rover Elite MPPT maximizes your solar charging energy through its smart tracking algorithm ensuring the most efficient to your battery. Additionally, the Rover Elite MPPT is equipped with multiple battery, controller, and solar protections giving you peace of mind and an optimized system you can trust.

Key Features

- 12V /24V Auto System Recognition

- Backlit LCD displaying system information and identifying error codes

- Advanced MPPT Technology with up to 99% high tracking efficiency, 98% conversion efficiency, and Lithium-reawakening feature

- 4 Pre-Set deep cycle battery ready: Gel, Flooded, Lithium-Iron Phosphate (12.8V), and Sealed/AGM

- Multiple Electronic Protections: over-charging, over-discharging, reverse polarity, and over-temperature
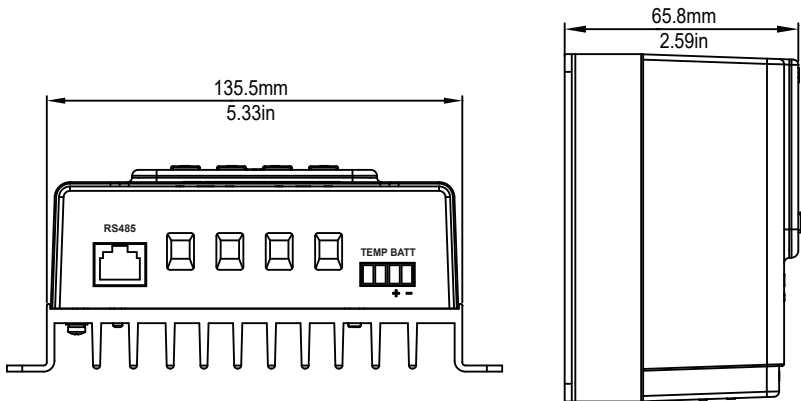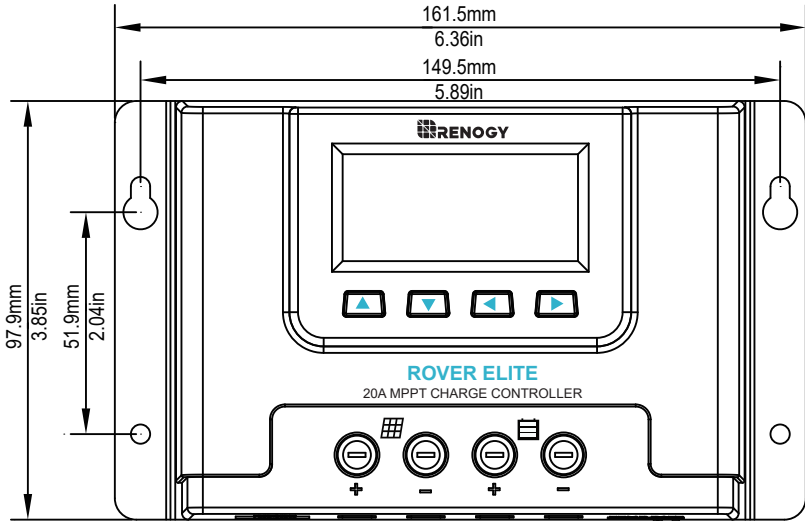
Product Overview

Identification of Parts
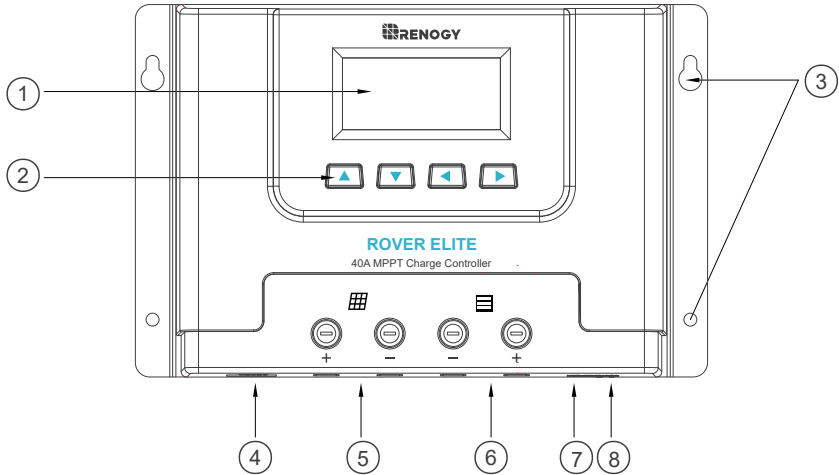
NOTE **Rover Elite 40A**

Key Parts

1. LCD Screen

2. Operating Keys

3. Mounting Holes

4. RS485 Communication port

5. PV Terminals

6. Battery Terminals

7. Remote Temperature Sensor Port
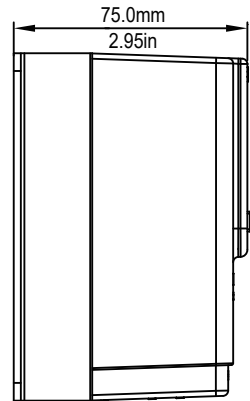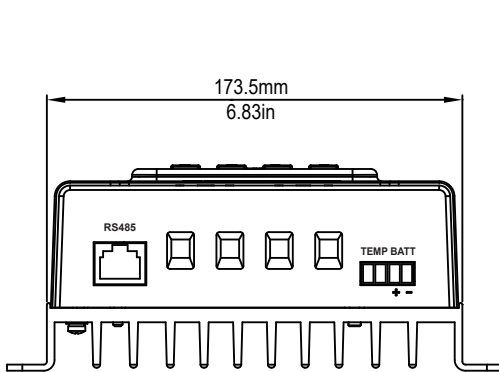
8. Battery Voltage Sensor Port

Dimensions

161.5mm
6.36in

149.5mm
5.89in

97.9mm
3.85in

51.9mm
2.04in

RENOGY

ROVER ELITE
20A MPPT CHARGE CONTROLLER

135.5mm
5.33in

RS485

TEMP BATT
+ -

65.8mm
2.59in

Rover Elite 20

Dimensions are in mm [inches]

199.5mm
7.85in

187.5mm
7.38in

129.9mm
5.11in

89.9mm
3.54in

RENOGY

ROVER ELITE
40A MPPT CHARGE CONTROLLER

75.0mm
2.95in

173.5mm
6.83in

RS485

TEMP BATT
+ −
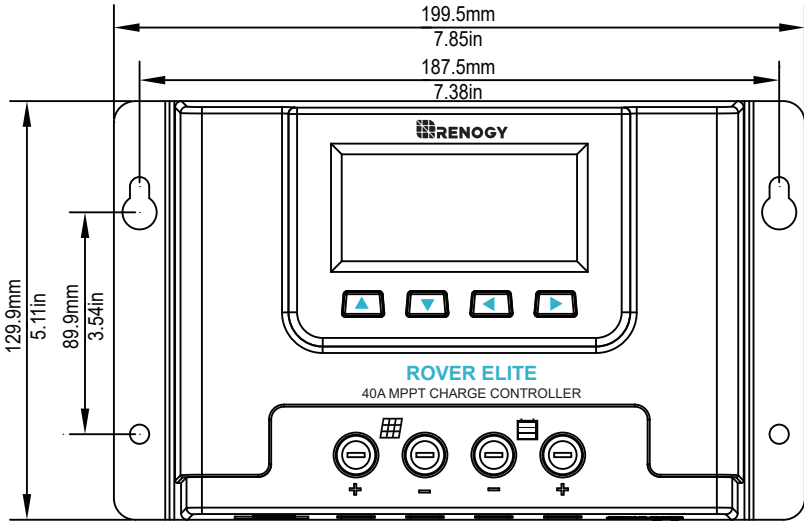
Rover Elite 40

Additional Components

■ **Additional components included in the package:**

Remote Temperature Sensor:

This sensor measures the temperature at the battery and uses this data for very accurate temperature compensation. The sensor is supplied with a 9.8ft cable length that connects to the charge controller. Simply connect the cable and adhere the sensor on top or the side of the battery to record ambient temperature around the battery.

> NOTE   Lithium batteries do not have temperature compensation.

Installation

Recommended tools to have before installation:

Screwdriver	Multi-Meter

WARNING   **Connect battery terminal wires to the charge controller FIRST then connect the solar panel(s) to the charge controller. NEVER connect solar panel to charge controller before the battery.**

CAUTION   **Do not over tighten the screw terminals. This could potentially break the piece that holds the wire to the charge controller.**
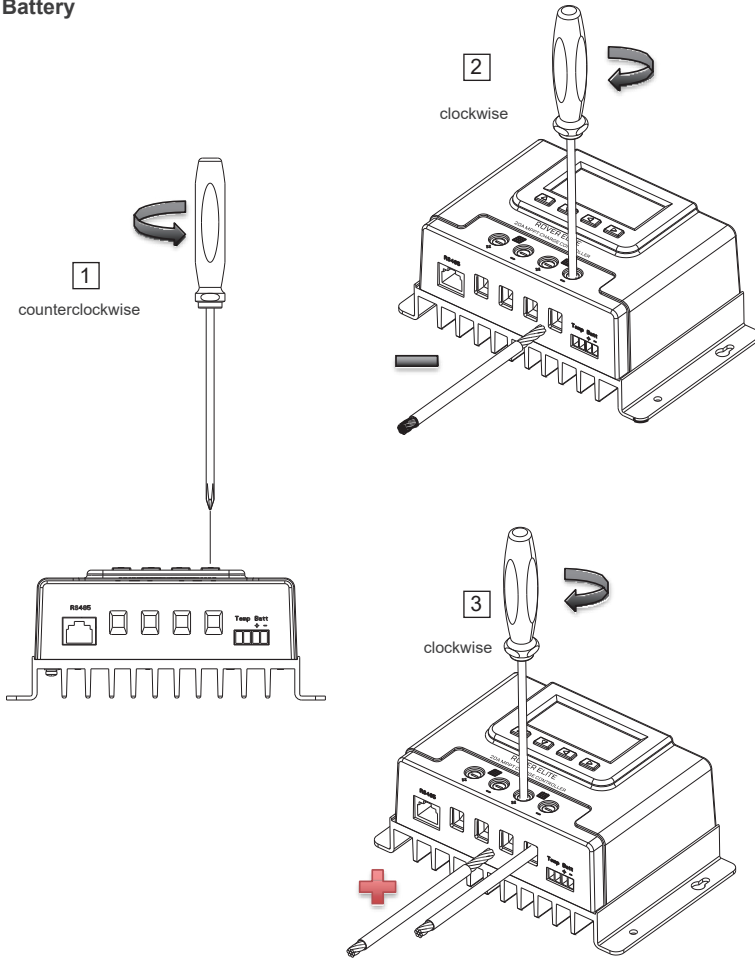
CAUTION   **Refer to the technical specifications for max wire sizes on the controller and for the maximum amperage going through wires.**

You are now ready to begin connecting your battery to your charge controller.
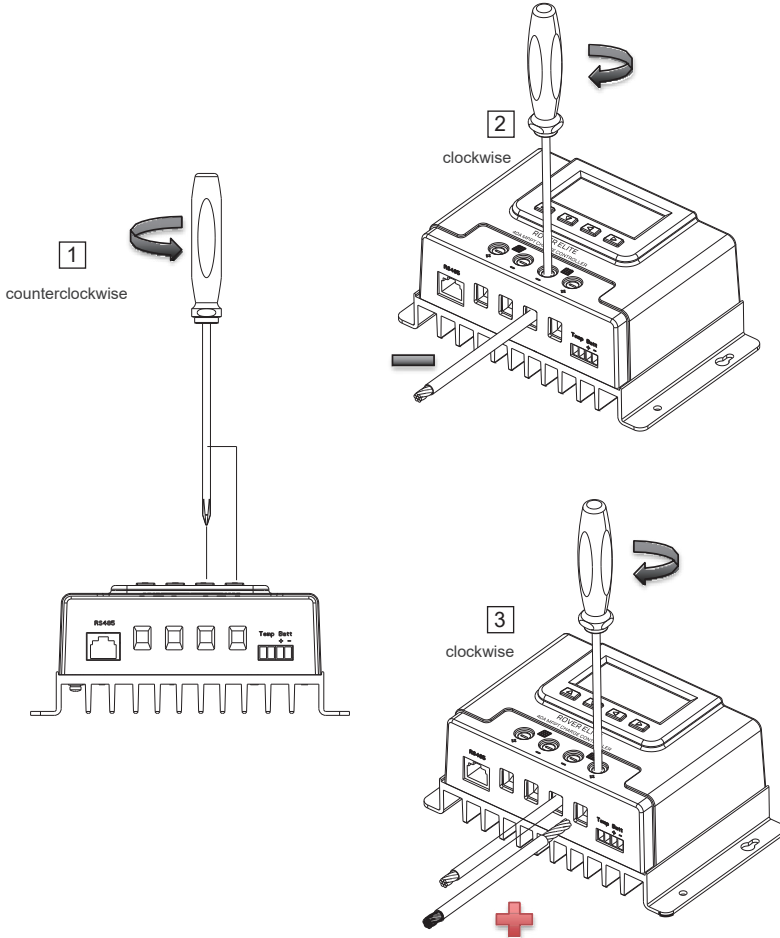
Connect the Charge Controller

■ **Battery**

1 counterclockwise

2 clockwise

3 clockwise

Rover Elite 20A

Battery

2

clockwise

1

counterclockwise

3

clockwise

Rover Elite 40A

Solar Panels

1

clockwise

1

clockwise

2

clockwise

2

clockwise
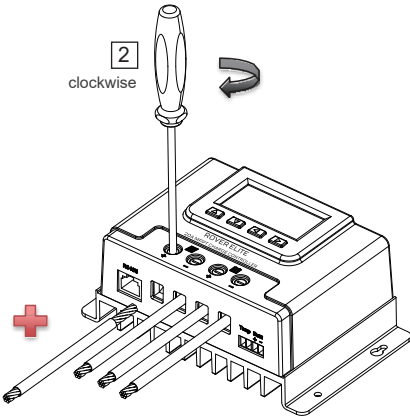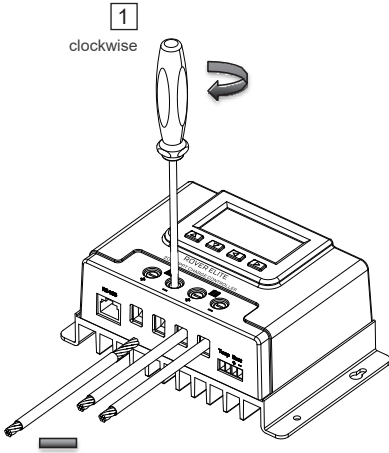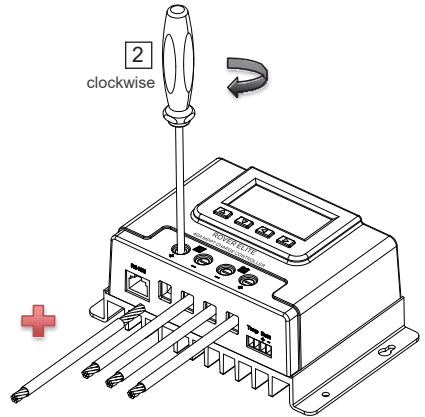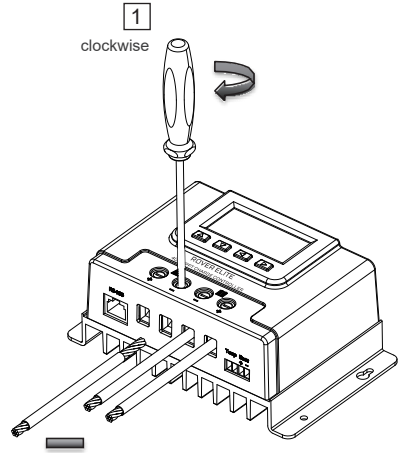
Rover Elite 20A

Rover Elite 40A

■ Temperature Sensor

Rover Elite 20A
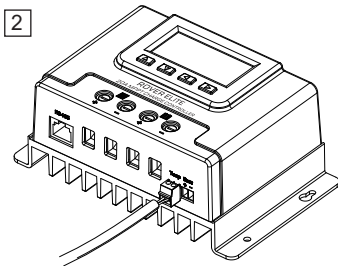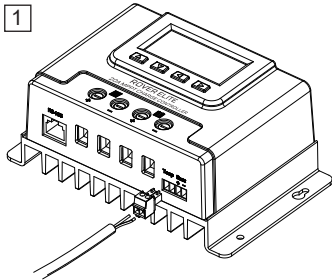
Rover Elite 40A

1

1

2

2

3   Place the sensor close to the battery
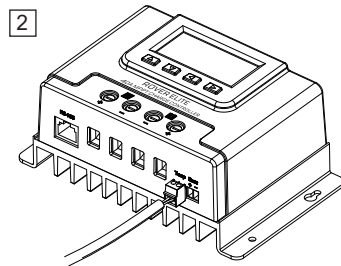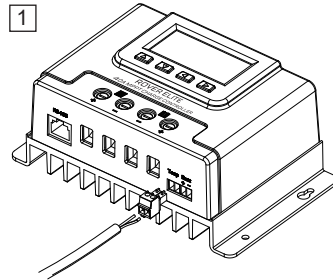
3   Place the sensor close to the battery

NOTE   Do NOT place the Temperature Sensor lug inside the battery cell.

Mount the Charge Controller

WARNING   **Never install the controller in a sealed enclosure with flooded batteries. Gas can accumulate and there is a risk of explosion.**

1. Choose Mounting Location—place the controller on a vertical surface protected from direct sunlight, high temperatures, and water. Make sure there is good ventilation.

2. Check for Clearance—verify that there is sufficient room to run wires, as well as clearance above and below the controller for ventilation. The clearance should be at least 6 inches (150mm).

3. Mark Holes

4. Drill Holes

5. Secure the charge controller.
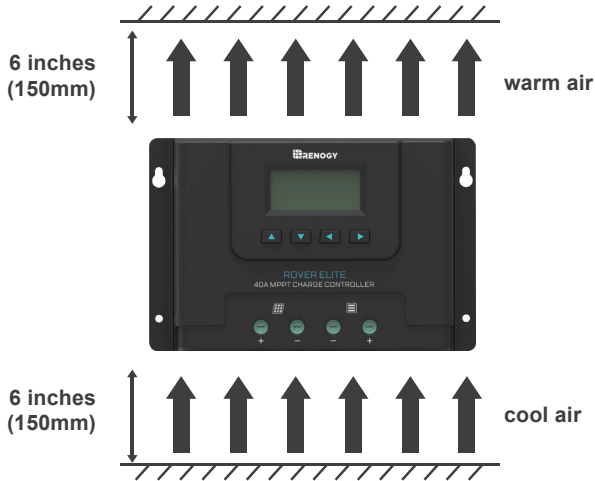
Cable Sizing		

Distance Wiring		
Cable Total Length One-Way Distance	< 10ft	10ft-20ft
Cable Size (AWG)	14-12AWG	12-10AWG

NEC Maximum Current for different Copper Wire Sizes								
AWG	16	14	12	10	8	6	4	2	0
Max. Current	10A	15A	20A	30A	55A	75A	95A	130A	170A

NOTE The solar controller should be installed as near the battery as possible to avoid efficiency loss.

NOTE When the connections are completed correctly, the solar controller will turn on and begin working automatically.

Operation

Rover Elite is very simple to use. Simply connect the batteries, and the controller will automatically determine the battery voltage. The controller comes equipped with an LCD screen and 4 buttons to maneuver though the menus.

User Interface

Main Display

Main Screen

MPPT
BATT **12.3**v 12V

Error Code

⚠ **EO**

Ambient Temperature

40.0 ℃ 12V

Solar Panel Voltage

PV **90.6**v 12V

Charging Current

BATT **00.0**ᴬ 12V

Battery Voltage

BATT **12.3**v 12V

Accumulated AH

21 kWh 12V
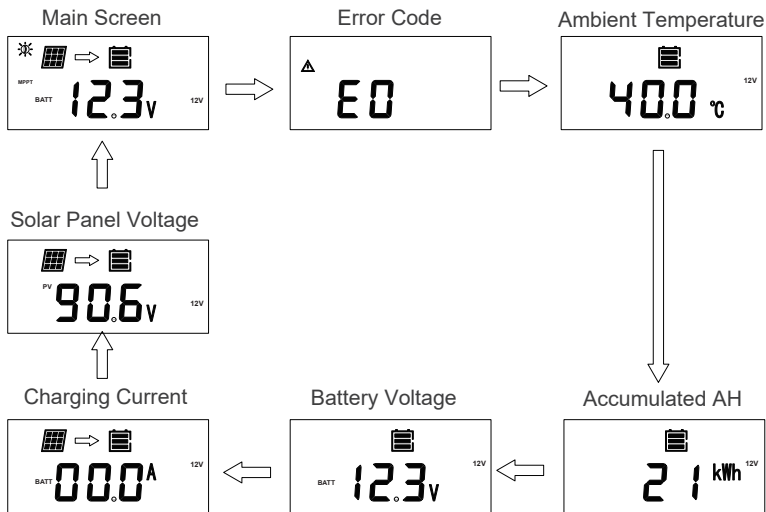
NOTE   The Error Code will not display unless there is an error. The menu will normally go from ambient temperature back to the main screen

LCD Indicators

solar panel · charging · battery

Daytime/Nighttime mode

abnormality

charging stage

MPPT · BOOST · FLOAT · EQUA

PV · BATT

AkWh · V°C%

12V · 24V

parameter value · unit · system voltage
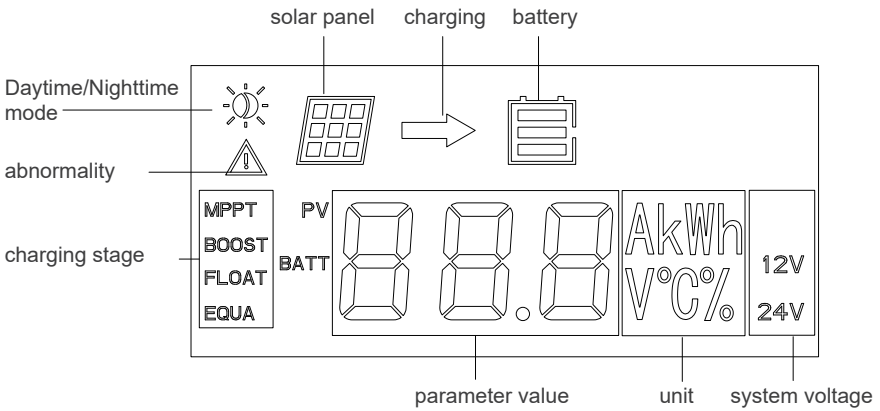
change the parameters
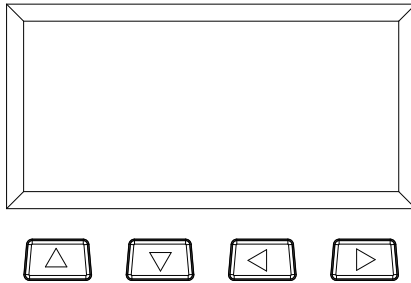
△	Cycles forward through the menu
▽	Cycles backwards through the menu
◁	Return to previous page in Parameter Setting Mode
▷	Hold to Enter Parameter Setting Mode Hold to Save Parameter Mode

1. Clear overall power generation to 0 KWh

The user can switch to the KWh screen by pressing the up/down button. In order to reset the current power value to 0 KWh, the user needs to long press the right arrow for three seconds, and then short press the "Up" arrow to clear the value when the power value flashes.

2. Selecting Battery Type

> **WARNING**
> Incorrect battery type setting may damage your battery. Please check your battery manufacturer's specifications to when selecting battery type.

> **NOTE**
> If selecting Lithium and wanting to set Battery Voltage or Charge Parameters, go to "3. Select lithium Battery Voltage and Charge Voltage," later in this table.
> SLD is referring to AGM battery

In the screen showing the battery voltage, hold down RIGHT ARROW for approximately 3-5 seconds before the screen flashes the current battery type.

Once flashing, use the UP or DOWN ARROW to select the proper battery type and then hold down RIGHT ARROW again to lock in the selected battery type.
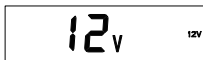
| SLd | GEL | FLd | LI |

## 3. Select Lithium Battery Voltage and Charge Voltage

In the screen showing the battery voltage, hold down RIGHT ARROW for approximately 3-5 seconds before the screen flashes the current battery type. Once flashing, use the UP or DOWN ARROW to highlight LI

Once LI is flashing, select RIGHT ARROW again and a 12V will flash

If you want 12V LI charging, then select the RIGHT ARROW again to move to LI Boost Charging Voltage. If you want a 24V LI charging, then you select UP or DOWN ARROW to move from 12V to 24V LI Charging. Once you confirm your LI Charging (12V or 24V) press RIGHT ARROW to move to LI Boost Charging Voltage.
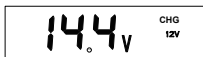
Press UP or DOWN ARROW to change the Boost Voltage. The default setting is 14.4V and the user can set it in the range 12.0~16.0V, in .2 increments. Once done, hold RIGHT ARROW to confirm the selection.

NOTE The above settings are ONLY available for LI setting

MPPT Technology

The MPPT Charge Controller 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'smaximum power point voltage (Vmp) 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 charge controller 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 controllers are not 100% efficient, they are very close at about 92-95% efficient. Therefore, when the user has a solar system whose Vmp 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 charge controller and likewise have the charge controller send 10 amps to the battery bank. This is the essence of the MPPT charge controllers and their advantage over traditional charge controllers. In traditional charge controllers, that stepped down voltage amount is wasted because the controller algorithm can only dissipate it as heat. The following demonstrates a graphical point regarding the output of MPPT technology.
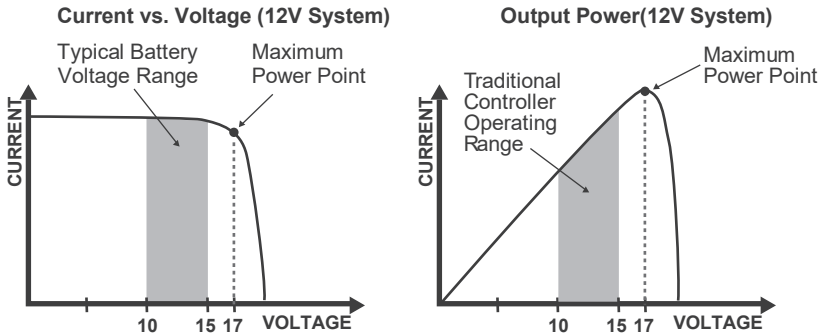
Limiting Effectiveness

Temperature is a huge enemy of solar modules. As the environmental temperature increases, the operating voltage (Vmp) 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 Elite 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.

Battery Voltage

A
Bulk Charge

B
Constant charging

C
Float Charge

Equalize
Boost

Boost

Float
Recharge

Bulk

Time

Battery Current

Duration Time:2h
(Range:10-180min)

Max Current

Cumulative Time:3h

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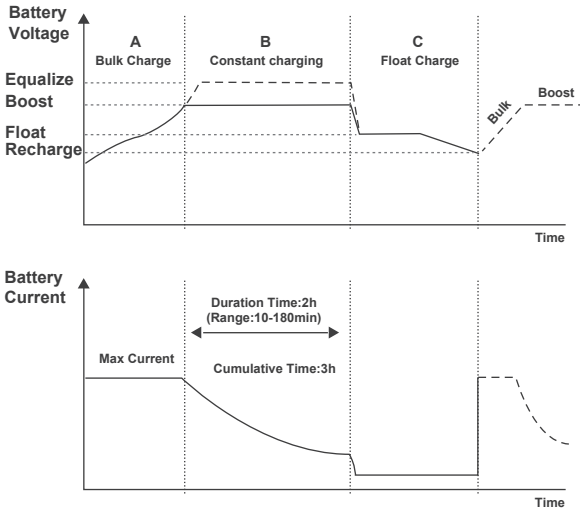
Bulk Charge: This algorithm is used for day to day charging. It uses 100% of available solar power to recharge the battery and is equivalent to constant current. In this stage the battery voltage has not yet reached constant voltage (Equalize or Boost), the controller operates in constant current mode,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

Constant Charging: When the battery reaches the constant voltage set point, the controller 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. The user can adjust the constant time and preset value of boost per their demand.

Float Charge: After the constant voltage stage, the controller 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 charge controller 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 controller will no longer be able to maintain the battery to a Float set point and the controller 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   Once equalization is active in the battery charging, it will not exit this stage unless there is adequate charging current from the solar panel. There should be NO load on the batteries when in equalization charging stage.

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.

WARNING   Equalization may increase battery voltage to a level damaging to sensitive DC loads. Ensure that all load allowable input voltages are greater than the equalizing charging set point voltage.

Lithium Battery Activation

The Rover Elite MPPT charge controller has a reactivation feature to awaken a sleeping lithium battery. The protection circuit of lithium battery will typically turn the battery off and make it unusable if over-discharged. This can happen when storing a lithium battery pack in a discharged state for any length of time as self-discharge would gradually deplete the remaining charge. Without the wake-up feature to reactivate and recharge batteries, these batteries would become unserviceable and the packs would be discarded. The Rover Elite will apply a small charge current to activate the protection circuit and if a correct cell voltage can be reached, it starts a normal charge.

The image on the right shows the activation interface of lithium battery.
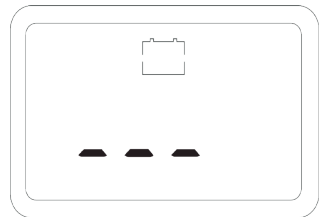
CAUTION

When using the Rover Elite to charge a 24V lithium battery bank, set the system voltage to 24V instead of auto recognition. To change the system voltage, press the Up or Down buttons then long press Right Arrow to save the selected system voltage.

Troubleshooting

Error Codes / Troubleshooting

If the Rover Elite is not functioning properly, it will display an error code not normally seen in the interface display. Depending on the code, you may attempt to troubleshoot the error to commence normal system operation.

Error Code	Meaning	Troubleshoot
E0	No Error	System behaving normally, no action needed. You will not see this error code.
E01	Over-discharged battery	Use a multi-meter to get a reading of the battery voltage in volts DC to validate error code. Battery is very low. Disconnect any loads to the battery and let the solar system charge the battery backup. If the battery voltage is low it may be in open battery protection mode, which is a Rover Elite Protection.
E02	Battery Over-charging	Use a multi-meter to get a reading of the battery voltage in volts DC to validate error code. Battery is charging very high and approached 16VDC. Disconnect any external chargers and isolate which charger is overcharging battery. Eliminate from system.
E06	Controller internals over temperature	Make sure controller is in ventilated area and that the appropriate wire sizes are used to connect to and from the controller. This may be creating heating issues inside the controller. The controller will resume normal operation upon cooling down.
E07	Controller is over-temperature	Record the ambient temperature found in the controller screen. Make sure the controller is not placed in direct line of heating sources or that it is over-heating due to over-sun exposure. The controller will resume normal operation upon cooling down.
E10	PV Over-voltage	The controller has a maximum dc voltage input of 100DC. If connecting your panels in series, make sure the reading does not go over this limit. Check with a multi-meter before connecting to the controller to ensure you're within this specification. This might require using less panels.
E13	PV reverse-polarity	The solar panel wires are connected in reverse polarity. Verify using a multi-meter to make sure your voltage reading has the correct polarity with a positive number in volts DC.
E14	Battery reverse polarity	The battery cables are reversed. Use a multi-meter to make sure your voltage reading has the correct polarity (Red to positive and Black to negative) with a positive number in volts DC. If the number is negative, switch the positive and negative battery cables in the battery terminal of the Rover Elite.

Protection Behaviors / Fixes

If the Rover Elite is not functioning properly and is not displaying an error code, it may be under-going an automatic protection function. This does not mean your Rover Elite is defective, but it requires some troubleshooting to commence normal system operation.

Behavior	Protective Function / Fixes
The battery is connected to the controller, but the controller is not turning on	**Reverse Battery Polarity Protection** The Rover Elite needs a correct battery connection to startup. This might mean that the battery cables are reversed. Use a multi-meter to make sure your voltage reading has the correct polarity (Red to positive and Black to negative) with a positive number in volts DC. If the number is negative, switch the positive and negative battery cables in the battery terminal of the Rover Elite.
The battery and solar panels are connected to the controller, but the controller shows nighttime.	**Solar Panels Reverse Polarity Protection** The solar panel wires are connected in reverse polarity. Verify using a multi-meter to make sure your voltage reading has the correct polarity with a positive number in volts DC. In some cases, with the battery and solar panels both connected in reverse polarity, the controller will not turn on, but the controller is not damaged. Simply correct the reverse polarity to continue normal operation.
When connecting solar panels to the controller it sounds an alarm	**Solar Panels Over voltage** The controller has a maximum dc voltage input of 100DC. If connecting your panels in series, make sure the reading does not go over this limit. Check with a multi-meter before connecting to the controller to ensure you're within this specification. This might require using less panels to make sure you are within the Rover Elite specified input.
My system stopped charging	**E02 Battery Overcharging** If the battery was charging fine and stopped, it could be because it was being overcharged by the solar source if not an external source. You might see an E02 display or perhaps an empty screen. Make sure your charging sources are not charging at 16VDC or check to see if your batteries are being equalized, an intentional over-charging, that might be triggering this error.
Current Limiting / Temperature Protection	**Current Limiting / E06 / E07** The max amp charging from the Rover Elite will be the respective amp rating. The Rover Elite will current limit any excess amperage than the rating of the controller, however, be cautious as this might create excess heat and put the controller in an internal/external temperature protection mode which will halt the controller performance until it can cool down and function normally again.
The charge controller believes the battery is over-discharged, but it is not	**Open Battery Protection Mode** Whether connecting the system for the first time or operating it for a while, you may experience an E01 error if the controller does not actually detect a battery and assumes it to be under-discharged. This can happen in an accidental line break or failure to connect it correctly the first time. This will not damage the controller, but you will need to make sure the battery voltage is the same as the battery terminal voltage or check for continuity. Once fixed, normal operation should continue.

Maintenance

For best controller performance, it is recommended that these tasks be performed from time to time.

1.Check wiring going into the charge controller and make sure there is no wire damage or wear.

2.Tighten all terminals and inspect any loose, broken, or burnt up connections

3.Occasionally clean the case using a damp cloth

Technical Specifications

Electrical Parameters		
Model	**RCC20RVRE-G1**	**RCC40RVRE-G1**
Nominal system voltage	12V/24V Auto Recognition	
Rated Battery Current	20A	40A
Max. Battery Voltage	32V	
Max Solar Input Voltage	100 VDC	
Max. Solar Input Power	12V @ 260W 24V @ 520W	12V @ 520W 24V @ 1040W
Self-Consumption	≤1.5W	
Temp. Compensation	-3mV/℃/2V, excludes LI	

General		
Model	**RCC20RVRE-G1**	**RCC40RVRE-G1**
Battery Types	SLD/AGM, GEL, FLD, LI	
Grounding Type	Common Negative	
Terminal Size	20-6 AWG	
Operating Temperature	-20℃ ~ 45℃ / -4°F ~ 113°F	
Storage Temperature	-40℃ ~ 80℃ / -40°F ~ 176°F	
Humidity Range	≤95% (NC)	
Dimensions	161.5 * 97.9 * 66.5 mm 6.36 * 3.85 * 2.62 in	199.5*130*76.7 mm 7.85*5.12*3.02 in
Weight	0.75 kg 1.65 lbs	1.364 kg 3.01 lbs
Enclosure	IP32	
Communication	RS485	
Certification	FCC Part 15 Class B; CE; RoHS; RCM	

Battery Charging Parameters

Battery	SLD/AGM	GEL	FLOODED	LI(LFP)
High Voltage Disconnect	16 V	16 V	16 V	16 V
Over Voltage Reconnect	15 V	15 V	15 V	15 V
Equalization Voltage	-----	-----	14.8V	-----
Boost Charge Voltage	14.6 V	14.2 V	14.6 V	14.4V User:12.0V-16V
Float Charge Voltage	13.8 V	13.8 V	13.8 V	-----
Boost Return Voltage	13.2 V	13.2 V	13.2 V	13.2 V
Over-discharge Recover	12.6 V	12.6 V	12.6 V	12.6 V
Over-discharge Warning	11.1 V	11.1 V	11.1 V	11.1 V
Equalization Interva	-----	-----	30 Days	-----
Equalization Duration	-----	-----	2 hours	-----
Boost Duration	2 hours	2 hours	2 hours	-----

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
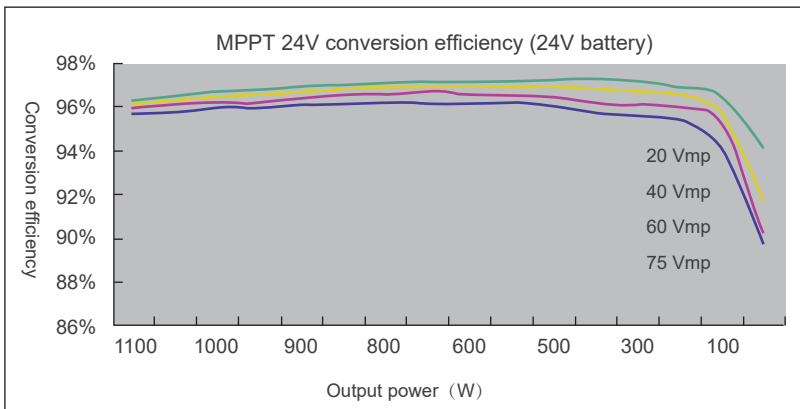(2) this device must accept any interference received, including interference that may cause undesired operation.

Illumination Intensity: 1000W/ m²   **Temp 25** ℃

1.12 Volt System Conversion Efficiency

MPPT 12V conversion efficiency (12V battery)

2. 24 Volt System Conversion Efficiency

MPPT 24V conversion efficiency (24V battery)
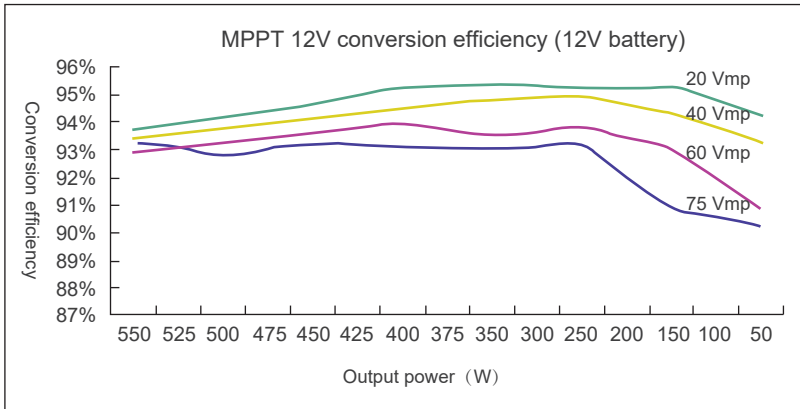
RENOGY

US
- 📍 2775 E Philadelphia St, Ontario, CA 91761, USA
- 📞 909-287-7111
- 🌐 www.renogy.com
- ✉ support@renogy.com

CN
- 📍 苏州高新区科技城培源路1号5号楼-4
- 📞 400-6636-695
- 🌐 https://www.renogy.cn
- ✉ support@renogy.cn

JP
- 🌐 https://www.renogy.jp
- ✉ supportjp@renogy.com

CA
- 🌐 https://ca.renogy.com
- ✉ supportca@renogy.com

AU
- 🌐 https://au.renogy.com
- ✉ supportau@renogy.com

UK
- 🌐 https://uk.renogy.com
- ✉ supportuk@renogy.com

DE
- 🌐 https://de.renogy.com
- ✉ supportde@renogy.com