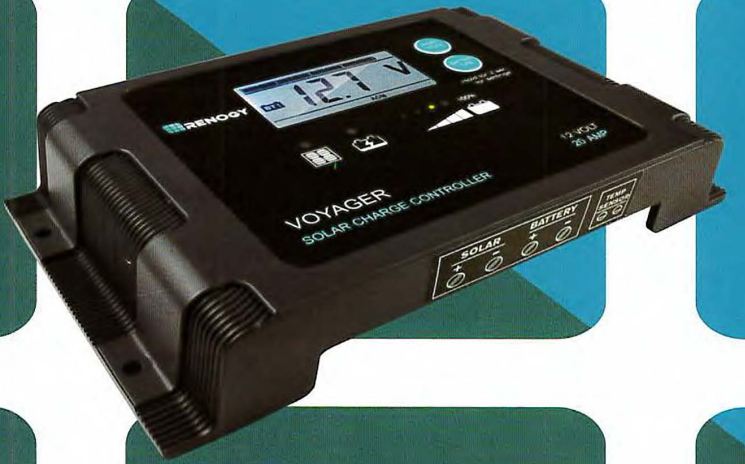
The Traveler Series™: *Voyager*

20A PWM
Waterproof PWM Controller w/ LCD Displayand LED Bar



RENOGY

Version 2.0

⚠ 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:

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.
- Make sure all connections going into and from the controller are tight. There may be sparks when making connections, therefore, make sure there are not flammable materials or gases near installation.

Charge Controller Safety

- **NEVER** connect the solar panel array to the controller without a battery. Battery must be connected first. This may cause a dangerous occurrence where the controller would experience a high open circuit voltage at the terminals.
- Ensure input voltage does not exceed **25 VDC** to prevent permanent damage. Use the Open Circuit (Voc) to make sure the voltage does not exceed this value when connecting panels together in series.

Battery Safety

- Lead-acid, Lithium-ion, LiFePO4, LTO batteries can be dangerous. Ensure no sparks or flames are present when working near batteries. Refer to battery manufacturer's specific charging rate setting. Do NOT charge improper battery type.
- Never attempt to charge a damaged battery, frozen battery, or non-rechargeable battery.
- Do **NOT** let the positive (+) and negative (-) terminals of the battery touch each other.
- Use only sealed lead-acid, flooded, or gel 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.
- 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.
- If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flush eye running with cold water for at least 10 minutes and get medical attention immediately.

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.

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General Information

The Voyager is an advanced 5-stage PWM charge controller suitable for 12V solar system applications. It features an intuitive LCD displaying information such as charging current and battery voltage, as well as an error code system to quickly diagnose potential faults. The Voyager is completely waterproof and suitable for charging up to 7 different battery types, including lithium-ion.

Key Features

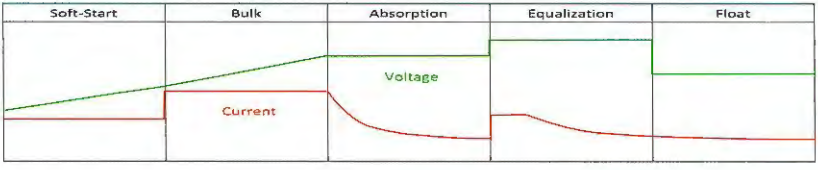
- Smart PWM technology, high efficiency.
- Backlit LCD displaying system operating information and error codes.
- LED Bar for easy to read charge state and battery information.
- 7 Battery Type Compatible: Lithium-ion, LiFePO4, LTO, Gel, AGM, Flooded, and Calcium.
- Waterproof design, suitable for indoor or outdoor use.
- 5 Stage PWM charging: Soft-Start, Bulk, Absorption. Float, and Equalization.
- Protection against: reverse polarity and battery connection, reverse current from battery to solar panel protection at night, over-temperature, and over-voltage.

PWM Technology

The Voyager utilizes Pulse Width Modulation (PWM) technology for battery charging. Battery charging is a current based process so controlling the current will control the battery voltage. For the most accurate return of capacity, and for the prevention of excessive gassing pressure, the battery is required to be controlled by specified voltage regulation set points for Absorption, Float, and Equalization charging stages. The charge controller uses automatic duty cycle conversion, creating pulses of current to charge the battery. The duty cycle is proportional to the difference between the sensed battery voltage and the specified voltage regulation set point. Once the battery reached the specified voltage range, pulse current charging mode allows the battery to react and allows for an acceptable rate of charge for the battery level .

Five Charging Stages

The Voyager has a 5-stage battery charging algorithm for a rapid, efficient, and safe battery charging. They include: Soft Charge, Bulk Charge, Absorption Charge, Float Charge, and Equalization.



Soft Charge:

When batteries suffer an over-discharge, the controller will softly ramp the battery voltage up to 10V.

Bulk Charge:

Maximum battery charging until batteries rise to Absorption Level.

Absorption Charge:

Constant voltage charging and battery is over 85% for lead acid batteries. Lithium-ion, LiFePO4, and LTO batteries will close fully charging after absorption stage, the absorption level will reach 12.6V for Lithium-ion, 14.4V for LiFePO4, and 14.0V for LTO batteries.

Equalization:

Only for Flooded or Calcium batteries drained below 11.5V will automatically run this stage and bring the internal cells as an equal state and fully complement the loss of capacity. Lithium-ion, LiFePO4, LTO, Gel and AGM do not undergo this stage.

Float Charge:

Battery is fully charged and maintained at a safe level. A fully charged lead acid battery (Gel, AGM, Flooded) has a voltage more than 13.6V; if the lead acid battery drops to 12.8V at float charge, it will return to Bulk Charge. Lithium-ion, LiFePO4, and LTO have NO float charge. If a Lithium-to Bulk Charge. If a LiFePO4 or LTO battery voltage drops to 13.4V after Absorption Charge, it will return to Bulk Charge.

WARNING **Incorrect battery type setting may damage your battery.**

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.

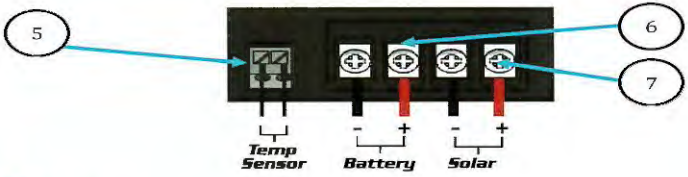
Charging Stages							
Soft-Charge	Output battery voltage is 3V-10VDC, Current = half of the solar panel current						
Bulk	10VDC to 14VDC Current = Rated Charge Current						
Absorption @ 25°C	Constant voltage until current drops to 0.75/1.0 amps and holds for 30s. Minimum 2 hours charging time and maximum 4 hours time out If charging current < 0.2A, stage will end.						
	Li-ion 12.6V	LiFePO4 14.4V	LTO 14.0V	GEL 14.1V	AGM 14.4V	WET 14.7V	CALCIUM 14.9V
Equalization	Only Wet (Flooded) or Calcium Batteries will equalize, 2 hours maximum Wet (Flooded) = if discharge below 11.5V OR every 28 days charging period. Calcium = every charging cycle						
	Wet (Flooded) 15.5V				Calcium 15.5V		
Float	Li-ion N/A	LiFePO4 N/A	LTO N/A	GEL 13.6V	AGM 13.6V	WET 13.6V	CALCIUM 13.6V
Under Voltage Recharging	Li-ion 12.0V	LiFePO4 13.4V	LTO 13.4V	GEL 12.8V	AGM 12.8V	WET 12.8V	CALCIUM 12.8V

Identification of Parts

(Front)



(Back)



Key Parts

1. Backlit LCD
2. AMP/VOLT Button
3. BATTERY TYPE Button
4. LED Bar
5. Remote Temperature Sensor Port (optional accessory)
6. Battery Terminals
7. Solar Terminals

Installation

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-torque or over tighten the screw terminals. This could potentially break the piece that holds the wire to the charge controller.

Refer to the technical specifications for max wire sizes on the controller and for the maximum amperage going through wires.

Mounting Recommendations:

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

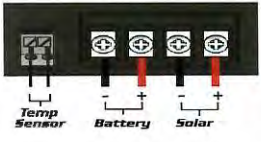
The Voyager is designed for vertical mounting on a wall.

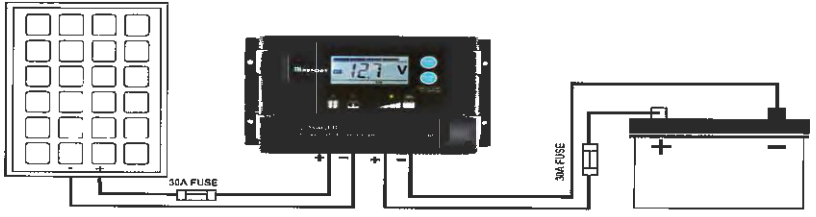
1. **Choose Mounting Location**—place the controller on a vertical surface protected from direct sunlight, high temperatures, and water. Make sure there is good ventilation.
2. **Check for Clearance**—verify that there is sufficient room to run wires, as well as clearance above and below the controller for ventilation. The clearance should be at least 6 inches (150mm).
3. **Mark Holes**
4. **Drill Holes**
5. **Secure the charge controller.**

Wiring

The Voyager has 4 terminals which are clearly labeled as "solar" or "battery".

(Back)





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

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

When the controller powers on, the Voyager will run a self-quality check mode and automatically display the figures on LCD before going into auto work.

8.8.8	Self-test starts, digital meter segments test
r0.8	Software version test
12.0	Rated voltage Test
20.0	Rated Current Test
25	External battery temperature sensor test (if connected)

Selecting Battery Type

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

The Voyager provides 7 battery types for selection: Lithium-ion, LiFePO4, LTO, Gel, AGM, Flooded, and Calcium Battery.

Press and hold the BATTERY TYPE Button for 3 seconds to go into battery selection mode. Press the BATTERY TYPE Button until the desired battery is displayed. After a few seconds, the highlighted battery type will automatically be selected.

NOTE

Lithium ion batteries shown in the LCD indicate different types shown below:

- Lithium Cobalt Oxide LiCoO2 (LCO) battery
- Lithium Manganese Oxide LiMn2O4 (LMQ) battery
- Lithium Nickel Manganese Cobalt Oxide LiNiMnCoO2 (NMC) battery
- Lithium Nickel Cobalt Aluminum Oxide LiNiCoAlo2 (NCA) battery

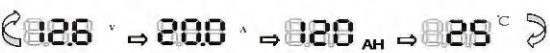
LiFePO4 battery indicates Lithium-iron Phosphate or LFP Battery

LTO Battery indicates Lithium Titanate Oxidized, Li4Ti5O12 Battery

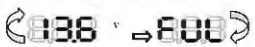
AMP/VOLT Button

Pressing the AMP/VOLT Button will sequence through the following display parameters: Battery Voltage, Charging Current, Charged Capacity (Amp-hour), and Battery Temperature (if external temperature sensor connected)

Normal Sequencing Display



The following is an alternative display voltage for when the battery is Fully charged



LED Display



LED Behavior

LED Indicators						
						
LED Color	RED	BLUE	RED	ORANGE	GREEN	GREEN
Soft-start charging	ON	FLASH	ON	OFF	OFF	OFF
Bulk charging (BV < 11.5V)	ON	ON	ON	OFF	OFF	OFF
Bulk charging (11.5V < BV < 12.5V)	ON	ON	OFF	ON	OFF	OFF
Bulk charging (BV > 12.5V)	ON	ON	OFF	OFF	ON	OFF
Absorption charging	ON	ON	OFF	OFF	ON	OFF
Float charging	ON	OFF	OFF	OFF	OFF	ON
Solar weak (Dawn or Dusk)	FLASH	OFF	According to BV			OFF
In the night	OFF	OFF				OFF

NOTE **BV = Battery Voltage**

LED Error Behavior

LED Indicators								
							Error Code	Screen
LED Color	RED	BLUE	RED	ORANGE	GREEN	GREEN		
Solar good, BV < 3V	ON	OFF	FLASH	OFF	OFF	OFF	'b01'	FLASH
Solar good battery reversed	ON	OFF	FLASH	OFF	OFF	OFF	'b02'	FLASH
Solar good, battery over-voltage	ON	OFF	FLASH	FLASH	FLASH	OFF	'b03'	FLASH
Solar off, battery over-voltage	OFF	OFF	FLASH	FLASH	FLASH	OFF	'b03'	FLASH
Solar good, battery over 65°C	ON	OFF	FLASH	FLASH	FLASH	OFF	'b04'	FLASH
Battery good, solar reversed	FLASH	OFF	According to BV			OFF	'PO1'	FLASH
Battery good, solar over-voltage	FLASH	OFF				OFF	'PO2'	FLASH
Over Temperature							'otP'	FLASH

Protection

System Status Troubleshooting

Description	Troubleshoot
Battery over voltage	Use a multi-meter to check the voltage of the battery. Make sure the battery voltage is not exceeding the rated specification of the charge controller. Disconnect battery.
Charge controller does not charge during daytime when the sun is shining on the solar panels.	Confirm that there is a tight and correct connection from the battery bank to the charge controller and the solar panels to the charge controller. Use a multi-meter to check if the polarity of the solar modules have been reversed on the charge controller's solar terminals. Look for error codes

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

Fusing

Fusing is a recommendation in PV systems to provide a safety measure for connections going from panel to controller and controller to battery. Remember to always use the recommended wire gauge size based on the PV system and the controller.

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

Technical Specifications

Electrical Parameters	
Model Rating	20A
Normal Battery Voltage	12V
Maximum Solar Voltage(OCV)	26V
Maximum Battery Voltage	17V
Rated Charging Current	20A
Battery Start Charging Voltage	3V
Electrical Protection and Feature	Spark-free protection.
	Reverse polarity solar and battery connection
	Reverse current from battery to solar panel protection at night
	Over temperature protection with derating charging current
	Transient overvoltage protection, at the solar input and battery output protects against surge voltage
Grounding	Common Negative
EMC Conformity	FCC Part-15 class B compliant; EN55022:2010
Self-consumption	< 8mA

Mechanical Parameters	
Dimensions	L6.38 x W3.82 x H1.34 inches
Weight	0.88 lbs.
Mounting	Vertical Wall Mounting
Ingress Protection Rating	IP65
Maximum Terminals Wire Size	10AWG(5mm²)
Terminals Screw Torque	13 lbf·in
Operating Temperature	-40°F to +140°F
Meter Operating Temperature	-4°F to +140°F
Storage Temperature Range	-40°F to +185°F
Temp. Comp. Coefficient	-24mV / °C
Temp. Comp. Range	-4°F ~ 122°F
Operating Humidity	100% (No condensation)

Dimensions





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