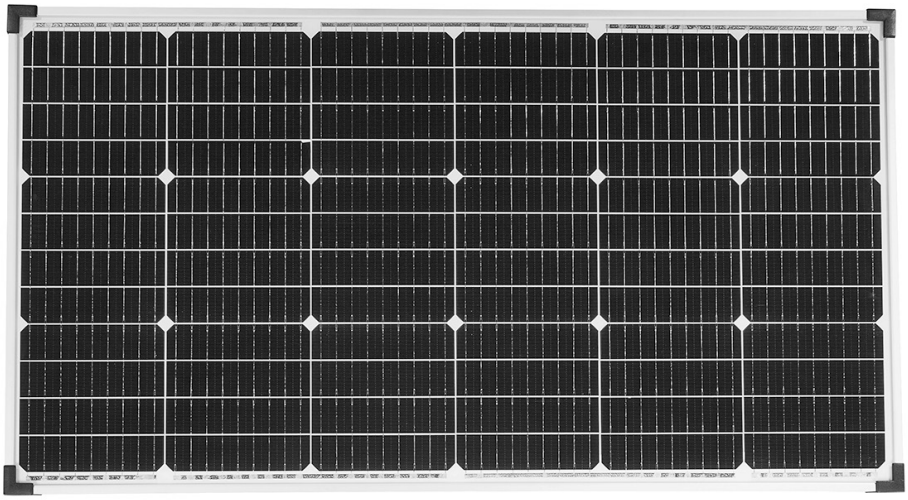
Owner's Manual & Safety Instructions

Save This Manual Keep this manual for the safety warnings and precautions, assembly, operating, inspection, maintenance and cleaning procedures. Write the product's date code in the back of the manual near the assembly diagram (or month and year of purchase if product has no number). Keep this manual and the receipt in a safe and dry place for future reference. 25e

THUNDERBOLT™ SOLAR

70735

100 WATT SOLAR PANEL KIT



Visit our website at: https://www.harborfreight.com
Email our technical support at: productsupport@harborfreight.com

When unpacking, make sure that the product is intact and undamaged. If any parts are missing or broken, please call 1-800-444-3353 as soon as possible.

Diagrams within this manual may not be drawn proportionally. Due to continuing improvements, actual product may differ slightly from the product described herein. Tools required for assembly and service may not be included.

⚠WARNING

Read this material before using this product. Failure to do so can result in serious injury. SAVE THIS MANUAL.

Table of Contents

THUNDERBOLT™ SOLAR

WARNING SYMBOLS AND DEFINITIONS	
⚠	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE CAUTION	Addresses practices not related to personal injury.

IMPORTANT SAFETY INSTRUCTIONS

⚠ WARNING

Read all safety warnings and all instructions.
Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury.

Save all warnings and instructions for future reference.

READ ALL INSTRUCTIONS

Installation Precautions

1. **Exercise special caution if working on roof or another high location.** Keep proper footing and balance at all times. Follow ladder supplier's precautions whenever working near or on a ladder.
2. **Install all sensitive electrical components (including wiring connections, regulator, and battery) inside a weatherproof enclosure to prevent electric shock.**
3. **Do not wire multiple panels in series.** If you need to connect two or more solar panels together, this work must be done by a qualified electrician unless they are connected through a regulator.
4. **Do not stand on or otherwise apply pressure to panel.**
5. This solar panel kit is not designed for tie-in to a grid. Only a licensed electrician and a licensed building contractor can safely design and implement a grid tie-in system. Any grid tie-in system must meet all applicable building and electrical codes, and must meet standards established by the area power company. Improper grid tie-in can result in electrocution, fire, and other serious personal injury and property damage. An incorrectly installed grid tie-in system can cause feedback voltage, resulting in electrocution of electrical utility workers.

6. **Handle solar panel with care, edges may be sharp.**

7. **Install components with enough space to allow proper cooling.**

8. **This product may occasionally produce more current and/or voltage than its rated output. Increase output ratings by 25% when determining component required voltage and amperage ratings.** Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may apply.

9. Panel must be connected using UL listed outdoor rated wire of the correct thickness (gauge) for the amperage rating and length (see warning number 9 also). Follow the guidelines in the chart below:

Current in Amps	Maximum Length				
	5'	10'	15'	20'	25'
0-5	18				
6-7	18				16
8	18			16	
10	18		16		
11-12					14
15			14		12
18	18	16			
20			14	12	10
22-24			12		
30	16	14	10		
40		12	10		8
50	14				
100	12	10	6		4
150	10	8	4		2
200	8	6			

Minimum Wire Gauge

10. Keep bystanders out of the area during installation.

11. Do not attach panel to battery or power grid without proper regulator, inverter, and/or charge controller.

12. Install and use according to applicable National Electrical Code (NEC) standards.

13. This panel is not rated for use as fire-resistant roofing. If installing on a roof, install only over a fire resistant roof covering rated for the application.

14. Verify that installation surface has no hidden utility lines before drilling or driving screws.

15. Install only according to these instructions. Improper installation can create hazards.

16. Do not leave this solar panel attached to an automobile or trailer while it is in motion.

17. Handle panel with care. Glass may break or a sharp edge may be exposed during movement.

18. Keep installation area clean and well lit.

19. Install out of reach of children.

20. Do not install when tired or when under the influence of drugs or medication.

21. The warnings, precautions, and instructions discussed in this instruction manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are factors which cannot be built into this product, but must be supplied by the operator.

Battery Precautions

1. **Wear splash-resistant ANSI-approved safety goggles and electrically insulated gloves while working near batteries.**

2. **Use an appropriate charge controller whenever connected to battery.**

3. Charge, store, and maintain batteries according to supplier's instructions.

Service Precautions

1. **Before service, maintenance, or cleaning:**
   a. **Dry solar panels and outdoor wiring thoroughly while wearing electrically insulated gloves.**
   b. **Cover all solar panels with an opaque cover, such as a blanket.**
   c. **Disconnect all solar panels.**
   d. **Disconnect all batteries.**

2. **Do not service during rain, fog, or any other wet/humid weather.**

3. **Do not stand on or otherwise apply pressure to panel.**

4. Do not allow children to play with or near this or electrical components.

5. 5. Maintain product labels and nameplates. These carry important safety information. If unreadable or missing, contact Harbor Freight Tools for a replacement.

Solar Panel Precautions

1. Inspect at least monthly; do not use if damaged, parts are loose, water is found inside the housing, electrical insulation is cracked or damaged, or connections are loose.
2. Install only according to these instructions. Improper installation can create hazards.
3. Use as intended only.
4. Use of an attachment not recommended or sold by the Solar Panel manufacturer may result in a risk of fire, electric shock, or injury to persons.
5. To reduce risk of damage to cable, pull by plug rather than cable when disconnecting Solar Panel.
6. Do not operate Solar Panel with damaged cable or plug – replace the cable or plug immediately.
7. Do not operate Solar Panel if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified serviceman.
8. Use with 12 volt batteries only.
9. Do not disassemble Solar Panel; take it to a qualified technician when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.
10. Do not focus light on panel.

SAVE THESE INSTRUCTIONS.

Solar Panel Specifications

Solar Panel Rated Output	19 VDC / 5.3 A / 100 W
Solar Panel Open Circuit Voltage	24.5V Max.
Solar Panel Short Circuit Current	5.7A

Note: Performance will vary depending on temperature, brightness and time of sun exposure. Summer production will be higher than in the winter. Bright sunny days will generate higher output than cloudy days.

Charge Controller Specifications

Charge Controller Rated Current	10A
Charge Controller System Voltage	12V/24V Auto
Maximum Input Voltage	50V
Float Voltage	13.8V / 27.6V
Low Voltage Disconnect	10.8V / 21.6V
Low Voltage Reset	12.6V / 25.2V
Absorb Voltage	Sealed: 14.4V / 28.8V GEL: 14.2V / 28.4V Flooded: 14.6V / 29.2V
High Voltage Disconnect	16.0V / 32.0V
High Voltage Reset	15.5V / 31.0V
No Load Loss	10.5mA / 12.5mA
Charge/Discharge Voltage Drop	<0.3V / <0.18V
USB Output	5V / 1.5A
Working Temperature	-20°C - 50°C
Storage Temperature	-30°C - 60°C
Humidity	10% - 90% (NC)

Set Up Instructions

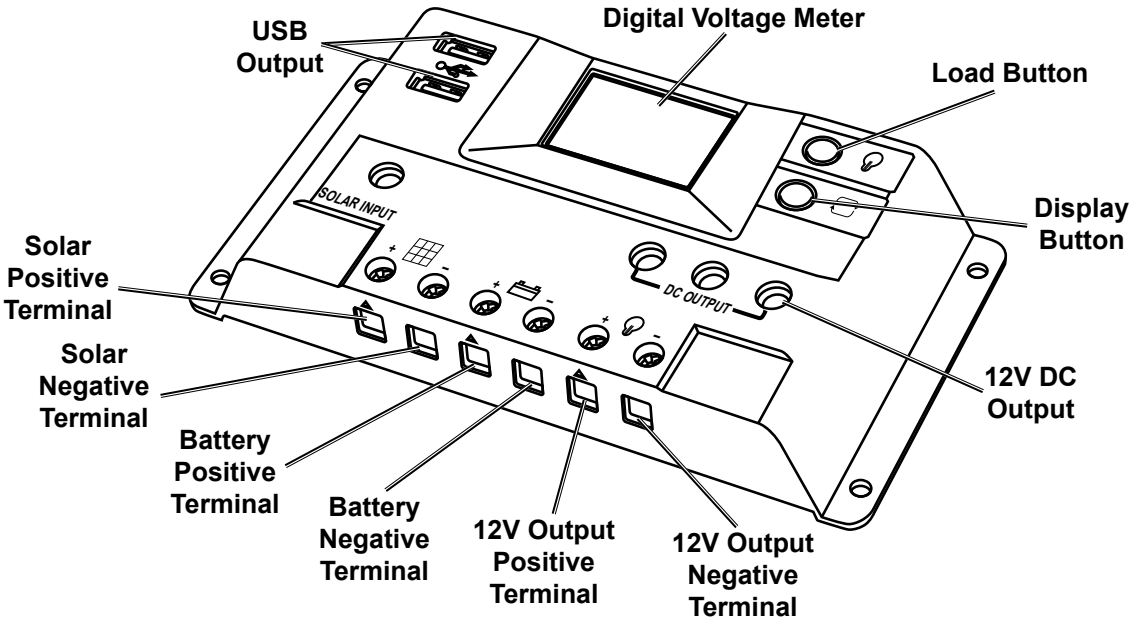
Read the ENTIRE IMPORTANT SAFETY INSTRUCTIONS section at the beginning of this manual including all text under subheadings therein before set up or use of this product.

⚠WARNING

TO PREVENT SERIOUS INJURY FROM ACCIDENTAL OPERATION:
Make sure that the Power Switch/Trigger is in the off-position and unplug the tool from its electrical outlet before performing any procedure in this section.

Note: For additional information regarding the parts listed in the following pages, refer to the Assembly Diagram near the end of this manual.

Functions



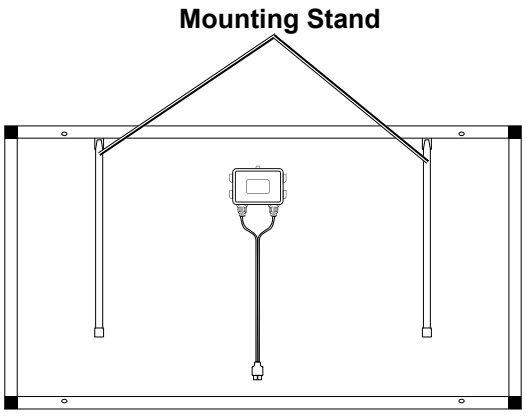
Location

Locate Solar Panel where it will receive full, unobstructed sunlight, especially during midday. Nearby trees or tall plants will drop debris, requiring the panel to be cleaned more frequently.

WARNING! TO PREVENT SERIOUS INJURY: Setup location for Solar Panel must be inaccessible to children to prevent electric shock or cuts from broken glass. Build a childproof enclosure if needed.

Temporary Setup

1. Pull out Mounting Stands on rear of panel. Avoid temporary setup on windy or stormy days. Angle face of Solar Panel towards sun.
2. If setting up Solar Panel temporarily and charging is complete, disconnect Solar Panel. Store Solar Panel in a dry, indoor area out of reach of children.



Permanent Mounting

Permanent installations must be weatherproof and meet all building and electrical codes and standards for your area.

1. Select mounting surface for solar panel brackets that will allow Solar Panel(s) to face towards true south at correct vertical angle for your latitude as much as possible.

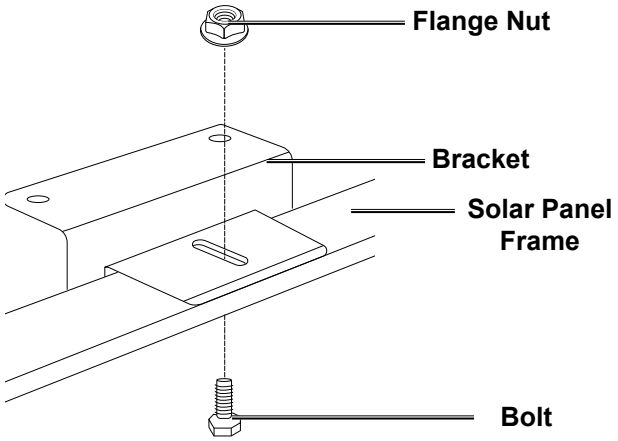
2. Angle face of Solar Panel Frame toward true south according to chart that follows:

Latitude	Solar Panel Angle
0-4°	10°
5-20°	Latitude + 5°
21-45°	Latitude + 10°
46-64°	Latitude + 15°
65° or more	80°

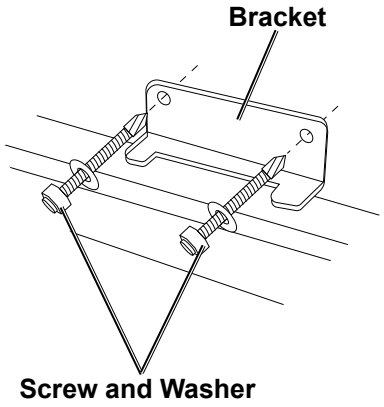
See “Adjustment” on page 13 for recommended seasonal adjustments.

Note: Angle towards true north if installed in southern hemisphere.

3. Attach Bracket to Solar Panel Frame using Bolt and Flange Nuts.



4. Use Screws and Washers to mount Solar Panel to desired surface.



Installation

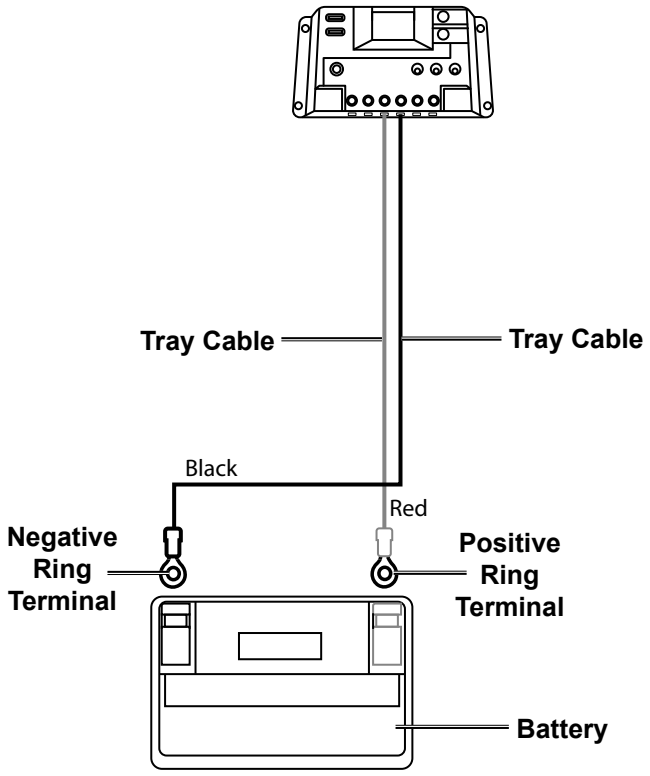
⚠WARNING

TO PREVENT SERIOUS INJURY:
Connect the battery to the Charge Controller first, then connect the Solar Panel to the Charge Controller. When disconnecting, disconnect Solar Panel first, then disconnect battery.

CAUTION: Do not over-torque or over tighten the screw terminals. This could potentially damage the main PCB inside the charge controller. Maximum wire size to connect to the terminals is 8 AWG.

Connecting Battery to Charge Controller

1. To connect 12VDC battery (sold separately) to Solar Panel, plug Tray Cables into Charge Controller.
   a. Connect POSITIVE (RED) Tray Cable to second POSITIVE (POS, P, +) terminal of Charge Controller (third terminal overall).
   b. Connect NEGATIVE (BLACK) Tray Cable to second NEGATIVE (NEG, N, –) terminal of Charge Controller (fourth terminal overall).
2. To attach the Tray Cable to the battery:
   a. Connect POSITIVE (RED) ring terminal to POSITIVE (POS, P, +) post of battery.
   b. Connect NEGATIVE (BLACK) ring terminal to NEGATIVE (NEG, N, –) post of battery.



Wiring

Note: Only a licensed electrician and a licensed building contractor can safely design and implement a grid tie-in system. Any grid tie-in system must meet all applicable building and electrical codes, and must meet standards established by the area power company.

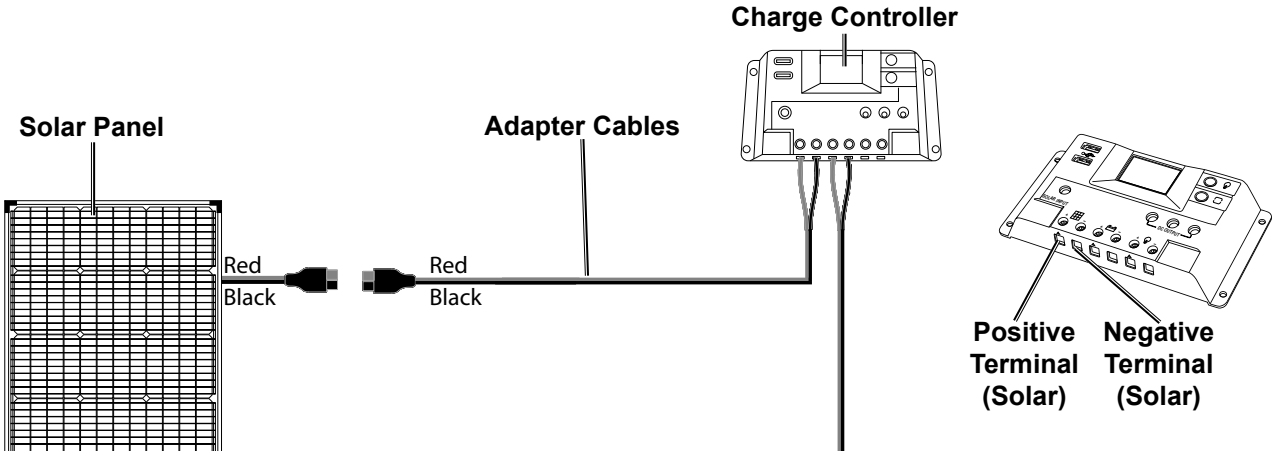
1. Run wires from panels, through weatherproof grommets and into enclosure where power inverter is located. Use wires of the proper size and rating and use twist connectors (not included) to connect wires.
2. Connect battery to a power inverter according to inverter's instructions.

WARNING! TO PREVENT SERIOUS INJURY:
Inverter must be properly rated and designed for this type of connection and power supply.

3. Secure all connections using terminals, or solder all wire splices to ensure good connections.
4. Weatherproof all connections and route the wire in a way that it will not be torn loose from the panel.

Connecting Solar Panels to Charge Controller

1. Connect Panel Wires to Adapter Cables.
   a. Connect POSITIVE (RED) Adapter Cable to first POSITIVE (POS, P, +) terminal of Charge Controller.
   b. Connect NEGATIVE (BLACK) Adapter Cable to first NEGATIVE (NEG, N, –) terminal of Charge Controller (second terminal overall).
2. Connect Adapter Cables to Solar Panel Cables.

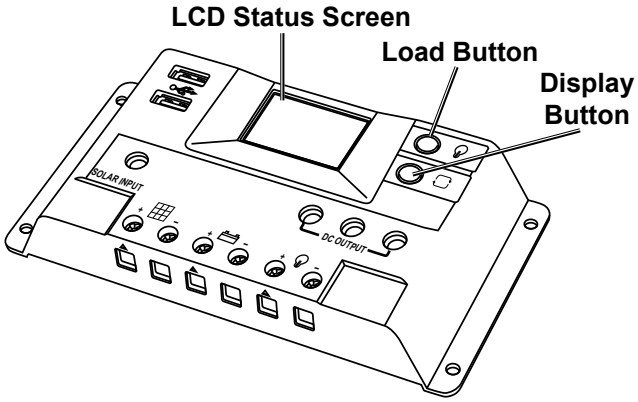


Read the ENTIRE IMPORTANT SAFETY INFORMATION section at the beginning of this manual including all text under subheadings therein before set up or use of this product.

Note: Performance of the Solar Panels will vary dependent on site location, angle of the panels in relation to the arc of the sun, and available sunlight.

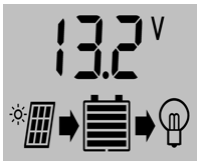
Charge Controller Settings

NOTICE: CONTROLLER MUST BE CONNECTED TO A CHARGED 12V BATTERY TO POWER THE DISPLAY.



Programming Battery Type

1. Make sure LCD Screen is on Status screen.



2. To select battery type, press and hold Display Button for 3 seconds. Battery Type screen will appear.

3. Release Display Button, then press and hold Display Button until battery type starts flashing.
4. Press Display Button to toggle down through each battery type. Use Load button to toggle back up.

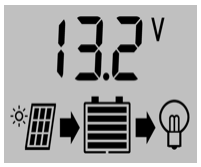
Note: The different battery types are User Mode (USr), Sealed, (SLd), Flooded (FLd), and Gel (GEL).

5. When desired Battery Type is found, press and hold Display button until display stops flashing. The set value will be saved by the controller.

Note: Pressing no buttons for 10 seconds will exit Battery Type screen and return to Status screen.

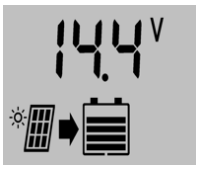
LCD Status Screen

Press the Display Button to cycle the Display between the 5 different settings shown below:



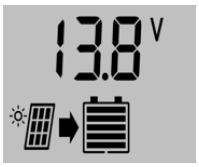
Status

Target charging voltage. Can also be used to access advanced settings.



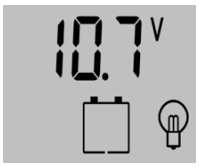
Absorption Voltage

Maximum charging output voltage to finish charging battery.



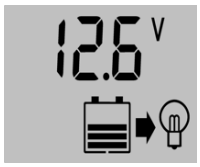
Float Voltage

Maintenance charge voltage.



Low Voltage Disconnect

Charge Controller will disconnect the Battery. “E11” will be displayed when this voltage is reached.



Low Voltage Reset

Minimum battery voltage where normal charging can resume.

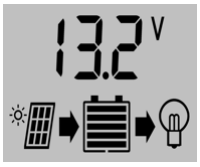
If battery type was set to USr, each of the above settings can be set manually by the user. To do this:

1. Press and hold the Display Button while the setting is shown until the voltage display starts blinking.
2. While the Display is blinking:
   a. Press the Display Button to increase setting.
   b. Press the Load Button to decrease setting.
3. When setting is complete, press and hold the Display Button until the voltage Display stops blinking. The set value will be saved by the controller.
4. Press Display button again to cycle to next setting.

Automatic Load Control

Unit can be programmed to only power the load by pressing Load Button, or to have load controlled by charge status.

1. Make sure LCD Screen is on Status screen.



2. To select battery type, press and hold Display Button for 3 seconds. Battery Type screen will appear.

3. Press the Display Button twice to change to Load Control screen.

4. Press and hold Display Button until the number starts flashing.
5. Press the Display Button to increase number. Press the Load Button to decrease number. Select number according to chart below.

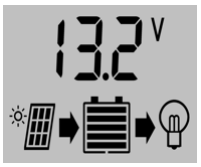
Setting	Mode	Description
1-13	Time Control	Load will turn on 30 seconds after incoming power stops. Load will then stay on for 1-13 hours, depending on this setting. If solar power returns during this period, load will turn off after 30 seconds
14	Automatic	Load will turn on 30 seconds after the incoming power stops. The load will then stay on until 30 seconds after the solar power returns.
15	Manual	Load is turned on and off only by pressing the Load Button at any time.

6. When finished, press and hold Display button until display stops blinking. The set value will be saved by the controller.

Temperature Compensation Ratio

If battery and charge controller are mounted in areas that vary greatly in temperature, a temperature compensation ratio can set. This will increase voltages going to the battery in cold temperatures, and reduce voltage warmer temperatures.

1. Make sure LCD Screen is on Status screen.



2. To select battery type, press and hold Display Button for 3 seconds. Battery Type screen will appear.

3. Press the Display Button once to change to Temperature Compensation screen.

4. Press and hold Display Button until number starts flashing.

5. Press the Display Button to increase number. Press the Load Button to decrease number.

Note: A reading of -4 indicates -4mV/cell/°C.

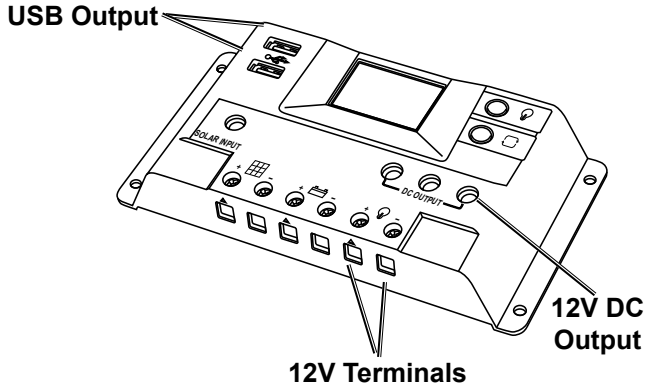
6. When finished, press and hold Display button until display stops blinking. The set value will be saved by the controller.

Using 12 Volt Lights and Accessories

NOTICE: CONTROLLER MUST BE CONNECTED TO A CHARGED 12V BATTERY TO POWER THE DISPLAY.

1. Press the Load Button to toggle the 12V output on/off.

2. Plug the end of the LED Light's cable into one of the 12V DC outlets on the Charge Controller.



3. Connect a DC adapter cable (not included) to the appliance.

CAUTION! Do not use the included 12V lights on a 24V system. If a 24V battery is used, this will damage the 12V lights.

4. Insert the plug on the other end of the cable into one of the 12V DC Outlets on the Charge Controller.

5. Activate your appliance.

NOTICE: Only use one appliance at a time with this Charge Controller.

6. When finished, unplug the DC adapter cable (not included) from the Charge Controller and then unplug the cable from the appliance.

7. To charge a cell phone or other small electronic item, plug the item's power cord into the USB Port on the front of the Charge Controller.

Note: Solar panels, lights, and accessories can be hardwired onto the terminals on the bottom of the charge controller instead of using the included plugs.

NOTICE: To prevent damage to the controller, carefully keep conductors from touching each other.

Procedures not specifically explained in this manual must be performed only by a qualified technician.

⚠WARNING

TO PREVENT SERIOUS INJURY FROM ELECTRIC SHOCK:
Before service, maintenance or cleaning:

a. **Dry solar panels and outdoor wiring thoroughly while wearing electrically insulated gloves.**
b. **Cover solar panels with an opaque cover.**
c. **Disconnect all solar panels and batteries.**

TO PREVENT SERIOUS INJURY FROM ELECTRIC SHOCK OR CUTS:
Do not use damaged solar panel.
If wiring insulation is damaged or weathered, glass is cracked, or housing is opened, have the problem corrected before further use.

Cleaning, Maintenance, and Lubrication

Clean and inspect the Solar Kit system MONTHLY, or more frequently to maintain peak efficiency.

1. Wear electrically insulated gloves and ANSI-approved safety goggles. Dry solar panels and outdoor wiring thoroughly.
2. Cover solar panels with opaque cover.
3. Disconnect all solar panels and batteries.
4. Clean solar panels one at a time with mild, non-abrasive cleanser and soft cloth and paper towels. Do not clean with brushes or abrasive cleaners.
5. Inspect general condition of Solar Kit system (panels, batteries, controllers, and mounting). Check for loose hardware, wiring insulation damage or weathering, cracked glass, open housing, cracked or broken parts, loose or corroded contacts, and any other condition that may affect its safe operation.
6. Maintain batteries according to supplier's instructions.

Adjustment

To increase efficiency:

1. **For Winter applications,** increase panel vertical angle by 10° - 15°.
2. **For Summer applications,** decrease panel vertical angle by 10° - 15°.
3. **For Spring, Fall, and All Year applications,** keep panel vertical angle the same as your latitude.

Error Codes

Note: The user may see the following Error Codes when voltage limits are reached:

1. **E11:** Low-voltage protection; battery voltage is below 10.5-10.8V. Controller will shut off and enter low-voltage protection state.
2. **E12:** High-voltage protection; battery voltage is above 16.1V. Controller will stop input and enter overvoltage protection state.
3. **E13:** Overload protection; indicates the occurrence of overcurrent. Controller will stop output and enter overload protection state.
4. **E14:** System short-circuit protection.

PLEASE READ THE FOLLOWING CAREFULLY

THE MANUFACTURER AND/OR DISTRIBUTOR HAS PROVIDED THE PARTS LIST AND ASSEMBLY DIAGRAM IN THIS MANUAL AS A REFERENCE TOOL ONLY. NEITHER THE MANUFACTURER OR DISTRIBUTOR MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND TO THE BUYER THAT HE OR SHE IS QUALIFIED TO MAKE ANY REPAIRS TO THE PRODUCT, OR THAT HE OR SHE IS QUALIFIED TO REPLACE ANY PARTS OF THE PRODUCT. IN FACT, THE MANUFACTURER AND/OR DISTRIBUTOR EXPRESSLY STATES THAT ALL REPAIRS AND PARTS REPLACEMENTS SHOULD BE UNDERTAKEN BY CERTIFIED AND LICENSED TECHNICIANS, AND NOT BY THE BUYER. THE BUYER ASSUMES ALL RISK AND LIABILITY ARISING OUT OF HIS OR HER REPAIRS TO THE ORIGINAL PRODUCT OR REPLACEMENT PARTS THERETO, OR ARISING OUT OF HIS OR HER INSTALLATION OF REPLACEMENT PARTS THERETO.

Record Product's Date Code Here:_____

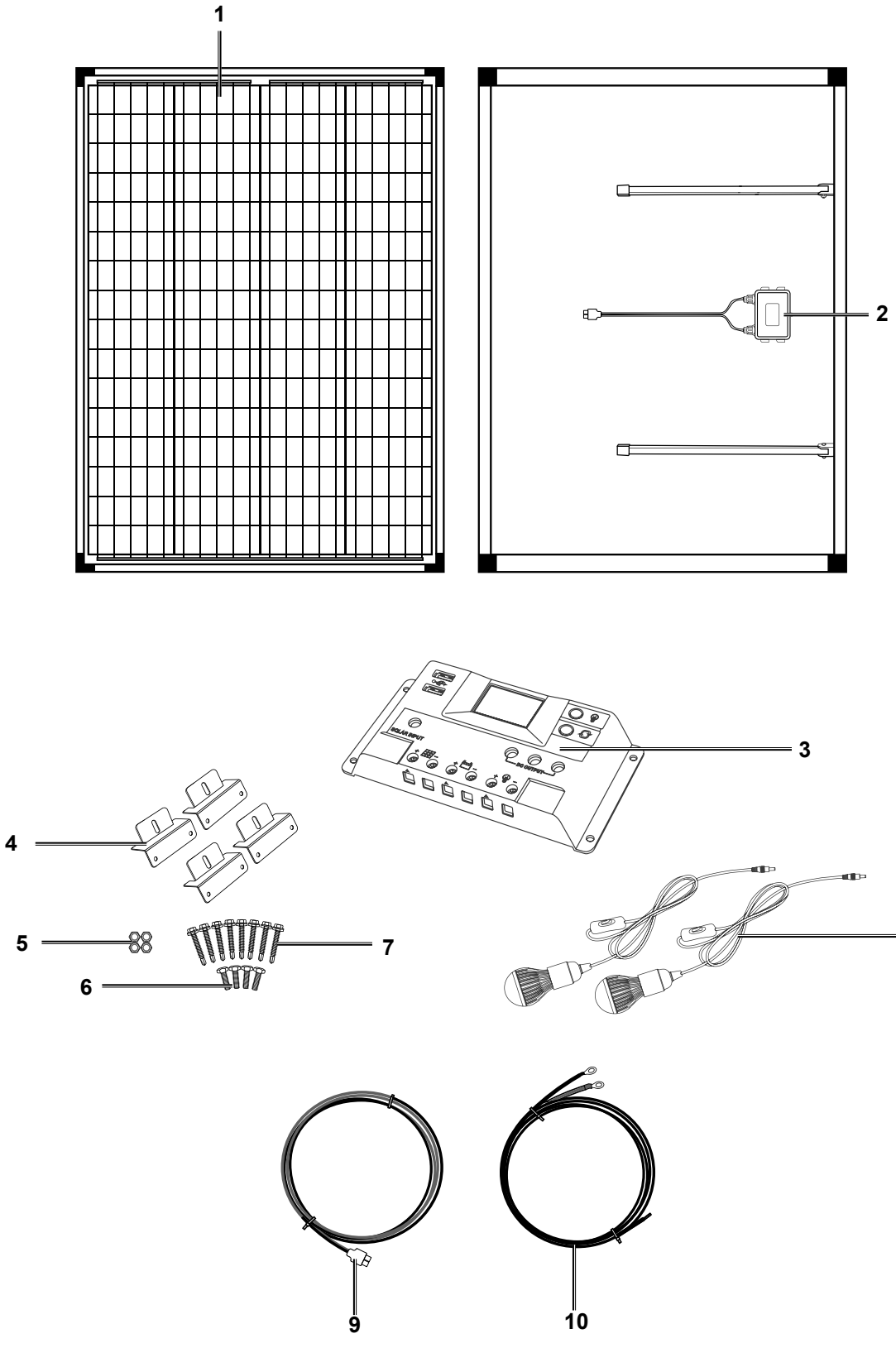
Note: If product has no date code, record month and year of purchase instead.

Note: Some parts are listed and shown for illustration purposes only, and are not available individually as replacement parts. Specify UPC 193175510327 when ordering parts.

Parts List and Diagram

Part	Description	Qty
1	Solar Panel	1
2	Solar Panel Junction Box and Cables	1
3	Charge Controller	1
4	Bracket	4

Part	Description	Qty
5	Nut	4
6	Bolt	4
7	Screw and Washer	8
8	LED Light	2
9	Anderson Adapter Cables	1
10	Tray Cables	1



Limited 90 Day Warranty

Harbor Freight Tools Co. makes every effort to assure that its products meet high quality and durability standards, and warrants to the original purchaser that this product is free from defects in materials and workmanship for the period of 90 days from the date of purchase. This warranty does not apply to damage due directly or indirectly, to misuse, abuse, negligence or accidents, repairs or alterations outside our facilities, criminal activity, improper installation, normal wear and tear, or to lack of maintenance. We shall in no event be liable for death, injuries to persons or property, or for incidental, contingent, special or consequential damages arising from the use of our product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation of exclusion may not apply to you. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.

To take advantage of this warranty, the product or part must be returned to us with transportation charges prepaid. Proof of purchase date and an explanation of the complaint must accompany the merchandise. If our inspection verifies the defect, we will either repair or replace the product at our election or we may elect to refund the purchase price if we cannot readily and quickly provide you with a replacement. We will return repaired products at our expense, but if we determine there is no defect, or that the defect resulted from causes not within the scope of our warranty, then you must bear the cost of returning the product.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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