

Off-Grid Phone Charger

Workshop

Constructing this simple and inexpensive rechargeable cellphone charger provides an introduction to soldering and electronics.

Practically, these units can be used for charging in regions of the world where grid electricity is not readily available.



Number of Participants: 2-15

Audience: Middle (ages 5-10) and up

Duration: 10-20 minutes

Difficulty: Level 3

Materials Required:

1. 12 V rechargeable deep-cycle battery (lead-acid)
2. Wire extensions
3. 12 V to 5 V DC-DC converter w/ USB port (inexpensive and commonly available)
4. 10 W solar panel (optional)
5. Charge controller (optional)

Setup:

1. Solder two extension wires to the 12 V side of the 12 V to 5 V converter port. Insulate the solder joints with a heat shrink.
2. Attach ring connectors to the other ends of the wire extensions. For safety, connect the positive lead to the battery first followed by the negative lead. (Likewise, when disconnecting, remove the negative lead first.)
3. Plug the USB charger into the converter and phone to charge the phone.

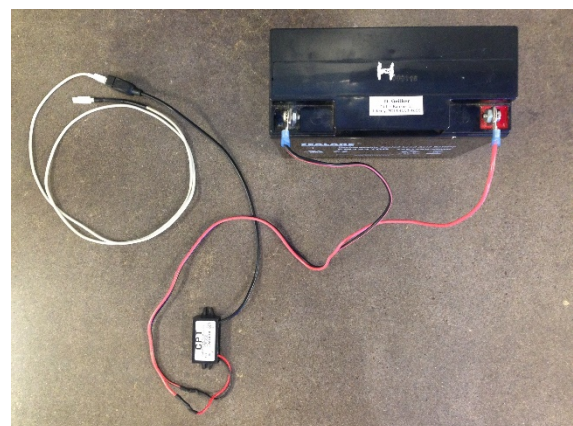


Figure 1

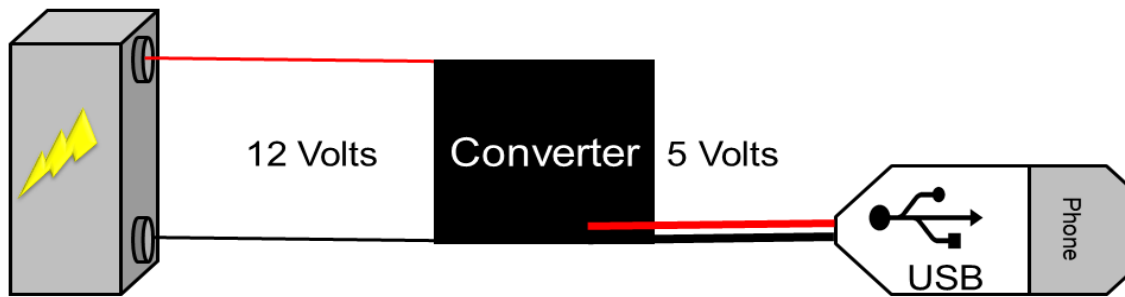


Figure 2: Circuit diagram for the phone charging system.

Recharging the 12 V battery:

Determine when the battery requires charging:

1. Monitor the battery voltage using a charge controller, digital multi-meter, or small voltage sensor. (Consider using a digital voltage gauge for a car or motorcycle.)
2. Recharge when the “no load” voltage approaches 12.2 V.

OR

1. Determine the level of discharge of the battery by multiplying the charging time by the current drawn during the phone charging process.
2. Recharge when the “stored charge” in amp-hours drops to approximately 75% of the rated capacity.

Recharging the battery:

For permanent installations, the solar panel, charge controller, and converter can stay connected at all times:

1. Connect the charger controller, 10 W solar panel, and 12 V to USB converter as shown in Figure 3.
2. Whenever the stored battery capacity drops below 100%, the controller will initiate recharging if the solar panel is illuminated. Phones can be recharged at any time so long as the battery voltage is above a limit set within the charger controller.

OR, if the solar panel is not permanently wired to the unit:

1. Connect the battery directly to a 10 W (12 V) solar panel using cable clamps.
2. Once the battery voltage reaches approximately 12.7 V, disconnect the solar panel.

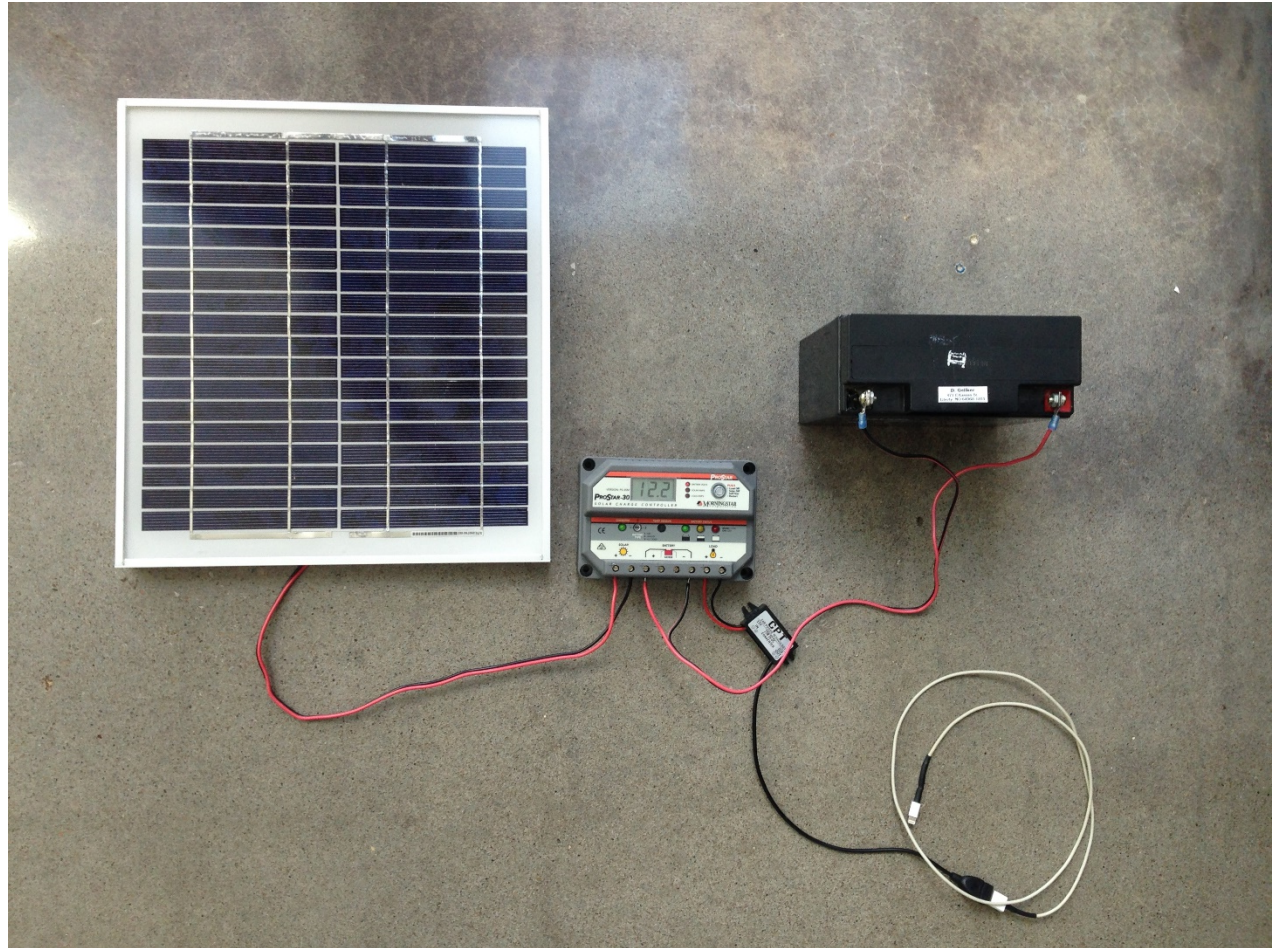


Figure 3

Additional Resources:

- Video by William Jewell College SPS Chapter
<https://www.youtube.com/watch?v=Gxt-F7FZU0w&feature=youtu.be>