SCAN FOR THE FULL GUIDE

Set up a small solar kit

One 12 V, 100 W panel, a 20 A PWM charge controller and a 12 V battery, sized for one job: a field pump, a LoRa gateway, or lights and charging through a power outage. The inverter is optional.

THE KIT

Panel	100 W “12 V”: about **18 V, 5.5 A** working, **22 V** open, ~6 A short-circuit
Controller	PWM, **20 A**, 12 V battery. Carries **two** 100 W panels in parallel (a 40 A carries five)
Battery	LiFePO4 12 V 100 Ah: about **1,280 Wh**, ~1,000 usable
Harvest a day	~19 Ah (240 Wh) on 4 sun hours · ~14 Ah (180 Wh) on 3
Inverter	Optional. **On the battery**, with its own fuse. Never on LOAD.

BEFORE YOU START

Have these on hand:

- A **fuse holder and fuse** for the battery’s positive terminal, sized for the wire.
- **Red and black cable** heavy enough for the current (the wire and fuse calculator on the site gives the size).
- Something to **cover the panel**, or wait for dusk: a panel in daylight is always live.
- A **multimeter** to read the battery’s voltage.

HOOK IT UP, IN ORDER

1. **Place the parts.** Controller close to the battery, dry, with air around it.
2. **Fit the fuse holder** on the battery positive, with the fuse **out**.
3. **Wire the controller’s BATTERY terminals** to the battery: positive through the fuse holder, negative direct.
4. **Insert the fuse.** The controller wakes and sets itself for 12 V. Set the **battery type** now.
5. **Connect the panel last**, covered, to the PV terminals. Uncover it and check the controller shows charging.
6. **DC loads** (pump, LED lights, USB adapter) go on the LOAD terminals, load output off, then on.
7. **Inverter, if any:** its own cables and fuse, straight to the battery, inverter switched off.

Taking it apart: the same list backwards. Loads and inverter off, panel covered and disconnected, battery fuse out, then the battery cables.

WRITE IN YOUR KIT

From the labels, before you wire. Keep this card with the controller.

Panel Voc open-circuit volts, on its label		Panel Isc short-circuit amps	
Controller max PV volts on the controller label		Load terminal rating amps	
Battery type set LiFePO4 / AGM / flooded		Battery fuse amps	
Inverter fuse amps, if any		Low-voltage disconnect volts, if adjustable	

MORE PANELS, TWO BATTERIES

- **Panels:** with a PWM controller, wire in **parallel** (+ to +, – to –). Series adds volts the controller throws away and can pass its input limit on a cold morning.
- **Batteries:** grow in **parallel** to keep 12 V. Wire diagonally: + from one battery, – from the other. A 24 V series bank cannot be charged by a 12 V panel.
- **Match them:** same chemistry, capacity and age, each charged full on its own before joining.

CAR BATTERIES IN AN EMERGENCY

- A starting battery, not deep-cycle. Use about **half**: rested, 12.7 V is full, 12.2 V is half.
- Two in parallel: about 100 Ah, ~**600 Wh** usable. Charge each full first; they should read the same voltage before joining.
- Set the controller to **flooded** (removable caps) or **AGM** (sealed). **Never** mix lead-acid and lithium in one bank.
- Flooded batteries give off **hydrogen** while charging: outdoors or moving air, no sparks, last connection at the fuse.

THE INVERTER, IF THE JOB NEEDS AC

Battery current	watts ÷ 12 ÷ 0.9 (300 W ≈ 28 A · 1,000 W ≈ 93 A)
Size	continuous ~25% above running watts; surge above the largest motor start; pure sine
Fuse	about 1.25 × full-output current, at the battery; cable rated above the fuse
Idle	switch it off when not working: half an amp idle is ~144 Wh a day

Never plug an inverter into a building's wiring. Power fed backward can kill a line worker. Run an extension cord to each device.

IF SOMETHING'S NOT WORKING

Controller shows nothing	Check the battery fuse and terminals. A LiFePO4 pack whose BMS has shut off reads near zero volts; follow its maker's wake-up steps.
Panel on, no charging	Check daylight, polarity at PV, and that the panel's Voc is under the controller's max PV volts. A full battery takes little current: that is normal.
Loads switch off at night	The low-voltage disconnect is protecting the battery. The job needs more than the kit makes: trim the load, add a panel, or add battery.
Inverter shuts off as a motor starts	The start surge is above its rating, or the cable is too thin and the voltage sags. Check the size and the cable.
No charge on a frosty morning	Many LiFePO4 packs refuse charge below freezing. That is the BMS protecting the cells; it resumes when they warm.

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