Solar Panel & Charge Controller Selection

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Selecting the right panel and charge controller determines whether your solar node stays online year-round. This page covers available options and selection criteria. Prices are approximate and volatile (as of 2026-06-08).

Solar Panels

RAK Solar Panel 5V - ~$3.50 (as of 2026-06-08)

A small 5V RAK panel (SKU 920399, ~80 × 45mm) that connects to WisBlock base boards (and to the RAK19012 solar input). Convenient if you are already using RAK hardware, but limited in output compared to generic monocrystalline panels.

RAK19012 Solar Module - ~$6.90 (as of 2026-06-08)

An all-in-one module combining USB-C input, solar input, and battery management with an onboard linear battery-charger chip (not MPPT, and not a true solar charge controller). Solar input is limited to ~5.5V. Designed for RAK WisBlock systems. Simplifies the power system significantly - connect the solar panel and battery, plug the output into the WisBlock, done.

6W 6V Monocrystalline Panel - $15 - $20 (as of 2026-06-08)

The community standard for DIY solar repeater builds. 6V panels work directly with the CN3791 MPPT charger; the TP4056 is a linear charger best paired with 5V panels (a 6V panel works, but its open-circuit voltage nears the TP4056's limit and the excess is dissipated as heat). Monocrystalline cells are more efficient per unit area than polycrystalline, particularly in low-light conditions.

- **Output:** 6W is the STC nameplate rating; real-world output is lower

- **Voltage:** ~6V at maximum power point (Voc typically ~7 - 7.5V; varies by panel)
- **Size:** Typically 180 × 130mm (varies by manufacturer) - fits on top of most enclosure sizes
- **Daily harvest:** 6W × peak sun hours × 0.75 derate. Use your location's worst-month (winter) PSH for sizing - as low as ~1.5 PSH in the Pacific Northwest, ~2.5 in the upper Midwest. At a generous 2.5 - 5 PSH this gives ~11 - 22.5 Wh/day, but the low (winter) end is optimistic for a fixed-tilt small panel and snow/low sun angle can push it lower. Size against the worst month, not the average.

Charge Controllers

TP4056 - ~$1 - $3 (as of 2026-06-08)

A basic single-cell Li-ion/LiPo charger. The TP4056 chip alone provides CC/CV charge control (4.2V); over-discharge and short-circuit protection require the DW01-equipped module variant. It is a linear CC/CV charger (not MPPT and not PWM) - excess panel voltage above ~4.2V is dissipated as heat. The cheapest option and adequate for simple builds with moderate solar irradiance. A standalone TP4056 module does not have a load output - use the TP4056 with integrated DW01 protection IC, or add a separate protection module. **Cold-weather warning:** the TP4056 has no temperature sensing and no low-temperature charge cutoff, so it will attempt to charge the cell below 0°C, which causes lithium plating and permanent damage. For cold/winter deployments add a BMS with low-temp protection or a controller with a battery temperature sensor.

- **Max charge current:** 1A (set by resistor; default 1A modules are common)
- **Input voltage:** 4.5 - 8V absolute, but recommended operating input is 4.5 - 5.5V (5V panels ideal). A 6V panel works but its Voc (~7 - 7.5V) approaches the 8V max and the excess becomes heat - prefer the CN3791 for 6V panels.
- **MPPT:** No (linear CC/CV)

CN3791 MPPT - $3 - $5 (as of 2026-06-08)

A step up from the TP4056. The CN3791 is a switching MPPT-style charger that approximates Maximum Power Point Tracking using the constant-voltage method - it holds the panel near a preset Vmp (set by an external resistor divider) rather than continuously hill-climbing like a true perturb-and-observe MPPT. Simpler and less accurate than perturb-and-observe MPPT, but better than PWM, particularly under partial shading or variable irradiance. Recommended over TP4056 for serious solar builds. Like the TP4056, the CN3791 has no low-temperature charge cutoff - add BMS low-temp protection for cold-climate builds.

- **Input:** 4.5 - 28V (works with 5V/6V panels up to higher-voltage panels)
- **MPPT:** Yes (constant-voltage approximation)
- **Charge current:** The CN3791 IC supports up to 4A (programmable via sense resistor); common modules ship configured for ~2A
- **Cost premium over TP4056:** $1 - $2 - worth it

Taidacent MPPT Module - ~$10 (as of 2026-06-08)

A slightly larger MPPT module, commonly listed with ~1A charge current and 6V input support (confirm the exact specs against the specific module's listing). Some variants include onboard LED status indicators. Good choice when you want visibility into charge state without adding telemetry hardware.

RAK19012 All-in-One - ~$6.90 (as of 2026-06-08)

Integrated USB-C + solar + battery management for RAK WisBlock systems, using a simple onboard linear charger (not MPPT). Not suitable for non-RAK builds, but the simplest option for WisBlock deployments.

Charge Controller Comparison

Controller	Price (as of 2026-06-08)	MPPT	Max Charge	Best For
TP4056	$1 - $3	No (linear CC/CV)	1A	Budget builds; good sun locations
CN3791	$3 - $5	Yes (constant-voltage)	IC up to 4A; modules often ~2A	Most DIY solar repeater builds
Taidacent MPPT	~$10	Yes	~1A (confirm per module)	When onboard monitoring is useful
RAK19012	~$6.90	No (linear charger)	onboard linear charger	RAK WisBlock builds only

Panel Orientation and Mounting

- **Face:** South-facing in the northern hemisphere; north-facing in southern hemisphere
- **Angle from horizontal:** A tilt equal to your latitude maximizes annual energy. For a node that must survive the winter worst case (the point of sizing for resilience), use latitude +10 - 15° to favor the low winter sun. For northern US (45 - 50°N latitude), this works out to roughly 45 - 60° tilt, with the steeper end tied to winter optimization. Steeper angles favour winter; shallower angles favour summer.
- **Shading:** Even partial shading of a small cell in the panel significantly reduces total output. Site the panel to avoid shading from trees, structures, or the node enclosure itself during peak sun hours.

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