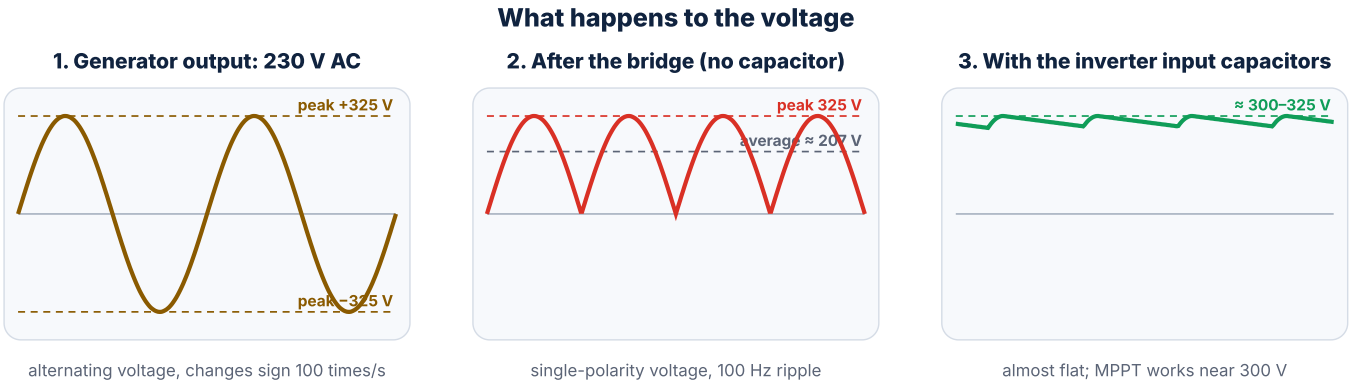
Charging a battery from a generator through the inverter's solar input: a diode bridge circuit

No grid power, little sun, but you have a generator – and the inverter "doesn't see" it, the charge jumps around or the relays click every half minute. There is a simple engineering trick: rectify the generator voltage with a diode bridge and feed it into the **solar (PV) input** of a hybrid inverter. The inverter will treat the generator as a very powerful solar panel and calmly charge the battery through its MPPT controller. Below we explain how it works, which circuit to build, which parts to buy, how to set up the inverter and where the main risks are.

> **In short.** 230 V AC after a diode bridge gives about **300–330 V DC**. Most 24 V and 48 V hybrid inverters accept up to 450–500 V on the PV input, so there is enough margin. Mandatory conditions: **a single 230 V phase** only, charge current limited to the generator's power, a "Solar / 0 / Generator" switch, fuses, a DC breaker and correct earthing.

How it works

A generator produces 230 V AC, so its peak value is 230 × 1.414 ≈ **325 V**. The diode bridge (four diodes connected in a diamond) passes both half-waves in one direction, so the output has a single polarity. The inverter's input capacitors smooth out the ripple, and the MPPT controller sees an almost flat voltage of about 300–325 V, as if a string of 7–8 solar panels were connected to it.



Voltage waveform before the bridge, after the bridge and at the inverter input

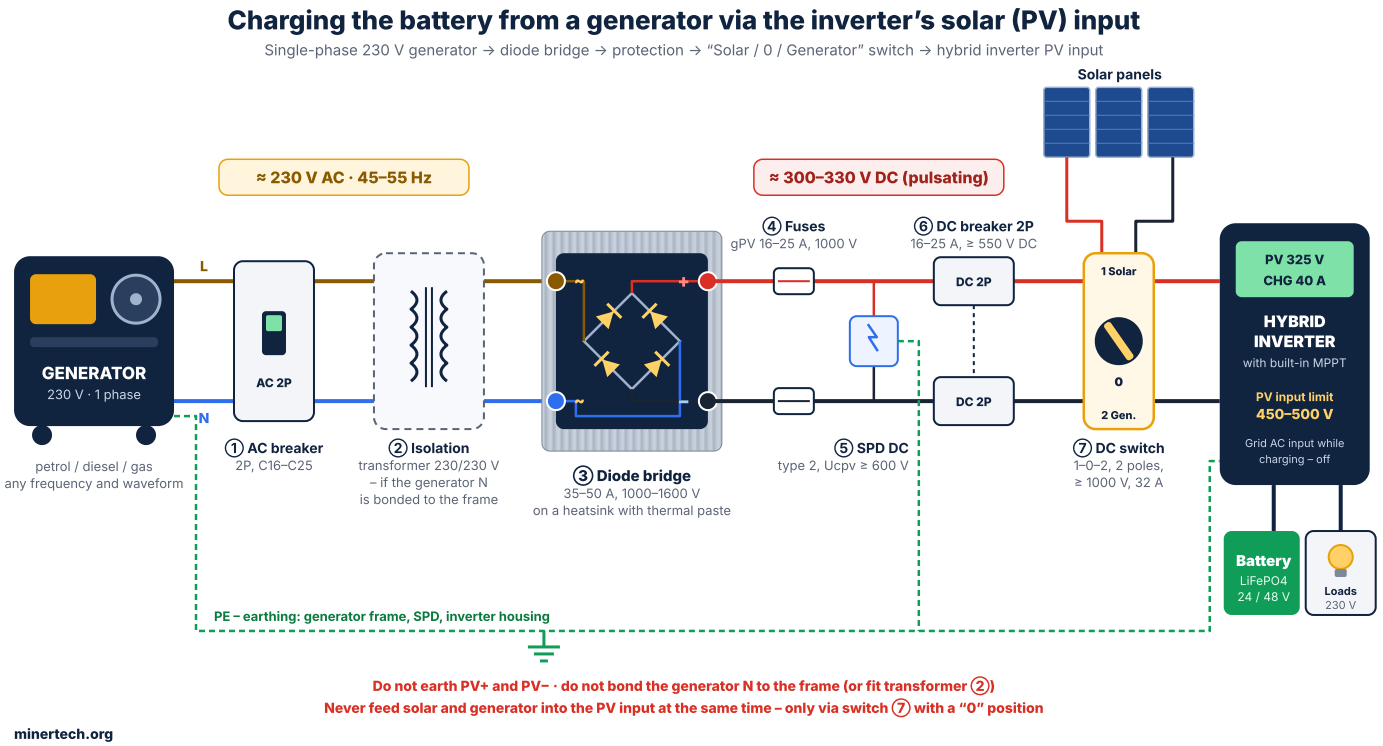
Then the MPPT does the same as with panels: it steps the voltage down to the battery level and charges it, while also powering the loads. The inverter does not need to synchronise with the generator's frequency and phase, so it does not care how "clean" the generator's sine wave is or whether the frequency drifts.

Why do this if there is an AC input

The standard way to charge from a generator is to feed 230 V into the inverter's AC input (preferably in "Generator" / APL mode). If the generator is good, do exactly that. The bridge circuit helps when the standard way does not work well.

	Via the AC input (standard)	Via a bridge to the PV input
Unstable frequency, "dirty" sine wave	The inverter rejects the generator, the relay clicks, "Fault"	Makes no difference: works with any frequency and waveform
Generator voltage sags	The inverter disconnects from the input	The MPPT simply takes a little less power
What the loads see	In bypass mode – the generator's voltage	Always the inverter's clean sine wave
AC input	Occupied by the generator	Free
Maximum charging power	Limited by the grid charger	Limited by the MPPT (its charge current)
Solar panels	Work in parallel	Disconnected for that time (switch)
Losses	Minimal	+2–3% in the bridge, the bridge heats up
Inverter warranty	Standard mode	Non-standard use of the PV input

Wiring diagram



Circuit diagram: generator → breaker → (transformer) → diode bridge → fuses → SPD → DC breaker → switch → PV input

1. **2P AC circuit breaker** at the generator output (C16 for 2–3 kW, C25 for 4–6 kW). It protects the wiring up to the bridge and lets you disconnect the generator.

2. **230/230 V isolation transformer** – only if the generator's neutral is bonded to its frame or to earth (see the "Earthing" section). Most portable generators do not need it.
3. **Diode bridge** rated 35–50 A and 1000–1600 V, screwed onto an aluminium heatsink with thermal paste.
4. **gPV fuses** rated 16–25 A and 1000 V DC in both plus and minus (DIN-rail holders).
5. **DC surge protective device (SPD)**, type 2, Ucpv ≥ 600 V – absorbs the voltage spikes the generator produces when a load is dropped.
6. **2P DC circuit breaker** rated 16–25 A and at least 550 V DC (1000 V is better). This is what you use to switch charging on and off.
7. **DC changeover switch "1–0–2"**, two-pole, from 1000 V and 32 A: position 1 – solar panels, 0 – everything off, 2 – generator. Panels and generator must never be connected in parallel.

Voltage check: can the inverter handle it

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Peak voltage = U_AC × 1.414 − 2 × 1 V (drop across the diodes)
230 V generator → 230 × 1.414 − 2 ≈ 323 V OK
Generator "runs high" at 250 V → 352 V OK
No load, surge to 265 V → 373 V OK, margin up to 450–500 V
Three-phase, between two phases 400 V → 564 V FORBIDDEN — it will burn the input
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> **Only phase and neutral, 230 V.** Connect a three-phase generator with one phase and neutral only (L–N). The voltage between two phases (400 V) gives about 565 V after the bridge, which is above the PV input limit of any of our hybrid inverters. For the same reason, do not use a three-phase bridge on a three-phase generator.

Which inverters are suitable

We checked all the hybrid inverters in the minertech.org catalogue against their specifications. What matters is the maximum PV input voltage and the MPPT range: 300–330 V must be inside the range, and 375 V (a generator surge) must be below the maximum.

Inverter	Battery	Max. PV	MPPT range	Max. PV power	Suitable
EASUN SMS-6.5KP 6.5 kW 48 V WiFi	48 V	500 V	60–450 V	9000 W	Yes
POWGROW SMS-6.5KP 6.5 kW 48 V	48 V	500 V	60–450 V	9000 W	Yes
POWLAND SMS-6.5KP 6.5 kW 48 V WiFi	48 V	500 V	60–450 V	9000 W	Yes
JSDsolar J6500HC 6.5 kW 48 V	48 V	500 V	60–450 V	9000 W	Yes

GSIKE 6.2 kW 48 V WiFi	48 V	500 V	60–500 V	6500 W	Yes
EASUN SMT-6.2KW 6.2 kW 48 V	48 V	500 V	60–500 V	8500 W	Yes
GSIKE 11 kW 48 V WiFi	48 V	500 V	60–500 V	2 × 5500 W	Yes on one of the two PV inputs
POWLAND SMS-12KW 12 kW 48 V WiFi	48 V	500 V	60–450 V	15,000 W	Yes
JSDsolar J12000HC 12 kW 48 V WiFi	48 V	500 V	60–450 V	2 × 7500 W	Yes on one of the two PV inputs
POWGROW SMS-5kW 24 V	24 V	500 V	60–450 V	9000 W	Yes
POWLAND SMS-5kW 24 V WiFi	24 V	500 V	60–450 V	9000 W	Yes
ECGSOLAX HVM 5 kW 24 V WiFi	24 V	500 V	60–450 V	9000 W	Yes
Aninerel ANL-4200T 4.2 kW 24 V	24 V	500 V	60–500 V	5000 W	Yes
ANENJI ANJ-4000 4.2 kW 24 V WiFi	24 V	500 V	60–500 V	4500 W	Yes
JSDsolar J4000E 4 kW 24 V	24 V	500 V	40–450 V	5000 W	Yes
EASUN SMT-4KW 24 V	24 V	500 V	60–500 V	4000 W	Yes
ECGSOLAX HVM 3.6 kW 24 V	24 V	500 V	40–450 V	5000 W	Yes
POWGROW 3.6 kW 24 V	24 V	450–500 V	40–450 V	5000 W	Yes
DATOU BOSS 3.3 kW 24 V	24 V	500 V	40–450 V	5000 W	Yes
EASUN SMT-2KW 12 V	12 V	500 V	30–500 V	2000 W	Yes, generator up to 2 kW
ECGSOLAX HVM 1.2 kW 12 V	12 V	115 V	17–115 V	800 W	NOT allowed
ECGSOLAX 1 kW 12 V	12 V	150 V	20–150 V	600 W	NOT allowed

Data from the manufacturers' specifications. Before connecting, check the label on the housing of your particular inverter: if it shows a different "PV max" value, go by the label.

> **12 V models with a 115–150 V PV input** (ECGSOLAX HVM 1.2 kW and ECGSOLAX 1 kW) **cannot withstand** this circuit: 325 V will destroy the input instantly. For them, charging from a generator is only possible through the AC input.

The main rule: limit the charge current

The MPPT always looks for the point of **maximum** power. With panels that is good, but with a generator it is dangerous: the controller will keep raising the current until the voltage starts to drop, that is, until the generator is overloaded. So the power the inverter draws must be limited manually with the **"Maximum charge current"** parameter in the inverter menu.

A diode bridge with capacitors draws current in short pulses at the peaks of the sine wave, so the generator heats up more than with an ordinary load. Keep the total power (charging + loads) within **60% of the generator's rated power**.

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Charge current = 0.6 × P_generator × 0.95 (MPPT efficiency) ÷ charge voltage
Charge voltage: 28 V for a 24 V battery, 56 V for a 48 V battery
Example: 3 kW generator, 48 V battery → 0.6 × 3000 × 0.95 ÷ 56 ≈ 30.5 A → set 30 A
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Generator (rated)	Usable power	Charge current, 24 V battery	Charge current, 48 V battery
2 kW	1.2 kW	40 A	20 A
3 kW	1.8 kW	60 A	30 A
5 kW	3.0 kW	100 A	50 A
6.5 kW	3.9 kW	inverter max.	60 A
8 kW	4.8 kW	inverter max.	80 A

The values are for charging **without** loads. If appliances are running in the house while charging, the MPPT powers them too, so it takes more from the generator. For every 1 kW of loads, reduce the charge current by about **35 A** (24 V battery) or **17 A** (48 V battery). It is better to switch off powerful appliances (water heater, heater, oven) while charging.

> **How to check in practice.** Watch the PV voltage on the inverter screen. With a properly loaded generator it stays at 290–325 V. If it falls below 270 V and the generator "groans" and its revs drop, reduce the charge current by 10–20 A.

Choosing the parts

Part	Generator up to 3 kW	Generator 3–6.5 kW	What to look for
Diode bridge	35 A, 1000 V (KBPC3510 package)	50 A, 1000–1600 V (KBPC5010 or a 1600 V module)	2× current margin because of the pulsed current
Heatsink	from 100 × 80 mm, finned	from 150 × 100 mm or with a fan	The bridge dissipates 20–40 W of heat; thermal paste is a must
Cable	2.5–4 mm²	4–6 mm²	On the DC side – double-insulated solar cable
2P AC breaker	C16	C25	No higher than the generator socket can handle
gPV fuses	16 A, 1000 V	20–25 A, 1000 V	Specifically gPV (for direct current), not household ones
2P DC breaker	16 A, ≥ 550 V DC	25 A, ≥ 550 V DC	An ordinary AC breaker will not break a 300 V DC arc
SPD	DC type 2, Ucpv 600–1000 V		Connected to PE

Switch	DC “1–0–2”, 2 poles, 1000 V, 32 A	Must have a “0” position

Everything except the generator fits into a small plastic enclosure for 12–18 modules. Mount the bridge on its heatsink in an enclosure with ventilation holes or separately, but so that its terminals cannot be touched by hand.

Capacitor: to fit or not

The inverter’s PV input already has large capacitors that smooth the voltage after the bridge. An extra large electrolytic capacitor is **not needed and even harmful**: at switch-on it causes a big inrush current through the bridge, and in operation it makes the current pulses even “sharper” and heats the generator. The inverter works perfectly well without it.

Earthing and safety

There is no galvanic isolation after the bridge. Both wires, “+” and “−”, carry a dangerous voltage relative to earth. Therefore:

- **Do not earth PV+ or PV−**, either at the inverter or at the bridge.
- **The generator’s neutral must not be bonded to its frame.** With the generator off, measure the resistance between the N contact of the socket and the frame with a multimeter. If it reads 0 Ω (a jumper), either remove the jumper (if the generator is used only for this circuit) or fit a 230/230 V isolation transformer of suitable power.
- **Disconnect the grid from the inverter’s AC input while charging** (switch off the input breaker). Otherwise a closed loop forms through the grid’s earthed neutral, the bridge diodes and the inverter’s power stage.
- **The frames** of the generator, inverter and enclosure, as well as the PE terminal of the SPD, must be connected to the earthing system.
- Do not touch the bridge terminals or DC cables when live: 300 V DC is more dangerous than 230 V AC.

Before the first start, check the polarity with a multimeter in DC mode: the bridge plus must go to the inverter’s PV+. Also check that the panels are completely disconnected in switch position “2”.

Inverter settings

- **Maximum charge current** – from the table above, corrected for the loads.
- **Charger source priority** – “Solar first” or “Solar only”, so that the inverter does not also try to charge from the AC input.
- **Output source priority** – SBU or “Solar first”: then the loads get the generator’s energy through the MPPT, and the battery only tops up.
- Do not change the battery parameters (type, charge voltage and cut-off) – they are the same for solar and generator.

Menu item numbers differ between models: look them up in the user manual for your inverter on its product page at minertech.org.

Switching on and off

Switching on

1. AC and DC breakers off, switch in “0”.
2. Disconnect the grid from the inverter’s AC input.
3. Start the generator and let it warm up for 1–2 minutes.
4. Switch on the AC breaker.
5. Switch to position “2 Generator”.
6. Switch on the DC breaker. The inverter will start charging within 10–60 seconds.
7. Check the PV voltage and charge current on the screen.

Switching off

1. Switch off the DC breaker.
2. Switch to “0”.
3. Switch off the AC breaker.
4. Stop the generator.
5. Return the switch to “1 Solar” and, if needed, reconnect the grid to the AC input.

Do not switch the DC line on or off with the changeover switch under load – that is what the DC breaker is for. And never stop the generator while the inverter is drawing current from it.

Risks and warranty

Manufacturers design the PV input for solar panels, so powering it from a generator through a bridge is **non-standard use**. Damage to the PV input from overvoltage (three-phase connection, a model with a low-voltage PV input), reversed polarity, connecting panels and generator at the same time or a short through earth **is not covered by the warranty**.

If the generator is good and the inverter accepts it, the simplest is to charge the standard way, through the AC input in “Generator” (APL) mode. Build the bridge circuit when the standard way does not work, and preferably have an electrician do it.

Frequently asked questions

▼ **Is an inverter generator suitable?**

Yes, and it is the best option: stable voltage, quiet, and the neutral is usually not bonded to the frame. The power limits are the same: no more than 60% of the rating.

▼ And a 110–120 V generator?

It will work: after the bridge you get about 160 V, which is within the MPPT range of most models. But at the same power the current is twice as high, so take the bridge, cable and fuses with a larger margin.

▼ Can the generator be connected in parallel with the panels, without a switch?

No. The voltage of the panels (up to 390–450 V) and of the generator (about 325 V) differ, and current will flow from one source into the other. Only a switch with a “0” position.

▼ Inverter with two PV inputs – can I put the sun on one and the generator on the other?

Technically the MPPT channels are independent, but the generator must still be limited by the charge current, and that parameter is shared for the whole inverter. It is safer to use a switch on one input and leave the other to the panels.

▼ Does the battery charge faster than through the AC input?

Not necessarily. The limit is your inverter’s MPPT charge current. The main advantage of the circuit is not speed but that it works with generators the inverter will not accept through the AC input.

▼ Does the circuit work without a battery?

No. The MPPT is designed to work with a battery, and the whole circuit only makes sense for charging the battery and powering the loads through the inverter.

Checklist before start-up

- ☐ Inverter PV input – 450–500 V (not 115–150 V).
- ☐ Generator connected with one 230 V phase (L–N), not between phases.
- ☐ Generator neutral not bonded to the frame, or an isolation transformer is fitted.
- ☐ Bridge 35–50 A / 1000+ V on a heatsink with thermal paste.
- ☐ gPV fuses and a 2P DC breaker rated ≥ 550 V DC, DC SPD.
- ☐ “1–0–2” switch: panels and generator never together.
- ☐ Polarity checked: bridge “+” to PV+.
- ☐ PV+ and PV− not earthed, frames earthed.
- ☐ Grid disconnected from the AC input while charging.
- ☐ Charge current limited in the menu: no more than 60% of the generator’s power.

We will select an inverter and battery for your generator and loads, and if needed install the circuit turnkey in Dnipro. Call us: 093 293 93 93, 099 054 40 38 (specialist Pavlo Leonidovych, Mon–Sat 10:00–18:00 Kyiv time).

See the catalogue

- Hybrid inverters
- LiFePO4 batteries

- Battery + inverter kits

Read also

- Connecting a generator for automatic operation
- Hybrid inverter: what it is and how it works with the grid, a battery and the sun
- How many solar panels to connect to an inverter: string calculation
- How to choose an inverter for your home: power, hybrid or not, 24 or 48 V
