

Solar Three-Line Diagram Examples and Pre-Submission Checklist

Annotated residential and commercial examples for solar installers and designers

What's Inside

- **Residential example:** 120/240 V split-phase system with a load-side connection under the 120% rule
- **Commercial example:** 208Y/120 V three-phase system with two inverters, a PV AC combiner panel, CT metering, and a utility transformer
- **Symbol legend** for every symbol used in the examples
- **How to read** a three-line diagram, step by step
- **Pre-submission checklist** to catch common AHJ and utility correction items

How to Use These Examples

Each drawing uses keyed notes that tie conductor sizes, overcurrent protection, and interconnection calculations to the NEC sections a reviewer will check.

Use them as a reference for what a complete three-line diagram documents, then run your own plan set through the checklist before submission.

Need permit-ready three-line diagrams?

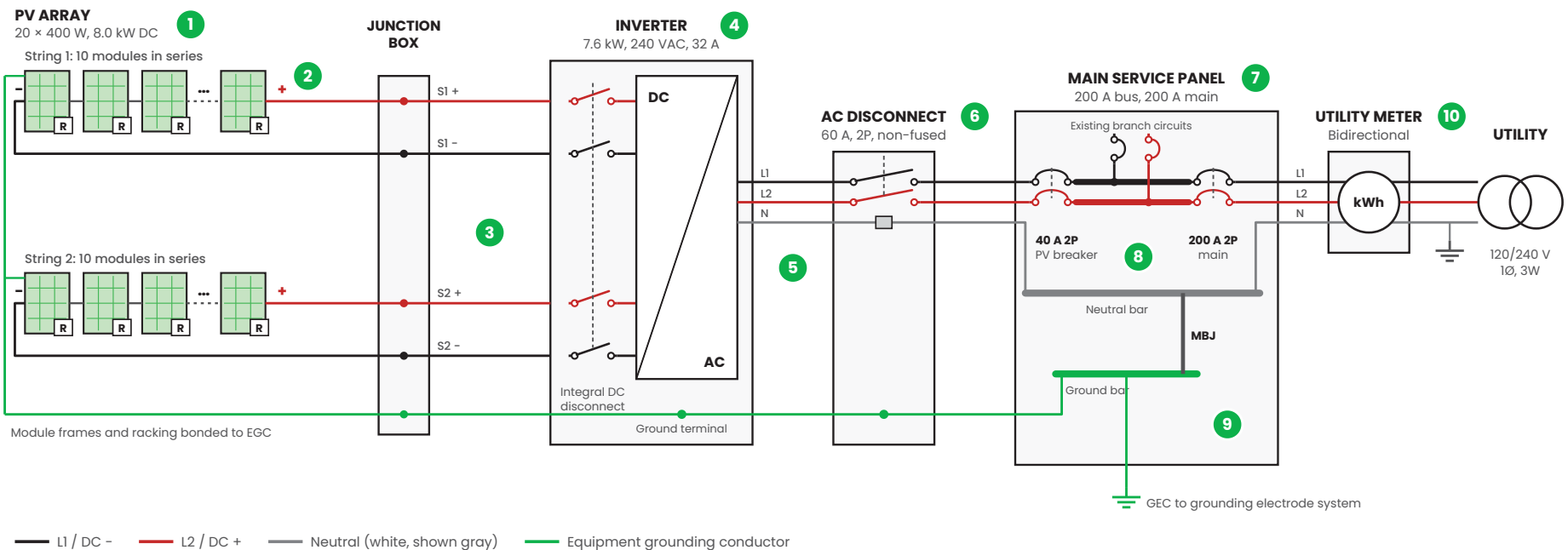
GreenLancer prepares solar plan sets with one-line and three-line diagrams for installers nationwide.

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Residential Solar Three-Line Diagram Example

120/240 V split-phase | 7.6 kW string inverter | Load-side connection, NEC 705.12(B)(3)(2)

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KEYED NOTES

- 1** PV array: 20 x 400 W modules in 2 series strings of 10 (8.0 kW DC), shortened with an ellipsis for clarity. Each module has a module-level rapid shutdown device (R) per NEC 690.12.
- 2** Max system voltage (690.7): $10 \times 37.1 \text{ V Voc} \times 1.117 = 414 \text{ V}$ at -20°C ($-0.26\%/^\circ\text{C}$ Voc coefficient), below the 600 V inverter max input. Use the site's design low temperature.
- 3** DC circuits (690.8): max current $1.25 \times 13.8 \text{ A Isc} = 17.3 \text{ A}$; required ampacity $1.25 \times 17.3 \text{ A} = 21.6 \text{ A}$. PV wire to junction box, then (4) #10 THWN-2 Cu + (1) #10 Cu EGC (690.45) in 3/4 in. EMT.
- 4** Inverter: 7.6 kW string inverter, 240 VAC split-phase output, 32 A max continuous output current, UL 1741 SB listed, integral DC disconnect (690.15).
- 5** Inverter output circuit: $1.25 \times 32 \text{ A} = 40 \text{ A}$. (2) #8 THWN-2 Cu L1/L2 (50 A at 75°C), (1) #8 THWN-2 Cu N where required by inverter instructions (705.95), (1) #10 Cu EGC (Table 250.122) in 3/4 in. EMT.
- 6** AC disconnect: 60 A, 240 VAC, 2-pole non-fused, NEMA 3R, lockable, utility-accessible where required. Serves as the rapid shutdown initiation device (690.12(C)) only where the listed inverter and RSD system support it. Show the transmitter or control arrangement and verify operation per manufacturer instructions.
- 7** Main service panel: 120/240 V, 1Ø, 3W, 200 A busbar, 200 A main breaker. 40 A 2-pole backfed PV breaker at the opposite end of the busbar from the main.
- 8** Load-side source connection, 120% rule (705.12(B)(3)(2)): $(1.25 \times 32 \text{ A}) + 200 \text{ A} = 240 \text{ A}$, not greater than $1.2 \times 200 \text{ A} = 240 \text{ A}$. Mark PV breaker as a power source output connection; do not relocate.
- 9** Grounding and bonding: neutral and EGC bonded only at the service (main bonding jumper). PV EGCs land on the ground bar. Existing GEC to grounding electrode system (250.50, 250.64).
- 10** Utility meter: bidirectional net meter, 120/240 V, 1Ø, 3W (utility-owned).

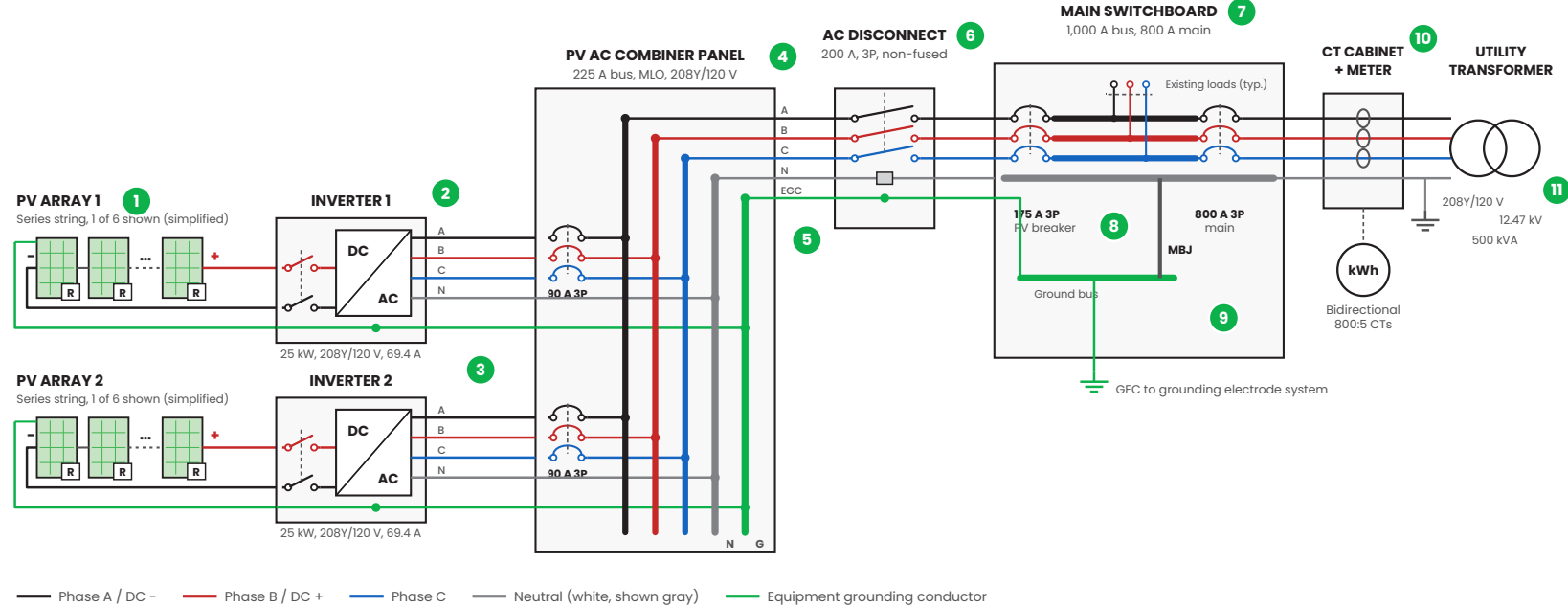
Representative example for education only. Not for construction. Equipment, values, and code sections (2023 NEC shown) vary by project, AHJ, utility, and adopted code edition.

Residential example: 120/240 V split-phase, single 7.6 kW string inverter, load-side source connection using the 120% rule (NEC 705.12(B)(3)(2)).

Commercial Solar Three-Line Diagram Example

208Y/120 V three-phase | (2) 25 kW inverters, 50 kW AC | Load-side connection, NEC 705.12(B)(3)(1)

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KEYED NOTES

- PV arrays: DC source circuits are simplified, with one series string shown per inverter (typical of 6). Actual plan sets must document every PV source circuit, conductor sizing, overcurrent protection, and inverter input configuration. Module-level rapid shutdown (690.12) on rooftop arrays.
- Inverters: (2) 25 kW three-phase string inverters, 208Y/120 VAC, 69.4 A max continuous output current each, UL 1741 SB listed, integral DC disconnect (690.15).
- Inverter output circuits (each): $1.25 \times 69.4 \text{ A} = 86.8 \text{ A}$, 90 A 3-pole breaker. (3) #3 THWN-2 Cu (100 A at 75°C), (1) #8 Cu N (705.95; confirm inverter instructions), (1) #8 Cu EGC (Table 250.122) in 1-1/4 in. EMT.
- PV AC combiner panel: 225 A busbar, 208Y/120 V, 3Ø, 4W, main lugs only. 705.12(B)(3)(3): $90 \text{ A} + 90 \text{ A} = 180 \text{ A}$, not greater than 225 A. Mark panel per 705.12(B)(3)(3).
- PV AC feeder: $1.25 \times 138.8 \text{ A} = 173.5 \text{ A}$. (3) 3/0 THWN-2 Cu (200 A at 75°C), (1) #4 Cu N (705.95), (1) #6 Cu EGC (Table 250.122, 175 A OCPD) in 2 in. EMT.
- AC disconnect: 200 A, 240 VAC, 3-pole non-fused with solid neutral, NEMA 3R, visible-break, lockable, utility-accessible where required. Serves as the rapid shutdown initiation device (690.12(C)) only where the listed inverters and RSD system support it. Show the transmitter or control arrangement and verify operation per manufacturer instructions.
- Main switchboard: 208Y/120 V, 3Ø, 4W, 1,000 A busbar, 800 A main breaker. PV connects through a 175 A 3-pole breaker.
- Load-side source connection, sum rule (705.12(B)(3)(1)): $173.5 \text{ A} + 800 \text{ A} = 973.5 \text{ A}$, not greater than the 1,000 A busbar. Breaker position is not restricted under this option.
- Grounding and bonding: main bonding jumper in the switchboard only, with no neutral-to-ground bond at PV equipment. GEC to grounding electrode system. Interrupting and SCCR ratings must meet available fault current (110.9, 110.10).
- Utility metering: CT-rated bidirectional revenue meter, 3Ø, 4W, 800:5 CTs in CT cabinet (utility-owned; confirm utility metering specifications).
- Utility transformer: pad-mount, 12.47 kV primary to 208Y/120 V secondary, 500 kVA, utility-owned. Secondary neutral grounded at transformer. Get available fault current from the utility.

Representative example for education only. Not for construction. Equipment, values, and code sections (2023 NEC shown) vary by project, AHJ, utility, and adopted code edition.

Commercial example: 208Y/120 V three-phase, two 25 kW inverters through a PV AC combiner panel, load-side source connection using the busbar sum rule (NEC 705.12(B)(3)(1)).

Solar Three-Line Diagram Symbol Legend

Symbols used in GreenLancer's residential and commercial three-line diagram examples

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PV module with RSD

Module with a module-level rapid shutdown device (R) for NEC 690.12 compliance.



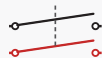
Inverter

Converts DC from the PV array to AC. Diagonal separates the DC and AC sides.



Circuit breaker

Overcurrent protective device. A dashed tie line means the poles trip together (2P or 3P).



Disconnect switch

Manually operated switch shown open. Dashed tie line means a gang-operated multi-pole switch.



Junction box

Enclosure where conductors are spliced or terminated, such as a PV wire to THWN-2 transition.



Neutral terminal and bar

Unswitched neutral connection point (top) and neutral bar or bus (bottom).



EGC and ground bar

Equipment grounding conductor with a ground terminal (top) and ground bar or bus (bottom).



Main bonding jumper (MBJ)

Bonds the neutral to the equipment grounding system at the service only.



Grounding electrode

Grounding electrode system, connected by the grounding electrode conductor (GEC).



Utility meter

Revenue meter. Bidirectional meters record both imported and exported energy.



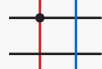
Current transformer (CT)

Measures current on each phase for a CT-rated meter on larger services.



Transformer

Changes voltage between primary and secondary windings, such as a utility pad-mount unit.



Connection vs. crossing

A dot means conductors are connected. Lines that cross without a dot are not connected.



Keyed note

Numbered callout that matches a note with ratings, sizes, and code references.



Conductor colors

Illustrative only: black L1/A and DC-, red L2/B and DC+, blue C, gray for white neutral, green EGC.

Symbols vary by drafting standard. Phase and DC colors are illustrative, not required field identification; neutral and EGC identification follows NEC 200.6 and 250.119.

How to Read a Three-Line Diagram

- 1. Start at the PV array.** Identify modules, string configuration, and rapid shutdown equipment.
- 2. Follow the DC circuits.** Check conductor sizes, polarity, and the DC disconnect.
- 3. Review the inverter.** Confirm DC input limits, AC voltage, phase configuration, and output current.
- 4. Trace the AC circuits.** Verify OCPD ratings, conductor sizes, neutral, and EGCs through each disconnect and panel.
- 5. Check the interconnection.** Confirm the load-side or supply-side method, busbar math, metering, and grounding at the service.

One-Line vs. Three-Line

A one-line diagram simplifies each circuit into one representative line. A three-line diagram draws each phase conductor separately, along with neutral and grounding conductors where present.

Read the full guide: [Solar Three-Line Diagram Guide for Installers](#)

Solar Three-Line Diagram Pre-Submission Checklist

Run each plan set through these checks before sending it to the AHJ or utility. Requirements vary by jurisdiction, utility, and NEC edition. For labeling details, see GreenLancer's guide to [solar labeling requirements](#).

Conductors and Overcurrent Protection

- ☐ Conductor sizes, insulation types, and ampacity match NEC 690.8 and Article 310, including temperature correction and adjustment factors.
- ☐ Every conductor is identified: L1/L2 or phases A, B, and C, neutral where present, EGCs, and the GEC.
- ☐ AC and DC overcurrent protective device ratings are shown and agree with the conductor schedule.
- ☐ Conduit types, sizes, and conductor counts match the conduit and conductor schedule.

PV Source and Inverter

- ☐ String voltage accounts for the design low temperature (690.7) and stays within the inverter's max DC input voltage.
- ☐ PV circuit maximum current is calculated using the applicable 690.8(A) method, and conductor ampacity satisfies both 690.8(B)(1) and (B)(2), including temperature and adjustment factors.
- ☐ Inverter make, model, AC voltage, phase configuration, and max continuous output current match the datasheet and equipment schedule.

Interconnection

- ☐ The interconnection method is labeled: load-side source connection (705.12) or supply-side connection (705.11).
- ☐ Load-side: busbar rating, main OCPD rating, PV breaker rating, and the 705.12(B)(3) option used are shown with the calculation.
- ☐ Supply-side: connection location, service conductors, disconnecting means, overcurrent protection, and conductor sizes are documented.
- ☐ Equipment interrupting and short-circuit current ratings meet the available fault current (110.9, 110.10).

Grounding and Bonding

- ☐ EGCs are sized per Table 250.122, and PV circuit EGCs per 690.45.
- ☐ The neutral-to-ground bond appears only at the service or a separately derived system.
- ☐ GEC and grounding electrode connections are shown.

Rapid Shutdown and Labels

- ☐ Where 690.12 applies, rapid shutdown equipment, the initiation device location, and applicable boundaries are shown.
- ☐ Required labels and placards are called out on the plan set.

Consistency and Utility Review

- ☐ The diagram matches the equipment that will be installed: models, breaker locations, and wire paths.
- ☐ Values agree with the equipment schedule, calculations, site plan, and other plan set sheets.
- ☐ Utility requirements are confirmed, including disconnect location, metering, CTs, and labeling.
- ☐ The NEC edition adopted by the AHJ is confirmed before submission.

SOLAR PERMIT DESIGN AND ENGINEERING

Get Permit-Ready Three-Line Diagrams From GreenLancer

One-line and three-line diagrams built to your AHJ and utility requirements, as part of complete solar plan sets.

GreenLancer three-line diagrams typically document:

- Phase, neutral, and grounding conductors with sizes, insulation types, and raceway details
- AC and DC overcurrent protection and disconnect ratings
- Inverter, battery, and string or branch-circuit configurations
- The interconnection method and applicable NEC 705 documentation
- A PE stamp from a licensed engineer, where the AHJ or utility requires one

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