lunar energy

Power Control System (PCS) Features for the Lunar System

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Introduction to PCS

Power Control System (PCS) features are a set of on-grid controls used to apply multiple independent limits by controlling the outputs of the Lunar ESS. With PCS, the Lunar ESS is able to dynamically limit current and loading on the busbars and conductors supplied by the Lunar System; as well as dictate the allowable PV vs battery behavior. As a result, PCS can reduce expensive electrical upgrades, reduce complicated load relocation, and ensure safe, compliant operation according to NEC and Utility regulations.

The Lunar System, which includes the Lunar Battery (ESS), Lunar Bridge or Lunar MSA-Controller, and optional Rogowski Coils (CTs), have been certified to both UL 1741 PCS CRD and UL 3141. Lunar PCS control ensures the maximum Open Loop Response Time (OLRT) is less than two seconds; that is, if the measured current of all sources combined exceeds the configured user limit, the aggregate output of all PCS-controlled sources (PV output, battery charge and discharge) will be curtailed to zero within two seconds. PCS is relevant to Article 705, 750, and 220 of the 2020 NEC, the 2023 NEC, and the 2022 CEC.

This Applications Note describes the implementation details and use cases of Power Control System features for the Lunar System. The following features are the distinct functions of the Lunar System. Installers may select one or multiple settings based on site conditions.

- Bridge Limit
- MSA (Meter Socket Adapter) Limit
- Panel Limit at Rogowski Coils
- PCS Modes
- Export Limit from Lunar System

Compliance Information

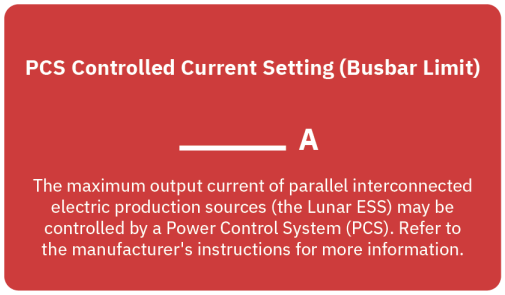
Labelling Requirements

Busbar Limit Labels

A busbar limit label is factory applied on the Lunar Bridge dead front. An additional busbar limit label shall be applied to the panelboard when the Rogowski Coils are installed. The Rogowski Coil Kit (90-06789A) is sold separately and contains two Rogowski Coils and field applied labels.

The installer must write in the respective **User Set Limit** for each label.

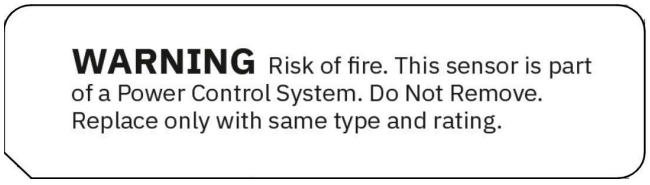
Figure 1. PCS Busbar Limit Label



CT Labels

A CT label (Figure 2) is required where busbar limits are applied. For Bridge Limit, the CT label is factory applied inside the enclosure near the built-in Bridge CTs.
For Panel Limit at Rogowski Coils, the installer shall apply the CT label (included in the Lunar Hardware Kit) inside the panelboard near the location where Rogowski coils are installed.

Figure 2. PCS CT Label



Qualified Personnel

PCS settings can only be configured by qualified personnel in the Lunar Installer App during commissioning. Access to the Lunar Installer App is protected by login credentials. Homeowners or any unqualified personnel are not capable of altering PCS settings.

Bridge Limit

By setting a PCS Busbar Limit at the Lunar Bridge, Lunar Inverter AC current will curtail as needed such that current on the Bridge busbar does not exceed the user set limit. Note that battery charge, battery discharge, and PV output may curtail as needed to limit current on the busbar.

✓ **Note:** Busbar limits apply to current on either L1 or L2.

Use Case: Install 200A Breaker for Lunar Bridge

- Site has a 200A breaker feeding the 200A rated Lunar Bridge.
- The Lunar ESS 50A breaker does not comply with the NEC 120% rule in the Bridge. Instead controlled backfeed is allowed per 705.13 of the NEC.
- In addition to controlling backfeed on the Bridge busbar, charge from grid behavior will curtail per NEC 220.70 to avoid tripping the 200A Bridge feeder breaker.

Installer Action

- In the Installer App → PCS limits, set Bridge Limit to 200A.
- Installer shall fill in “200” on the busbar limit label of the Bridge deadfront.
- Note Bridge has built-in CTs. No additional Rogowskil Coils (CTs) are required.

Figure 3. Bridge Limit - System Diagram

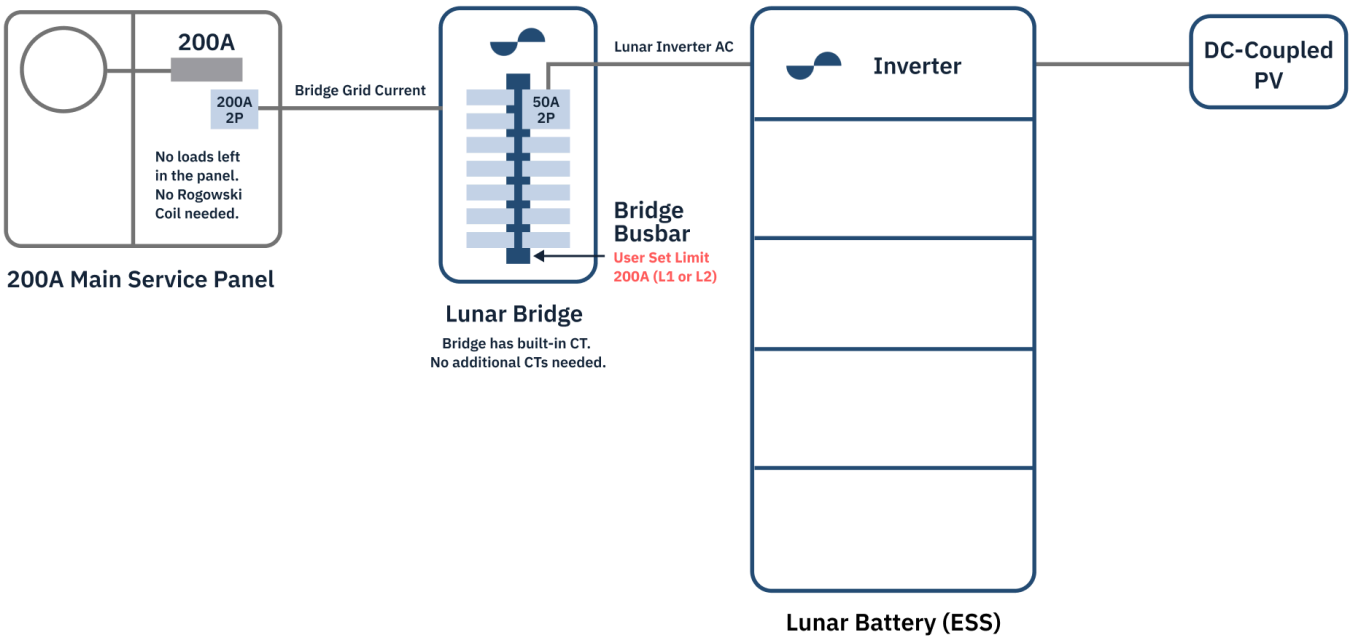
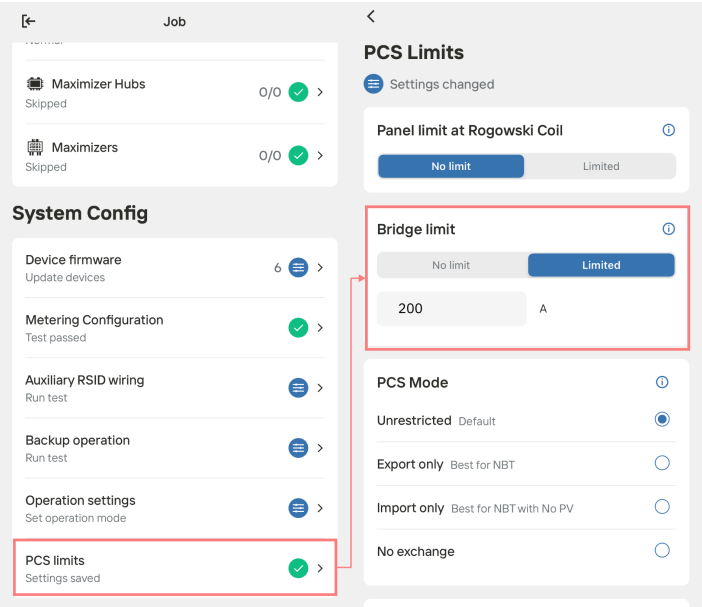


Figure 4. Set Bridge Limit in the Installer App



MSA Limit

Similar to a Bridge Limit, the Meter Socket Adapter (MSA) can have a PCS Busbar Limit set. By setting a PCS Busbar Limit at the MSA, Lunar Inverter AC current will curtail as needed such that current at the MSA does not exceed the user set limit.

Use Case: Connect Lunar ESS to undersized main panel

- Site has a 100A main service panel with 100A service disconnect.

Installer Action:

- Install ConnectDER IslanDER MSA and Lunar MSA Controller
- In the Installer App → PCS Limits, set MSA Limit to 100A
- Installer applies the busbar limit to the main panel. CT labels are on the MSA device.

Figure 5. MSA Limit for 100A Homes - System Diagram

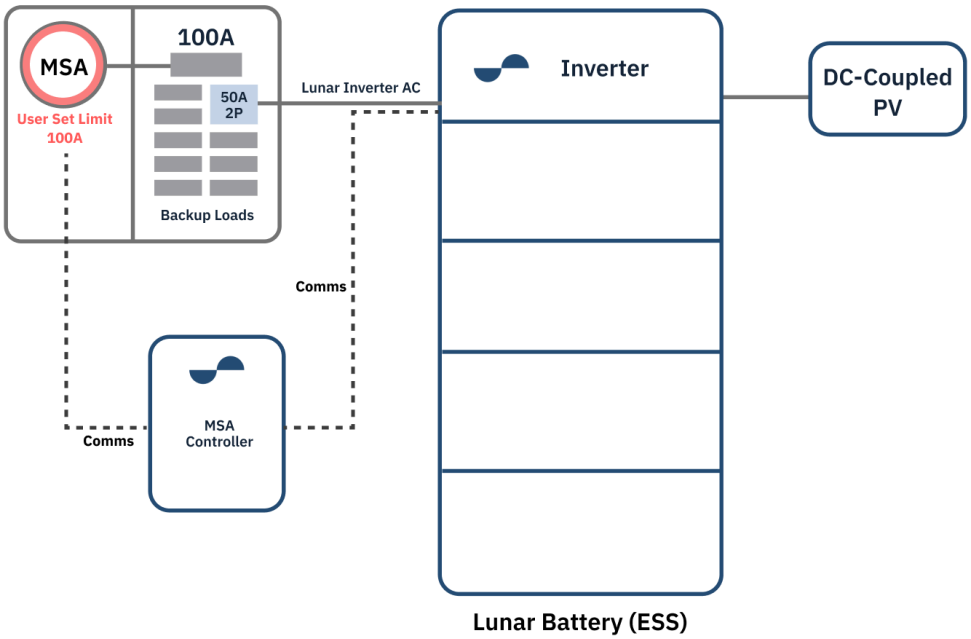
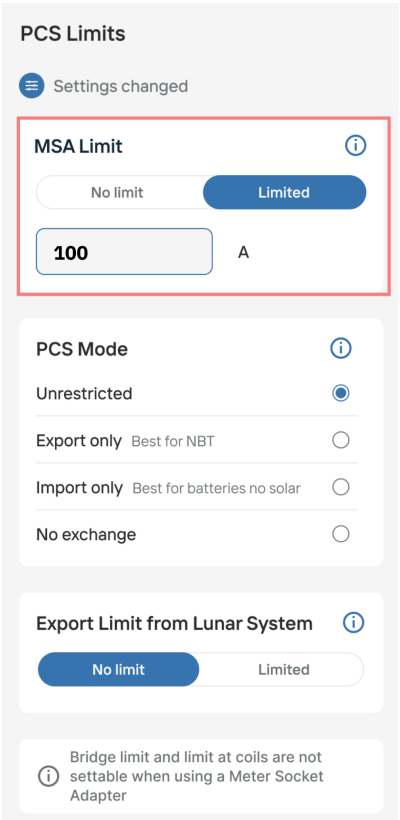


Figure 6. Set MSA Limit in the Installer App



Panel Limit at Rogowski Coils

By setting a PCS Panel Limit at Rogowski Coils (CTs), Lunar Inverter AC current will curtail as needed such that current on the Coil (CT) measured busbar does not exceed the User Set Limit. Note that battery charge, battery discharge, and PV output may curtail as needed to limit current on the busbar. See Lunar Applications Note on Rogowski Coils for all Coil (CT) related requirements.

Use Case: Avoid Main Panel Upgrade for 100A Service Homes

- Site has a 100A main service panel with 100A service disconnect. The main panel feeds the Lunar Bridge via a 100A branch breaker.
- A 60A non-backup load is left in the main panel.
- The main panel does not comply with the NEC 120% rule nor the NEC Sum of Breakers rule, per 2020 NEC 705.12(B)(3)(2) and 705.12(B)(3)(3)). Instead controlled backfeed is allowed per 705.13 of the NEC.
- In addition to controlling backfeed on the main panel busbar, charge from grid behavior will be curtailed per NEC 220.70 to avoid tripping the service disconnect.

Installer Action:

- Install Rogowski Coils at the service disconnect .
- In the Installer App → PCS Limits, set Busbar Limit at Rogowski Coils to 100A.
- Installer applies both the busbar limit and the CT label at the main panel.

Figure 7. Panel Limit at Rogowski Coil for 100A Homes - System Diagram

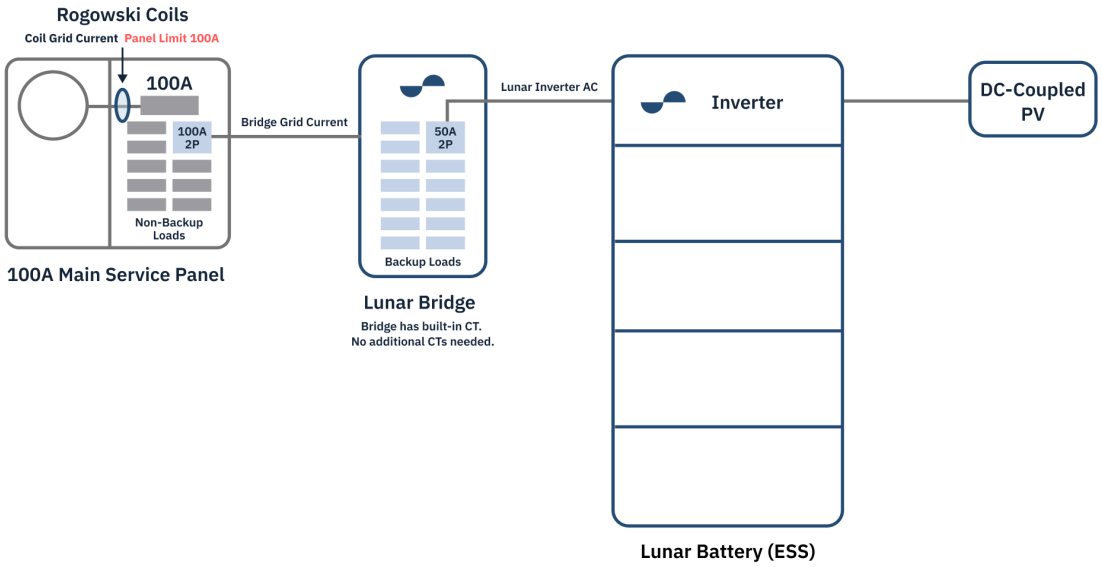
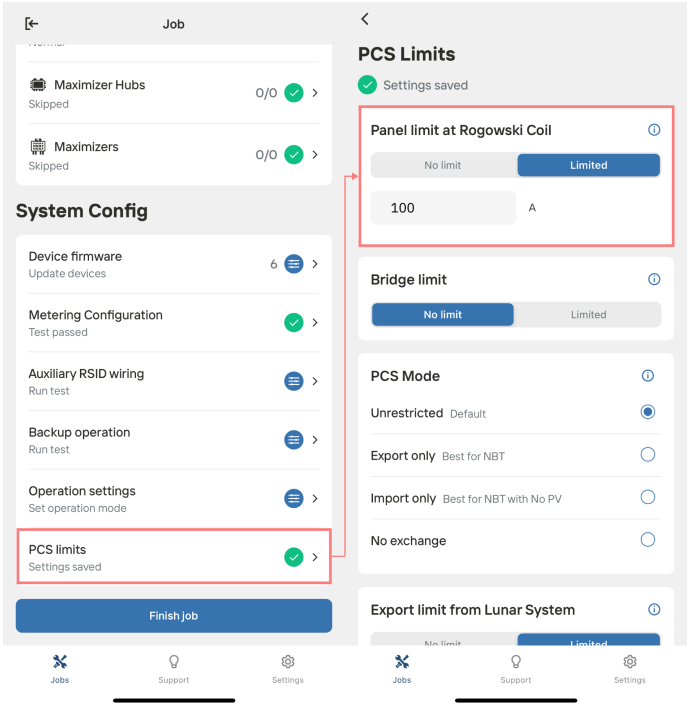


Figure 8. Set Panel limit at Rogowski Coil CTs



PCS Modes

The Lunar System is certified to the four ESS operating modes defined from the applicable standards. Each of these four modes determines battery import and battery export permissions.

PCS Modes*	Battery Export to Grid	Battery Import from Grid	PV Export to Grid
No Restriction	Yes	Yes	Yes
Export Only	Yes	No, only charge from PV**	Yes
Import Only	No, only discharge to offset site load	Yes	Yes
No Exchange	No, only discharge to offset site load	No, only charge from PV**	Yes

* The maximum open loop response time (OLRT) for grid operating modes are less than 2 seconds.
** For Export Only and No Exchange modes, battery may temporarily charge from the grid for critical maintenance or ahead of extreme weather events.

Note: Installer is responsible for confirming that grid operating mode in the utility-approved NEM agreement matches the commissioned system. PCS Mode can be confirmed in the Installer App or in the Commissioning Report.

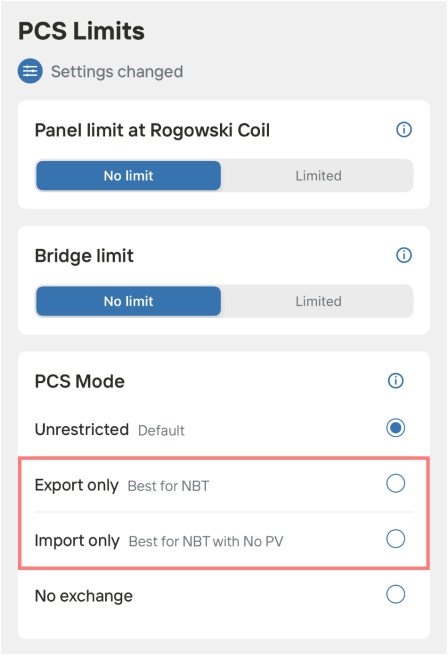
Use Case: Interconnection Requirements for CA Net Billing Tariff (NBT)

- California investor-owned utilities (PG&E, SCE, and SDG&E) require that energy storage systems paired with NEM PV choose either Import Only or Export Only as the ESS operating mode.

Installer Action

- Export Only mode is recommended for battery and PV installation so the battery can charge from PV during the day, and export to the grid when net metering export credits are most valuable. Homeowners can leverage Export Only mode to improve the payback on their system. To set up in the Installer App, go to PCS Limits → PCS Modes, select Export Only.
- Import Only mode is recommended for standalone battery installation (no AC and no DC PV) given there is no PV and battery can only charge from grid. To set up in the Installer App, go to PCS Limits → PCS Modes, select Import Only.

Figure 9. Set PCS Modes in the Installer App



Export Limit from Lunar System

The Export Limit determines the maximum power the Lunar System can export from the site to the grid. Lunar Inverter AC output power (PV and battery) will be curtailed as needed to meet the User Set Limit. The Export Limit is applied at Rogowski Coils. If there are no Rogowski Coils installed, the Export Limit applies at the Bridge CTs by default.

- **Note:** Export power limit applies to L1 and L2 combined.
- **Note:** Setting an Export Limit of 0 W may prevent Lunar from capturing VPP export credits.
- **Note:** Lunar system does not import in order to try to be under the Export Limit.

Use Case: Site Export Limit due to Undersized Distribution Transformer

- A distribution transformer (10kVA) has been serving neighboring homes, which have been exporting up to 7.6 kW AC PV in total. The transformer is undersized for the unlimited export of the Lunar System (9.6kW). Utility may ask the customer to pay for upgrading the transformer, which can be very expensive and time consuming.

Installer Action

- Export Limit may be set at the size of the remaining transformer capacity on site (10kW - 7.6kW = 2.4 kW), or conservatively at 0 Watt, based on utility interconnection guidance.
- The Export Limit protects the existing transformer from overloading, and avoids transformer upgrade.

Figure 10: Export Limit at Rogowski Coil - System Diagram

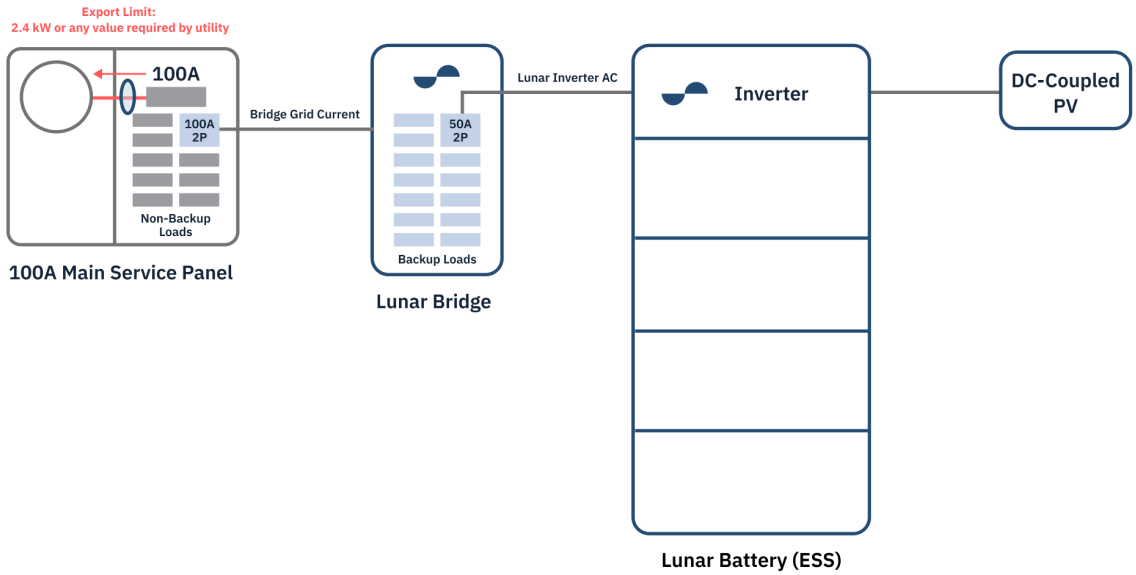
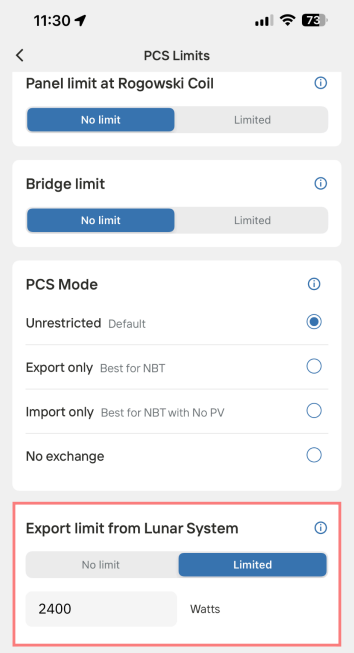


Figure 11: Set Export Limit in the Installer App



Apply PCS limits for sites with AC-Coupled PV

Installers can apply PCS limits to ensure sites with AC-coupled PV comply with NEC and utility interconnection requirements.

✔ **Note:** The Lunar system does not control or curtail AC coupled PV while on-grid. For more detail on behaviors with AC PV, please refer to the EATON AbleEdge smart breaker application note.

Use Case: AC-Coupled PV in Backup

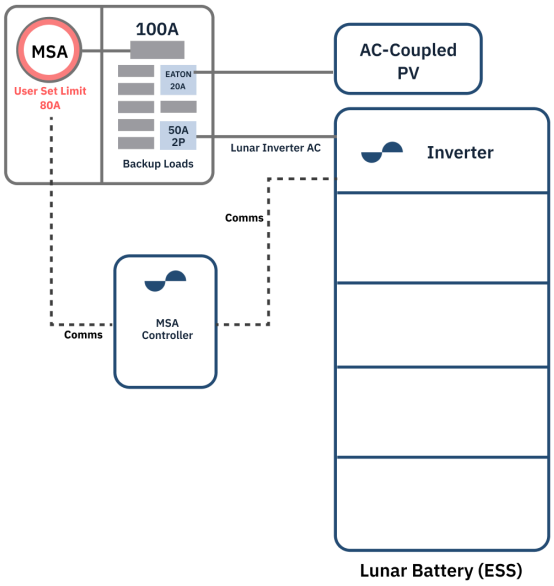
- Site has a 100A main panel, 100A main breaker, with an existing solar inverter of 16A max continuous output (20A circuit breaker), along with the Lunar ESS of 40A continuous / 50A breaker. AC-coupled PV charges the battery and supports home consumption on and off-grid. AC PV and Lunar ESS breakers are installed in the main panel.

Installer Action

- Use the Eaton AbleEdge smart breakers for AC-coupled PV.
- Install ConnectDER IslanDER MSA and Lunar MSA Controller
- Set an MSA Limit of 80A

Note: The AC PV is not controlled for PCS. Set the PCS busbar limit to account for the PV operating at peak output power.

Figure 12: Set MSA limit the Installer App when AC PV is present



Use Case: AC-Coupled PV not in Backup

- Site has a 100A main panel, 100A main breaker, 100A branch breaker feeding the Bridge, and an existing solar inverter in the main with a 16A max continuous output (20A circuit breaker).
- The main panel does not comply with the NEC 120% rule or the NEC Sum of Breakers rule, per 2020 NEC 705.12(B)(3)(2) and 705.12(B)(3)(3)). Instead controlled backfeed is allowed per 705.13 of the NEC.

Installer Action

- Install Rogowski Coils and apply labels at the main panel.
- Ensure AC PV is excluded from backup.
- AC-coupled PV is an uncontrolled source. When selecting the PCS panel limit, the installer must assume the uncontrolled power source is outputting at its maximum current (16A). In the Installer App → PCS limits, set Panel Limit at Rogowski Coils to 84A. (100A - 16A = 84A).

Figure 13. Panel Limit at Rogowski Coil for AC-coupled PV - System Diagram

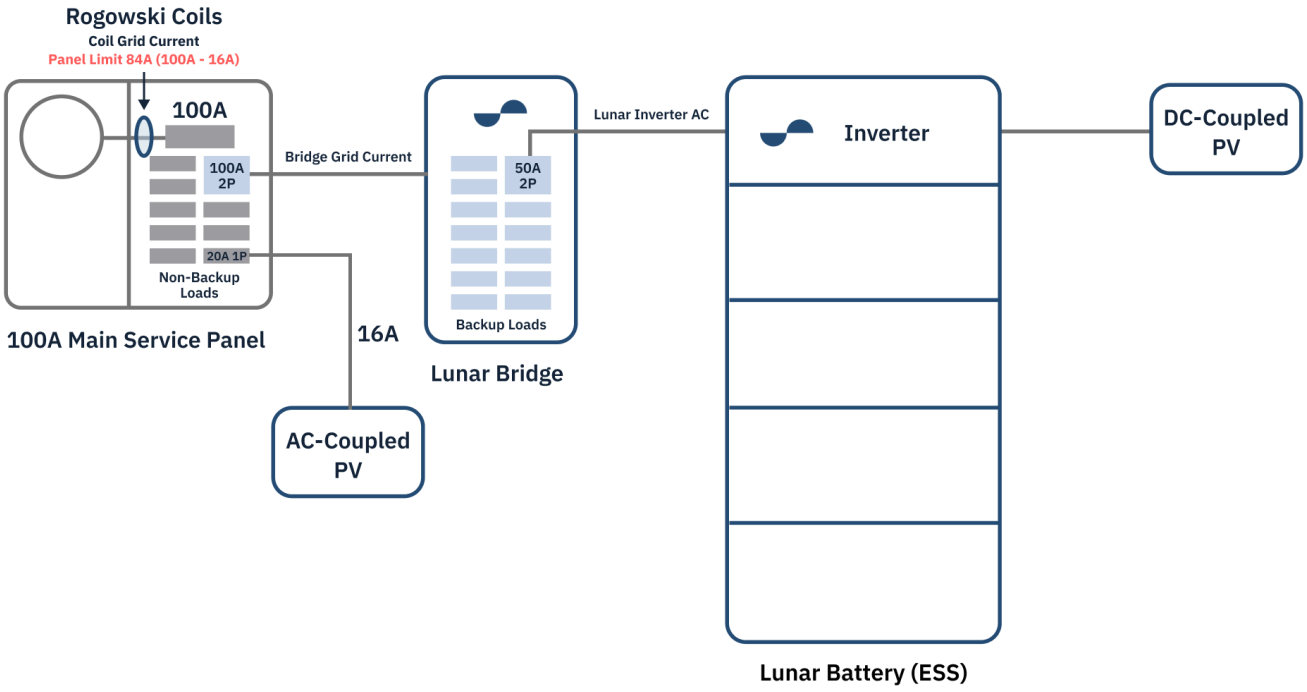
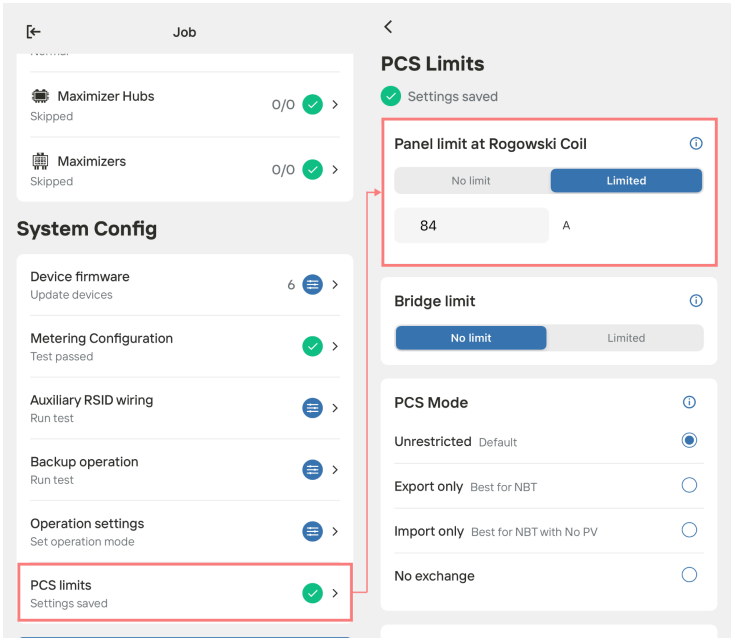


Figure 14. Set Panel Limits in the Installer App when AC PV is not in backup.



Use Case: NEM-2 Compliance with AC-Coupled PV

- A customer in California has an existing NEM-2 PV system and plans to add more PV and battery.
- To prevent moving to NEM-3 (Net Billing Tariff), which significantly reduces the export value of PV, customer need to set up the expansion system as Non-Export compliant.

Installer Action

- With the Export Limit set to 0 Watts (Non-Export), the Lunar System never exports power from the Bridge to the main panel. It only outputs power to offset the backup loads on the load side of the Bridge.
- Do **not** install Rogowski Coils so that export limit is applied at the Bridge CTs and existing AC PV can export independently to the grid to maximize NEM2 credits.

Note: The Export Limit of 0W AC applied at the Bridge ensures the main panel (and grid) sees no backfeed from the Lunar System; therefore it complies with 705.13.

Figure 15: Export Limit with AC-Coupled PV - System Diagram

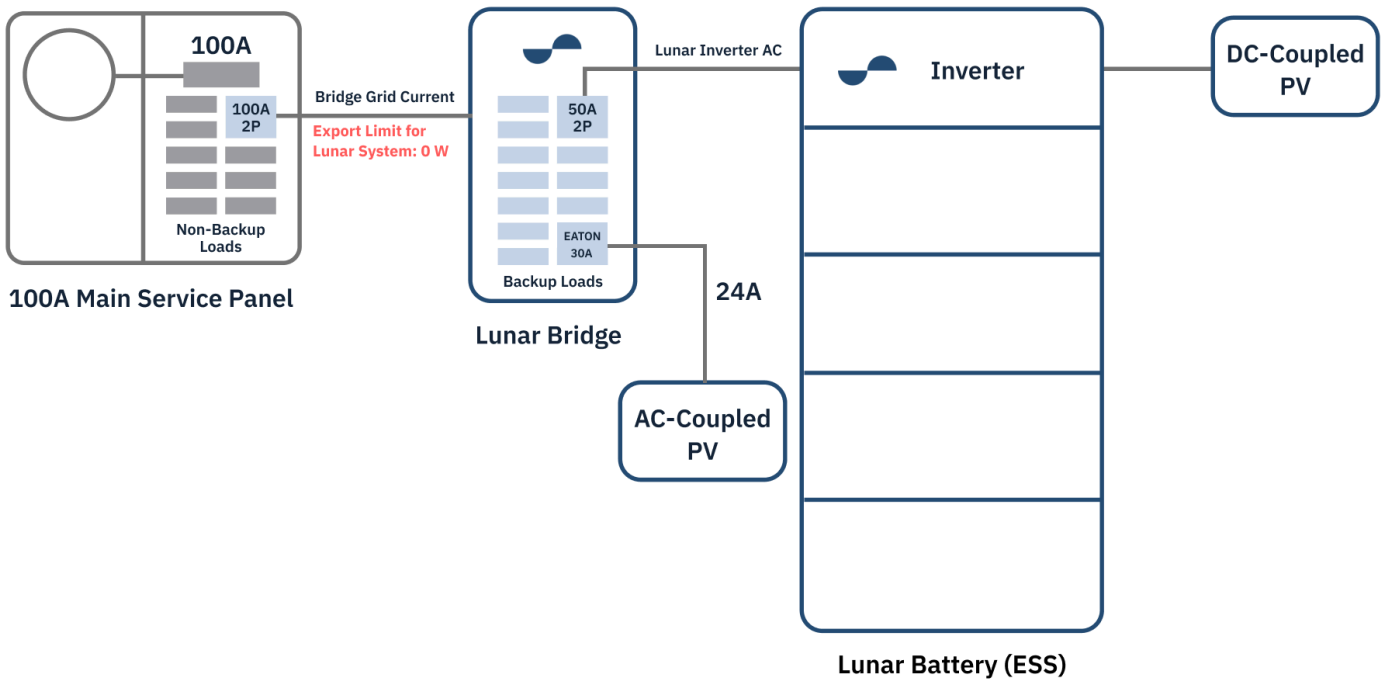
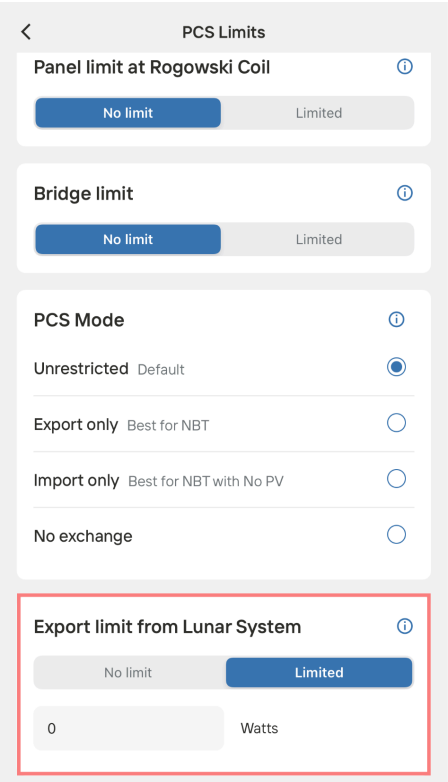


Figure 16: Setting Export Limit in the Installer App



FAQs

Would PCS work if there is a communication failure?

PCS settings will continue to work as configured if the Lunar System loses communication to the internet. In the event the Lunar ESS loses communication to the Lunar Bridge, the Lunar ESS will limit all output as dictated by PCS certifications.

Can I set multiple PCS settings for a site?

Yes, you may select any combination of the 4 PCS settings (Bridge Limit, Panel Limit at Rogowski Coils, PCS Mode, and Export Limit) for an individual site.

Can I permanently derate inverter current output?

No, this is not allowed.

How do I demonstrate to AHJs that PCS limits have been successfully enabled for the site?

You may present the commissioning report produced by the Installer App, which includes all PCS settings shown below.

PCS settings

PCS Mode	Unrestricted
Bridge Limit	Unlimited
Panel Limit at Rogowski Coil	-
Export Limit	Unlimited

Can I set a grid import limit?

Site import limit from grid is not accessible to users through the Installer App. Please contact Lunar if it is required for a specific site. For curtailment of battery charge from grid behavior to avoid tripping main breakers, use either Bridge Limits, MSA Limits or Panel Limits at Rogowski Coils. Both implementations of busbar limits will curtail battery charge from grid behavior as needed to limit peak load of the site.

Glossary

Lunar Battery: Lunar Energy Storage System (ESS) consisting of a hybrid inverter and multiple battery blocks.

Lunar Bridge: Lunar microgrid interconnect device with integrated load center.

Lunar System: A suite of Lunar products that includes Lunar Battery, Lunar Bridge, Lunar Maximizers and optional Rogowski Coils.

Rogowski Coils: Lunar's flexible current transformers (CT) for current monitoring.

Lunar Inverter AC: Current and/or power output from both PV generation and battery charge and discharge.

User Set Limit: PCS current or power limit entered in the Lunar Installer App during commissioning

120% Rule: 2020 NEC 705.12(B)(3)(2) 120% Rule states where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power-source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar.

Sum of Breakers Rule: 2020 NEC Sum of Breaker Rules 705.12(B)(3)(3) states that the sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar.

Revision History

Revision	Description of Change	Effective Date
1	Initial Release	1/27/2025
2	Labeling Requirements for Rogowski Coils	03/17/2025
3	MSA limit, AC PV in backup	09/24/2025