AC COUPLING GUIDE

Commercial & Industrial

North America

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Introduction

This guide walks you through setting up AC-coupled equipment with Sol-Ark C&I inverters. These instructions include:

- Basic installation wiring
- Requirements for AC coupling
- Pros and cons of AC coupling
- How to program the Sol-Ark inverter for AC coupling

Scope

This guide defines the design considerations and operational behavior of AC-coupled systems when integrated with a Sol-Ark hybrid inverter. It's intended to assist installers, electricians, and system designers in understanding how AC-coupled solar generation interacts with existing electrical infrastructure and backup power systems.

This guide includes:

- Appropriate use cases for AC coupling, including system expansions and retrofitting existing inverters
- Electrical connection points for AC-coupled systems such as **GRID** side and **GEN** side
- Power flow behavior during grid-connected and grid-outage operating modes
- System limitations, including maximum allowable AC-coupled capacity
- Monitoring and visibility considerations
- General efficiency considerations related to AC coupling compared to DC coupling

Supported Sol-Ark Models and Firmware

This AC coupling guide reflects functionality supported by all Sol-Ark Commercial and Industrial inverters listed below, with the following or later firmware revisions.

For all inverters: COMM 104F

Sol-Ark Inverter	Firmware Version
30K-3P-208	1110
60K-3P-480	1110

AC Coupling versus DC Coupling

What Is AC Coupling?

***AC coupling* refers to connecting solar panels to an external inverter system and then interfacing that system with the Sol-Ark inverter** at one of several approved connection points.

AC-coupled solutions might include microinverters, string inverters, other battery-based inverters, and, in some rare circumstances, an additional Sol-Ark inverter.

With AC Coupling, the external system converts DC power from the solar panels into 120/208 V and 277/480 V. The Sol-Ark inverter can then use this AC power to charge batteries after it's converted back to DC, supply loads, and export energy to the grid when a grid connection is present.

What Is DC Coupling?

DC coupling means connecting solar modules directly to the Sol-Ark inverter's MPPT inputs.

With DC Coupling, the Sol-Ark manages the solar power directly, routing it to the batteries as needed and converting DC to AC to power loads, and exporting energy to the grid when it's configured to do so.

Key Operational Differences

The primary difference between AC coupling and DC coupling is the number of energy conversion steps required. With AC coupling, solar modules connect to a third-party inverter that converts DC power into AC. The Sol-Ark inverter then accepts the AC power, and when charging batteries, converts it back into DC for energy storage. This additional DC-to-AC-to-DC conversion introduces extra conversion steps compared to DC coupling.

Each additional conversion step results in efficiency losses. The size of these losses depends on the specific AC-coupled inverter and system design used in the installation.

By contrast, DC-Coupled systems deliver solar power directly to the Sol-Ark inverter's MPPTs, allowing battery charging with fewer conversions and higher overall efficiency.

When to Use AC Coupling

The most common use case for using AC coupling is to retrofit an older inverter with a Sol-Ark inverter to get the benefits of a hybrid inverter. This provides backup capability at the installation site.

When AC Coupling is Not Recommended

We do not recommend AC coupling if you cannot sell back to the grid. Although the Sol-Ark can prevent and control sell-back from DC power sources, it cannot control the export power from an AC-coupled inverter.

- ***With only AC coupling***, sell-back can occur even when Grid Sell is disabled on the inverter settings.
- ***With AC and DC coupling***, the inverter may drop production of the DC-Coupled solar power source and rely on an AC-coupled source to manage multiple power demands, such as charging the batteries and supplying the load. This is because the Sol-Ark inverter can limit the DC production to a desirable level. However, for an AC-coupled source, the Sol-Ark inverter does not have this control; it can only turn the AC-coupled source on and off.

Why DC Coupling is Generally Recommended

Production Control Advantages

The control for the DC-coupled solar is a significant advantage for the Sol-Ark inverter. It enables control of the PV power received from your solar modules: the inverter MPPTs can reduce or increase the current demanded from the solar modules, which in turn reduces or increases the amount of power delivered to the inverter.

Grid Export Control (Preventing Sell-Back)

When using DC-Coupled generation, the Sol-Ark inverter has full control over the power flowing into it. This allows DC-coupled production to be precisely managed and export to be limited or prevented as required.

By contrast, AC-coupled generation is not directly controlled by the Sol-Ark inverter. Instead, the inverter relies on frequency curtailment to signal AC-coupled inverters to turn production on or off when the Sol-Ark inverter is operating off-grid. As a result, control of AC-coupled power is indirect and less granular than with DC-coupled systems.

Efficiency Considerations

DC coupling eliminates one power conversion stage compared to AC coupling, allowing energy to flow more directly into the inverter and battery system. The reduced conversion path leads to higher efficiency, improved battery charging performance, and less energy loss during normal operation.

When AC Coupling May Be Useful

Increased Grid Sell Capability

When you AC couple, you have the ability to sell back additional power to the grid from the Sol-Ark inverter. The maximum sell-back depends on the inverter model. You can find this limit in “AC-Coupled Power Limits and Sizing” on page 9.

Solar Production Monitoring Considerations

If your installation requires greater visibility into individual solar modules, AC-coupled systems using microinverters can provide module-level monitoring and more granular insight into system performance. This level of visibility can be useful for identifying underperforming modules, shading impacts, or maintenance needs.

Note that module-level optimizers can also provide individual module monitoring, offering similar visibility without requiring a fully AC-coupled architecture. An appropriate solution depends on system design goals, monitoring requirements, and overall system complexity.

System Requirements for AC Coupling

Supported AC-Coupled Inverter Types

The Sol-Ark can AC couple with microinverters, string inverters, and other hybrid inverters. Depending on your needs, you can even use another Sol-Ark hybrid inverter for AC coupling.

Certification Requirements (UL 1741 | UL 1741 SA | UL 1741 SB)

All AC-coupled sources must comply with UL 1741, UL 1741SA, or UL 1741SB. Compliance allows the AC-coupled source to recognize the Sol-Ark inverter as grid-forming and disconnect when the Sol-Ark implements frequency curtailment.

Voltage and Phase Compatibility

Inverter	Connection Point	Supported Voltages / Phases
30K-3P-208V	Grid Side	120/208 V three-phase (Wye)
	Gen Side	120/208 V three-phase (Wye)
60K-3P-480V	Grid Side	277/480 V three-phase (Wye) 480 V three-phase (Delta)
	Gen Side	277/480 V three-phase (Wye) 480 V three-phase (Delta)

Grid-Forming and Frequency-Shifting Overview

The Sol-Ark inverter provides the frequency and voltage that an AC-coupled source looks for. This is because the inverter follows the UL 1741, UL 1741SA, or UL 1741SB standard, depending on the grid profile you use on your Sol-Ark inverter.

AC-Coupled Power Limits and Sizing

Maximum AC-Coupled Input by Inverter Model

- 30K-3P-208: **30 kW**
- 60K-3P-480: **60 kW**

Usable Combined AC + DC Power Limits

- 30K-3P-208: 30 kW DC couple + 30 kW AC couple = **60 kW total***
- 60K-3P-480: 60 kW DC couple + 60 kW AC couple = **120 kW total***

***Notes**

These values represent the absolute maximum usable power limits for each inverter model when using a combination of AC-coupled and DC-coupled generation.

The inverter's individual DC input limits and AC input limits remain in effect at all times. You can balance AC- and DC-coupled sources to achieve your desired system performance, as long as you follow all specified power limits and operating constraints.

AC Coupling Connection Options

Connection Locations

The Sol-Ark inverter provides two possible connection points for AC-coupled sources, each with its own advantages and limitations depending on the installation site. A clear understanding of how each AC coupling location interacts with the inverter's operation, control, and monitoring capabilities is essential to selecting the optimal configuration and achieving the best overall system performance.

GEN Terminal (Recommended)

AC coupling through the **GEN** terminal is the preferred method, as it preserves most inverter features, maintains proper system behavior during grid and backup operations, and allows the AC-coupled source to be fully monitored through the Sol-Ark monitoring platform. AC coupling on the **GEN** terminal requires a battery to be installed.

GRID Terminal (Main Service Panel)

AC coupling through the **GRID** terminal means that the AC-coupled system is independent of the Sol-Ark inverter.

The AC-coupled solution will produce as much as possible when the grid is available and push all the power back to the grid (except for what's consumed by loads on the main service panel). However, when the grid is down, the AC-coupled system will shut down and won't be able to produce any power until the grid is stable.

This configuration requires using the external CTs so the inverter can read the production of your AC-coupled solution to prevent issues such as overselling to the grid. Be sure that CT sensors are properly placed according to the installation manual for the Sol-Ark 30K-3P-208V or 60K-3P-480V inverter.

AC coupling without a battery is possible on the grid side.

Operational Behavior by Connection Type

Monitoring Capabilities

Using the **GEN** terminal on outdoor-rated C&I inverters lets you monitor the power received from the AC-coupled source. This monitoring is reported in MySolArk for your viewing and record keeping. The Sol-Ark inverter's GUI screen does not clearly display the AC power you're producing: you'll see power being delivered to loads, your battery, or sold to the grid. However, there's no display of where this power is coming from on the inverter.

Behavior During Grid Outages

During a grid outage, AC coupling through the **GRID** terminal will not support your backup loads, and there's no accurate monitoring capability through the **GRID** terminal for this AC source. Your monitoring capability stays intact on the **GEN** terminal, and the inverter can still back up loads connected to the inverter's **LOAD** terminal. However, your transfer time will be affected by this setup without a DC-coupled source.

Transfer Time Impacts

The transfer time on the **GEN** terminal remains unaffected when an AC-coupled source is connected to it. The inverter maintains a **15-ms transfer time** in the event of a grid outage. Because AC coupling on the grid terminal is independent of the Sol-Ark inverter, the inverter maintains its 15-ms transfer time.

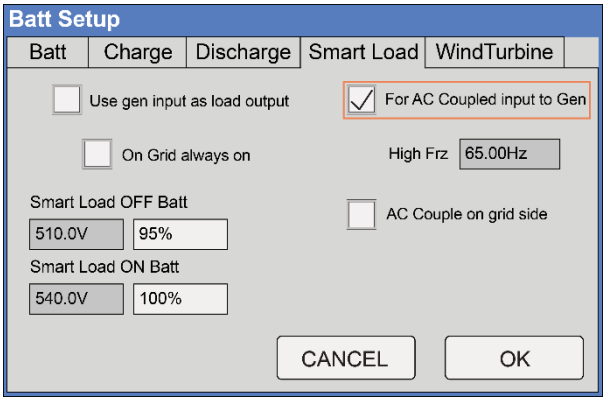
Programming the Sol-Ark Inverter for AC Coupling

Overview of Required Settings

Note: The **AC couple on load side** option is NOT supported and will be removed in the next update.

AC Coupled input to Gen

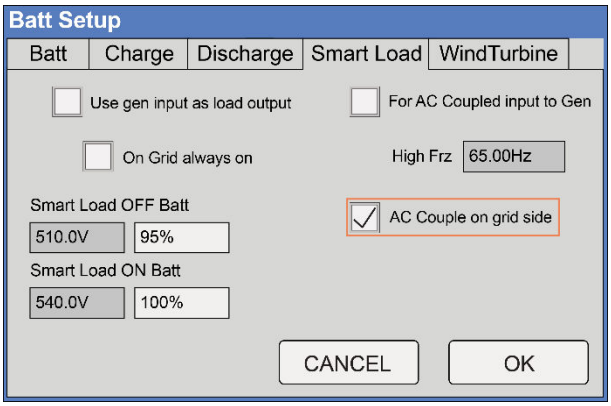
This allows the inverter to account for an AC-coupled solution that's connected to the **GEN** terminal of the inverter.



AC Couple on grid side

This setting enables the inverter to recognize and account for an AC-coupled source connected on the grid side.

By installing the external CT sensors on the main grid conductors, the Sol-Ark inverter can monitor real-time power flow to and from the grid. This allows the system to accurately measure exported and imported power, and to manage grid interactions.

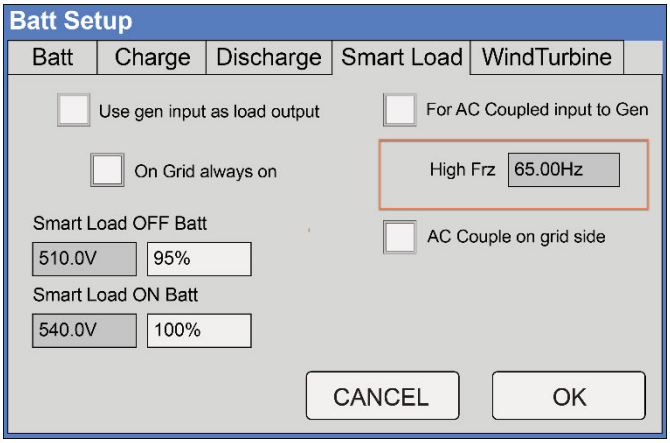


High Frz

This sets the cutoff frequency for your AC-coupled source. This is how high the Sol-Ark inverter raises its output frequency when the **Smart Load OFF Batt** value is reached.

By default, this setting is at **62 Hz**, which satisfies the requirement for UL 1741SA and UL 1741SB. If the AC-coupled source is certified for UL 1741, it's recommended to set this parameter to **65 Hz**.

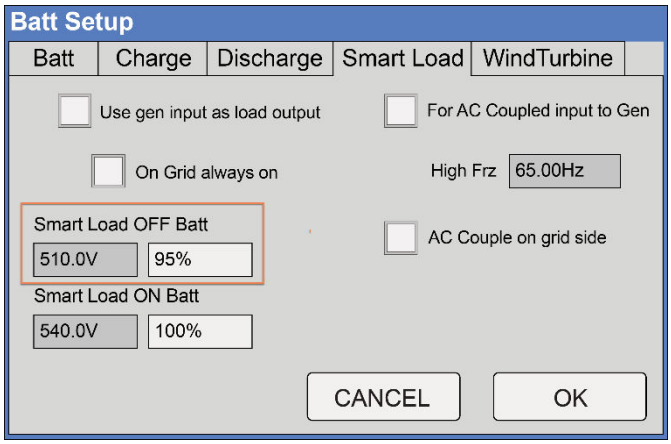
It's best to consult the AC-coupled inverter manufacturer to confirm the optimal frequency setting for your specific equipment.



Smart Load OFF Batt

This is the battery SOC percentage at which the Sol-Ark inverter will raise its frequency and prevent the **GEN** terminal from receiving power from your AC-coupled source when off-grid.*

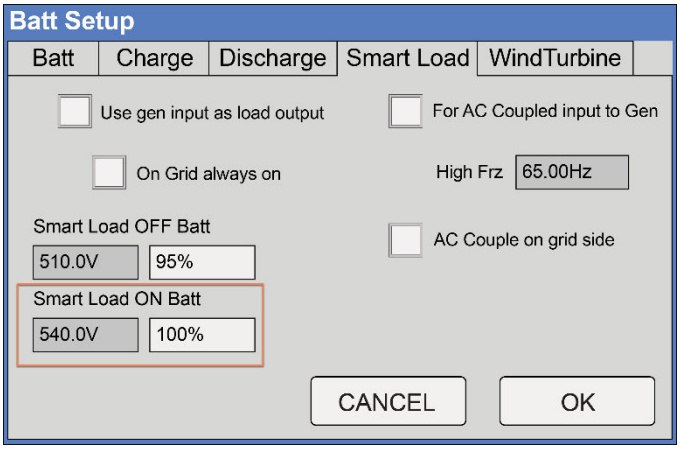
When the grid is available, your AC-coupled source will produce, regardless of your battery SOC value.



Smart Load ON Batt

This is the battery SOC percentage at which the Sol-Ark allows the **GEN** terminal to start receiving power from your AC-coupled source when off-grid.

When the grid is available and stable, your AC-coupled source will produce, regardless of your battery SOC value.



Notes

- When the battery reaches the **Smart Load OFF Batt** setpoint, the inverter shifts its output frequency to the programmed value. This allows the battery to discharge and supply the connected loads.
- The inverter continues discharging the battery until its state of charge (SOC) drops by 1%. At this point, the frequency returns to its normal level, and the AC-coupled system will reconnect to cover the loads and charge the battery when available.
- If the battery is charged to the **Smart Load OFF Batt** setpoint again, the inverter will shift the frequency again. This cycle repeats until the inverter reconnects with the grid.
- During off-grid operation, if AC-coupled power charges the battery at a rate higher than the programmed **Max A Charge** setting, the inverter will shift its frequency.

Configure AC Coupling on **GEN** Side (Recommended)

1. From the inverter settings menu, go to **Batt Setup > Smart Load tab.**
2. Select the check box for **AC Coupled Input to Gen.**
3. Specify the **High Frz** value to meet the standard or requirement for your installation (according to your utility, site specification, or local code requirements). By default, this is set to **62 Hz**, which generally is acceptable for most newer inverters following UL 1741SA or UL 1741SB.
4. Set **Smart Load OFF Batt** (AC-coupled inverter OFF threshold) to the battery SOC percentage. This is the value at which the Sol-Ark commands the AC-coupled inverter(s) to turn OFF while the inverter is off-grid.

   Recommended setting: **90% SOC**
5. Set **Smart Load ON Batt** (AC-coupled inverter ON threshold) to the battery SOC percentage. This is the value at which the Sol-Ark allows the AC-coupled inverter(s) to turn ON while the inverter is off-grid.

   Recommended setting: **80% SOC**
6. Click **OK** on the bottom right corner of the screen to save your settings.

Verify Operation

Do an off-grid test when your battery SOC is 3% below the programmed **Smart Load Off Batt** value.

1. Make sure you do not have loads running that can pull power from your AC-coupled source. This would prevent the AC-coupled source from charging your batteries.
2. Disconnect the grid and check whether your AC-coupled source stops transferring power.
3. If your AC-coupled source is still running, let it charge the batteries until they reach your programmed **Smart Load OFF Batt** value.
4. After the SOC of your battery reaches this value, check whether your AC-coupled source stops charging the battery.

   Your Sol-Ark inverter should raise the frequency to the level of your programmed **High Frz** setting and the AC-coupled source should stop.

   If the AC-coupled source continues to run into the inverter after this point, contact Sol-Ark Technical Support to review your setup and help troubleshoot the issue.

Note: The correct grid type (utility profile) must be configured in the inverter before setting up AC coupling. The grid type determines how the inverter responds to voltage and frequency conditions, including anti-islanding behavior and frequency shifting limits.

If the grid type is not set correctly, the inverter may not control AC-coupled sources properly, which can result in improper operation, nuisance shutdowns, or noncompliance with local utility or safety standards. Always verify the grid profile matches the utility and regulatory requirements for the installation site before enabling AC coupling.

Configure AC Coupling on **GRID** side

Confirm your utility's maximum allowed export (sell-back) power (in watts).

1. From the inverter display, navigate to the **Limiter Settings** menu
2. Enable the **Grid Sell** setting to limit Grid Sell
3. Set the maximum export limit allowed (watts) in the **Power Value** field on the right of the **Grid Sell** setting. This **Power Value** field specifies the maximum combined output of the AC-coupled source and the Sol-Ark inverter.
4. From the inverter display, go to **Batt Setup > Smartload tab**, and select **AC Couple on Grid Side.**

Install the CT (current transformer) sensors as required for grid-side AC coupling.

1. Confirm the CTs are reading correctly so the inverter can measure exported power from the AC-coupled source
2. Verify that export limiting is configured correctly:
   a. Check the amount that your AC-coupled source is producing
   b. Check the amount of power the Sol-Ark inverter is selling back to the grid by calculating the amount of power that the Sol-Ark inverter should be approximately outputting

   Example: If your AC-coupled source produces around 10,000 watts, the inverter has a "Grid-Sell" value of 18,000, and the Sol-Ark is producing and exporting 8,000 watts, this is ideal. However, if the Sol-Ark is producing and exporting more power, it can be an issue requiring help from Sol-Ark Technical Support to ensure proper programming is in place.

   Note: The correct grid type (utility profile) must be configured in the inverter before setting up AC coupling. The grid type determines how the inverter responds to voltage and frequency conditions, including anti-islanding behavior and frequency shifting limits.

   If the grid type is not set correctly, the inverter may fail to control AC-coupled sources properly, which can result in improper operation, nuisance shutdowns, or noncompliance with local utility and safety standards.

   Always verify that the grid profile matches the utility and regulatory requirements for the installation site before enabling AC coupling.

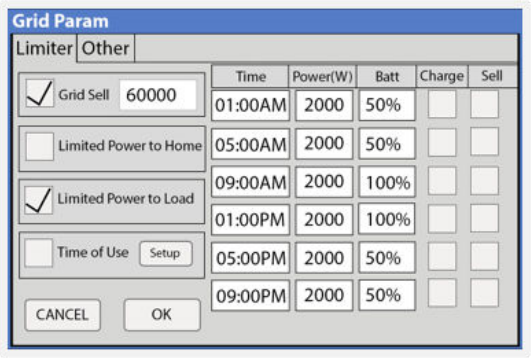
Verify CT Operation

Confirm the CTs are reading correctly so the inverter can measure exported power from the AC-coupled source. You can verify whether your CT sensors are oriented correctly by checking the **Grid HM** values. To access this, tap the battery icon on the inverter's home screen.

In **Limited Power to Home** mode with no selling enabled on the inverter, the **Grid HM** value should be positive under normal operating conditions. If the reading is negative when it should be positive, this usually means that the CT sensors are either installed in the wrong orientation or wired incorrectly.

Limiter Setup Requirements

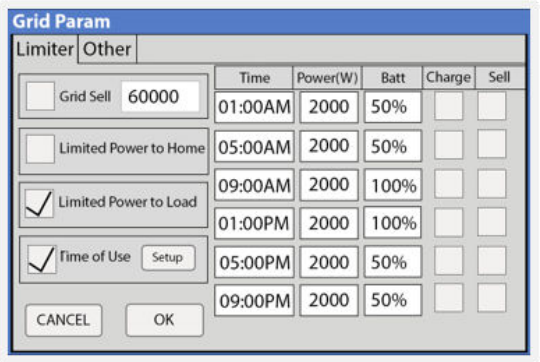
When a system is on-grid with an AC-coupled input, this excludes the Grid side, the Sol-Ark needs the **Grid Sell** option enabled. This means the system is either on **Grid Sell only** mode or in **Limited Power to Load** or **Limited Power to Home** in conjunction with **Grid/Solar sell** enabled. The AC-coupled power will cover the loads, charge the battery, and send any excess power to the grid.



TOU Considerations

It's recommended to use **Limited Power to Home** and to install the CT sensors that came with the Sol-Ark inverter to properly charge the battery. To charge the battery using an AC-coupled solution with **Time of Use** enabled, select the **Charge** boxes in the **TOU** menu at the desired time slots to charge the battery using an AC power source (such as Grid or AC-coupled input).

If you do not want to charge from the grid, be sure the **Grid Charge** check box is cleared on the **Batt Setup** menu's **Charge** tab.



Off-Grid Operation with AC Coupled Sources

Risks of AC Coupled Only Off-Grid Operation



It's not recommended to use only an AC-coupled source while off-grid as a permanent solution. The inverter has minimal control of the incoming power from the AC-coupled source.

It's recommended to have a DC-Coupled source in addition to your AC-coupled source. This allows your inverter to recharge a depleted battery beyond shutdown parameters and assist with safely charging your batteries to 100% SOC.

If you allow the AC-coupled source to charge your batteries to 100% SOC by increasing the **Smart Load OFF** setting beyond the recommended limit of 90%, your batteries are at risk of overcharging.

Frequency Shifting Behavior

When off-grid, if the inverter needs to turn off the AC-coupled power source, it will initiate frequency shifting to turn off or on the AC-coupled source. The inverter will increase the frequency it's generating incrementally.

Battery SOC Management

The inverter should charge the batteries to only 95% SOC with AC-coupled power. Trying to charge the batteries to 100% can be risky, as this could overcharge your batteries. To safely charge your batteries to 100% SOC, you need to do so with DC-Coupled power.

AC Coupling in Parallel Systems

Benefits of AC Coupling in Parallel Configurations

AC coupling in a parallel configuration increases the capacity of what you can add to your installation for AC-coupled power. This is because the number of inverters in parallel that you add to your installation site acts as a multiplier to the capacity for your AC-coupled source. Make sure the AC-coupled input is shared with all the parallel Sol-Ark inverters.

AC Coupling with a Generator

When using AC coupling in a system that includes a generator, the generator must be connected on the grid side of the inverter.

Note: If an AC-coupled source is producing power, the Sol-Ark inverter prioritizes that AC input.

Sol-Ark's C&I inverters CANNOT distinguish whether the power source connected to the **GRID** terminal is a utility grid or a generator. Because of this, there's a risk of backfeeding power into the generator whenever the AC-coupled power output exceeds what's needed for battery charging plus the connected load.

To connect the generator to the grid side, you may need an automatic transfer switch (ATS) in conjunction with the grid.

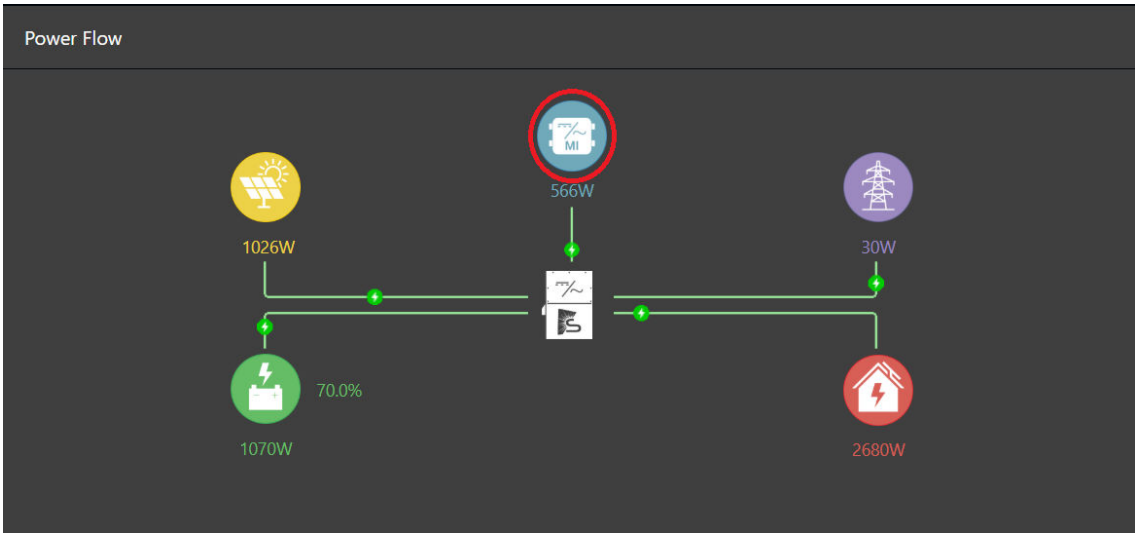
Monitoring and Verification

The power of the AC-coupled source is not displayed on the Sol-Ark inverter. If you're using the **GEN** terminal for AC coupling, you can view your AC-coupled power usage through the MySolArk app (MSA).

How to View AC-Coupled Power (GEN Side Only)

To view the power production of the AC-coupled solution, navigate to your plant on MSA and go to **Overview > Power Flow**. You'll see an icon that looks like a microinverter showing the power production of your AC-coupled source.

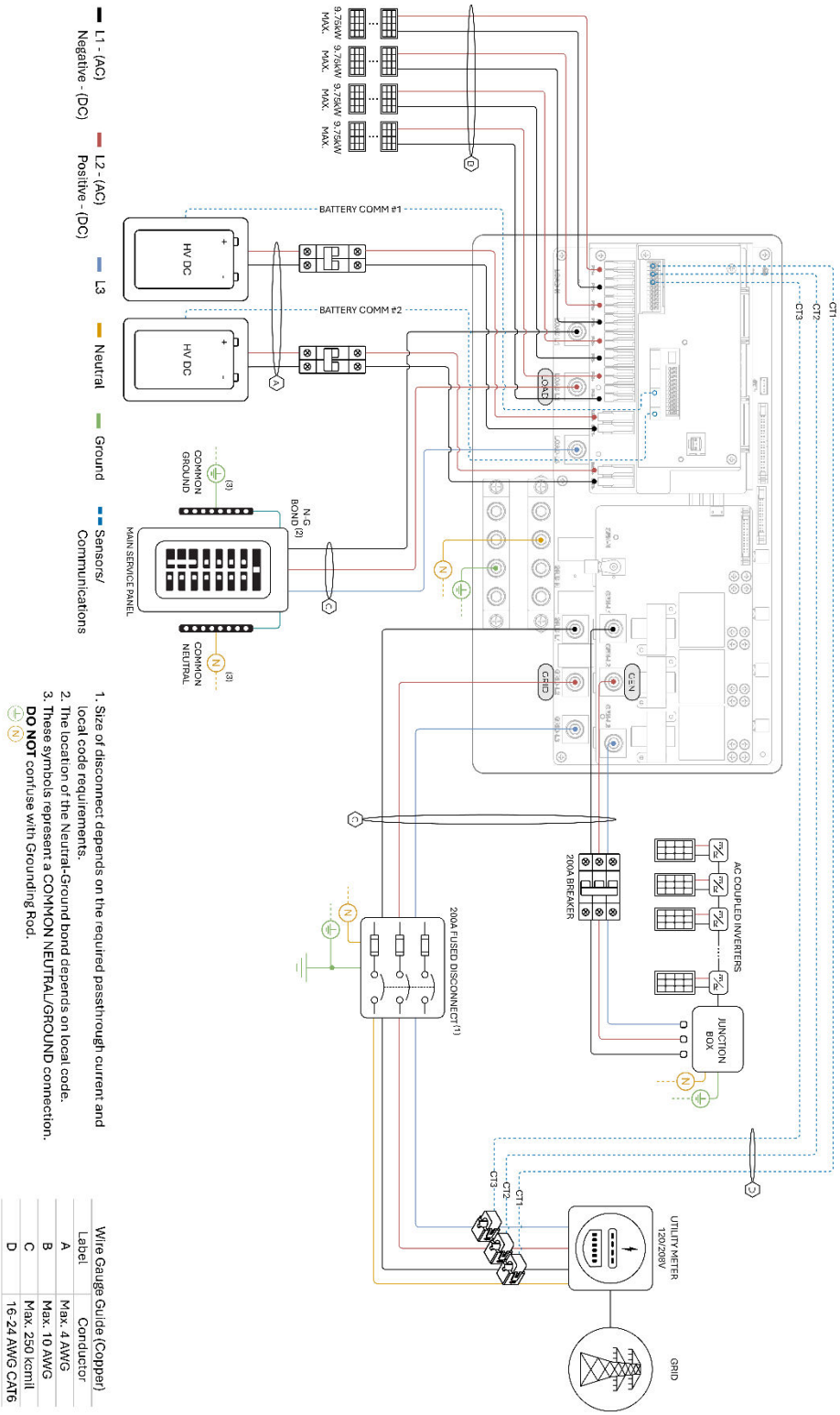
This is also where you can determine the wattage received from the AC-coupled source. Please note that the Sol-Ark inverter does not monitor individual strings or panels.



If AC coupling is not set up through the **GEN** terminal, an accurate reading of your AC-coupled solution is not available. This is because loads can combine with your AC-coupled solution to pull power from the solution.

Wiring Diagrams

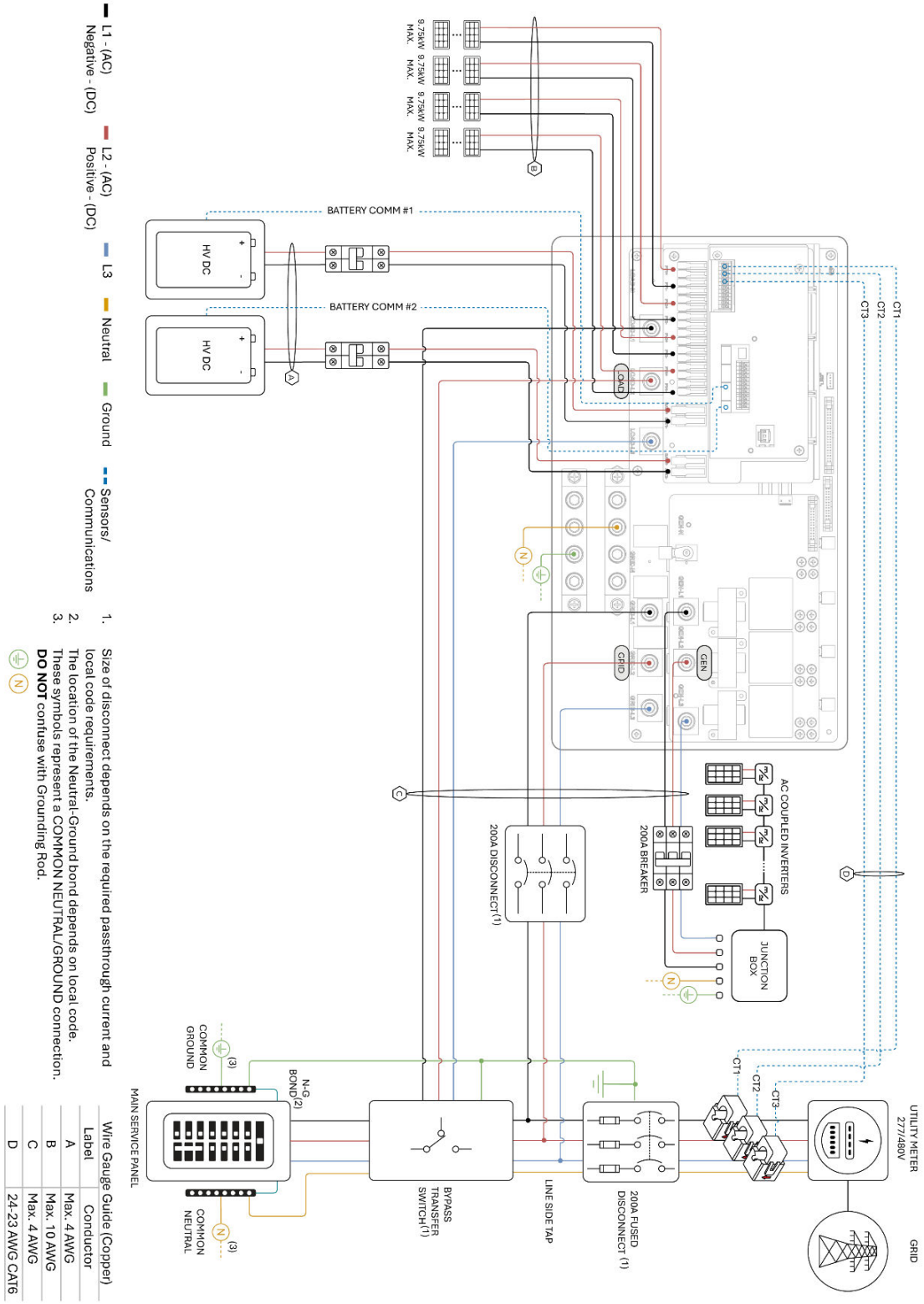
30K-3P-208 Gen Side AC Coupling



1. Size of disconnect depends on the required passthrough current and local code requirements.
2. The location of the Neutral-Ground bond depends on local code.
3. These symbols represent a COMMON NEUTRAL/GROUND connection. **DO NOT** confuse with Grounding Rod.

Wire Gauge Guide (Copper)	
Label	Conductor
A	Max. 4 AWG
B	Max. 10 AWG
C	Max. 250 kcmil
D	16-24 AWG CAT6

60K-3P-480 Gen Side AC Coupling



Wire Gauge Guide (Copper)	
Label	Conductor
A	Max. 4 AWG
B	Max. 10 AWG
C	Max. 4 AWG
D	24-23 AWG CAT6

QuickStart Workflow

Do you already have an existing solar inverter?

Yes: Continue to **AC Coupling Path**

No: DC Coupling recommended (Wire PV directly to Sol-Ark MPPTs)

AC Coupling Path

1. Identify the AC Coupled Source Type

➞ Confirm source is:
UL 1741 / UL 1741SA / UL 1741 SB certified

- Microinverters
- String inverter
- Battery-based inverter
- Additional Sol-Ark inverter

2. Choose AC Coupling Connection Location

✅ GEN Terminal (Recommended)

✓ Best control and compatibility
✓ Supports off-grid operation
✓ Allows frequency shifting
✓ AC power monitoring available (outdoor models)
➞ Proceed to GEN Configuration

⚠ GRID SIDE (Main Service Panel)

✓ Independent operation from Sol-Ark
❌ No power from AC-coupled source during grid outage
❌ No inverter control of production
⚠ CT sensors required
➞ Proceed to **GRID Configuration**

3. Verify AC Coupled Power Limits by checking inverter model limits:

- 30K-3P-208: 30 kW DC couple + 30 kW AC couple = **60 kW total**
- 60K-3P-480: 60 kW DC couple + 60 kW AC couple = **120 kW total**

❗ Disabling the **Grid Sell** function will NOT prevent AC-coupled power from being exported to the grid.

Configuration Paths

1. GEN Terminal Configuration
   a. Enable the option ☑ **For AC Coupled Input to Gen**
   b. Set **High Frz** according to the AC-coupled inverter's UL certification
      - UL 1741 SB → 62 Hz
      - UL 1741 SA → 62 Hz
      - UL 1741 → 65 Hz
   c. Off-Grid Settings:
      - Smart Load OFF Batt → 90% (recommended)
      - Smart Load ON Batt → 80% (recommended)

2. GRID Side Configuration
   a. Enable ☑ **AC Couple on Grid Side**
   b. Enable **Grid Sell**
   c. Set export limit (per utility)
   d. Install CT sensors
   e. Verify grid export does not exceed limit

3. Off-Grid Check
   a. Will the system permanently operate off-grid?

   Yes:

   ✓ DC coupling strongly recommended
   ⚠ AC-coupled-only off-grid systems are not recommended
   ❗ Do NOT exceed 90% SOC using AC coupling

   No:

   - AC coupling is acceptable

4. Final Check
   a. Verify operation
      - AC power accepted correctly
      - No over-export to grid
      - SOC behavior matches expectations
      - Monitoring visible in MySolArk (GEN only)

Document Revision History

Rev.	Date	Author	Description of Changes
1	09/01/2026	Jose Rubio	Document created