

Fortress Power - Sol-Ark Inverter Guide

Introduction

Battery Datasheets / Manuals: See “Downloads” section of individual product pages

Email: techsupport@fortresspower.com

Discord Support: <https://discord.gg/kxX6QMjKfw>

Phone: (877) 497-6937 x 2

Hours: 9:00AM - 6:00PM EST – Use Discord for After Hours / Weekends

Warranty Submittal: <https://www.fortresspower.com/warranty/>



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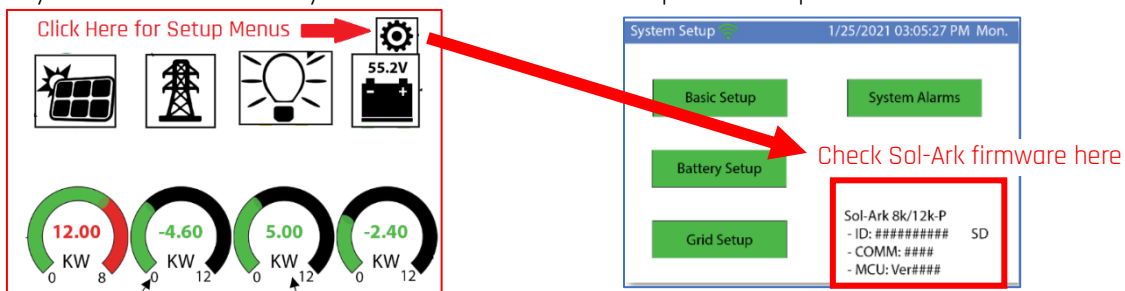
Step 1 – Getting Started. Turn each battery on individually while unpacking the batteries and note the voltage of each battery as well as the serial numbers. The batteries must be within +/- 0.5V of each other before commissioning. Turn off the batteries and install in parallel. Install the battery-to-battery communication cables and proceed with system commissioning.

Pro tip: If the battery voltages are significantly different, wire the batteries in parallel without communication cables and only turn on the lowest voltage battery. Use the inverter or external charger to charge the battery to the voltage of the 2nd lowest battery. Turn the 2nd battery on and charge the battery bank to the 3rd lowest battery voltage. Repeat until all batteries are at the same voltage. Keep total charging voltages under 15A per battery during this process.

Pro tip: If the batteries are just slightly outside the +/- 0.5V range, you can avoid using an inverter or an external charger to balance the batteries by only turning the lowest voltage batteries on (ONLY if within 0.5V relative to each other) and allowing those batteries to balance. Repeat this process with the highest voltage batteries. This brings the lowest and highest voltage battery towards to the middle of the group.

Pro tip: It is not usually necessary to apply a firmware update to Fortress batteries during system commissioning, but our installer firmware update tool can help speed up commissioning times.

Step 2 – Update Sol-Ark Firmware. Power up the Sol-Ark from grid, generator, or batteries. This step can be done during pre-commissioning while running the batteries in “master only” mode, ahead of installing the battery communication circuits. Set up Wi-Fi with Sol-Ark Inverter using Sol-Ark’s PowerView App (search for Powerview in the app store, but it is called PV Pro) and have your site name and Wi-Fi dongle serial number handy. Call Sol-Ark at (972)-575-8875 and request a firmware update. This process can take up to 60 minutes. You may want to take a picture of your firmware version so you can tell when the firmware update is complete.



Click Here for Setup Menus →

12.00 KW, -4.60 KW, 5.00 KW, -2.40 KW

55.2V

System Setup 1/25/2021 03:05:27 PM Mon.

Basic Setup, System Alarms, Battery Setup, Grid Setup

Check Sol-Ark firmware here

Sol-Ark 8k/12k-P
- ID: ##### SD
- COMM: ####
- MCU: Ver####

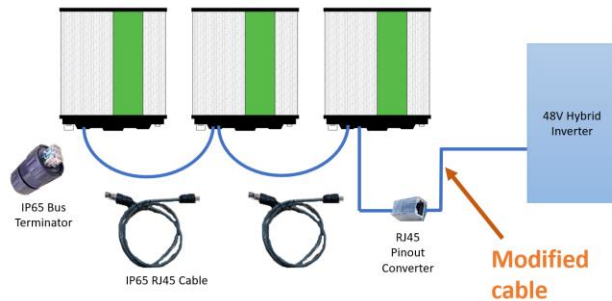
Pro tip: If a BMS error occurs when powering up the inverter, turn the batteries off. Connect the inverter and any battery breakers so that power can flow from the batteries to the inverter. Turn the batteries back on again. Then power up the inverter again. You may need to repeat this process up to three times to pre-charge the inverter enough for it to power up.

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Step 3 – Install the battery-to-battery communication circuit

When installing multiple batteries, it is necessary to use the canbus terminators. This procedure is different for the eFlex, eVault MAX, and eVault Classic.

eFlex and eVault Classic:



It does not matter which communication port you plug into on the eVault or eFlex – they are universal. The canbus terminator looks like a standard ethernet plug without a cable attached.

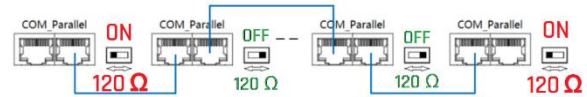
The eFlex uses an RJ45 pinout connector between the eFlex battery and the battery inverter.

The eVault Classic does not use RJ45 pinout converter and can only parallel up to 2 eVaults when communicating to the inverter.

If not communicating to the inverter, put a canbus terminator plug on each end of the communication circuit.

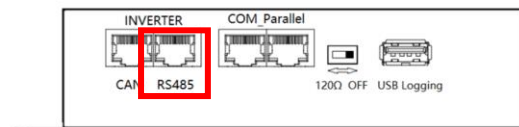
See product manuals for additional detail.

eVault MAX:



The eVault MAX has the canbus terminators built into the unit. The two eVault MAX units on the end have the canbus terminators set to ON.

It does not matter if the canbus terminator is ON or OFF when installing one eVault MAX.



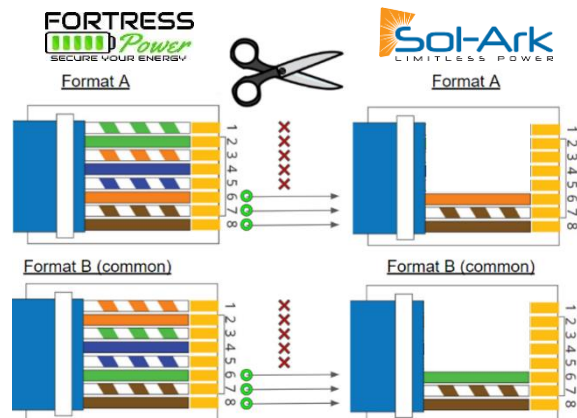
The eVault MAX has dedicated a dedicated port for inverter communication. For the Sol-Ark inverter, use the RS485 port of the master eVault MAX.

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Step 4 – Modify the Battery-to-Inverter Communication Cable

In 2020, Sol-Ark replaced the individual wire ports for RJ485 communication with an ethernet port, making a custom conversion from our data cable “pin out” to Sol-Ark’s necessary. This conversion can be made in the field with locally procurable items, but registered Fortress installer-dealers can also purchase pre-made cables at <https://fortresspower.com/shop>. It is okay to omit wire #6 on the communication circuit – it is a ground wire that does not serve a real function.

eFlex Instructions:

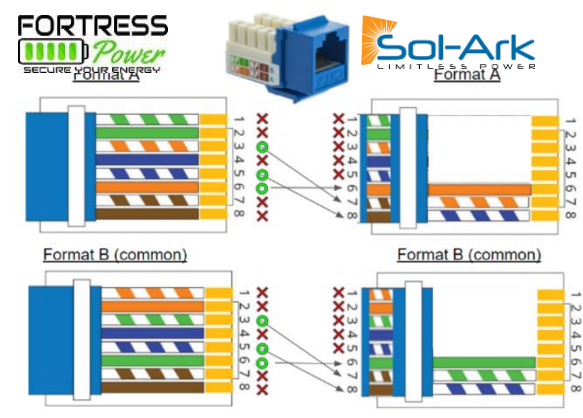


eFlex RJ45 pins 6+7+8 correspond to SolArk pins 6+7+8. All that is necessary is to physically cut into the ethernet cable and snip out wires 1-5, and then tape the ethernet jacket back up. While seemingly crude, this is the most reliable method to secure eFlex to Sol-Ark data communication.

Most ethernet cables are type B format, but it is worth checking if it is type A format. The color of wire 6 will either be green (type B format) or orange (type A format).

Wire 6 is an unnecessary ground wire, so just preserve wires 7+8 if you are unsure as to which cable format you have. Wires 7+8 will always be brown-white and brown, regardless of cable format.

eVault Max + eVault Classic Instructions:



The eVault and eVault MAX pins 3+5+6 correspond to SolArk pins 7+8+6. Because of this, it is necessary to crimp a custom RJ485 cable or cross-over the cable using an ethernet keystone. The eVault MAX includes a keystone – otherwise they may be purchased at a local hardware store in the computer aisle. If crimping a custom cable, consider crimp all 8 wires and then snip out wires 1-5, similar to the eFlex procedure. Leaving empty wire slots in a RJ45 connector can cause the remaining wires to jump out of their position, resulting in an incomplete crimp.

If using a keystone, take special care that communication wire coming from the Fortress battery lands on the keystone, with an unmodified ethernet cable plugging in between the Fortress and the SolArk. It is very easy to make a mistake and wire the RJ485 cable or keystone in “reverse”.

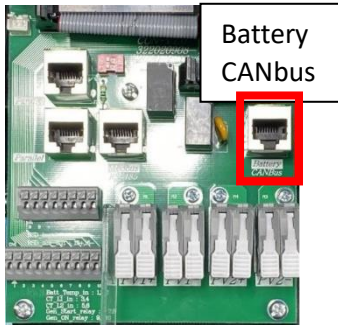


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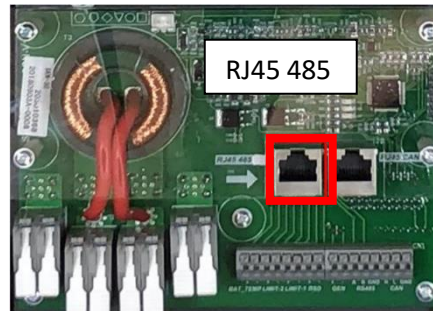
Step 6 – Plug the modified end of the cable into the correct Sol-Ark port.

Fortress batteries communicate with Sol-Ark over RS485 modbus. Even so, Sol-Ark labels its communication port on its most recent communication card as the “Battery/Canbus” port. Legacy SolArk inverters may use the RS485 port for battery communication.

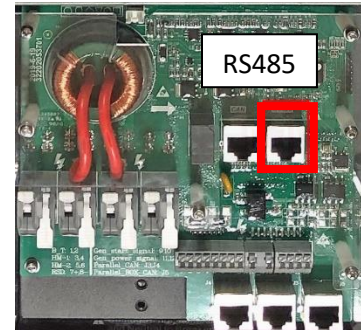
Typical SolArk - Battery / CANbus port



Indoor 8kW unit - RJ45/485 port



Indoor 12kW Unit / RS485 Port



Step 7 – Program the first three tabs in the Battery Setup menu.

Touch the gear icon on the main SolArk home screen to find the Battery Setup menu. Program the batt/charge/discharge tab as shown below. **Call or email for LFP-5/10/15 settings.**

Batt Setup	
Batt	Charge Discharge Smart Load Wind
Batt Capacity	105Ah per eFlex 360Ah per eVault
Max A Charge	185A
Max A Discharge	185A
Tempco	0 mV/C/Cell
	<input type="checkbox"/> Use Batt V charged <input checked="" type="checkbox"/> Use Batt % Charged <input type="checkbox"/> No Battery <input checked="" type="checkbox"/> BMS Lithium Batt 04 <input checked="" type="checkbox"/> Activate Battery

Note: to recalibrate the Battery % Charged, uncheck the BMS Lithium Battery 04, and check the Use Batt V charged box. Let the battery run for a day of sunny weather to charge the battery to 56V and then renable BMS control.

Use Batt V charged – only use this feature when not using BMS control. Select to enable voltage-based programming.

Use Batt % Charged – Most Sol-Ark installations will use this feature.

Activate Battery – does not activate the battery but instead helps the battery after deep discharges.

Max A Charge / Discharge - Fortress requires 1 eVault or 2 eFlex per SolArk inverter in BMS control to max out the SolArk 185A setting. When not using BMS control or when using an undersized battery bank, limit this charge to 55A per eFlex or 100A per eVault. **Call Fortress for settings when installing LFP5/10/15 legacy batteries.**

Tempco – if this item is not programmable, the BMS is already in control. Don't worry about it.



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Batt Setup				
Batt	Charge		Discharge Smart Load Wind	
Start V	50.5V	51.4V	Float V	56V
Start %	10%	15%	Absorption V	56V
	A 185A for 2+ eFlex 185A for 1+ eVault		Equalization V	56V
				30 days
				0 Hours
	<input type="checkbox"/> Gen Charge		<input checked="" type="checkbox"/> Grid Charge	

Start V is not programmable / disabled when Use Batt % charge is enabled.

Start % autostarts the grid or generator charge and charges the battery to 100%. Avoid this charge by programming the Time-of-Use settings in the Grid Setup.

Float V / Absorb V should be set to 54.4V if not using battery-to-inverter communication, (Ex. 3+ eVault classics).

Equalization should be set to 0 hours to disable equalization.

A - Fortress requires 1 eVault or 2 eFlex per SolArk inverter, which will max out its 185A

setting when using BMS control for properly sized batteries. When not using BMS control or for undersized battery banks, limit this charge to 55A per eFlex or 100A per eVault. Call Fortress for LFP5/10/15 settings.

Grid Charge – Check this box for grid-tied arrays or off-grid arrays with generators.

Gen Charge – Check this box if tying in a <8kW generator to the generator breaker on the Sol-Ark.

Batt Setup				
Batt	Charge	Discharge	Smart Load Wind	
Shutdown	49V	5%	Batt Resistance	5 mOhms
Low Batt	51.4V	20%	Batt Charge Efficiency	98%
Restart	51.8V	25%	BMS_Err_Stop	<input type="checkbox"/>
Batt Empty V	48V			

Shut down % - is the low battery cut off point which either shuts down the inverter or transfers to grid power. This value should be raised to 10% if not using the Time-of-Use grid parameters function. Regularly cycling the battery below 20% will reduce the Fortress warranty.

Low Batt – provides an alert when the battery hits this level. This adjustable setting is useful to keep this setting equal to when the full grid charge turns on.

Batt Resistance – may not be programmable/ disabled in BMS control. Don't worry about it.

Restart – determines when the battery can be used again after reaching the shutdown %.

BMS_Err_Stop – disables the BMS communication alarm. It is up to you to select it or not.

Batt Empty V – Keeps a few volts in the battery to avoid locking the battery out during accidental deep discharges. Set to 49V if the battery will be unattended for long periods of time.



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Step 8 – Confirm BMS communication.

After completing steps 1-7, go to the home screen of the SolArk unit, touch the gear icon, and select the new “Lithium Batt Info” option in the setup menu options screen. If data appears across the top of the menu option *as well as across line 2 only*, then the battery is communicating to the SolArk. Otherwise this option will only populate with zeroes.

Header data appears here 56V 185A etc...

```

1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2: Battery Data appears here when successful
3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
.....
16: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
        
```

Step 9 – Program Grid Parameters.

Go back to the home screen, touch the gear icon, and select “Grid Setup”. The Grid Parameters menu will appear and the Grid Limiter Function will be the first tab. You may still need to program other tabs, but this Grid Limiter tab plays an important role in battery behavior. The programmed levels are user specific, so think carefully when programming this menu relative to the specific job site and grid policy.

Suggested Grid-Tie Parameters

Grid Param		Time	Power(W)	Batt	Charge	Sell
<input checked="" type="checkbox"/> Grid Sell	9000	3:00AM	3kW	30%	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Limited Power to Home		5:00AM	3kW	20%	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Limited Power to Load		9:00AM	9kW	100%	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Time of Use	Setup	3:00PM	3kW	100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		7:00PM	6kW	60%	<input type="checkbox"/>	<input type="checkbox"/>
		9:00PM	3kW	45%	<input type="checkbox"/>	<input type="checkbox"/>

Grid Sell – Select to sell back to the grid when the batteries are 100% full.

Limited to Home – Select when not allowed to backfeed the grid or when utility solar buyback rates is horrible. Typically requires 200A SolArk CTs around the main grid feed.

Limited to Load – Select when off grid.

Time-of-use – Almost always select this feature even when off-grid. It is useful not only for time-of-use rate structures but to optimize battery use conditions such as grid/generator charging.

Charge Time of Use Column – The battery will stop being used at the % programmed.

Checking the box will force a grid charge.

Discharge Time of Use Column – Select to for a sell back to the grid. Useful for utility battery incentive programs or where time-of-use rate structures where the utility solar buyback rate is advantageous. Not commonly used, as the battery will sell back to the grid if the grid sell column is checked.

Batt % Column – If more solar power is available than load, solar will always charge the battery to 100% before selling back to the grid, unless the Sell column is checked. Alternately, if the battery falls below this % and grid power is available, the battery will switch over to grid power. Useful for keeping the battery at 20% without triggering a full grid recharge.



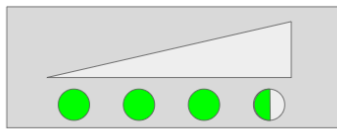
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Steps 10 - Verification:

Confirm all batteries are “working” before leaving site by confirming amperage is flowing in or out of each battery. If the battery is showing 0 amps while other batteries are working, then that battery has not been commissioned correctly.

eFlex + Instructions

On eFlex batteries, apply a charge current and confirm the state-of-charge light is blinking on each battery or confirm using the Fortress firmware update tool.



A blinking State of Charge Indicator Light confirms that the eFlex is charging.

eVault MAX / Classic Instructions

Touch the LCD screen to see that amperage is flowing in or out of each eVault. If either eVault is not turning on, switch the master-slave roles on the eVaults in the communication circuit and power cycle the batteries.

Step 10 – Calibrating the State of Charge Controller (optional):

Note: This step can be performed after installation remotely by changing settings within Powerview if necessary. It can be performed during commissioning if time allows but is not usually necessary to do so.

Batt Setup	
Batt	Charge Discharge Smart Load Wind
Batt Capacity	105Ah per eFlex 360Ah per eVault
Max A Charge	100A per eFlex 185A per eVault
Max A Discharge	100A per eFlex 185A per eVault
Tempco	-5mV/C/Cell
	<input checked="" type="checkbox"/> Use Batt V charged <input type="checkbox"/> Use Batt % Charged <input type="checkbox"/> No Battery <input type="checkbox"/> BMS Lithium Batt <input type="text" value="04"/> <input checked="" type="checkbox"/> Activate Battery

Calibrating the SoC controller should occur automatically, but can be forced manually by charging to 56V. Disable BMS control and putting the inverter in “voltage based control”.

The inverter should already programmed to float/absorb at 56V. Let the batteries operate like this on a sunny day to bring the batteries gently to 56V via float charge. This will recalibrate the SoC controller.

Then return the battery settings to BMS 04 % charged control.

eFlex-specific instructions: Useful if an eFlex is not showing four “state of charge lights” when charged full or if only reaching a 99% during normal operation.

eVault-specific instructions: Useful if eVault shows 100% when voltage is less than 54V.



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Step 11 – Updating firmware (optional):

All Fortress batteries are now shipping with firmware necessary for closed-loop communication with Sol-Ark inverters. While firmware updates are not something an end user should regularly perform, installers get in the habit of bringing the Fortress firmware update tool and Windows laptop to site during any site visit to update battery firmware and access detailed battery information that can speed up commissioning and diagnostics. Do not update battery firmware while the battery is under load.

Fortress installers should request a firmware update tool at <https://www.fortresspower.com/support> by filling out a support ticket. End users and installers who have not filled out the dealer form may purchase the tool for ~\$50 by filling out the support ticket.

Visit <https://www.fortresspower.com/firmware> for instructions.

Step 12 – Operating in Voltage Based Control (for paralleled eVault Classics):

The eVault Classic BMS is not capable of BMS control for 3+ eVaults. Voltage controls can actually be more accurate when the battery is near full or near empty – there is little if any real function difference between running in %-based BMS control or voltage based control. Use this chart to approximate battery voltage and state of charge for “Grid Limiter” settings. Also, change the float and absorption charge to 54.4V instead of 56V.

Batt Setup				
Batt	Charge		Discharge Smart Load Wind	
Start V	50.5V	51.4V	Float V	54.4V
Start %	10%	20%	Absorption V	54.4V
A	100A per eFlex 185A per eVault		Equalization V	56V
<input type="checkbox"/> Gen Charge	<input checked="" type="checkbox"/> Grid Charge			30 days
				0 hours

SOC (%)	Cell Voltage	Unit Voltage
0	< 2.8	<48.5
5	3.05	48.8
10	3.2	51.2
15	3.23	51.68
20	3.24	51.84
25	3.26	52.16
30	3.27	52.32
35	3.27	52.32
40	3.28	52.48
45	3.29	52.64
50	3.29	52.64
55	3.3	52.8
60	3.3	52.8
65	3.3	52.8
70	3.3	52.8
75	3.31	52.96
80	3.32	53.12
85	3.32	53.12
90	3.32	53.12
95	3.33	53.28
100	3.5	54.4

Congratulations on reading the entire Fortress / Sol-Ark integration guide. on't forget to join our Discord chat group.