

Fortress Power - Sol-Ark Inverter Guide

Introduction

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

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

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



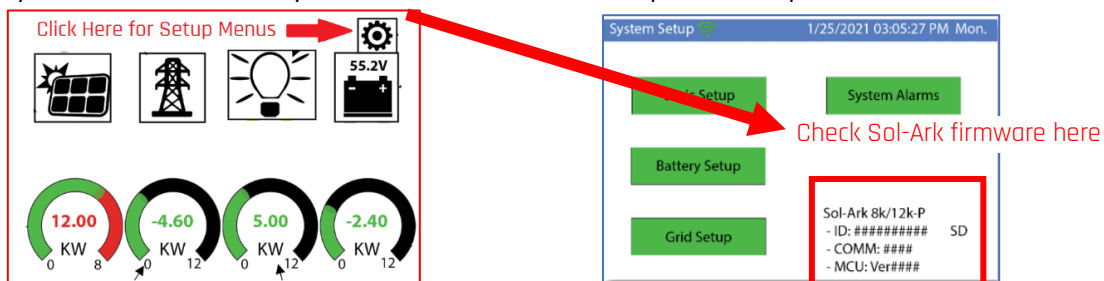
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Step 1 – Getting Started. Turn each battery on individually while unpacking the batteries and note the voltage of each battery as well as the serial numbers. The batteries must be within +/- 0.5V of each other before commissioning. Turn off the batteries 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. Turn on the lowest voltage battery. Use the inverter or external charger to charge the lowest voltage battery to the voltage of the 2nd lowest battery. Turn on the 2nd battery and charge both batteries 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 battery bank is slightly outside the +/- 0.5V tolerance, balance the batteries without using the inverter or external charger. Check that the lowest voltage batteries are within 0.5V of each other and only turn those batteries on. Allow a few minutes for the batteries to back-feed each other. Repeat this process with the two highest voltage batteries. This process will bring battery bank voltage to within 0.5V of the entire group.

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 wifi 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 wifi 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.



Pro tip: If a BMS error occurs when powering up the inverter, turn the batteries off. Make the inverter and battery breakers such that power could flow from the battery bank to the inverter. Turn the batteries back on (for the eVault series, hold the push button until the green status light comes on). This enables a trickle charge from the battery to the inverter. Power up the inverter. Repeat this process up 2-3x until the inverter powers up.

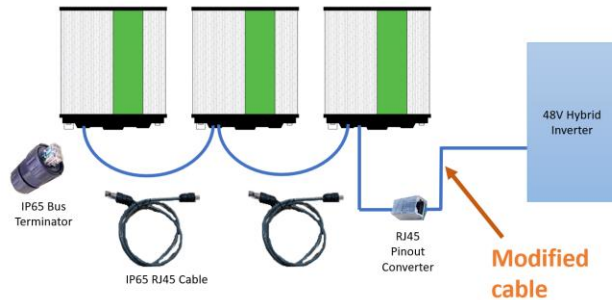
Pro tip: It is not usually necessary to apply a firmware update to Fortress batteries during system commissioning, but our installer firmware update tool can help speed up commissioning times.

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

When installing multiple batteries, it is necessary to place canbus terminators at the end(s) of the communication circuit. This procedure is different for the eFlex, eVault MAX, and eVault Classic. If not installing battery-inverter communication, put a canbus terminator on both ends of the battery-to-battery communication circuit. See product manuals for additional detail.

eFlex:



It does not matter which communication port you plug into on the eFlex – the ports 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.

eVault Classic:

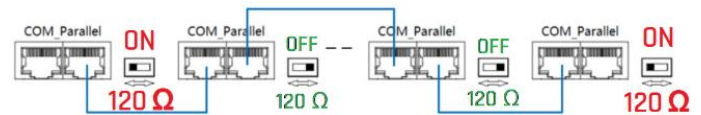
The eVault Classic can only parallel up to 2 eVaults when communicating to the inverter.

It does not matter which communication port you plug into on the eVault – the ports are universal.

The canbus terminator looks like a standard ethernet plug without a cable attached. It does not have the black plug housing that the eFlex has (pictured above).

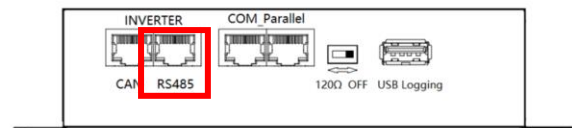
The eVault communication wiring looks similar to the eFlex communication wiring pictured above, *except that it does not use the RJ45 pinout connector.*

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 set to 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.

LFP5/10/15 Legacy Series:

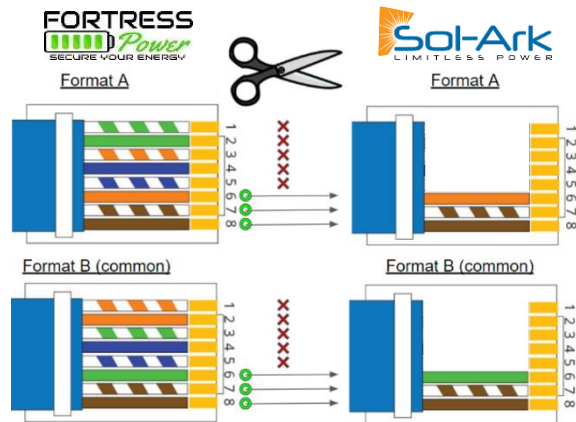
There is no battery-to-battery communication when installing the LFP legacy series. Be sure to use external 80A fuses when paralleling multiple batteries of this product line. The eFlex and eVault batteries series do not require external fuses because of their internal advanced BMS.

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

Due to Sol-Arks decision to use an ethernet port for battery-to-inverter communication, rather than an individual data wire ports for RJ485 communication, it is necessary to modify the ethernet cable between the battery and inverter. This process is different for the eFlex vs. the eVault and eVault MAX.

eFlex Instructions:

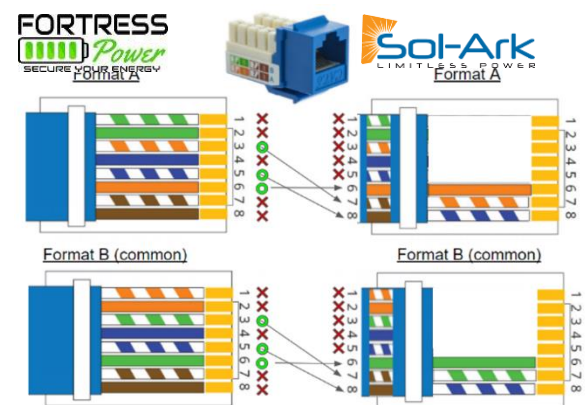


eFlex RJ45 pins 6+7+8 correspond to SolArk pins 6+7+8. All that is necessary is to physically cut into the ethernet cable and snip out wires 1-5, and then tape the ethernet jacket back up. While seemingly crude, this is the most reliable method to secure eFlex to Sol-Ark data communication.

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 inbetween the Fortress and the SolArk. It is very easy to make a mistake and wire the RJ485 cable or keystone in “reverse”.

eVault Classics purchased before March 2020 should omit wire #6.

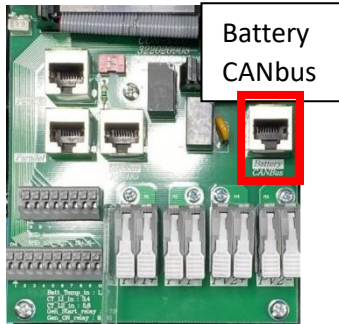


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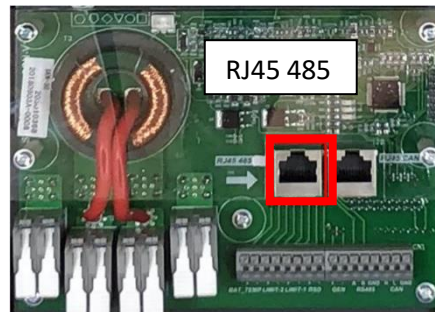
Step 6 – Plug the modified end of the cable into the correct Sol-Ark port.

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
	185A for 2+ eFlex 185A for 1+ eVault		Equalization V	56V
A				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	50V	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.

Grid Param		Suggested Grid-Tie Parameters				
Limiter	Sell Control	Grid Input	FreqVolt	PowFac	Relay	
<input checked="" type="checkbox"/> Grid Sell	9000	Time	Power(W)	Batt	Charge	Sell
<input type="checkbox"/> Limited Power to Home		3:00AM	3kW	30%		
<input type="checkbox"/> Limited Power to Load		5:00AM	kW	20%		
<input checked="" type="checkbox"/> Time of Use	Setup	9:00AM	9kW	100%		
		3:00PM	3kW	100%	<input checked="" type="checkbox"/>	
		7:00PM	9kW	60%		
		9:00PM	3kW	45%		

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 if utility solar buyback rate is horrible. Typically requires 200A SolArk CTs around the main grid feed.

Limited to Load – Select when offgrid.

Time-of-use – Almost always select (even without TOU rates or off-grid). Useful for 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.

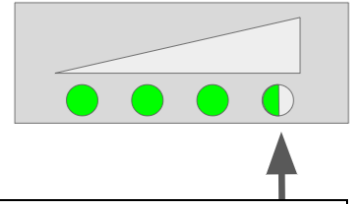


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Next Steps:

Before leaving site, verify that all batteries are working. This can be simply done on eVaults by looking at the LCD screen and confirming amperage is flowing in or out of each battery. 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.

If time allows, consider charging the batteries full to ensure the state-of-charge controller is calibrated. The battery state-of-charge controller may not be calibrated out of the box. While the calibration should happen naturally on its own, it can be forced manually by disabling the BMS control in the battery setup menu and charging the batteries to 56V. This can fix issues such as the eFlex batteries not showing 4 full state of charge lights or the eVault batteries not showing 100% when at 54.4V-56V. For example, if the batteries show 100% at 53.0V or show 60% full at 53.7V after a few cycles, a manual SoC recalibration may be necessary. This operation can be performed remotely.



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

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. In most cases, it is not necessary to update the battery firmware. But installers should bring the firmware update tool to site during site visits and get in the habit of updating battery firmware during the site visit. The tool is also useful for speeding up the commissioning process and diagnosing system errors. Do not update battery firmware while the battery is under load.

It is not usually necessary to run the battery in voltage-based controls, and voltage does not directly translate into % state of charge, because of how the voltage fluctuates during charge/discharge cycles.

The best way to translate voltage into % SoC is to remove any load from the battery before measuring battery voltage.

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.

Don't forget to submit your product warranty. *If not submitting the warranty on site, write down your battery serial numbers.*

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