Fortress eVault MAX - Solark Inverter Guide

Unpack the Batteries

Use the push button to turn each battery on and check its voltage.

Pre-commission the batteries by pre-charging them individually if the batteries are not within +/- 0.5V of each other.

Do not charge individual batteries at full power when recovering from below 51V. Keep charges amperage below 10A when recovering below 48V.
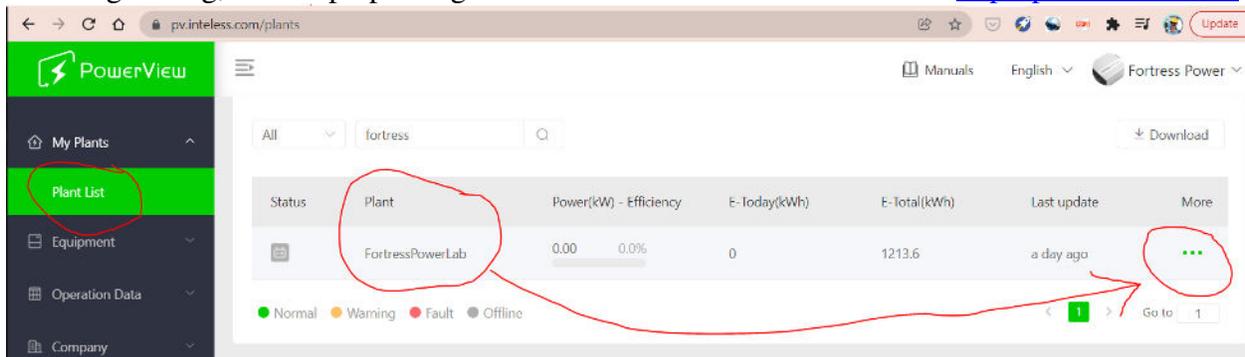
Install the batteries in parallel. Do not connect the terminals together or land any charge controllers, solar panels, trickle chargers, or inverter leads onto the battery terminals while those devices conductors are hot.

Help beta test our new support system: https://support.fortresspower.com/

Share Sol-Ark Monitoring w/Fortress

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 to register the system online with Sol-Ark.

After registering, use a laptop to log into Powerview via a web browser at http://pv.inteless.com/

Next, share the plant including manager level permissions with techsupport@fortresspower.com
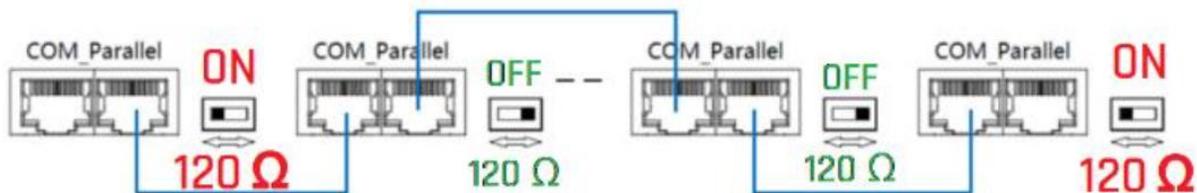
Battery Communication

The eVault MAX uses canbus to communicate from battery to battery.
This occurs over the COM_Parallel ports. The ports are bidirectional.
Canbus communication requires resistor termination to function without blips.
Fortunately, the eVault MAX has internal canbus resistors!
Terminate these resistors by using the dipswitches in the upper service cabinet within the battery.

The dip switches should be in the ON position for the batteries at the end of the communication circuit.
The dip swiches should in in the OFF position for the batteries in the middle of the communication circuit.

<u>Example - 4 batteries with end battery dipswitch ON and middle battery dipstiches OFF</u>

Number of Batteries	Dipswitch Order
1	ON
2	ON, ON
3	ON, OFF, ON
4	ON, OFF, OFF, ON
5	ON, OFF, OFF, OFF, ON

Note: the eVault MAX can parallel up to 20 battery units in closed loop communication.

Battery Touchscreen

The eVault has a touch screen. The bottom corners of the eVault are touch interactive.

        Battery ID, bottom left   Protocol ID, bottom right

Note: Power cycle the first battery in the battery-battery communication circuit after adjusting any of these settings on any battery in the circuit.

Battery ID
Number each battery 1,2,3,4,5.... until the end of the battery circuit.
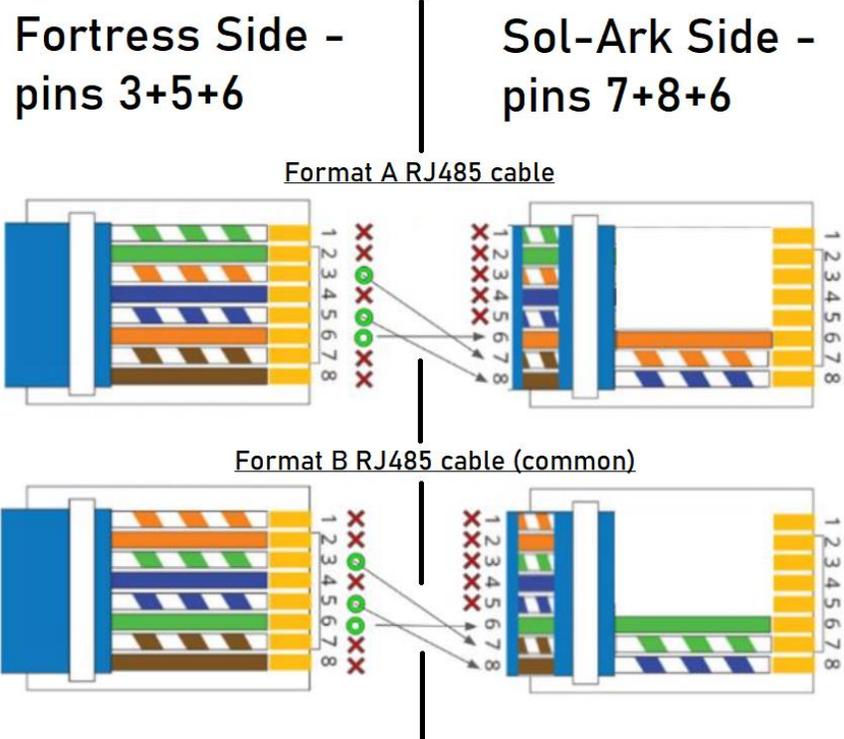Except, if only installing one eVault MAX, number the battery "0".

Protocol ID
1 = Sol-Ark / Any inverter
2 = SMA
3 = Reserved
4 - Victron
5 = Schneider

Battery-Inverter Communication

## eVault MAX Making the Inverter Communication Cable

The eVault MAX RJ45 pins 3+5+6 correspond to SolArk pins 6+7+8 (exactly like the original eVault). eVault MAX units are now shipping with a pre-made Sol-Ark inverter communication cables, which should begin appearing around March 2022, so check inside the box to see if a grey communication cable has been included.

Fortress Side – pins 3+5+6

Sol-Ark Side – pins 7+8+6

Format A RJ485 cable

Format B RJ485 cable (common)

<u>To create your own modified cable, you can use a variety of strategies:</u>
1) A limited number of our vendors distribute a pre-made cable such as [can be found here](#).
2) Crimp a custom RJ45 connector **or** use an RJ45 Ethernet keystone **or** cut and strip an Ethernet cable, twisting the appropriate communication wires together with small wire nuts or electrical tape if necessary.
3) Most Ethernet cabling is Type B-format cable, but it is also common to find Type A-format cable. Tape the Ethernet jacket back up when finished. You may use any Ethernet cable for this task.
4) Plug in the **Battery** end of the communication cable into the **RS485** port of the master eVault MAX. This port will plug into the Sol-Ark **Battery CANBUS** port as

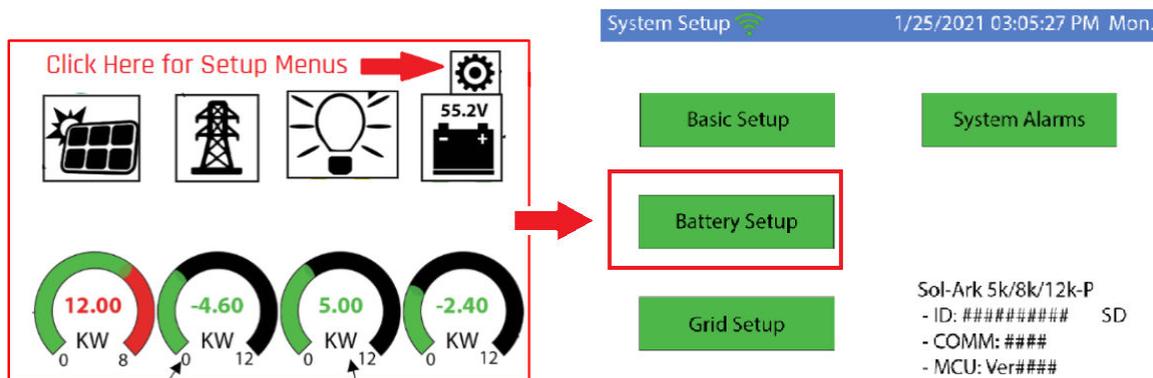detailed in following steps, despite the name this port is also capable of **RS485/MODBus** communication.
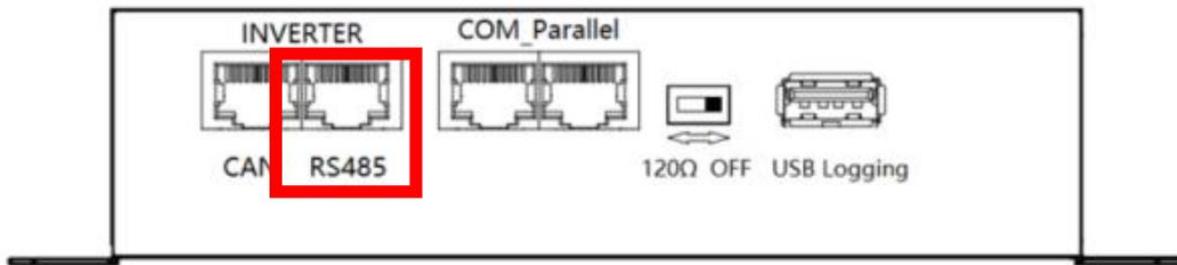
Additional notes:
1) It matters which side of the cable is plugged into the battery and inverter respectively (follow the labels on the cable itself if using the included factory cable).
2) eVault MAX as of March 2022 are now shipping with a pre-made Sol-Ark inverter communication cable.
3) The yellow cable included with the Sol-Ark is fine stranded and difficult to crimp. If crimping a custom RJ45 connector, you may want to find an alternate cable to modify.
4) If providing your own RJ45 cable and routing alongside the battery power conductors, it is best (but not required by Fortress) to use a shielded cable.

Program the Inverter

1. Start by pressing the gear icon on the top right of the inverter screen and then pressing the battery setup menu (or use the online interface).

2. Program the first 'Batt' tab:

Notes:

a) To run the batter without inverter communication, uncheck "BMS Lithium Batt 04" and select "Use Batt V charged", such as during a calibration charge.

b) Enabling BMS Lithium Batt 04 will adjust some values and make other values unadjustable (like the temperature coefficient above). Just ignore those values - the BMS is in control.

c) The eVault is a 9.2kW battery and the Sol-Ark is a 9kW inverter, resulting in a 1:1 ratio per the Fortress minimum inverter sizing standards. If you have installed more inverters than batteries, you must disable "BMS Lithium battery 04" and enable :Use Batt-V based control".

d) If recovering a deep discharge battery, adjust the above charge amps to 10A.

3. Program the Charge tab in Battery Setup menu:

Notes:
a) If operating in "Use Lithium Batt V mode", set float to 54.4V and absorb to 55V.
b) You must select the gen or grid charge boxes to program grid or gen start triggers. Larger generators are commonly tied into the grid side of the inverter rather than the dedicated generator input.
c) Fortress batteries may be discharged to its full rated capacity without voiding the warranty, but for best overall experience and battery life, limit the discharge to 80% except for very rare occasions. Here is a list of our suggested triggers:

Application	Gen Trigger	Grid Trigger
Grid-tied, no generator	not checked	checked, 51.2V or 15%, TOU
Grid-tied, with portable generator	checked, 51.1V or 10%, shutdown 8%	checked, 51.2V or 15%, TOU
Off-grid, with stationary generator	not checked	checked, 51.4V or 20%
Off-grid, with portable generator	checked, 51.4V or 20%	not checked
Off-grid, with two generators	checked, 51.1V or 10%, shutdown 8%	checked, 51.4V or 20%

It is okay to raise the grid or generator start triggers to increase the reserve capacity of the system.

4. Program the Discharge Tab



Notes

a) Shutdown turns the inverter off and waits for the sun to recharge the battery, whenever that may be in the future. You can increase the shutdown level to increase the "reserve capacity" of the system, but that will prevent that battery range to be used. The correct shutdown level is specific to the project site.
b) Low battery is an alarm also specific to the project site, integrated with the Sol-Ark monitoring app. We suggest a 20% state of charge as a good low battery alarm level, but it can be higher.
c) The battery empty voltage should not be lower than 48V. If increasing the reserve capacity in the above note a, then increase the battery empty voltage to 49V or 50V. More on voltage levels later.

Secure the battery

The eVault MAX has wheels that assist with installation, but is not a portable battery. It is intended to rest on its fixed support legs, using the included wall bracket if additional security is necessary.

Some jurisdictions may have seismic requirements which require bolting the battery to the floor. The evault MAX can be mounted directly to floor by replacing the adjustable legs with Pieces of unistut. Unistrut mounted directly to the eVault MAX frame using M12 x 1.75 bolts into the adjustable legs mount. A second piece of Unistrut or similar material is mounted to the floor that the eVault Frame mounted Unistrut sits on top of and is secured appropriately to the floor.
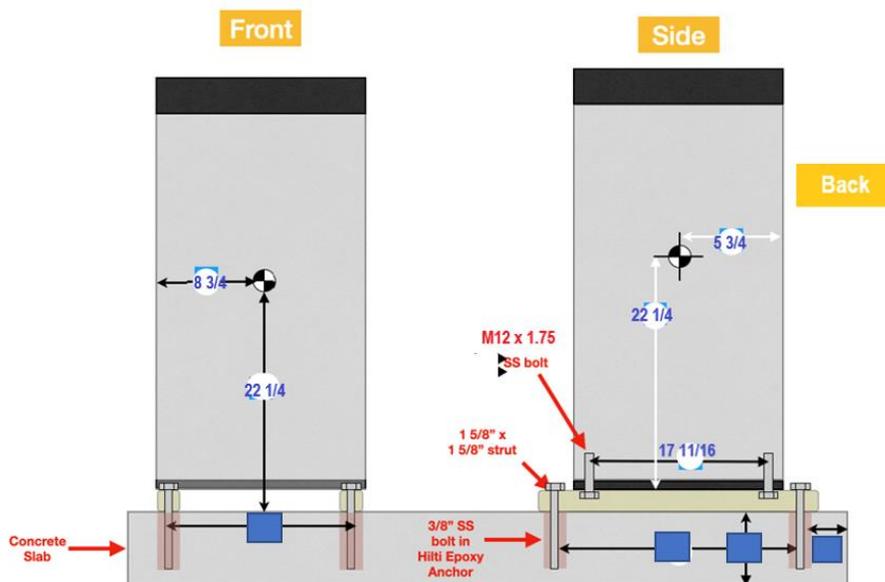
Confirm Inverter-Battery Communication

Confirming Inverter-Battery Communication

Typical SolArk - Battery / CANbus port | Indoor 8kW unit - RJ45/485 port | Indoor 12kW Unit / RS485 Port

Before plugging into the inverter, please confirm you have followed the previous eVault or eFlex specific instructions. The communication cable plugs into the Battery/CANbus port on the Sol-Ark. Only if the Sol-Ark communication card does not have a Battery/CANbus port - such as on an older Sol-Ark inverter, plug into the 'RJ45 485' or 'RS485' port.

To confirm BMS communication, enable "BMS Lithium Battery 04" in the Sol-Ark battery setup menu That will enable a "Lithium Battery Info" screen under the main Sol-Ark setup menu.
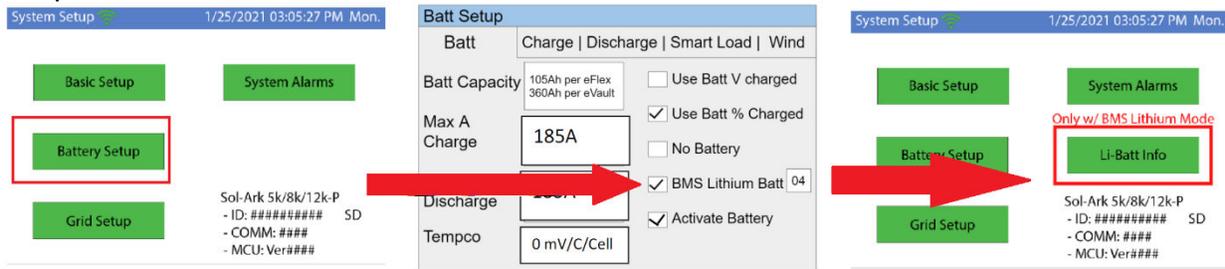
Click on the gear icon to reveal the Lithium Battery Info menu. If the battery is communicating to the inverter, a line of battery data will appear across line 2 of the Sol-Ark menu. The other data lines will remain 0s.

Now that closed loop communication is confirmed, move the inverter to %-based control and program any percentage-based triggers as detailed in previous steps.

Grid Setup Menu

Time-of-use settings are specific to each end user but also important to having system behavior meeting customer expectations. system to behave as the end user wants it to behave. There are a few important things to know when programming Sol-Ark's time-of-use settings:
1) Checking the "charge" column boxes will force a grid charge to that battery.
2) Leaving the "charge" column boxes unchecked will act as a low battery cut-off.
3) Enabling "grid-sell" will allow the battery to sell back to the grid when it is otherwise 100% full.
4) Solar will charge the battery to 100% if there is enough sunlight available and all the loads are otherwise met.
5) Additional settings worth exploting in the Grid Setup Menu are the frequency ranges and grid profile settings useful for generator compatibility.
<u>Back-up Only Customers:</u>
Batteries work better and last longer if they are used, rather than staying 100% full. Our recommendation is to allow the battery to drop to 70% during the early morning hours and then have it go to 100% during the day. You do not need to enable a grid-charge for this functionality. You may want to increase the grid start % or voltage in the battery setup menu.

<u>Time-of-use Customers:</u>
1) To maintain solar tax credit compliance, you will want to prioritize battery charging in the hours before the time-of-use period so that the battery is 100% going into the time frame.
2) You may also want to enable a grid charge the hour before the time-of-use period to ensure the battery reaches 100%
3) You may not want to discharge the battery too aggressively. Sticking to no more than 9kW per eVault or 3.3kW per eFlex is optimal for maximizing battery life under time-of-use grid sell-back. Likewise, selling back at less than the full rated value of the inverter is healthy for inverter life. So for example, if you can identify that the battery and inverter will be fully utilized over the time of use rate period by discharging at 5kW rate instead of the full rated capacity of the inverter, it will extend battery life.
4) That said, the mantra is "use it or lose it" - it is more economically advantageous for the end user to use the battery when it is financially advantageous to do so, rather than to keep the battery at 100% always.

Bad Utility Buyback Rates aka "no net-metering" aka "bad net-metering":
Allow the battery to discharge to a 20% state-of-charge over night, so that it can absorb as much solar power as possible during the day rather than having that energy sold back to the grid. Staggering the step down percentages throughout the night so that the battery so that the battery hits 20% right in the early morning will mitigate the risk of power outage between sun up and sun down. Maintain the final 20% time-of-use step with a grid charge to make sure the battery does not go below 20% (which would trigger a full grid recharge at 15% per prior steps). During the day, it does not matter if you prioritize the grid or the battery first when recharging with solar power.

Grid Param — Suggested Grid-Tie Parameters

Limiter | Sell Control | Grid Input | FreqVolt | PowFac | Relay

☑ Grid Sell 9000

☐ Limited Power to Home

☐ Limited Power to Load

☑ Time of Use [Setup]

[CANCEL] [OK]

Time	Power(W)	Batt	Charge	Sell
3:00AM	3kW	30%		
5:00AM	3kW	20%		
9:00AM	9kW	100%		
3:00PM	3kW	100%	✓	
7:00PM	6kW	60%		
9:00PM	3kW	45%		

Note: Change the programming from Percentage to Voltage in the Battery setup menu. (Use Batt % Charge / Use Batt V charge)

Calibration Charge SoC

Calibrating the battery literally means charging the battery 100% full and confirming the battery resting voltage is above 54V. This can be done onsite or remotely.
Calibration is not a regular task. Good times to calibration are:

- System commissioning
- occasionally when batteries are kept 80-100% full
- deep discharge recovery
- extended periods of overcast / low production days
- anytime when the % state-of-charge says 100% but battery voltage is below 54V

Performing a calibration charge onsite:

1) Go to the battery setup menu.
2) Check "Use Batt V charged" (Use Batt % Charge will unselect).
3) Uncheck "BMS Lithium Batt 04"
4) Switch back to "Use Batt % Charged" and "BMS Lithium Batt 04" after battery climbs above 55V. The Sol-Ark should read 100% at above >54V after switching back over.

Onsite:

Online:

Setting(2009234348)

Battery Setting	Mode	⦿ Lithium Batt ◯ Batt-V ◯ Batt-% ◯ No Battery
System Work Mode		
Grid Setting	* Battery Capacity(0-9999Ah)	210

Performing a calibration charge quickly:

1. Complete steps 1-3 in the previous step.
2. Go into the Grid Setup menu and enable time-of-use settings.
3. Find the current time zone and set the voltage to 55.5V. Then check the "grid charge" box in the adjacent column.
4. Once the battery reaches 55.5V, the battery should displays 100% and the original settings can be restored.

Onsite:

Calibrating the battery to 100% SoC using Time-of-Use paratmeters in voltage mode

Online:

Setting(2009234348)

Battery Setting

System Work Mode

Grid Setting

SmartLoad

Basic Setting

Advanced setting

Work Mode   ○ Grid Selling   ◉ Limited power to Load   ○ Limited to Home

Solar sell   ⬜

* Max Sell Power   [9000]

Energy pattern   ◉ Batt First   ○ Load First

Time Of Use   🟢

☑ Mon.   ☑ Tue.   ☑ Wed.   ☑ Thu.   ☑ Fri.

☑ Sat.   ☑ Sun.

Charge   ⬜ Time 1   ⬜ Time 2
⬜ Time 3   ⬜ Time 4
⬜ Time 5   ⬜ Time 6

Time 3   🕐 09:00

* Power3   5000

* Battery V3   **55.5V**

Firmware Updates

Firmware updates are rarely needed. Most firmware updates solve a minor issue - major firmware updates typically are adding compatibility with new-to-market hardware or to accommodate developments in battery-inverter communication.

Most of our installers use the firmware update tool to confirm proper system commissioning or unlock batteries from their protective modes during a deep discharge. To update the battery firmware, please visit https://www.fortresspower.com/firmware. Solar contractors should visit https://www.fortresspower.com/support and request a firmware update tool.
If you cannot determine the instructions, we are happy to assist you with a remotely - there are things we can do before you visit site to make your site visit much easier, and we can also assist you onsite (preferably scheduled in advance).
Firmware update tools are available for sale at https://www.fortresspower.com/products/firmware-update-tool/
However, we recommend end users wait for the Fortress Guardian Hub instead of buying the firmware update tool.
Click this link if you are interested in being a beta tester.

Voltage to % Chart

The voltage curve of lithium is very flat from the bottom 20% of the battery to the top 80% of the battery, at which point is becomes rather steep at both ends. It is very easy to tell when a battery is moving towards the bottom or top of its range - the middle bit is hard to guess because it will fluctuate with load. Here is a very loose approximation of Fortress battery voltage and state-of-charge:

Resting Voltage	% State of Charge (SoC)
48V	0
51V	10
51.5V	20
52V	30
52.3V	40
52.4V	50
52.5V	60
52.8V	70
53.2V	80
53.7V	90
>54V	100