



How To Set Up Fortress Power Lithium Batteries Using Outback Inverter/Chargers

Battery Bank Sizing

Please make sure to go through these steps to make sure you have properly sized your system to avoid damaging your battery. There are 4 ways of properly calculating the battery bank size for a given system as outlined below:

1. **Match Overcurrent Protection Device (OPD) Ratings**

$$\sum_{\text{battery bank breakers}} \geq \sum_{\text{inverter breakers}}$$

2. **Match Inverter Rating to Maximum Current Rating of Battery**

$$\sum_{\text{battery bank continuous rating}} \geq \sum_{\text{inverter continuous rating}}$$

&

$$\sum_{\text{battery bank surge rating}} \geq \sum_{\text{inverter surge rating}}$$

3. **Match Charge Controller to Battery Bank charge capacity**

$$\sum_{\text{battery bank max charge current}} \geq \sum_{\text{charge controller max output}}$$

4. **Calculate the required battery bank capacity based on actual loads**

$$\frac{\sum_{\text{total energy used (kwh)}}}{\sum_{\text{total available battery capacity (kwh)}}} \times 100\% \leq 80\%$$

For the following battery bank size calculations, the below system assumptions apply:

- 1 Outback Radian 8048 Inverter utilizing (2) 104A DC Breakers
 - Nameplate Capacity: 8000 Watts continuous / 156A DC
 - Surge Capacity: 12,000 Watts for 5 seconds / 240A DC
- 2 Outback FLEXmax 80 charge controllers
 - Nameplate Capacity: 80A DC / ~4000 Watts DC per Charge Controller
 - Nameplate Capacity for 2 parallel charge controllers: 160A DC

1. **Match Overcurrent Protection Device (Breaker Sizes):**

- A single Radian 8048 inverter has (2) 104A breakers
- The LFP-5 has a 125A breaker

$$\sum_{(2) \text{ LFP-5 battery breakers}} (125A + 125A) \geq \sum_{\text{inverter breakers}} (104A + 104A) \quad \checkmark$$

- The LFP-10 has a 150A breaker

$$\sum_{(2) \text{ LFP-10 battery breakers}} (150A + 150A) \geq \sum_{\text{inverter breakers}} (104A + 104A) \quad \checkmark$$

- A single eVault 18.5 has a 250A breaker

$$\sum_{\text{eVault battery breakers}} (250A) \geq \sum_{\text{inverter breakers}} (104A + 104A) \quad \checkmark$$



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2. Match Inverter Rating to Maximum Current Rating of Battery:

- A single Radian 8048 Inverter has a continuous rating of 156A and a surge capacity of 240A.
- The LFP-5 has a continuous rating of 80A with 180A surge capacity

$$\begin{array}{l}
 \sum_{(2) \text{ LFP-5 battery continuous rating}} (80A + 80A) \geq \sum_{\text{inverter continuous rating}} (156A) \quad \checkmark \\
 \sum_{(2) \text{ LFP-5 surge rating}} (180A + 180A) \geq \sum_{\text{inverter surge rating}} (240A) \quad \checkmark
 \end{array}$$

- The LFP-10 has a continuous rating of 100A with 200A surge capacity

$$\begin{array}{l}
 \sum_{(2) \text{ LFP-10 battery continuous rating}} (100A + 100A) \geq \sum_{\text{inverter continuous rating}} (156A) \quad \checkmark \\
 \sum_{(2) \text{ LFP-10 surge rating}} (200A + 200A) \geq \sum_{\text{inverter surge rating}} (240A) \quad \checkmark
 \end{array}$$

- The eVault 18.5 has a continuous rating at 180A with 240A surge capacity

$$\begin{array}{l}
 \sum_{(1) \text{ eVault battery continuous rating}} (180A) \geq \sum_{\text{inverter continuous rating}} (156A) \quad \checkmark \\
 \sum_{(1) \text{ eVault surge rating}} (240A) \geq \sum_{\text{inverter surge rating}} (240A) \quad \checkmark
 \end{array}$$

3. Match Charge Controller to Battery Bank charge capacity.

- Each FLEXmax 80 charge controller has a maximum output current of 60A. Two parallel FLEXmax 80 charge controllers can output 160A.
- The Technical Specifications: charge current is 80A.

$$\sum_{(2) \text{ LFP-5 battery max charge rating}} (80A + 80A) \geq \sum_{\text{inverter max charge rating}} (160A) \quad \checkmark$$

$$\sum_{(2) \text{ LFP-10 battery max charge rating}} (80A + 80A) \geq \sum_{\text{inverter max charge rating}} (160A) \quad \checkmark$$

- The eVault has a maximum charge current of 170A.

$$\sum_{(1) \text{ eVault battery max charge rating}} (170A) \geq \sum_{\text{inverter max charge rating}} (160A) \quad \checkmark$$



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4. Calculate the required battery bank capacity based on actual loads.

Every load on the Back-Up Panel will need to be analyzed (load power and duration). All total energy is calculated by summing the individual energies for each load. Assume the following loads and a customer who wants to run 24 hours off batteries only:

1	Appliance	Running wattage	Operating hours/day	Daily Consumption
2	Refrigerator	250 W	12 hrs/day	3 kWh
3	Lights:	100 W	6 hrs/day	0.6 kWh
4	Well Pump	3000 W	1 hr/day	3.0 kWh
5	Internet and continuous Phantom Loads	100 W	24 hrs/day	2.4 kWh
6	TV	200 W	4 hrs/day	0.8 kWh
			Sum	9.8 kWh



REMINDER! Always try to maintain the recommended Depth of Discharge (%DOD) of 80%, for healthy battery life and performance.

1. 2 LFP-5's = 10.24kwh. Therefore, not acceptable.

$$\frac{\sum_{total\ energy\ used\ (kwh)}(9.8kWh)}{\sum_{total\ available\ battery\ capacity\ (kwh)}(10.24kWh)} \times 100\% = 97\% \leq 80\% \quad \text{✗}$$

2. 1 LFP-10 = 10.2kwh. Offering 2 LFP-10's at 20.4 kwh yields approx. 48% DOD. Acceptable, but oversized.

$$\frac{\sum_{total\ energy\ used\ (kwh)}(9.8kWh)}{\sum_{total\ available\ battery\ capacity\ (kwh)}(20.4kWh)} \times 100\% = 48\% \leq 80\% \quad \text{✓}$$

3. 1 eVault at 18.5kwh however, would be the better option.

$$\frac{\sum_{total\ energy\ used\ (kwh)}(9.8kWh)}{\sum_{total\ available\ battery\ capacity\ (kwh)}(18.5kWh)} \times 100\% = 53\% \leq 80\% \quad \text{✓}$$

If the customer cannot supply the load information, or assumptions cannot be made, the rule of thumb as an absolute minimum battery size is to match the power rating of the inverter in kW to the energy rating of the battery in kWh. A single Radian 8048 is rated at 8kW meaning a minimum battery size of 8kWh would be required. In that case two LFP-5, with an 80% discharge capacity of 8kWh would be enough to meet the minimum battery size by this very basic calculation method.



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Parameter Setting for Fortress battery with Outback Inverter/Chargers

This guide covers the recommended set up and configuration of Schneider equipment for optimizing performance with Fortress LFP batteries. More information on Fortress products can be found on our website: www.fortresspower.com

Inverter	80% DoD, 6000 cycles	90% DoD, 3000 cycles
Absorb Voltage and Time	54.4, 1 hour	54.6, 1 hour
Float Voltage and Time	54.4 Time = 0 = Disable	
Re-float Voltage	52.5	
Re-Bulk Voltage	51.5	
AC Input Mode	Grid Tied (default, adjust as needed)	
AC Charger Limit in AC	LFP-5/LFP-10:17A@240V or 34A@120V per battery eVault: 30A@240V or 60A@120V per battery	
Low Battery Cut-Out Voltage	50.7	50.3
LBCO Delay	120 seconds	
Low Battery Cut-in Voltage	51	
High Battery Cut-Out Voltage	58	
HBCO Delay	10 seconds	
High Battery Cut-in Voltage	56	
SellRE (Offset) Voltage	53.2	
Charge Controller		
Absorb Voltage and Time	54.8, 0.3 hours	56, 0.3 hours
Float Voltage	54	
Rebulk Voltage	51.5	
DC Current Limit **	LFP-5/LFP-10:80 A per battery eVault: 150 A per battery	
Absorb End Amps	0	
FLEXnet DC (FN-DC)		
Battery AH	LFP-5: 100 per battery LFP-10: 200 per battery eVault: 360 per battery	
Charge Voltage	54.0	
Charged Return Amps	10A	
Battery Charge	96%	
Relay Invert Logic	No	
Relay Voltage	High = 53.4 ; Low = 49.6	
Relay SOC High/Low	SOC High = 0% SOC Low = 0%	
Relay Delay	High = 1, Low = 0	
MATE3/MATE3s		
FLEXnet DC Advanced	Low SOC Warning = 15%	
FLEXnet DC Advanced	Critical SOC Warning = 10%	



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⚠ Please reassess capacity and charge/discharge current settings, when Fortress battery quantities change.

Integrating with a SkyBox

The settings below should be programmed into the unit under the Custom choice. Please consult the SkyBox Programming Guide for detailed instructions on how to adjust these settings.

Inverter	
Maximum SOC	100%
Minimum SOC	20%
Absorb Charge	Timed
Absorb Voltage	54.4 Vdc
Absorb Time	00:20
Float Charge	Disabled
Float Voltage	Can be left at default
Float Time	Can be left at default
Re-float Voltage	52.5 Vdc
Re-bulk Voltage	51.5 Vdc
Equalize Voltage	54.4 Vdc
Minimum Equalize Time	00:00
Max Charge Current (Adc)	LFP-5 & LFP-10: 50Adc eVault: 100Adc
Max Discharge Current (Adc)	LFP-5 & LFP-10: 90Adc eVault: 180Adc
Grid Charge Limit (kW)	Site specific
Low Battery Cutout	50.7 Vdc
LBCO Delay	15 seconds
Low Battery Cut-in	51.0 Vdc
High Battery Cutout	56.0 Vdc
HBCO Delay	10 seconds
High Battery Cut-in	55.5 Vdc
Battery Series	Custom
Battery Model Number	Custom
Battery Description	Fortress Power
Battery Total Amp-Hours	LFP-5: 100Ah LFPP-10: 200Ah eVault: 360 Ah
Charge Efficiency Factor	96%
Absorb End Amps	10.0 Adc



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***Ensure the maximum battery charging current is not exceeded after all charge controllers are taken into consideration (i.e. – 2 FM100 controllers would charge at 200 A dc total, a violation of the limit if only one LFP-10 is used).*

Best Practice Operation

During testing, it was seen that a commissioning charge was necessary to properly calibrate the SkyBox state of charge monitor. If possible, a full load test should also be performed. Each time the battery reaches the low battery cutout voltage, the SkyBox recalculates a state-of-health (SOH) for the battery. This number is used to more accurately track the SOC.

Should you have any questions, please don't be hesitate to contact us!

Warm regards from Fortress team