



Design and Installation Guide

Topic

Product Introduction

Design Guide

Installation Guide

Parameter Setting



Product Introduction

Fortress Lithium Batteries – Standard Product Line (48V)



Technical Specification

	eVault 18.5	LFP-10	LFP-5
Total Energy [KWH]	18.5	10.2	5.1
Capacity [AH]	360	200	100
Battery Voltage [V]		48V	
Max. Charge Current (Continuous) [A]	170	80	80
Max Discharge Power (Continuous) [KW]	9 (180A)	5 (100A)	4 (80A)
Peak Output [KW] for 5 sec	12 (240A)	7.5 (150A)	7.5 (150A)
Parallel Stacking	12	2	3
LCD Monitoring	Yes	No	No
Communication	CAN/RS485	N/A	N/A
Breaker	250A	150A	125A
Warranty	5/10	years; up-to 6,000 cyc	les

Battery Management System (BMS)

Multilevel Safety Concept for Highest Reliability

- ✓ Voltage and Temperature Monitoring
- ✓ Overcharge and Deep Discharge Protection
- ✓ Over-heat Protection
- ✓ Over Current Protection (DC Breaker)
- ✓ Cell Monitoring and Balancing



Compatible Inverters

COMPATIBLE WITH MOST 48V CHARGERS AND HYBRID INVERTERS!

Brand	Inverter/Charger Mode	Configuration
Schneider **	Conext XW MPPT charge controller; XW+ series; XW+ pro series; Conext SW;	AC or DC coupled
Outback	Skybox, FLEX max charge controller (48V), FLEXpower series (48V); Radian series (48V); Radian series (48V); FXR(A) and FXR (E) series (48V); GVFX and GVFX series (48V);	AC or DC coupled
Magnum	MS 4448PAE; MS 4048-20B	AC or DC coupled
SMA**	SUNNY ISLAND 4548-US/6048-US; SUNNY ISLAND 3.0M/4.4M/6.0H/8.0H	AC coupled
Sol-Ark**	8 KW Inverter	AC or DC coupled
Victron **	Phoenix VE.Direct Inverter; MultiPlus and Quatro Inverter/Charger; Skylla-TG Charger; General; Color Control or Venus GX	DC coupled
Morning Star	TriStar MPPT 600V; TriStar MPPT; Tristar PWM	DC coupled
Midnite Solar	Solar Classic 150, 200 & 250; Solar Classic 150, 200 & 250-SL	DC coupled

** we're establishing communication with those inverters!

Fortress + Schneider XW+ or XW pro (AC & DC Coupling)

Key features:

- Over 10 years in operation
- All in one unit (Off-Grid; Time-of-Use; Load shifting; Back-up; Grid export)
- Allows DC & AC coupling
- Single or three phase systems from 7 kW to 102 kW
- Performs in hot environments up to 70°C
- Auto-Gen Start optional



Technical Specification of XW+ & XW Pro

	Technical Specification			
Inverter AC output	5.5 KW 6.8 KW			
Surge power at backup	7/9.5 kW (30 min/60 sec)	8.5/12 kW (30 min/60 sec)		
Storage capacity	10/18.5 KWH per unit; scalable to 222 KWH			
UPS Grid Failure Transfer time	Built-in 60A auto-transfer relay at 8ms			
Compatible PV Inverters	AC-coupled to Enphase, AC modules, Solaredge, SMA, Fronius 10 kW+, etc.			
Stack-ability	 Max. 4 in 1-Ph (120/240V) Max. 9 in 3-Ph (120/208V): 3 units per phase 			



Fortress Energy Storage Sizing Tool

4 Steps to Size Up Energy Storage for Backup



Available to our authorized installers

Select Critical Load Panel & Calculate the Daily Consumption

Category	Item	Quantity	Starting Watts	Running Watts	Hours/Day	Watthours/Day	
1 Essential	Refrigerator/Freezer-Energy Star	1	1200	200	8	1600	
2 Essential	Incandescent Light Bulb-60 Watt	6	360	360	4	8640	
3 Essential	LED Light Bulb-60 Watt Equivalent	8	64	64	4	2048	
4 Essential	Sump Pump-1/3 HP	1	1300	800	0	0	
5 Essential	Water Well Pump-1/3 HP		1400	750	3	2250	
6 Kitchen	Electric Range-6" Element		1500	1500	1	1500	
7 Kitchen	Microwave Oven-650 Watts		1000	1000	0.1	100	
8 Personal Electronics	TV-Flat Screen-46"		190	190	6	1140	
9 Personal Electronics	Cell Phone Charger	2	50	50	2	200	
10 Personal Electronics	Computer-Laptop		250	250	3	750	
STANDBY POWER	Schneider XW+6848NA		8	8	24	192	
Inverter Type	Quantity**	Watthours/Day	1522	Surge Power		Running	Watts
Schneider XW+6848NA	1	18420 Watts	467	78 Watts Av	vailable	1636	Watts Available

Sizing Battery Bank - Example with Schneider Inverter

Inverter: 1 Schneider XW+6848 Inverter

- Breaker: 250A DC
- Capacity: 6.8 kW / 136A DC
- Surge: 12 kW for 60s / 240A DC

Charge Controller: 2 Schneider MPPT-60-150

- Max Charing Rating: 60A DC
- Max Input: 3000W DC per Charge Controller

Battery: LFP-10

- Breaker: 150A DC
- Max Discharging Rate: 100A DC
- Surge: 180A DC
- Max Charge Rate: 80A

How many LFP-10 do I need?

Methods for Sizing Battery Bank

- 1. Match Overcurrent Protection Device (OPD) Ratings
 - $\sum_{battery \ bank \ breakers} \geq \sum_{inverter \ breakers}$
- 2. Match Inverter Surge Rating to Maximum Current Rating of Battery

 $\Sigma_{battery \ bank \ continuous \ rating} \geq \Sigma_{inverter \ cotinuous \ rating}$ &

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

3. Match Charge Controller to Battery Bank charge capacity

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

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

 $\frac{\sum_{total energy used (kwh)}}{\sum_{total available battery capacity (kwh)}} x \ 100\% \le 80\%$

Sizing based on Overcurrent Protection Device (OPD) Ratings



Sizing based on System's Maximum Current

2. Match Inverter Rating to Maximum Current Rating of Battery

 $\sum_{battery \ bank \ continuous \ rating} \geq \sum_{inverter \ cotinuous \ rating} \mathbf{k}$

 $\Sigma_{battery \ bank \ surge \ rating} \geq \Sigma_{inverter \ surge \ rating}$



Sizing based on Charge Controllers

3. Match Charge Controller to Battery Bank charge capacity

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



Sizing based on Total Daily Energy Consumed

 $\frac{\sum_{total \, energy \, used \, (kwh)}}{\sum_{total \, available \, battery \, capacity \, (kwh)}} x \, 100\% \, \le 90\%$

$$\frac{\sum_{total energy used (kwh)} (18.4kWh)}{\sum_{total available battery capacity (kwh)} (20.4kWh)} x \ 100\% = 90.2\%$$

	3000 Cycles	6000 Cycles
Depth of Discharge	90%	80%

Sizing based on Total Daily Energy Consumed

Critical Load Consumption Report

Item	Watthours/Day
Refrigerator/Freezer-Energy Star	1600
Incandescent Light Bulb-60 Watt	8640
LED Light Bulb-60 Watt Equivalent	2048
Sump Pump-1/3 HP	(
Water Well Pump-1/3 HP	2250
Electric Range-6" Element	1500
Microwave Oven-650 Watts	100
TV-Flat Screen-46"	1140
Cell Phone Charger	400
Computer-Laptop	750

Select Battery Bank Size

Fortress Power Battery	LFP -10
System Size:	10,240 Wh
Battery Quantity	2
Depth of Discharge:	90%
Available Power:	18,432 Wh

TOTAL

18428 Wh/Day

Estimated Average Daily PV Production

	Solar		Energy Per Day	Full charge on	avail. Energy after
	Radiation	AC Energy	(watthours)	battery	battery charged
January	3.8	751	24,226	(18,432)	5 <mark>,794</mark>
February	4.28	746	26,643	(18,432)	8,211
March	5.23	986	31,806	(18,432)	13,374
April	5.91	1,039	34,633	(18,432)	16,201
May	6.32	1,132	36,516	(18,432)	18,084
June	6.74	1,106	36,867	(18,432)	18,435
July	6.36	1,090	35,161	(18,432)	16,729
August	5.78	1,004	32,387	(18,432)	13,955
September	5.19	886	29 <mark>,53</mark> 3	(18,432)	11,101
October	5.08	926	29,871	(18,432)	11,439
November	4.14	749	24,967	(18,432)	6,535
December	3.38	646	20,839	(18,432)	2,407
			WHAT TO EXPE	CT	
able power in	Battery at	90% DoD	18,432 Wh		1 Days
est average dai	ly available	e PV Powe	r: 20,839 Wh	I	
est average da	ily availabl	e PV Powe	er: 36,867 Wh		

Additional Requirement for AC Coupling

a) PV array Size < hybrid Inverter full load power

b) PV array Size/48V < Battery max charge rate

Example: using one Schneider XW+ 6848 to AC couple Enphase micro inverters

1) PV array must be less than 6.8 KW 2) If the PV array is 6.5 KW, the battery max charging rate must be great than 135A (6.5 KW/48V = 135A)



6.8 kW/30 kWh ESS



Installation Guide

Select Battery Cables

Maximum Ampacties for Wire and Cable				
Wire Size (AWG)	Copper Conductor Temp. Rating		Aluminum Temp.	Conductor Rating
14*	20A	25A		
12*	25A	30A	20A	25A
10*	35A	40A	30A	35A
8	50A	55A	40A	45A
6	65A	75A	50A	60A
4	85A	95A	65A	75A
2	115A	130A	90A	100A
1	130A	150A	100A	115A
1/0	150A	170A	120A	135A
2/0	175A	195A	135A	150A
3/0	200A	225A	155A	175A
4/0	230A	260A	180A	205A



M8 Terminal Ring (diameter:8mm or 5/16 inches)



knockouts 3/4, 1& 1 ¼ inch

Commission LFP-5 & LFP-10

- 1. Put the battery breaker on the "ON" position.
- 2. Turn on the inverter

If the inverter has 2 breakers or more, such as Outback Radian 8048, please follow the below steps:

- a. Finish the Step 1 as above
- b. Put ONLY ONE (1) Inverter breaker into the "ON" position, leaving the rest of the breakers "OFF".
 - Turning on Inverter by utilizing only one (1) of the inverter breakers to limit Amperage

C. after a few minutes, turn the other Inverter breaker(s)

If you install multiple inverters with one or more LFP batteries, please turn the first Inverter by following the abovementioned steps, then power up the remaining inverters

Commission eVault 18.5

- 1. Push the button on the front for 6 seconds to bring on the LCD display.
- 2. Put the battery breaker on the "ON" position.
- 3. Turn on the inverter

If the inverter has 2 breakers or more, such as Outback Radian 8048, please follow the below steps:

- a. Finish the Step 1 and Step 2 as above
- b. Leave one Inverter breaker on "OFF" position, while put other Inverter breakers on "ON" position.
- c. Turn on Inverter by utilizing only one (1) of the inverter breakers to limit Amperage
- d. After a few minutes, turn the other Inverter breaker(s)

If you install multiple inverters with one or more eVault 18.5, please turn the first Inverter by following the abovementioned steps, then power up the remaining inverters

Select "+" and "-" Battery Terminal Bus Bar

a. M8 or 5/16" Stud.

b. 48V

c. Make sure it can handle the total max charging & discharging amperage of all batteries.



Max 300A



Midnite battery combiner 1000A

How to Parallel LFP-5 & LFP-10



- 1. Check all battery voltages (must be within a total range 0.5V)
- 2. All batteries must have the DC breaker in the "OFF" position
- 3. Inverter must be "OFF" (or breaker in the "OFF" position)
- Wire the battery cables and connect them to "+" and "-" terminal bus bar respectively
- 5. Connect the "+" and "-" terminal bus bar to the inverter
- 6. Turn all battery breakers to the "ON" position
- 7. Commission the system by turning on the inverter

How to Parallel eVault 18.5



RS485

CAN

RS485

CAN

RS485

CAN

- 1. Prepare Connection Cables (RJ45 <u>cables</u>)
- Connect the batteries together via the RJ45 <u>cables</u>. Start the chain at the first unit's "RS485" <u>port</u> and connect to next unit's "CAN" port.
- 3. Check all Battery voltages (all within a range of 0.5V)
- 4. Set each battery to "slave" through the touch screen
- 5. Reset all batteries by pushing the power button "OFF" then "ON", while the battery air breaker is in the "OFF" position
- Wire the battery cables and connect them to "+" and "-" battery bus bar respectively
- 7. Connect the "+" and "-" battery bus bar to the inverter
- 8. Set up the FIRST unit as "Master" battery via Touch Screen as described below
- 9. Start commission by turning on inverter/inverter breaker



Integration Guide-Inverters/Charger Setting

Charger/Inverter configuration recommendation for best performance:

	90% D.O.D. (3000 Cycles)	(80% D.O.D. 6000 Cycles)
Equalized Support	Off	Off
Capacity Limit	LFP-5: 100 Ah / LFP-10	0: 200Ah / 18.5: 360Ah
Equalized Voltage	Off	Off
Recharge Voltage	51V	51V
Bulk Voltage	54.6V	54.4V
Absorb Voltage	54.6V	54.4V
Low Battery Cut Out Voltage	50.3V (48V)	50.7V (48V)
High Battery Cut Out Voltage	61V	61 V
Float Voltage	OFF/unless use as back up (54.4V)	
Max Charge Current	LFP-10: 80A per battery eVault 18.5: 170A per battery	LFP-10: 50A per battery eVault 18.5: 100A per battery

The Battery Parameter Setting Guides with Schneider, Outback and SMA inverters are available to download on <u>www.fortresspower.com/Resource</u>



Setting Up Max Charging & Discharging Rate

- □ Follow Parameter Settings before commissioning your battery!
- Critical to the health of the on-board BMS

Example: 2 Schneider MPPT 60/150; 1 XW+ 6848; 2 LFP-5

Recommended Setting: I Battery Max Charge = 80A per Battery; Total: **160A**

I Charge Controller Max Charge =60A (100%) per Charge Controller; Total 120A

I *Inverter Max Charge* must be less than or = 40A (Charger set to 28% of max)

Our Product Advantages



Authorized Installer Benefits



Thank You & Contact Us

If you want to go fast, go alone; if you want to go far, go together!



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