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# 1.1 About Fortress Power

Our mission is to provide compact, user-friendly, and affordable energy storage solutions using the latest technology for all homes and businesses. Fortress solar energy storage batteries can easily integrate with new and existing PV systems and work with a wide range of existing inverter and charge controller manufacturers for ease in system design.

## Contact Information

**Address:**

Corporate Headquarters  
505 Keystone Rd, Suite D  
Southampton, PA 18966 USA

**Website:** [www.fortresspower.com](http://www.fortresspower.com)

**Email:** [techsupport@fortresspower.com](mailto:techsupport@fortresspower.com)

**Phone:** (877) 497-6937

## 1.2 Safety Precautions and Instructions

All types of damage to the product may lead to a leakage of electrolyte or flammable gas.

During installation of the battery, the utility grid, solar input must be disconnected from the Battery Pack wiring. Wiring must be carried out by qualified personnel. The battery pack contains no user serviceable parts. High voltage or current is present in the device. The electronics inside the Battery Pack are vulnerable to electrostatic discharge. Observe the following precautions:

- Risks of explosion
  - Do not subject the battery pack to strong impacts.
  - Do not crush or puncture the battery pack.
  - Do not dispose of the battery pack in a fire.
- Risks of fire
  - Do not expose the battery pack to temperatures in excess of 122°F (50°C).
  - Do not place the battery pack near a heat source such as a fireplace.
  - Do not expose the battery pack to direct sunlight.
  - Do not allow the battery connectors to touch conductive objects such as wires.
- Risks of electric shock
  - Do not disassemble the battery pack
  - Do not touch the battery pack with wet hands
  - Do not expose the battery pack to moisture or liquids
  - Keep the battery pack away from children and animals.
- Risks of damage to the battery pack
  - Do not allow the battery pack to come in contact with liquids.
  - Do not subject the battery pack to high pressures.
  - Do not place any objects on top of the battery pack.



**IMPORTANT NOTE:** Circuit Breakers, Disconnects and Fuses should be employed throughout the energy storage and generation installation to isolate effectively and protect all components of the system against faults, short circuits, polarity reversals or a failure of any component in the overall system.

**Fuses, breakers, wiring ratings and values should be determined by established standards and evaluated by certified electricians, licensed installers, and regional code authorities. The eVault Max must always be installed and commissioned with settings to protect**

**the batteries from open PV voltage and other high voltage charging sources. The eFlex Battery Management System (BMS) alone will not protect the batteries from these extreme electrical events. Failure to adhere to installation protocol will void the warranty.**



CAUTION! Verify polarity at all connections with a digital voltmeter before energizing the system. Reverse polarity at the battery terminals will void the warranty and destroy the batteries. Do not short circuit the batteries.

Most batteries pose some risk of shock or sparking during the installation and initial wiring and connection process. Wearing insulated gloves, clothing and footwear and using electrically insulated tools are required when working with eFlex. Cover or remove jewelry or conductive objects (metal bracelets, rings, belt buckles, metal snaps, zippers, etc.) when working with any electrical or mechanical device. Cover or restrain long hair and loose clothing when working with any electrical or mechanical device. CAUTION! Do not disassemble or modify the battery. If the battery housing is damaged, do not touch exposed contents.

# 1.3 Data Sheet

## Fortress eFlex 5.4 kwh Data Sheet

Electrical Specifications	
Nominal Voltage:	51.2V
Nominal Capacity:	105 Ah
Rated Capacity @ 0.5C (50A):	5.374 kwh
Resistance	<10 mΩ
Efficiency	>98%
Self-Discharge	<1%/month (powered off)
Maximum Allowed Modules in Parallel	16 (86.4 kwh)
Depth of Discharge	Up to 100%
Warranty	10 Years
Cycle Life	8,000 (@ 80% daily depth-of-discharge)

Electrical Specifications	
Dimensions: (L*W*H)	18 x 23 x 7.3"
Weight:	108 lbs
Terminal Type:	M8
Terminal Size	3/8" or 1/2" hole size
Terminal torque	7.0 - 7.7 Nm / 5.1-5.7 ft-lb
Terminal Cover	1 set, plastic
Case Material	Anodized Aluminum
Enclosure Protection	IP65
Cell Chemistry	Tier 1 EV Grade Lithium Iron Phosphate (LiPO4)

Cycle Life	8,000 (@ 80% daily depth-of-discharge)
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Charge Specifications	
Recommended Charge Current	≤55A (longest life)
Maximum Charge Current	100A
Recommended Charge Voltage:	54.4V
Maximum Charge Voltage	56V with battery-inverter communication
BMS Disconnect	58V

Discharge Specifications	
Recommended Discharge Current (ex. grid sell-back, demand management)	60A (3kW DC)
Maximum Discharge Current	100A (5kW 60 Min)
Maximum Surge Current (5 Second)	130A (6.6kW)
Recommended Low Voltage Disconnect	48V
Battery Low Voltage Protection	<45V
Battery Recovery Voltage	45V

Compliance Specifications	
Certifications	UL9540, UL9540A, UL1973, UL1642, CEC, SGIP, LUMA
Shipping Classification	UN 38.3 CLASS 9 (Lithium Ion Battery)



Do not mix with lead acid batteries when recycling.

Basic Charging Profile (without battery-inverter communication)	
Bulk + Absorb Charge	54.4V
Absorb Time	60 minutes
Solar Charge Controller Float Charge	54V
Grid Float charge	no float / 2-stage
Equalization	No equalization
Temperature Compensation	None

Temperature Specifications		
Discharge Temperature	-4°F to 131°F,	-20°C to 55°C
Charge Temperature	32°F to 114°F,	-0°C to 45°C
Storage Temperature (powered off)	20°F to 95°F	-6°C to 35°C

# 1.4 Warranty and Support

Unless otherwise submitting a Fortress warranty through the Guardian hub, please submit your eFlex warranty here:

<https://fortresspower.com/warranty>

Beyond this product manual, you may also find our inverter guides useful to system installation and commissioning:

<https://www.fortresspower.com/inverter-guides>

Beyond that, please find additional resources within our Support Portal

<https://support.fortresspower.com/portal/en/kb>

- Create a support ticket
- Inverter Guides
- Product Manuals
- Firmware Updates
- Warranty Submittal
- System Design
- Application Notes
- Scheduled Meetings
- Accessories
- And More!

Note: Sign into the Support Portal to access all features

# 1.5 Quickstart Guide

## Pre Check List

- System is De-energized
- eFlex is Turned off

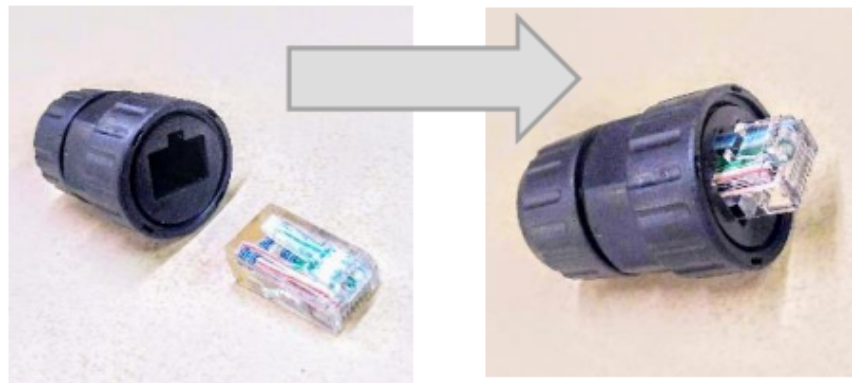
1. After unboxing, turn on unit by press-and-releasing the push button and wait for the light show to complete.
  - Verify battery voltage of EACH battery 49V with a volt meter
  - If the batteries are not within 0.5V of each other, a special process must be followed before commissioning
  - Take pictures of the battery serial numbers for warranty submittal.
2. Wire up the batteries. Torque battery cable connections to 7-7.7 Nm or 5.1-5.7 ft-lbs.
3. Install communication circuits.
  - Batteries without inverter communication should have CANBus terminators on both ends of the battery-battery communication chain. Hand-tighten but do not over tighten.
  - Batteries with inverter communication should substitute one CANBus terminator with the female-female RJ45 pinout connector
  - Batteries with the Guardian hub and battery-inverter communication do not use the CANBus terminators.
  - See inverter guides for additional programming details.
4. Make any disconnects between inverter and batteries.
5. Turn on the batteries.
  - Any battery may be turned on so long as it is within 0.5V of the DC bus voltage.
    - i. If batteries are not just outside of the 0.5V range, use this procedure to bring the highest and lowest voltage batteries closer together:
      1. Turn on the lowest and middle voltage battery and let them settle.
      2. Turn on the highest and middle voltage battery and left them settle.
      3. If now within 0.5V, proceed to turn on all the batteries. lower group and middle group are within 0.5V, turn them on.
    - ii. Alternately, use an external trickle charger to raise the battery voltage.
    - iii. If charging the batteries individually using solar charging equipment, limit the charge to 60A. Do not use this technique on batteries <49V.
  - If installing multiple inverters or charge controllers and they fail to power up, turn the breakers to any secondary inverter or charge controls OFF and repeat step 5 with only the master inverter and charge controller breakers in the ON position. Turn the remaining inverter charger equipment ON after starting up the primary inverter / charger.
6. Use Fortress inverter guides to program inverter settings at <https://fortresspower.com/inverter-guides>
7. Take a "far away" photo of the completed installation and submit your warranty at <https://fortresspower.com/warranty>
8. Visit <https://support.fortresspower.com> to submit technical support requests.

## 2.1 Unboxing Check List

**Please confirm and do not discard the following items:**

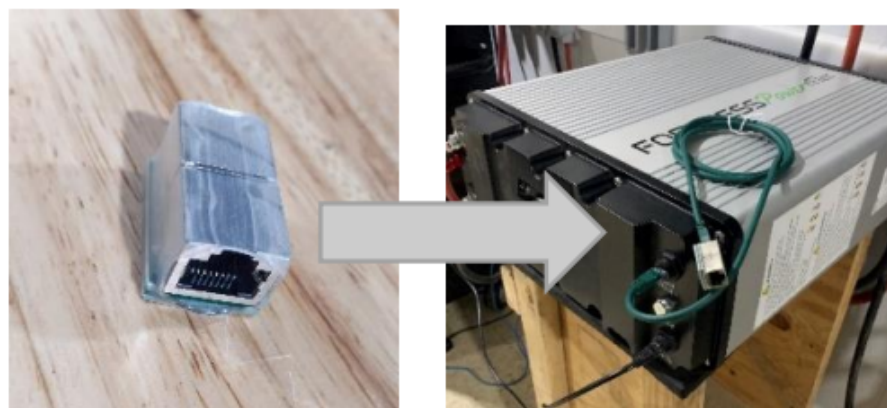
### **CAN Bus Terminator + Cap.**

Installed on the last available communication port of the eFlex when paralleling multiple batteries. The terminator is installed backwards into the cap.



### **RJ45 adapter.**

Installed between the eFlex communication port and the battery inverter during closed loop communication on compatible inverter systems. Alternately, this can be used along with a RS485 cable as a CAN bus terminator if the Can Bus terminator + cap is lost.



### **RS485 cable + RJ45 Cable + Cable glands**

The included RS485 cables are waterproof and moisture proof. Please match environmental ratings of additional RS485 cables if appropriate.



### **Battery Terminal Caps**

The eFlex battery terminal caps have been upgraded to provide additional weather protection and physical contact prevention. Place these caps over battery terminals to protect against accidental contact.



Note: terminal caps have been upgraded and are now screw-on hard plastic.

### **eFlex Wall Mount Bracket (does not include wall fasteners):**





## 2.2 System Sizing

Please refer to our sizing guide and warranty letter for appropriate sizes between various inverter models and the eFlex.

<https://support.fortresspower.com/portal/en/kb/articles/minimum-battery-sizing>

Instead of memorizing the above chart, a good rule of thumb is a maximum of 3.3kW of power output per eFlex without battery-inverter communication. Alternately, you may design with 5kW of power output per eFlex with battery-inverter communication, but it may limit the inverter burst capacity.

Under no circumstance should you install an inverter with charging capacity greater than 100A per eFlex, even if you intend to limit the charge or discharge capacity of the inverter either manually or digitally.

Design questions can be submitted as support tickets at:

<https://support.fortresspower.com>

## 2.3 Storage and Self-Discharge

Fortress Lithium Batteries should be stored out of direct sunlight under the following temperature conditions:  
Do not expose the battery to high temperatures.

Relative Humidity (Min./Max.): 5%~75% RH Storage Temperature (Min./Max.):

Minimum storage temperature		Maximum storage temperature		Storage Duration	Minimum State of Charge
-20°C	-4°F	95°F	35°C	3 Months	50%
-10°C	14°F	95°F	35°C	6 Months	40%
0 - 15°C	32°F – °59F	95°F	35°C	12 Months	20%

### Every 1-3 months:

Systems should be put into storage at 60% SOC and checked to ensure the system SOC does not fall below 20%.

Power the battery off while in long term storage.

The self-discharge rate of the battery is 1% **when powered off** and SoC is above 20%.

### Every 6 months:

Charge the battery to ~60% SoC every 6 months.

### Note for leaving energized systems unattended for long periods of time:

If leaving the battery unsupervised for long durations, consider a high battery cutoff voltage. If the site electricity is critical and the solar charging source may become covered by snow or dust, install a backup generator with an autostart. The inverter and battery management system components put a small load on the battery even while other loads are turned off, which can drain the battery if no charging sources are unavailable for long periods of time.

## 2.4 Temperature Considerations



CAUTION! Do not attempt to charge the battery below 32 degrees F (0 degrees C). Attempts to charge at subfreezing temperatures can adversely affect State of Health (SOH) and cycle life and will void the warranty; never charge battery if it is frozen; never charge a visibly damaged battery. Charging the battery near freezing should only be done with a low amperage external charger or closed-loop communication inverter, unless the battery bank is heated. There is no need to heat the batteries above 50F.

✓ Do not charge the battery when ambient temperature is at freezing or below. Discharge current at sub-freezing temperatures should also be significantly reduced. Consider the Fortress DuraRack cabinet for din-rail friendly heater installation.



**CAUTION! Do Not Operate Fortress Lithium Batteries where average internal battery temperature exceeds 30 °C / 86 °F over the life of the battery.**

### **Recommended operating parameters of charger/Inverters For 3,000 Cycles:**

- Internal battery temperature range: 32 F to 120 F (0 °C to 49°C) without close-loop communication.
- Bulk voltage and absorb voltage should be set to 54.4V if no battery-inverter communication is available.

### **Recommended operating parameters of charger/Inverters For 8,000+ Cycles:**

- Operating temperature range: 50 F to 110 F (10°C to 43°C) with closed-loop communication

## 2.5 Transportation and Handling

- Do not knock, drop, puncture, or crush the battery;
- Do not expose battery to flames, incinerate or direct sunlight;
- Do not open battery case or disassemble the battery;
- Do not lift battery by the terminal cables;
- Do not vibrate battery;
- Do not expose battery to water or other fluids;
- Do not expose battery to open flame;
- Do not place the product nearby highly flammable materials, it may lead to fire or explosion in case of accident; Store at cool and dry place.
- Do not store in greenhouses and storage areas for hay, straw, chaff, animal feed, fertilizers, vegetables or fruit products;
- Store the product on a flat surface; A ventilated area is strongly recommended for handling the product;
- Store the product out of reach of children and animals;
- Store the product where it should be minimal dust and dirt in the area; do not transport battery upside down or with the terminals towards the ground.
- Batteries should be discharged to 30% state of charge or 52.0V resting voltage before transporting.

## **2.6 UL9540 / UL9540a Fire Test Report**

The eFlex has been listed to UL9540 standards as a DC ESS, without any dependency upon an external inverter or power conditioning system. It has passed the UL9540a large-scale fire testing.

Here is a summary taken directly from the rtest report:

### 3.10 Performance Summary Remark Against Criteria

Installation level testing is not required as the following performance conditions are met during the unit level test, considered residential Installations and Non-Residential Installations, Indoor Floor Mounted and Outdoor Ground Mounted.

Details see below table,

Performance requirements	Remark	Verdict
a) If flaming outside of the unit observed, separation distances to exposures shall be determine by greatest flame extension observed during test. <i>(No flaming)</i>	No flaming observed in both external and internal of unit during the test.	Pass
b) Surface temperatures of modules within the target units adjacent to the initiating unit do not exceed the temperature at which thermally initiated cell venting occurs. <i>(Surface temperatures of module in the target units do not exceed the temperature at which thermally initiated cell venting occurs)</i>	The maximum surface temperature of module within the initiating unit, adjacent to the initiating module was 94.9 °C; the maximum surface temperature of module within the target unit was 40.9 °C, far below the cell venting temperature 200°C.	Pass
c) For units intended for installation near exposures, surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient. <i>(Temp. measured on wall 1, wall 2 and unit3 surface close to the unit shall not exceed 97°C+ambient temp.)</i>	Surface temperature rise measurements on wall surfaces and target unit surface adjacent to unit1 was 39.7°C, far below the 97°C.	Pass
d) Explosion hazards are not observed, including deflagration, detonation or accumulation of battery vent gases; <i>(The explosion shall not be observed)</i>	Explosion hazards were not observed in both external and internal of unit, during the test.	Pass
e) Heat flux in the center of the accessible means of egress shall not exceed 1.3kW/m <sup>2</sup>	No attributable heat flux detected, see clause 3.5 of this report.	Pass
f) The concentration of flammable gas does not exceed 25% LFL in air for the smallest specified room installation size.	A LFL level of 25% in air not exceeded for smallest room size of 17.5 m <sup>3</sup> . The smallest room size=Total flammable gas/25%LFL =210L/(25%*4.8%) =17500L=17.5m <sup>3</sup>	Pass

Please find additional information on the Fortress eFlex product page in the Downloads section:

<https://www.fortresspower.com/products/eflex-5-4kwh-lifepo-battery/>

## 2.7 Response To Emergency Situations

The battery pack consists of multiple batteries and a sophisticated Battery Management System that are designed to prevent hazards resulting from failures. However, Fortress Power cannot guarantee their absolute safety.

- Leaking Batteries
- If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. If a person is exposed to the leaked substance, immediately perform the actions described below.
- Inhalation: Evacuate the contaminated area and seek medical attention.
- Contact with eyes: Rinse eyes with flowing water for 15 minutes and seek medical attention.
- Contact with skin: Wash the affected area thoroughly with soap and water, and seek medical attention
- Ingestion: Induce vomiting, and seek medical attention
- Fire
- In case of fire, make sure that an extinguisher is available near the battery pack. If possible, move the battery pack to a safe area before it catches fire.

### **Note: Fire extinguisher**

- Water, carbon dioxide, dry chemical powder and foam are the most effective means to extinguish a Lithium Ferrous Phosphate (LFP) battery fire
- Use ABC Fire extinguisher, if the fire is not from battery and has not spread to it yet.

## 3.1 Tools & Materials

The following tools and materials are required:

- Positive and negative battery cables, we recommend copper cable starting at 1/0 AWG for runs of less than 10ft. Please refer to your adopted version of the National Electric Code or Local Authority Having Jurisdiction for more guidance (not included)
- Positive and Negative Terminal lug recommendation: M8 (diameter: 8mm or 5/16in). Note that the ring terminal size for the terminal lug is 3/8ths or larger.
- Screwdriver (not included) • Battery parallel communications cable (included)
- Inverter to Battery CAT5/5e communications cable (not included)
- Communication Bus Terminator: to Match Impedance during parallel setup
- RS 485 cable
- Wall Mount Stabilizers (included)
- OSHA approved personal protective equipment such as the following (not included)



Insulated gloves



Safety Glasses



Safety Shoes

## 3.2 Outdoor Installations

The Fortress eFlex is an IP65 battery with a 1/4" thick aluminum case. It is suitable for indoor and outdoor use, both residential and commercial. It does not emit any gas during operation and has passed UL9540a large-scale fire unit tests.

The eFlex should not be installed in direct exposure to the sun. Likewise, its terminal caps should be protected against rain. Heated battery cabinets are also recommended where operating temperatures are below 40F, even if staying above freezing.

***Consider the DuraRack battery cabinet in cold, very hot, or very humid Outdoor environments.***

When **wall mounting outdoors**, only one configuration is allowed:



Mounting in any other orientation may void the warranty.

**When wall mounting indoors**, the eFlex may be mounted in any orientation except with the lid facing right, with the text logo upside down:



## 3.3 Pre-Installation Checklist

- Check the battery package, type, quantity, appearance and other components for damage and completeness
- Check the battery terminals and connections to make sure they are clean, free of dirt, fluids or corrosion
- All battery cables and their connections should be tight, intact, and NOT broken or frayed
- Check torque on terminal bolts
- Replace any damaged batteries and cables.
- Check the Open Circuit Voltage.
- Set the battery on a clean working space.
- Make sure the + and - terminals are not contacting anything.
- Locate the eFlex Power Button and press it momentarily. Wait for ~10 seconds for the LED self - diagnostic to complete before continuing to the next eFlex.
- Confirm that the LED lights are green and that the BMS light does not remain on. The operator should see the LED lights indicating the battery state of charge.
- Using a Voltage Meter check that the voltage across the terminals is between 50V-55V.
  1. If Voltage is <50V, charge the battery using an approved battery charger.
  2. If the Voltage is >55V, contact Fortress Power.

**IMPORTANT NOTE: Please inform us of any problems with the battery within 7 days of receipt of goods. Otherwise, we will deem the product delivered in good condition**

The battery pack must be installed indoors. In addition, make sure that the installation location meets the following conditions:

- At minimum, the eFlex should be protected from inclement weather with a cover/enclosure. The IP65 rating of the eFlex prevents ingress of direct water spray and dust. However, the eFlex cannot be immersed in water, nor are its exposed terminals waterproof.
- The area is completely waterproof.
- The floor is flat and level (Inclination < 15°).
- There are no flammable or explosive materials nearby.
- The optimal ambient temperature is within the range from 59° to 95°.

- The temperature and humidity are maintained at a constant level.
- There is minimal dust and dirt in the area. **IMPORTANT NOTE:** If the ambient temperature is outside the operating range, the battery pack may stop operating to protect itself. Frequent exposure to harsh temperatures may deteriorate the performance and life of the battery pack.

## 3.4 Mechanical Installation

### Mounting the battery pack to a wall

The eFlex 5.4 can be easily wall-mounted using the included wall mount bracket. The wall-mounting brackets are sold separately. Please ensure the wall and mounting hardware can handle the weight of the batteries. Please note that wall mounting the eFlex is not an acceptable UL9540a fire tested installation configuration. However, Fortress Power allows the eFlex to be wall mounted.

Before getting started, please see Site Selection for section of this manual for allowable orientation of wall mounted eFlex.

1. Line up the top bracket on the wall.
  - a. Mark the desired placement using a level to ensure the bracket is horizontal
  - b. Affix the larger mounting bracket into the wall
2. Using the T-slot screws, fix the smaller brackets onto the eFlex.
3. Carefully lift the battery with the help of a second person and gently drop it into the wall mounted brackets.
4. Screw in the security screw into the center mounting location using the included hex key. It may be necessary for a second person to position the battery while performing this task.

### Floor mount installation

The eFlex 5.4 can be floor-mounted in several orientations. The orientation depicted to the right, with the terminals towards the ground, is the only orientation NOT allowed. All other orientations are allowed, but regardless of orientation, the included floor mounting bracket must be used to prevent the battery from tipping over. Therefore, it is common to put the back of the eFlex battery against the wall.

1. Place the eFlex in the preferred orientation.
2. Attach the mounting bracket using the T-slot fastener and T-slot groove on the back of the eFlex.
3. Screw the mounting bracket into the wall.
4. Connect the battery terminals to the corresponding bus bar and inverter.



## Other installation methods

The eFlex is designed for multiple installation methods. The T-slot at the back of the enclosure provides the flexibility to use a standard size 8 - M6 or M8 hammer screw to secure the battery to a variety of racks, including 19" server racks. In all cases, a clearance of 1" around the eFlex battery is required. Please visit <https://www.fortresspower.com/fortress-power-video-library-2/> for videos on installing the eFlex.

## 3.5 Cabinet Options

Note: Fortress Power allows wall mounting, cabinet mounting with Fortress-approved cabinets, and floor-mounting as valid cabinet mounting options. Installers are also welcome to fashion their own racking, utilizing the T-channel slots on the back of the eFlex.

Use of Fortress DuraRack or Flextower cabinets are recommended for additional environmental protection, security, and appearance but are not required by Fortress Power. The DuraRack is included with the FlexTower. Battery-combiner cables are included with either cabinet option (battery-inverter cables not included).

The Fortress eFlex is UL9540 listed regardless of what mounting methodology is selected. Use of the DuraRack may be required by your local jurisdiction for UL9540a compliance. Please see product pages for additional UL9540 information.

Please visit the eFlex section of our support center for DuraRack or FlexRack manuals.

<https://support.fortresspower.com/portal/en/kb/product-manuals/eflex>

### DuraRack



### FlexTower



## 3.6 Wall Mount Bracket

### Wall mount bracket

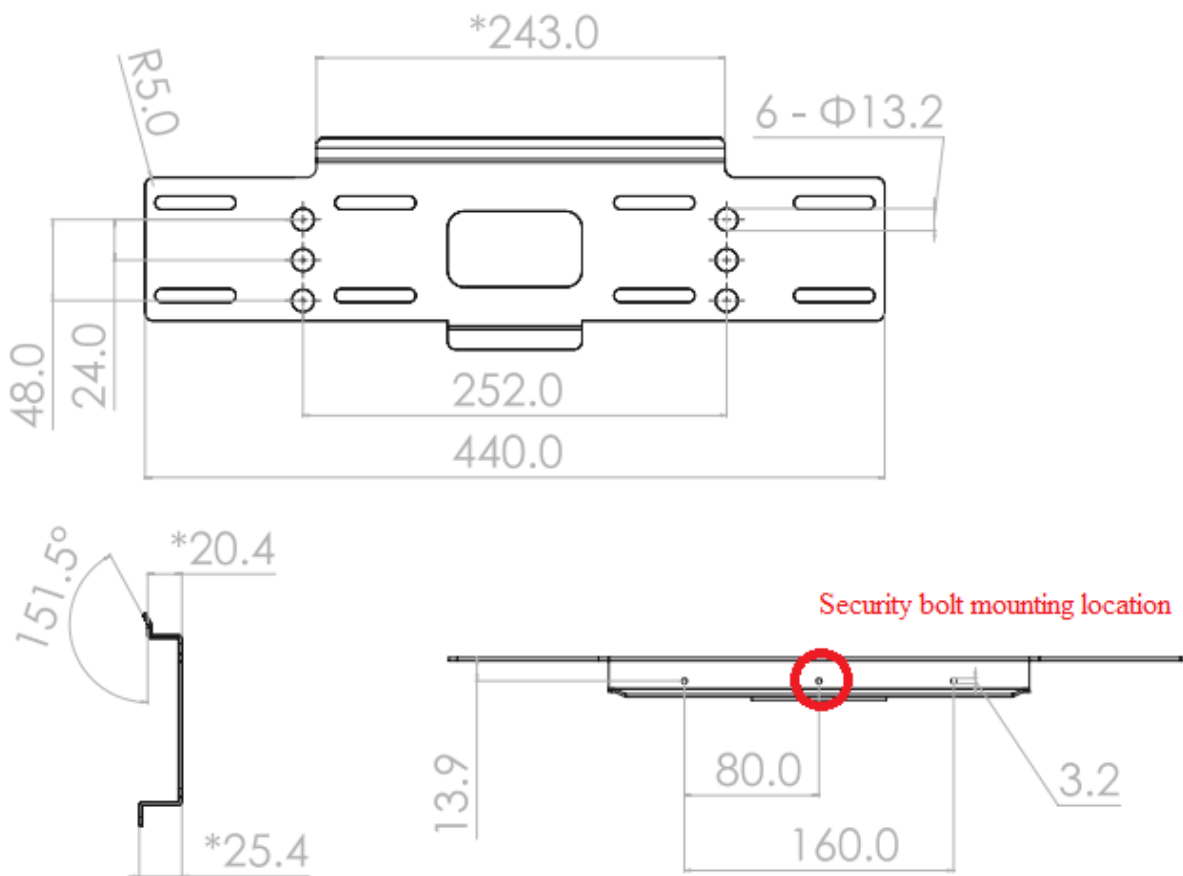
The Fortress wall mount bracket consists of two mounting plates which are connected by a security bolt.

Attach the eFlex plate to the eFlex using the included T-bolts.

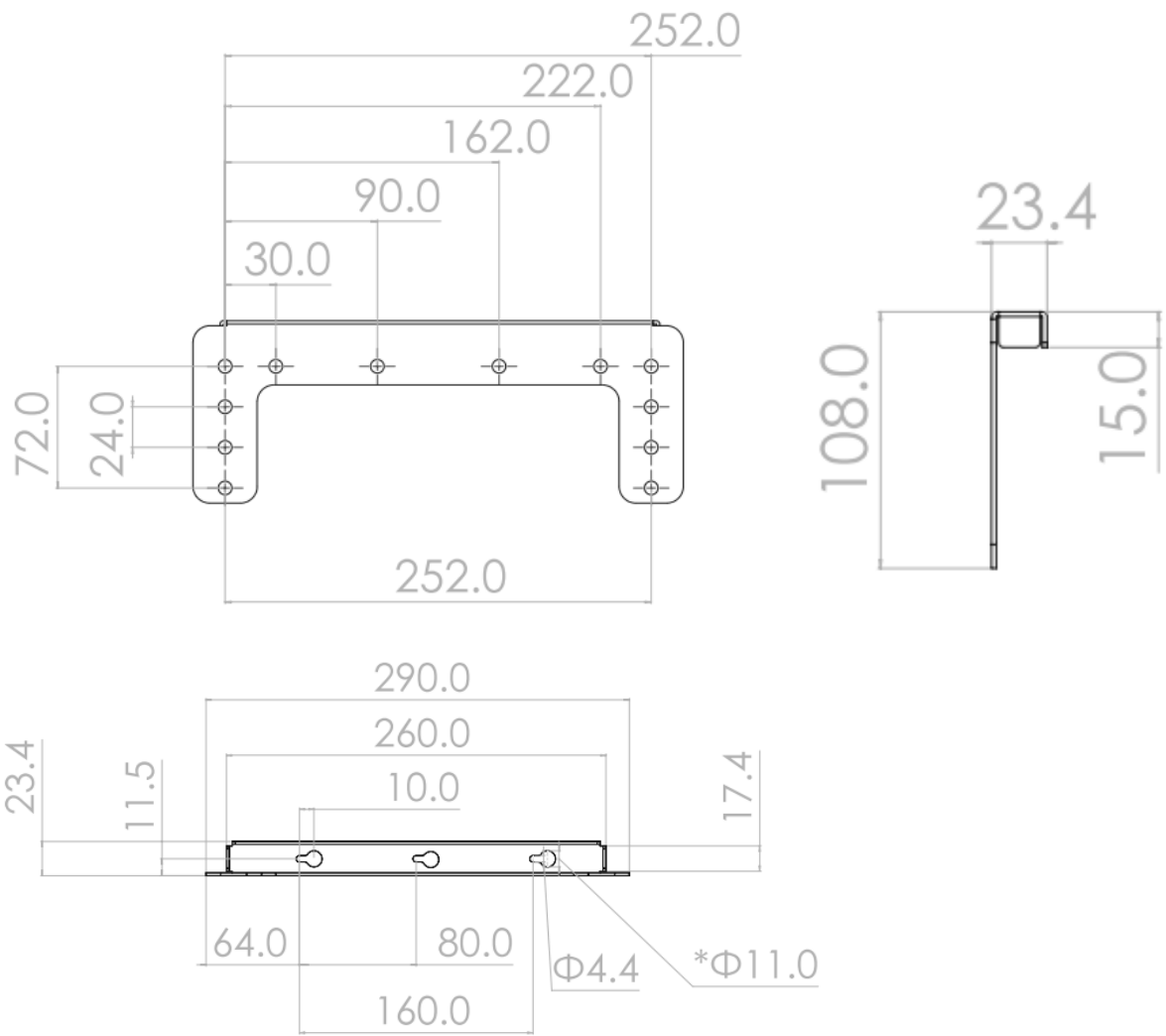
Attach the wall plate to the wall using the Wall plate.

Secure the eFlex plate to the wall plate using the included security bolt.

### Wall Mount Bracket Wall Plate:



Wall Mount Bracket eFlex Plate:



## 3.7 Electrical Installation

### Connecting the battery to the Charge Controller and/or Hybrid Inverter

1. Ensure the battery is turned off by verifying the LED lights are off and there is no voltage across the terminals.
2. Install the positive cable first and the negative cable second. Do not cross the positive and negative terminals; also, ensure the terminals are not connected to any metal mounting, fixture, or body part. Ensure the terminals are tightened to the recommended terminal torque of 7.0 – 7.7 Nm (5.1 – 5.7 ft-lb)

The Fortress Lithium Batteries are equipped with two M8 threaded terminals with a lock washer and nut. 8mm ring terminals or 3/8ths inch ring terminals, along with proper size wiring cables, are required to connect the battery to the inverter/charger. Do not reverse polarity-- doing so will void warranty. Use a voltmeter to check polarity before connecting terminals.

## 3.8 Battery Communication Circuits

### Using RS485 modbus and CAN communication

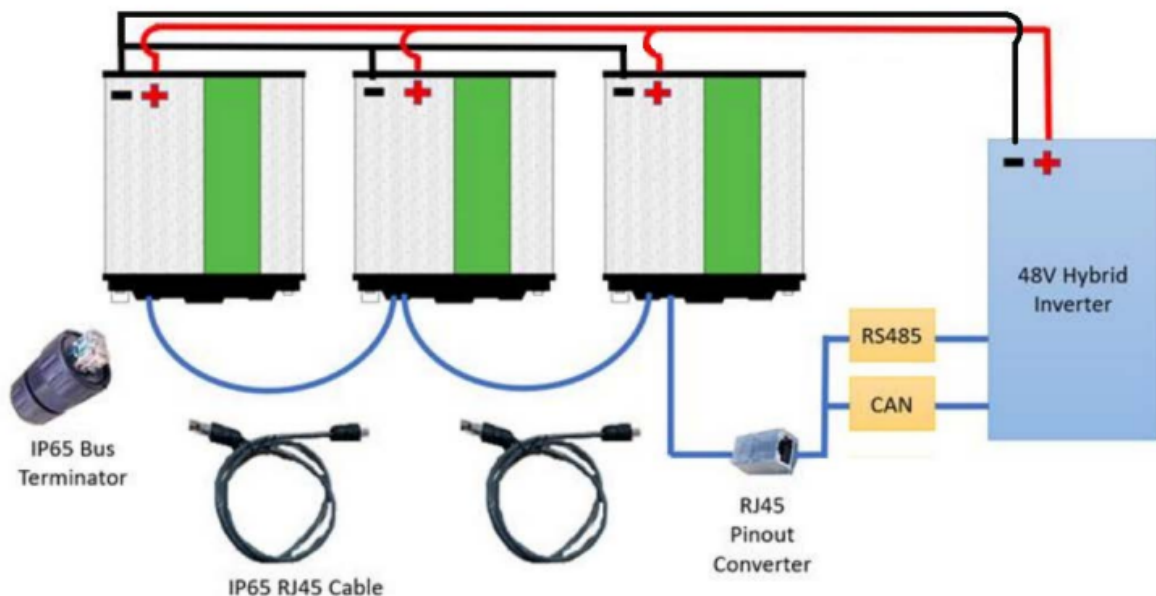
The eFlex 5.4 has two universal ports on the lid of the battery, which handle both the battery-battery and battery-inverter communication.

Battery-inverter communication is not required for the eFlex 5.4 to safely operate with most programmable 48V inverters.

At a minimum, the inverters need to be digitally programmed to comply with correct amperage and voltage stated elsewhere in this guide. Special communication cables may need to be field made. If using battery-inverter communication, please consult our inverter guides: <https://www.fortresspower.com/inverter-guides>

Fortress eFlex batteries also contain battery-battery communication circuits. This communication circuit is required to be installed unless otherwise directed by Fortress technical support. Battery-battery communication requires a canbus terminator be installed at one end of the battery communication circuit. The other end of the circuit either requires another canbus terminator, or the RJ45 pinout converter to terminate the battery-battery communication while passing through the battery-inverter communication. Do not forget to install the RJ45 pinout converter when using battery-inverter communication!

Battery-battery communication is installed as pictured:



If making a communication cable, please refer to the pin out diagram for an RJ45 cable below.

Type A format ethernet cable may also be used.

Pin	Color (B format)	Assignment
1	White Orange	CAN1_H
2	Orange	CAN1_L
3	White Green	CAN1_ground
4	Blue	CAN2_H
5	White Blue	CAN2_L
6	Green	CAN2_ground
7	White Brown	RS485A (modbus)
8	Brown	RS485B (modbus)



## 4.1 LED Display

The eFlex has six LEDs on the front face allowing the user to decode the state of the battery as well as any important messages from the BMS. When the eFlex is turned on, each LED will also turn on and display a LED mode.



The red “BMS” light will turn on during start-up diagnostic as well as when there is a communication error between batteries. If the problem persists, please fill out a support ticket at <https://support.fortresspower.com> .

In normal operation, the “RUN” LED light will be on or flashing.

The number of charging lights (LED1-4) that are on depends on the battery state of charge.

If the BMS requires calibration, perform the following steps:

If the batteries are showing four green State-of-Charge LEDs, but the battery resting voltage is below 54V, manually charge the battery to 54.4V. If the batteries are showing less than four green SoC LEDs, charge the battery manually to 56V or until the SoC lights all show solid green. Then restore original inverter settings.

See chart below:

Battery status	SOC status	LED1	LED2	LED3	LED4
Full of rest	100%	ON	ON	ON	ON
Charge	0~25%	Flash	OFF	OFF	OFF
	26~50%	ON	Flash	OFF	OFF
	51~75%	ON	ON	Flash	OFF
	76~100%	ON	ON	ON	Flash
Over discharge protection	0%	OFF	OFF	OFF	OFF
Discharge	0~25%	ON	OFF	OFF	OFF
	26~50%	ON	ON	OFF	OFF
	51~75%	ON	ON	ON	OFF
	76~100%	ON	ON	ON	ON

## 4.2 Inverter Guides

Fortress inverter guides are for programming popular 3rd party inverters. They also serve as a "quick start" guide for powering up the entire system.

They are found in our online knowledge base:

<https://support.fortresspower.com/portal/en/kb>

Please differ to our product documentation when programming the inverter with Fortress batteries.

For example, if the inverter manufacturer says charge the battery at 56.7V, and our inverter guide indicates a charge rate of 56V, please use the voltage listed in our inverter guide.

Charge rates listed in Fortress inverter guides are based on lab testing and field feedback.

We have inverter guides for:

- Sol-Ark
- Schneider
- SMA
- Victron
- Outback
- Magnum
- LuxPower
- Studer
- Morningstar
- Phocos

For additional inverter sizing and compability information, please visit:

<https://www.fortresspower.com/dealers/inverter-compatibility/>

When using an inverter or charge controller that is not on the above list, the charge conditions listed in this product manual are sufficient. Fortress Inverter guides can expand system charge/discharge voltages and amperage beyond values stated in this guide while maintaining Fortress warranty. In most cases, these expanded settings require successful communication between the battery and inverter.

## 4.3 Voltage and Amperage Settings

The battery must be transported, stored, and used according to the instructions in this manual. If any of the following improper operations occur, this product will cancel the warranty.

- Do not use unqualified equipment for charging and discharging, please follow the correct instructions for use
- Do not discharge the battery when the battery is depleted
- Do not charge or discharge batteries that are hot, deformed, or leaking.
- The output cable length of the battery should be less than 10 meters long
- Do not connect a power and load that exceed the power level to the two ends of the battery
- Do not mix different batteries
- Different manufacturers, chemistry, models, and lifespans cannot be paralleled.

### **Charging Voltage:**

Without battery-inverter communication, eFlex batteries should be charged at 54.4V

With battery-inverter communication, eFlex batteries this voltage may be increased according to the published inverter guides:

<https://www.fortresspower.com/inverter-guides>

### **Low battery cut-off voltage:**

The eFlex battery is below a 20% state-of-charge when its resting voltage is below 51.4V. In order to keep the inverter and battery system powered up while waiting for a charge, this is the recommended low battery cut-off voltage. It is appropriate to lower this to 51V if using a generator or grid charge to automatically maintain or charge the battery at 51.4V or above. Many older battery inverters cannot program a low battery cut-out voltage above 48V. The eFlex has a safety feature that will cut around this voltage level if necessary. If regularly deep discharging the eFlex down to 48V, please increase your battery size or upgrade your inverter to maintain warranty compliance.

### **Charging and Discharging Amperage**

The eFlex can safely operate at 100A, but its maximum rating is not intended for long duration use. Unless otherwise specified through our inverter guides, set the charge and discharge rates of the eFlex at 60A to comply with the 10 year warranty. Any grid sellback or demand management function should also be limited to 60A per eFlex. Limiting the charge rate of the eFlex to 60A will result in longest battery life.

Precaution should be taken when adding charging sources which are not controlled by a single inverter or control system (Ex. using different manufacturer's DC charge controllers and inverters, solar + wind inverters, EV chargers etc) to ensure the total system charges or discharges the battery within its specification. controllers do not charge the battery concurrently, when and if their combined charge current totals are greater than the

charge current of the combined battery bank. Take additional extra precautions when using wind power to charge the battery, or if the inverter and charge controllers are not the same manufacturer.

## Charging Notes

If the following scenarios occur, the battery must be charged before use, otherwise the battery damage caused is not covered by the warranty:

- The battery has not been powered on or otherwise discharged without any charging sources available.
- The battery has been turned off for a long period during transportation or storage.
- The battery has been deeply discharged and reached under-voltage protection status.
- The battery has been aggressively recharged during deep discharge conditions through bypassing the BMS
- The battery has been recharged during freezing condition through bypassing the BMS.
- Bypassing the BMS is not allowed without logging a support ticket with Fortress Technical Support at <https://support.fortresspower.com>

## Discharging Notes

✓ Do not regularly discharge battery below 51V, 20% SoC. This capacity should be reserved for power outages and idleing the load until a charging source can be applied.

✓ Do not discharge battery at rates greater than maximum continuous current.

# Parameter set up guide for Charger/Inverter

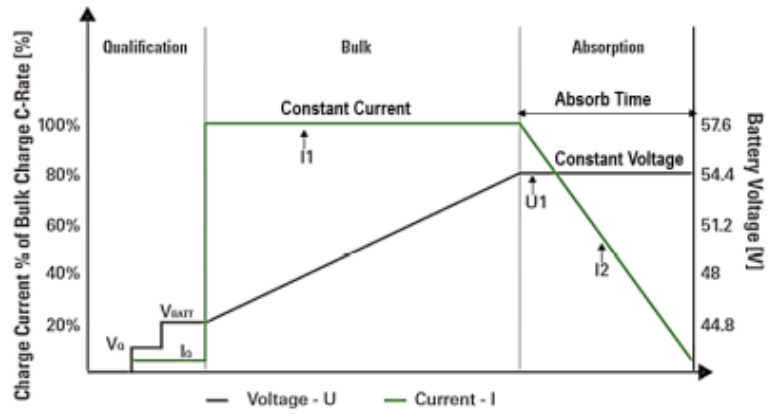
Unless explicitly stated in Fortress inverter guides or contrary to the above charging amperages and voltages, charge controller and inverter settings must be programmed per the manufacturer's recommendations. Consult the manufacturer's manuals and/or access technical support. In order to achieve extended life cycles and to comply with the Warranty, the following guidelines should be followed:

## Understanding Charge Stage

1. Bulk Charge: Charge at Constant Current (CC) to Bulk/Absorb Voltage.

2. Absorption Charge: Maintain Constant Bulk/Absorb Voltage (CV). Note - if the battery is not reaching 100% capacity, it is allowable to adjust this voltage from 54.4V to 55V. Any higher charging voltage must be explicitly stated a Fortress inverter guide specific to that brand of inverter.

3. Unless otherwise stated in a Fortress inverter guide, keep float voltages at 54.4V or less to maintain warranty compliance. While most end users will want to enable a float mode of operation if available to keep batteries at 100%, it is healthier for the battery only to use the bulk/absorb cycle - which allows the batteries to exercise daily.



## 4.4 Commissioning

### Commissioning a single eFlex battery pack

1. Turn the eFlex on momentarily to check battery voltage. Check that voltage between terminals is between 50-55V. If the voltage is too low, a slow charging to 50V is needed. Turn off the eFlex.
2. Put the inverter disconnect into “OFF” position (if there is any). Make sure the eFlex battery and any charge controllers are off/disconnected as well.
3. Connect the eFlex DC positive and negative terminals to the inverter.
4. Put the inverter breaker into “ON” position. Note: always turn the eFlex battery on first prior to turning on the inverter. If a shut down is required, always turn the inverter OFF first prior to turning OFF the eFlex battery.
5. Put any DC charge controllers into the “ON” position.
6. Turn on eFlex unit by pressing the eFlex power button and waiting ~10sec until LED diagnostic is complete. Under normal operation, the eFlex LEDs will show state of charge after the diagnostic is complete. The red BMS light should not be on.

### Commissioning multiple eFlex batteries in parallel

For a maximum battery bank size of 81KWH, up to 15 eFlex batteries can be connected in parallel. All wires should be an appropriate gauge and constructed to handle the loads that will be placed upon them. A qualified installer should understand this and must adhere to industry standards and published electrical guidelines. The storage capacity and total permissible charging and discharging amperage are increased by the parallel arrangement. The overall voltage is not changed. Instead, the available amperage from the system is increased with each additional parallel battery. For example, in a parallel system with two batteries, the available charging and discharging current is twice that compared to a single battery.

Please follow this procedure to commission eFlex batteries in parallel:

1. Turn OFF all equipment in the system
2. Turn on batteries to check voltages independently. Make sure the voltage difference between the highest voltage and lowest voltage battery is less than 0.5V to ensure trouble-free start-up of the whole system.
3. Connect the positive and negative common DC bus to the inverter.
4. Prepare and connect communication cable. Each unit comes with one IP65 rated RJ45 cable is used using the RS485 standard. Daisy chain the RS485 cables to each unit utilizing either one of the RJ485 ports.
5. Plug the can bus terminator into the last RJ485 port at the end of the daisy chained eFlex units.

a. Open Loop Communication. If open loop communication is to be used, plug a second can bus terminator into the first RJ485 port on the daisy chained eFlex units.

b. Closed Loop Communication. If close loop communication is to be used with a compatible inverter, plug a RJ45 cable into the first RJ485 port, and then plug the other end into the RJ45 pinout converter.

6. Turn on the first eFlex unit and wait 10 seconds for the diagnostic to complete before turning on the next eFlex unit.

7. Turn on the inverter system and then the charge controller system. Note: some inverters have high in-rush current and need to be pre-charged manually, or you can choose to use BMS pre-charge function to start it up. This may require the inverter to be turned on first before you turn on the battery.

8. For inverter-specific settings, visit <https://www.fortresspower.com/resources/> for the most recent integration manual for the specific inverter brand.



CAUTION! Installation should be designed to minimize the voltage drop between batteries. There are a few best practices: Maintain identical wire length and wire construction from each Fortress Power Battery terminal to the common bus. If you parallel more than 4 units, a battery combiner/bus bar is highly recommended.



CAUTION! For connecting multiple units: Maintain the recommended clearance between units - at least 0.5 inches (12mm).



CAUTION! When paralleling the eFlex 5.4 batteries without connecting them via RJ45 cable(s), please make sure the difference between the highest voltage and lowest voltage does not exceed 0.5 volts. A large current flow from the higher voltage battery to the lower voltage battery could potentially damage one or both batteries. Resulting damage to the battery will void the warranty.

## **4.5 Decommissioning**

At the End of Cycle Life retained capacity is equivalent to 70% Year 1 Capacity.

eFlex contains scrap material useful to recycling.

Dispose of the battery at a local recycling center or ship back to Fortress Power.

Transport end-of-life batteries at 30% state-of-charge, <52V resting.

## 4.6 Key Points Summary

1. Each Fortress Lithium Battery contains circuitry that protects the Lithium Ferro Phosphate cells from overcharging, over-discharging, and excessive load amperage. If the values specified are exceeded, the battery will enter a protective shut down state. In some cases, this may result in the need to re-initialize an inverter charger or other pieces of equipment in the installation. In other cases, the inverter's system settings may be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common among most inverter chargers. Check your inverter manufacturer specifications.
2. Although each Fortress Lithium Battery contains circuitry that protects the Lithium Ferro Phosphate cells from overcharging, over-discharging and excessive load amperage, Fortress Lithium Batteries must always be installed with a charge controller and the appropriate settings to protect the batteries from open PV and other high voltage sources. Fortress Lithium Batteries alone will not protect from extreme electrical phenomena.
3. GRID TIED SYSTEMS: Once the Fortress Lithium Battery has been installed, turn on the entire system to test. Once testing has been completed, please disconnect the batteries from the load center until your local Utility Inspector is ready to turn on the entire system. The charge controllers and inverter monitoring systems can drain the Fortress Lithium Batteries over an extended period when the entire system is not fully operational due to the electrical draw of the system components.
4. OFF GRID SYSTEMS: Do not connect the Fortress Lithium Batteries until the entire system is ready to turn on and is fully operational.
5. See Inverter and Charge Controller Settings on the Fortress Power website for recommended settings at <https://www.fortresspower.com/resources/>.

### System Commissioning

Final installation and operation guidelines will be dictated by your Electrician and Installer based on the specifics of your installation and any code requirements that apply to your region. Fortress Power technicians and sales staff are available to provide any additional information on the Fortress Lithium Batteries as needed.

Please be aware of the potential electrical hazards before interacting with any and all electrical or mechanical devices. Please take all necessary safety precautions in your projects and installations.

## 5.1 Updating Firmware

eFlex firmware does not require firmware updates.

There is always a risk to performing firmware updates, so only perform them with a valid reason.

Use our support ticket system if you are unsure whether you should update the eFlex firmware.

Please visit <https://fortresspower.com/firmware> for firmware update instructions.

Here is a video tutorial (subject to change):

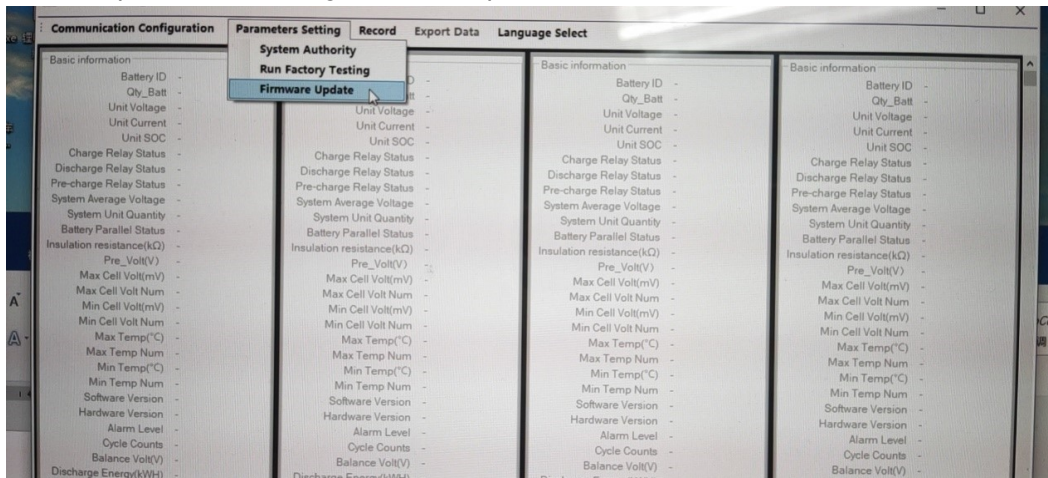
<https://www.youtube.com/watch?v=uFoByJey0FU>

# 5.2 BMS Recovery

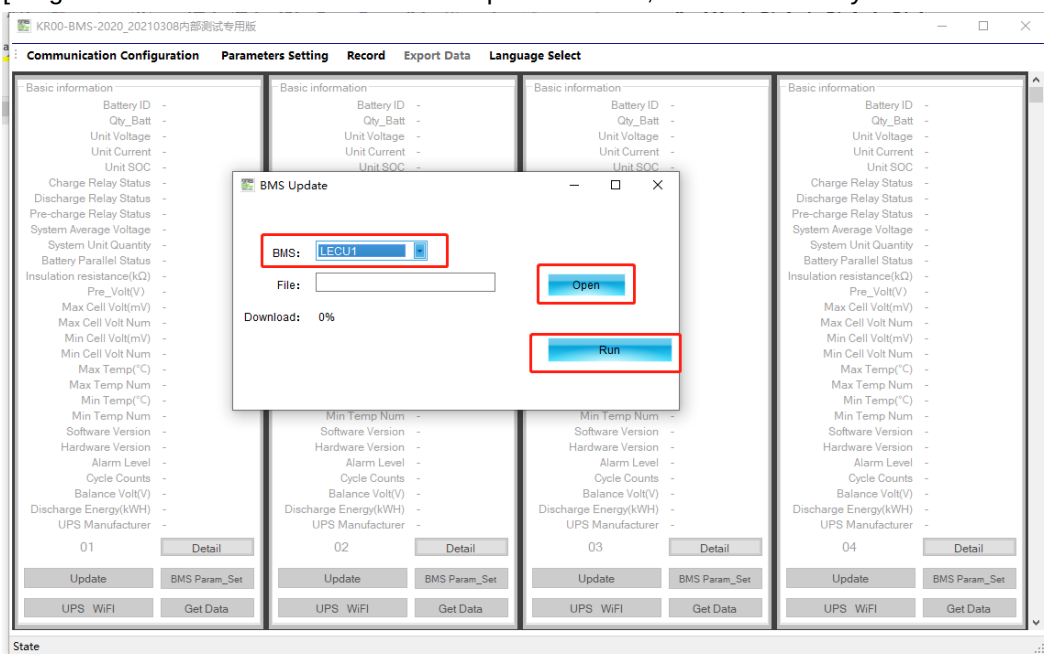
is method can be used to recover a "bricked" BMS due to firmware update failure failure (i.e. non-functional battery after firmware update).

**struction:**

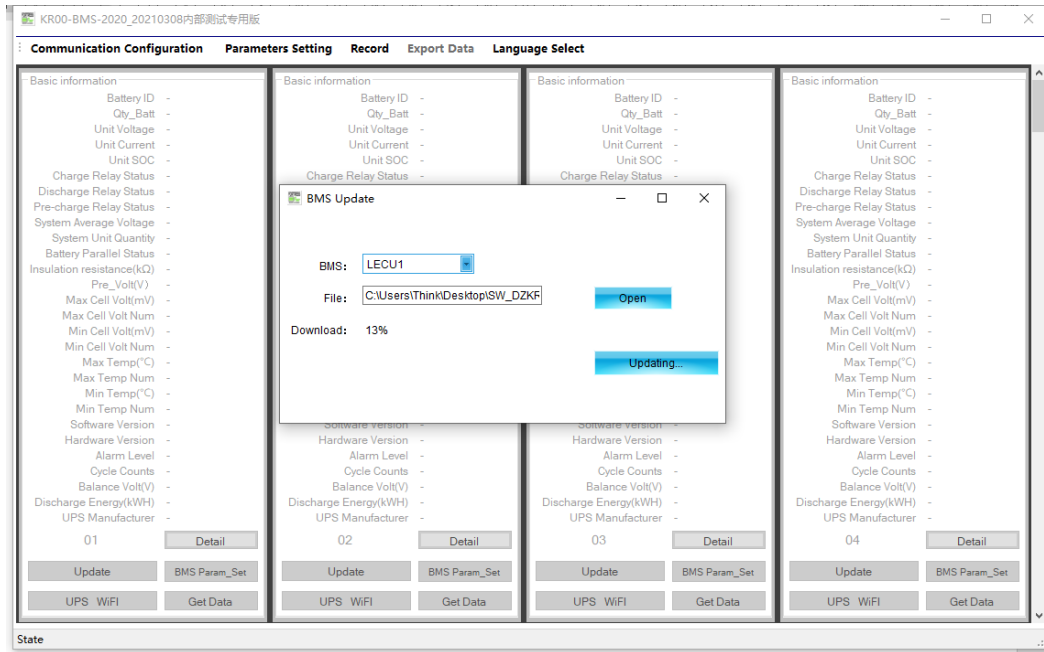
1. Connect the battery and the PC with CAN box, as you would during a firmware update.
2. Turn the battery off.
3. Open the firmware update software and make the CAN connection in the Communication configuration menu.
4. Even though the battery is turned off, perform a firmware update. Check the Fortress firmware update instructions to make sure you are using the correct firmware and software.
3. Click parameters setting->firmware update



4. Choose the BMS and firmware you want to update, [Single-machine mode Select LECU1. In parallel mode, select the battery number of the BMS]



5. Click run and right after, within 1-2 seconds, turn the eFlex battery on. The firmware will begin loading.



7. Update started. Please wait for the update complete message before power cycling and recommissioning the battery.

## 5.3 Deep Discharge Recovery

**This procedure is to be followed only when the battery voltage is ~48V or less.** If the eFlex lights still come on, you may turn the eFlex off and request a firmware update tool through our support portal. We can mail you an installer tool that may allow you to recover the battery without removing the lid or use of an external charger. Keep charging below 10A and above 40F.

To see where to connect the charger's alligator clips, **refer to the figure below.** The charger may be removed once the battery voltage exceeds ~52V.

### Positive and Negative internal terminals



#### **Warning!**

- Ensure correct polarity: positive to positive (red), negative to negative (black).
- Alligator clips must be connected to the battery prior to turning on the charger.
- After the battery is charged, turn off the charger before removing alligator clips.
- Check continuity across the fuse (where the positive terminal is) to diagnose blown fuse issues.



## 5.4 Removing the eFlex Lid

Caution: Removing the eFlex lid should only be done in coordination with Fortress technical support.

Please submit a support ticket at <https://support.fortresspower.com> prior to removing the eFlex lid. Please wear insulating gloves when servicing the eFlex. Do not sweat into the eFlex when servicing.

Caution: eFlex with serial numbers ranging from 1901-2206 may use glue seal the lid to the eFlex. This has been replaced with a gasket. When mounted outdoors, if the eFlex lid is glued on, use outdoor-rated sealant on lid perimeter and screw holes with re-installing the lid.

### Removing the eFlex Lid

1. Make sure both positive and negative battery terminals are disconnected and both communication ports are empty
2. Remove the ten (10) screws that attach the front plastic cover. Note: outdoor installations require weather-rated caulk to be applied to screw locations when re-installing the lid. Do not under any circumstance remove the base of the eFlex.



3. eFlex with serial number 2205## (made in May 2022 onward) contain a gasket lid, which can be easily removed after the screw removal.

Note: eFlex with serial number prior 2205## have a glued-on lid is difficult to remove without

- hammer
- wood block
- metal blade putty knife

Caution - do not use a sharp knife with a short blade or handle (ex. boxcutters, pocket knives) to break the glue around the eFlex lid perimeter. If you do not have a sufficient putty knife, use an alternate thin, dull metal blade that is both long and flexible, like a metal architect's ruler.

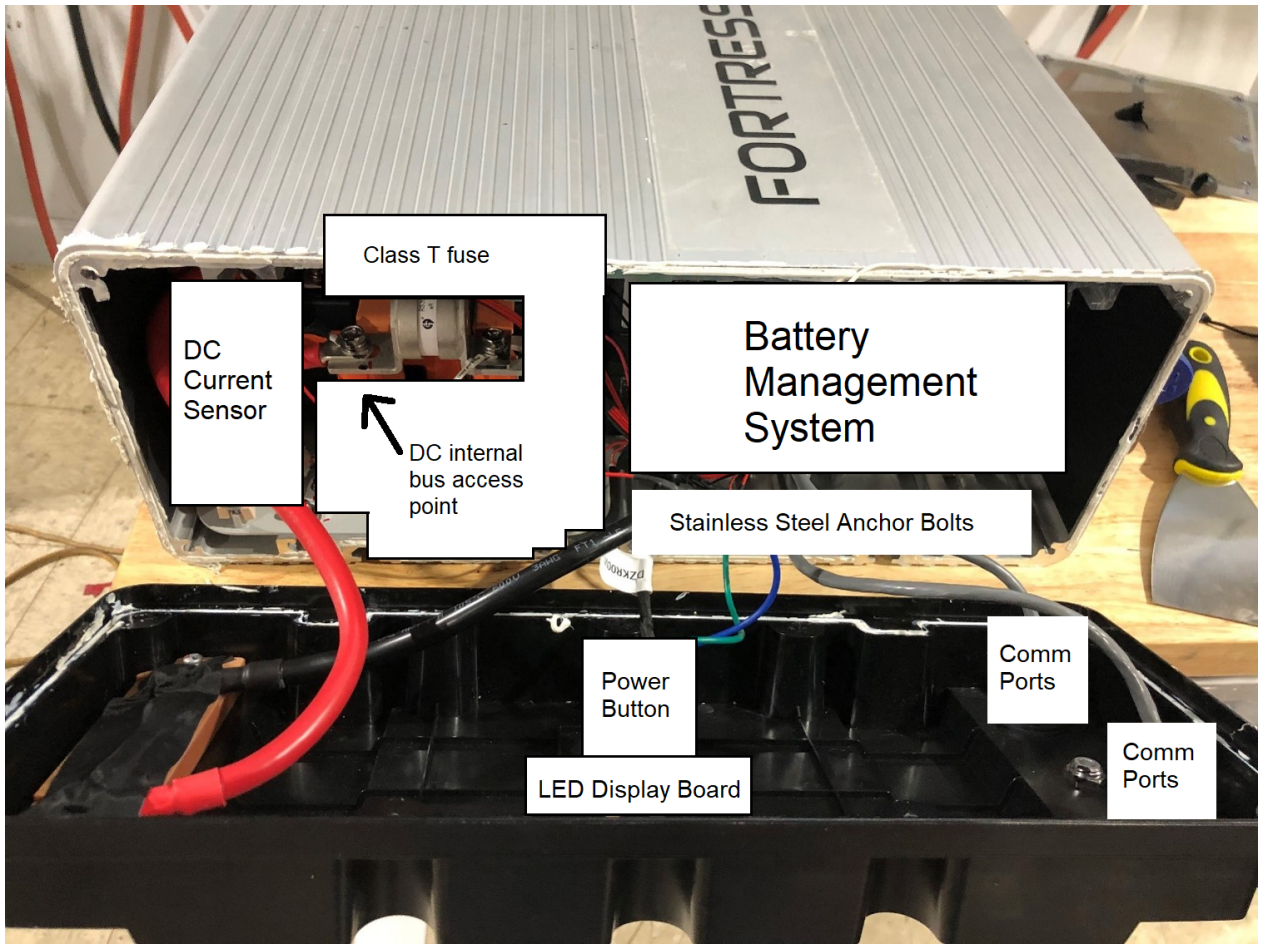
A putty knife is pressed into the underside of the lid on all sides of the battery case, as pictured below:



Next, use a hammer and wood block to tap the lid off of the battery.



4. Pull open the cover, taking care not to over-extend the wires connected to the cover
5. You should now have access to the battery internals. Please wear insulated gloves when servicing the eFlex. Be sure to log a support ticket with Fortress at <https://support.fortresspower.com> before servicing the battery. Please note the battery serial number when filling out a support ticket.



DC Current Sensor

Class T fuse



DC internal bus access point

Battery Management System

Stainless Steel Anchor Bolts

Power Button

LED Display Board

Comm Ports

Comm Ports

## 5.5 Fuse Replacement

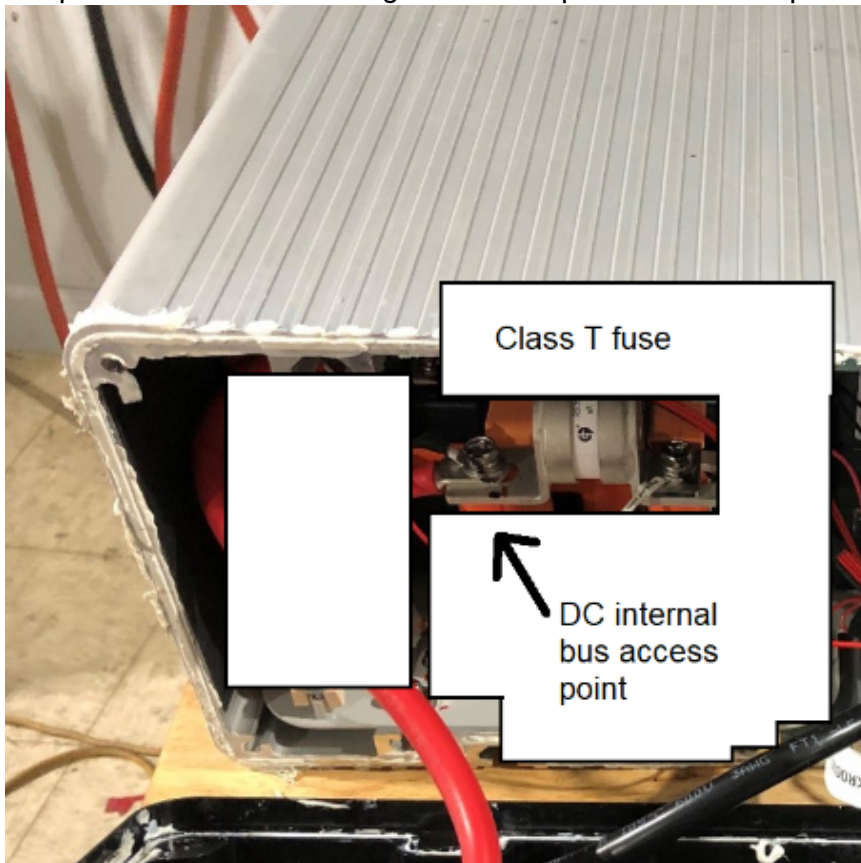
Caution: Replacing the eFlex fuse should only be done in coordination with Fortress technical support.

Please submit a support ticket at <https://support.fortresspower.com> for a replacement fuse.

Please wear insulating gloves when servicing the eFlex.

Do not sweat into the eFlex when servicing.

1. Follow the steps for removing the eFlex lid.
2. Disconnect the red power on the side of the fuse labeled "DC internal bus access point". Wrap terminal with insulating electrical tape until fuse is replaced.



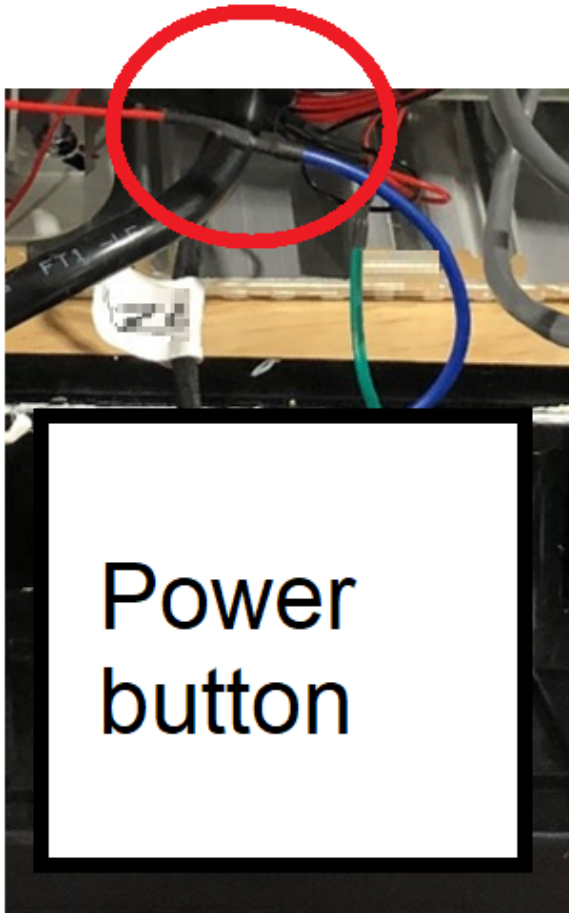
3. Remove bolt from other side of fuse. Do not forget to install the voltage sensing cable when replacing this bolt.

4. Install the fuse and replace the bolts and lid.

## 5.6 BMS Replacement

After turning the eFlex off using the push button, please see the instructions for [Removing the eFlex lid](#) and follow the safety guidelines discussed.

Detach the power button connector from the eFlex BMS.



The eFlex BMS is on a caddy that can be slid out from the battery case by loosening the anchor bolts

# Battery Management System

## Stainless Steel Anchor Bolts

Slide the caddy out, taking pictures as you go.

The eFlex BMS connectors shaped such that they can be unsnapped and easily identified.



Install the new eflex BMS and retorque the anchor bolts.

Then

Please take pictures as you go.

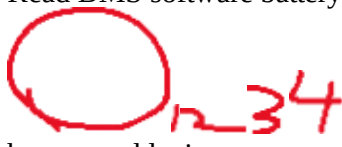
# 5.7 Cell Inspection

Inspecting battery cells is not a regular maintenance or service task. It should only be performed by a Fortress authorized contractor with fine-pointed DC voltmeter.

1. Battery should be off the system. no charge or discharge apply to the battery terminals.
2. Plug in BMS software, click in detail. Take screen shot of battery cell voltage.



3. Charge Battery to 56 V, take the battery off the system.
4. Read BMS software battery cell voltage information as step 1. Take screen shot.



Open battery front Cover take off the BMS sensor Plug,1,2,3,4. Leave the battery and let it rest.



6. After ~ 60 Mins: use multi-meter to read battery cell voltage from the plug. You will need fine/thin probe leads to analyze voltage in this manner.

