



## FORTRESS EFLEX 5.4 kWh LITHIUM BATTERY INSTALLATION MANUAL

*SECURE YOUR ENERGY WITH FORTRESS LITHIUM BATTERY SYSTEMS*

Fortress battery systems utilize the industry's most environmentally benign chemistry- Lithium Ferro Phosphate (LFP), which eliminates operating temperature constraints, toxic coolants, and the risk of thermal runaway and fire. The built-in smart Battery Management System (BMS) integrates multilevel safety concepts: Overcharge and Deep Discharge Protection; Voltage and Temperature Observation; Cell balancing.

Fortress high-performance Lithium Batteries are manufactured at the highest quality standards. It comes with large power capacity and a fast charging and continuous

discharge power. LFP Chemistry also has nearly twice the cycle life of other Lithium technologies such as NMC. The proprietary architecture and BMS eliminate the need for cooling or ventilation, which creates a nearly 99% efficient round-trip conversion of energy.

The Fortress Lithium Battery is safe, easy to install, consistently reliable, and highly efficient. It provides you with the lowest lifetime energy storage cost.

This installation manual contains information concerning important procedures and features of Fortress Power Lithium batteries. Read all the instructions in this manual before installation, operation, transportation, storage, and maintenance.



## General Information



**CAUTION! Do not combine Fortress Lithium Batteries with other brands or chemistries; Do not mix Fortress Lithium Batteries from different installations, clients, or job sites.**



**CAUTION! Do not disassemble or modify the battery. If the battery housing is damaged, do not touch exposed contents.**



**Ambient Temperature impact battery performances, please follow instruction to set up system parameter**



**Fortress Lithium Batteries are designed for parallel operation only - do not arrange in series for increased voltage. Series arrangement can result in damage to Fortress Lithium Batteries and will void warranty!**



**Do not combine Fortress Power Battery with other brands or chemistries. Do not mix different capacity batteries, do not mix batteries from different installations, or job site.**



**CAUTION! Verify polarity at all connections with a standard 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.**



**Retrofitting Fortress Lithium batteries to an existing system is not recommended. Like all other batteries, Fortress Lithium Battery's open voltage will diminish during the operation. Parallel batteries with different open voltage may cause reverse currents, which could damage the batteries.**



**CAUTION! Connect communication cable before turning on eFlex.**



**CAUTION! Fortress Lithium Batteries are designed for parallel operation only - do not arrange in series for increased voltage. Series arrangement can result in damage to Fortress Lithium Batteries and will void warranty!**



**NOTE! Without exception, products experiencing terminal burn out will not covered under the warranty.**

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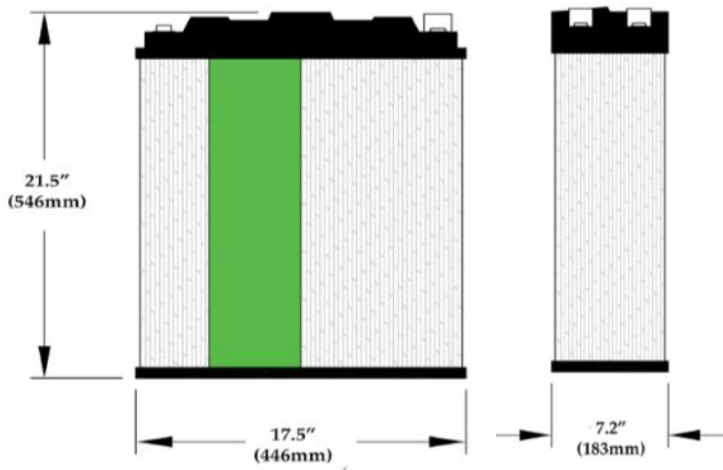
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# Specifications

Electrical Specifications	
Nominal Voltage:	51.2V
Nominal Capacity:	105AH
Rated Capacity @ 0.5C (50A):	5.374 kWh
Resistance:	<10 mΩ
Efficiency (at 1C):	>99%
Self-Discharge:	<0.8%/Month
Maximum Modules in Parallel (Customizable Per Request):	15

Discharge Specifications	
Recommended Continuous Discharge Rate:	<68A (3.5kW DC)
Peak Continuous Discharge Rate:	100A (5kW 60 Min)
Maximum Surge Power Rate:	130A (6.6 KW 5sec)
Recommended Low Voltage Disconnect:	48V
Battery Low Voltage Protection:	41V
Battery recovery Voltage:	45V



Mechanical Specifications	
Dimensions: (L*W*H)	21.5x17.5x7.2in (546x446x183 mm)
Weight:	116lbs (53kg)
Shipping Weight:	123lbs (56kg)
Shipping Dimensions:	25.7x22.9x11.3 in (652x582x283mm)
Terminal Type:	M8
Case Material:	Aluminum
Enclosure Protection:	IP65
Cell Type - Chemistry:	Prismatic - LiFePO <sub>4</sub>

Charge Specifications	
Recommended Charge Current:	<55A
Maximum Charge Current:	100A
Recommended Charge Voltage:	54.4V
BMS Charge Voltage Disconnect:	59V

Temperature Specifications	
Discharge Temperature:	32° ~ 131°F (0°C ~ 55°C)
Charge Temperature:	32° ~ 113°F (0°C ~ 45°C)
Storage Temperature:	32° ~ 95°F (0°C ~ 35°C)

# Features



# Registering for the Fortress Power Warranty

Fortress Power batteries come with a warranty that depends on charge parameters that define the depth of discharge (DoD) and other important variables. To ensure that Fortress Power is able to honor the warranty, please fill out the warranty letter (available at [fortresspower.com/resources](http://fortresspower.com/resources)) as soon as the system is commissioned and send to [sales@fortresspower.com](mailto:sales@fortresspower.com). The charge parameters will depend on your brand of inverter and our engineers have written specific integration guides for many common inverters, which are also available on the “resources” page referenced above. If you need further help setting the parameters, please contact [techsupport@fortresspower.com](mailto:techsupport@fortresspower.com)

## 1. SAFETY

### 1.1 General safety precautions

- ❖ All types of breakdown of 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. Battery Pack is not user serviceable. 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.
    - 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.
    - Do not wear watches, bracelets, bracelets, rings and other conductive objects during operation
  - ❖ Risks of damage to the battery pack
    - Do not allow the battery pack to come into 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 several points of a power storage and generation installation to effectively isolate and protect all components of the system to safeguard 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 Fortress Lithium Batteries must always be installed with a charge controller and the appropriate settings to protect the batteries from open PV voltage and other high voltage charging sources. The Fortress Battery Management System (BMS) alone will not protect the batteries from these extreme electrical phenomena. Failure to adhere to installation protocol will void the Warranty.



**CAUTION! Verify polarity at all connections with a standard 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 Fortress Power Lithium Batteries. Cover, restrain 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.

## 2. IMPORTANT NOTES

### 2.1 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. Do not disassemble the battery or change the structure of the battery by yourself.

### 2.2 Storage

Do not expose battery to high temperatures. Fortress Lithium Batteries should be stored out of direct sunlight under the following temperature conditions. The battery circuit/BMS should be off.



Storage Temperature (Min./Max.): 41°F/5°C – 95°F/35°C

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

Systems should be put into storage at 60% SOC and checked monthly to ensure the system SOC does not fall below 20%. At 20% SOC the battery will self-discharge in approximately 2 months. Also check the voltage every 3 months and recycle every 6 months if the battery is not use for long time.

## 2.3 Response to emergency situations

The battery pack comprises multiple batteries 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 one 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 fires, make sure that the extinguisher is available near the battery pack. If possible, move the battery pack to a safe area before it catches fire.

**Note:** FM-200 fire extinguishers, sands, 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 not spread to it yet.

## 2.4 Charge/Discharge

❖ 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, chemistries, models, and lifespans cannot be paralleled

## 2.5 Charging notes

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

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

- ❖ The battery has undergone long-term transportation or storage and has not been operated in accordance with the supplementary power requirements.
- ❖ The battery is in a disabled or standby state for a long period of time during transportation or storage.
- ❖ The battery was vented during use and reached under-voltage protection status. For more than 30 days, the battery was not operated in accordance with the requirements of battery recharge.

## 2.6 System sizing

Proper system sizing is vital to the health and proper operation of your battery. Using an inverter with a charging rate too close to the maximum recommended charge rate of the battery can cause the battery to malfunction due to safety mechanisms. Therefore, it is important to size the number of batteries correctly, depending on the power of the inverter.

The table below lists some common inverters and the **minimum number of eFlex batteries necessary to avoid malfunction.**

Furthermore, it is necessary to remember the contribution of MPPT solar charge controllers to charging current when designing a system. The max charge current of the batteries must be greater than or equal to the sum of max charge output of the inverter and the MPPT charge controller. Or,

$$\sum_{\# \text{ eFlex batteries at max charging current}} \geq \sum_{\text{ inverter + charge controller max charge output}}$$

An example is proposed to illustrate the matter. Consider a Schneider XW+ 6848, which has a max charge rating of 120A and one MPPT charge controller capable of charging at 60A. In addition, assume 3 x eFlex batteries connected in parallel, which are recommended to be charged at 55A or less. If we follow the equation above and sum the values we have, we get

$$55A + 55A + 55A \geq 120A + 60A$$

or

$$165A \geq 180A \quad \mathbf{X}$$

Therefore, the potential charging current exceeds the maximum charge current of the 3 parallel batteries. In this scenario the **3 x eFlex batteries are not sufficient** to handle the full charging power of the inverter and the charge controller at the same time. To remedy this situation it is necessary to either add a fourth eFlex battery in parallel. If four batteries is not an option, please contact Fortress Power tech support for help sizing the system.

	Inverter	eFlex 5.4
		51.2Vnom
Magnum / Sensata	MS 4448	2
	MS 4048	2
OutBack Power	Radian 8048A	4
	Radian 4048A	2
	SkyBox SBX 5048	2
	VFXR 3648A	2
	FXR 3048A	2
SMA	Sunny Island 6048	3
	Sunny Island 4548	2
Schneider Electric	XW Pro 6848	3
	XW+ 6848	3
	XW+ 5548	3
	SW 4048	2
Selectronic	SP PRO SPMC 481- AU	2
	SP PRO SPMC 482- AU	4
Sol-Ark	8K	4
	12K	4
Victron Energy	Quattro 48/3000/35	2
	Quattro 48/5000/70	2
	Quattro 48/10000/140	4
	Quattro 48/15000/200	6

## 3. PRODUCT INTRODUCTION

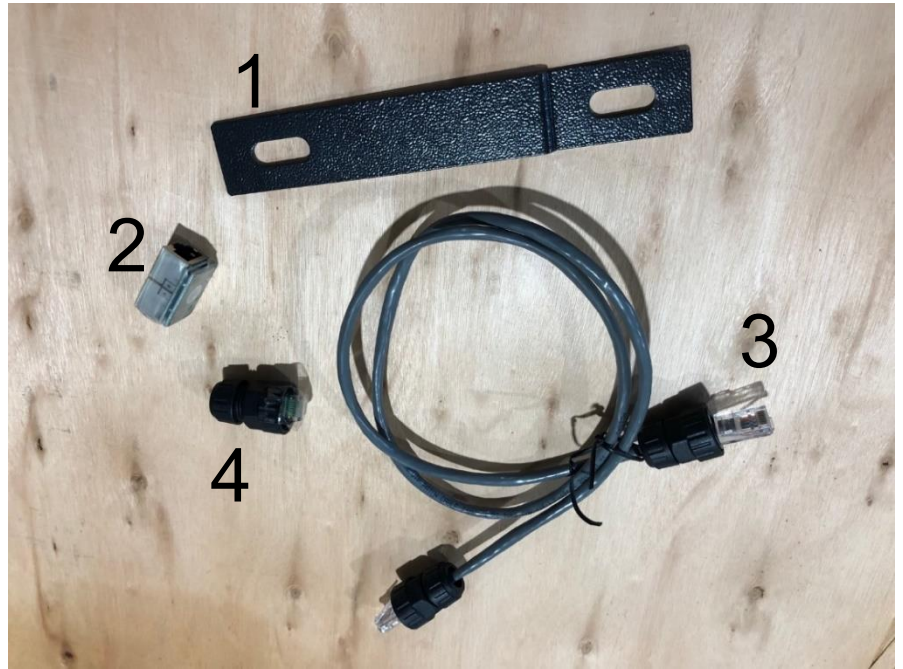
### 3.1 Technical data

<b>Model</b>	<b>eFlex 5.4</b>
Total Energy(kWh)	5.4
Recommend Charge Current [A]	55
Max. Charge Current (Continuous) [A]	100
Recommend discharge current [A]	<68
Max. Discharge Current (Continuous) [A]	100
Max Pulse Current for 5sec [A]	130
Capacity [Ah]	105
Voltage [V]	51.2 (48)
Charging Temperature [F]	32~113
Discharging Temperature [F]	32~131
Dimension [LxWxH] [inches]	21.5x17.5x7.2
Packaging Dimension [inches]	25.7x22.9x11.3
Connection Terminal	M8
Weight [lb]	116
Enclosure Protection Rating	IP65
Scalability	Up to 15
Battery Operation Efficiency	>99%

### 3.2 Unboxing Check list

The following items are included in the eFlex package:

- ❖ Battery
- ❖ 2 x Rubber terminal cap
- 1. Floor mount stabilization bracket
- 2. RJ45 adaptor and CAN resistor
- 3. RS485 Waterproof cable
- 4. CAN Bus terminator



### 3.3 Accessories and Part

#### Numbers

The following accessories are available for purchase to mount the eFlex in several different ways. Please contact [sales@fortresspower.com](mailto:sales@fortresspower.com) if interested in these kits.

Name	Fortress Kit Description	Item	Description	Kit Quantity
Wall mount kit	eFlex - wall mount kit	10069625	Wall Mount panel	2
		10069626	Wall Mount Kits	4
		10019875	Hammer screw M6	4
		10061513	Hammer nut M6 8mm	4
Side mount kit	eFlex - side mount kit	10019875	Hammer screw M6	4
		10062392	Side Mount Kits	2
		10061513	Hammer nut M6 8mm	4
Rack Mount Bracket	eFlex- rack bracket	10077187	Rack mount kit left	1
		10019875	Hammer screw M6	4
		10061513	Hammer nut M6 8mm	4
		10077188	Rack mount kit right	1
Floor stand connection plate	eFlex - floor stand plate kit	10077186	Connection Plate	1
		10061513	Hammer nut M6 8mm	1
		10019875	Hammer screw M6	1

## 4. INSTALLATION

Safe and reliable installation requires trained and certified technicians. The following discussion of Fortress Power Battery configurations is a basic primer. Follow all requirements for Energy Storage Systems in the National Electric Code. Due to the variety of systems and components in the field, all possible scenarios are not covered. This is not the purpose of this section of the manual. Refer to professional installers regarding your system and its components and specifications. We encourage you or your installer to contact us with any specific questions for technical support. We are committed to working with you and your installation team to achieve a safe, reliable storage system that will provide years of maintenance free service.

### 4.1 Tools & Materials

- ❖ The following insulated tools and materials are required:

- Positive and negative battery cables. It is recommended **to install a 150A fuse between the bus bar and the battery**. We recommend copper cables larger than AWG 2/0. The battery cables are not included. Please refer to the published Battery Cable Sizing Chart for the proper size, based on your system specification.
- Positive and Negative Terminal lug recommendation: M8 (diameter: 8mm or 5/16in)
- Screwdriver
- Communication Bus Terminator: to Match Impedances during parallel setup
- RS 485 cable
- RECOMMENDED: Small 48V Charger for trickle-charge purposes
- OSHA approved personal protective equipment

		
Insulated gloves	Safety Glasses	Safety Shoes

## 4.2 Inspection before Installation

- ✓ Check the battery package, type, quantity, appearance and other components
- ✓ Check if there is any damage on the battery box
- ✓ Check the battery terminals and connections to make sure they are clean, free of dirt, fluids and corrosion
- ✓ 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.
  - Confirm that the LED lights are green (there should be statement here on what the operator should see once the eFlex is turned on and operating normally.
  - Using a Voltage Meter check that the voltage across the terminals is between 50V-55V.
    - If Voltage is <50V, charge the battery using an approved battery charger.
    - If the Voltage is >55V, contact Fortress Power.



**IMPORTANT NOTE:** Please inform us of any problems within 7 days of receipt of goods. Otherwise, we deem that clients have no objection to the goods.

## 4.3 Installation Considerations

Although the eFlex is IP65 rated, if it is to be installed outdoors it is recommended that the installation location meet the following conditions:

- ✓ At minimum, the eFlex should be protected from inclement weather with a cover/enclosure.
- ✓ The area is completely waterproof.
- ✓ The floor is flat and level (Inclination < 15°).
- ✓ There are no flammable or explosive materials.
- ✓ The optimal ambient temperature is within the range from 59 °F to 95 °F.
- ✓ 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.

- ✓ 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

## 4.4 Installation Steps

### 4.4.1. Mounting on a Server Rack

The eFlex 5.4 is designed to fit easily into any standard, widely available, 19-inch industrial server rack. Please pay attention to the following major notes when selecting a standard server rack as a battery rack.

- ✓ eFlex is designed for shelf mounting, not for rack mounting
- ✓ Shelf weight rating > 120lb.
- ✓ Shelf usable width should be > 17.5 inch.
- ✓ Overall server rack weight rating needs to be considered according to the total weight of eFlex in one server rack system
- ✓ Server rack usable depth greater than or equal to 24 inches
- ✓ Calculate the size of the desired server rack

U = Rack Unit (1.75")



Server Rack [Rack Unit]	Useable Depth [Inch]	eFlex Height [Inch]	Quantity of eFlex
18U	≥24	7.20	4
21U	≥24	7.20	4
27U	≥24	7.20	6
35U	≥24	7.20	8
40U	≥24	7.20	9
45U	≥24	7.20	10

Please follow the following steps to mount the eFlex in a 19" server rack.

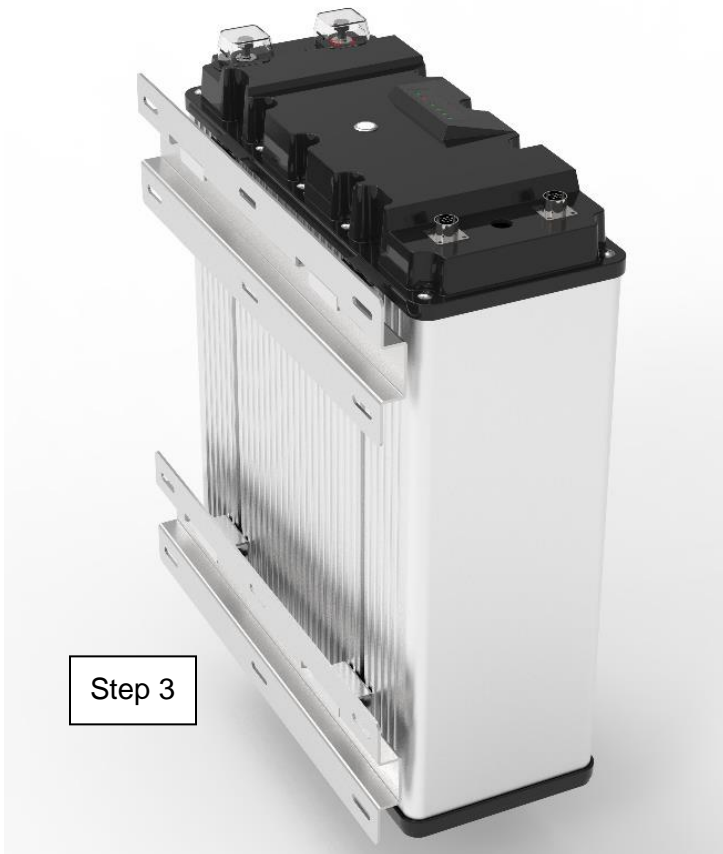
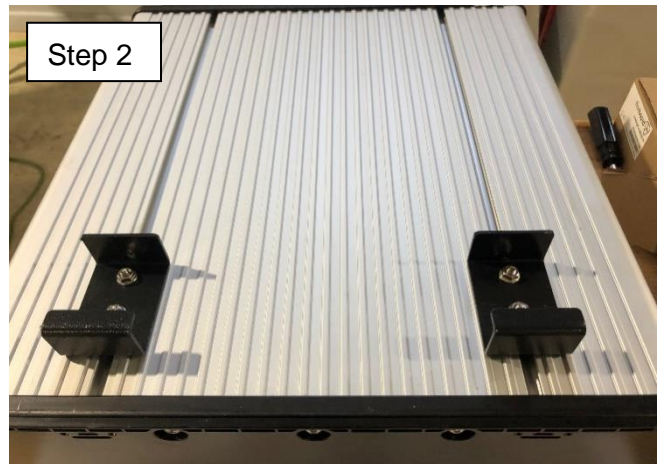
1. Ensure your shelf mounts are properly secured
2. Optional: If you choose to use the stabilizing brackets, affix those to the eFlex using T-slot bolts
3. Slide the eFlex onto the shelf mount
4. To connect the terminals to the inverter, a busbar for the positive and negative leads (either in the front or in the back) is recommended
  - a. Please refer to the rack installation manual for more information



### 4.4.2. Mounting the battery pack to a wall

The eFlex 5.4 can be easily wall-mounted using our custom T-slot brackets. The wall-mounting brackets are sold separately. Please ensure the wall and mounting hardware can handle the weight of the batteries.

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 mounting bracket into the wall
2. Using the T-slot screws, fix the male brackets onto the slots in the battery
3. Once all brackets are properly positioned, carefully lift the battery with the help of someone and gently drop it into the female wall mounted brackets



### 4.4.3 Floor standing installation

The eFlex 5.4 can be floor-mounted in several orientations to best suit your application. When determining the battery orientation for floor-mounting, it is important to note that the orientation depicted to the right, with the terminals closest to the floor is NOT recommended.

When mounting the eFlex to the floor, use the included mounting brackets to prevent the battery from tipping over.

1. Gently place the eFlex on the floor 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



### 4.4.4 Connecting the battery to the Charge

#### Controller and/or Hybrid Inverter

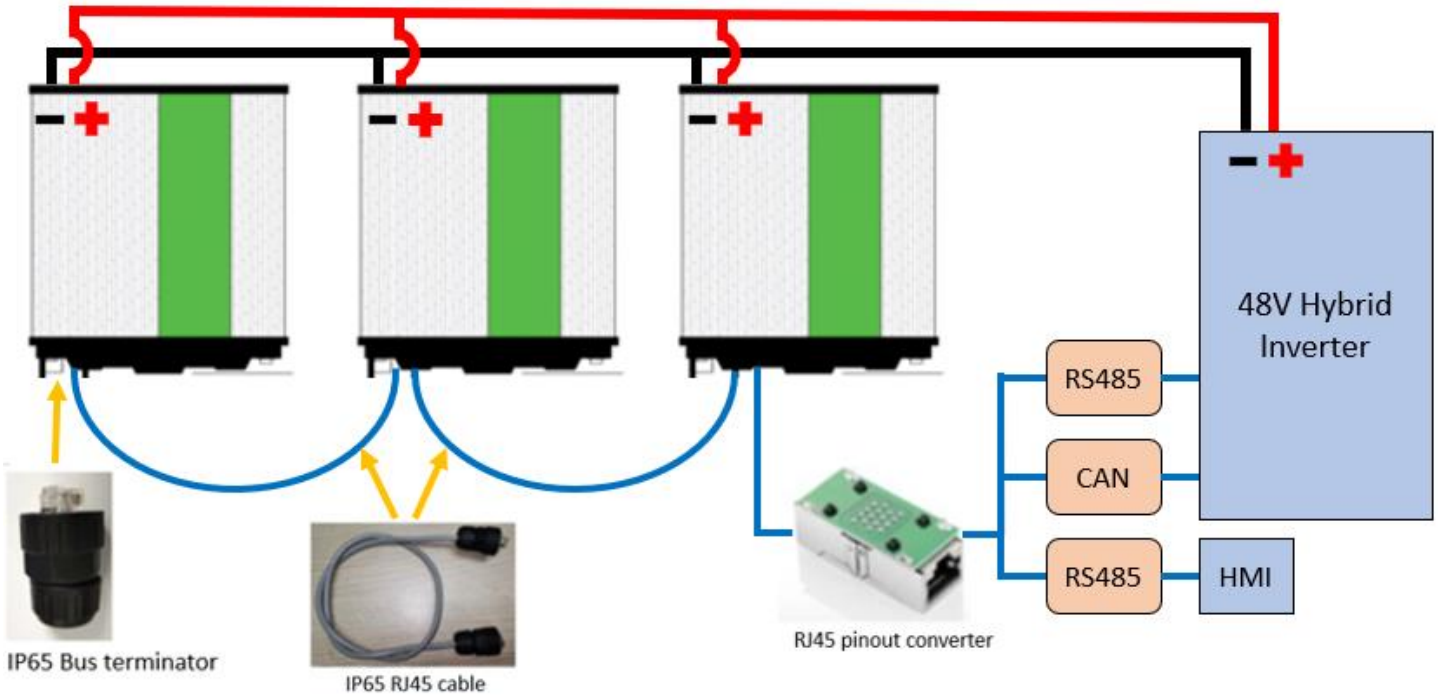
Ensure the battery is turned off by verifying the LED's are off and there is no voltage across the terminals. Install the positive cable first and the negative cable second. Do not cross the positive and negative terminals; also, ensure the terminals are not connected to any metal mounting, fixture, 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 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.**

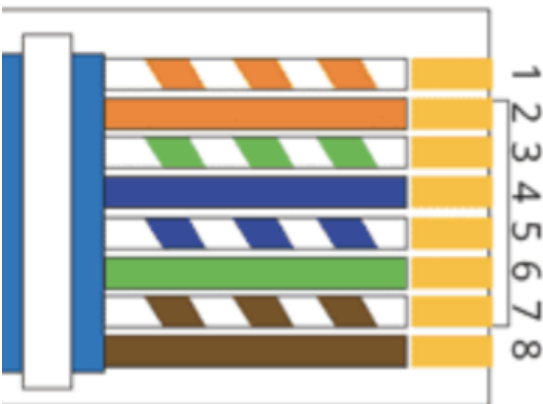
### 4.4.5 Using RS485 and CAN Communication

Fortress eFlex 5.4 has a self-managed Battery Management System (BMS). No communication is required between a battery-based inverter and the eFlex 5.4 to operate the system. The unit has two ports on the front face of the battery. Both ports are designed to support RS 485 and CAN communication. These ports are used in multi-battery in parallel setup (see section 4.4.7.) or in some cases to communicate with a compatible hybrid

inverter/charge controller. Below is a sketch of the communication between paralleled batteries.



If you need to make a communication cable, please refer to the pinout diagram for an RJ45 cable below.



Pin	Color	Assignment
1	White Orange	CAN1_H
2	Orange	CAN1_L
3	White Green	RS485A2
4	Blue	CAN2_H
5	White Blue	CAN2_L
6	Green	RS485B2
7	White Brown	RS485A1
8	Brown	RS485B1

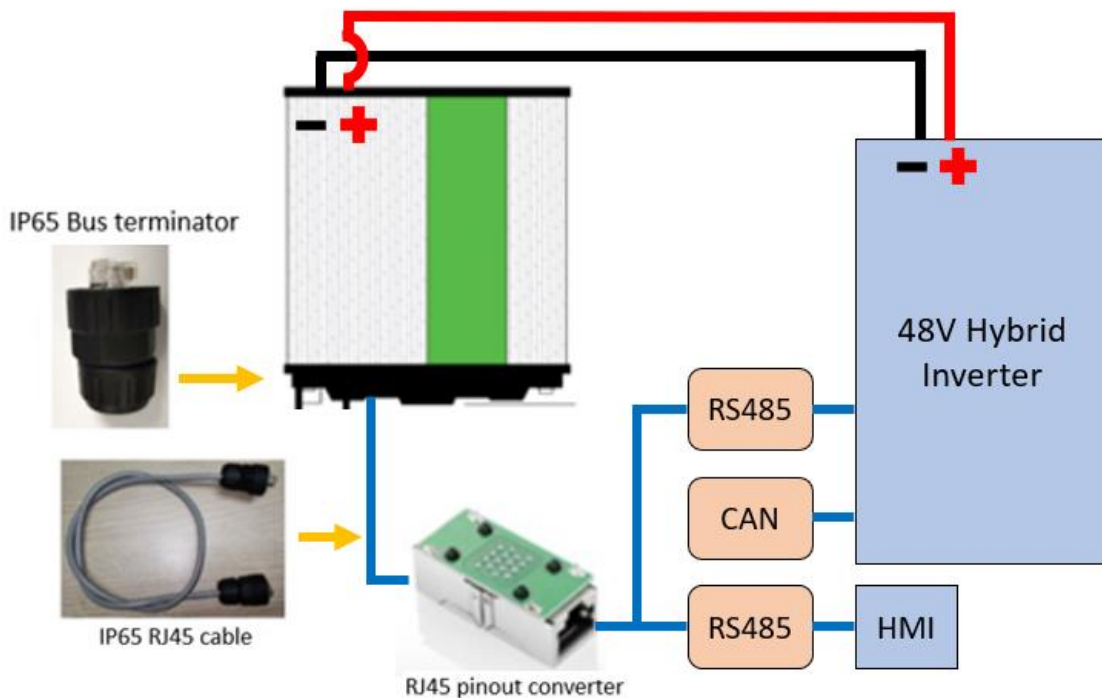


**CAUTION!** Please check with Fortress Power to see if you can use the CAN comm. port to connect the battery to your charge controller or battery-based inverter.

## 4.4.6 Using a single eFlex battery pack

### Installation procedure for a single eFlex battery

1. Put the inverter breaker/on and off switch into “OFF” position (if there is any)
2. Connect the positive and negative terminals to the inverter
3. Turn on eFlex unit by pressing the eFlex power button and waiting ~10sec until LED diagnostic is complete.
4. Check that the LED’s are showing normal operation (there must be a description of what the operator should see (which LED’s are on and what color) to verify that all is OK and the inverter can be started)
5. 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.
6. 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.



If you install multiple inverters with one or more eFlex 5.4, please turn the first Inverter on by following the abovementioned steps, then power up the remaining inverters.

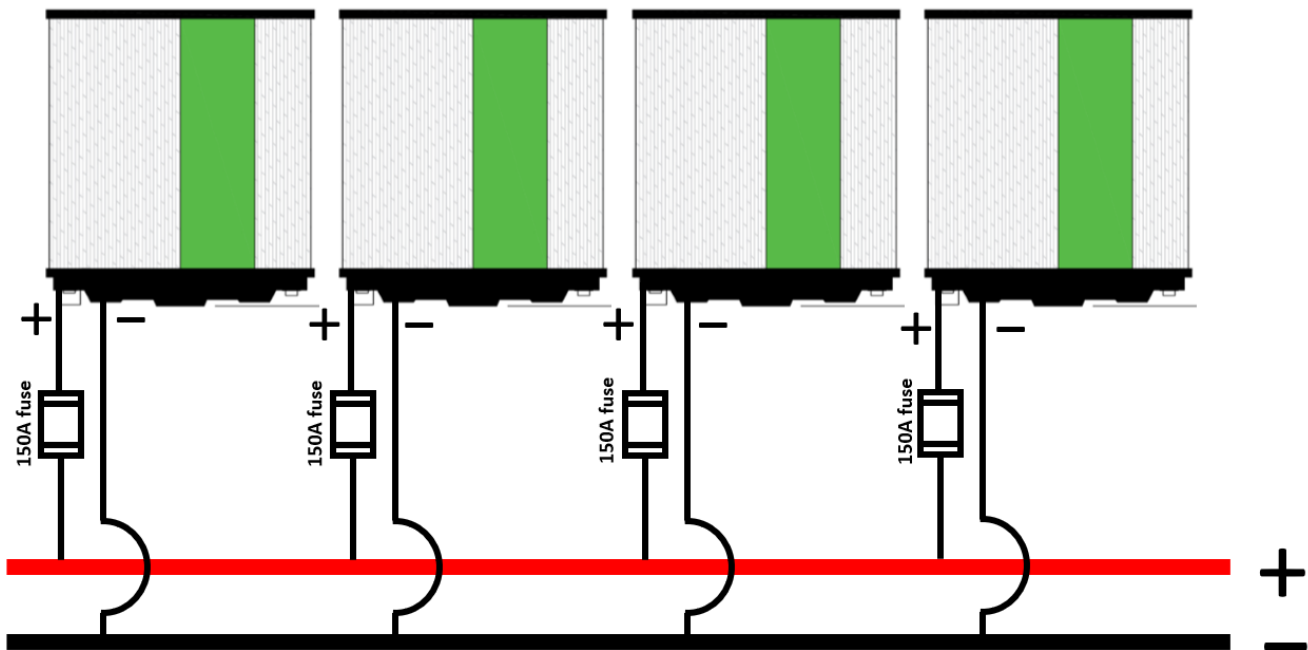
### 4.4.7 Parallel Connection of >1 eFlex battery

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. Heavy gauge, fine strand copper wire is the industry standard due to its stability, flexibility, efficiency and overall quality. A qualified installer should understand this and must adhere to the industry standard and published electrical guidelines.

The storage capacity and total permissible charging and discharging amperage are increased by the parallel arrangement. The illustration below shows how to connect multiple batteries in parallel. Please note the overall voltage is not changed. The available amperage from the system is increased with each additional parallel battery. In a parallel system with two batteries, the available charging and discharging amperage is doubled compared to a single battery.

**Prior to installation: check all battery voltages independently.** Make sure the voltage difference between the highest voltage and lowest voltage battery is **less than 1V** to ensure trouble-free start-up of the whole system.

The schematic below illustrates the proper paralleling of eFlex batteries. The best way to ensure proper cell balancing and longevity is by using common positive and negative bus bars and connect each battery to the bus bar individually. In addition, it is good practice to install a 150A Overcurrent Protection Device on the positive terminal of the battery as a precaution.



**Please follow this procedure to commission eFlex batteries in parallel:**

1. Turn OFF all equipment in the system
2. Connect the positive and negative common bus to the inverter.
3. **Prepare and connect communication cable.** Each unit comes with one RJ45 cable. If the cable is missing, please make sure the cable you purchase on the market meets the following standards. Please note that a standard RS485 cable is used. Please see section 4.4.5 for the pinout information. Daisy chain the RS485 cable to each unit utilizing one of the RJ485 ports. **A bus termination (Section 3.2) must be plugged into the second RJ485 port of the first and last daisy chained eFlex units. If communication is to be used with a compatible inverter, use the provided RJ45 converter in place of one of the bus terminators to connect the RJ-485 cable to the converter.**
4. Turn on the first eFlex unit (if there is communication with the inverter, the connection unit is the “first” unit.). After the self-diagnostic of ~ 10 seconds and LED indication showing the unit is operating normally, then turn on the rest of the units. Confirm all units complete their self diagnostics and the LED’s indicate normal operation (what does normal operation look like?)
5. Turn on the inverter system Note: some inverters have high in-rush current and need to be pre-charged manually, or you can choose use BMS pre-charge function to start it up. This requires the inverter to be turned on first before you turn on the battery. Please refer to the inverter manual for proper startup.



**CAUTION!** Installation should be designed to minimize the voltage drop between battery. 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 the eFlex in parallel: Maintain identical wire lengths and wire type/size from each Fortress Power Battery terminal to the common bus.



**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.

## 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.
4. 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.
5. OFF GRID SYSTEMS: Do not connect the Fortress Lithium Batteries until the entire system is ready to turn on and is fully operational.
6. See Charge Controller Settings in the Appendix of this manual. Fortress Lithium Batteries are compatible with almost all Inverter Chargers and Charge Controllers. Please contact Fortress Power to learn the recommended settings for any device not explicitly covered in this manual.

## 4.6 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. OPERATION

### 5.1 Charging

Never attempt to charge a battery without first reviewing and understanding the instructions for the charger being used. Only use a Fortress Power Approved Lithium Ferro Phosphate (LFP) charger if ancillary charging is required before installation, testing or troubleshooting. Failure to use a Fortress Power approved LFP charger may damage the battery and void the warranty

#### Temperature Table of Charging:

Ambient Temp	Max Charge Current	Max Discharge Current
0°C < T ≤ 5°C	0.1C	1C
5°C < T ≤ 10°C	0.2C	1C 0.5C
10°C < T ≤ 15°C	0.5C	
15°C < T ≤ 35°C	1C	
35°C < T ≤ 49°C	0.5C	None
49°C < T ≤ 55°C	None	



**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.**

#### 5.1.1 Please follow the following steps to use the charger to charge the battery:

1. Connect the charger leads to the battery.
2. Make sure that the charger leads, both at the charger and the battery side, connections are tight.
3. Turn the charger on.



**CAUTION! Recommended charging current is 80A, Max. 170A (Please follow the specification on Fortress Lithium Battery Datasheet.)**

### 5.2 Discharging

- ✓ Do not discharge battery below operating voltage.
- ✓ Do not discharge battery at rates greater than maximum continuous current.
- ✓ Do not operate in conditions that will exceed the internal operating temperatures of the battery.

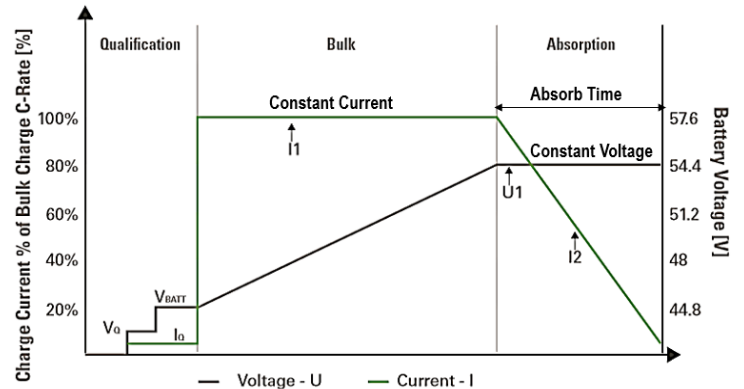
### 5.3 Parameter set up guide for Charger/Inverter

Before commissioning the energy storage system, the appropriate controller and inverter settings must be programmed per the manufacturer’s recommendations. Consult the manufacturer’s manuals and/or access technical support (Darfon, Schneider, Outback, SMA, Sol-Ark, Magnum, Outback).

Although Fortress Lithium batteries can perform at very high rates and depths of discharge within a very wide temperature range, 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)
3. Terminate when charge current drops below 0.05C
4. Unlike Lead Acid batteries, Lithium Ferro Phosphate batteries do not require Float Charge



#### Charger/Inverter configuration recommendation for best Performance:

The Battery Parameter Setting Guides with SMA, Sol-Ark, Schneider and Outback Inverters/Chargers are available to download on [www.fortresspower.com/Resource](http://www.fortresspower.com/Resource)

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

- Operating temperature range: 32 F to 120 F (0 °C to 49°C)
- Bulk voltage and absorb voltage should be set to 54.4V

Recommended operating parameters of charger/Inverters For 6,000 Cycles:

- Operating temperature range: 50 F to 110 F (10°C to 43°C)
- Storage must be equal to or more than twice the rated output of the Inverter
- Bulk voltage and absorb voltage should be set to 54.4V

At the End of Cycle Life capacity is Equivalent to 70% Retained Capacity



**CAUTION! Do Not Operate Fortress Lithium Batteries at an average temperature exceeding 30 °C / 86 °F over the life of the battery.**

## 6. DIAGNOSTIC/INTERFACE GUIDE

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 contact Fortress Power tech support. In normal operation, the “RUN” LED light will be on. The number of charging lights (LED1-4) that are on depends on the battery state of charge. Below is a chart that explains the SOC as a function of the charging LED lights.

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

**PLEASE CONTACT US FOR TECHNICAL SUPPORT**

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