Installation and Operation Manual

Residential

Commercial

Industrial

Utilities and Telecom

FUSION ESS ENERGY STORAGE
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INTRODUCTION

FUSION ESS lithium iron phosphate battery system has been developed for energy storage applications.

This manual contains all the information relevant to the installation, operation, and maintenance of the 51.2V 100Ah battery and cabinet.

Chapters	Contents
1. Overview	Background, Applications and Advantages
2. Operation Principle	Operating Principles
3. Parameters	All parameters of operation of FES-512 Battery
4. Installation	Installation Instructions and operation
5. Shipping, Storage, and Disposal	Shipping, Storage, Maintenance and Disposal

BEFORE YOU START

Read all the safety information provided in this document prior to installing and/or operating the equipment.

To handle or operate with Fusion Power System:

• You must be qualified for electrical work; DC Current is dangerous if not handled with care.

• Lithium batteries are capable of very large currents which can lead to fire and explosions, previous experience on the installation of Lithium battery banks is required.

• Remove any possible metallic shorting risk of Jewel, Watches, Pens. Metal bars and frames

• All tools must be insulated

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SAFETY SYMBOLS

Symbol	Definition
	Important safety information, please read carefully
	DO NOT dispose of battery in a fire.
	Recycle or dispose of Lithium batteries in accordance with local Laws/regulations.
	DO NOT dispose of battery in the trash.

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READ BEFORE INSTALLATION

What Not To Do

Please read and comply with the following conditions of installation and use of the battery, incorrect installation using the battery may cause personal injury or damage to the product.

1. DO NOT expose the battery to water, battery enclosure is not waterproof. Store batteries in a cool and dry environment when not in use.
2. DO NOT place batteries close to heat or fire sources, excessive heat and fire can lead to battery explosion.
3. When charging the battery , specialized equipment needs to be employed capable of performing multistage charging, follow max current and voltage parameters, do not use unqualified chargers.
4. DO NOT reverse positive and negative terminals, do not connect the battery directly to AC power, avoid battery short circuit.
5. DO NOT use batteries from different manufacturers or different kinds, types together, and do not mix use old batteries and new batteries.
6. DO NOT use the battery if become hot, bulges, deforms or leaks.
7. DO NOT puncture the battery; Do not step or sit on it.
8. DO NOT open or try to repair the battery when it is defective. Warranty invalid if the battery repaired or disassembled. Only Qualified service centers can diagnose and repair batteries.
9. DO NOT Install batteries directly on the floor, the battery system is design to be installed at a standard 19" Electronic Equipment's rack.
10. DO NOT connect this battery module model in Series, only parallel connection is acceptable. Different Battery Module Specifications for higher voltage is required for Serial Connections.

Warning

1. Batteries are charged only to 30% SOC before shipment, do not fully charge batteries until these are at its final installation rack properly connected, Don't use the battery if it's hot, bulged, or an acrid smell is present.
2. If you need storage the battery for a long time, please charge and discharge the battery every three months to ensure the best performance, and the best state of charge for storage is between 50%~60%.
3. Please use the battery in the temperature range which defined in the manual. Very low temperatures affect the battery performance significatively.
4. Lithium Iron Phosphate Batteries can be potentially damage by excessive current or Voltage, please verify the inverter and load pairing settings of your system carefully before starting operations.

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1.1 BACKGROUND AND APPLICATIONS

In recent years, with the rapid development of lithium ion battery technology, the pace of lithium ion batteries to replace the traditional lead-acid batteries have gradually accelerated in various fields. Compared with the traditional lead-acid batteries, lithium ion batteries boast with high energy density, small volume, light weight, long life, wide applicable temperature range and other advantages, particularly the advantages of lithium iron phosphate (LiFePO4) battery are comprehensive more prominent. At present, the lithium iron phosphate battery technology is becoming mature, with the cost is gradually decreasing, it has then quickly become the mainstream option for high-end back-up power solutions.

FES-512 Series are the first Lithium Battery systems for ESS applications. The Fusion ESS system combines high energy lithium iron phosphate cells and intelligent management system, to achieve a high degree of integration and intelligent management, and can be widely applied in various conditions

2.1 Description

Fusion ESS has been designed for Small to Medium size energy storage systems operating in a low DC bus (51.2 VDC Nominal). The system design is modular with the possibility of adding in parallel multiple FES-512 modules to increase the current capacity of the system. Each module is equipped with its own Battery management system controlling charge and discharge as well as monitoring, Voltages, Currents and Temperatures inside of the unit to operate the on board protections.

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2.2Architecture

The Architecture of FES-512 is shown in Figure 2.1. Battery Modules can operate in standalone mode provided currents and voltages are set correctly to avoid over charging- discharging or in parallel via individual battery ID setup. All battery modules in a system are connected in parallel adding extra current to the system.

CAN communication is implemented for communication among battery modules and an optional Global Battery management system. Ad hoc communication from the GBMS to larger inverter systems can be configured via the GBMS communication protocol.

Each Battery module is issued an individual ID via the toggle switches available for this purpose at the front of this battery allowing for multiples of 8 x FES-512 batteries per cluster (40Kwh Gross Storage per 8 Modules cluster)

Battery Modules are rated to 100Ah capacity but the DC terminals at each module are rated to a maximum of 400 Amps, this means that the paralleling of multiple batteries is limited to 4 batteries per cluster. Additional DC combination is required with a separate cabinet for larger systems. FES-512 have NOT been designed for series application and shall never be connected in series for higher voltage applications.

3.1 Module Specifications

Table 3.1 V-LFP51.2V100Ah products

Model Type	Voltage(V)	Capacity	Energy	Length	width	Height	Weight(Kg
FES-512	51.2	100	5120Wh	446mm	543mm	160mm	49

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3.2 Module Layout

The panel layout of FES-512 battery system is shown in figure3.2

Figure 3.2 Panel of FES-512 battery system

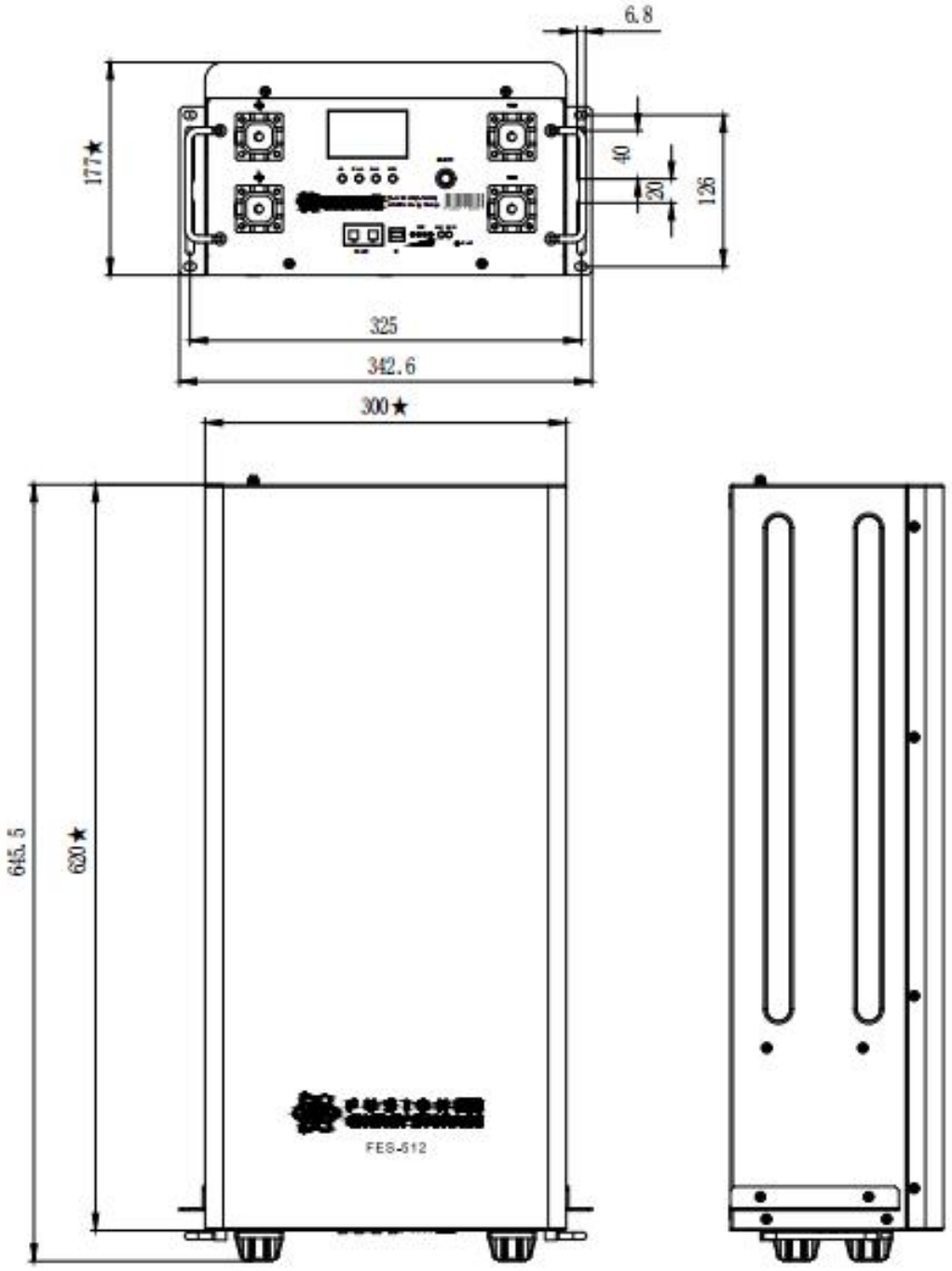

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Table 3.3 Description of the battery module

NO.	Name	Function	Remarks
1	Handle	For carrying，handling	
2	Terminals	Connect to power line for charging and discharging	400 Amp rating
3	Fixture	Installing and fixed	19”Rack
4	ID	Assign address of every model	See Table 3.4
5	RUN	Operating indicates LED	Always ON when operating
6	RS232	RS232 Communication interface	
7	RS485	RS485 Communication interface	
8	Circuit breaker	Switch on/off the BMS	
9	ALM	Alarming indicates LED	
10	SOC	The state of charge	Four small green LED
11	Maintain port	Recharge the cell	

Table 3.4 Assignment of ID address

Code				Address	Assign	Remarks
ON	ON	ON	OFF	1	Model 1	
ON	ON	OFF	ON	2	Model 2	
ON	ON	OFF	OFF	3	Model 3	
ON	OFF	ON	ON	4	Model 4	
ON	OFF	ON	OFF	5	Model 5	
ON	OFF	OFF	ON	6	Model 6	
ON	OFF	OFF	OFF	7	Model 7	
OFF	ON	ON	On	8	Model 8	

Note: In the table 3.4, code bits are in accordance with the control panel ID code corresponding to the binary digit, Up position is the "OFF " position, and the down position is the " ON ", the left dial is low digit, the right dial is high digit, encoding in the range of 0~15

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Table 3.5 LED indicator description

State	Warning/ Normal	RUN	ALM	SOC LED				Definition
				25%	50%	75%	100%	
Shutdown		OFF	OFF	OFF	OFF	OFF	OFF	All OFF
Standby	Normal	ON	OFF	Indicator as the battery capacity				
	Protection	OFF	ON					
Charge	Normal	Flash1	OFF					
	Protection	OFF	ON					
Discharge	Normal	Flash 2	OFF					
	Warning	Flash 2	Flash 2					
	Protection	OFF	ON					

Note：SOC means "state of charge", there are 4 LED for SOC, From left to right, each light indicates increment of 25% SOC. When the battery is shut down, all the lights go out, when the battery start to work, the green "RUN" LED is always bright. When the battery is protected, the red LED"ALM" is always bright.

Note: Flash 1——0.5s ON and 0.5S OFF; Flash 2——0.5S ON and 1.5S OFF.

3.6 BATTERYMANAGEMENTSYSTEM（BMS）

3.6.1 VOLTAGE PROTECTION

●Over Charge Protection

During charging, if the voltage of any cell exceeds the setting for cell protection or total voltage of the system is greater than the setting for the system, the BMS stop charging. And when all voltage of each cell and total voltage of the battery drop to the recovering-set values, the protection removes automatically. The voltage settings are shown in table 3.6.

●Over Discharge Protection

During discharge, if the voltage of any one cell or total voltage of the battery is lower than the protection settings, the BMS stops discharge. And when all cell voltage and total voltage go up to recovering setting, the protection remove automatically. The settings are shown in table 3.6.

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3.6.2 CURRENT PROTECTION

●Charging Current limitation

During charging, if the charging current is greater than the setting value, the BMS will limit the charging current to less than the setting value, this is charging current limitation. The settings are shown in table 3.6.

●Discharging Over Current Protection

During discharge, if the discharging current is bigger than the setting value, the BMS will stop discharging, this is discharging over current protection. Remove the load or charge the battery. The settings are shown in table 3.6.

●Short Circuit Protection

During discharging, if the current bigger than the normal working current, it's considered as a short circuit, the BMS protections will be activated and output suspended. The settings are shown in table 3.6.

● Reverse Polarity Protection

BMS monitor current flow direction, when reverse polarity is detected the BMS will immediately enter its protection mode, this to protect battery and Inverter from being damaged by high current returning from the inverter.

3.6.3 TEMPERATURE PROTECTION

●Cell Temperature Protection

There are several thermal sensors to monitor the cell temperature，if the temperature of any cell is higher than 70℃ or lower than 0℃，the BMS will stop charging, this is charge temp. protection; If the temperature of any cell is higher than 75℃ or lower than －20℃，BMS will stop the discharge. This is the discharging protection. The settings are shown in table 3.6.

●PCB over-heat Protection

There is a thermal sensor to monitor the PCB temperature，if the PCB temperature is higher than 95℃, it will trigger the PCB protection and stop charging or discharge until the temperature drop to normal range. The settings are shown in table 3.6.

3.6.4 CELL BALANCE

●Smart Cell Balance

During charging, If all cell voltages are greater than 3.40V and the voltage difference between cells ΔU＞40mV, BMS will trigger the balancing process, the balance current is designed base on the capacity of battery pack.

ΔU=max. Cell voltage – min. Cell voltage

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Table 3.7 Protection Settings

NO.	Type		Function	Setting value	Remarks
1	Voltage	Charge	Cell Voltage Protection	3.7V Warning/3.8V Protection	Clear at 3.6V
2			Total Voltage Protection	59.2V Warning/60V Protection	Clear at 57.2V
3		Discharge	Cell Voltage Protection	2.8V Warning/2.5V Protection	Clear at 3.1V
4			Total Voltage Protection	45V Warning /43.2V Protection	Clear at 48V
5	Current	charge	Normal	≤100A	
6			Over current protection 1	100A < current <105A delay 20s protection	Limited current
7			Over current protection 2	≥105A	Limited current
8		Discharge	Normal	≤100A	
9			Over current protection 1	102A<current<112A delay 30s protection	Clear at 60s
10			Over current protection 2	⩾122A delay 2-3s protection	Clear at 60s
			Over current protection 3	＞250A,delay0.5-1.5s protection	Clear at 60s
11		Short circuit protection		LORD>0.1R,delay 0.4ms	Take Load away /charge current>1.0A
12	Temp	Cell	Temperature protection	Charging Range 0℃~70℃ Discharging Range-20℃~75℃;	Recover at charging range 0℃~60℃,discharging range -10℃~65℃
13		PCB		≥95℃	Recover below 75℃

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4 INSTALLATIONAND TESTING

4.1PREPARETO INSTALL

●Safety

The installation, operation, and maintenance of Fusion lithium iron phosphate battery system must be performed by trained and qualified professional personnel. Before installation and use, please carefully read the product safety precautions and related operating rules. Strictly abide by the following safety rules and local safety regulations, personal injury or damage to the product can occur due to improper installation.

1. Make sure that the inverter system is switched off as well as any DC related equipment as Solar Chargers.
2. Before installation, make sure that all batteries are Shut Down (Off);
3. All the electrical wiring cables must have corresponding grade of insulation and cross-sectional diameter, please ensure that all wires are terminated with appropriate cable logs and that Insulated Heat shrink is used to protect any connections.
4. Make sure that the battery and inverter system have reliable ground connection.
5. Make sure that al battery modules to be connected in Parallel have a group voltage which is within 0.3 VDC maximum difference from each other. Please note that large Voltage differences when paralleling modules will create large currents in between the modules and could damage the equipment. Such damages are not covered under warranty and careful planning is required for adequate initial paralleling of the battery modules.
6. Make sure that the Battery installation rack is affixed to the wall and ground before installation of the modules. A fully loaded rack is very heavy and could harm a person if it topples. Always load the rack from the bottom for safety reasons.
7. Verify that the size of Lithium battery Bank is adequate to the desired charging current and maximum loads of the system. It is a very common mistake to size Energy Storage Banks only considering energy requirements and not taking into consideration the current capabilities of the installed battery storage system.

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4.1.1 Requirements of Installation Area

The requirement of installation environment is shown in table 4.2. While the Fusion system has a wide operating envelope, it is recommended to install the equipment at a room or area where the system can be kept away from people and Flammable materials. NEVER install Battery storage systems inside living quarters.

Table 4.2 Environmental Requirements

Type	Requirement
Working Temperature	Working Range：-20℃~+60℃/ Charging only above 0℃
Storage Temperature	-20℃~+60℃
Relative Humidity	＜95%
Atmospheric Pressure	86kPa~106kPa
IP Rating	IP 20 (Only Indoors)
Site Requirements	No conductive dust and corrosive gas, no vibration. Keep away from heat and flame.

4.1.2 Tools and Materials

Table 4.3 Tools and Materials

Name	Name
User manual	Ethernet Tester
Screw driver	multimeter
Wrench	Ammeter
Plier	Insulating tape
Wire stripping pliers	Electrostatic prevention Bracelet
Wristband	Clamp band

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4.1.3 Site Survey

●Equipment Inspection

1. Check that the equipment to be connected to the battery Rack is in good condition, and check for wiring mistakes (ie: Reverse Polarity).
2. Verify the Voltage of the Inverter system and that this matches to FES-512 Voltage requirements.
3. Verify Inverter, make sure the maximum output current is matched with the selected battery. Check and confirm the output voltage is in the range showed in table 3.7.
4. Check the maximal working current of backup Loads connected to battery bank, make sure that the current is less than the maximum discharge current of the products showed in table 3.8.

Ground Check

Verify that there is an effective negative grounding point for the Battery system to ground all Battery enclosures and Battery racks. It is very important that all exposed metal pieces inside the Battery storage rack are grounded to Earth. Adequate Earth connection points are provided at both the battery modules and cabinets.

4.1.4 Battery Check

1. On the installation site, check the battery packaging to make sure it's intact.
2. Check battery box according to the packing list, make sure all the material is complete.
3. Please be careful while handling batteries, avoid any mechanical damage.

4.1.5 Storage System - Sizing

Verify that the intended loads and charging currents stay below the limits described at the table below, failure to do this will cause system protection events, potential Battery damages and could lead to an electrical fire. Always be conservative on current calculations when using Lithium Storage banks.

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Table 4.4 Storage Bank Sizing

FES-512 Modules	Nominal Storage (Kwh)	Net Storage (Kwh) @ 80% SoC	Max Charge Current Total (Amps)	Max Discharge Current Total (Amps)	Max Load Output (Kw)
1	5.1	4.08	25	50	2.4
2	10.2	8.16	50	100	4.8
3	15.3	12.24	75	150	7.2
4	20.4	16.32	100	200	9.6
5	25.5	20.4	125	250	12
6	30.6	24.48	150	300	14.4
7	35.7	28.56	175	350	16.8
8	40.8	32.64	200	400	19.2

4.2 INSTALLATION

4.2.1 PRECAUTION

Please keep in mind the following points before installation:

1. Installation space and Battery Weight: Make sure that the cabinet to be used for the battery modules installations can withstand the weight of the total number of modules to be installed. The battery cabinet must be anchored to the floor and walls for safety. Consider that a full rack with 4 x Modules and a BMS can weight more than 240Kg.
2. Cable specifications. To ensure that the use of the connection of the power supply line can meet the maximum current requirements of equipment operation.
3. Project layout. Design an equipment layout before the installation. DC wiring needs to be made long enough for function but not excessively long to avoid losses.
4. Supplied DC wiring is designed to match the maximum specification of the battery module into a central combiner box + BMS combo module. Longer distances will require bigger cable diameter. Calculate the required cable sizes prior to installation.
5. Improper cable sizing can lead to cable overheating and fire.
6. Do not install Battery modules on the floor or resting on its back, the modules are designed for rack installation (HORIZONTAL) and shall be installed as such in a rack to prevent them from movement and to keep them away from potential flooding on the floor.

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⚠ CAUTION： Please ensure the installation site is safe before installation. This includes verification of possible areas for water ingress into the room, ventilation, and dust proofing. Always make sure that a suitable Lithium Fire Extinguisher is available during and after installation of the Battery bank.

4.2.2 INSTALLATION STEPS

Battery installation steps are shown in table 4.4.

Table 4.4 The installation steps

Step NO.	Name	Definition
1	Turn off power supply	The entire Inverter system must be powered down before installation and that all battery module Breakers are in OFF Position.
2	Mechanical installation	1. Install Batteries at Racks with mounting lugs, be aware that space may be required in between some modules for return DC wire to the GBMS or DC Combiner
		2. Make sure minimum 2 people is available for Mounting the batteries
3	Electrical installation	1. Grounding cable installation.
		2. DC Power cable installation
		3. DC Connecting equipment installation
		4. Communication cables installation
4	Electrical commissioning	System commissioning

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●Step 1. Interruption of Power Supply

Before installation, please ensure the batteries are powered off, please verify with a multimeter that the POS and NEG voltage are zero. Switch off inverter system and open any Circuit breaker or Fuse protection to and from battery bank into Inverter bank.

●Step 2. Battery Installation

1. Mounting lugs installation. Equipment packaging with the chassis mounting lugs, before the installation of equipment, fix the mounting lugs on both sides of the battery box, ensure that the installation strong.

2. Battery installation. Battery module preference mounted in the rack 19 inch (or cabinet), when installed, portable handle arranged in parallel on the frame (or cabinet) supporting plate, push rack (or cabinet), ensure the mounting lugs and frame (or cabinet) edge fixing hole tightly, and then using a screwdriver with screw for fixation screwed into the rack to the mounting holes, to ensure that the battery pack mounted solid.

●Step 3. Electrical Installation

1. Grounding cable. The grounding cable end with screw press-fit fixation in the chassis rear grounding hole, the other end is connected to the frame (or cabinet) grounding copper bar. To ensure the stable connection.
2. Preliminary operations Test: Before proceeding with the connection of DC wiring, proceed to switch ON each battery module independently and verify that Voltage is present at the terminals. Verify in this stand-alone configuration that no warnings or lights are present at each battery module. If no Voltage Output is measured at the module output terminals isolate the battery module and do not use at the installation. This module will have to be inspected in more detail by the technical support department. Test each battery OFF function, by switching off the battery breaker, you should not encounter any voltage at the battery terminals. Again if there is any residual voltage proceed to Isolate the battery and do not use at the installation until this has been verified carefully by Technical Support.
2. DC wiring installation. FES-512 is designed only for parallel Installation, all batteries at the string must be connected in Parallel. In order to facilitate the wiring, the POS and

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NEG terminals can be Daisy Chained together (POS in Connected in Parallel to each other in Daisy Chain per example) Up to a maximum of 4 battery Modules. Since in a parallel connection the voltages stay constant and the currents are additive, paralleling more than 4 modules using the provided IN and OUT terminals at each module could exceed the maximum current specification of the battery terminals (400Amps). If more than 4 modules need to be paralleled the GBMS module can be used. This module has 2 inputs rated to 400 Amps and 1 Output rated to 800 Amps, thus allowing for 2 clusters of 4 batteries in parallel to be feed in, the GBMS module in turn will provide an 800A maximum output for connection to the Battery bank Circuit Breakers and fuses.

3. After all DC connections are completed to either a DC combiner or the GBMS module, the Battery Bank requires at a minimum two additional and redundant protections prior to connection to the Inverters. A circuit breaker should always be connected in between the main combination point of the battery cabinet and the inverters with a DC rated fuse rated to at least 1.2 times the Circuit breaker rated current. Failure to install adequate DC protections at the battery bank output can result on damages or Electrical fires in the event of equipment malfunction. NEVER use the fuse holders as an Isolator since these are not intended for that purpose.

Figure 4.5 Multi-Unit Installation Configuration

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3. Communication cable installation. When a single battery is used, please skip this step. When multiple batteries are used in parallel according to table 3.4, please dial in the ID settings for module and proceed to connect each battery in a daisy chain as showed on the Multi Unit configuration figure. Connect the first or last battery in the Daisy Chain back to the Global BMS unit (If available) for global monitoring of the battery bank.

- Step 4. Storage System Commissioning

Always test communication wiring with an ethernet tester to make sure that each communication cable is operating correctly. Make sure that the Battery storage Rack output Circuit breaker is OFF before proceeding any further. Once all communication wiring has been completed and tested proceed to switch ON via the onboard circuit breaker each battery module and wait for each module to boot and to show correct SoC and no warning lights. If any warning light is present, proceed to connect to the battery showing the Alarm of fault using the supplied monitoring and control software. To connect always remember to use the ID assigned to the battery you wish to query. Once all batteries are switched ON, no Faults or Alarm lights are present proceed to close the Main output circuit breaker to feed power to the Inverters.

⚠ Caution：If you have any question about the installation, please stop and contact Fusion ESS or EASYPOWER technical support immediately. If the battery does not start or battery Control panel lights do not lit up, please disconnect the battery from the DC bus, restart the battery, if still this does not reboot the battery contact technical support for assistance. Never attempt to open the battery Modules on your own.

⚠ Caution：NEVER connect modules with Voltage differences bigger than 0.5 VDC in between, if pairing of new modules is required it is necessary to boost the lowest voltage modules always to the highest Voltage modules before electrical connection. If in doubt about this procedure, please contact the technical assistance department.

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5.2 WARNING Lights and its meaning

It is always important to understand the reason behind any Alarms or warnings displayed at the Battery Module Panel. Table 5.1 below show the conditions which will trigger the ALM (Alarm) light to be triggered on.

.

Table 5.1 The main alarm and protection

State	Type	Indicator	Disposal
Charging	Over voltage protection	ALM	Stop charge, check module voltage and charger
	Over current protection	ALM	Stop charge, check the settings and limitation
	Temperature protection	ALM	Stop charge, wait for the temp recovery
Discharging	Low voltage protection	ALM	Stop discharge, turn to charging mode
	Over current protection	ALM	Stop discharge, check if there is an over load
	Temperature protection	ALM	Stop discharge, wait for the temp recovery

5.3 COMMON FAULTS AND SOLUTIONS

Common faults and solutions are shown in table 5.2.

Table 5.2 Common faults and solutions

NO.	Fault phenomenon	Analysis	Solution
1	No DC output	Low voltage protection/Fuse broken	Charge the battery and try again or replace fuse
2	Short discharge time before battery CutOff	Battery capacity is too small or battery was not charged full prior to discharge	Maintenance or replacement
3	Battery cannot be charged to full	Bulk Charge Voltage set too Low, or too little Bulk charge time allowed	Review Inverter settings according to the Battery manual
4	ALM LED remains ON	Protection State/ Power output will be OFF	Review BMS internal error log using provided monitoring and maintenance Software
5	The battery output voltage is unstable	Battery management system do not operate normally	Press the reset button to reset the system, then reboot the system.
6	Communication lost or data fault	Communication settings fail	Check the communication settings and verify RS485 communication wiring.

⚠ Note: If you have some special technical problems which not mentioned above, please contact Fusion ESS technical staff.

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6 SPECIFICATIONS

NO.	Item	General Parameter	Remark
1	Model	FES-512	
2	Casing material	Steel case	
3	Assembly	16S1P	Single cell capacity 100Ah
4	Rated voltage	51.2V	Working voltage
5	Standard capacity（0.2C5A）	100Ah	
6	Standard Charging voltage	57V	
7	Cut-off voltage	45V	**Recommended**
8	Maximum discharge current	100A	
9	Maximum charge current	100A	<50A recommended
10	Operating temperature around module	Charging temp. range: -5 ~ 55℃ Discharging temp. range: -30 ~ 55℃	**Recommended 0-45℃**
11	Standard charging (0℃~60℃)	CC-CV Charge: 57V/0.2 C5A Charging end current: 0.01C5A	Charging time: About 5.5hours
12	Recommended Floating charge	Charging volt. 55.2-56V	3.45-3.5/cell
13	Battery module dimension (Length*Width* Height)	See drawing	±2mm
14	Recommended charge type	CC-CV-floating charge	CC: 0.2C to 57V CV:57V Floating: 55.2V
15	Battery Weight (Approx. including case)	49Kg	
16	Storage temperature range	Less than 18 months at -20~25℃	
		Less than 12 months at 25~35℃	
		Less than 3 months at 35~55℃	

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7. ProductWarranty

Fusion ESS Battery warrants that the Product will be free of defects caused by improper workmanship or defective materials.
This warranty commences the period of ten (10) years from the earlier of three (3) months after the manufacturing date or from the date of sale to the end customer, whichever occurs first.

(Warranty Period) subject to the conditions in clause 7.1 and the Exclusions in clause 7.3. This warranty does not include any accessories and tool kit items provided with the Product.

Fusion ESS Battery will repair or replace the Product if the Product is defective and returned during the Warranty Period at its own discretions through its distributors.

7.1 WarrantyConditions

The warranties in respect of the Product only apply if the Product:

1. Battery Is purchased from Superstart Batteries PTY LTD.
2. Has the official original manufacturer serial number still present and attached to the battery.
3. Has been installed in an approved Geography covered by this warranty.
4. The battery PACK is covered under a 10 years manufacturer's defect warranty or 2,000 cycles. Whichever is reached first. (A cycle as defined by a max SOC of 80% under 0.5C charging and 0.5C discharging conditions)
5. The average discharge current should never exceed 0.8C (80A) during the life of the battery, and the peak value should not exceed 120A @ <2S.
6. Is installed by personnel adequately qualified for the installation of Lithium storage modules.
7. System installed,operated,and maintained in accordance with the Product Instructions;and Operations/Installation manual.
8. Used on a single daily cycle basis and only for energy storage system,
9. If Batteries operate in an open loop (no communication with Inverters), including on grid or off grid applications, the inverter settings must be confirmed by Superstart Batteries PTY LTD.
10. Battery pack should be operated in an environment of 15 ~ 36℃ under regular use circumstances, and must never be operated in an environment of more than 45 ℃, otherwise it will reduce battery life considerably.

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11. The warranty would be voided if the defect in or failure of the Product's performance is attributable to your misuse, abuse, accident, incorrect installation, incorrect inverter settings, overloading or non-observance of the Product technical specifications.
12. Adequate caliber wiring has been used for the installation of the battery modules.
13. Supplied communications cables are employed for inter-module communication.
14. The installation is performed according to the Battery cabinet IP rating in a clean and well insulated/ventilated room.

7.2 Warranty Claim

Claims can be made to Fusion ESS Battery directly. In order to claim under this Warranty,

You must:

1. present the certificate of warranty declaration in its original form;
2. submittheinvoicefortheprocurementoftheProductindicatingthedateofdelivery;and
3. provide the Fusion ESS Battery Internal system log data recorded by the Product as an indication of whether the MinimumCapacityhasbeenachieved(Considering this is not a definitive assertion to that situation).
4. Battery type/Quantity
5. The Installation dates
6. Ambient temperature (Temperature/ Humidity)
7. Battery connection (series__cell, parallel__line)
8. Charging Module Settings (Charging voltage and current settings)
9. Actual /Theoretical load (power or current) and Inverter models and quantities connected to the battery bank
10. Photographic record of the battery bank installation detailing connections, DC and communications wiring used, Fuses and protections, DC combiners and any part of the electrical installation of the battery bank considered as mandatory by the installation manual.

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To make a claim to Fusion Batteries directly, please contact:

Address: Unit 30/76 Hume Highway LANSVALE Unit 30/76 Hume Highway LANSVALE NSW 2166 AUSTRALIANSW 2166 AUSTRALIA

Telephone : (02) 9755 7851
email: Solar@superstart.com.au

Superstart Batteries may contact you for further information regarding a defect. Fusion ESS may require You to complete root analysis testing of the Product to provide evidence supporting the claim. Final verification of the claim will be made by Superstart Batteries.

If You dispute Fusion Batteries verification of the claim, the Product must be evaluated by Australian government certified testing lab or a certified 3rd party testing company. You will bear the cost of any 3rd party evaluation service charge.

If any testing of the Product's capacity is required, the testing must occur in the following conditions

a) The ambient temperature of the Product must be $25^{O}C \pm 2^{O}C$

b) The initial temperature of the battery pods must be $25^{O}C \pm 1^{O}C$
Power shall be discharged by the Product at 10A as measured at the 54V DC link from an initial 100% charge capacity.

c) New Batteries Total discharge capacity: Each new battery is tested before delivery to guarantee the advertised current capacity.
   - 100Ah± 5Ah (25 ℃@0.5C).
   - A new battery capacity will be established at a Fusion ESS Technical Support center as the measured capacity after 3 complete cycles of charge and discharge at 0.5C rate.
   - It is normal that a new battery will require careful initial charging to achieve full capacity.
   - If the rated capacity is not achieved within +/-5%, please contact Superstart Batteries for processing.

Refer to contact details below

If the Product is no longer available or has been discontinued,Fusion ESS may,atitsdiscretion,replace the Product with are furbished product or different product or parts with equivalent functions and performance according to the latest technical information available.

Once a valid warranty claim has been approved the battery module will be repaired or replaced at Fusion ESS battery discretion.

7.3 Exclusions of Warranty

To the extent permitted by law,Fusion ESS Battery exclude sallli ability for the Product to the extent that any damage or defect has been caused or contributed to by the following:

1. Inverter or charger failure;
2. the Product being installed with inverters or charger which have not been certified by Superstart Batteries;
3. Improper or negligent product treatment or in any other inappropriate way, including using the Product outside the recommended ambient temperature condition in accordance with the Product Instructions;
4. transportation,including but not limited by dropping,trampling,deforming,impacting,or spearing with a sharp item;
5. storage,installation,commissioning,modification or repair of the Product that has been performed by a person other than Superstart Batteries;
6. abuse, misuse, negligence, accidents or force majeure events, including but not limited to lightning,
   flood,fire,extreme cold weather,or other events out side there as on able control of Superstart Batteries;
7. any attempt to extend or reduce the life of the product without written confirmation from Fusion ESS Battery, whether by physical means, programming or others;
8. removal and reinstallation at an other place from the original installation with out the written confirmation from Superstart Batteries;
9. water, conductive dust or corrosive gas;
10. the Product has been connected with different types battery modules;
11. failure to install,operate or maintain the product in accordance with the Product Instructions;
12. normal wear and tear or deterioration, or superficial defects, dents or marks that impact the performance of the Product and theft or vandalism of the Product or any of its components.
13. Usage of battery outside recommended temperature limits. The battery can be operated at low temperature (0-15 ℃) but the capacity will attenuate accordingly, this reduction in operating life is not covered under the warranty terms. Usage above 45 °C as well will reduce considerably life and is not covered under the warranty terms.

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7.4 General Provisions

This warranty is subject to the law of the Australia.

If any provision in this document is unenforceable, illegal or void or makes this document or any part of it unenforceable, illegal or void, then that provision is severed, and the rest of this document remains in force.

If any provision in this document is unenforceable, illegal or void in 1 jurisdiction but not in another jurisdiction or makes this document or any part of it unenforceable, illegal or void in 1 jurisdiction but not in another jurisdiction, then that provision is severed only in respect of the operation of this document in the jurisdiction where it is unenforceable, illegal or void.

7.5 Definitions

1. **Authorized Reseller** means an approved Fusion ESS retailer or distributor in the Territory.
2. **Consumer Law** means: Australian Consumer Law
3. **Minimum Capacity** means at least 70% of the Nominal Energy during the Warranty Period.
4. **Nominal Energy** means the initially rated capacity of the Product as printed on the label of the Product.
5. **Product** means Fusion ESS battery system manufactured by Super Start Batteries;
6. **Product Instructions** means the instructions and manuals issued by Super Start Batteries with the Product that set out how the Product should be installed and operated.
7. **Fusion ESS** means Fusion ESS Battery.
8. **Territory** means all the countries in South Africa, depending on where the Product was purchased.
9. **You** means the natural person that acquired the Product.
10. 10. Superstart Batteries means Superstart Batteries PTY LTD

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