

Narada®

LITHIUM IRON PHOSPHATE BATTERY

FEN4850

(Outdoor battery for Telecom-5G)



OPERATION MANUAL

Version 2.0

NARADA POWER SOURCE CO., LTD

Email: intl@narada.biz Website: en.naradapower.com

Notes	Safety and Warning	03
One	Product Introduction	04
	Product Features	4
	Main application	4
	Dimension	5
	Layout	6
	Working principle	8
Two	Technical Characteristic	10
	Discharge performance	10
	Charge performance	10
Three	Operation	11
	Parameter settings	11
	Operation condition	11
Four	Storage and Installation	12
	Storage	12
	Installation	13
Five	Maintenance	17
	General	17
	Troubleshooting and Solutions	18
	Annex1	19
	Annex2	20
	Annex3	21
	Annex4	22
	Annex5	23
	Annex6	24

Safety and Warning

Chapter Notes

The FEN4850 LiFePO₄ battery system installation, operation, maintenance should follow important recommendations in this manual:

- ⓘ The equipment shall be installed by the professional trained staff.
- ⓘ Battery maintenance should be carried out by the experienced professionals and aware of the preventive measures on the potential harm of the battery.
- ⓘ Note: Be care of the risk of electric shock for large current in case of battery short circuit, pay attention to the following points during operation
 - Remove watches, rings or other metal objects
 - Use tools with insulated handles
 - Do not place tools or metal objects on the battery
- ⓘ Do not direct access to the battery system to the mains grid power outlet.
- ⓘ Do not put the battery system into fire, do not use or storage the battery near to the high temperature source.
- ⓘ Do not use liquid or other objects placed into the battery system.
- ⓘ Do not open or cut the battery, not hit, throw or step on the battery.
- ⓘ Using special communication between battery module and power plant to charge battery
- ⓘ Be sure to subject to charge and discharge parameters setting in this manual.
- ⓘ The output interface of the system is still voltage when grid power cut, avoid electric shock or short circuit when operation.
- ⓘ Please check if the box is damaged. If damaged, please immediately notify the supplier
- ⓘ If you find leaking liquid or white powder residue on product, prohibit operation.

Please take care of the following marks

				
Warning	Electricity danger	Protecting your eyes	Watch Short-circuits	With adults custody
				
Read the manual	Fire forbidden	Circle used	Do not put batteries into dustbin	The product has passed the UL authentication

Product Introduction

Chapter One/01

Product Features

Narada FEN4850 lithium iron phosphate battery is a safe and reliable 5G micro-station backup power system, which can meet the backup power supply requirements of 5G micro stations, network equipment, communication equipment, transmission equipment.

The module is able to adapt a variety of 48V communication power system, It has many characteristics, such as flexible configuration, modular design, IP65 waterproof, outdoor pole installation, background remote monitoring function and multi-group system parallel communication function, internal heating system for low temperature use, intelligent battery management technology with protection functions such as voltage, current and temperature, high energy density, long life, high charge and discharge rate, etc.,.

Main application

- ⓘ Outdoor distribution system
- ⓘ Telecom Micro-Station

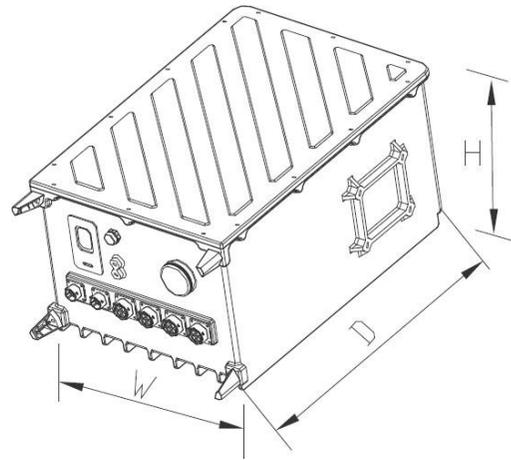


Fig.1-1 Structural Drawing of FEN4850 Batteries



Fig.1-2 Battery Output Terminal

Table 1-1 Battery Model & Dimension of SFEN4850 Battery

Battery Model ^①	Typical Weight (kg)	Dimensions(mm)			Battery Output Terminal
		Width (No ear)	Height	Depth	Φ
FEN4850	34	310	222	448	---

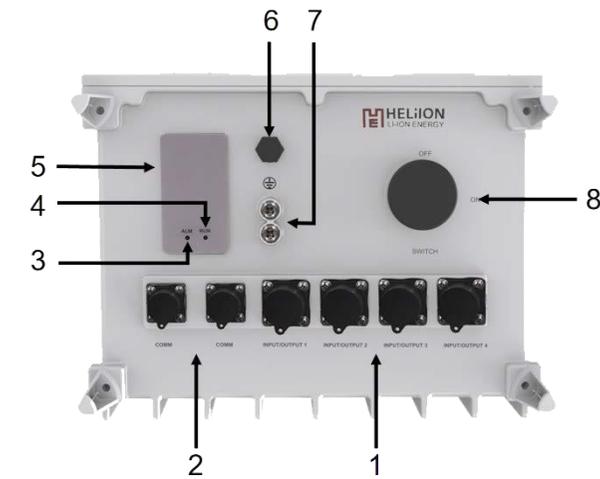


Fig. 1-3 Layout of Front Panel for FEN4850 Batteries

(Received product may not have all parts above, this instruction is as an example)

Table 1-2 Instruction for Layout of Front Panel

No.	Marks	Functions	Detailed Information
1	Input/Output	Power Terminals	FEN4850 battery has 4 power input and output ports, each input and output port can input and output power independently, please see Annex 3 for details.
2	COMM	communication port	It is adopting RS485 series port communication pattern to upload data. Contents of data transmit include BMS parameters, battery running status, alarms, etc. Communication of modules connected in parallel is available through RS485, FEN4850 battery have 2 COMM for communication. please see Annex 3 for details.
3	ALM	Indicator for alarms	There is one red LED light in front panel indicating alarms. Detailed information is shown in Annexed Table 1.2.
4	RUN	Indicator for running status	There is one green LED light in front panel indicating running status. Detailed information is shown in Annexed Table 1.1.

5	WIFI	WIFI Module	It can be used to view battery information through WIFI, please see Annex 4 for details.
6	Safety valve	Pressure relief valve	In case of safety problems, the pressure relief valve can release the pressure inside the battery in time to ensure the safety of the battery.
7	GND	Ground screw	Connect earth by flexible cable above GREEN Sheathed, UL94-V0, gauge of the grounding wire should be equal to or greater than the gauge of the battery return wire.
8	Power Switch	Key Switch	The FEN4850 battery can be turned on and off by using the key switch, and the key can be pulled out and inserted in the on and off state.

Working Principle

The FEN4850 battery system mainly includes Lithium battery pack, battery protection, cell balancing unit, monitoring module and charge-discharge management module for optional. Its schematic diagram shown in Figure 1-4

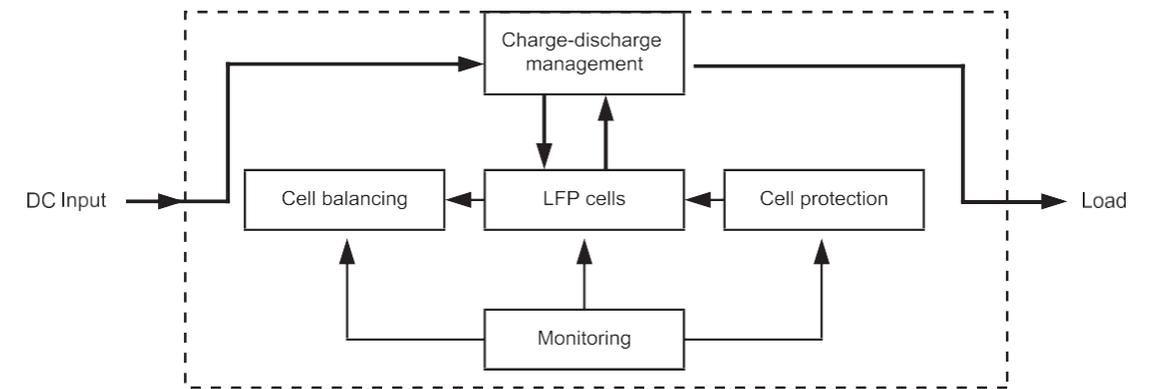


Fig. 1-4 Schematic Diagram

LFP cells	Chemical power, energy storage and power supply components.
Cell protection	Protect LFP cells against overcharge, over discharge, over current, over temperature, short circuit
Cell balancing	Equalization LFP cells for cells unbalanced
Monitoring	Support centralized monitoring system (optional according to customer requirements)

FEN4850 battery working principle:

DC power input rectifier after filter, DC divided two circuits, one circuit directly supply the load, another circuit charge lithium battery. When grid power on, the system supplies the loads and charging inside lithium batteries; When grid power failure, lithium inside system supply DC power to the load, to ensure uninterrupted power supply as power system.

Battery Management System (BMS)

Smart BMS technology is adopted for battery modules of FEN4850 battery to assure smart automatic management for batteries. Features of BMS are shown as below:

Technical Characteristic

Chapter Two/02

Discharge performance

- There is a centralized monitoring unit in BMS. Functions such as remote measurement, remote communication, remote controlling are available. Battery modules can be controlled remotely by staffs in control center. FEN4850 battery are in line with the requirements of the development of modern communications technology.
- It is combined by technologies of power source and computer. Parameters and status of rectifiers and AC/DC distributions can be detected and controlled.
- Excellent electromagnetic compatibility. BMS used for battery modules of FEN4850 battery can comply with the outdoor power plants during operation, no interfere with each other.
- BMS can provide protections against overcharge, over-discharge, over-temperature, over current, short circuit, etc., to assure reliable safety and operation life.
- With patented cell balancing technology, BMS provide high efficiency for cell balancing and prolong system operate life.
- Configuration flexibility, support parallel connection expansion

CC Discharge to 40.5 V at different constant current rate

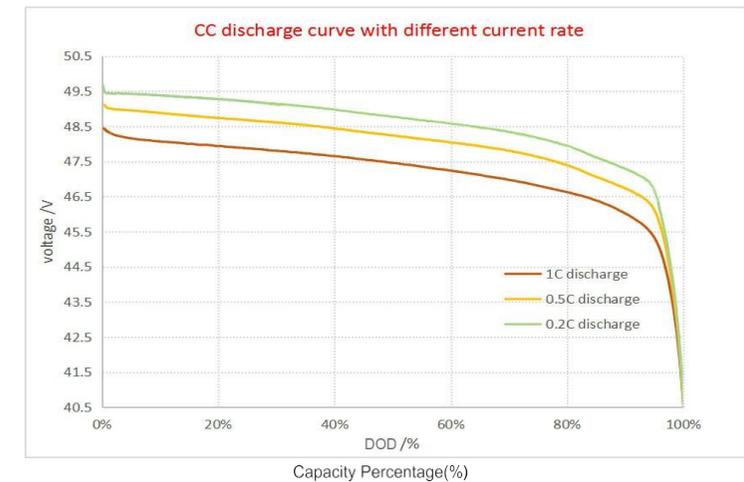


Fig.2-1 Discharge curve at different constant current of FEN4850 battery

Charge performance

CC-CV charge with different constant current rate and 54.5 V constant voltage

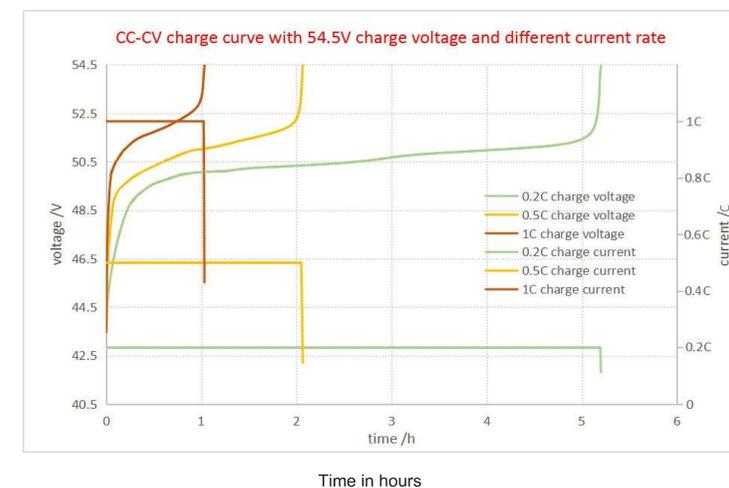


Fig.2-2 Charge curve at different current limitation of FEN4850 battery

Operation

Chapter Three/03

Parameter settings

Lead-acid batteries can be replaced by lithium battery of FEN4850 battery if power is matched. Table 3-1 is new parameter settings of power plant for lithium battery.

Table 3-1 Parameter Settings of Power Plant for FEN4850 Batteries

No.	Parameters	Units	Defaults
1	Float charge voltage	V	54.0
2	Equalization charge voltage	V	NA or 54.1
3	Standard charge current	A	0.2C
4	Charge current limitation	A	0.5C ~ 1.0C
5	Equalization charge interval	day	NA
6	Equalization charge duration	H	NA
7	Condition to equalization charge	A	NA
8	Condition to float charge	A	0.05C
9	Recovered LLVD voltage	V	50.0
10	LLVD	V	47.0
11	BLVD	V	43.2
12	Temperature compensation for float charge	-mV/°C	NA
13	Temperature compensation for equalization charge	-mV/°C	NA

Note:

1. Equalization charge is requested to switch off for FEN4850 batteries.
2. Rectifier parameter shall be set according to specific site requirement based on battery units used.
3. If the battery connected more than 2 in parallel, the max. charge current recommend 0.5C.

Operation Condition

Table 3-2 Requirements for Operation Environment

Temperature Range (°C)	Discharge	-40 ~ +60
	Charge	-40 ~ +60
	Storage	0 ~ +40
Recommended Temperature(°C)	Discharge	+15 ~ + 35
	Charge	+15 ~ + 35
	Storage	+15 ~ + 30
Humidity		5% ~ 95%

Storage and Installation

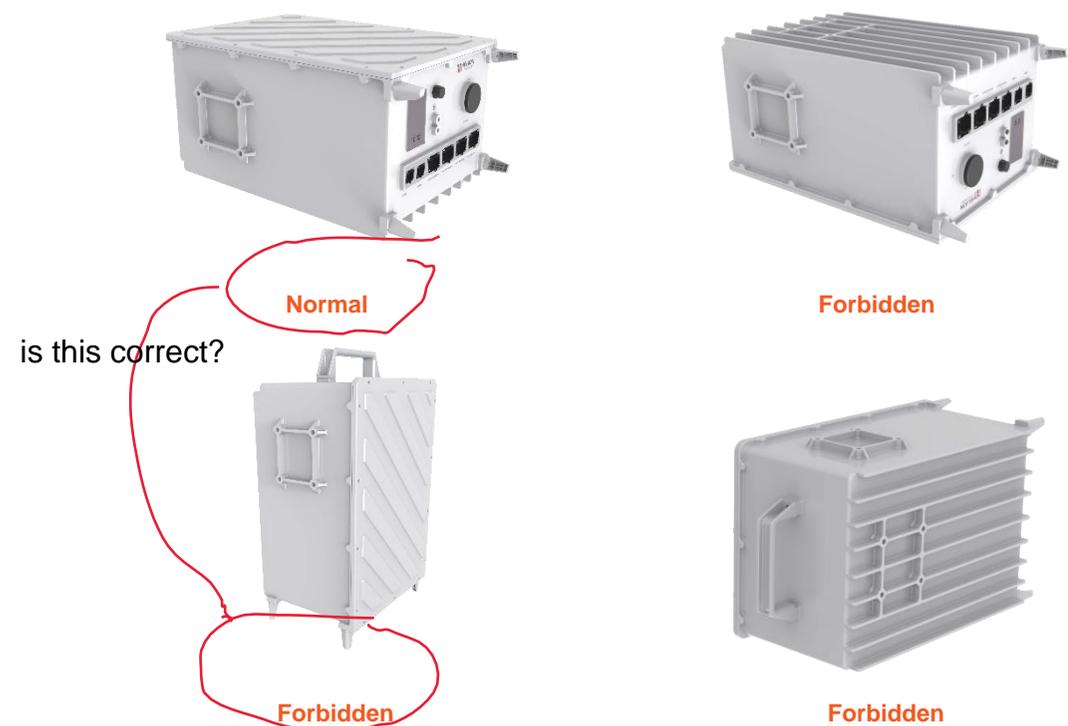
Chapter Four/04

Storage

- Storage temperature range: 0°C to 40°C.
- Storage battery should be at 50%-80%SOC.
- Recharge charge before using to recover capacity loss of self-discharge during storage and transport.
- Recharge battery during long-term storage for self-discharge. Recharge program as follow table:

Storage temperature	Recharge interval	Single Module Recharge Procedure
0°C-30°C	Every 6 months	1) Charge with 0.2C to 100%SOC 2) Discharge with 0.2C to 0%SOC
30°C-40°C	Every 3 months	3) Charge with 0.2C per module for 4 hours

- Storage battery over 40°C or under 0°C will reduce battery life,
- Storage battery in dry and low temperature, well ventilated place
- Battery performance degradation after long-term storage, please shorten shelf time as possible as you can.
- When the battery is stored and transported, the battery should be placed strictly in the following:



Installation

Unboxing & Inspection

- Please study this manual before installation.
- Please inspect the package before unboxing, if any destroy with appearance, contact with the supplier as soon as possible.
- This device shall be installed and operated by professionals.

Preparation for Installation

- Batteries shall not be placed close to heat source.
- Batteries shall be installed in place with good ventilation to assure enough heat dissipation.
- Batteries shall be placed in are with clean ambient and low humidity.
- Heavy weight shall not be placed on any cable.
- Following are the tools possibly but not limited be use for installation:



Installation of Battery Modules

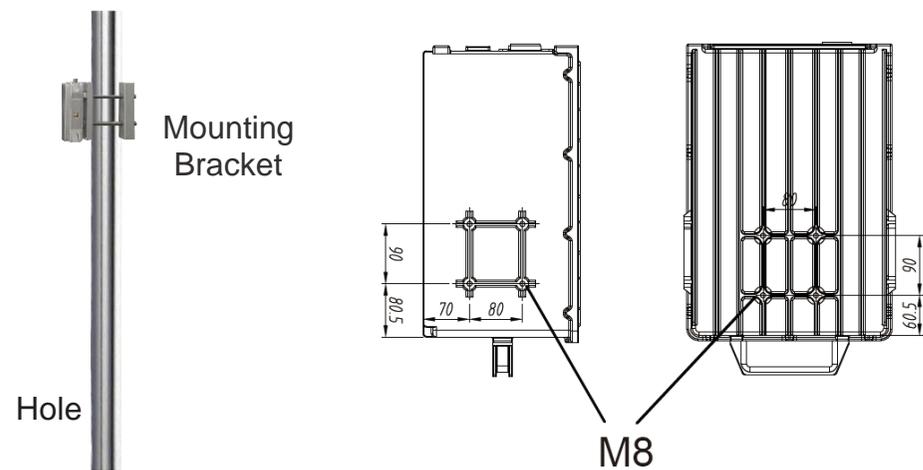
1. Installation of mounting bracket

Mounting the mounting bracket of fen4850 battery on the pole.

Note:

Because customers have different requirements for mounting brackets, Narada does not provide mounting brackets for the time being. It is configured by the customer, but the mounting holes of the mounting brackets need to match the mounting holes of the FEN4850 battery.

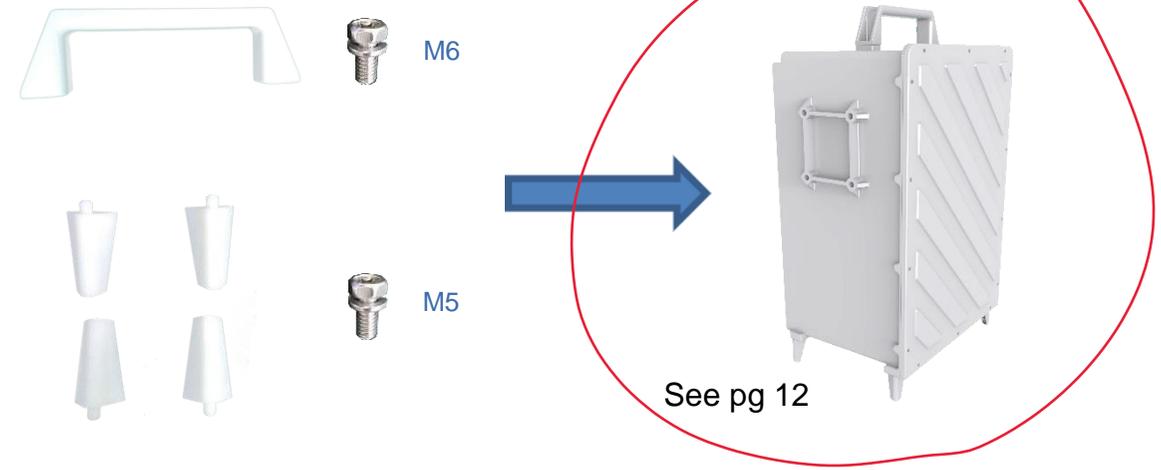
If the mounting bracket must be provided by Narada, the customer needs to provide Narada with a drawing of the mounting bracket.



Mounting holes: (Depth: 10mm)

2. Installation the handle and corner guard

Install the handle and corner protector on the battery with the mounting bolt provided by Narada. In order to facilitate the transportation of the battery, and protect the battery terminal from being damaged when the battery is dropped, causing a short circuit and causing danger.



3. Installation the battery

Install and fix the battery on the mounting bracket.

Note:

1. Due to the heavy weight of the battery, safety protection should be taken during installation to avoid personal injury when the battery accidentally falls.
2. The installation must be tight, and the battery port must face the ground.
3. Although the FEN4850 battery has an IP65 protection level and has a lightning protection configuration, it is still necessary to take protective measures such as lightning protection for the installation pole.
4. FEN4850 battery can be installed in two ways: back mounting and side mounting



4. Ground connection

Connect earth by flexible cable above GREEN Sheathed, UL94-V0, gauge of the grounding wire should be equal to or greater than the gauge of the battery return wire, .no less than 6AWG, The FEN4850 battery has 2 grounding bolts (M6).



5. RS485 communication connection

- Connect the battery to the device/PC through the communication cable provided by Narada. The cable has an anti-misconnection setting.
- If there is only one battery module in operation, communication between battery module and computer can available through RS485.
- If there are more than one battery modules in operation, parallel communication can be available using RS485.
- Communication protocols for RS485 are shown in Annex 3.

6. Battery output connection

- Connect the battery and the device busbar through the power cable provided by Narada, and the cable has an anti-misconnection setting.
- The red of the power cable is the positive, and the black is the negative.(See Annex 3)
- If multi battery modules will be connected in parallel, please take note of follows:
 - 1) The battery modules connected no more than 8 in parallel.
 - 2) Connect '+' of battery output of each battery module with positive copper bar of power plant,and '-' with negative copper bar of power plant or power switch separately.
 - 3) Length of cable between battery module and power plant shall be less than 2.0m. To make sure similar voltage drop of cable for each battery, length of all positive and negative cables should be the same.

7. Power on for battery module

- When installation is accomplished, battery module is in dormant state. Take on of the Key Switch, battery will go into normal running status, and discharge/charge can be available.
- Parameter settings for lithium battery modules in power plant are shown in Table 3-1.
- After the battery is turned on, you need to pull out the key and close the key switch protective cover to ensure that the IP protection level of the battery is IP65, and keep the key properly to avoid the loss of the key and the battery cannot be turned off and on.

6. Discharge with dummy load

- Dummy load cannot be larger maximum discharge current of FEN4850 battery according to the datasheet, and BLVD is larger than 43.2V.
- Voltage drop on cable between battery module and power plant shall be less than 0.5V . Method of calculation for cross sectional area of cable is shown as below.

$$A = \Sigma I \times L / (K \times \Delta U)$$

In the above formula, A is across sectional area of wire (mm²), ΣI is the total current (A), L is length of cable, ΔU is the permit voltage drop on cable (V), and K is electrical conductivity of wire. For example, for copper, K = 57.

Maintenance

Chapter Five/05

General

Proper maintenance will prolong the life of a battery and will aid in assuring that it can satisfy its design requirements. A good battery maintenance program will serve as a valuable aid in determining the need for battery replacement. The users must consider their application and reliability needs if maintenance procedures, other than those recommended in this document, are used. Battery maintenance should be performed by personnel knowledgeable of batteries and the safety precautions involved.

FEN4850 batteries can be used at an altitude of less than 5000 meters. If the altitude more than 5000 meters, it will affect the battery performance and life due to the decrease of air pressure and temperature.

- The battery shall be recharged every three months if in long time storage
- Please use clean and dry cloth/fabric to clean up the cabinet, if need further cleaning, please use neutral cleanser. Alcohol or ammonia synthesis is forbidden.
- Carrying shall be handled gently, prevent from severe compact
- Prevent battery from splashing liquid
- Suggest inspect the tighten of output screw every years

Troubleshooting and Solutions

Table 5-1 Troubleshooting and Solutions

Troubles	Troubleshooting	Solutions
Battery cannot discharge	Protection against under-voltage	Charge battery
	Protection against over-temperature or under-temperature (cell temperature is lower than -30°C or higher than 70°C)	Regulate cell temperature in the range of -20°C to 65°C for discharge
	Battery output is short circuit	Relieve short circuit and charge battery
	Protection against over current	Remove some unimportant load and charge battery
Battery cannot charge	System failure	Shutdown system and call maintenance service
	Battery is fully charged. Normal charge management	Do not need to solve
	Protection against over voltage	Do not need to solve
	Protection against over-temperature or under-temperature (cell temperature is lower than -0°C or higher than 65°C)	Regulate cell temperature in the range of 0°C to 55°C for charge
All LED indicators on	System failure	Shutdown system Call for maintenance service
	System failure	Shutdown system and call maintenance service
Communication failure	Fault of communication cable	Inspect communication cable
	Halt of System communication management	Restart Key Switch
	System failure	Shutdown system Call for maintenance service

Different flash status of LED indicators represents corresponding running status or alarms. Detailed information is shown Annex 1.

Note: The improvement of product and technology, and the possible of battery specification and appearance changes, Narada hold the right of final explanation!

Annex 1-Instructions for LED Flash

Annex Table 1.1 – RUN Indicators Description

Flash Status	Running Status of Battery
Flash 1	Activation state, but neither charge nor discharge
Flash 2	Charging state
Continue light	Discharging state
Extinguish	Dormant state

Annex Table 1.2 – ALM Indicators Description

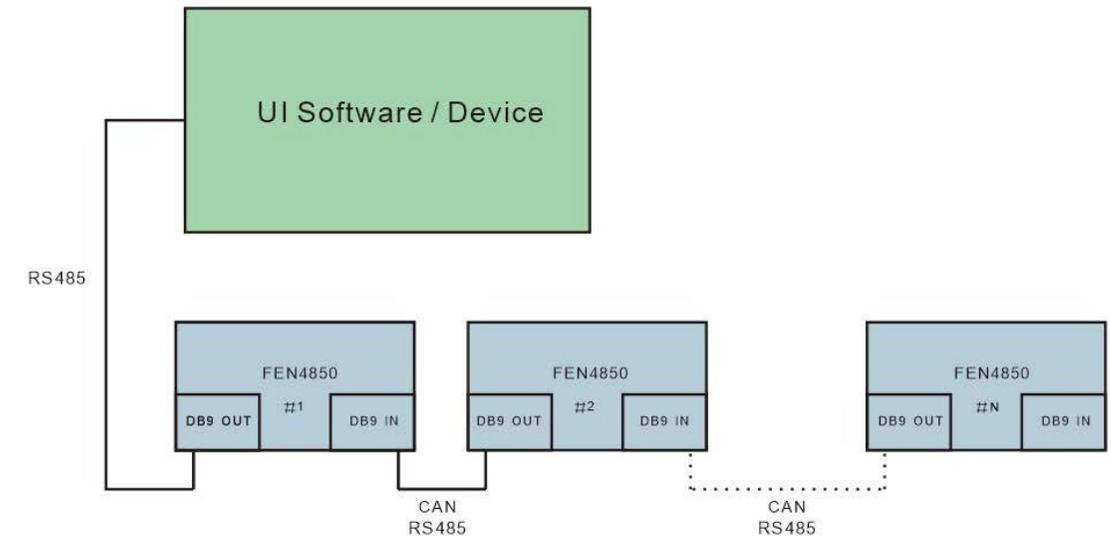
Flash Status	Alarm Information of Battery
Extinguish	Normal, no alarm
Flash 2	Minor Alarm(Various Alarm Status)
Flash 3	Major Alarm(Various protection status)
Continue light	Fail(Various fail)

Annex Table 1.3 – Flash Instruction of LED Indicators

Flash Status	ON	OFF
Flash 1	0.25s	3.75s
Flash 2	0.5s	0.5s
Flash 3	0.5s	1.5s

Annex 2 – Instructions for Parallel Communication

FEN4850 battery packs are automatic assigned addresses through CAN bus for parallel communication, and RS485 interface realizes communication with PC or other intelligent terminals. The bus interface of multiple batteries in parallel is shown in the figure below. Parallel communication supports 16 batteries maximum.

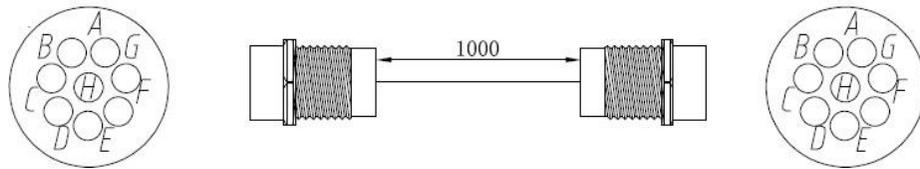


Instructions for Parallel Communication of FEN4850 battery

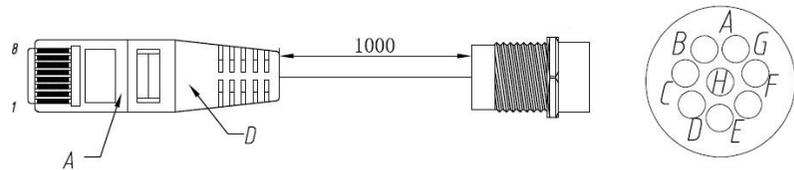
Annex 3 – Pin assignment for Communication and Power cable

The pins of power port and communication port of FEN4850 battery are marked, and the Port has anti-misconnection settings. When the corresponding pin is wrong, the connection line and terminal cannot be connected. The following is the detailed information of port pin:

Annex Table 3.1 – Pin assignment for Communication port and cable



Pins	Color	Definition
A-A	Red	-----
B-B	Black	-----
C-C	White	RS485 A (+)
D-D	Yellow	RS485 B (-)

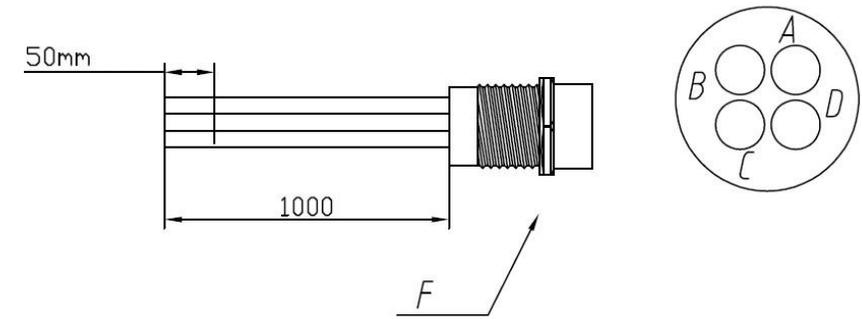


Pins	Color	Definition
1-D	Orange & White	-----
2-C	Orange	RS485 A (+)
3-D	Green & White	RS485 B (-)
4-	-----	-----
5-	-----	-----
6-	-----	-----
7-A	Brown & White	-----
8-B	Brown	-----

Communication Protocol:

Narada Modbus 1.5 (Can be changed according to customer requirements)

Annex Table 3.2 – Pin assignment for Power port and cable



Pins	Color	Definition
A	Red	Positive
B	Red	Positive
C	Black	Negative
D	Black	Negative

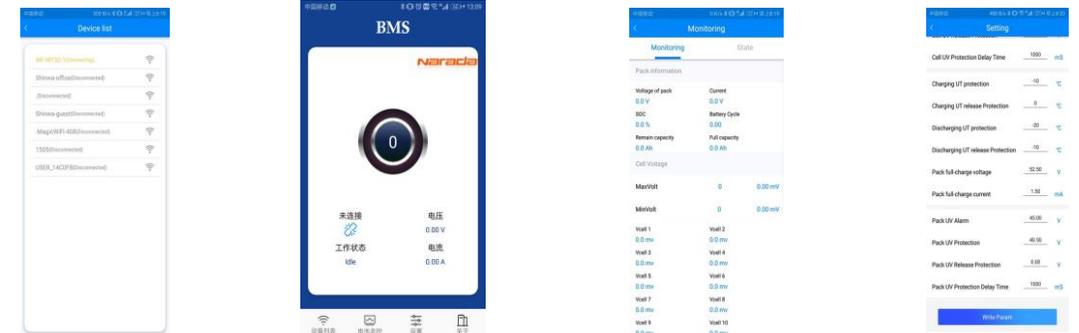
Annex 4– Introduction of WIFI

FEN4850 battery has WIFI function, you can connect the battery through mobile phone WIFI and view battery data.(Only supports Android system)

- 1, Install the WIFI App on the mobile phone, and open the WIFI of the phone.



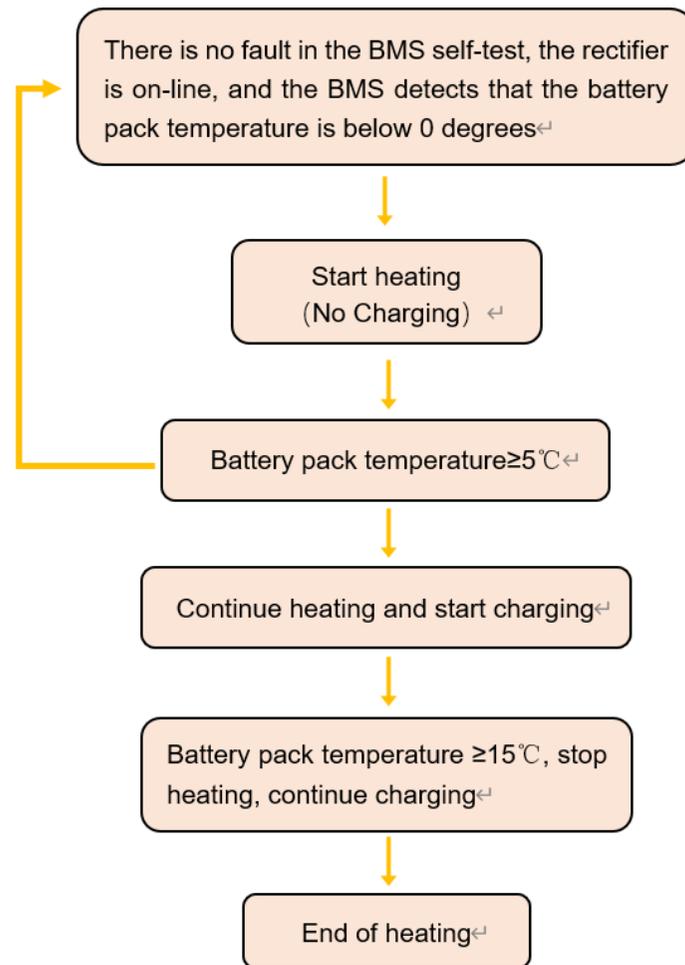
- 2, Open the App and connect the corresponding battery WIFI, then you can check the data of battery,



Annex 5 – Heating Introduction

The FEN4850 battery has a low temperature heating function. When the ambient temperature is too low, the battery will automatically heat up.

Annex Table 5.1 – Heating Process



Note:

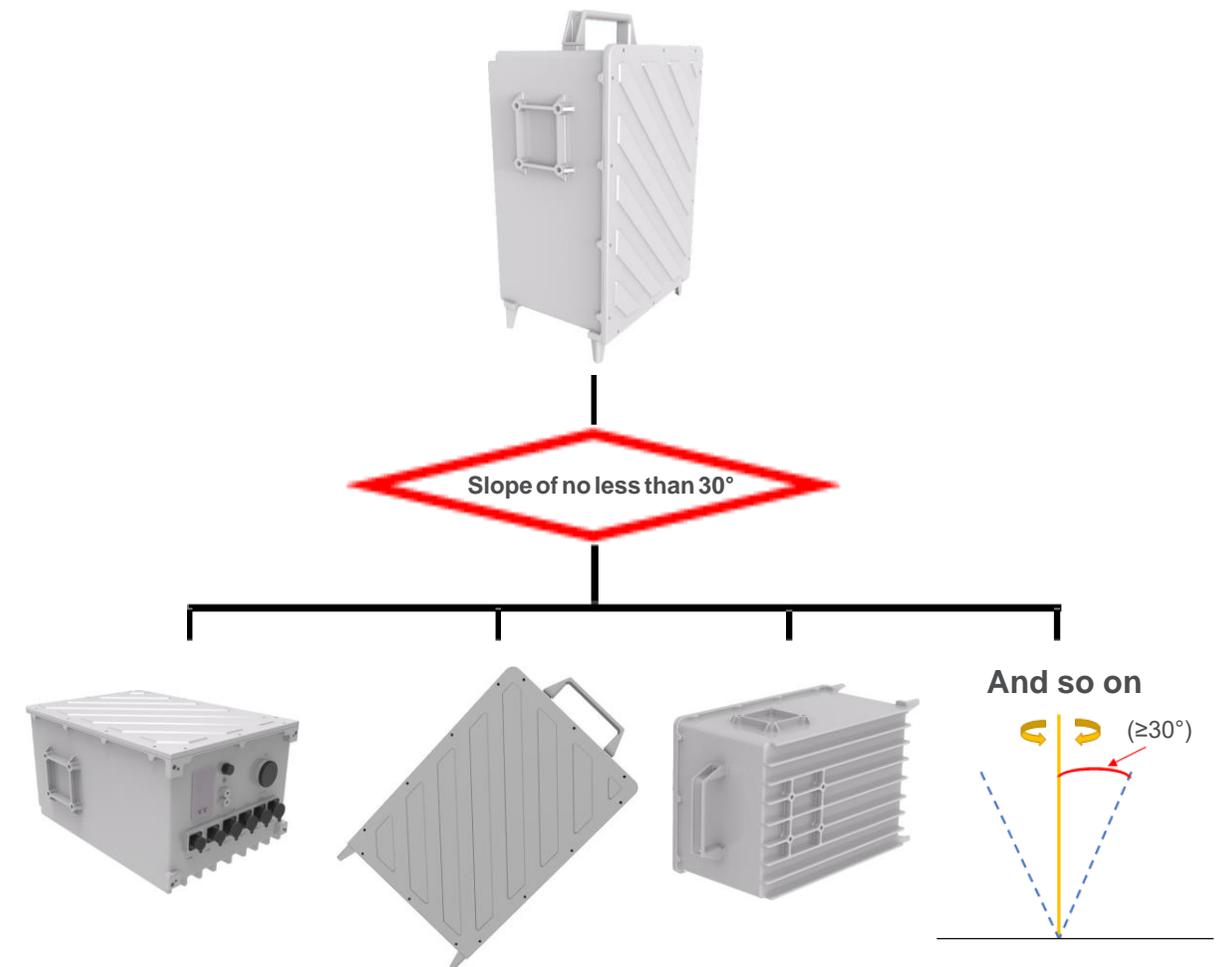
- The minimum temperature is greater than 15 degrees to stop heating.
- Stop heating when the minimum temperature is higher than 10°, and the maximum temperature is greater than 30 degrees or full power.
- When the minimum temperature is higher than 10° and the temperature difference is greater than 10°C, stop heating and stop heating.
- The normal rated power of the whole heating module is 230W.

Annex 4 – Anti-theft(Tilt Sensor) Instruction

The tilt sensor is a sensitive vibration sensor that has been added to the battery. After moving the battery, the tilt sensor generates a signal and transmits it to the BMS. BMS receives and analyzes whether the movement meets the conditions for locking the battery. If the conditions are met, the battery will be locked and cannot be discharged. Otherwise, the battery can be used normally.

Annex 4.1 Trigger condition

When slope angle of battery is moved more than 30° in space direction, tilt sensor generate a signal and send to BMS.



Annex 4.2 Factory default state

1	The anti-theft function is turned off by default when the battery out the factory.	
2	When the customer receives the battery, turn on the battery switch and connect the battery to the UI software. After the connection is successful, use the UI software to turn on the anti-theft function of the battery.	
3	When the battery triggers the lock condition, the battery will be locked.	
4	If battery is installed "vertically", the gyroscope should be set to "horizontal".	

Annex 4.3 Unlock method

Send an unlocking command from UI software, transfer it to BMS with RS485 communication cable. And then BMS unlock battery.

1	Connect the battery and computer with RS485 communication cable
2	Open the software on the computer, communication the battery and the software
3	Enter the unlock password in the software and click the "Unlock" button
4	The battery is successfully of unlocked

Annex 4.4 Disable anti-theft setting

Operate in software of laptop, enter disable password, then close anti-theft function.

1	Connect the battery and computer with RS485 communication cable
2	Open the software with the computer, communication the battery and the software
3	Enter the password of "Close security" in the software and click the "Disable" button
4	The battery is successfully to turn-off the anti-theft function
5	If re-enable the anti-theft feature, open the software to select Anti-theft and click the "Enable" button

Annex 4.5 Tilt Sensor Installation method setting (Optional)

1	Connect the battery and computer with RS485 communication cable
2	Open the software with the computer, communication the battery and the software
3	Setting the "Install-method" of the tilt sensor(Vertical/Horizontal), click the "Write/Set" button
4	The tilt-sensor is successfully to setting the install-method
5	If the battery is placed horizontally, the tilt sensor should be set to "vertical" installation; if the battery is placed vertically, the tilt sensor should be set to "horizontal" installation.

After-sale Services

NARADA POWER SOURCE CO., LTD.

Building A, No.822 Wen'er West Road, Hangzhou, Zhejiang, China

Tel: +86-571-56975980

Fax: +86-571-56975955

Website: en.naradapower.com E-mail: intl@narada.biz

NARADA ASIA PACIFIC PTE. LTD.

Block 9 Khaki Bukit Road 1 #02-10 Eunos Technolink, Singapore 415938

Tel: +65-6848 1191

Fax: +65-6749 3498

Website: www.narada-ap.com

Email: sales@narada-ap.com

NARADA EUROPE (UK) LIMITED

Spectrum House, Dunstable Road, Redbourn, St. Albans, Herts AL3 7PR

Tel: +44 (0)845 612 2031

Fax: +44 (0)845 612 2031

E-mail: sales@naradaeurope.com

MPINARADA – North America

44 Oak Street Newton, MA 02464, U.S.A

Tel: +1 800-982-4339

Fax: +1 800-982-4339

E-mail: sales@mpinarada.com

Website: www.mpinarada.com