

LiFePO4 Battery 12.8V24AH

Instruction Manual

Soshine International
www.soshine.com.cn
summer@soshine.com.cn

1 Model: IFR12.8V24AH(4S4P)M5

2 Application Condition

Customers should use the battery according to the following correct conditions of use, customer should apply BMS to monitor, manage and protect each battery.

2.1 Authorization

Without authorization, the customer shall not modify or change the design and framework of the battery management system, to make sure not to affect the performance of the battery.

2.2 Management files

Customer shall build the battery management files. The customer shall keep the monitoring data of the complete battery operation as a reference for product quality responsibility.

The Soshine does not undertake the product quality assurance responsibility without the inspection data of the complete battery system.

2.3 Management system requirements

The battery management system needs to meet the following basic requirements:

| No. | Parameter | Specification | Protection Action |
|-------|--------------------------|-----------------------------|---|
| 2.3.1 | Absolute Charge | 14.2V | Stop charging when the voltage reaches 14.2V |
| 2.3.2 | Absolute Discharge | 10.8V (Min.) | Stop discharging when the battery voltage reaches 10.8V, Minimize the current |
| 2.3.3 | Charge mode | CC/CV | Constant current charging to 14.2V, constant voltage charging to 14.2V. Cutoff current 0.01C(240mA) |
| 2.3.4 | Short-circuit Protection | Disconnect | When a short circuit occurs, the battery is disconnected from the over current |
| 2.3.5 | Over current Protection | According to 4.11, and 4.14 | the battery management system controls the discharge current to meet the specifications |
| 2.3.6 | Overheat Protection | According to 4.16 and 4.17 | The charge/discharge is terminated when the temperature exceeds the specification of this specification |
| 2.3.7 | Charging Time Protection | Within 8 hours | Stop charging when charging time is over 8 hours |

NOTES: As for above No. 11.3.1, 11.3.2, 11.3.4, 11.3.6 are warning clauses, the customer please note: when the battery reaches any of these describe indicators and parameters, it means that the battery has already beyond the conditions of use, the customer should be in accordance with the "protection" and other relevant provisions this specification of battery protection measures, at the same time, Soshine statement on the using state of the battery does not undertake any guarantee responsibility for the quality.

2.4 Charge

Charging current: The maximum charging current specified in the specification cannot be exceeded.

Charging voltage: Not exceed the highest limit voltage specified in the specification.

Charging temperature: The charging temperature of the battery must be performed in accordance with the temperature range of the specification.

Charging method: Constant current and then constant voltage charging.

2.5 Discharge current

The battery discharge current cannot exceed the maximum discharge current specified in the specification. Excessive current discharge will cause the battery to heat up and reduce its capacity.

2.6 Over-discharge

The battery may be permanently damaged when the battery voltage is less than 6V, and the product quality assurance of Soshine will be invalid. According to 11.1.3.2 this specification, the internal energy consumption of the system should be reduced to minimum when the discharge cut-off voltage is below 10.8V, and the storage time is prolonged before recharging. The customer needs to train the user to recharge the battery in the shortest time to prevent the battery from over-discharge state.

2.7 Battery storage

If the battery is expected to be stored for more than 30 days, the SOC should be adjusted to about 30%. If the battery is expected to be stored for more than 180days, the SOC should be adjusted to about 80% and the battery to be charged and discharged at least once in the whole SOC range (10.8~14.2V) for every 90 days .

2.8 Charge at low temperatures

The battery should avoid charging (including standard charging, quick charging, emergency charging) in the low-temperature conditions which is prohibited in this specification, otherwise, unexpected capacity reduction may occur. The battery management system should be controlled according to the minimum charge and regenerative charging temperature. It is forbidden to charge when temperature is lower than the temperature conditions specified in this specification. Otherwise, Soshine shall not be liable for quality assurance

2.9 Battery heat diffusion

In the design of the electric box, the heat diffusion of the battery should be fully considered. Soshine shall not be responsible for the quality assurance due to the overheating of the battery or battery caused by the design of the electric box.

2.10 Waterproof and dustproof

The waterproof and dustproof problem should be fully considered in the electrical box design, and the electric box must meet the waterproof and dust-proof grade stipulated by the relevant national standards. Soshine is not responsible for quality assurance due to the damage caused by the waterproof and dustproof problem (such as corrosion, rust, etc.).

3 Charger Requirements

3.1 Special charger for LiFePO4 battery

It is recommended to use a special charger for LiFePO4, constant current and constant voltage charging (fully charged cut-off voltage 14.2V), with short circuit protection, overcharge protection, reverse connection protection, and anti-backfill function. Charging current 12A (max).

3.2 Solar panel intelligent charge and discharge controller

Select LiFePO4 charger mode.

Constant current and constant voltage charging (fully charged cut-off voltage 14.2V), with short circuit protection, overcharge protection, reverse connection protection, and anti-backfill function.

Charging current 12A (max)

3.3 Lead-acid battery charger

It is recommended to use three-stage charger with overcharge protection, and short-circuit protection.

Voltage range: charge cut-off voltage 13.5~4.6V, float voltage 13.7~3.8V, over discharge voltage 10.8~11V.

Charging current 12A (max)

Lead-acid chargers that meet the above requirements can be used, but the battery may be overcharged, and the long-term use will shorten the life of some batteries or not fully charged, and the full capacity will be reduced by about 5% compared to the normal capacity.

4 Battery Specification

| No. | Items | Specifications | | Remark |
|------|---|---|------------------------|--|
| 4.1 | Type | LiFePO4 | | Lithium iron phosphate |
| 4.2 | Capacity | Nominal Capacity | 24Ah | 0.2C Standard discharge & new battery status |
| | | Minimum Capacity | 23.5Ah | |
| 4.3 | Voltage | Nominal Voltage | 12.8V | Means operation voltage |
| 4.4 | | Operation Voltage | 10.8~14.2V | |
| 4.5 | | Absolute Charging Voltage | 14.2 ±0.03V | By standard charge method, 3.55V max for unit cell |
| 4.6 | | Discharge Cut-off Voltage | 10.8V | 2.7V for unit cell |
| 4.7 | | Delivery Voltage | 12.8~13.2V | Within 10 days from factory |
| 4.8 | Standard Charging Method | 0.2C constant current, 14.2V constant voltage charge to 14.2V, continue charging till current decline to ≤0.01C | | |
| 4.9 | Charge Current | 0.2C(Standard) | 4.8A | Standard charge, charge time about 7.5h(Ref) |
| 4.10 | | 0.5C | 12A | Rapid charge, charge time about: 3h(Ref) |
| 4.11 | | 0.5C(Maximum) | 12A | For continuous charging mode. Ambient temperature 25°C |
| 4.12 | Discharge Current | 0.2C(Standard) | 4.8A | constant current discharge to 10.8V |
| 4.13 | | 0.5C | 12A | For continuous discharge mode. Ambient temperature 25°C |
| 4.14 | | 2C(Maximum) | 24A | The surface temperature of the cells ≤60°C |
| 4.15 | Impedance | Battery Internal | <60mΩ | Internal resistance measured at AC 1KHz new battery after 50% charge new battery |
| 4.16 | Operation Temperature and Relative Humidity Range | Absolute Charge | 0~45°C 60±25%R.H. | Battery Surface Temperature Charge at a very low temperature such as below 0°C, will be get a lower capacity and reduce cycle life of the battery. Beyond the temperature range of charge and discharge, the battery must stop working. |
| 4.17 | | Absolute Discharge | -20~60°C 60±25%R.H. | |
| 4.18 | | Standard Charging Temperature | 25±2°C | |
| 4.19 | | Standard Discharging Temperature | 25±2°C | |
| 4.20 | Storage Temperature for a Long Time | -20~25°C 60±25% R.H. | | Do not store for more than a year. It must be charged once in storage for half a year. |
| 4.21 | Self-discharge Rate Per Month | ≤3.5% | | New battery after stored more than 3 months. |
| 4.22 | Shipment Capacity | 30% SOC (≥7.2Ah) | | |
| 4.23 | Weight | About 2.9±0.3kg | | |
| 4.24 | Cycle | >1000-2000 times | | 80% D.O.D. |
| 4.25 | Output Terminals | M5 | | |
| 4.26 | Maximum Number of Concatenations | Four in series | | The dropout voltage between batteries ≤0.1V |

5 BMS Specification

| No. | Items | Specifications | |
|------|---------------------------|--|----------------------------------|
| 5.1 | Current | Operating current | $\leq 24A$ |
| 5.2 | Temperature | Operating temperature | $-40^{\circ}C \sim +85^{\circ}C$ |
| 5.3 | Self-consumption | Operating state | $\leq 100\mu A$ |
| 5.4 | Internal resistance | MOSFET | $\leq 30m\Omega$ |
| 5.5 | Overcharge protection | Protective voltage | $3.90 \pm 0.05V$ |
| 5.6 | | Restore voltage | $3.60 \pm 0.1V$ |
| 5.7 | | Overcharge protection delay | $0.5S \sim 2S$ |
| 5.8 | Over-discharge protection | Protective voltage | $2.0 \pm 0.1V$ |
| 5.9 | | Restore voltage | $2.70 \pm 0.1V$ |
| 5.10 | | Over discharge protection delay | $10 \sim 200mS$ |
| 5.11 | | Over current protection | $150 \pm 30A$ |
| 5.12 | Short circuit protection | Protection delay | $200 \sim 800\mu s$ |
| 5.13 | | Recovery conditions | Cut off the load |
| 5.14 | Temperature protection | Charging temperature protection (battery) | $75 \pm 5^{\circ}C$ |
| 5.15 | | Discharge temperature protection (battery) | $75 \pm 5^{\circ}C$ |
| 5.16 | Charge equalizer | Start-up voltage | $3.55 \pm 0.05V$ |
| 5.17 | | Equalize the current | $65 \pm 5mA$ |

6 Features

6.1 Superior “Useable” Capacity

Unlike with lead acid batteries, it is considered practical to regularly use 90% or more of the rated capacity of a lithium battery bank, and occasionally more

6.2 Extended Cycle Life

in real use, standard quality LiFePo4 batteries can deliver at least 2000 charge/discharge cycles at 80% DoD and 1C discharge rate, and the remaining capacity remains above 80%. These values are dependent on the charge rate, the depth of discharge but more importantly on the quality of the cells used.

6.3 Voltage Sag Virtually Non Existant

The discharge curve of lithium batteries (especially relative to lead acid) is essentially flat – meaning that a 20% charged battery will be providing nearly the same output voltage as an 80% charged battery.

This prevents any issues caused by the “voltage sag” common to lead acid as they discharge, but does mean that any battery monitor or generator auto-start dependent upon voltage levels will likely not work well at all when monitoring a lithium bank.

6.4 Size & Weight Advantages

The same capacity battery, lead-acid battery is twice the volume and three times heavier than the iron-lithium battery

7 Charging Time & Discharging Time

7.1 Charging Time

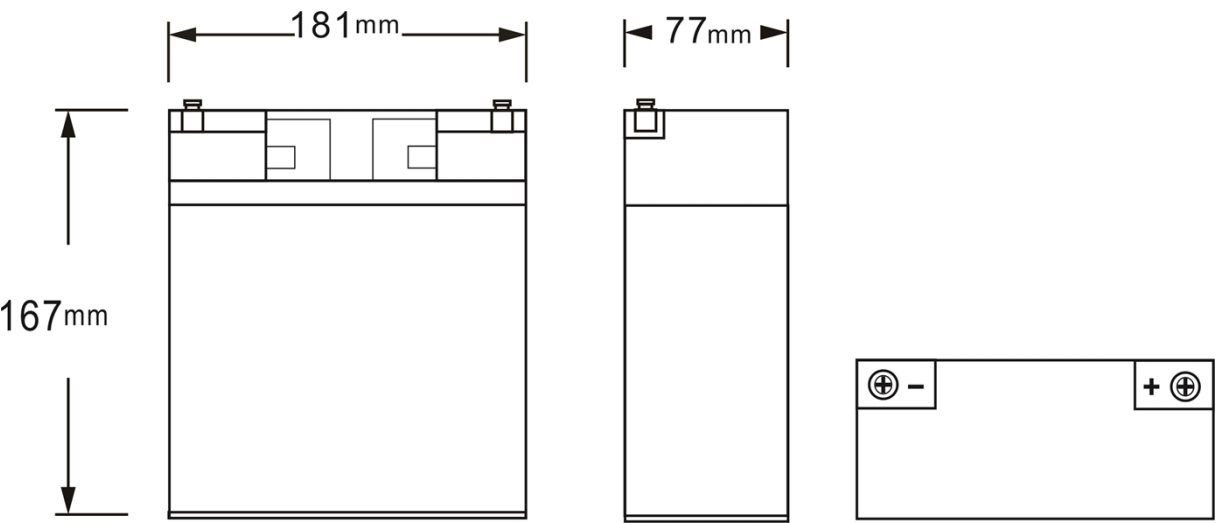
| Item | Specifications | | | |
|----------------|----------------|-----------|-----------|-----------|
| Charge current | 0.2C(4.8A) | 5A | 6A | 0.5C(12A) |
| Charge mode | CC/CV | CC/CV | CC/CV | CC/CV |
| Charging time | 7 hours | 6.7 hours | 5.6 hours | 2.8 hours |

7.2 Discharging Time

| Item | Specifications | | | | |
|-------------------|----------------|------------|------------|-----------|-----------|
| Discharge current | 1A | 0.1C(2.4A) | 0.2C(4.8A) | 0.5C(12A) | 0.5C(24A) |
| Discharging time | 24 hours | 10 hours | 5 hours | 2 hours | 1 hour |

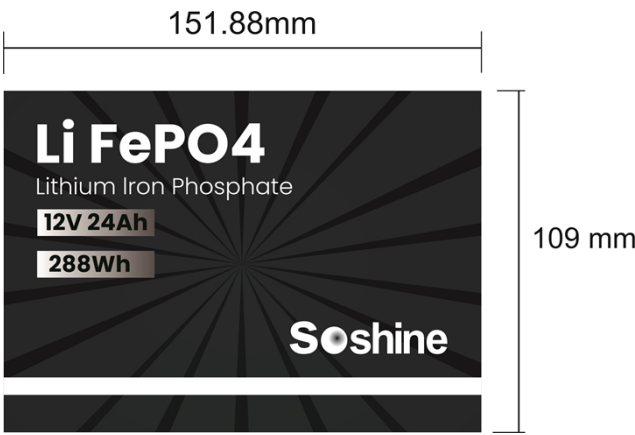
8 Battery Initial Dimensions and Label

8.1 Dimensions



| No. | Item | Unit: mm |
|-----|----------------|-----------|
| 1 | Battery length | L 181±0.2 |
| 2 | Battery width | W 167±0.2 |
| 3 | Battery height | H 77±0.2 |

8.2 Battery label



9 Considerations for Different Charging Methods

| Battery Surface Temperature | Standard Charge | Fast Charge | Fierce charge |
|-----------------------------|-----------------|-------------|---------------|
| $<0^{\circ}\text{C}$ | Prohibited | Prohibited | Prohibited |
| $>45^{\circ}\text{C}$ | Prohibited | Prohibited | Prohibited |
| $0\sim10^{\circ}\text{C}$ | 0.2C | 0.5C | Prohibited |
| $10\sim20^{\circ}\text{C}$ | 0.5C | 0.5C | Prohibited |
| $20\sim45^{\circ}\text{C}$ | 0.5C | Prohibited | Prohibited |

10 Battery Replacement

Battery life is limited. Customers should set up an effective tracking system to detect and record the internal resistance of the battery. The measurement methods and calculation methods of internal resistance require customers and Soshine to discuss and agree with both parties. When the battery internal resistance is more than 250% of the initial resistance, they should stop using the battery. Any violation of the requirements shall be exempted from Soshine's quality guarantee responsibility which based on product sales contract and this specification.

11 Storage and Cycling Performance

| No. | Parameter | Specification | Conditions |
|------|--------------------------------------|---|--|
| 11.1 | Recoverable Capacity (Short time) | $\geq 23.28\text{Ah}$ | New battery is charged to 50% SOC, then stored at 25°C for 28 days. Test capacity according to the standard charge and discharge conditions listed in Sections 4.9, 4.5 and 4.12, 4.6 of this specification. |
| 11.2 | Recoverable Capacity (Long time) | $\geq 22.8\text{Ah}$ | New battery is charged to 50% SOC, then stored at 25°C for 180 days. Test capacity according to the standard charge and discharge conditions listed in Sections 4.9, 4.5 and 4.12, 4.6 of this specification. |
| 11.3 | Absolute Storage Temperature | $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$ | |
| 11.4 | Capacity After Cycle | $\geq 19.2\text{Ah}$ (1000 times cycle) | New Battery, cycled according to the standard charge/discharge 80% D.O.D. |

12 Period of Warranty

The period of warranty is one year from the date of shipment. Guarantees to give a replacement in case of batteries with defects proven due to manufacturing process instead of the customer abuse and misuse.

13 Storage of the Batteries

The batteries should be stored at room temperature, charged to about 30% to 80% of capacity.

We recommend that batteries be charged about once per half a year to prevent over discharge.

14 Battery Performance Attenuation

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

15 Note

Any other items which are not covered in this specification shall be agreed by both parties.

16 CAUTIONS IN USE

To ensure proper use of the battery please read the manual carefully before using it.

Handling

- When charging and discharging, do not reverse the battery connection. The positive pole must correspond to the positive pole, and the negative pole must correspond to the negative pole
- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery.
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.
- Don't transport and store the battery together with metal objects such as necklaces, hairpins.
- Don't pierce the battery with a nail or other sharp object.

Charge and discharge

- Battery must be charged in appropriate charger only.
- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

Storage

- Store the battery in a cool, dry and well-ventilated area.

Disposal

- **If the battery beyond the useful-life, please fully discharged, sticks the battery with insulating tape, then put the battery to the specialized recycle bin.**
- Regulations vary for different countries. Dispose of in accordance with local regulations.