



## 12V COOLING SYSTEM – 2000EL

### User Manual

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Version 1.0

01/01/2025



# Table of Contents

<b>1. Introduction .....</b>	<b>4</b>
<b>2. Safety Instructions.....</b>	<b>5</b>
2.1 General Safety Information .....	5
2.2 Understand Signal Words .....	5
<b>3. Product Information.....</b>	<b>6</b>
3.1 Product Application .....	6
3.2 Performance Parameters .....	7
3.3 Product Features .....	9
<b>4. A/C Unit Working Principle .....</b>	<b>10</b>
4.1 Wire Diagram .....	10
4.2 Cooling Schematic Diagram .....	11
4.3 Parts Name .....	11
<b>5. A/C Unit Operation Instruction .....</b>	<b>12</b>
5.1 Remote Control and Display Panel Operation .....	13
5.2 Maintenance .....	14
5.3 Troubleshooting .....	15
5.4 Warranty .....	16
<b>6. Battery Operation Instruction .....</b>	<b>17</b>
6.1 Safety and Convenience Features.....	17
6.2 Installation Do's & Don'ts .....	18
6.3 Usage Do's & Don'ts.....	19
6.4 Maintenance Do's & Don'ts.....	19
6.5 Troubleshooting Tips .....	20
6.6 Frequently Asked Questions.....	20
6.7 Warranty .....	21
<b>7. Contact Us .....</b>	<b>22</b>

# 1. Introduction

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Thank you for purchasing the Polar Fox E-APU Elite 24V Cooling System – 2600EL. This service manual provides detailed instructions for installation, maintenance, and troubleshooting. We encourage you to read this manual carefully before use to ensure optimal performance and safe operation of your electric APU.

Please note that due to ongoing product improvements or updates, the electric APU you received may differ slightly from the images or descriptions in this manual. We apologize for any inconvenience this may cause. If you have any questions or need assistance, please don't hesitate to contact us directly for prompt support.

Thank you once again for choosing the Polar Fox E-APU. Enjoy your cooling comfort!

## 2. Safety Instructions

This manual has safety information and instructions to help consumers eliminate or reduce the risk of accidents and injuries.

### 2.1 General Safety Information

This is the safety alert symbol. When seeing this symbol in this manual, be alert to the potential for personal injury.



### 2.2 Understand Signal Words

A signal word, **WARNING** or **CAUTION** is used with the safety-alert symbol. They indicate the level of risk for potential injury.

This symbol indicates the hazard or unsafe operation which, if not avoided, could result in death or serious injury.



This symbol indicates the hazard or unsafe operation which, if not avoided, could result in personal injury or damage to air conditioner.



This symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.



Read and follow all safety information and instructions carefully.

## 3. Product Information

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Model Number: 2000EL

### 3.1 Product Application

A. This split-mounted air conditioner, with the cooling function only, powered by a 400AH DC12V dual-purpose battery bank, can cool while the vehicle is running or the engine is turned off.

B. This split-mounted air conditioner is designed for Trucks, Construction Vehicles, and other Specialty Vehicles and Equipment.

C. This split-mounted air conditioner features high cooling performance, high anti-vibration, and anti-impact ability, and can be widely applied on various vehicles and lifting equipment.

D. The ability of the air conditioner to maintain the desired inside temperature depends on the heat gain of the area being cooled. Some preventative measures taken by the vehicle's occupants can reduce the heat gain and improve the air conditioner's performance. During extremely high outdoor temperatures, the heat gain of the vehicle may be reduced by:

- ◆ Parking the vehicle in a shaded area;
- ◆ Using window shades (blinds and/or curtains);
- ◆ Keeping windows and doors shut and minimizing their usage;
- ◆ Avoiding the use of heat-producing appliances.

E. Operating on a *High Fan/Cooling* mode will maximize efficiency in high humidity or outside temperatures.

## 3.2 Performance Parameters

### Air Conditioner Specification

Model NO.		DL2600EL
Items	Unit	Value
Rated input voltage	VDC	24
Working voltage range	VDC	21.5~32V
Cooling capacity	BTU	10000
Rated input power	W	912
Rated current consumption	A	38
Working current range	A	10-45
Airflow	CFM	300
Climate Type	/	T1
Working temperature range	°F	69.8-109.4
Adjustable temperature range	°F	60.8-89.6
The Max. Working suction & exhaust pressure	Mpa	0.4/1.8
Refrigerant charging weight	R-134a	700g
Compressor Type	/	DC24V Electric Compressor
Compressor lubricating oil	RB68EP	350ML
Gross/Net weight	lbs	22.0/15.4 (Evaporator System)
		39.7/35.3 (Compressor System)
		15.4/13.2 (Condenser System)
Dimensions(L*W*H)	Inch	21.0*12.4*8.74 (Evaporator System)
		13.9*10.7*6.8 (Compressor System)
		18.5*14.1*7.6 (Condenser System)

### Test condition for cooling capacity

1. Indoor dry-bulb temperature: 80.6°F, wet-bulb temperature: 67.1°F;
2. Outdoor dry-bulb temperature: 95°F, wet-bulb temperature: 75.2°F.

Note: a. Concerning product improvement, we reserve the right to change the parameters without prior notice.

### Battery Bank Specification

Items	Unit	Value
Applicable voltage platform	/	12V
Cell type (UL1962/1973,9540)	/	LiFePO4
System Capacity	Ah	400
Serial-parallel configuration	/	1P4S
Energy capacity	kWh	5.12
Operating voltage range	V	10-14
Maximum continuous charging current	A	400 (up to the capacity of the alternator)
Charging voltage upper limit	V	14.6
Maximum starting current	A	9,600
Operating temperature	°F	-40 - 149
Storage temperature	°F	-4 - 140
Operating humidity	R.H.	0-90% ±5
System static power consumption	mA	≤5
Communication	/	CAN/Bluetooth
Upgrade method	/	CAN/App
Ingression protection	/	IP67
Weight	lbs	119.2±4.4

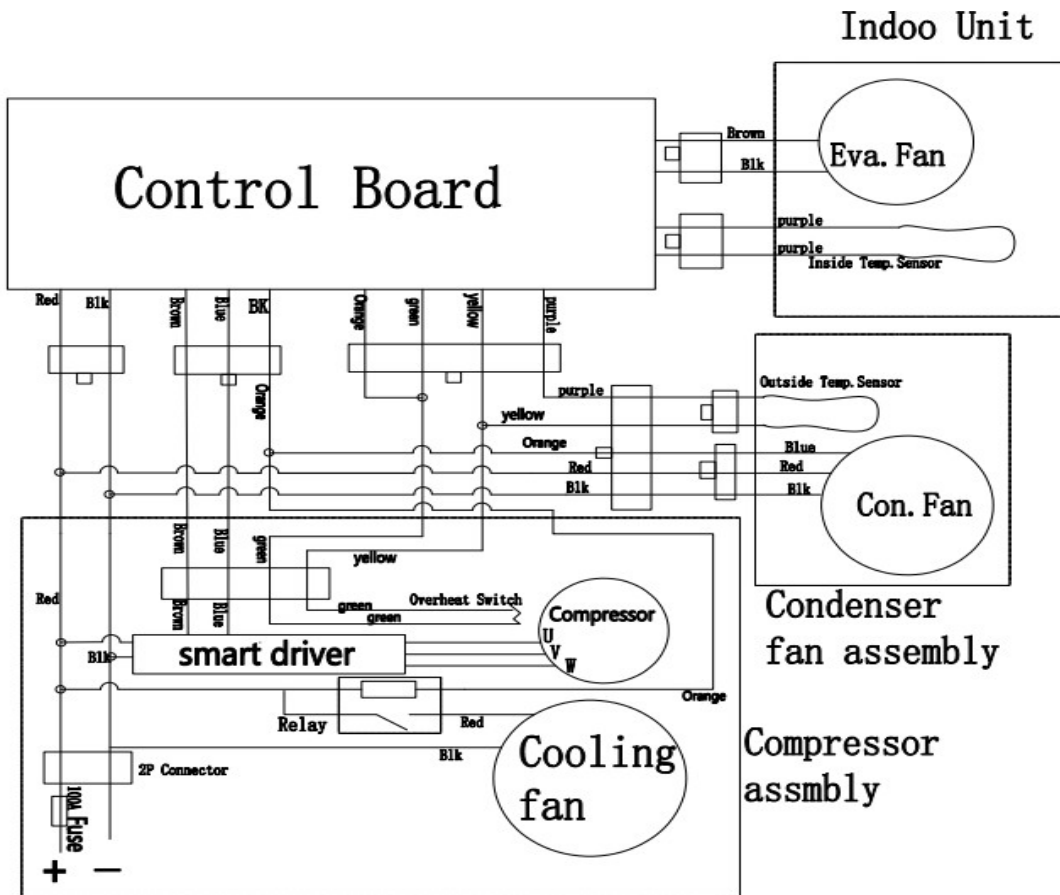


### 3.3 Product Features

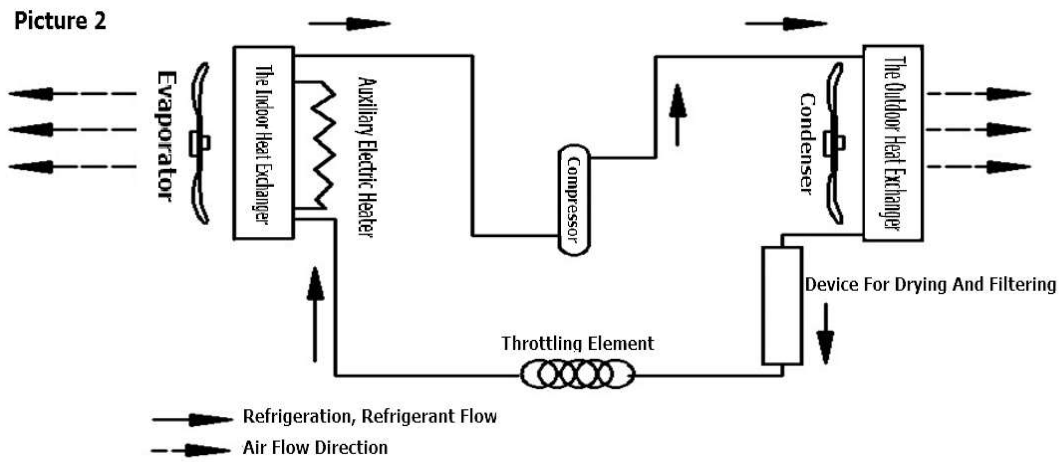
- ▶ **Excellent operation efficiency:** this is a self-contained DC (direct current) air conditioner energized exclusively by the vehicle's battery pack dedicated to the air conditioner. No Inverters, auxiliary power units, or generators are needed. Reliance on the "grid" is not required. The batteries are charged when the vehicle is running; the batteries are discharged when running the air conditioner.
- ▶ **Environmental protection:** R134a environmental-protection refrigerant is used in the unit, the most environmentally friendly refrigerant in the market.
- ▶ **Frequency conversion:** designed with the frequency conversion technology, the running speed of the compressor and heating exchange fans would be changed upon different setting temp. and the ambient temp., allowing quick cooling and power saving.
- ▶ **Rapid refrigerating/adjustable temperature:** The efficiency of the compressor allows the environmental temperature to be reduced to the desired comfort level by the user in a short time.
- ▶ **Fuel cost saving:** The product is powered by the DC12V battery pack and converts to 24V with a converter. It creates a comfortable cabin for drivers/operators without idling, letting the drivers/operators enjoy the free cooling.
- ▶ **Low noise:** the frequency conversion design offers quiet working during nighttime use, letting the drivers/operators enjoy comfortable cooling.
- ▶ **Reduces maintenance:** The less engine idles, the less maintenance they require.
- ▶ **Safety features:** The air-conditioning system includes system pressure fault protection, power over-voltage and under-voltage protection, motor over-current, and overload or default phase self-protection, resulting in a system that is safe and reliable.
- ▶ **Bluetooth phone connectivity via mobile app** makes it easy to monitor battery status, and cycles, identify the charging and discharging state of the battery, and diagnose whether faults are vehicle or battery-related. For example, if there is no charging current after starting, you can check whether the line contact is good or the generator is working.
- ▶ **Our dual-purpose lithium-ion battery** powers cabin heating, cooling, and other power loads.

## 4. A/C Unit Working Principle

### 4.1 Wire Diagram



## 4.2 Cooling Schematic Diagram



Picture 2 Refrigeration Principle

## 4.3 Parts Name



Compressor System



Condenser System



Evaporator System

## 5. A/C Unit Operation Instruction

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Read and thoroughly understand this user manual before operating and maintaining the air conditioner.

Please do not use this air conditioner where the ambient temperature over 43°C/109°F, otherwise, it may result in operating inefficiency or automatically switching off the air conditioner by over current protection.

When the air conditioner is in cooling operation and in under-voltage protection mode, the compressor and condenser motor will stop, but they will be restarted when the input voltage recovers to 25V.

The working voltage of the air conditioner must be the rated voltage of 21.5V~32VDC. Too low or too high voltage could result in abnormal operation of the air conditioner.

The air conditioner must be strictly inspected to ensure continual proper use, efficiency of operation, and safety.

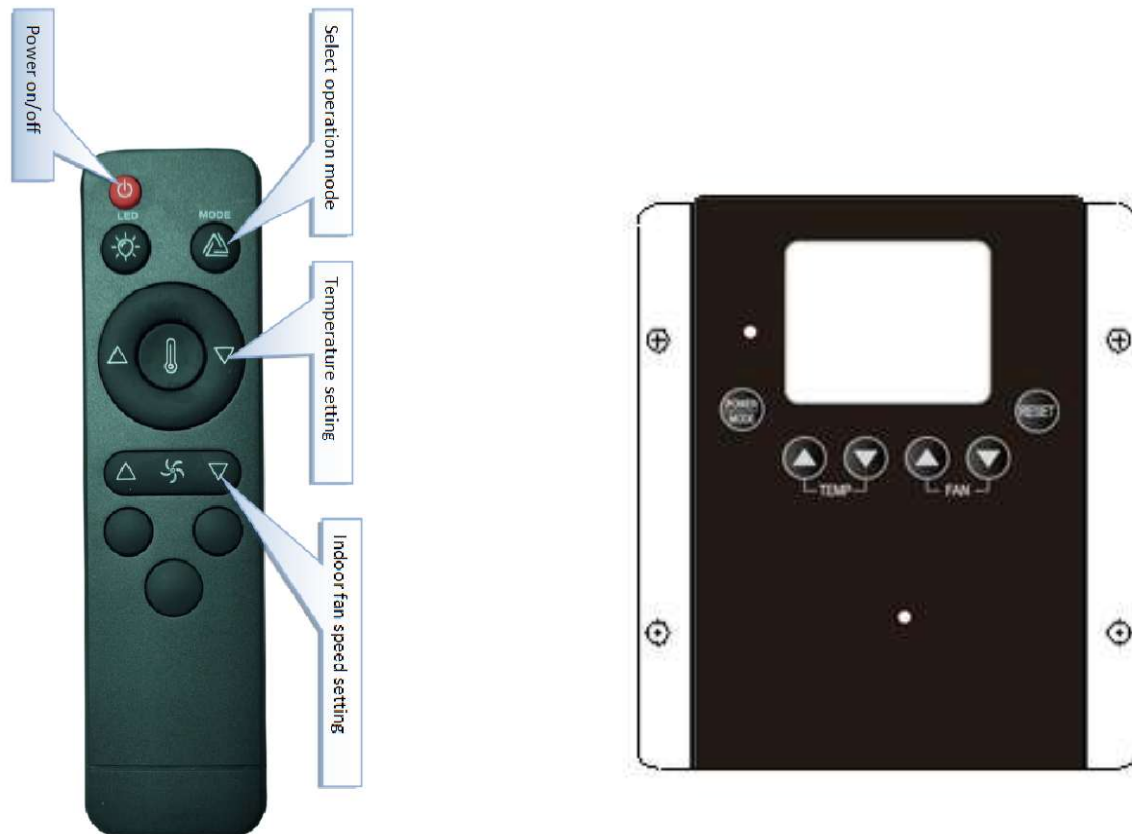
Please inspect the air conditioner regularly, and all components are securely mounted.

Under-voltage protection value: 21.5VDC, recovery voltage value: 25VDC

Over-voltage protection value: 32VDC, recovery voltage value: 28VDC

Over-current protection value: 55±3A.

## 5.1 Remote Control and Display Panel Operation



- Power On/Off

You can use the power key on the remote control to turn on the unit or long-press the Power/Mode button on the display panel to turn on the unit.

- Operation Mode

Click the Mode key on the remote control to change the operation mode, or short-press the Power/Mode button on the display panel to change the operation mode. The available operation modes are Cooling, Auto, and Fan.

- Temperature Setting

Use the temperature Up and Down keys from the remote control and display panel to set the desired temperature.

During normal operation, the temperature displayed on the display panel is the current indoor air temperature. When pressing the Up and Down keys on the remote control or display panel, the temperature displayed on the display panel shows the desired temperature.

- Fan Speed Setting

Use the fan Up and Down keys from the remote control and display panel to set up the desired fan speed.

- Switch between Celsius and Fahrenheit

Use the LED key on the remote control to make the switch.

## 5.2 Maintenance

### CAUTION

- ▶ Switch off the air conditioner before cleaning the air conditioner.
- ▶ It is recommended to clean the air filter in the evaporator system yearly.
- ▶ To maximize the air conditioner's service life, the accumulated dust in the air conditioner must be regularly cleaned.
- ▶ Do not use the abrasive cleaning cloth or volatile oil (such as benzene or banana oil) and other solvents to clean the outer casing of the air conditioner
- ▶ Do not use hair spray, perfume, or insecticide near the air conditioner.
- ▶ Inspect the unit regularly to make sure all components are securely mounted.

## 5.3 Troubleshooting



### Common faults and troubleshooting

Faults description	Reasons	Troubleshooting
The compressor doesn't start or frequently start and stop	<ul style="list-style-type: none"> <li>The voltage is too high or too low</li> <li>Power supply cable is not suitable</li> <li>Improper temperature setting</li> <li>Severe refrigerant leak in the system</li> </ul>	<ul style="list-style-type: none"> <li>Regulate voltage to specified voltage scope</li> <li>Use the power supply line specified</li> <li>Set temperature again</li> <li>Repair leakage point and add refrigerant</li> </ul>
Reduced Cooling	<ul style="list-style-type: none"> <li>Filter or condenser is blocked with dust.</li> <li>Frequent opening of indoor doors and windows</li> <li>Indoor temperature is too high</li> <li>Abnormal exchange of the condenser</li> </ul>	<ul style="list-style-type: none"> <li>Clean filter and condenser</li> <li>Reduce the frequency of doors or windows opening and install an air conditioner with a higher cooling capacity</li> <li>Inspect the heating exchange of the condenser and condenser fan</li> </ul>
The air conditioner cannot be powered on	<ul style="list-style-type: none"> <li>The fuse is in burnout</li> <li>Too low power voltage</li> <li>The wiring or plug-in connector is not connected well</li> </ul>	<ul style="list-style-type: none"> <li>Replace the fuse</li> <li>Reconnect the wire, and restart the system</li> </ul>
Reduced operating time on the air conditioner	<ul style="list-style-type: none"> <li>Power line is not specified or it's too long, the high voltage consumption of the power line may result in low-voltage for the air conditioner</li> <li>Low battery capability or poor battery performance.</li> </ul>	<ul style="list-style-type: none"> <li>Use the qualified power line</li> <li>Check the battery status on the app to make sure it is working properly.</li> </ul>

## Error codes

Error Code	Error Description
24	Compressor over-temp protection (The surface temperature of the compressor exceeds a certain value and the overheat protection switch is turned off)
25	Low-pressure protection (Low-pressure sensor open circuit)
30	Low Input Voltage Protection(The battery is Undervoltage) The protection value of the 24V air conditioning unit is $21.5 \pm 0.3V$
31	The evaporator temp is below freezing and frosting (There is a thin layer of ice or frost on the flat tube of the evaporator at the air outlet of the indoor unit)
32	Compressor Controller over current protection (The protection is caused by excessive system load due to bad heat dissipation, excessive refrigerant charge, high ambient temperature, etc.)
42	Compressor serial communication Error (The evaporator control board did not send or receive the feedback signal from the compressor controller.)

If the issue still exists after troubleshooting process, please visit [polarfoxapu.com](http://polarfoxapu.com) to find the nearest dealership to repair the system.

## 5.4 Warranty

Air conditioner unit is warrantied from manufacturing defect for 1 year from the date of purchase

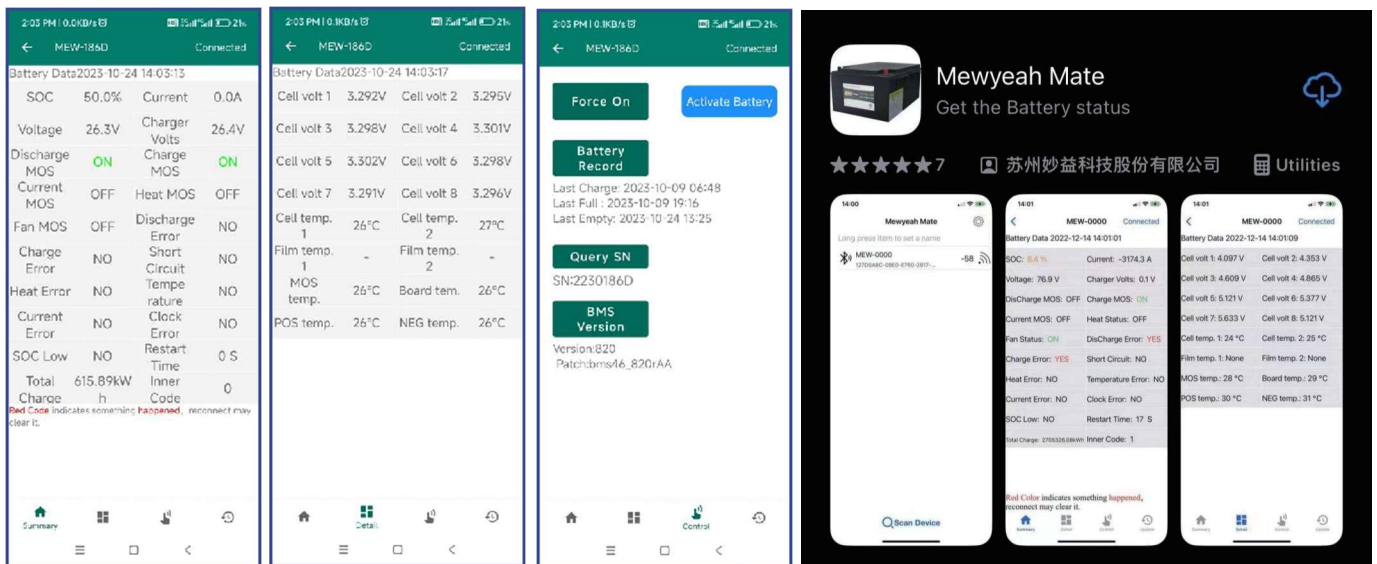


## 6. Battery Operation Instruction

The following guide will describe the safety and convenience features of the battery, installation instructions, best practices for usage, maintenance and charging, troubleshooting tips, frequently asked questions and warranty policy. Please read this guide in its entirety to ensure you get the longest life possible out of the battery while keeping yourself and others safe.

### 6.1 Safety and Convenience Features

1. The Mewyeah mobile app offers functions including battery status display, forced startup, fault diagnosis, data logging, and online upgrades. iPhone users can search for “Mewyeah Mate” on the App Store to download.



2. In order to protect the vehicle's electrical circuitry and prolong battery life, the SmartStart is equipped with a Battery Management System (BMS). When the protective mechanism is triggered, the BMS will automatically shut off the power for safeguarding purposes.
3. While the vehicle is parked and the engine is off, the SmartStart's eAPU function has a built-in low-charge protection function. The SmartStart can calculate how much electricity has been charged and discharged, providing an accurate assessment of the state of charge (SOC). This allows for reserving a portion of the electricity for starting, preventing situations where excessive power usage leaves the vehicle unable to start.

Additionally, the BMS in the winter can reserve electricity for heating the battery to ensure successful starts.

Ambient temperatures	Reserved charge level
above 41°F	12%
below 41°F	40%

Equipped with a low-charge protection feature, when ambient temperatures are above 41°F, the reserved charge level is set at 12%, whereas when temperatures are below 41°F, the reserved charge level is 25%. Upon reaching the stored charge threshold, the entire vehicle will power down. In such instances, it is necessary to initiate a forced startup via the mobile application or by pressing the battery's forced startup button once. The vehicle's engine must be restarted within 2 minutes to promptly exceed the reserved charge threshold, as failure to do so will result in another stored charge-induced power down. Relying solely on monitoring battery voltage to estimate remaining power is unreliable. Battery voltage can vary depending on factors such as dynamic internal resistance at different current levels and temperature fluctuations. Therefore, estimating the remaining power based solely on battery voltage is inaccurate and frequently leads to the catastrophic situation of engine start failure.

4. Engine starting difficulties caused by issues such as the fuel system, etc., may lead to prolonged cranking of the starter, triggering the lithium battery's starting protection. After the activation of the starting protection, the entire vehicle will experience a power cutoff. During this period, it is necessary to await the automatic reconnection of the lithium battery (approximately 1 minute) before attempting to start the vehicle again.
5. At temperatures below -4° F when a single startup attempt is insufficient, the first startup will activate the battery's automatic heating function. Restarting is possible once the total voltage reaches 12V (check on the app). This may take several minutes.

## 6.2 Installation Do's & Don'ts

1. During installation, take care not to simultaneously connect the "+" and "-" terminals with metal tools to avoid short circuits. To avoid this hazard, wrap your tools with insulating tape before installation.
2. Under no circumstances should this SmartStart be connected in series with lead-acid batteries, as doing so may damage the vehicle's low-voltage electrical system or the

lithium-ion battery itself. In cases where the SmartStart is installed in parallel with lead-acid batteries, it is recommended to add a manual switch to the positive line in the parallel connection.

3. The installation location of the SmartStart should be positioned as far away as possible from the rear of the exhaust pipe and, if proximity to the exhaust pipe is unavoidable, thermal insulation material or other heat-resistant devices must be added to the installation.
4. Position the SmartStart within the battery compartment to shield it from exposure to wind, sun, rain, and high temperatures, which can lead to external casing degradation.
5. Pay attention to accessories such as air conditioners and other aftermarket electrical components; their wiring harnesses should be connected at the front end of the main switch.
6. Ensure that the bottom of the SmartStart installation location is level, flat, and free from any protrusions. The clamps must be tightly and securely fastened.
7. The lithium-ion battery should not bear any weight or be subjected to compression, as doing so may result in battery damage.

## 6.3 Usage Do's & Don'ts

1. Do not subject battery to trampling, squeezing, or impact.
2. Keep the battery away from heat sources and open flames.

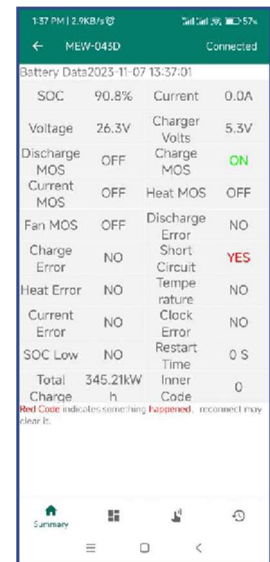
## 6.4 Maintenance Do's & Don'ts

1. Inspect the battery terminals for secure installation every three months or when high pole temperature warnings are issued from the app. Clean with a suitable solution or a lint-free cloth.
2. Before prolonged vehicle storage, fully charge the battery and disconnect the negative terminal.
3. When the SmartStart remains unused for over three months, it should be fully charged before storage, and a supplementary charge is necessary if it surpasses one month without use. Batteries that have experienced insufficient capacity due to various reasons during usage should be recharged timely.
4. If there is any damage or corrosion on the positive and negative terminals, they should be replaced without delay.

5. Regularly inspect the cable connections at the terminal interface for secure fastening, and promptly replace any cables or fasteners exhibiting oxidation or corrosion.
6. In instances where vehicle maintenance needs electric or argon welding, it is important to dismantle the negative cable from the SmartStart to prevent harm to the vehicle's low-voltage system and the lithium battery.

## 6.5 Troubleshooting Tips

1. If the battery reports a short-circuit fault, wait for 30 seconds, and then attempt another startup. The possible reasons for the fault may include excessive startup current (often occurring at the moment of startup) or a short circuit in the vehicle's wiring (investigate the wiring fault).
2. If you have any questions or encounter any unusual issues with the SmartStart, please contact the dealer or our company. Never attempt to open the casing on your own.



The screenshot shows the MEW-043D app interface. At the top, it displays '1:37 PM | 2.9KB/s' and 'Satellite 90% > 57%'. Below this, there's a status bar with '← MEW-043D' and 'Connected'. The main section is titled 'Battery Data 2023-11-07 13:37:01'. It contains a table of battery parameters:

SOC	90.8%	Current	0.0A
Voltage	26.3V	Charger Volts	5.3V
Discharge MOS	OFF	Charge MOS	ON
Current MOS	OFF	Heat MOS	OFF
Fan MOS	OFF	Discharge Error	NO
Charge Error	NO	Short Circuit	YES
Heat Error	NO	Temperature	NO
Current Error	NO	Clock Error	NO
SOC Low	NO	Restart Time	0 S
Total	345.21KW	Inner Code	0
Charge	h		

Below the table, a red text warning states: 'Red Code indicates something happened, reconnect every clear it.' At the bottom, there are icons for 'Summary', a grid, a person, and a refresh symbol.

## 6.6 Frequently Asked Questions

### 1. Q: Why is using the SmartStart more cost-effective than using lead-acid batteries?

A: The SmartStart employs lithium iron phosphate (LiFePO<sub>4</sub>) batteries as energy storage, with a deep charge-discharge cycle count of 2000 to 3000 cycles, whereas lead-acid batteries offer only 150 to 300 cycles. When a vehicle is equipped with an air conditioner, the deep charge-discharge of the starting power source may reach 200 cycles per year. For LiFePO<sub>4</sub> batteries, this means they can be used for approximately 10 years, compared to only about 1 year for lead-acid batteries.

### 2. Q: Is a lithium-ion battery safe?

A: The safety of lithium-ion batteries primarily depends on the quality of the battery cells and their proper usage. Quality issues with battery cells can arise from raw material defects and manufacturing process flaws. Over the past decade, lithium-ion battery quality has significantly improved, with low-quality materials and outdated processes largely eliminated. Choosing cells from reputable and well-established manufacturers ensures quality. Improper usage includes overcharging, over-discharging, exposure to high temperatures, charging in low-temperature conditions, excessive current, short circuits, and more. Starting batteries with built-in Battery Management Systems can help prevent these improper uses, thereby reducing safety risks. There are various types of

lithium-ion batteries with differing performance characteristics. In terms of safety, LiFePO<sub>4</sub> batteries are notably safer compared to other lithium-ion variants. LiFePO<sub>4</sub> batteries have demonstrated excellent safety records, with no instances of explosion in extreme tests such as puncturing and compression. Our company has over a decade of experience in developing and producing BMS, ensuring comprehensive and reliable protection. To prove quality and safety, Mewyeah batteries are certified the following globally recognized safety standard including SDS, UN 38.3 and E-MARK.

## 6.7 Warranty

1. The warranty period for this product is five years.
2. During the warranty period, in cases of malfunctions resulting from normal usage as stipulated in the user manual (as determined by authorized personnel of our company), repairs will be provided free of charge.
3. During the warranty period, the following conditions will be subject to chargeable repairs:
  - Malfunctions and damage resulting from improper usage or unauthorized self-repairs.
  - Malfunctions or damage incurred during transport, handling, or accidental drops after purchase.
  - Malfunctions and damage resulting from other unavoidable external factors.
  - Damage caused by improper use leading to the entry of water or other liquids into the equipment.

## 7. Contact Us

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