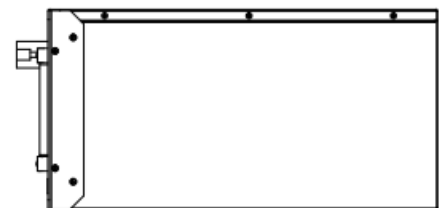
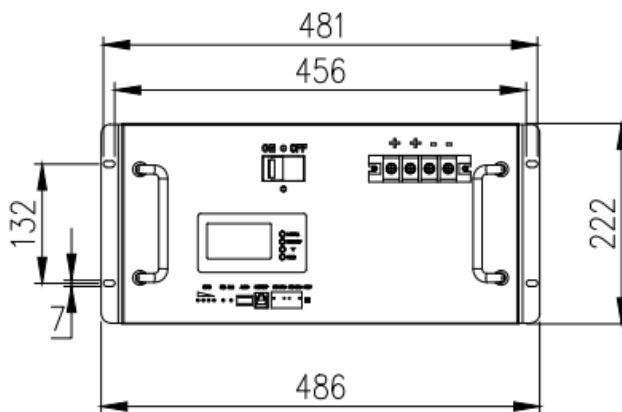
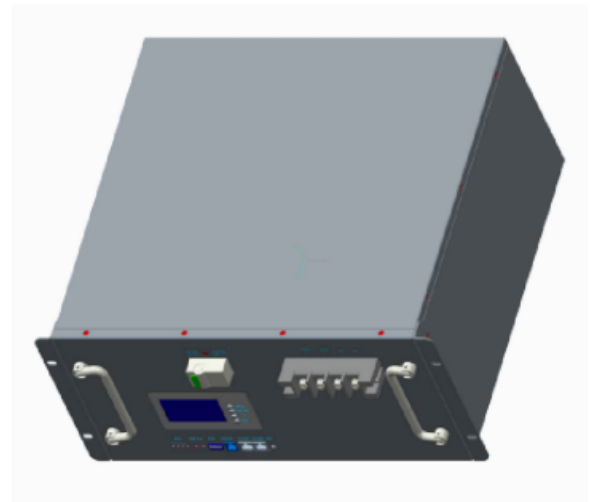
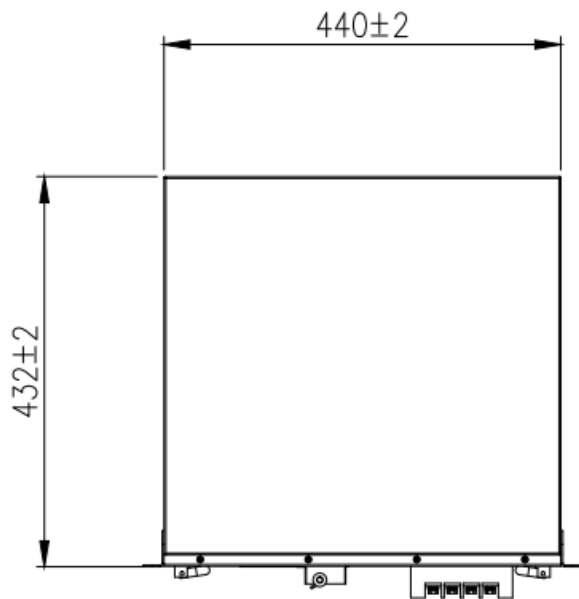


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This specification book applies to Trophy Battery Model 48V110C-1 only.

Battery Dimensions in millimeters



| | Battery Dimension in Inches (L*W*H) | Battery Weight (Pounds) | Wooden Case Dimensions (inches) (L*W*H) | Wooden Case Weight (Pounds) | Total Weight (Pounds) |
|----------|---|-------------------------------|---|--------------------------------------|--------------------------|
| 48V110AH | 17.01", 19.13", 8.74" | 125.62 | 21.65", 22.05", 17.32" | 22.99 | 148.61 |

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1. Battery Management System (BMS) Functional Description

1.1 Battery cell and battery pack voltage detection

The BMS provides both individual battery cell and overall battery pack over-voltage and under-voltage protection.

The BMS voltage detection accuracy of the battery cell is

± 10 mV, from 0C to 45C,

± 20 mV, from -20C to 0C and

± 20 mV from 45C to 70C

1.2 Battery Charge and Discharge Current Detection and Protection

The BMS provides over-current detection and protection during charge and discharge, and battery short-circuit protection.

The BMS supports continuous charge and discharge current rates of up to 100 Amps.

The temperature rise is less than 50%, and the current detection accuracy is better than 2%.

1.3 Temperature Detection and Protections

The BMS detects high temperature and low-temperature conditions of the battery cells, ambient temperature, and temperature of the power MOS circuits.

The BMS provides high temperature and low-temperature protection.

The 6-way temperature monitoring system includes:

Four (4) battery cell temperature sensors,

One (1) ambient temperature sensor,

One(1) power MOS temperature sensor,

All sensors have a temperature detection accuracy of ± 3%.

1.4 Battery State-of-Charge and Battery Cycle Reporting

The BMS calculates the real-time battery State-of-Charge (SOC).

The SOC calculation accuracy is better than 5%.

The BMS automatically records the number of charge and discharge cycles.

1.5 Charging and Discharging via the MOSFET circuits

The MOSFET circuits have low internal resistance and high current capabilities, with an optimized design for high current loads and zero switching. The circuits are designed for backup power applications.

1.6 Individual Battery Cell Equalization

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The battery cells are equalized automatically to improve the life of the battery.

1.7 LED lamp status indication

Six LEDs indicate the battery's State-of-Charge, operating mode, and alarm status.

1.8 On/Off/Reset Button

The recessed On/Off/Reset Button can manually start the battery, shut it off, and perform other functions. These are "Wake from Dormancy", "Reset Alarm Conditions", and "Reset the BMS".

A long press of the button can reset the BMS software and reset the BMS hardware, thus removing alarm indications.

1.0 RS-485 and CAN Communications

There are two communication ports on the front panel of the battery. Each can be used as a CAN Port, RS-485 Port, or one of each.

A host computer can be connected to the battery via RS-485 or CAN protocol for data monitoring, operation control, and setting BMS parameters.

The RS-485 and CAN communications ports also enable monitoring and management of multiple identical batteries connected in parallel.

RS-485 and CAN communication may be used to set BMS parameters.

All battery management parameters such as single-cell voltage limits, overall battery voltage limits, maximum allowed charge current, maximum allowed discharge current, cell high and low-temperature limits, environment high and low-temperature limits, cell balancing strategy, and battery capacity can be reset via the host computer.

1.9 Function Switch Control

You can switch on and off the discharge MOS circuits, charging MOS circuits, current limiting function switch, buzzer alarm, forced dormancy, etc.

1.10 Current-limiting functions (customizable)

The 10A and 20A current limit functions can be set via a host computer or disabled to allow higher current charging.

1.11 Hardware watchdog function

The BMS design includes a unique hardware watchdog protection circuit.

This circuit ensures that the BMS operates well under severe conditions.

1.12 Data storage function

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The BMS system can enable the system to record running data in real-time for system monitoring, analysis, and maintenance.

1.13 System Upgrade Function

The BMS supports firmware updates through a communication port.

1.14 Short-Circuit Protection Function

The BMS short circuit protection function activates when a short circuit occurs, which quickly turns off the discharge circuits.

The short circuit protection is reset by charging the battery or pressing the On/Off/Reset button for 3 seconds.

1.15 Reverse Polarity Protection

The battery BMS protects against reverse polarity power connections.

When the positive and negative polarity of the external power source are reversed (if only briefly), the BMS is not damaged, the battery activates its internal alarms, and the protection circuits are activated.

Recovery conditions for reverse polarity protection: Remove the power source immediately. Prolonged duration of reverse polarity will not be covered under warranty.

1.16 Display feature

The battery includes an LCD with a user interface.

Various BMS parameters and status displays are available on the LCD.

1.17 Anti-Surge function

The BMS has surge protection capabilities and suppresses 4 Kilovolt shocks.

3. LED lamp instructions

3.1. Capacity indication

| LED | | Charging | | | | Discharge | | | |
|-----------------------|--------|----------|--------|--------|--------|-----------|-----|-----|-----|
| State of Charge LED's | | L4● | L3● | L2● | L1● | L4● | L3● | L2● | L1● |
| | 0~25% | Off | Off | Off | Varies | Off | Off | Off | On |
| | 25~50% | Off | Off | Varies | On | Off | Off | On | On |
| | 50~75% | Off | Varies | On | On | Off | On | On | On |
| | ≥75% | Varies | On | On | On | On | On | On | On |
| Run LED ● | | On | | | | Varies | | | |

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3.2 Status indications

| System Status | Exception Events | RUN | ALM | Power LED | | | | Comment |
|---------------|--|--------------|--------------|---|---|---|---|---------|
| | | • | • | • | • | • | • | |
| Off | | Off | Off | Off | | | | |
| Standby | Normal | Flash 1 | Off | According to the current state of charge | | | | |
| | Alarm | Flash 1 | Flash 2 | | | | | |
| Charging | Normal | Often bright | Off | According to the current state of charge Maximum Charging when Alarm is Flashing | | | | |
| | Maximum Charging Current | Often bright | Flash 2 | | | | | |
| | Overcharge protection | Often bright | Off | On | | | | |
| | Temperature protection | Flash 1 | Flash 2 | According to the current state of charge | | | | |
| | Failure protection | Off | Often bright | Off | | | | |
| Discharging | Normal | Flash 3 | Off | According to the current state of charge | | | | |
| | Over-Current | Flash 3 | Flash 2 | | | | | |
| | Under-voltage protection | Flash 3 | Off | Off | | | | |
| | Over-current, short-circuit protection | Off | Often bright | Off | | | | |
| Failure | | Off | Often bright | Off | | | | |

4. Working Mode

4.1 On/Off/Reset Button Usage

When the Battery/BMS is Off (dormant), press the On/Off/Reset button for one (1) second, and the LED indicators will light for ½ seconds. This action wakes up the BMS and the battery.

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When the Battery/BMS is already active (not dormant), press the On/Off/Reset button for three (3) seconds, then release. The Run LED will light for ½ second. The battery will then be in a normal mode for charging and discharging.

4.2 Sleep (Dormant)

When any of the following conditions are met, the system enters into a low power mode:

- 1) When an alarm or fault condition exists for 30 minutes, Press and Release the On/Off/Reset button for 3 seconds.
- 2) When the minimum individual cell voltage is lower than the dormancy set voltage (default 3300mV) and reaches the dormancy delay duration (default 1440 minutes) during which time there has been no communication activity and no charging or discharging.
- 3) You may force a shutdown through the host software.

Before entering dormancy, make sure the battery is not being charged. Otherwise, it will enter low power mode instead of dormancy.

4.3 Wake up

When the system is in the low power mode and meets any of the following conditions, the system will exit the low power mode and enter the normal operation mode:

- 1) When the Inverter or Charger sends a proper voltage to charge the battery.
- 2) When the On/Off/Reset button is pressed for one (1) second and released.
- 3) When connected to a host computer via a communication port and the host software is running.

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5.48V110C-1 System Parameters

| | | Item | Parameters |
|-----------------------|--|--|--|
| Single battery | 1 | Battery Cell Brand and Model | CATL 3.2V120AH |
| | 2 | Product material system | Lithium iron phosphate + graphite |
| | 3 | Rated voltage (Volts)(V) | 3.2 |
| | 4 | Rated capacity (Amp-Hour)(AH) | 120 |
| | 5 | Size (mm) | 47*173*170mm |
| | 6 | Weight (kg) | 2.7 |
| Battery system | 1 | Product model | 48V110C-1 |
| | 2 | Product Applications | Numerous |
| | 3 | Cell Configuration | 16s1p |
| | 4 | Cooling mode | Natural cooling |
| | 5 | Rated voltage (V) | 51.2 |
| | 6 | Rated Capacity (AH) \pm 5% | 110 |
| | 7 | Rated Energy (Watt-Hours) \pm 5% | 5632 |
| | 8 | Charge and Discharge Terminals | Common (Same for charge and discharge) |
| | 9 | Communication port CAN/RS485: | Two, each can be CAN or RS-485 |
| | 11 | Maximum Batteries in Parallel | 16 |
| | 12 | System charging termination voltage (V) | 57.6 |
| | 13 | System discharge termination voltage (V) | 43.2 |
| | 14 | Single-cell charging protection voltage (V) | 3.65 |
| | 15 | Single-unit discharge protection voltage (V) | 2.5 |
| 16 | Charging operating temperature Range (°C) | -0~45 | |
| 17 | Discharge Operating Temperature Range (°C) | -10~50 | |
| 18 | Continuous Charging Current (A) | 100 | |
| 20 | Continuous Discharge Current (A) | 100 | |

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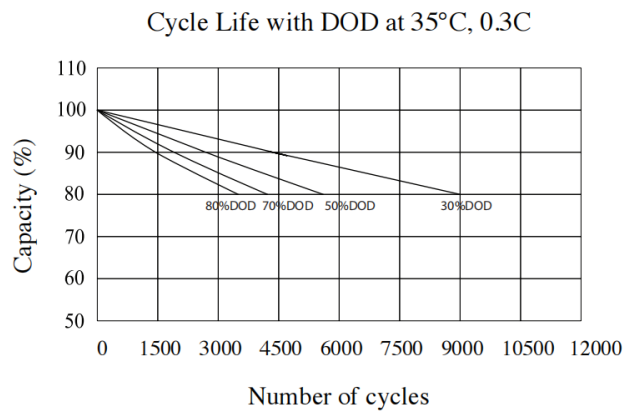
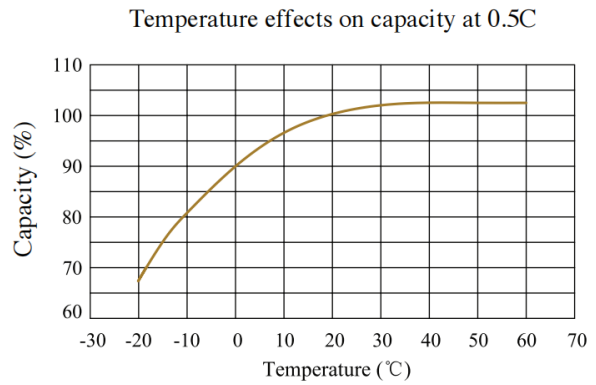
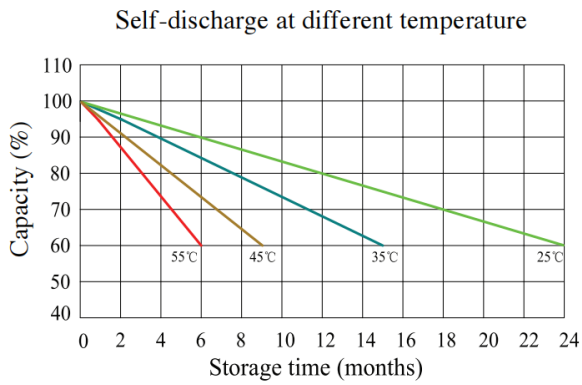
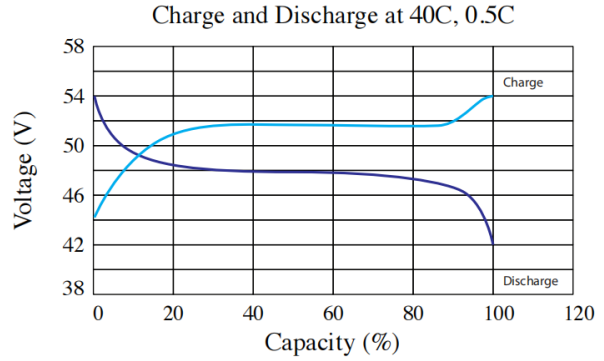
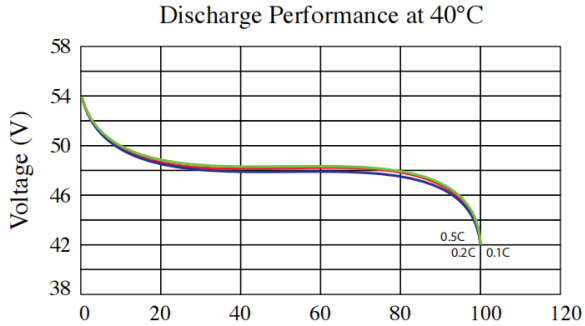
| | | |
|---------|--|---|
| 21 | Discharge Protection Over-current (A) | 110 |
| 22 | Charge and Discharge Cycles to 20% State of Charge (SOC) (80% Depth of Discharge) at 0.3 C at 25°C ambient temperature, Refer to Battery Charts below. | Approximately Cycle 3500 times to 20% SOC, Cycle 4200 times to 30% SOC, Cycle 4500 times to 50% SOC, Cycle 9000 times to 70% SOC With capacity retention ≥ 80% |
| 23 | Battery Case Size Length, width, depth in mm | 432±2, 486±2, 222±2 |
| 24 | Battery Case Weight tolerances are ± 2kg | 55KG |
| 25 | Country of Manufacture | China |
| Comment | | |

The Battery Charts are on the next page

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PERFORMANCE CURVES



Performance may vary depending on, but not limited to cell usage and application. If cell is used outside specifications, performance will diminish. All specifications are subject to change without notice. All information provided herein is believed, but not guaranteed, to be current and accurate.

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6. Storage and Transportation

6.1 During transportation, use, and storage, the recommended environmental conditions should be followed to preserve the life and performance of the battery.

6.2 During the storage and transportation, maintain the SOC level of about 50% to 70%.

Avoid short circuits by ensuring that miscellaneous metal parts are shipped or stored with the battery. Ensure that no liquids enter the battery.

6.3 If the battery is in storage, the battery shall be stored at 10C to 35C temperatures in a clean, dry, and well-ventilated warehouse.

6.4 During the loading and unloading process, the battery should be carefully handled to prevent drops, jolts, and rolling.

7. Important Warning and Precautions for battery use

To prevent possible battery leakage, heat and explosion, pay attention to the following precautions:

Warnings!

- The battery can produce dangerous voltages and currents. If improperly used or treated, it can cause damage, severe harm, or death to people and pets. Keep pets away from the battery.
- Do not short-circuit the battery.
- Only connect the battery to other electrical equipment designed for 48V Class batteries. The battery will produce a varying output voltage, with a nominal DC voltage of 51.2 Volts. The voltage will vary from 43.2 to 57.6 volts but can be slightly higher or lower.
- Use a licensed electrician or a competent person familiar with high current batteries.
- Improper installation or use can harm you and others or can be fatal.
- While installing or working on batteries, ensure that the circuit breaker is in the off position and manually measure the output terminals to ensure no voltage is present.
- Do not underestimate the power in the batteries.
- Keep children, pets, and others away from the batteries. The battery is not a toy.
- Do not allow any liquids to enter the battery case or the battery.
- Keep batteries while in storage or in operation at cool temperatures, ideally at room

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temperatures, to extend the life of the batteries

- When connecting to other equipment and batteries, never reverse the positive and negative poles.
- Never connect the batteries in series.
- Never short the positive and negative terminals of the battery with any object
- Never drop anything on the battery or damage the outer case.
- Never transport or store batteries together with any metal.
- Do not physically abuse the battery in any way.
- Do not weld anything to the batteries or puncture them in any way.
- Do not use a damaged battery, or one that has an unusual order, or emits fumes or leaks liquids out of the battery.
- Do not connect different models or types of batteries in parallel or series.
This practice is unsafe.
- Do not make any connections to the battery or BMS not mentioned in this document.
- You may connect up to 16 batteries of the same model together.
- It is necessary to use appropriately sized electrical cables that safely carry the high current that our batteries can deliver.

Notes!

- Please do not use or allow the battery to be exposed to high temperatures (hot sun, hot car, or hot environment); otherwise, it may cause overheating, fire or functional failure, and reduced life. The recommended long-term storage temperature is 10-45°C.
- It is forbidden to dispose of batteries in fire or high temperatures to prevent fire, explosion, and environmental pollution; scrapped batteries must be returned to a battery recovery point for disposal.
- It is forbidden to place the battery in strong static electrical fields or strong magnetic fields. Otherwise, the battery may be damaged.
- If the battery leaks do not get the battery electrolyte into one's eyes and keep pets away. Do not rub your eyes. Wash eyes immediately and thoroughly with water, and immediately send them to the hospital for treatment. Otherwise, your eyes will be damaged. Call for help.

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- If the battery emits odors, heat, or if you see discoloration, deformation, or any abnormality during use, storage, charging, the battery shall be immediately removed from use and disabled.
- It is forbidden to directly connect positive and negative battery terminals to AC, including household AC. A purpose-built inverter or charger for 48V LiFePO4 batteries must be used. Vehicle alternators must not be used for charging. Lead-acid and other types of battery chargers must not be used.
- Only after performing all standard safety measures and checks, including checking the battery voltage and connections, should the battery be turned on and used.
- If the battery is not used for three months, the battery should be recharged to a 50% state of charge.
- If the electrodes are dirty, apply a dry cloth before use. Otherwise, it may cause poor contact and functional failure.

General Information and Legal Disclaimers

We plan to offer additional models of our batteries over time. We cannot guarantee that current models will be available in the future. Trophy Battery reserves the right to revise its product specifications without incurring the obligation to retrofit previous models. If you find errors in the specifications, please notify Trophy Battery. No Warranty of Merchantability and No Warranty of Fitness for a Particular Purpose” are supplied.

Trophy Battery believes these specifications are accurate but cannot be held liable for errors.

It is the purchaser’s responsibility to ensure that the battery is suitable for its intended purposes, install and use the battery properly, following all instructions, cautions, and warnings provided in this document and on the www.TrophyBattery.com website.

Trophy Battery will be happy to advise and consult with those interested in our batteries but offers no guarantees that our advice is accurate. We cannot be held liable for our good-faith communications.