waveshare UPS Power Module (C)

Waveshare UPS Power Module (C) for Jetson Orin - Instruction Manual

1. Introduction

This manual provides detailed instructions for the installation, operation, and maintenance of the Waveshare UPS Power Module (C). This module is designed to provide uninterruptible power to Jetson Orin series boards, ensuring stable operation and data integrity during power fluctuations or outages. It supports three 21700 Li-ion batteries (not included) and features real-time battery monitoring via I2C communication.

2. Package Content

Verify that all items listed below are included in your package:

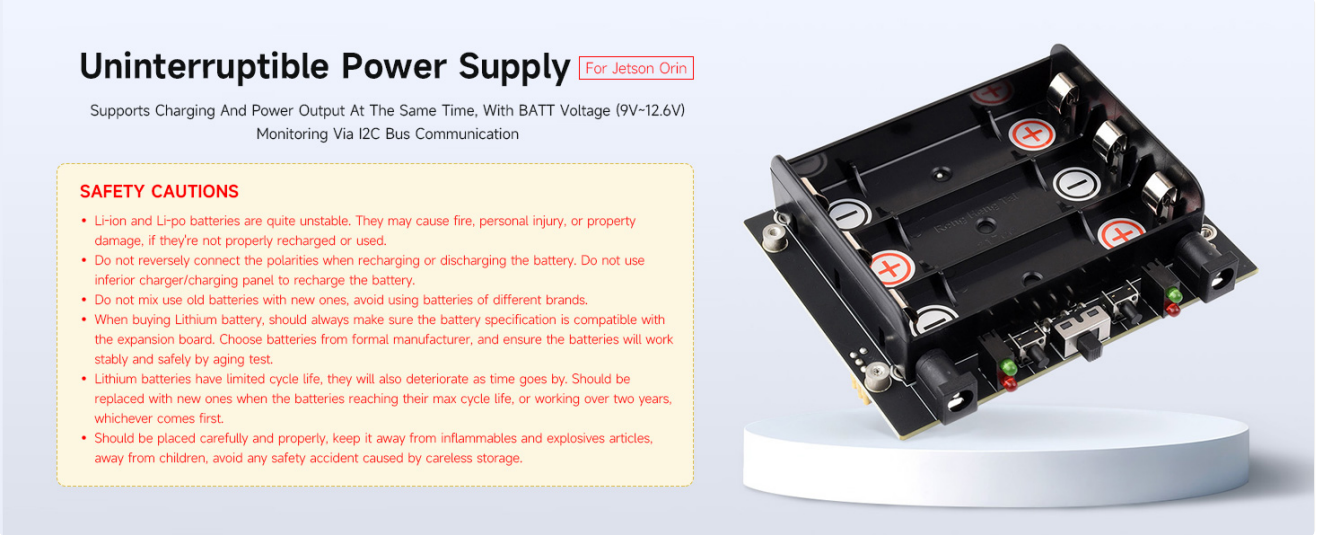


Figure 2.1: Included components of the Waveshare UPS Power Module (C) package.

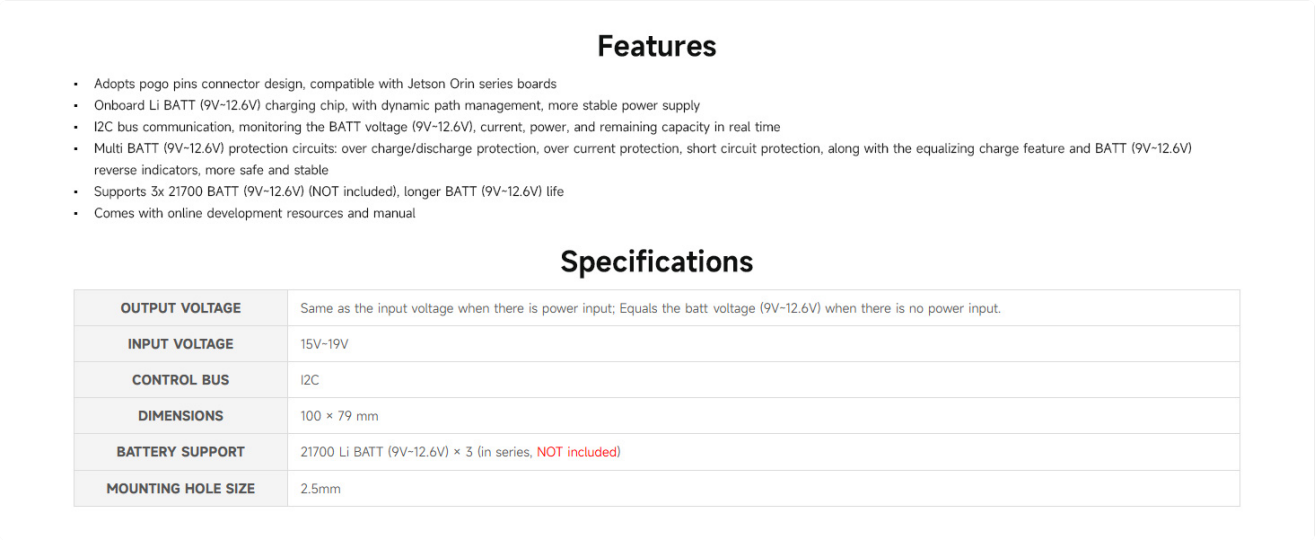
- UPS Power Module (C) x1

- Acrylic protection panel x1
- DC dual-plug cable x1
- Screws pack x1

Note: Three 21700 Li-ion batteries (9V-12.6V) are NOT included and must be purchased separately.

3. Safety Cautions

Please read and adhere to the following safety guidelines to prevent personal injury or damage to the product:



Features

- Adopts pogo pins connector design, compatible with Jetson Orin series boards
- Onboard Li BATT (9V~12.6V) charging chip, with dynamic path management, more stable power supply
- I2C bus communication, monitoring the BATT voltage (9V~12.6V), current, power, and remaining capacity in real time
- Multi BATT (9V~12.6V) protection circuits: over charge/discharge protection, over current protection, short circuit protection, along with the equalizing charge feature and BATT (9V~12.6V) reverse indicators, more safe and stable
- Supports 3x 21700 BATT (9V~12.6V) (NOT included), longer BATT (9V~12.6V) life
- Comes with online development resources and manual

Specifications

OUTPUT VOLTAGE	Same as the input voltage when there is power input; Equals the batt voltage (9V~12.6V) when there is no power input.
INPUT VOLTAGE	15V~19V
CONTROL BUS	I2C
DIMENSIONS	100 × 79 mm
BATTERY SUPPORT	21700 Li BATT (9V~12.6V) × 3 (in series, NOT included)
MOUNTING HOLE SIZE	2.5mm

Figure 3.1: Important safety cautions for battery handling and module usage.

- Li-ion and Li-Po batteries are inherently unstable. Improper recharging or usage may lead to fire, personal injury, or property damage.
- **Do not** reverse battery polarities during recharging or discharging.
- **Do not** use inferior chargers or charging panels.
- **Do not** mix old batteries with new ones, or use batteries from different brands.
- When purchasing Lithium batteries, ensure their specifications are compatible with this expansion board. Use batteries from reputable manufacturers that have passed aging tests for stability and safety.
- Lithium batteries have a limited cycle life. Replace them when they reach their maximum cycle life or after two years, whichever comes first.
- Handle the module and batteries carefully. Keep them away from flammable and explosive materials. Store away from children to prevent accidents.

4. Features

The Waveshare UPS Power Module (C) offers the following key features:

Figure 4.1: Overview of module features and specifications.

- Supports simultaneous charging and power output.
- Battery voltage monitoring via I2C bus communication.
- Pogo pins connector design, ensuring compatibility with Jetson Orin series boards.
- Onboard Li battery charging chip with dynamic path management for a stable power supply.
- Multi-battery protection circuits: over charge/discharge, over current, short circuit.
- Equalizing charge feature and battery reverse indicators for enhanced safety and stability.
- Supports three 21700 batteries (not included) for extended battery life.

5. Specifications

Parameter	Value
Output Voltage	Same as input voltage when power is present; equals battery voltage (9V-12.6V) when no power input.
Input Voltage	15V~19V
Control Bus	I2C
Dimensions	100 × 79 mm
Battery Support	21700 Li-ion Battery × 3 (in series, NOT included)
Mounting Hole Size	2.5mm
Material	Plastic
Color	Black
Item Weight	0.12 Kilograms
Connector Type	Pogo Pins

6. Setup and Installation

6.1. Battery Installation

Insert three 21700 Li-ion batteries (not included) into the battery holders on the module. Ensure correct polarity by matching the '+' and '-' markings on the batteries with those on the module. Incorrect insertion will trigger the battery reverse indicators.

6.2. Module Mounting

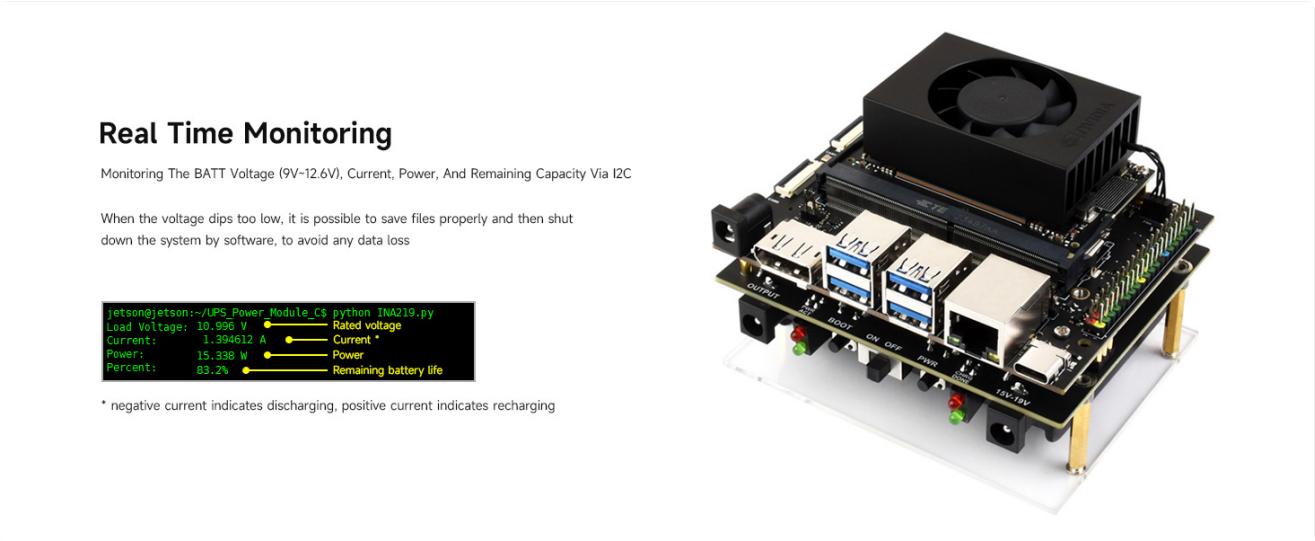


Figure 6.1: UPS Power Module (C) compatibility with Jetson Orin Nano and Jetson Orin NX.

Align the UPS Power Module (C) with the pogo pins on your Jetson Orin Nano or Jetson Orin NX board. Gently press down to ensure the pogo pins make proper contact. Secure the module to the Jetson board using the provided screws and standoffs. The mounting holes are designed for precise alignment.

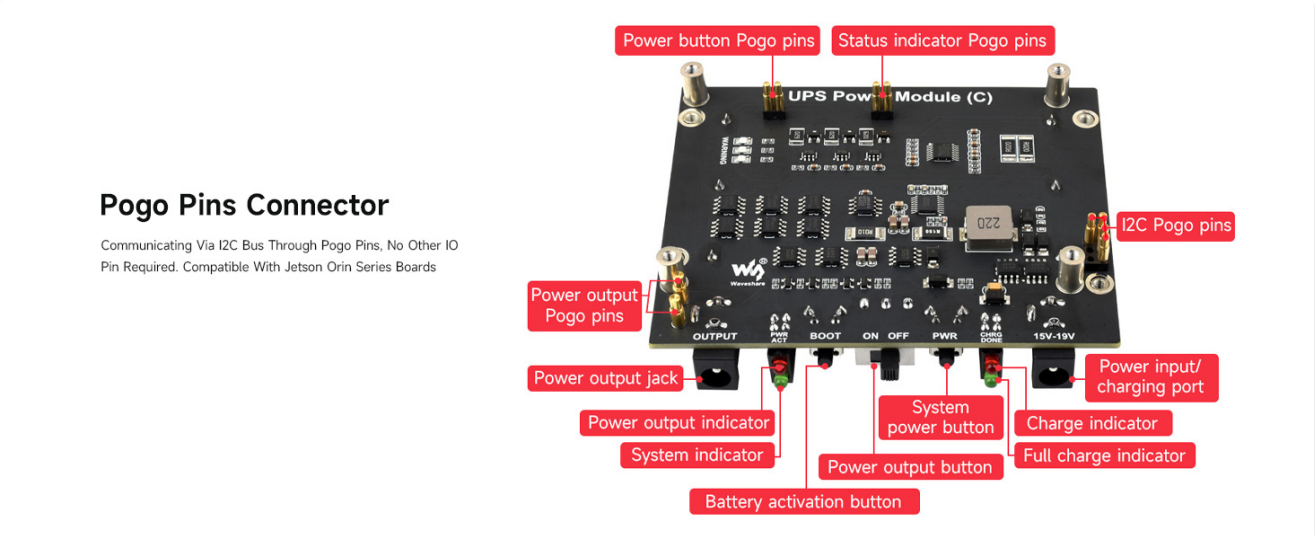


Figure 6.2: Pogo Pins Connector and module interfaces.

6.3. Acrylic Protection Panel

Attach the acrylic protection panel to the module using the remaining screws. This panel provides physical protection for the module's circuitry.

6.4. Power Connection

Connect the provided DC dual-plug cable to the module's 15V-19V input port. Connect the other end of the cable to a compatible 15V-19V power adapter (not included).

7. Operation

7.1. Power On/Off

Use the onboard system power button to turn the module and the connected Jetson board on or off. A short press typically powers on, and a long press initiates a shutdown sequence.

7.2. Charging and Power Output

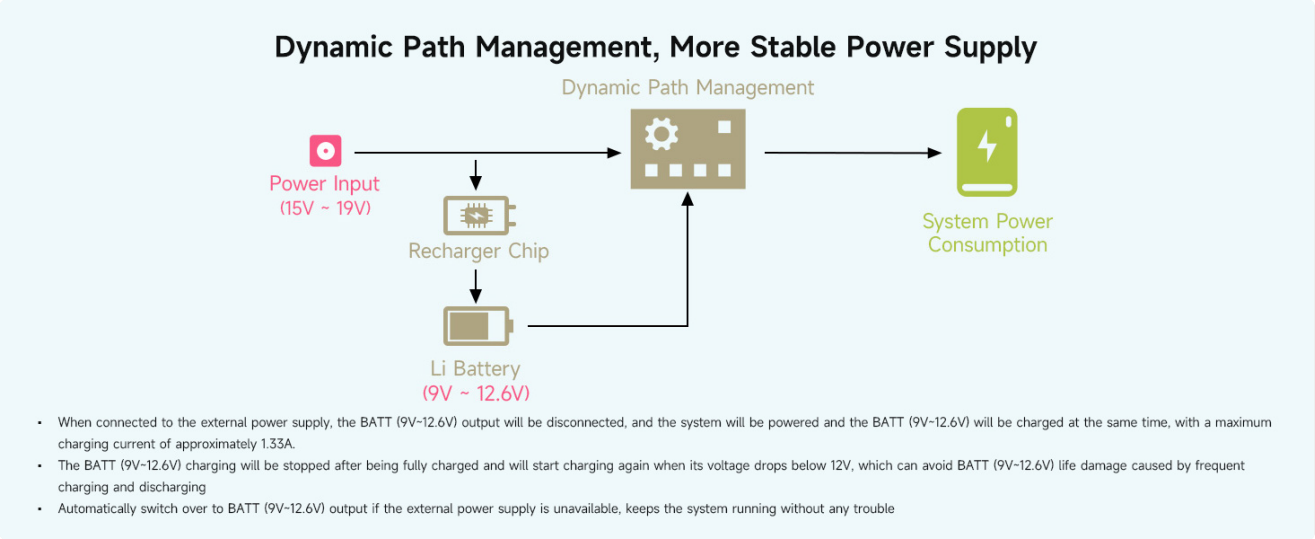


Figure 7.1: Uninterruptible power and real-time monitoring in action.

When an external power supply (15V-19V) is connected, the module will charge the installed 21700 batteries. The charge indicator LED will illuminate during this process. The module simultaneously provides power to the Jetson board. If external power is lost, the module automatically switches to battery power, ensuring continuous operation without interruption.

7.3. Indicators

- **Charge Indicator:** Illuminates when batteries are actively charging.
- **Full Charge Indicator:** Illuminates when batteries are fully charged.
- **System Indicator:** Indicates the operational status of the system.
- **Battery Reverse Indicators:** Light up red if a battery is inserted with incorrect polarity.

8. Dynamic Path Management

Figure 8.1: Dynamic Path Management System Diagram.

The module incorporates dynamic path management for efficient power delivery. When an external power supply (15V-19V) is connected, the battery output is disconnected. The system is powered directly by the external supply, and the installed batteries are charged simultaneously with a maximum charging current of approximately 1.33A. Battery charging automatically stops once fully charged and resumes if the battery voltage drops below 12V. This intelligent charging mechanism prevents damage to the batteries from frequent charging and discharging cycles. If the external power supply becomes unavailable, the system seamlessly switches to battery power, ensuring continuous operation without interruption.

9. Real-Time Monitoring

The UPS Power Module (C) utilizes I2C bus communication to monitor critical battery parameters in real-time, including voltage, current, power, and remaining capacity. This data can be accessed by the connected Jetson Orin board.

In scenarios where the battery voltage drops below a critical threshold, the system can be configured via software on the Jetson board to automatically save any open files and initiate a graceful shutdown. This feature helps prevent data loss during unexpected power outages.

When monitoring current, a negative value indicates that the batteries are discharging (powering the system), while a positive value indicates that the batteries are recharging.

10. Safe and Stable Circuit Design

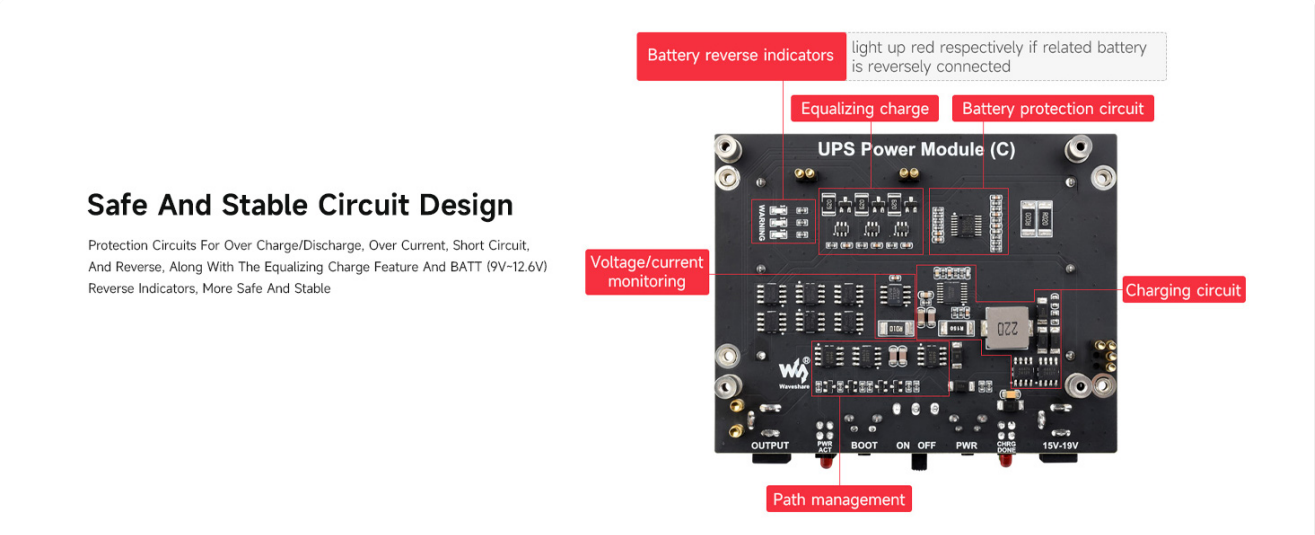


Figure 10.1: Internal circuit design with protection features.

The module is engineered with multiple protection circuits to ensure safe and stable operation. These include:

- **Overcharge Protection:** Prevents batteries from being charged beyond their safe voltage limit.
- **Over-discharge Protection:** Prevents batteries from being discharged below their safe voltage limit, prolonging battery life.
- **Over-current Protection:** Safeguards against excessive current draw.
- **Short Circuit Protection:** Automatically cuts off power in case of a short circuit.
- **Equalizing Charge Feature:** Balances the voltage across the three series-connected 21700 batteries, which helps extend their overall lifespan and performance.
- **Battery Reverse Indicators:** Visual alerts (red LEDs) if a battery is inserted with incorrect polarity, preventing immediate damage.

11. Pin Definition and Outline Dimensions

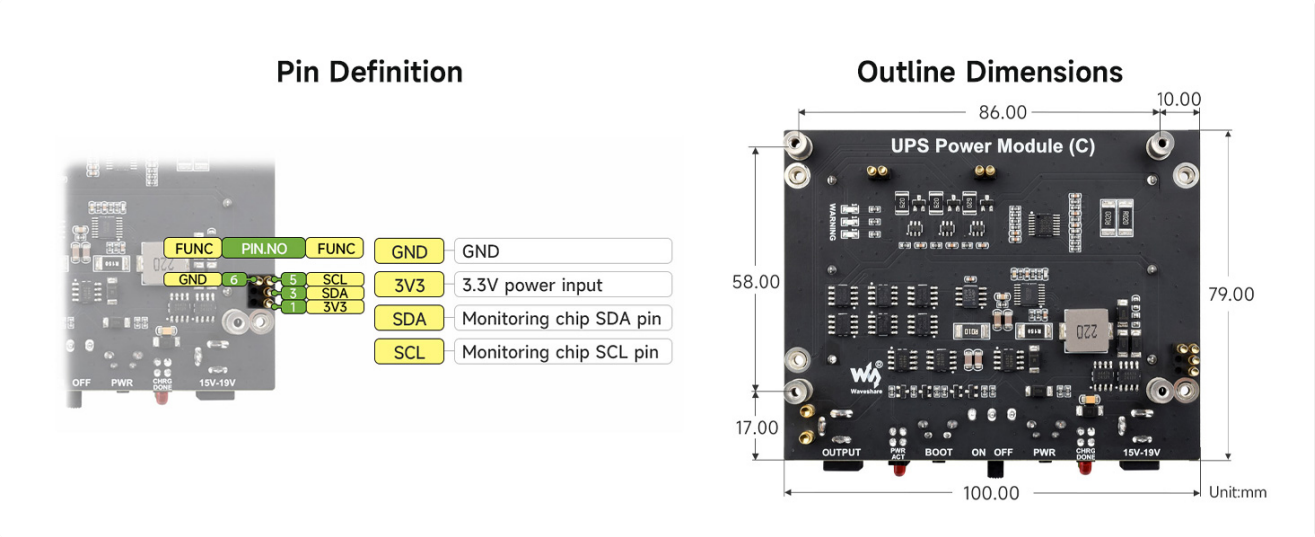


Figure 11.1: Pin definitions and physical dimensions of the module.

11.1. Pin Definition

The I2C communication pins are defined as follows:

- **GND:** Ground
- **3V3:** 3.3V power input
- **SDA:** Monitoring chip Serial Data line
- **SCL:** Monitoring chip Serial Clock line

11.2. Outline Dimensions

The physical dimensions of the UPS Power Module (C) are:

- **Length:** 100.00 mm
- **Width:** 79.00 mm
- **Mounting Hole Spacing (Horizontal):** 86.00 mm
- **Mounting Hole Spacing (Vertical):** 58.00 mm

12. Maintenance

12.1. Battery Care

Regularly inspect the 21700 batteries for any signs of damage or swelling. Replace batteries that show signs of wear or have reached their end-of-life cycle (typically after two years or a specified number of charge cycles).

12.2. Cleaning

Keep the module free from dust and debris. Use a soft, dry cloth to gently clean the surface. Avoid using liquids, solvents, or abrasive cleaners, as these can damage the electronic components.

12.3. Storage

If the module will not be used for an extended period, remove the 21700 batteries and store them separately in a cool, dry place, away from direct sunlight and extreme temperatures. Store the module in its original packaging or an anti-static bag.

13. Troubleshooting

13.1. Module Not Powering On

- **Check Battery Installation:** Ensure all three 21700 batteries are correctly installed with proper polarity.
- **Verify Battery Charge:** Confirm that the batteries are sufficiently charged.
- **External Power Supply:** Ensure the 15V-19V external power supply is connected and functional.
- **Pogo Pin Connection:** Check that the module is securely connected to the Jetson board via the pogo pins.

13.2. Batteries Not Charging

- **External Power Supply:** Confirm the external power supply is connected and providing 15V-19V.
- **Charge Indicator:** Check if the charge indicator LED is illuminated. If not, there might be an issue with the power input or battery connection.
- **Battery Health:** Verify the health and proper insertion of the batteries.

13.3. I2C Monitoring Data Incorrect or Unavailable

- **I2C Connection:** Ensure the pogo pin connection for I2C communication between the module and Jetson board is secure.
- **Software Configuration:** Verify that the I2C communication is correctly configured in the Jetson board's operating system or application.

13.4. Battery Reverse Indicator On

- **Immediate Action:** Immediately power off the module and correct the battery polarity. Operating with reversed batteries can cause damage.

14. Warranty and Support

14.1. Warranty Information

This Waveshare UPS Power Module (C) is covered by a 1-year manufacturer's warranty from the date of purchase. This warranty covers defects in materials and workmanship under normal use. It does not cover damage caused by misuse, accidents, unauthorized modifications, or improper installation.

14.2. Technical Support

For additional resources, detailed documentation, software examples, or technical assistance, please refer to the official Waveshare Wiki resources. The Wiki often contains comprehensive guides and community support. Contact information for direct technical support can typically be found on the official Waveshare website.