

DIY Charging System Manual for Security Drone

This manual provides detailed instructions for assembling a 4S1P battery pack for the AME 504 security drone, including soldering, wiring, charge control setup with the iSDT 608AC acting as both charger and BMS, and integration with the drone and docking subsystems. Following these steps ensures a reliable power source for 24/7 autonomous surveillance, adhering to safety and performance standards.

1. All Components Needed

- 1.1. 4 Samsung 50S 21700 Li-Ion Cells (5000mAh, 25A max discharge)
- 1.2. 1 XT60 Connector (Male & Female)
- 1.3. 4 Magnetic Pogo Pin Connectors (2-pin Male & Female for power, 5-pin Male & Female for data)
- 1.4. Nickel Strips (0.15mm thick, 8mm wide, 50mm length, 8 pieces)
- 1.5. Kapton Tape (for insulation)
- 1.6. Electrical Tape (for securing)
- 1.7. 1 iSDT 608AC Smart Battery Charger (AC 50W, DC 200W, 8A max, with BMS functionality)

2. Extra Equipment

- 2.1. 10 ft 16 AWG Silicone Wires (red and black)
- 2.2. Soldering Kit (soldering iron, solder wire, flux, desoldering braid)
- 2.3. Spot Welder (for nickel strips)
- 2.4. Multimeter (for voltage checks)
- 2.5. Heat Shrink Tubing (assorted sizes)
- 2.6. Wire Strippers and Cutters
- 2.7. Safety Gloves and Glasses (for handling Li-Ion cells)
- 2.8. Fireproof Li-Ion Charging Bag (for safe charging)

3. Safety Instructions for Handling Samsung 50S 21700 Li-Ion Cells

- 3.1. Always wear safety gloves and glasses when handling Li-Ion cells to protect against potential chemical leaks or explosions.
- 3.2. Do not short-circuit the cells; keep positive and negative terminals insulated using Kapton tape to prevent accidental contact.

- 3.3. Avoid overcharging or over-discharging; do not charge above 4.2V or discharge below 3.0V per cell, as this can cause thermal runaway or permanent damage.
- 3.4. Store and assemble cells in a cool, dry environment away from flammable materials, and charge inside a fireproof Li-Ion charging bag to mitigate fire risks.

4. Instructions

4.1. Preparing the Cells

- 4.1.1. Inspect the 4 Samsung 50S 21700 cells for damage or defects. Use a multimeter to verify each cell's voltage is approximately 3.6V (nominal). If any cell is below 3.0V or above 4.2V, do not use it to prevent safety hazards.
- 4.1.2. Arrange the 4 cells in series (positive to negative) in a straight line, ensuring proper polarity. Secure the cells temporarily with Kapton tape to prevent movement during assembly, as shown in Figure 1.

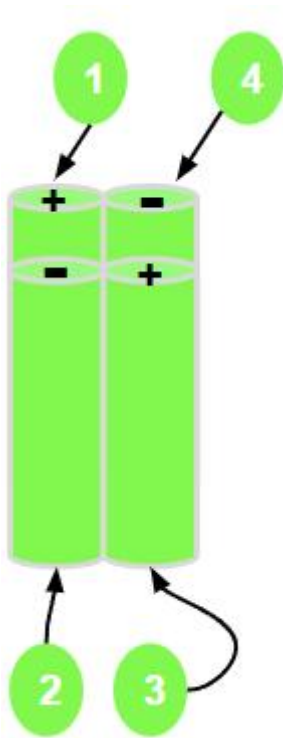


Figure 1: Arrangement of 4 Samsung 50S 21700 cells in series with Kapton tape

4.2. Spot Welding the Nickel Strips

- 4.2.1. Using a spot welder, attach nickel strips to connect the cells in series. Weld a nickel strip from the positive terminal of the first cell to the negative terminal of the second cell, repeating for all cells to form a 4S configuration, as shown in Figure 2. Ensure at least 4 weld points per connection for reliability.

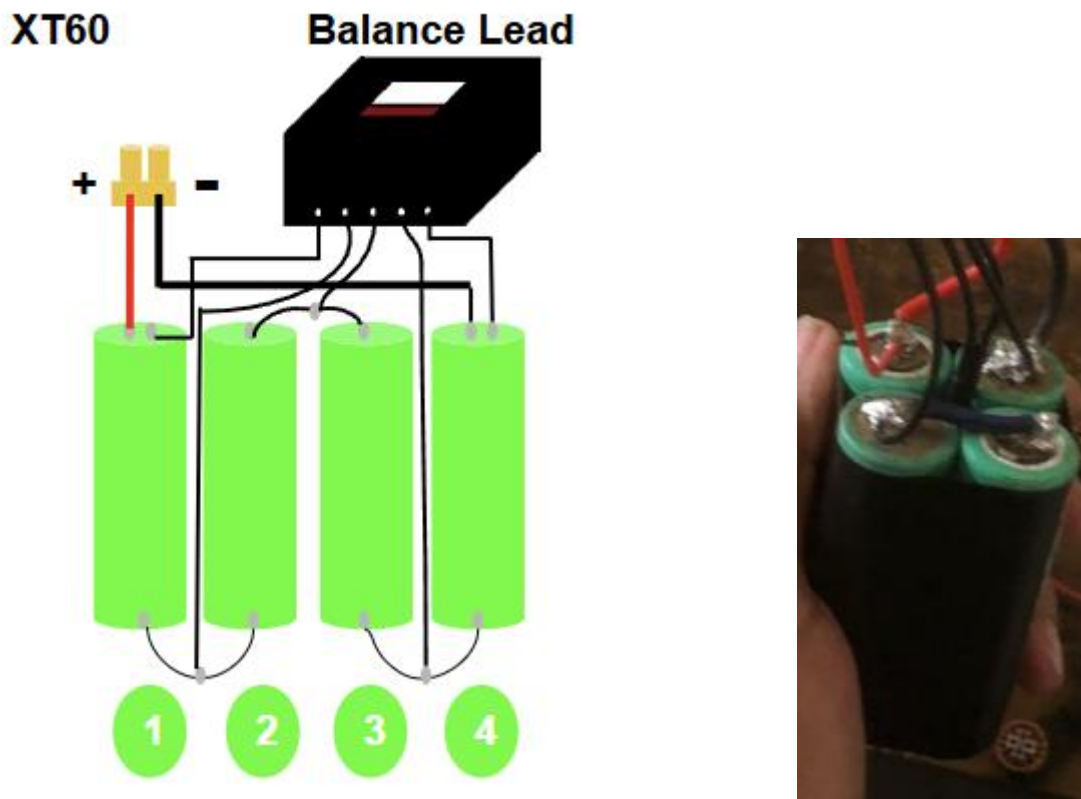


Figure 2: Nickel strip connections for 4S configuration on 21700 cells

4.2.2. Weld additional nickel strips to the positive terminal of the first cell and the negative terminal of the last cell, extending outward to serve as the main power leads for the XT60 connector.

4.3. Soldering Electrical Components

4.3.1. Solder 16 AWG red and black wires to the main power leads (positive and negative nickel strips). Attach the XT60 connector to these wires, ensuring the positive wire connects to the XT60's positive terminal and the negative to the negative terminal, as shown in Figure 3. Use heat shrink tubing to insulate the solder joints.

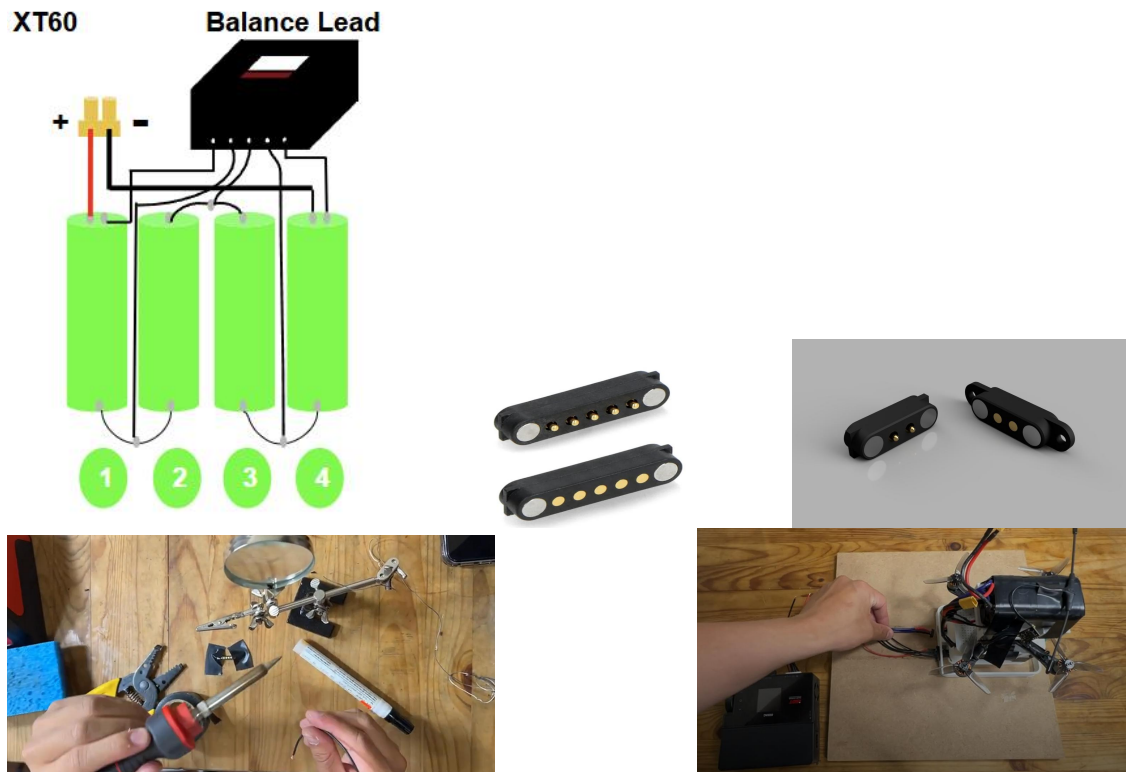


Figure 3: Wiring diagram of the 4S1P battery pack with XT60 and Pogo Pin connectors for iSDT 608AC integration

- 4.3.2. Solder the 2-pin Pogo Pin connector (male) to the power leads for charging, and the 5-pin Pogo Pin connector (male) to additional 16 AWG wires extending from the cell junctions (positive of first cell, junctions between cells, and negative of last cell) for SoC monitoring by the iSDT 608AC, as depicted in Figure 3. Insulate all connections with heat shrink tubing to prevent short circuits.

4.4. Insulation and Securing

- 4.4.1. Wrap the entire battery pack with Kapton tape to insulate exposed terminals and prevent short circuits. Secure the pack with electrical tape to ensure the cells remain tightly bound.

4.5. Setting Up Charge Control with iSDT 608AC Charger

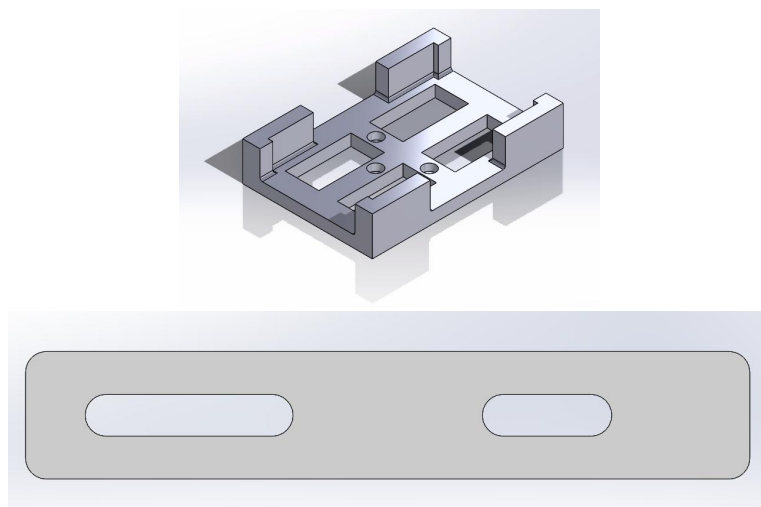
- 4.5.1. Connect the iSDT 608AC charger to the battery pack via the XT60 connector, ensuring proper polarity (positive to positive, negative to negative). Attach the 5-pin Pogo Pin connector (female) on the docking station to the charger's balance port to enable SoC monitoring and cell balancing, as shown in Figure 3. Place the battery in a fireproof Li-Ion charging bag during charging to enhance safety.
- 4.5.2. Configure the iSDT 608AC charger for a 4S Li-Ion battery with the following settings, informed by the battery sizing calculations: set the charging current to 5A (1C rate for 5000mAh capacity), charge voltage to 16.8V (4.2V per cell), and enable balance charging mode to ensure uniform cell voltages. The charger's built-in BMS functionality provides thermal monitoring (cutoff above 60°C), overcharge protection (stops at 4.2V per cell), overvoltage protection (limits to 16.8V), and overcurrent protection (caps at 8A), ensuring safe operation, as shown in Figure 5.



Figure 5: iSDT 608AC charger setup with the 4S1P battery pack for safe charging and BMS functionality

4.6. Integration with Security Drone Subsystems

- 4.6.1. Mount the battery pack onto the drone's CAD battery mount using electrical tape, ensuring the XT60 connector aligns with the drone's power input. Connect the XT60 female connector on the drone to the battery's XT60 male connector as seen in Figure 6.



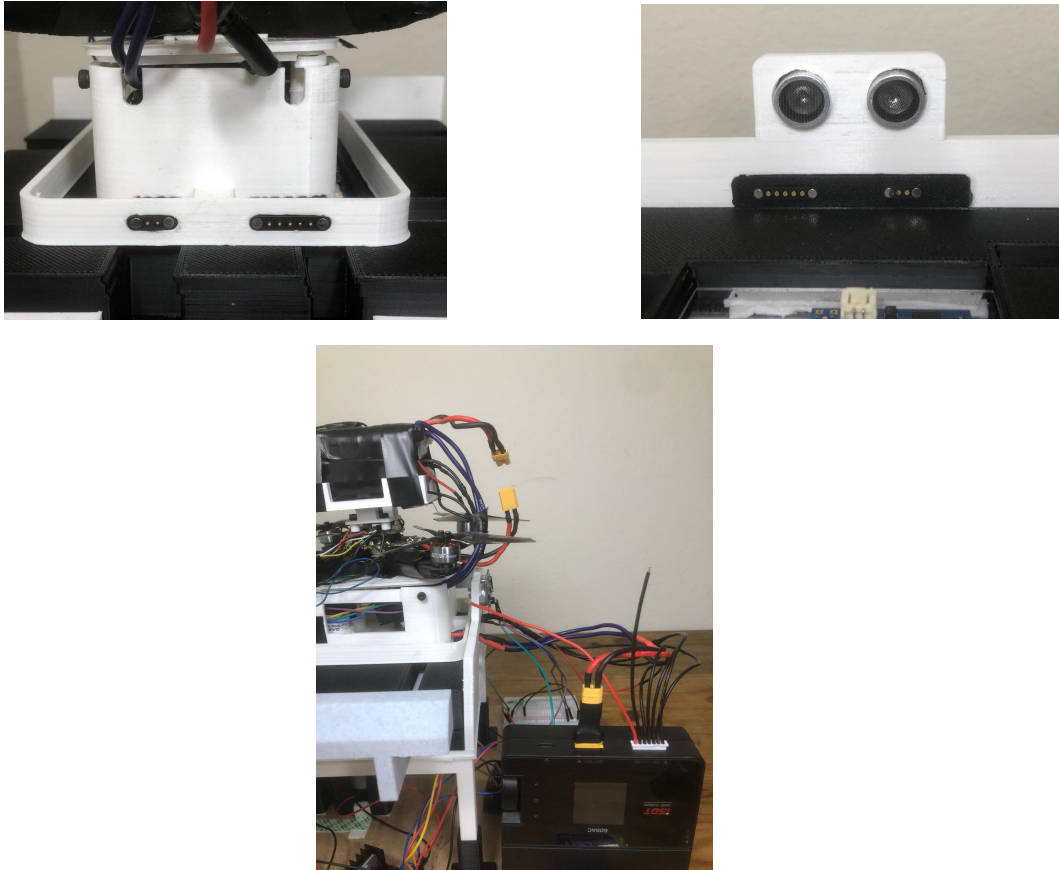


Figure 6: CAD of the battery mount, magnetic pogo pin connector fixture and battery wiring connection

4.6.2. Align the Pogo Pin connectors (male) on the battery with the female counterparts on the docking station's charging interface. The 2-pin connector facilitates power transfer (5A charging current), while the 5-pin connector enables SoC data communication with the iSDT 608AC via the docking system, ensuring closed-loop charging, as shown in Figure 7.

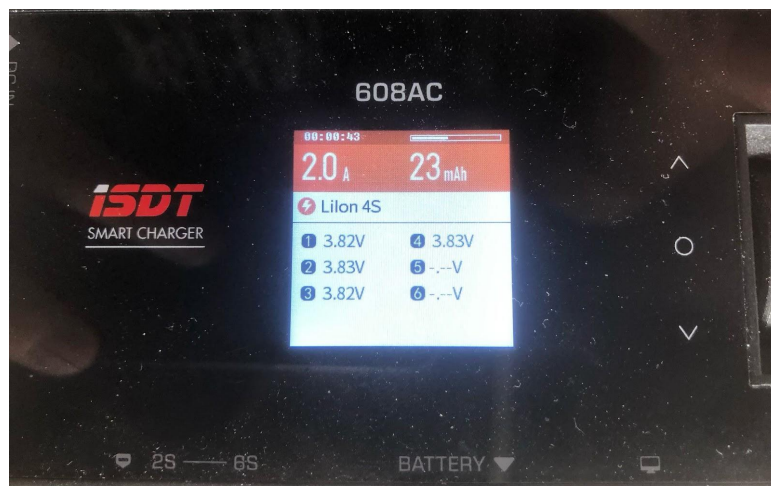


Figure 7: iSDT 608AC showcasing Drone Individual Battery Balancing & Charging

4.6.3. Test the integration by placing the drone on the docking station. Verify that the

Pogo Pins make contact, initiating charging via the iSDT 608AC charger, and that the charger's BMS functionality monitors SoC and balances cells, confirming for no- human-in-the-loop operation.

5. Result

The final assembled 4S1P battery pack provides a reliable power source for the security drone, seamlessly integrating with the flight, docking, and charging subsystems to enable autonomous operation with safe and efficient charging managed by the iSDT 608AC.