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› [Yahboom Robot Expansion Board V3.0 with STM32F103RCT6 User Manual](#)

Yahboom ROS Expansion Board 3.0

Yahboom Robot Expansion Board V3.0 with STM32F103RCT6 User Manual

Model: ROS Expansion Board 3.0

1. INTRODUCTION

The Yahboom Robot Expansion Board V3.0 is a versatile control board designed for robotics development, compatible with various single-board computers such as Raspberry Pi 5, Jetson, and RDK series. It integrates an STM32F103RCT6 microcontroller, a 9-axis IMU sensor, and provides rich peripheral interfaces for motor control, servo operation, and multiple communication methods. This manual provides essential information for setting up, operating, maintaining, and troubleshooting your expansion board.

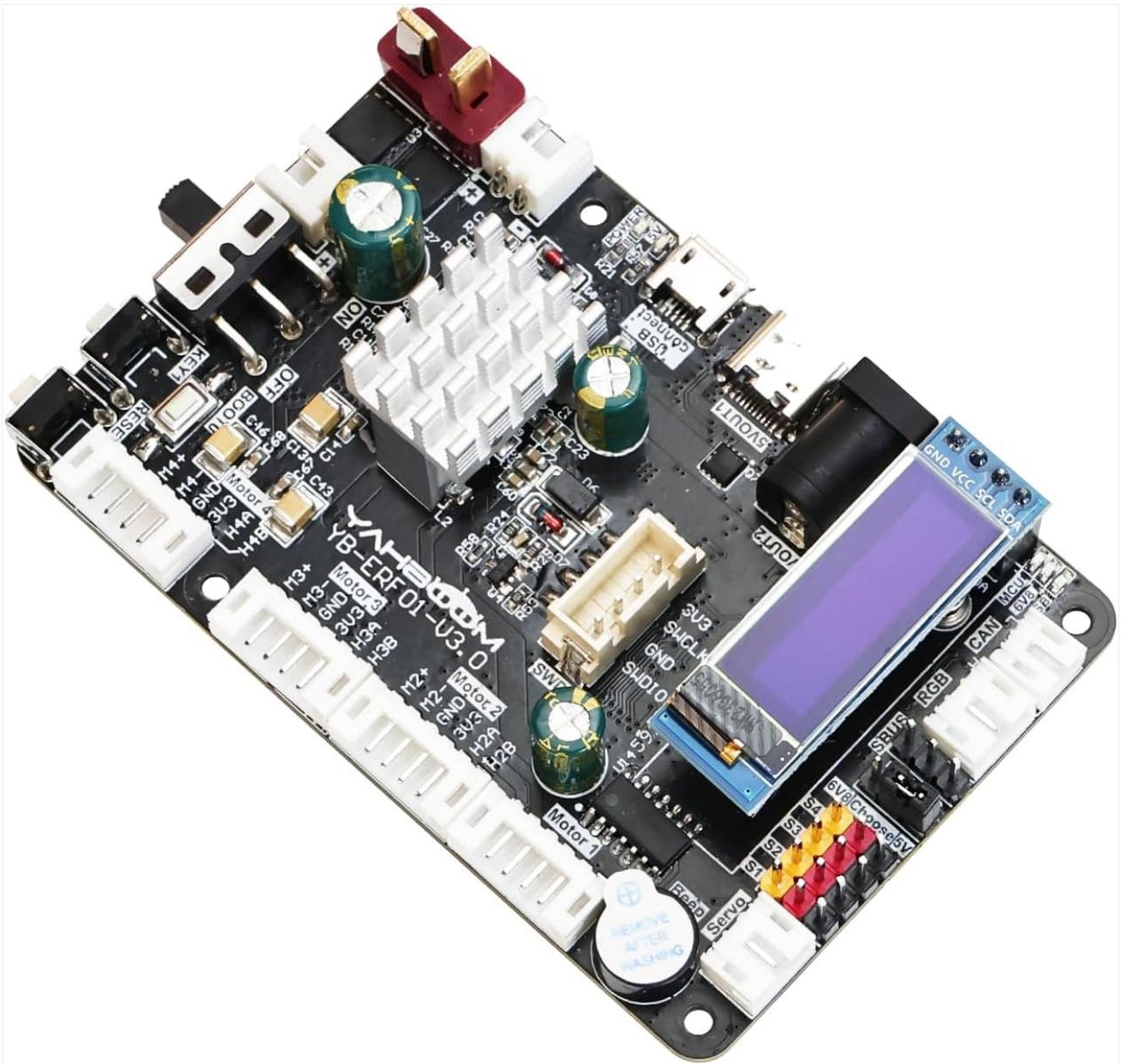


Figure 1: Yahboom Robot Expansion Board V3.0

2. SETUP

2.1 Package Contents

Before beginning, ensure all components are present:

- Yahboom Robot Expansion Board V3.0 (PCB with STM32F103RCT6 and 9-axis IMU Sensor)
- Micro-USB data cable
- Double-ended Type-C power supply cable
- Double-ended DC power supply cable
- OLED 0.91-inch display
- Copper post screw package

2.2 Compatible Development Boards

The expansion board is compatible with:

- Raspberry Pi series (including Raspberry Pi 5, with support for its power supply protocol)
- Jetson series development boards
- RDK series development boards
- Industrial control board development boards



Figure 2: Compatibility with various development boards

2.3 Power Supply

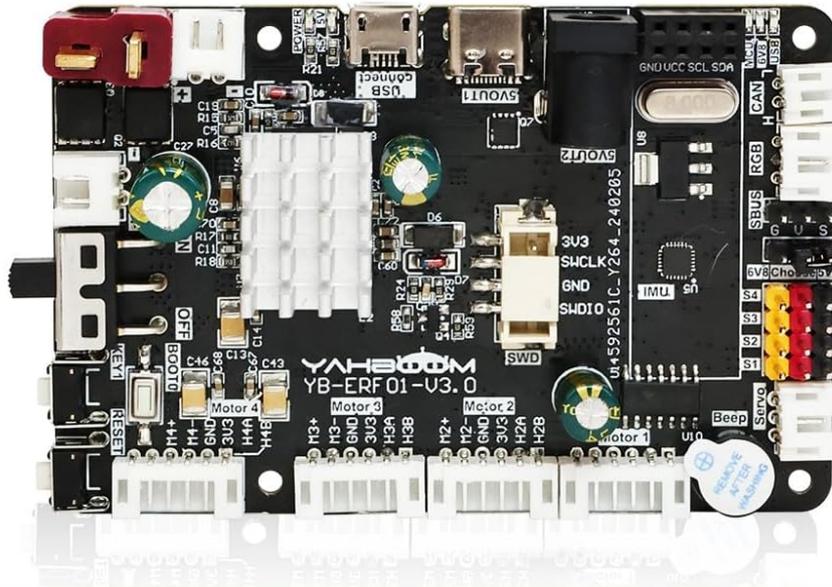
The board supports 12V voltage input and provides multiple power supply interface outputs. For Raspberry Pi 5, the board supports its power supply protocol, providing 5.1V/5A power to lift the current limit of the Raspberry Pi 5 USB port, ensuring full performance for USB peripherals.

2.4 Connecting the Board

Connect the expansion board to your chosen development board using the appropriate cables. Ensure all connections are secure before powering on. The board features microUSB and Type-C interfaces for data communication and power.

ROS robot control board

Brand New Upgrade Third Generation



V1.0

①Support Raspberry Pi, JETSON, industrial computers, RDK Series, etc. for ROS robot development and application, and provides information and tutorials in details.

V2.0

- ①Fully compatible with ROS2, providing ROS2 development materials.
- ②Added SWD interface to facilitate STM32 program simulation and writing.
- ③The power circuit is upgraded to adopt a smaller and better performance buck module.

V3.0

- ①Support Raspberry Pi 5 power supply protocol .
- ②Upgrade the 9-axis IMU solution to the ICM20948 solution.
- ③Improve the material tutorial on ROS robot development.

Figure 3: Labeled interfaces on the expansion board

2.5 Initial Software Setup

Yahboom provides fully open-source data, including basic peripheral driver routines written in STM32CUBEIDE. These routines cover driving encoder motors, PWM servos, serial bus servos, reading 9-axis attitude sensor data, and controlling communication interfaces. Hardware schematics are also available to assist with driver routine integration.

For detailed software setup and driver installation, refer to the official Yahboom documentation and tutorials. A relevant video demonstrating the MicroROS expansion board functionality is provided below:

Video 1: MicroROS Expansion Board Overview and Functionality

3. OPERATING

3.1 Motor Control

The expansion board supports 4-way encoder motors, enabling control of various vehicle types such as mecanum wheels, four-wheel differentials, and tracked robots. PID control can be implemented for precise motor speed management.

On-board 9-axis IMU sensor

The original data of the 9-axis IMU, including the data of the 3-axis gyroscope, 3-axis accelerometer and 3-axis magnetometer can be printed.

I2C communication rate
100kHz

Data read rate
100Hz

Number of sensor axes
9Axis

✓ ROS IMU attitude visualization display

With the ROS environment to display the visual posture, rviz visualizes the posture of the car model.

✓ 9-axis attitude sensor

The raw data of the sensor 3-axis gyroscope, 3-axis accelerometer and 3-axis magnetometer can be provided. It comes with a digital motion processor, which is convenient for attitude calculation.

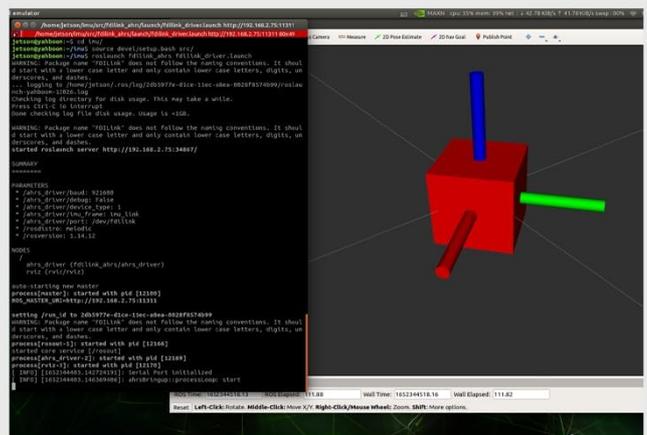
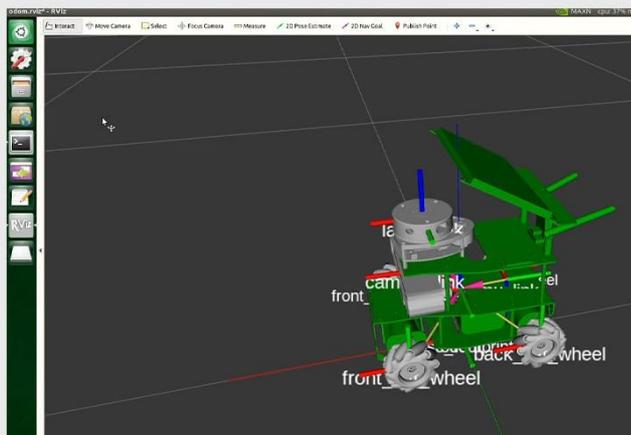


Figure 4: Motor and servo connections

3.2 Servo Control

Both PWM servos and serial bus servos are supported, allowing for adaptation to various robot arm configurations. The onboard interface supports cascading up to 6 serial bus servos.

3.3 IMU Sensor

Equipped with a 9-axis IMU attitude sensor (ICM20948), the board can acquire real-time posture information of the robot. This data is crucial for ROS robot development and attitude calculation.

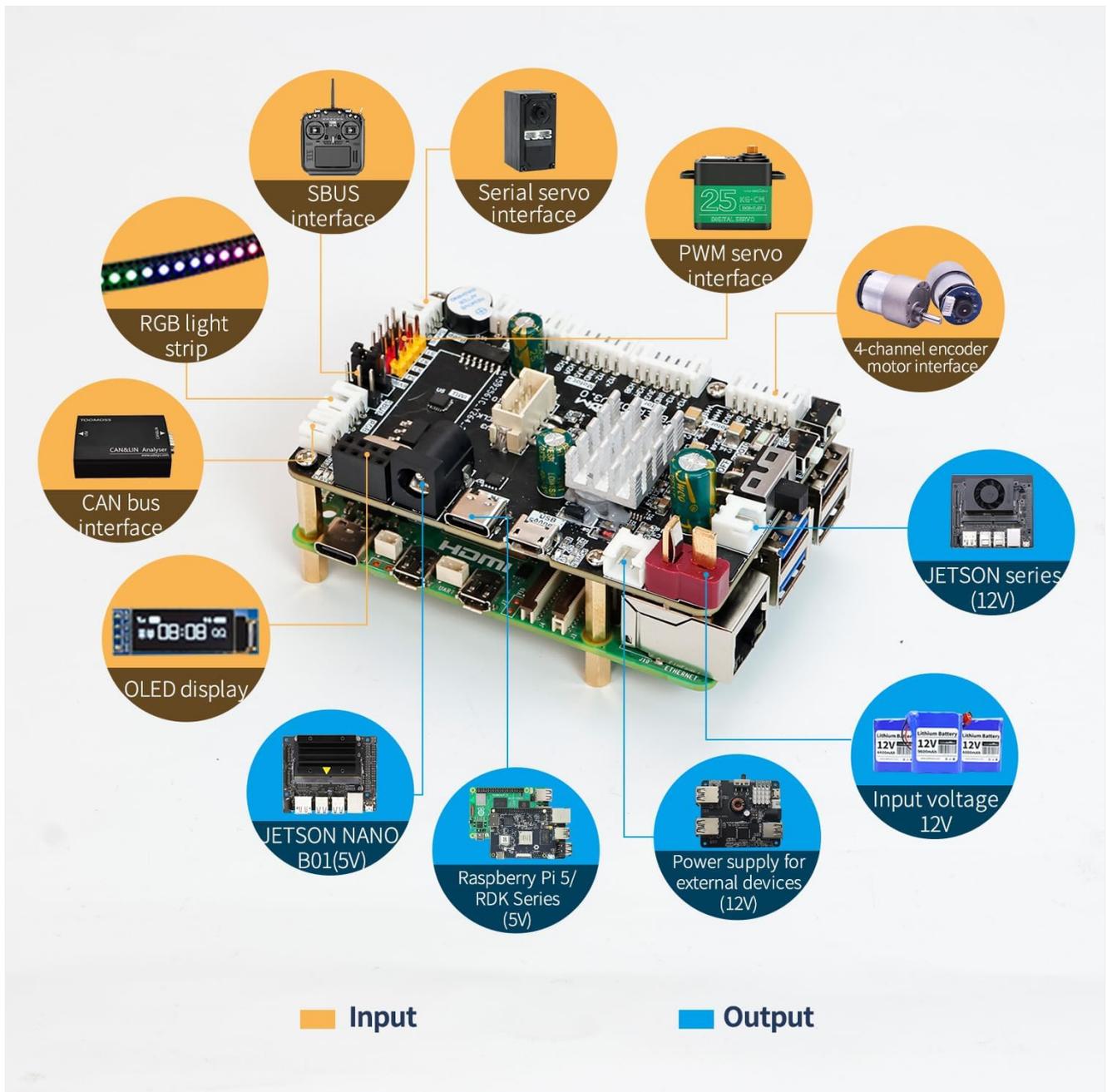


Figure 5: On-board 9-axis IMU sensor details

3.4 Communication Interfaces

The board supports multiple communication methods:

- **USB Serial Communication:** Utilizes a built-in serial port to USB communication chip for plug-and-play functionality with various main control boards.
- **CAN Bus Communication:** The factory firmware includes a CAN chip driver protocol, supporting access to CAN networks for receiving and executing control instructions.
- **SBUS Bus Communication:** Firmware supports connecting to aircraft model receivers via the SBUS communication interface.

3.5 ROS Support

The expansion board supports both ROS1 and ROS2 environments, providing SDKs and technical support for integration into robotics projects.

4. MAINTENANCE

4.1 General Care

To ensure the longevity of your expansion board, keep it in a dry environment and avoid exposure to extreme temperatures, humidity, or corrosive substances. Handle the board by its edges to prevent damage to components.

4.2 Firmware Updates

Firmware updates can be performed using the microUSB data interface in conjunction with an MCUSP tool. Refer to the official Yahboom documentation for specific instructions on updating the firmware.

4.3 Protection Features

The board incorporates several protection circuits, including servo over-current protection, anti-reverse connection protection, and short-circuit protection, to safeguard the components during operation.

5. TROUBLESHOOTING

5.1 Power Issues

- **Board not powering on:** Verify the 12V power input connection. Ensure the main power switch (DC 12V) is in the ON position.
- **Raspberry Pi 5 not powering from the board:** Ensure the Type-C power supply cable is correctly connected and the Raspberry Pi 5 power supply protocol is supported and enabled. If issues persist, consult the Yahboom documentation for specific power configuration details.

5.2 Communication Problems

- **USB communication not detected:** Check the microUSB cable connection. Ensure the correct drivers for the CH340 chip (USB to serial port chip) are installed on your host system.
- **CAN/SBUS communication errors:** Verify wiring and termination. Ensure the correct firmware and software configurations are applied as per Yahboom's documentation.

5.3 Sensor Malfunctions

- **IMU data incorrect or missing:** Check the IMU sensor connection. Ensure the driver routines for the 9-axis IMU are correctly implemented and calibrated.

5.4 General Issues

For more in-depth troubleshooting and specific error codes, refer to the comprehensive development materials and online resources provided by Yahboom. These resources often include FAQs, community forums, and detailed guides for common problems.

6. SPECIFICATIONS

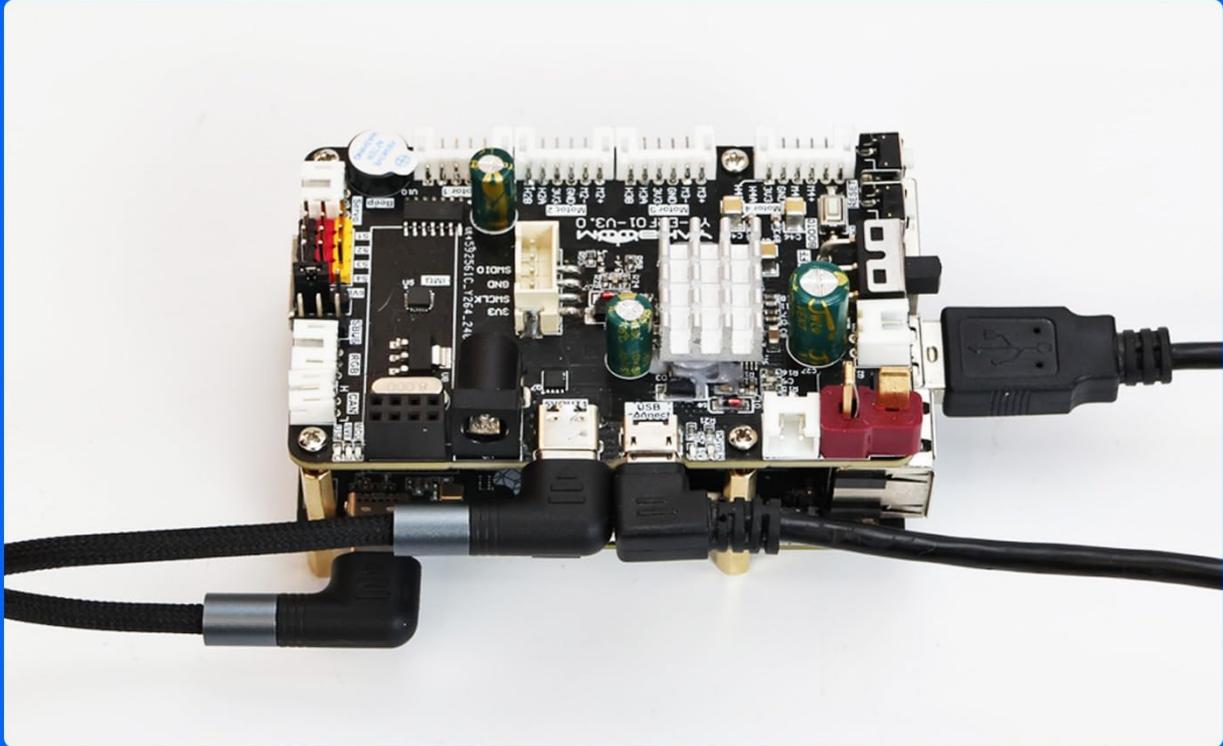
6.1 Product Parameters

Parameter	Value
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On board MCU model	STM32F103RCT6
Communication baud rate	115200bps
Data interface	microUSB interface
USB to serial port chip	CH340 chip
Data output method	microUSB data interface
Command control	Support serial commands: whistle, light up, drive motor, etc.
IMU chip	ICM20948 nine-axis IMU attitude sensor
Motor drive model	AM2861 driver chip*4
Encoder motor	Support 4-channel 12V encoder motor
SBUS model aircraft remote control	Support, the factory firmware has been adapted to the driver function
CAN communication	Support, the factory firmware has been adapted to the driver function
Other peripheral interfaces	Support PWM servos, serial servos, RGB light bars, OLED displays, buzzers, and SWD debugging interfaces
Button	RESET key, KEY1 key, BOOT0 key
Firmware update method	microUSB data interface + MCUSP tool to update firmware
Operating voltage	T type DC12V input
Stand-by current	About 50mA
Voltage output	DC 12V interface*2, DC 5V interface*1, Type-C 5V output interface (supports Raspberry Pi 5 power supply protocol)*1
Protect the circuit	Servo over-current protection, anti-reverse connection protection, short-circuit protection
Operating temperature	-40°C ~ +85°C
Product Size	85mm*56mm
Product weight	About 46g

Support RDK series board

Supports stacked installation of RDK series board
and ROS expansion board



It can power the RDK X3 board through Type-C interface (included)

*The picture shows the power supply connection + data communication connection between RDK X3 and ROS robot expansion board.

Figure 6: Product dimensions

7. WARRANTY AND SUPPORT

The Yahboom Robot Expansion Board V3.0 is manufactured by Yahboom. For warranty information, technical support, and access to the latest documentation, drivers, and software, please visit the official Yahboom website or contact their customer service directly. Always refer to the manufacturer's official resources for the most accurate and up-to-date support.