



# Rosbot User Manual

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## ROBOWORKS

# SUMMARY

Rosbot is both ideal for ROS beginner or experienced developer. The key components of Rosbot can be tailored towards your needs and budgets. The entire package is flexible and practical. Customers can switch between ROS 1 or ROS 2 easily. The main control unit can be based on Jetson Nano, Raspberry Pi or x86 Industrial PC. Onboard sensors include depth camera and LiDAR. Available accessories can range from light-weight robotic arms, LCD displays to larger battery packs. Each Rosbot comes with free tutorials backed by ROS communities around the globe. Rosbot is your welcome ticket to the world of ROS developers.

# KEY FEATURES

- Ideal for Autonomous Mobile Robot (AMR) and Autonomous Driving Prototype projects.
- ROS Controllers - Raspberry Pi/Jetson Nano/Jetson TX/Xavier/x86
- Builtin Slamtec/LD/RoboSense LiDAR, Orbbec Depth Camera
- Remote controlled by mobile apps (iOS and Android)

# PRODUCT FAMILY

## 1. Rosbot Mini

- Entry level package
- Ideal for ROS beginner, educator and students

## 2. Rosbot Pro

- Professional level package
- Ideal for AMR R&D projects

## 3. Rosbot Plus

- Ideal for product prototyping
  - Strong outdoor performance with 4WD Independent Suspension System
  - Suitable for autonomous driving R&D projects
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# SPECIFICATIONS

Product Matrix			
Product Name	Rosbot Mini	Rosbot Pro	Rosbot Plus
Motor Reduction Ratio	1:27	1:18	1:18
Max Speed	1.3m/s	1.65m/s	2.33m/s
Weight	5.92kg	19.54kg	35.16kg
Max Payload (Standard)	10kg	35kg	22kg
Max Payload (Extra)	22kg	60kg	45kg
Size	445*358*125mm	774*570*227mm	766*671*319mm
Minimal Turning Radius	0.77m	1.02m	1.29m
Battery Life	About 8 hours (no load), About 7 hours (full load)	About 4 hours (no load), About 2.5 hours (full load)	
Power Supply	22.2v 5000mAh battery + 2A current smart charger		
Steering Gear	HWZ020 20kg torque digital servo	WH060 60kg torque digital servo	
Wheels	125mm diameters solid rubber wheels	180mm diameters solid rubber wheels	254 mm inflatable rubber wheels
Encoder	500 line AB phase high precision encoder		
Suspension System	Coaxial Pendulum Suspension System		4W Independent Suspension System
Control Interface	iOS & Android App via Bluetooth or Wifi, PS2, CAN, Serial Port, USB		

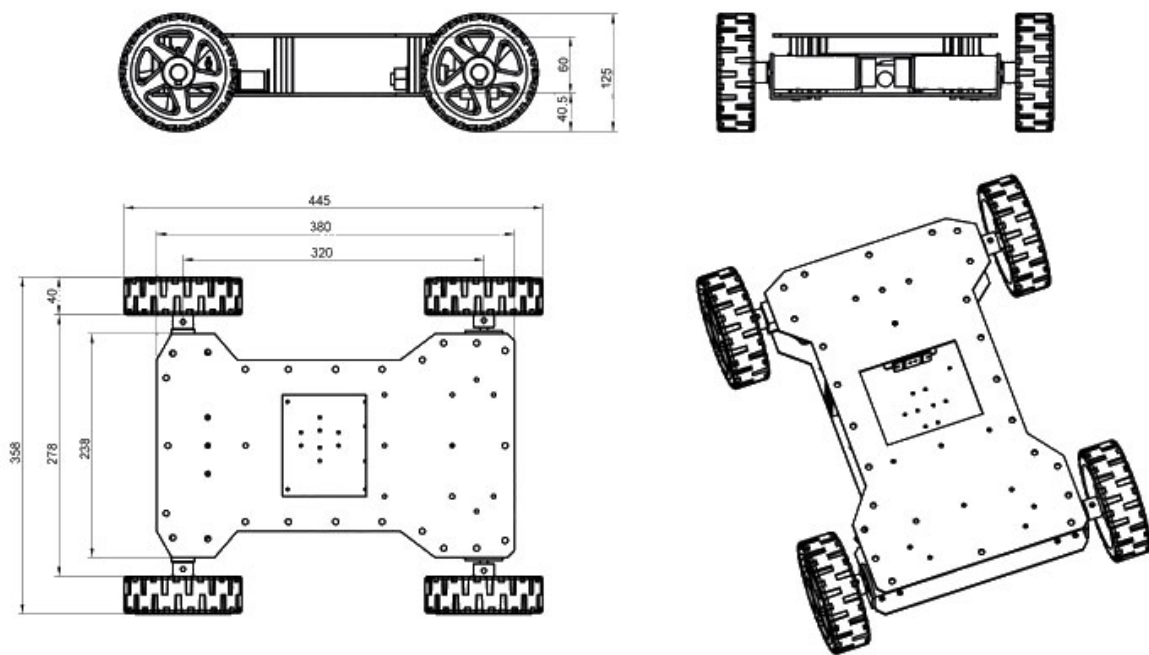
## ROS CONTROLLERS COMPARISON

ROS Master	Raspberry Pi 4B	Jetson Nano	Jetson TX1
CPU	ARM Cortex-A72 64-bit@1.5GHz (quad core)	ARM Cortex-A57 64-bit@1.43GHz (quad core)	ARM Cortex-A57 MPCore 64-bit@1.73GHz (quad core)
GPU	Broadcom VideoCore VI(32-bit)	128-core Maxwell @921MHz	256-core NVIDIA Maxwell GPU
RAM	4GB	4GB 64-bit LPDDR4@1600MHz 25.6 GB/s	4GB 64-bit LPDDR4 Memory
USB Interface	2*USB3.0+2*USB2.0	4*USB3.0	2*USB3.0,1*Micro USB
Video Input	MIPI CSI		
Video Output	2 Micro-HDMI Resolution up to 4Kp60	2 HDMI 2.0/DP1.2/eDP 1.2 2*MIPI DSI	1 HDMI2.0
Video Encoding	H.264(1080p30)	H.264/H.265(4Kp30)	
Video Decoding	H.264(1080p60) H.265(4Kp60)	H.264/H.265(4Kp60, 2*4Kp30)	H.264/H.265(4Kp60)
Onboard Storage	32G Micro SD Card		16 GB eMMC 5.1+64G SSD
Network Interface	Gigabit Ethernet Wifi 802.11	Gigabit Ethernet /M.2 Key E	10/100/1000 BASE-T Ethernet
GPIO Pin Number	40		
Rated Power	15W(5V/3A)	5W/10W two modes	15W
Power Input	5V		DC12~24V+/-10%
Size	85.60*53.98mm	100*80mm	128*98*70mm

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CHASSIS DESIGN DIAGRAM

Unit:mm



High Grade Version MD36 Motor Parameters							
Motor model	Motor voltage	Speed after deceleration	Rated speed	Rated torque	No-load current	Rated current	Locked-rotor current
MD36NP27	24V DC	325±30rpm	230±20rpm	13.5kg.cm	0.3A	2.3A	7A
MD36NP51	24V DC	172±15rpm	122±10rpm	25.5kg.cm	0.3A	2.3A	7A

Note:  
 \* MD36NP27 is used for high grade version normal type car  
 \* MD36NP51 is used for high grade version heavy-duty type car

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### HWZ020 SERVO FOR HIGH GRADE VERSION

- Maximum angle: 180°
- Voltage: 4.8-7.4V
- Torque: 20kg.cm
- Reaction speed: 0.14sec/60°
- Servo type: digital servo
- Gear: metal gear
- Net weight: 59.6g
- Working dead zone: 3us

### INTERFACE DESCRIPTION

- CAN: The mobile platform can receive commands from the CAN port, or send its own data (odometer and IMU) through the CAN port
- Serial port: The mobile platform can receive commands from the serial port and send its own data (odometer and IMU) through the serial port
- USB interface: used to connect to the computer, download the program with one key, and receive the command control sent by the computer and send its own data (odometer and IMU) to the serial port
- Bluetooth (or wifi): can send its own information to APP, can receive APP remote control commands, can adjust PID parameters
- For PS2 interface: Provide socket for PS2 controller, provide code plug and play
- SWD interface: Provide SWD interface for online debugging

### OPEN SOURCE AND ALGORITHM DESCRIPTION

- Provide the complete source code of the mobile platform and the schematic diagram of the controller. Provide detailed communication protocol and development manual of the interface. Provide PID development notes and video tutorials.
- The mobile platform is mainly to solve the problem of "making wheels" in everyone's projects. Built-in PID closed-loop control and kinematic analysis, can receive commands from serial ports, CAN and even laptops.

### ROS KIT WITH ROS MASTER, LIDAR AND DEPTH CAMERA

- ROS master: For Raspberry Pi 4B (2G+32G), Jetson Nano B01, Jetson TX2, industrial computer, etc. (optional)
  - Bottom master: STM32F103RCT6 (based on operating system for FreeRTOS)
  - Operating system: For Ubuntu 18.04+ROS melodic
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- Lidar: SLAMTEC RPLIDAR A2 (If you need A1, A3, S1 and other radars, please contact customer service)
- Camera: For Astra Pro depth camera
- Functions: remote control, lidar mapping and navigation, visual mapping and navigation, multi-point cruise, lidar follow, depth vision follow, visual line patrol, APP image transmission, etc.
- Attention: It has been assembled and debugged for the above functions, and you can use them when you get them.
- Open source: open source the full set of underlying code for the above functions, ROS source code, development manual, video tutorial
- Camera angle: manually adjustable

## FUNCTION LIST

- Low-level ROS serial communication
  - Reserved CAN communication interface
  - IMU and odometer data feedback
  - Voltage detection and voltage alarm
  - MPU9250 nine-axis attitude sensor
  - Support serial port one-click download
  - Stepless adjustment of radar frequency
  - Gyro zero drift clearing
  - Keyboard node control
  - APP gravity sensor control
  - APP adjusts PID parameters
  - For opencv applications and tutorials
  - Robot dynamic obstacle avoidance
  - Robot fixed-point navigation and multi-point navigation
  - TEB and DWA path planning
  - ROS APP image transmission and control
  - WEB browser displays camera image
  - Lidar mapping navigation
  - rtab pure visual mapping navigation
  - rtab vision + radar mapping navigation
  - Gmapping
  - Hector mapping
  - Karto build map
  - Cartographer
  - Tensorflow object recognition
  - Lidar tracking
  - Deep visual tracking
  - KCF tracking
  - AR label recognition
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- RGB visual line tracking (integrated radar obstacle avoidance)
- ROS APP mapping (NEW)
- ROS APP navigation (NEW)
- RRT Independent Mapping (NEW)
- Multi-agent collaborations (NEW)

## MORE DETAILS

- Rtabmap vision and lidar mapping navigation: support for vision SLAM, gmapping, hector, karto, Google Cartographer and other algorithms for mapping. Support fixed-point navigation, multi-point navigation
- Lidar follow: Lidar can follow any object including people in all directions
- Depth camera follow: Through the RGBD depth camera, you can measure the distance to the front object and follow
- Visual line inspection: The camera can navigate by sticking lines, and the general electrical glue can be used. The color of the patrol line is blue, black, red, green, yellow, etc. adjustable
- Support APP control, view images, build maps, and navigate. It can display the camera image on the mobile phone at the same time when it can be controlled by APP, and control from the first perspective
- Autonomous exploration and mapping: no need to manually control the car, use the RRT algorithm to autonomously complete the exploration and mapping, save the map, and return to the starting point
- Multi-aircraft formation: multi-aircraft cooperative operation, distributed formation control, support single-point and multi-point navigation functions
- Support airplane model remote control: Built-in remote control interface of airplane model, plug in the remote control of airplane model, and it can be controlled normally
- Support for PS2 wired controller: Built-in interface and program, connect it and use it
- Snow protection grade tires: Snow skid-proof standard/metal wheels. High grade version uses solid rubber wheels with a diameter of 125mm. Single wheel weighs 0.48kg
- Humanized design and multiple protections: This system board is suitable for motion control projects, such as robots, balancing cars, and inverted pendulums. Reverse connection protection, overcurrent protection, short circuit protection, electrostatic protection, CAN controller, integrated MPU6050
- MircoUSB data cable, one-click download: Are you tired of the tedious steps of plugging and unplugging the Dupont cable, modifying the BOOT0 setting, and pressing the reset button every time you adjust the program? We provide a one-click download function, using a MircoUSB data cable to download the program and communicate with the serial port
- Industrial-grade dual-channel DC motor drive module: built-in over-voltage protection, under-voltage protection, over-heat protection, control signal optocoupler isolation

## SLAMTEC RPLIDAR A2

- 5-year lifespan
  - OPTMAG optical and magnetic fusion
  - 18 meters measuring radius
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- 4CM ultra-thin appearance
- Measurement frequency 8000 times/sec

## NEW BLUETOOTH & WIFI VERSION APP

- Support gravity sensor remote control and two-hand button remote control mode.
- Support 5-channel waveform display interface, you can view the waveform at any time without the data line.
- Support 9-channel parameter adjustment interface, support PID parameter online adjustment and power-off save.
- Optimize electric quantity alarm mechanism, the APP accurately pushes low-voltage alarm notifications to avoid over-discharge.
- Support for BLE Bluetooth 4.0 module.
- Support the latest version of the system for Android.

## PACKING LIST

### Chassis Parts:

- 4 x 125mm Diameter Solid Rubber Wheels
- 1 x HWZ020 20kg Torque Digital Servo
- 2 x MD36N 35W DC Brush Motors
- 2 x Simple L-shaped Motor Brackets
- 1 x Set of Aluminum Alloy Plate (as chassis frame)
- 3 x Small Tie Rods
- 2 x Small Steering Cups
- 2 x 500 Line AB phase Photoelectric Encoders
- 1 x Mini Linear Guide
- 1 x Coaxial Pendulum Suspension System
- Several Screws, Nuts, Pillars, Wires

### Electric Control Parts:

- 1 x STM32F103RC Controller (integrated IMU CAN, etc.)
- 1 x Dual MOS Large Current DC Motor Drive Module
- 1 x Adapter Board
- 1 x Bluetooth Module
- 1 x OLED Display
- 1 x Charger
- 1 x Data Download Cable
- 1 x Flat Cable
- 1 x Wired Controller Joystick

### ROS Parts:

- ROS Master For Jetson Nano B01
  - 1 x SLAMTEC RPLIDAR A2
  - 1 x Depth Camera & Angle Adjustment Mechanism
  - 1 x 32G Memory Card
  - 1 x Large-Volume Metal Heat Sink (For Jetson Nano B01)
  - Several Cables
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