

# Rosbot User Manual

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## ROSBOT OVERVIEW

### Introduction

Rosbot is designed for ROS (Robot Operating System) developer, educator and students. The heart of Rosbot is the fully programmable software framework and configurable hardware architecture based on the most popular robotic platform - ROS.

Rosbot comes with three categories:

**Rosbot Mini** - Suitable for ROS beginners and low budget projects.

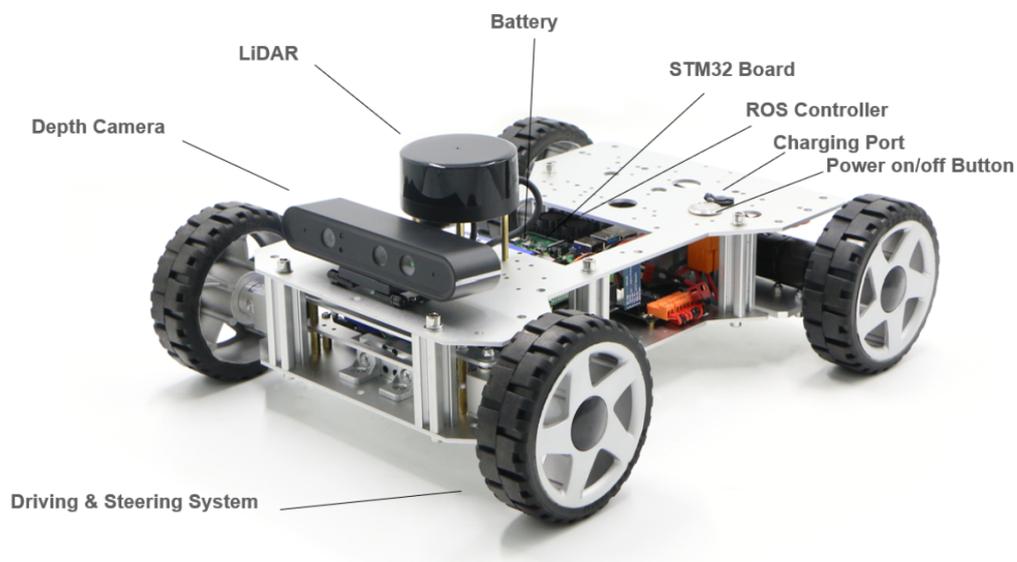
**Rosbot Pro** - Suitable for ROS developers and educators who need a versatile system for rapid prototyping or teaching.

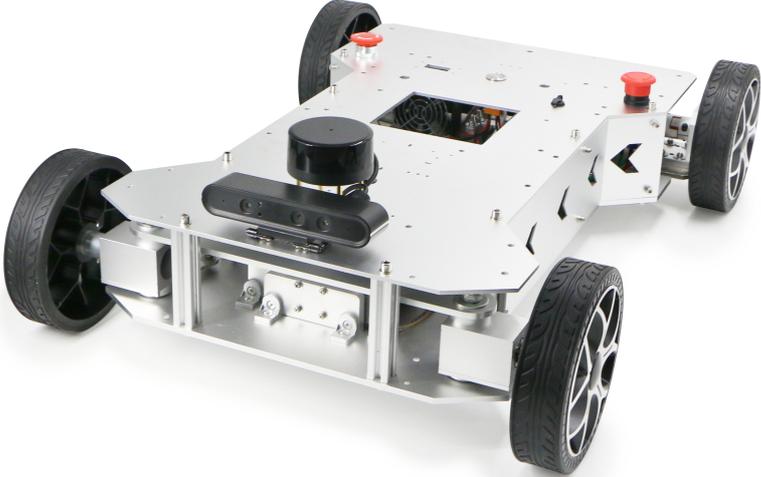
**Rosbot Plus** - This is the 4WD version of Rosbot with Independent Suspension Systems. This category is serious enough to be considered for industrial and commercial development.

Rosbot comes with popular ROS controllers such as:

- Jetson Nano
- Jetson TX
- Xavier
- X86 Industrial PC (Built-to-Order Option)

### Key Components



Variation	Image
Rosbot Mini	 A compact, four-wheeled robot with a white plastic chassis. It features a central black sensor unit, a blue battery pack, and four black wheels with white and orange accents.
Rosbot Pro	 A larger, more complex robot with a white metal chassis. It has four black wheels and a prominent black sensor unit on top. The chassis is more open, revealing internal components like a motor and battery pack.

Rosbot Plus



## Product 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	10kg	35kg	22kg
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 (fully load)	About 4 hours (no load), About 2.5 hours (fully 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	150mm 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		

## Introduction of ROS Controllers

There are 3 types of ROS Controllers available for use with the Rosbot based on Nvidia Jetson platform. Jetson nano is suited more towards research and development. Jetson TX is ideal for product prototyping. Jetson Xavier is used more often in research and commercial applications. X86 Industrial PC is designed for robust commercial applications and it is only available for Built-to-Order configurations.

The following table the main technical differences between the various controllers available from Roboworks. Both boards allow high level computation and are suited towards advanced robotic applications such as computer vision, deep learning and motion planning.

	Jetson Nano	Jetson TX1	Xavier Nx	X86 Industrial PC
<b>Users</b>	Edu/R&D	R&D/Commercial	R&D/Commercial	Commercial
<b>CPU</b>	ARM Cortex-A57 64bit@1.43GHz Quad Core	ARM Cortex-A57 MPCore 64bit@1.73GHz Quad Core	6 Core Nvidia <sup>SEP</sup> Camel ARM v8.2 <sup>SEP</sup> 64bit, 6MB L2 +4MB L3	Intel Core i5-4200U 2.5 GHz Dual Core
<b>GPU</b>	128-core Nvidia Maxwell	256-core Nvidia Maxwell	384-core Nvidia Volta	Intel HD Graphics 5500
<b>RAM</b>	4GB 64 bit LPDDR4	4GB 64 bit LPDDR4	8GB 128 bit LPDDR4	8GB
<b>Storage</b>	64G MicroSD	16G eMMC 5.1 +64G Hard Drive	16G eMMC 5.1 +64G Hard Drive	128G Hard Drive
<b>USB</b>	USB3x4	USB3x1 +MicroUSBx1	USB3.1x4	USB3x4

## Sensing System: LiDAR & Depth Camera

A Leishen LSLiDAR is installed on all Rosbot variations with either the N10 or M10 model being used. These LiDAR's offer a 360 degree scanning range and surroundings perception and boast a compact and light design. They have a high Signal Noise Ratio and excellent detection performance on high/low reflectivity objects and perform well in strong light conditions. They have a detection range of 30 metres and a scan frequency of 12Hz. This LiDAR integrates seamlessly into the Rosbots, ensuring all mapping and navigational uses can be easily achieved in your project.

The below table summaries the technical specifications of the LSLiDARs:

<b>LiDAR</b>	<b>N10</b>	<b>M10</b>
<b>Detection Range</b>	25m	30m
<b>Scan Frequency</b>	10Hz	12Hz
<b>Samples Frequency</b>	4500Hz	20000Hz
<b>Output Contents</b>	Angular, Distant and Light Intensity Data	Angular and Distant Data
<b>Angular Resolution</b>	0.8	0.22
<b>Interface Type</b>	Serial Port	Ethernet Port

Additionally, all Rosbots are equipped with an Orbbec Astra Depth Camera, which is an RGBD camera. This camera is optimized for a range of uses including gesture control, skeleton tracking, 3D scanning and point cloud development. The following table summarizes the technical features of the depth camera.

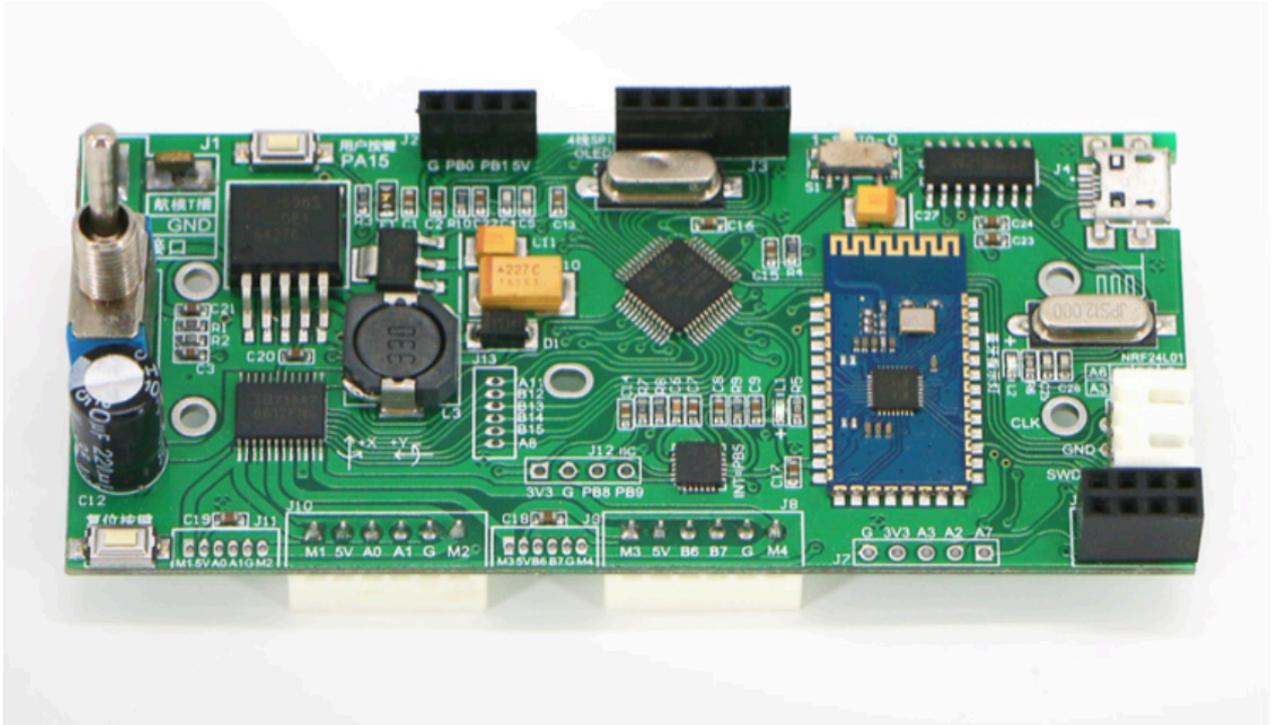
<b>Orbbec Astra Depth Camera</b>	<b>Specs</b>
<b>Depth Resolution</b>	640x480
<b>RGB Resolution</b>	640x480
<b>RGB Sensing Angle</b>	63.1x49.4 degree
<b>Depth Sensing Angle</b>	58.4x45.5 degree
<b>Monocular/Binocular Structural Light</b>	Monocular Structural Light + Monocular RGB
<b>Depth Frame per Second</b>	640x480@30fps
<b>RGB Frame per Second</b>	640x480@30fps
<b>Depth Range</b>	0.6~4m
<b>Data Transfer Interface</b>	USB2.0 or above

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## STM32 Board (Motor Control, Power Management & IMU)

The STM32F103RC Board is the micro-controller used in all Rosbots. It has a high performance ARM Cortex - M3 32-bit RISC core operating at a 72MHz frequency along with high-speed embedded memories. It operates in -40°C to +105°C temperature range, suiting all robotic applications in worldwide climates. There are power-saving modes which allow the design of low-power applications. Some of the applications of this microcontroller include: motor drives, application control, robotic application, medical and handheld equipment, PC and gaming peripherals, GPS platforms, industrial applications, alarm system video intercom and scanners. Below is the circuit diagram.

STM32F103RC	Features
<b>Core</b>	ARM32-bit Cortex –M3 CPU Max speed of 72 MHz
<b>Memories</b>	512 KB of Flash memory 64kB of SRAM
<b>Clock, Reset and Supply Management</b>	2.0 to 3.6 V application supply and I/Os
<b>Power</b>	Sleep, Stop and Standby modes $V_{BAT}$ supply for RTC and backup registers
<b>DMA</b>	12-channel DMA controller
<b>Debug Mode</b>	SWD and JTAG interfaces Cortex-M3 Embedded Trace Macrocell
<b>I/O ports</b>	51 I/O ports (mappable on 16 external interrupt vectors and 5V tolerant)
<b>Timers</b>	4x16-bit timers 2 x 16-bit motor control PWM timers (with emergency stop) 2 x watchdog timers (independent and Window) SysTick timer (24-bit downcounter) 2 x 16-bit basic timers to drive the DAC
<b>Communication Interface</b>	USB 2.0 full speed interface SDIO interface CAN interface (2.0B Active)



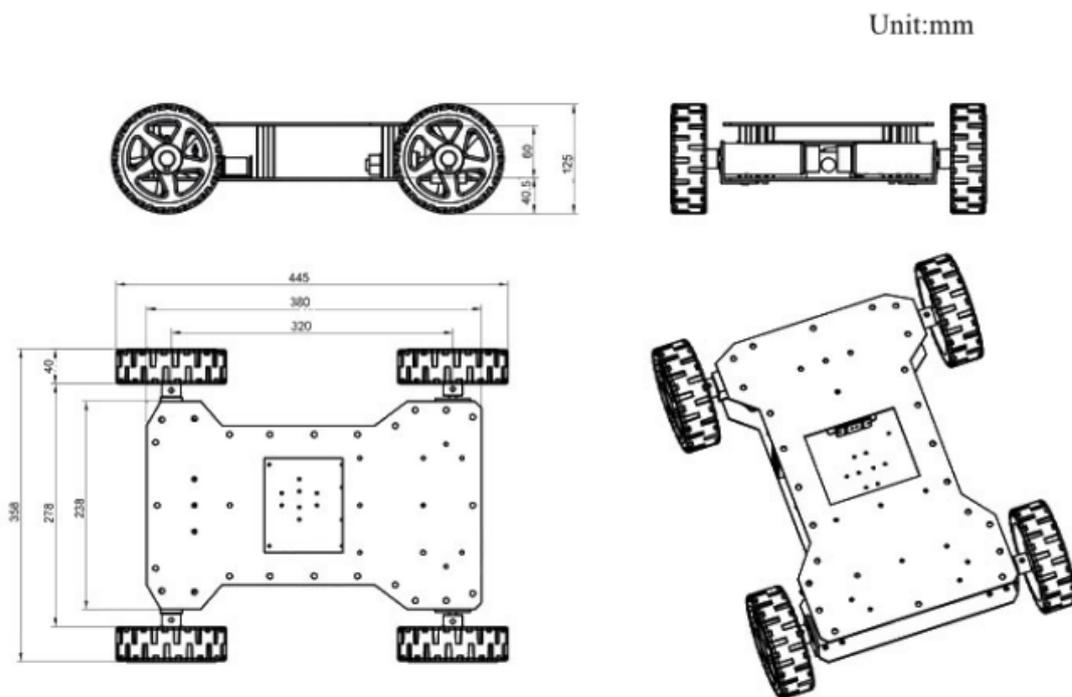
## Steering & Driving System

The Steering and Driving system is integrated with the design and build of the Rosbot. Depending on the model purchased it will be either a 2 wheel or 4 wheel drive, with both options being suitable to a variety of research and development purposes. The wheels on all Rosbots are solid rubber with snow protection grade tires. There is a coaxial pendulum suspension system, and the top range Rosbots are equipped with shock absorbers with independent suspension systems, ensuring it is able to successfully navigate difficult terrain.

**Steering and Driving Technical Specifications:**

Steering and Driving Aspect	Features
<b>Wheels</b>	4 x 125mm diameter solid rubber wheels Snow protection grade tires
<b>Motors</b>	1 x HWZ020 20kg Torque Digital Servo 2 x MD36N 35W DC Brush Motors
<b>Brackets</b>	2 x Simple L-shaped Motor brackets
<b>Chassis Material</b>	Aluminium Alloy plates
<b>Encoder</b>	2 x 500 Line AB phase Photoelectric Encoders
<b>Linear guide</b>	1 x Mini linear guide
<b>Suspension System</b>	1 x Coaxial pendulum suspension system

**Robot Chassis Design Diagram:**



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## Power Management

All Rosbots come with a 5000 mAh battery and a Power Charger. Customers can upgrade the battery to 10000 mAh or 20000 mAh with additional cost. The 20000 mAh battery is too large to house within the enclosure of any Rosbots. It can only be installed on the top of the Robot chassis.

### Battery echnical Specifications:

Battery parameter	Features		
	5000mAh	10000mAh	20000mAh
Battery Voltage	22.2V	22.2V	22.2V
Size	124*71*42mm	124*71*71mm	156*122*71mm
Power Charger	DC 5.5 Charging plug T-shaped discharge plug	DC 5.5 Charging plug T-shaped discharge plug	DC 5.5 Charging plug T-shaped discharge plug
Performance	15A continuous discharge	30A continuous discharge	60A continuous discharge
Weight	0.66kg	1.25kg	2.4kg