



**MAKER
& CODER**
EXPLORE. INNOVATE. EXCEL

MC 4.0 BASE KIT

Build · Code · Innovate · Compete



**SOLID METAL
CHASSIS**

**MECANUM OMNI
ROBOT**

**3-WHEEL ROBOT
READY**

**AUTONOMOUS
PROJECTS**

**COMPETITION
READY**

Maker and Coder Global

Everything you need to build, program, and compete – straight out of the box.

CONTENTS

1. About the MC 4.0 Base Kit.....	2
2. Chassis.....	3
3. Complete Kit Contents	3
4. What's Inside — Item Descriptions	5
5. Projects You Can Build	8
5. Mecanum Omnidirectional Robot Projects.....	8
6. Assembly Guide	10
7. Programming Platform Support.....	11

1. About the MC 4.0 Base Kit

The MC 4.0 Base Kit is the complete, ready-to-assemble robotics and programming package from Maker and Coder Global. Designed for students, educators, and makers, it delivers a full autonomous robot build experience from unboxing to first program with no additional components required. Every item in the kit has been carefully selected to work together as a unified system.



The kit is built around the MC 4.0 Controller — a 320×240 pixel touchscreen microcontroller powered by the ESP32 dual-core processor with built-in Wi-Fi and Bluetooth. It is paired with a solid black anodised metal chassis that serves as the structural foundation for both robot configurations included in the kit. The chassis arrives pre-drilled and fully ready for motor installation — mount the motors, attach the wheels, stack the modules, plug in the sensors, and you are ready to code.

What makes this kit exceptional is its dual-configuration design. The same chassis, the same controller, and the same motor module support two completely different robot drive systems: a four-wheel Mecanum omnidirectional robot and a three-wheel differential-drive robot. Users can switch between configurations at any time, making the Base Kit two robots in one package.

Configuration A

Mecanum Omnidirectional Robot

All four Mecanum wheels mounted to all four encoder motors. Enables full holonomic movement — forward, backward, sideways strafing, diagonal travel, and in-place rotation — by independently varying each motor's speed and direction.

- 4 × Mecanum Wheels (2 LH + 2 RH)
- 4 × BO DC Metal Gear Encoder Motors
- Full omnidirectional holonomic drive
- Advanced autonomous navigation
- Ideal for Mecanum competitions

Configuration B

3-Wheel Differential Drive Robot

Two BO wheels driven by two rear encoder motors for differential steering, with a single free-spinning caster wheel at the front for smooth, stable forward support. Simple to program and the ideal platform for line-following and obstacle-avoidance.

- 2 × Standard BO Motor Wheels (rear)
- 1 × Free-spinning Caster Wheel (front)
- 2 × BO DC Metal Gear Encoder Motors
- Differential drive — simple and reliable
- Ideal for line-following & competitions

2. Chassis

The structural foundation of the MC 4.0 Base Kit is its solid black anodised metal chassis. Unlike plastic chassis that flex under load or degrade over time, the metal chassis delivers the rigidity and durability required for both classroom use and competitive environments. The black anodised finish gives the robot a premium, professional appearance that stands out on any competition floor or exhibition table.

Chassis Features

- Solid anodised metal — rigid, durable, professional
- Solid black colour — premium competition-grade aesthetic
- Pre-drilled motor mounting points — no drilling needed
- Supports all 4 encoder motors simultaneously
- Mounting positions for MC 4.0 controller stack
- Sensor mount positions — front and underside
- Compatible with both Mecanum and 3-wheel builds

Ready to Build

- Arrives ready — no machining or modification needed
- All screws, standoffs, and nuts included
- Dedicated screwdriver included — no extra tools needed
- Motor installation is a straightforward screw-mount
- Controller stack attaches with included standoffs
- Full robot assembly achievable in under 30 minutes
- Switch configurations without any permanent changes

3. Complete Kit Contents

The MC 4.0 Base Kit contains 15 items across three categories: Electronics, Mechanical Components, and Accessories. Every component is included — nothing extra needs to be purchased to complete your first build.

No.	Item	Quantity
ELECTRONICS		
1	4 Encoder Motor Module & Charging Connector	1
2	Ednex Battery Module	1
3	MC 4.0 Controller & USB Type-C Cable	1
4	RGB Ultrasonic I2C Sensor & Grove Cable	1
5	6-Way Grayscale Line Follower Sensor & Grove Cable	1
6	Adapter / Charger	1
MECHANICAL COMPONENTS		
7	Solid Black Metal Chassis	1
8	BO DC Metal Gear Encoder Motors & Cables	4
9	Mecanum Wheels	4
10	Standard BO Motor Wheels ×2	2
11	Caster Wheel ×1	1
HARDWARE & ACCESSORIES		
12	Screws Set	1
13	Screwdriver	1
14	Adapter / Business Card	1
15	Magnetic Closure Box	1
16	EVA Carry Bag Case	1



4. What's Inside — Item Descriptions

01 4 Encoder Motor Module & Charging Connector

The 4 Encoder Motor Module is the motor driver at the base of the MC 4.0 stack. It connects directly to the controller via the stacking interface — no wiring harness, no soldering. It drives all four BO DC Metal Gear Encoder Motors independently, with closed-loop encoder feedback per channel enabling precise speed control, exact distance travel, and accurate angle rotation. In the 3-wheel configuration, only two channels are active. Includes a dedicated charging connector for the battery module.

02 Ednex Battery Module

The Ednex Battery Module is a 7.4V 500mAh LiPo rechargeable battery stack that connects between the motor module and the MC 4.0 controller. It includes an integrated Battery Management System (BMS) for overcharge, over-discharge, and short-circuit protection. A physical on/off switch controls power to the entire stack, and a 5V/Vin selector switch lets users choose the power rail for connected peripherals. A dedicated external charging port allows the battery to charge from the included adapter while the USB-C port remains free for programming.

03 MC 4.0 Controller & USB Type-C Cable

The MC 4.0 is the brain of the kit — a 320×240 pixel full-colour capacitive touchscreen microcontroller powered by the ESP32 dual-core processor running at 240 MHz with built-in Wi-Fi and Bluetooth. On-board hardware includes a 6-axis IMU, Real-Time Clock, MEMS microphone, speaker with amplifier, vibration motor, RGB LED, three Grove ports (A/B/C), and a MicroSD card slot. The included USB Type-C cable is used for programming from a computer and also powers the device from any USB-C power source.

04 RGB Ultrasonic I2C Sensor & Grove Cable

A dual-function sensor combining ultrasonic distance measurement (range 2–400 cm) with a programmable RGB LED ring surrounding the transducer face. It communicates via I2C over Grove Port A — plug-and-play with no pin configuration. Users set distance threshold zones and assign a different LED colour to each zone, so the robot visually signals how far away an obstacle is without needing a screen. Used in both robot configurations for obstacle detection. Includes Grove cable and mounting screws.

05 6-Way Grayscale Line Follower Sensor & Grove Cable

A 6-channel grayscale reflectance sensor array with I2C interface via Grove Port A. Each of the six channels independently reads surface reflectance as a value from 0 to 255, enabling high-resolution detection of lines, edges, and surface patterns. Six channels provide a wider sensing field than 5-channel sensors and support weighted centroid line-position calculation — the mathematical basis of smooth, high-speed PID line following. Primarily used in the 3-wheel robot configuration. Includes Grove cable and mounting screws.

06 Adapter / Charger

A dedicated power adapter for safely charging the Ednex Battery Module via its external charging port. Delivers the correct voltage and current profile for reliable LiPo battery charging. Designed to charge the battery independently so the USB-C port remains available for simultaneous programming and development.

07 Solid Black Metal Chassis

The structural backbone of the kit — a solid black anodised metal chassis pre-drilled for all motor mounting positions, sensor placements, controller stack standoffs, and wheel configurations. The rigid metal construction eliminates the flex and vibration seen in plastic chassis, ensuring consistent sensor readings and repeatable robot movement. The solid black finish delivers a competition-grade aesthetic. The chassis supports both the 4-motor Mecanum wheel layout and the 2-motor plus caster 3-wheel layout without any modification.

08 BO DC Metal Gear Encoder Motors & Motor Cables

Four BO DC Metal Gear Encoder Motors — one for each wheel channel. Each motor features an all-metal gear train for high torque and long-term durability, combined with an integrated rotary encoder that feeds position and speed data back to the motor driver module. This encoder feedback is what enables closed-loop motion control: the robot can travel a precise distance, rotate an exact angle, or hold a consistent speed regardless of load or surface. Pre-terminated motor cables connect directly to the four Grove motor ports on the 4 Encoder Motor Module. In the 3-wheel configuration, two motors are used.

09 Mecanum Wheels

Four omnidirectional Mecanum wheels — two left-hand (LH) and two right-hand (RH) roller orientation for the four chassis corners. Mecanum wheels have angled barrel rollers on their circumference that generate lateral thrust components, enabling full holonomic movement: forward, backward, sideways strafing, diagonal, and in-place rotation. This is achieved by independently controlling the speed and direction of each of the four motors. Used exclusively in Configuration A — the Mecanum omnidirectional robot. The four wheels mount directly onto the BO DC Metal Gear Encoder Motor output shafts.

10 Standard BO Motor Wheels & Caster Wheel

Two standard BO motor wheels and one free-spinning caster wheel — the complete wheel set for the 3-wheel robot configuration. In this layout, the two BO wheels are mounted on the two rear encoder motors for differential-drive steering, while the single caster wheel is mounted at the front-centre of the chassis to provide smooth, stable forward support with 360-degree swivel. This three-wheel differential-drive configuration is straightforward to program and is the recommended starting point for line-following and obstacle-avoidance projects. The caster wheel ensures the robot glides smoothly on flat surfaces without the tipping or drag that a fixed third wheel would cause.

11 Screws Set

A complete hardware set containing all screws, bolts, nuts, and standoffs required for full robot assembly in both configurations. Includes motor mounting screws for all four motors, chassis standoffs for the MC 4.0 controller stack, sensor mounting hardware for the front and underside sensor positions, and caster wheel bracket screws. Every fastener needed from chassis to finished robot is included.

12 Screwdriver

A precision screwdriver compatible with all screw types included in the kit. Included so builders have the correct tool from the moment the box is opened. Suitable for all motor, chassis, sensor, and standoff assembly steps.

13 Business Card

Maker and Coder Global official business card with contact information, MCLab platform URL, and a QR code linking directly to product documentation, tutorial projects, and community support resources.

14 Magnetic Closure Box

A premium rigid magnetic-closure presentation box for storing and protecting the MC 4.0 Controller and key electronic components. The magnetic closure provides secure protection and presents the controller professionally for demos, exhibitions, and classroom use.

15 EVA Carry Bag Case

A durable EVA foam-padded carry bag sized for the complete assembled or disassembled MC 4.0 Base Kit. The semi-rigid EVA construction absorbs impacts and prevents compression damage during travel to schools, competition venues, maker spaces, and field sites. Carries all kit components in a single organised package.



5. Projects You Can Build

Every project below is achievable using only the components included in the MC 4.0 Base Kit — programmed via MCLab (Scratch block coding or Python) or the Arduino IDE with C++. Projects are grouped by recommended robot configuration and difficulty level.

3-Wheel Differential Drive Projects

~ Line Follower Robot

Level: Beginner → Intermediate

Mount the 6-way line follower sensor at the chassis underside and program the robot to follow a black line on a white surface. Begin with simple on/off left/right logic, then upgrade to weighted centroid PID control for smooth, high-speed tracking around bends and intersections.

🚧 Obstacle Avoidance Robot

Level: Beginner → Intermediate

Use the RGB Ultrasonic I2C sensor to detect objects within a programmable distance threshold. The robot automatically steers around obstacles and resumes its path. The RGB LED ring changes colour as objects approach, providing live visual distance feedback.

🏁 Line Following Race Robot

Level: Intermediate → Advanced

Tune the 3-wheel PID line follower for maximum speed. Adjust proportional, integral, and derivative gains to eliminate oscillation and achieve fast, precise tracking. Use encoder feedback to maintain consistent motor speeds and measure lap times.

🗺 Maze Navigation Robot

Level: Intermediate

Program the robot to navigate a physical maze using the ultrasonic sensor for wall detection and encoder odometry for precise turns and distance measurement. Implement a left-wall-following or flood-fill algorithm for autonomous maze solving.

5. Mecanum Omnidirectional Robot Projects

◇ Mecanum Omni-Drive Robot

Level: Intermediate

Program all four Mecanum wheels for full holonomic movement — forward, backward, sideways strafing, diagonal travel, and in-place rotation. Build a remote-controlled omnidirectional robot using MCLab over Bluetooth or Wi-Fi from a smartphone or browser interface.

🌐 Autonomous Waypoint Navigator

Level: Intermediate → Advanced

Use encoder-based odometry to program the robot to navigate a sequence of precise grid positions — move forward exactly 50 cm, strafe right exactly 30 cm, rotate exactly 90 degrees. No external localisation needed — pure encoder feedback navigation.

🕸 Remote-Controlled Mecanum Bot

Level: Beginner → Intermediate

Build a Wi-Fi or Bluetooth controlled Mecanum robot with a live dashboard on MCLab. Control forward, backward, strafing, and rotation from a smartphone, tablet, or laptop browser. Display real-time IMU and sensor readings on the touchscreen.

⚙ Precision Geometry Drawing Bot

Level: Intermediate

Program the Mecanum robot to draw geometric shapes — squares, circles, hexagons, stars — on the floor using its exact omnidirectional movement capability combined with encoder tick counting. A visual demonstration of closed-loop motion control.

Projects for Both Configurations

Competition Robot

Level: All Levels

Both the Mecanum and 3-wheel configurations are competition-ready. Enter line-following competitions with the 3-wheel config, Mecanum navigation challenges with the omni config, or open-category competitions with either. The metal chassis and encoder motors meet competition standards.

IoT Sensor Dashboard Robot

Level: Intermediate

Connect the MC 4.0 to Wi-Fi and stream live sensor data — ultrasonic distance, encoder counts, IMU accelerometer and gyroscope readings — to an MCLab browser dashboard in real time. Monitor and log your robot's behaviour from any device on the same network.



6. Assembly Guide

All tools and hardware required are included in the kit. Assembly time is approximately 20–30 minutes for first-time builders. Follow the steps below for a smooth build.

STEP 01 Inspect & Organise

Unbox all items and lay them on a clean flat surface. Cross-reference with the Kit Contents list. Sort the screws set into sizes. Identify the chassis, motors, wheels, module stack, and sensors before starting.

STEP 02 Choose Your Configuration

Decide whether to build Configuration A (Mecanum — 4 motors + 4 Mecanum wheels) or Configuration B (3-Wheel — 2 motors + 2 BO wheels + 1 caster wheel). Both use the same chassis and controller stack.

STEP 03 Mount Motors to Chassis

Use the screws and screwdriver to mount the BO DC Metal Gear Encoder Motors to the pre-drilled motor mount positions on the black metal chassis. For Mecanum: mount all 4 motors. For 3-wheel: mount 2 rear motors and leave the front motor positions empty.

STEP 04 Attach Wheels

Mecanum: press the 4 Mecanum wheels onto the motor shafts — check LH roller orientation at front-left and rear-right, RH at front-right and rear-left. 3-Wheel: press the 2 BO wheels onto the rear motor shafts, then mount the caster wheel bracket at the front-centre chassis position with the provided screws.

STEP 05 Assemble the Module Stack

Stack from bottom to top: (1) 4 Encoder Motor Module at the base, (2) Ednex Battery Module in the middle, (3) MC 4.0 Controller on top. Align each stacking connector and press firmly together. No cables are needed between modules.

STEP 06 Mount Stack onto Chassis

Using the standoffs and screws from the Screws Set, secure the assembled module stack to the chassis at the designated controller mounting positions. Ensure the stack is level and firmly fastened.

STEP 07 Connect Motor Cables

Connect the four motor cables to the M1–M4 Grove motor ports on the 4 Encoder Motor Module. Assign each port to its corresponding wheel position: Front-Left, Front-Right, Rear-Left, Rear-Right for Mecanum. Rear-Left and Rear-Right only for 3-wheel.

STEP 08 Mount & Connect Sensors

Mount the RGB Ultrasonic I2C Sensor at the front of the chassis using the included screws. For the 3-wheel configuration, also mount the 6-Way Line Follower Sensor on the underside at the chassis front. Connect both sensors to Grove Port A on the MC 4.0 using the included Grove cables.

STEP 09 Charge Battery & Power On

Connect the included adapter to the Ednex Battery Module external charging port and charge fully before first use. Once charged, press the battery module on/off switch. The MC 4.0 touchscreen will illuminate with the startup display.

STEP 10 Connect to MCLab & Start Coding

Using the MC 4.0 touchscreen, connect to your Wi-Fi network. Open MCLab in a browser on any device. Choose Scratch block coding or Python, select a project, and start programming. Alternatively, connect via USB-C and program using Arduino IDE, VS Code + PlatformIO, or MATLAB.

7. Programming Platform Support

MCLab

- Scratch (block, ages 7+)
- Python & Micro python text coding
- Browser — no installation
- Wi-Fi / Bluetooth / USB
- AI and IoT projects built-in

Arduino IDE + VS Code

- C++ full hardware control
- M5Core2 library included
- VS Code + PlatformIO support
- Advanced debugging tools
- Full third-party ecosystem

MATLAB & ROS 2

- MATLAB + Simulink — HIL simulation
- Control algorithm design
- ROS 2 via micro-ROS library
- University and research grade
- Serial and Wi-Fi integration

MC 4.0 Base Kit

Two Robot Configurations. One Kit. Unlimited Projects.

MCLab · Arduino IDE · VS Code + PlatformIO · MATLAB & Simulink · ROS 2

Maker and Coder Global — Build. Code. Innovate.

CONTROLLER & ELECTRONICS

MC 4.0, Battery Module, Motor Driver, Sensors

MECHANICAL COMPONENTS

Metal Chassis, 4 Motors, Mecanum + BO + Caster Wheels

TOOLS & ACCESSORIES

Screwdriver, Screws Set, Adapter, Carry Case & Box