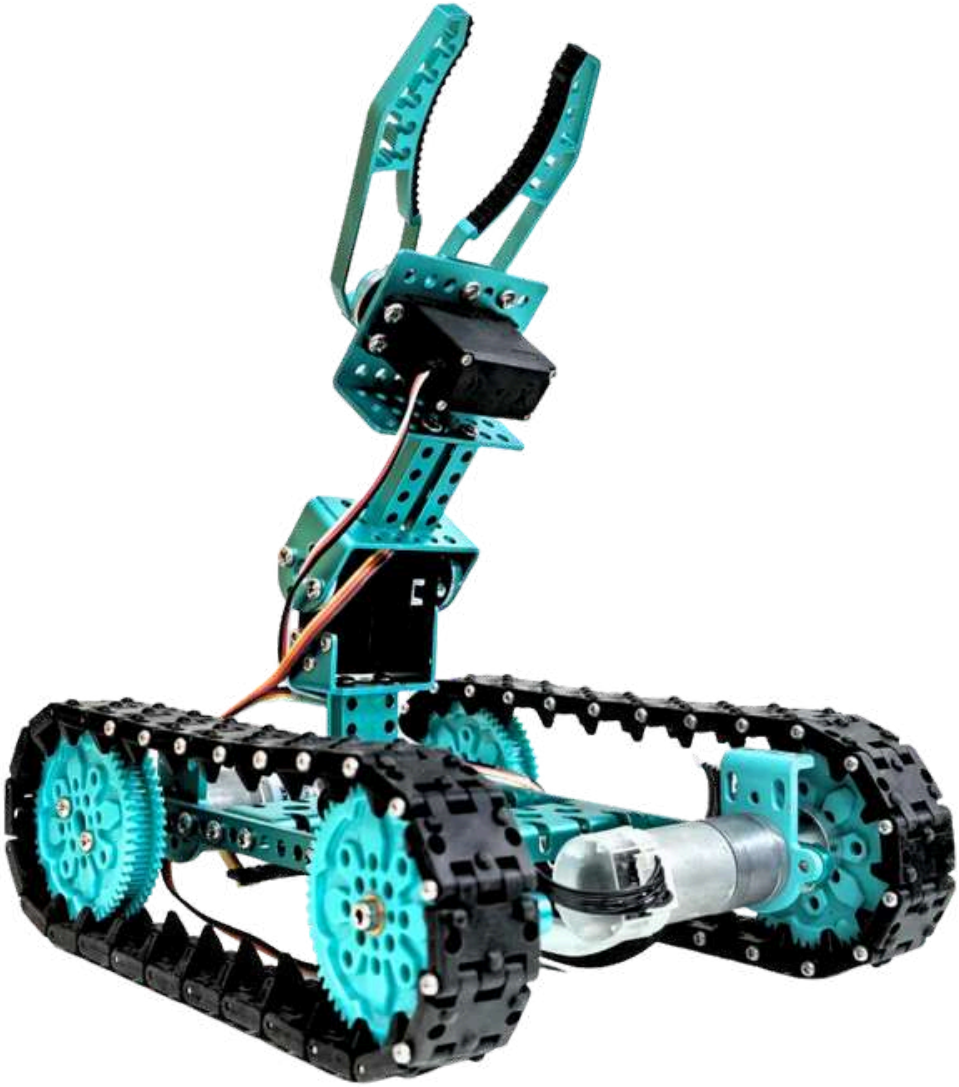
MAKER &CODER
EXPLORE, INNOVATE, EXCEL

MC 4.0 STEAM KIT

Science • Technology • Engineering • Arts • Mathematics



Designed for Learners Age 12+ | Block & Script Programming | Real-World Robotics

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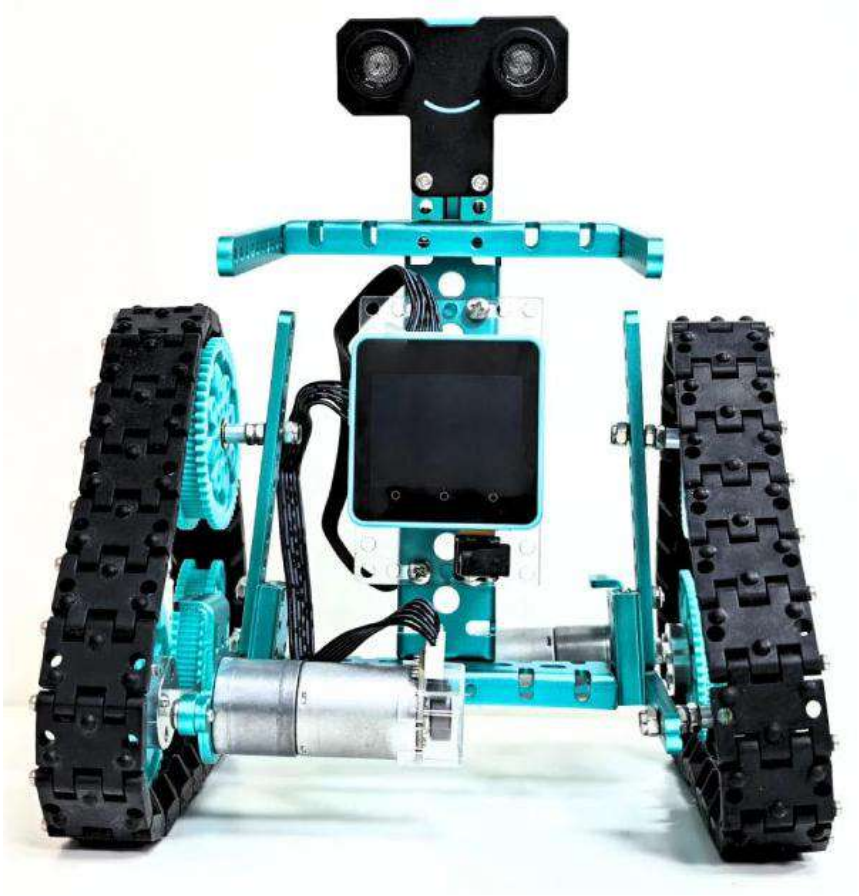
1. Executive Overview

The MC 4.0 STEAM Kit is Maker & Coder's flagship hands-on education platform, engineered to bridge classroom theory with real-world engineering and robotics. Built around the powerful MC 4.0 Controller, the kit provides everything students and educators need to design, build, program, and iterate working robotic systems — from beginner drag-and-drop code blocks to advanced Python scripting.

Designed for learners aged 12 and above, the kit is equally at home in school STEAM labs, maker spaces, after-school programs, or individual learning environments. Its modular architecture, broad sensor ecosystem, and progressive curriculum pathway make it a long-term investment in technical education.



1.1 Key Value Proposition

Dimension	What the MC 4.0 STEAM Kit Delivers
For Students	Hands-on building, progressive coding journey, real robotics skills
For Educators	Curriculum-aligned, group & solo project support, no prior coding needed
For Institutions	Modular, expandable, durable tray-box packaging for classroom storage
Technical Depth	Block-based → Arduino/Python scripting, encoder motor precision, multi-sensor integration

2. Complete Bill of Materials

Every MC 4.0 STEAM Kit ship with the following items. Quantities are exact and verified for each unit.

S.No	Product Description	Qty	Category
1	MC 4.0 Controller & C-Type Small Cable	1	Controller
2	4 Encoder DC Motor Module & Charging Connector	1	Motor Driver
3	Battery Module	1	Power
4	RGB Ultrasonic I2C Sensor & Grove Cable with Screws	1	Sensor
5	6-Way Line Follower Sensor & Grove Cable with Screws	1	Sensor
6	STEAM Kit Necessary Spares & Accessories	1 Set	Hardware
7	DC Silver Motor with Grove Wire	2	Actuator
8	MG 995 Servo Motor with Grove Wire	1	Actuator
9	Dual Axis Servo Motor with Grove Wire	1	Actuator
10	Adapter / Charger	1	Power
11	STEAM Kit Manual & Instructions Book	1	Documentation

Note: The Spares & Accessories set (Item 6) includes all mechatronic metal structural parts, beams, gears, fasteners, spacers, and tools as listed in the full structural hardware inventory.

3. MC 4.0 Controller — Technical Overview

The MC 4.0 Controller is the brain of the STEAM Kit. It is a purpose-built embedded computing module that provides rich I/O, onboard peripherals, and a developer-friendly programming environment — all in a compact, student-safe enclosure.

3.1 Onboard Hardware Features

Feature	Description
Display	Built-in Touchscreen for real-time data display and UI interaction
Audio I/O	Onboard Speaker + Microphone for sound feedback and voice input
Motion Sensing	IMU (Inertial Measurement Unit) for orientation, tilt, and gesture detection
Timekeeping	RTC (Real-Time Clock) for time-stamped logging and scheduling
Haptic Feedback	Vibration Motor for tactile alerts and interactive feedback
Connectivity	USB-C charging and data interface
Programming	Block-based visual coding + Arduino/Python scripting
Expandability	Compatible with Grove sensors and additional MC modules

3.2 Programming Environments

- Block-based visual programming — ideal for beginners; drag-and-drop logic building with no syntax required.
- Arduino (C/C++) scripting — for intermediate learners transitioning to text-based code.
- MicroPython scripting — for advanced projects requiring data processing, loops, and conditional logic.
- Progressive pathway: students start with blocks and advance naturally to script-based programming without switching platforms.

4. 4 Encoder DC Motor Module — Technical Specification

The 4 Encoder DC Motor Module is a 4-channel precision motor driver that gives the MC 4.0 STEAM Kit full closed-loop motor control capability. It communicates with the MC 4.0 Controller over I2C, enabling precise positioning, speed regulation, and direction control.

4.1 Core Specifications

Specification	Parameter
MCU	STM32F030C8T6
Motor Driver IC	BL5617 H-Bridge Driver
Number of Channels	4 (independent encoder motor channels)
Maximum Current per Channel	3.0 A
Maximum Power	10 W
External DC Power Input	6 V – 12 V DC

Specification	Parameter
Communication Interface	I2C @ Address 0x24
Operating Temperature	0°C – 40°C
Module Dimensions	54.0 × 54.0 × 13.1 mm
Module Weight	15.8 g
Encoder Signal Type	AB Quadrature Pulse Signal
Power Monitoring	INA199 — real-time voltage & current sensing

4.2 Control Modes

- Duty Cycle Control — direct PWM percentage control for variable speed driving.
- Absolute Position Positioning — move motor to a precise encoder count target.
- Speed Adjustment Mode — maintain a set RPM with closed-loop feedback.
- Direction Control — forward rotation, reverse rotation, coast stop, and active brake.

4.3 Key Technical Capabilities

- AB pulse encoder input on all 4 channels enables accurate odometry and arm positioning.
- I2C slave address is software-configurable, allowing multiple driver modules on one bus.
- Integrated INA199 power monitoring provides real-time voltage and current data to the controller.
- Onboard power input selector supports DC 5 V (via bus) or external DC 6–12 V for higher-power motors.
- Compatible with standard Grove cabling for clean, tool-free wiring in student environments.

5. Actuators — Motors & Servos

5.1 DC Silver Motor

Two DC silver gear motors are included for primary drivetrain use. These motors connect via Grove wire to the 4 Encoder DC Motor Module, enabling precise encoder-based closed-loop speed and position control. Applications include wheeled chassis locomotion, conveyor mechanisms, and gear-driven arms.

5.2 MG 995 Servo Motor

The MG 995 is a high-torque metal-gear servo providing robust angular positioning. It connects via Grove wire and is ideal for gripper actuation, rotating arm joints, and load-bearing pivot applications. Its metal gears provide durability under student repeated-use conditions.

5.3 Dual Axis Servo Motor

The dual-axis servo enables two-axis articulation from a single module — useful for pan-tilt camera mounts, 2-DOF robotic wrists, or multi-directional control mechanisms. It connects via Grove wire and is programmable through block or script environments.

6. Sensors

6.1 RGB Ultrasonic I2C Sensor

The RGB Ultrasonic I2C Sensor measures distance using ultrasonic sound pulses. Equipped with integrated RGB LEDs for visual status indication, it communicates over I2C via Grove cable. Typical range: 2 cm to 400 cm. Applications include obstacle avoidance, proximity detection, and distance-based automation logic.

6.2 6-Way Grayscale Line Follower I2C Sensor

The 6-way grayscale line follower i2c sensor provides six independent infrared sensing channels, enabling accurate line detection and tracking for autonomous navigation challenges. The increased channel count compared to basic 2-channel sensors delivers smoother curve tracking and more reliable edge detection. Connects via Grove cable with screws for secure chassis mounting.

7. Structural Hardware Inventory

The STEAM Kit includes a comprehensive set of precision mechatronic metal and plastic structural parts, fasteners, and tools. All parts are designed for compatible assembly with the beam and bracket system.

7.1 Structural Beams & Linkages

Part Name	Qty	Notes
Linkage 0208-24	2	Short linkage
Beam 1030-100-B	2	Wide beam
Beam 1030-100	2	Wide beam
Beam 1030-132	2	Wide beam
Beam 0410-106	4	Slim beam
Beam 0410-130	4	Slim beam
Beam 0410-154	2	Slim beam
Beam 0410-186	2	Slim beam
Slide Beam 0824-16	1	Short slide
Slide Beam 0824-32	2	Long slide
Acrylic Bracket	1	Mounting plate
Motor Bracket 4 (25)	2	Motor mounting

7.2 Drive & Transmission Components

Part Name	Qty	Notes
Driving Flange Hub 4mm	4	Shaft adapter
Flat Shaft 4-160	2	Drive axle
56T Plastic Gear	12	Main transmission gear

Part Name	Qty	Notes
8T Plastic Gear (Flat Hole)	2	Pinion gear
Copper Bearing 4×8×3.5	8	Precision bearing
Track Pack (54 links)	1	Rubber track set
Tire 64×16	2	Wheeled chassis option
Plastic Caster	1	Rear support wheel
Metal Gripper Pack	1	Full gripper assembly

7.3 Fasteners & Spacers

Part Name	Qty	Notes
Headless Screw M4×5	8	Set screw
Countersunk Screw M3×6	6	Flush mount
Pan Head Screw M2×4	2	Fine fastener
Screw M4×8	40	Standard structural screw
Screw M4×10	15	Standard structural screw
Screw M4×14	10	Medium structural screw
Screw M4×20	15	Long structural screw
Screw M4×35	6	Extra-long screw
Screw Nut M4	30	Standard hex nut
Nylon Locknut M4	15	Locking hex nut
Aluminum Column 4×6×6	8	Rigid standoff
Nylon Spacer 4×7×2	30	Thin spacer
Nylon Spacer 4×7×3	15	Medium spacer
Nylon Spacer 4×7×10	10	Long spacer

7.4 Tools Included

Tool	Qty	Purpose
PH1 Screwdriver	1	Phillips head assembly
M1.6–M4 Multifunction Wrench	1	Nut & bolt tightening
2mm Hex Key (Allen Key)	1	Headless set screw tightening

8. Learning Pathway & Curriculum Alignment

8.1 Progression Model

Stage	Skill Level	What Students Build
Stage 1	Beginner	Basic wheeled robot, simple motor forward/backward, obstacle stop
Stage 2	Intermediate	Line-following robot, gripper arm control, servo positioning
Stage 3	Advanced	Encoder-based precision positioning, multi-sensor integration, autonomous navigation
Stage 4	Expert	Custom Python scripts, sensor-triggered logic, mechanical design innovation

8.2 STEAM Subject Coverage

- **Science:** Sensor data collection, cause-effect analysis, physics of motion and gear ratios.
- **Technology:** Controller programming, I2C communication, motor driver operation.
- **Engineering:** Structural beam design, load analysis, iterative prototype refinement.
- **Arts:** Product design, labeling, presentation of solutions — integrated creative expression.
- **Mathematics:** Encoder counts, gear ratio calculations, speed-distance-time equations.

8.3 Deployment Environments

- **School classrooms** — fits within single-period or multi-session lesson structures.
- **STEM/STEAM lab workshops** — group challenges and solo project tracks supported.
- **After-school programs and maker spaces** — open-ended exploration mode.
- **Home learning** — complete standalone experience, no additional tools required.

9. Compatibility & Expandability

The MC 4.0 STEAM Kit is designed with modularity at its core. Students are not limited to the components in the box — the platform grows as skills grow.

- Compatible with the Maker & Coder Autonomous Kit Add-On Series, enabling autonomous navigation and advanced mission challenges.
- Grove connector standard allows plug-and-play addition of compatible sensors and actuators without soldering.
- I2C bus architecture supports daisy-chaining of additional sensor and motor driver modules.
- Block-based IDE is forward-compatible: projects created in block mode can be converted to text scripts for review.
- Programming languages supported: Block-based visual coding, Arduino (C/C++), MicroPython — all on the same MC 4.0 Controller.

10. Product Specifications Summary

Specification	Details
Product Name	MC 4.0 STEAM Kit
Brand	Maker & Coder
Target Age	12 Years and Above
Kit Type	STEAM Education Robotics Kit
Controller	MC 4.0 (Touchscreen, Speaker, Mic, IMU, RTC, Vibration Motor)
Motor Driver	4-Channel Encoder Motor Module (I2C, STM32 + BL5617)
DC Motors	2× DC Silver Gear Motors with Grove Wire
Servo Motors	MG 995 High-Torque Servo + Dual Axis Servo
Sensors	RGB Ultrasonic I2C + 6-Way Line Follower
Mobility Options	Track Tires (54-link) + Pneumatic Tires (64×16)
Structural System	Mechatronic metal beams, gears, linkages, brackets
Programming Languages	Block-Based, Arduino (C++), MicroPython
Connectivity	Grove (I2C, Analog, Digital), USB-C
Power	Onboard battery module + DC adapter/charger included
Expandability	Compatible with MC Autonomous Kit Add-On Series
Included Tools	PH1 Screwdriver, M1.6–M4 Wrench, 2mm Hex Key
Documentation	Full manual and instructions book included
Packaging	Educational tray box for classroom storage and transport

11. Support & Contact Information

For technical support, curriculum integration assistance, bulk procurement enquiries, or warranty claims, please contact the Maker & Coder team.

Channel	Details
Brand	Maker & Coder Education Technology
Product Line	MC 4.0 STEAM Kit
Manual / Instructions	Included in box (printed) and available digitally on request
Add-On Compatibility	MC Autonomous Kit Add-On Series
Warranty	Please refer to the warranty card enclosed in the kit box