

Manual Drive

Overview

In this initial activity, students recreate the functionality of Mode A–Manual Drive of the mBot Default Program. Students are given a quick introduction to mBlock programming as they create their first program. Students learn how to control mBot with the IR Remote Control as well as how to turn on the LEDs. In the following activities in this module, students reuse and build upon these programs.

Objectives

- Learn about the three preprogrammed modes of operation of the Default Program.
- Write code to develop a basic program for mBot.
- Learn about using the IR Remote Control with mBot.
- Practice using variables, "if-then-else" blocks, and loops in mBlock.
- Learn about the "play sound" block.
- Learn about using the LEDs on mBot.
- Practice writing code, uploading and running a program on mBot, and troubleshooting code when problems arise.
- Understand the importance of adding comments to programs.

Computer Science Teachers Association (CSTA) Standards

2-AP-11	Create clearly named variables that represent different data types and perform operations on their values.
2-AP-12	Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
2-AP-13	Decompose problems and subproblems into parts to facilitate design, implementation, and review of programs.
2-AP-19	Document programs in order to make them easier to follow, test, and debug.

Materials

- mBot
- mBot battery (Makeblock's 3.7 V rechargeable battery or battery pack with 4 AA batteries)
- mBot IR Remote Control (note that the required CR2025 coin cell battery is not included)
- computer (Windows or macOS) **or** Chromebook with mBlock 5 software installed
- USB cable **or** Makeblock® Bluetooth® Dongle (Vernier order code: MB-BLE)

Tips

1. In the Electronic Resources you will find a PDF of the student pages, as well as sample programs for this activity. The PDF allows you to print the activity for your students or distribute the activity electronically. The sample programs are fully functioning; you can open them in mBlock, and then upload them to mBot. Sign in to your account at **vernier.com/account** to access the Electronic Resources.

The sample programs are fully functioning mBlock 5 programs; you can open them in mBlock 5 and then upload them to mBot. You, or your students, can also use them as starting points for programming.

The Electronic Resources also includes a student edition of *Coding with mBot: Self-Driving Vehicles*. This PDF includes an Introduction written specifically for students as well as all nine student activities; the Instructor Information is not included.

2. Information on how to load mBlock 5 software on your computer or to start up mBlock on a Chromebook, is in the *Getting Started with mBot and mBlock 5* on the Vernier website at **<https://www.vernier.com/files/manuals/mblock5-getting-started.pdf>**
3. Students will need room to test their mBot programs. The iterative process of testing mBot programs is most efficient if the robot-testing area is close to the students' computers or Chromebooks.
4. Before beginning this activity, give your students time to play with mBot in Mode A of the Default Program. Once students have a clear understanding of mBot's default actions, they will have a better idea of what they will need to implement in their code.
5. In this activity, students write code to mirror how mBot behaves in the Default Program. If you have extra mBots, consider keeping one with the Default Program. Having a single mBot with the Default Program loaded saves students from switching back and forth between programs.
6. Driving speed varies with the state of the mBot battery. When the battery is fully charged, mBot will move faster for a given, specified power level, than when the battery is low.
7. mBot will run for a surprisingly long time on one battery charge. You can leave mBot running for a few hours, if you like.
8. We recommend using rechargeable AA batteries in mBot or the rechargeable battery made specifically for mBot (**www.vernier.com/mbot-bat**, order code: MBOT-BAT).
9. mBlock 5 software supports the Makeblock Bluetooth Dongle (Vernier order code: MB-BLE), which can be a good option for these activities. After pairing the Dongle to a mBot robot, students are able to connect to and program their robot remotely; you do not have to connect and disconnect a USB cable as you go through the programming and testing cycle. The only disadvantage of this method of connection is that the uploading of programs is somewhat slower. **NOTE** If you use the Bluetooth Dongle, you still use the Upload mode for all activities in the book. Makeblock considers this a USB connection; do not switch to the Bluetooth 4.0 tab when connecting to mBot via the Bluetooth Dongle.

Solutions to Challenge Extensions

EXTENSION 1 Change Speed with Numeric Buttons

In this Challenge Extension solution, we use the **1**, **2**, and **3** buttons to set the power level.



FIGURE 1 Manual Drive program with speed control (IR Remote Control buttons **1**, **2**, and **3**)

Of course, there are lots of other ways to control the speed. For example, you could have the **0** button decrease the value of the "level" variable and the **1** button increase it.

EXTENSION 2 Backup Warning

In example solution in Figure 2, we use a high sound for 0.5 s and then silence for 0.3 s. This will repeat as long as the backward button is pressed (and the car will also move backward). **NOTE** In the "Security and Emergency" activity, students learn more about incorporating sound in their programs.



FIGURE 2 Manual Drive program with back up warning