



**education**

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**Getting started with  
LEGO® MINDSTORMS® Education EV3  
MicroPython**

*Version 2.0.0*

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This guide provides instructions on how to start writing MicroPython programs for your LEGO® MINDSTORMS® EV3 robot. The guide will outline a two step process:

- **Installation:** Where you will prepare your computer and your EV3 Brick by collecting and installing the required tools. In addition, you will learn how to turn the EV3 Brick on and off and to navigate the EV3 screen menus.
- **Creating and running programs:** Where you will learn how to create a program and download it to the EV3 Brick. You will also learn how to start that program from your computer or from the EV3 Brick.

After you have run your first MicroPython program, you will be ready to try out other example programs and then start writing your own programs in MicroPython.

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# CHAPTER ONE

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## INSTALLATION

This section will guide you through the steps required to download and install the necessary software you will need to start programming.

### 1.1 What do you need?

To get started, you will need:

- A Windows 10 or Mac OS computer
- Internet access and administrator access

This is required during the installation only. You will not need special access to write and run programs after installation.

- A microSD card

You will need a card with a minimum capacity of 4GB and a maximum capacity of 32GB. This type of microSD card is also known as microSDHC. A Performance Class A1 microSD card is recommended.

- A microSD card slot or card reader in your computer

If your computer does not have a (micro) SD card slot, you can use an external USB (micro) SD card reader.

- A mini-USB cable, like the one included with your EV3 set

The typical configuration of this equipment is summarised in Figure 1.1.

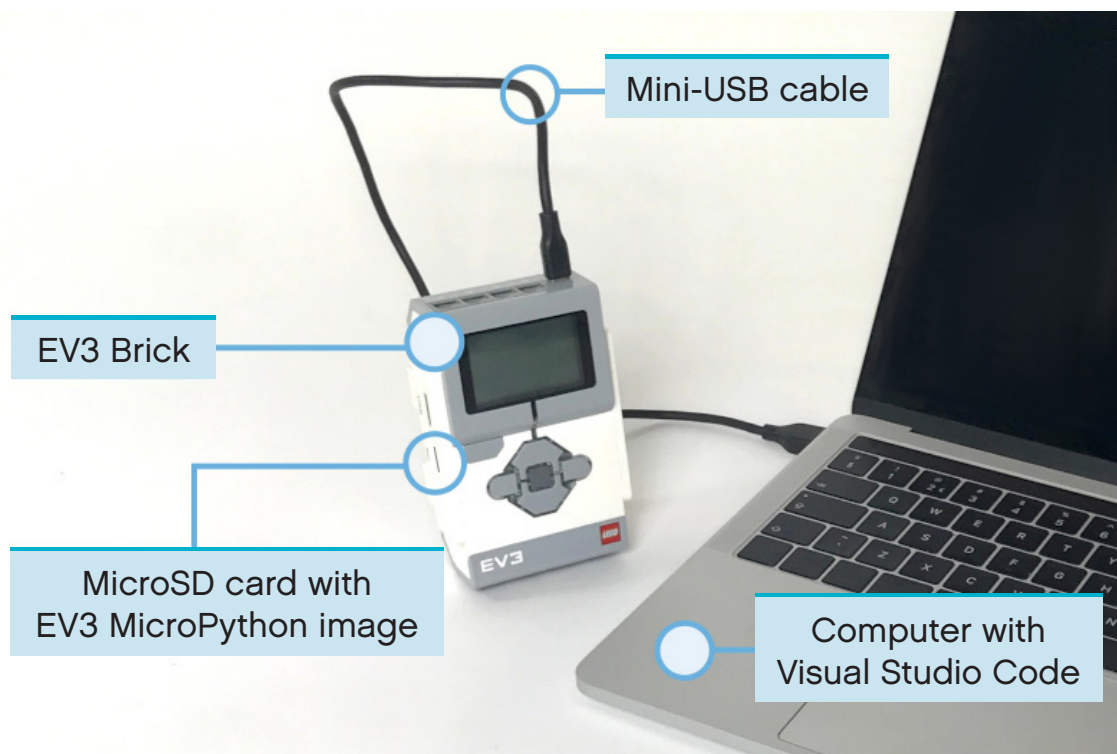


Figure 1.1: Setup overview

## 1.2 Preparing your computer

You will write your MicroPython programs using Visual Studio Code. Follow the steps below to download, install, and configure this application:

1. Download Visual Studio Code.
2. Follow the on-screen instructions to install the application.
3. Launch Visual Studio Code.
4. Open the extensions tab.
5. Install the EV3 MicroPython extension as shown in Figure 1.2.

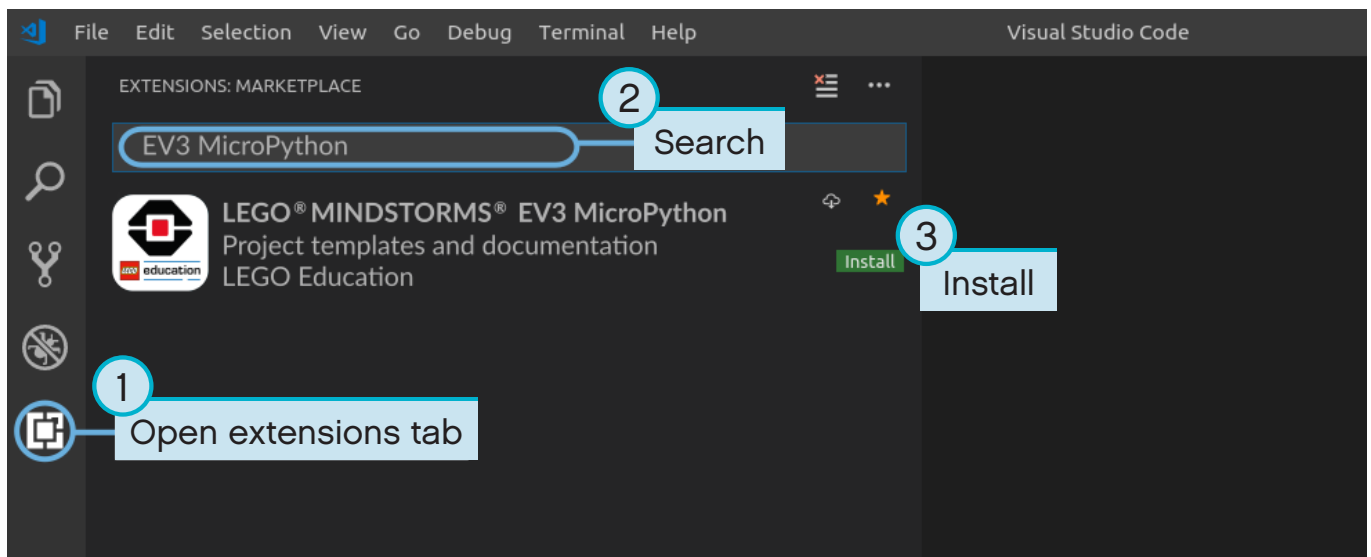


Figure 1.2: Installing the extension from the Visual Studio Code marketplace

## 1.3 Preparing the microSD card

To run MicroPython programs on your EV3 Brick, you will need to install the MicroPython operating system on your microSD card.

If the microSD card contains files which you want to keep, make sure you have created a backup of the contents first. See 'Managing files on the EV3 Brick' to backup your previous MicroPython programs if necessary.

*This process erases everything on your microSD card, including any previous MicroPython programs on it.*

To install the MicroPython operating system on your microSD card:

1. Download the EV3 MicroPython microSD card image and save it in a convenient location. This file is approximately 360 MB. You do not need to unzip the file.
2. Download and install a microSD card flashing tool such as [Etcher](#).
3. Insert the microSD card into your computer or card reader.
4. Launch the flashing tool and follow the steps on your screen to install the file you have just downloaded. If you use Etcher, you can follow the instructions below, as shown in Figure 1.3.
  - a. Select the EV3 MicroPython microSD card image file you have just downloaded.
  - b. Select your microSD card. Make sure that the device and size correspond to your microSD card.
  - c. Start the flashing process. This may take several minutes. Do not remove the card until the 'flashing' process is complete.

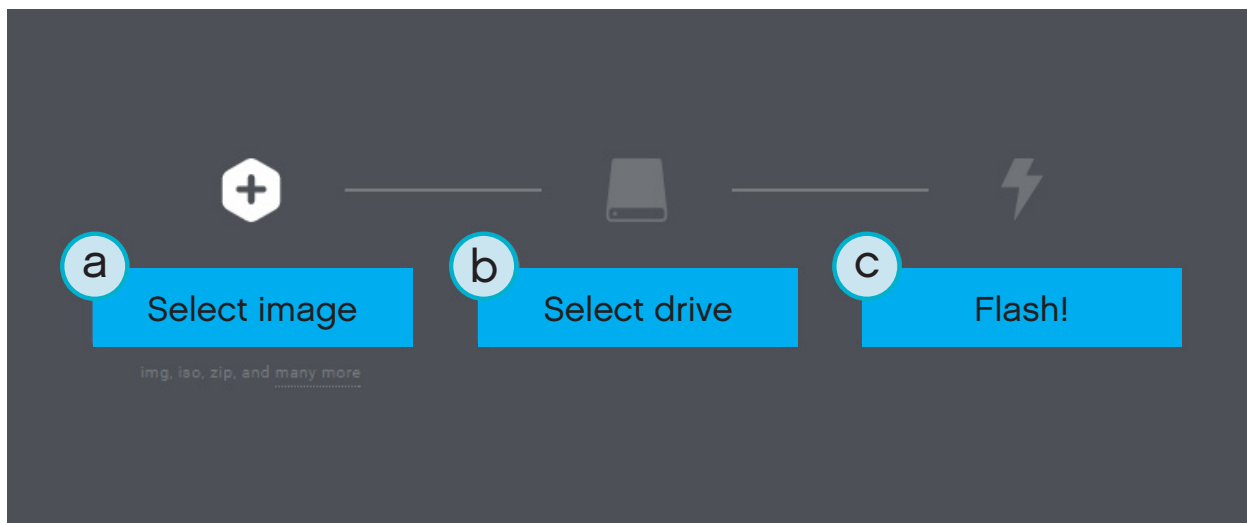


Figure 1.3: Using Etcher to flash the EV3 MicroPython microSD card image

## 1.4 Updating the microSD card

To update the microSD card, download a new image file using the link above and then flash it to the microSD card as described above. Be sure to back up any MicroPython programs you want to save.

You do not need to erase the contents of the microSD card first. This is done automatically when you flash the new image file.

## 1.5 Using the EV3 Brick

Make sure the EV3 Brick is turned off. Insert the microSD card you prepared into the microSD card slot on the EV3 Brick, as shown in Figure 1.4.

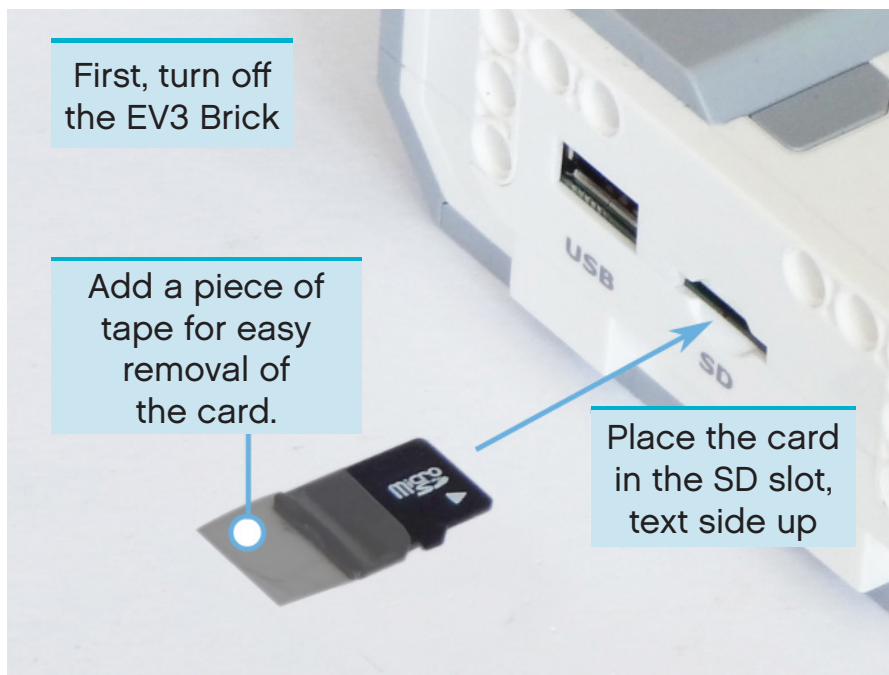


Figure 1.4: Inserting the flashed microSD card into the EV3 Brick

## 1.5.1 Turning the EV3 Brick on and off

Turn on the EV3 Brick by pressing the dark grey centre button.

The booting process may take several minutes. While booting, the EV3 Brick Status Light will turn orange and blinks intermittently. There will be text on the EV3 Display. The EV3 Brick is ready for use when the Status Light turns green.

To turn the EV3 Brick off, open the shutdown menu with the back button, and then select Power Off using the centre button, as shown in Figure 1.5.

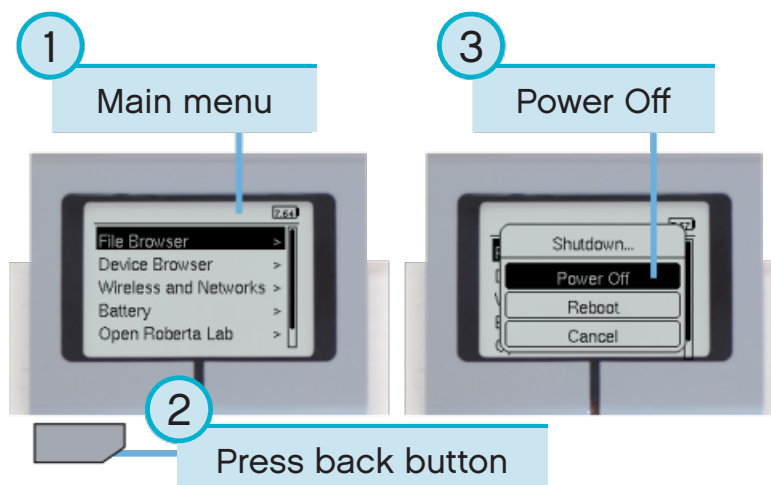


Figure 1.5: Turning the EV3 Brick off



## 1.5.2 Viewing motor and sensor values

When you are not running a program, you can view the motor and sensor values using the device browser, as shown in Figure 1.6.

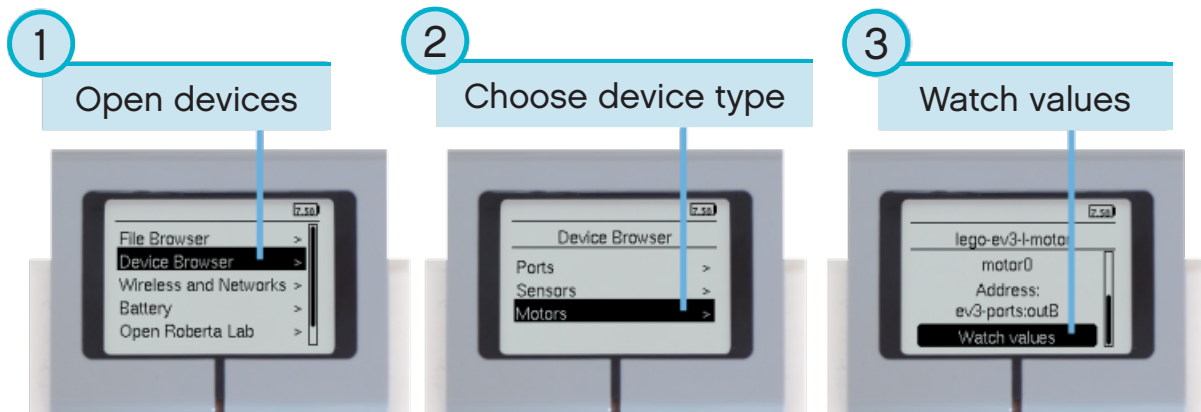


Figure 1.6: Viewing motor and sensor values

## 1.5.3 Going back to the original firmware

You can go back to the LEGO® firmware and your LEGO programs at any time. To do so:

1. Turn the EV3 Brick off as shown above.
2. Wait for the Display and brick Status Light to turn off.
3. Remove the microSD card.
4. Turn the EV3 on.

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## CHAPTER TWO

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# CREATING AND RUNNING PROGRAMS

Now that you have set up your computer and EV3 Brick, you are ready to start writing programs.

To make it easier to create and manage your programs, this chapter will outline how MicroPython projects and programs are organised.

Programs are organised into project folders, as shown in Figure 2.1. A project folder is a directory on your computer that contains the main program (**main.py**) and other optional scripts or files. The project folder and its contents will be copied to the EV3 Brick, where the main program will be run.

This section outlines how to create a project and how to transfer it to the EV3 Brick.

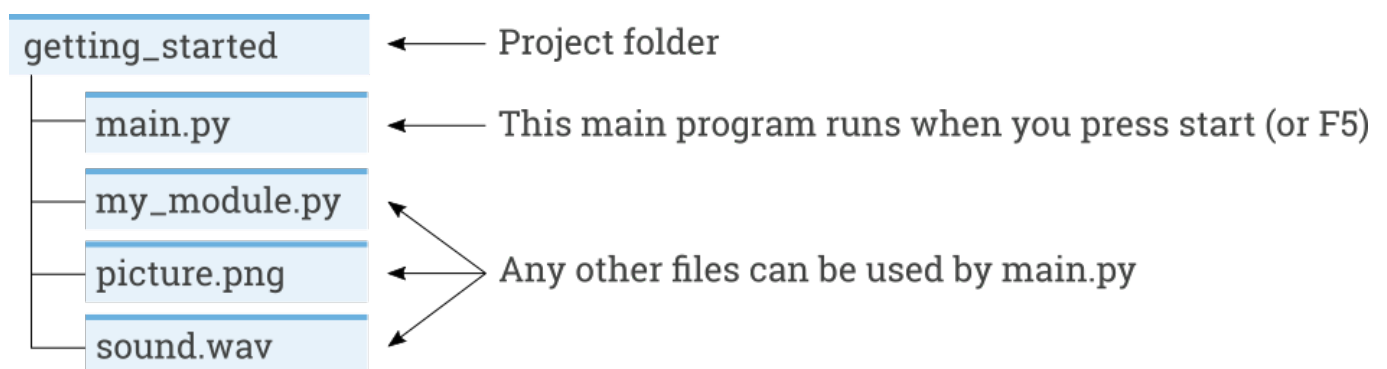


Figure 2.1: A project contains a program called **main.py** and optional resources like sounds or MicroPython modules.

## 2.1 Creating a new project

To create a new project, open the EV3 MicroPython tab and click *create a new project*, as shown in Figure 2.2. Enter a project name in the text field that appears and press *Enter*. When prompted, choose a location for this program and confirm by clicking *choose folder*.

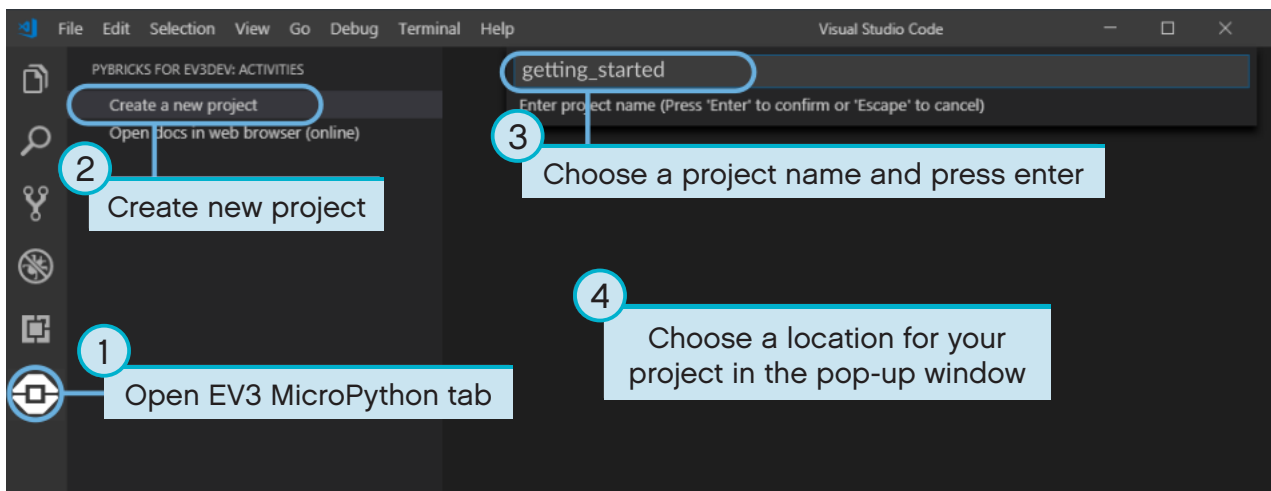


Figure 2.2: Creating a new project. This example is called `getting_started`, but you can choose any name.

When you create a new project, it already includes a file called `main.py`. To see its contents and to modify it, open it from the file browser as shown in Figure 2.3. This is where you will write your programs.

If you are new to MicroPython programming, we recommend that you keep the existing code in place and add your code to it.

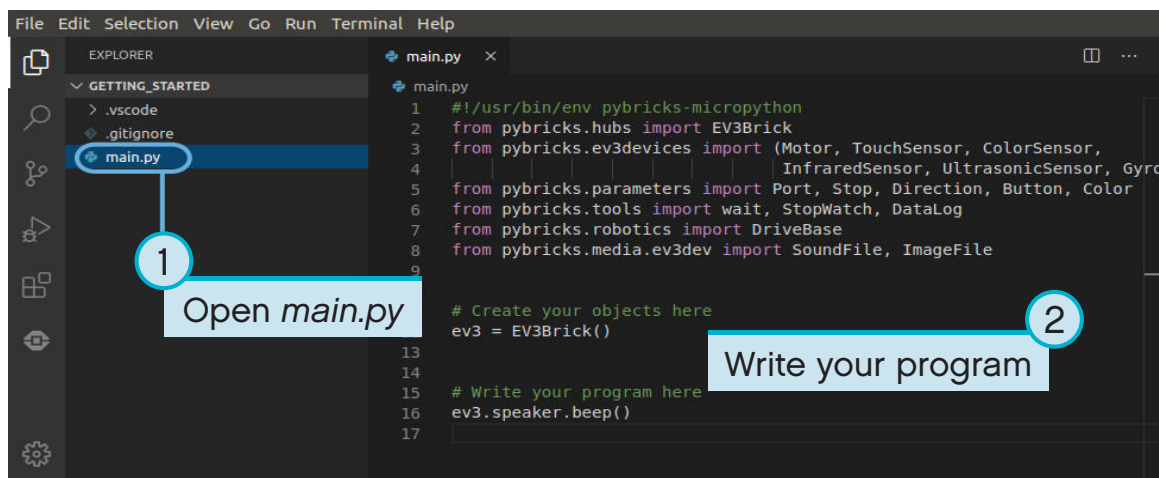


Figure 2.3: Opening the default `main.py` program.

## 2.2 Opening an existing project

To open a project you have previously created, click *File* and click *Open Folder*, as shown in Figure 2.4. Next, navigate to your previously created project folder and click *OK*. You can also open a recently created project using the *Open Recent* menu option.

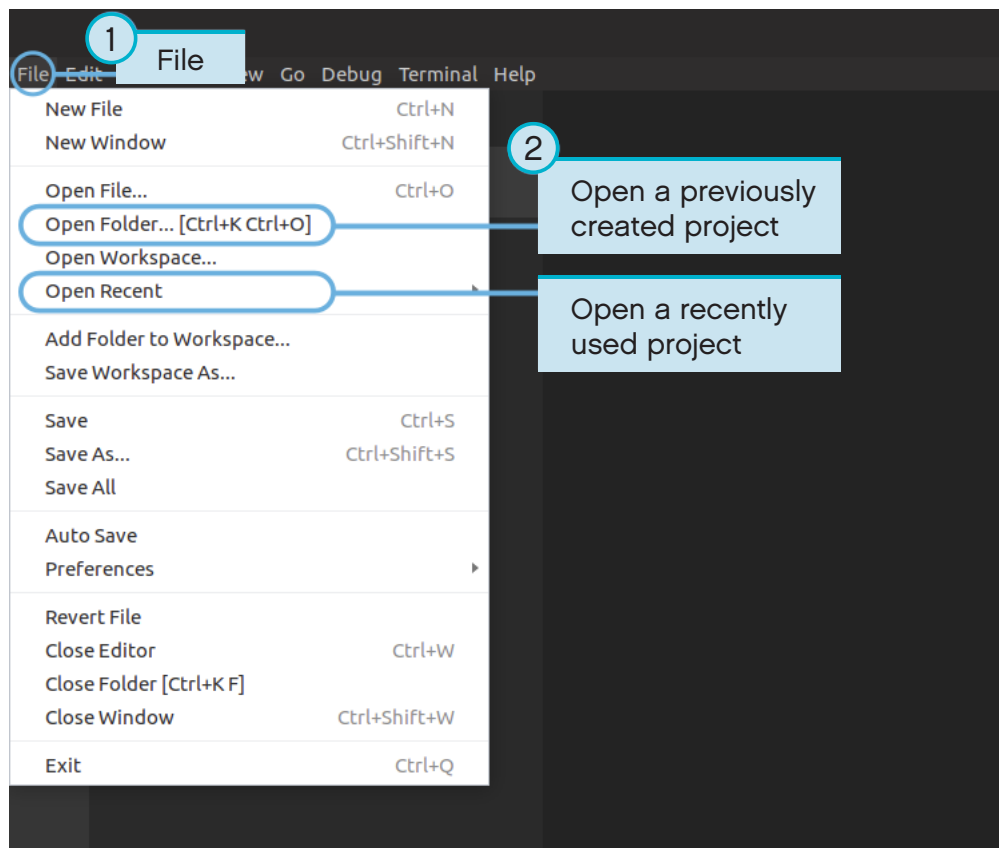


Figure 2.4: Opening a previously created project.

## 2.3 Connecting to the EV3 Brick with Visual Studio Code

To transfer your code to the EV3 Brick, you will need to connect the EV3 Brick to your computer with the mini-USB cable and configure the connection with Visual Studio Code. To do so:

- Turn the EV3 Brick on
- Connect the EV3 Brick to your computer with the mini-USB cable
- Configure the USB connection as shown in Figure 2.5.

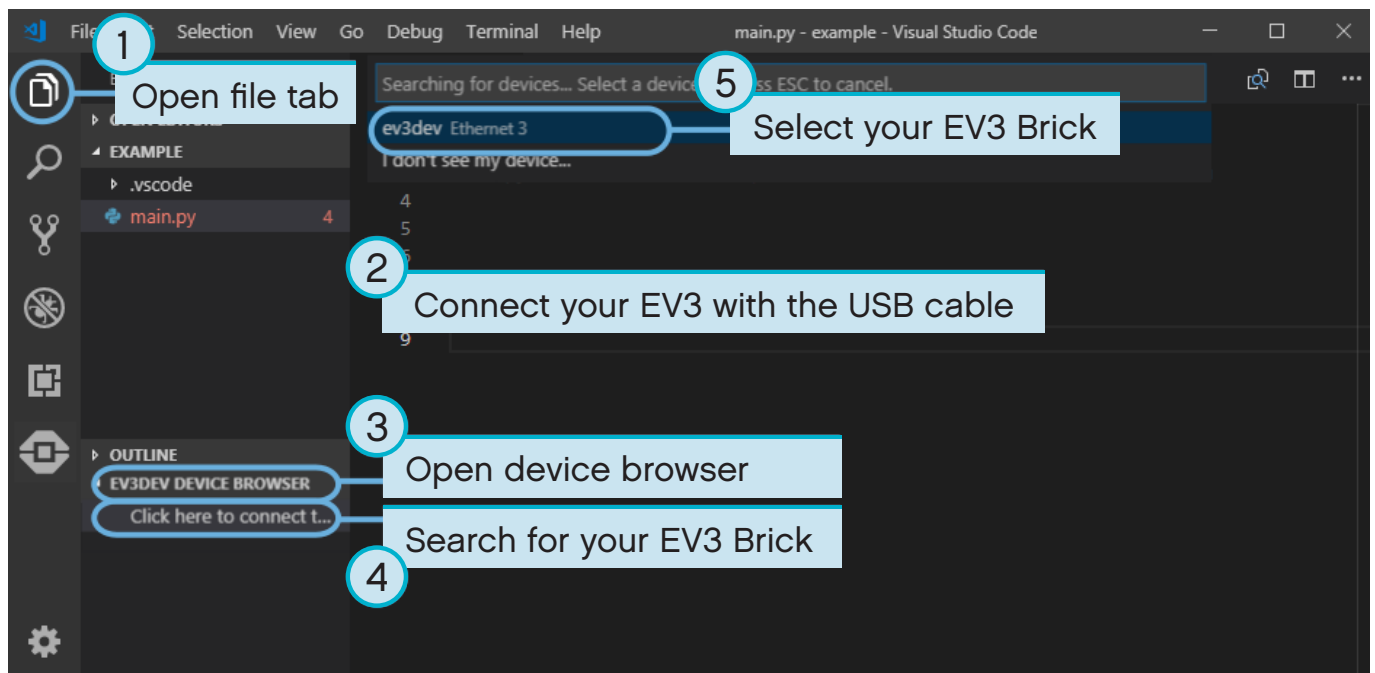


Figure 2.5: Configuring the USB connection between the computer and the EV3 Brick.

## 2.4 Downloading and running a program

You can press the F5 key to run the program. Alternatively, you can start it manually by going to the debug tab and clicking the green start arrow, as shown in Figure 2.6.

When the program starts, a pop-up toolbar will allow you to stop the program if necessary. You can also stop the program at any time using the back button on the EV3 Brick.

If your program produces any output with the *print* command, this is shown in the output window.

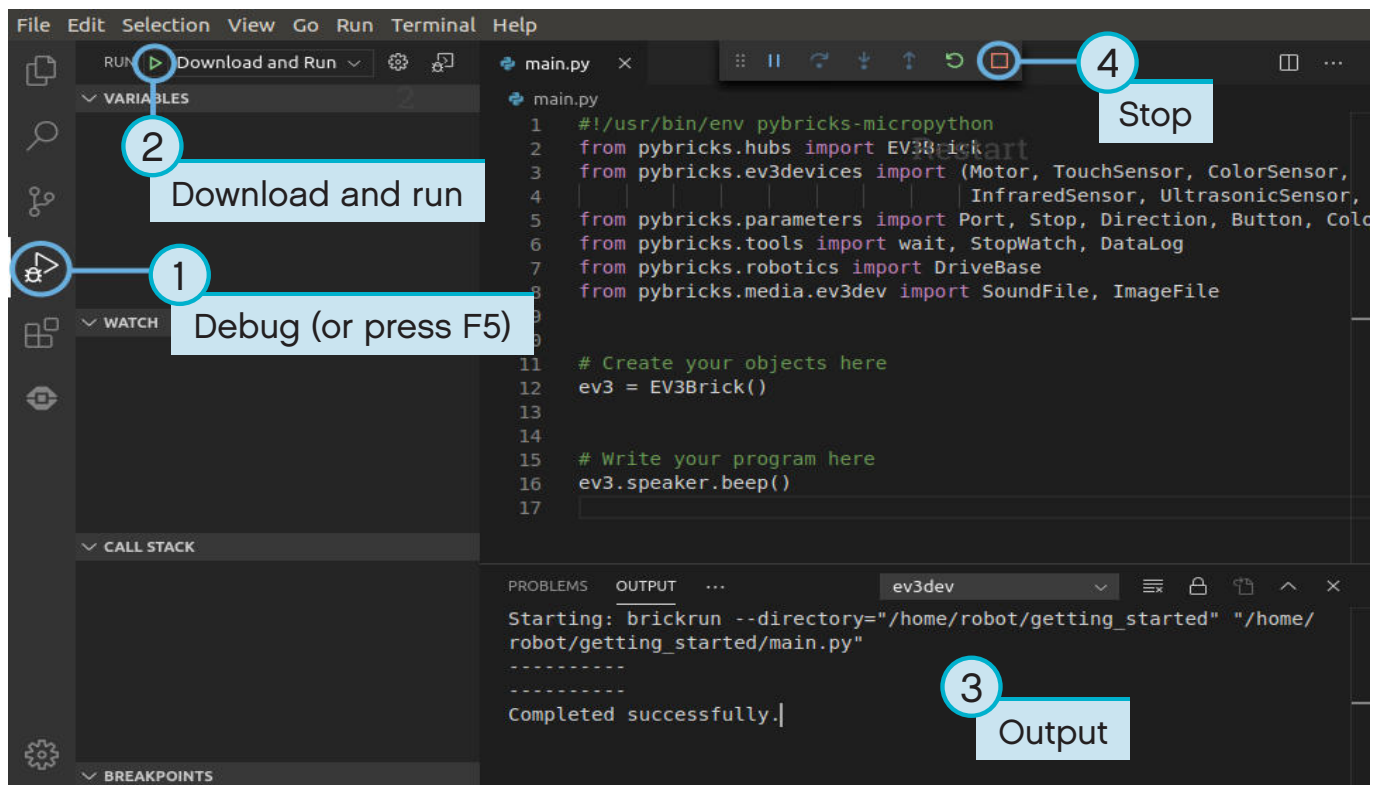


Figure 2.6: Running a program.

## 2.5 Expanding the example program

Now that you have run the basic code template, you can expand the program to make a motor move. First, attach a Large Motor to Port B on the EV3 Brick, as shown in Figure 2.7.

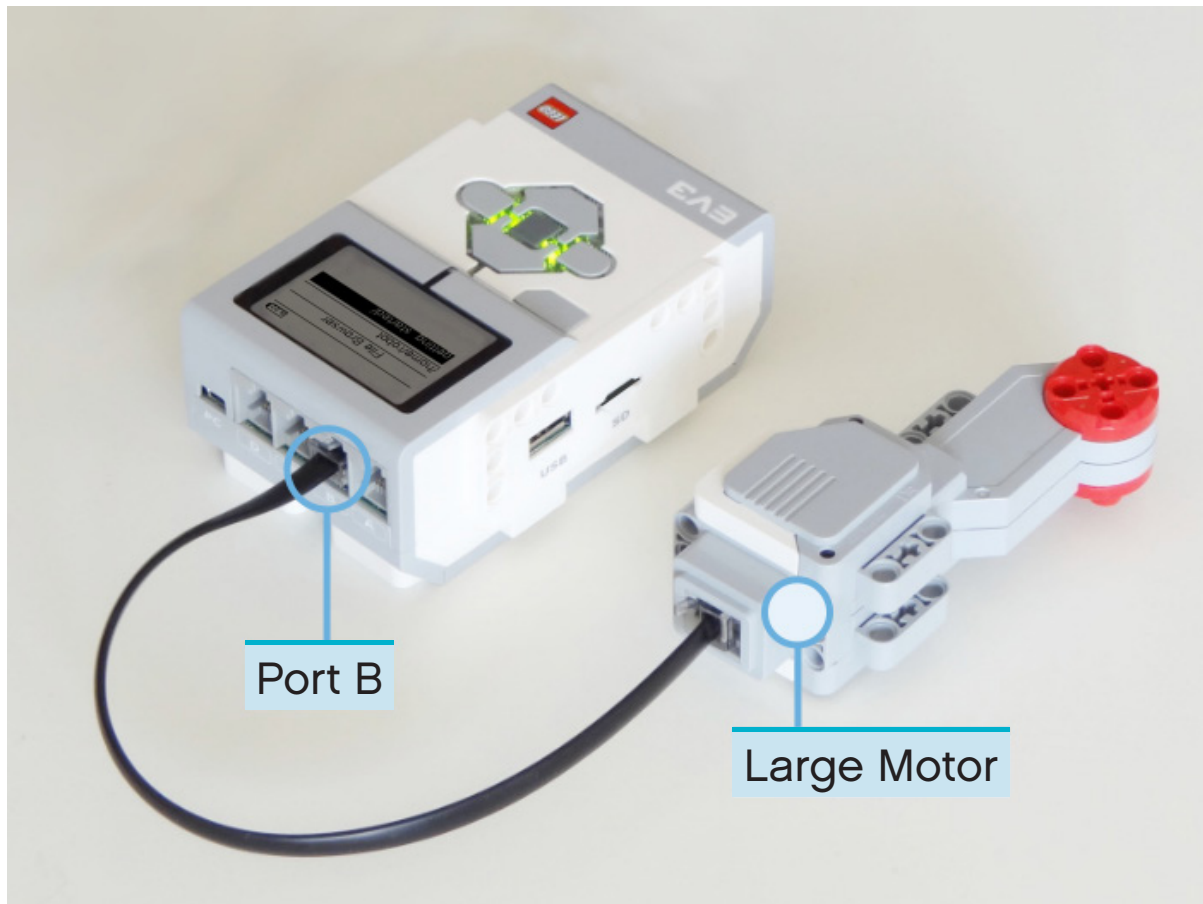


Figure 2.7: The EV3 Brick with a Large Motor attached to port B.

Next, edit *main.py* to make it look like this:

```
#!/usr/bin/env pybricks-micropython

from pybricks.hubs import EV3Brick
from pybricks.ev3devices import Motor
from pybricks.parameters import Port

# Initialize the EV3 brick.
ev3 = EV3Brick()
# Initialize a motor at port B.
test_motor = Motor(Port.B)

# Play a sound.
ev3.speaker.beep()
# Run the motor up to 500 degrees per second. To a target angle of 90 degrees.
test_motor.run_target(500, 90)
# Play another beep sound.
ev3.speaker.beep(1000, 500)
```

This program will make your robot beep, rotate the motor, and beep again with a higher pitched tone. Run the program to make sure that it works as expected.

## 2.6 Managing files on the EV3 Brick

After you have downloaded a project to the EV3 Brick, you can run, delete, or back up programs stored on it using the device browser as shown in Figure 2.8.

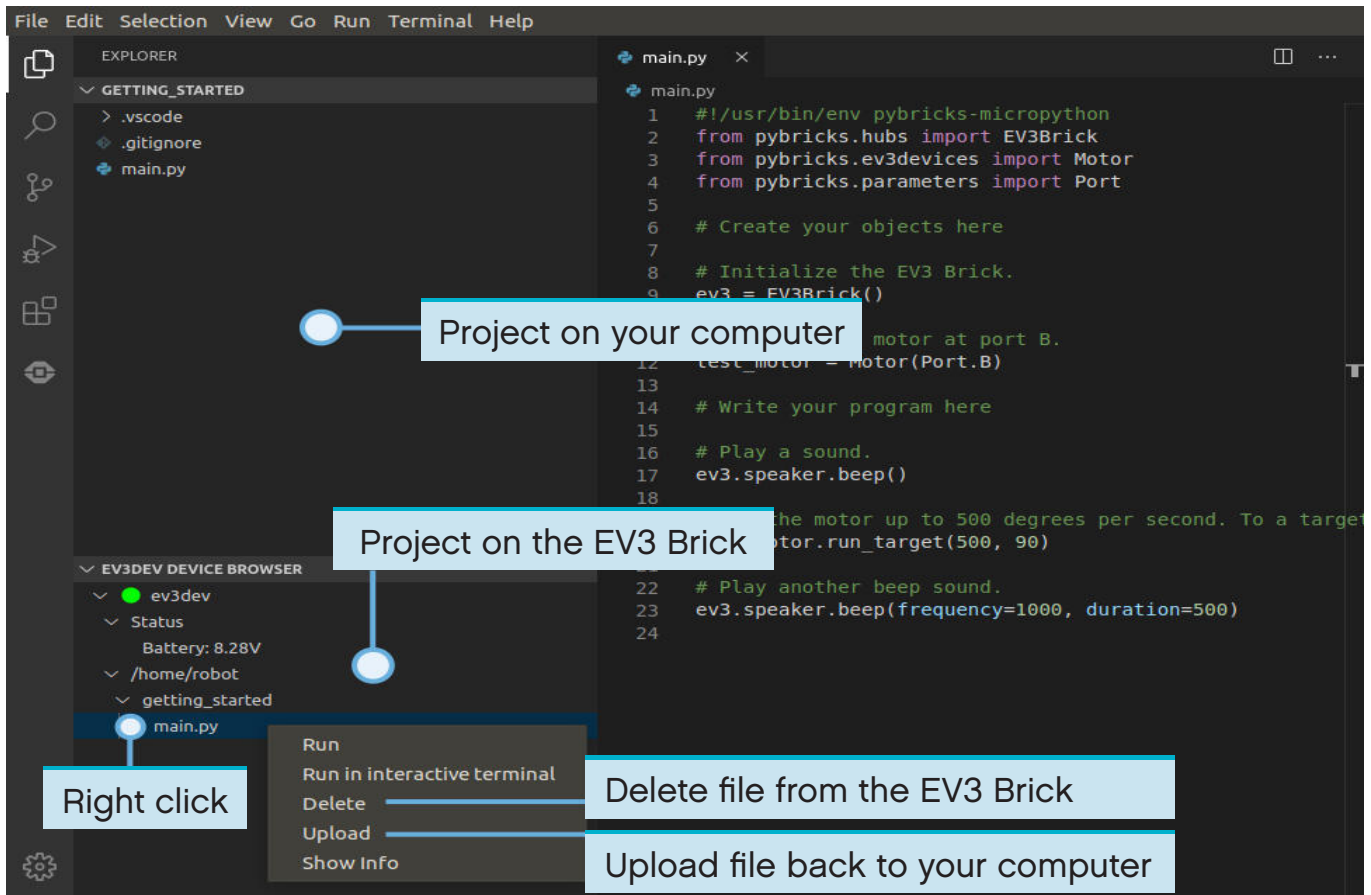


Figure 2.8: Using the EV3 device browser to manage files on your EV3 Brick.

## 2.7 Running a program without a computer

You can run previously downloaded programs directly from the EV3 Brick.

To do so, find the program using the *file browser* on the EV3 Display and press the centre button key to start the program as shown in Figure 2.9.



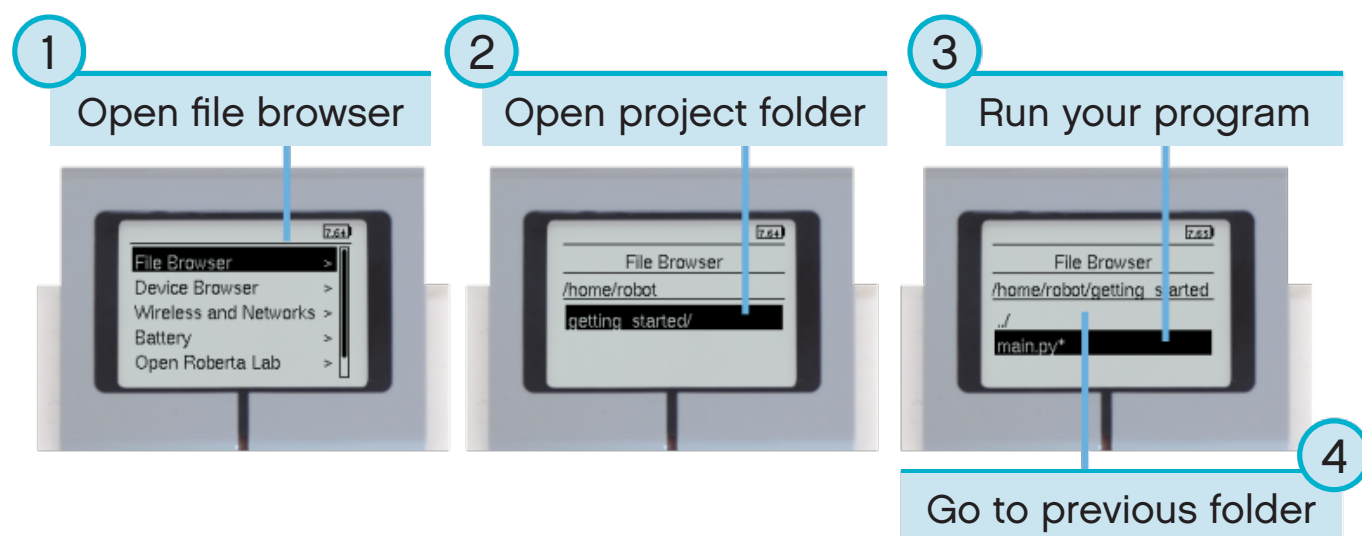


Figure 2.9: Starting a program using the buttons on the EV3 Brick.