



education

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

Version 2.0.0

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This guide shows you how to get started with writing MicroPython programs for your LEGO® MINDSTORMS® EV3 robots. You'll learn to do this in two steps:

- **Installation:** First you'll prepare your computer and your EV3 Brick by collecting and installing the required tools. You'll also learn how to switch the EV3 Brick on and off, and how to navigate the on-screen menu.
- **Creating and running programs:** Next, you'll learn how to create a program and download it to the EV3 Brick. You'll also learn how to start that program from your computer or from the EV3 Brick.

After you've run the first demo program, you'll be ready to try out the example programs and start inventing your own programs.

CHAPTER ONE

INSTALLATION

This page guides you through the steps for collecting and installing everything you need to start programming.

1.1 What is needed?

To get started, you'll need:

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

This is only required during the installation process. You will not need special access in order to write and run programs later on.

- A micro SD card

You'll need a card with a minimum capacity of 4GB and a maximum capacity of 32GB. This type of micro SD card is also known as 'micro SDHC'. We recommend using cards with the Application Performance Class A1 rating.

- A micro SD card slot in your computer, or a card reader.

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 in your EV3 set.

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

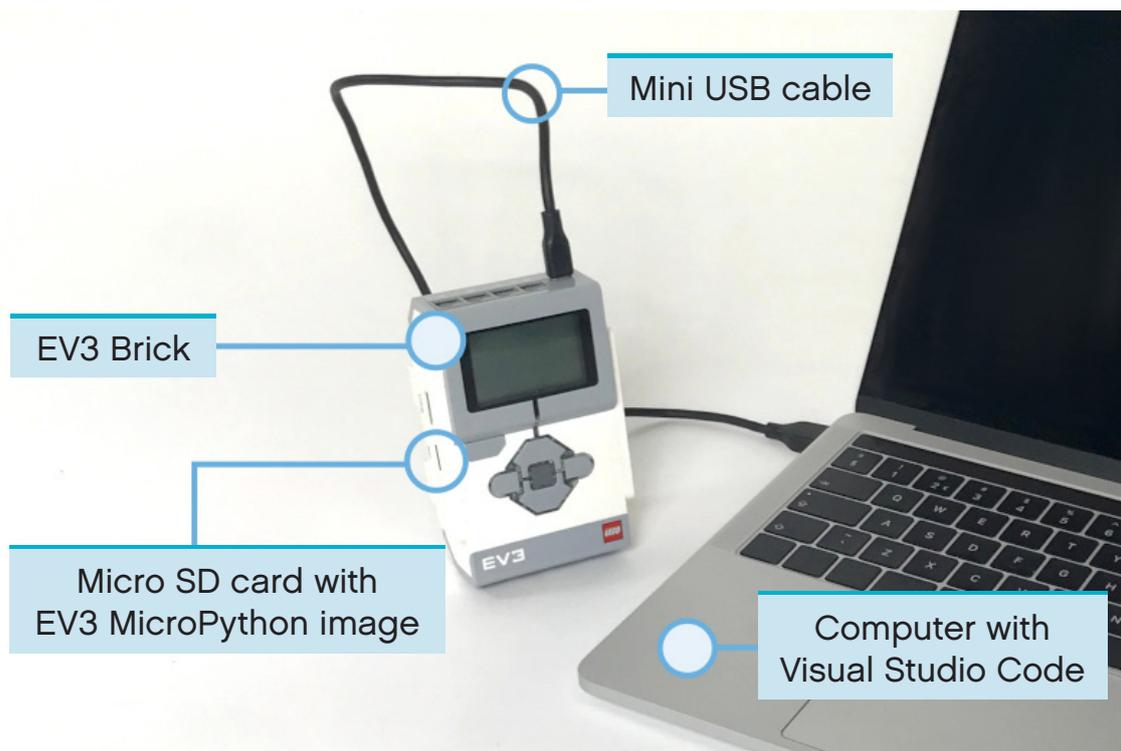


Figure 1.1: Setup overview.

1.2 Preparing your computer

You'll 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 complete installation.
3. Launch Visual Studio Code.
4. Open the 'extensions' tab.
5. Install the EV3 MicroPython extension as shown in Figure 1.2.

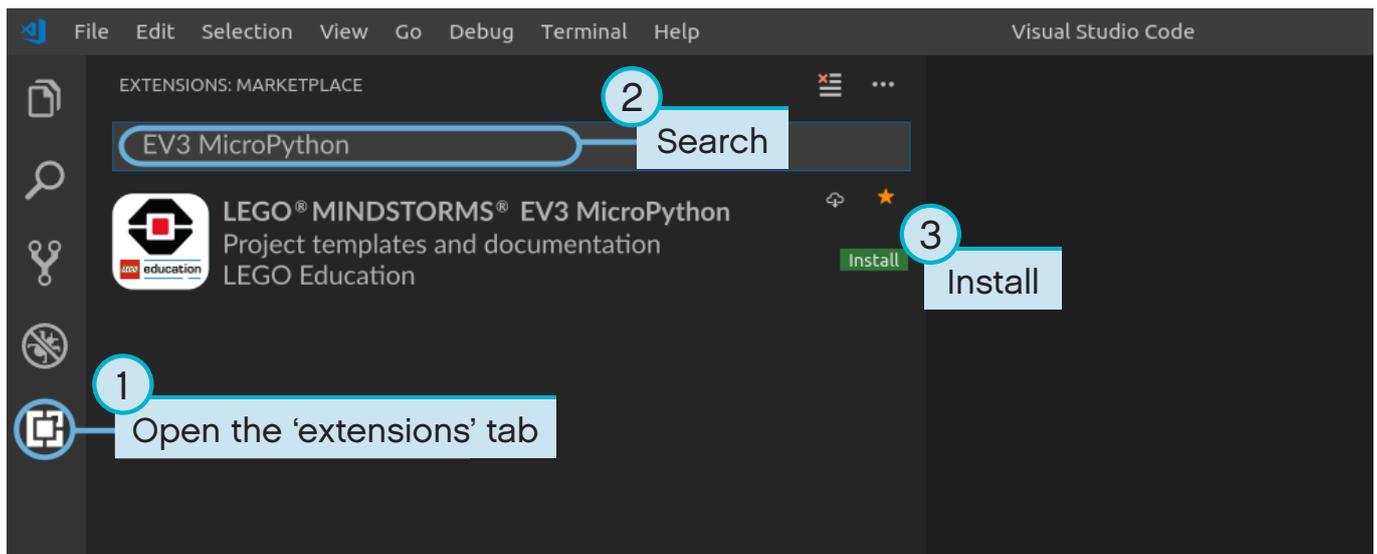


Figure 1.2: Installing the extension from the Visual Studio Code Marketplace.

1.3 Preparing the micro SD card

Now you'll learn how to install the required tools onto your micro SD card. This will make it possible to run MicroPython programs on your EV3 Brick.

If the micro SD card contains files you wish to keep, make sure you create a backup of its contents before installing the tools. If necessary, please refer to 'Managing files on the EV3 Brick' to learn how to back up your previous MicroPython programs.

This process erases everything on your micro SD card, including any previous MicroPython programs that are stored on it.

To install the MicroPython tools on your micro SD card:

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

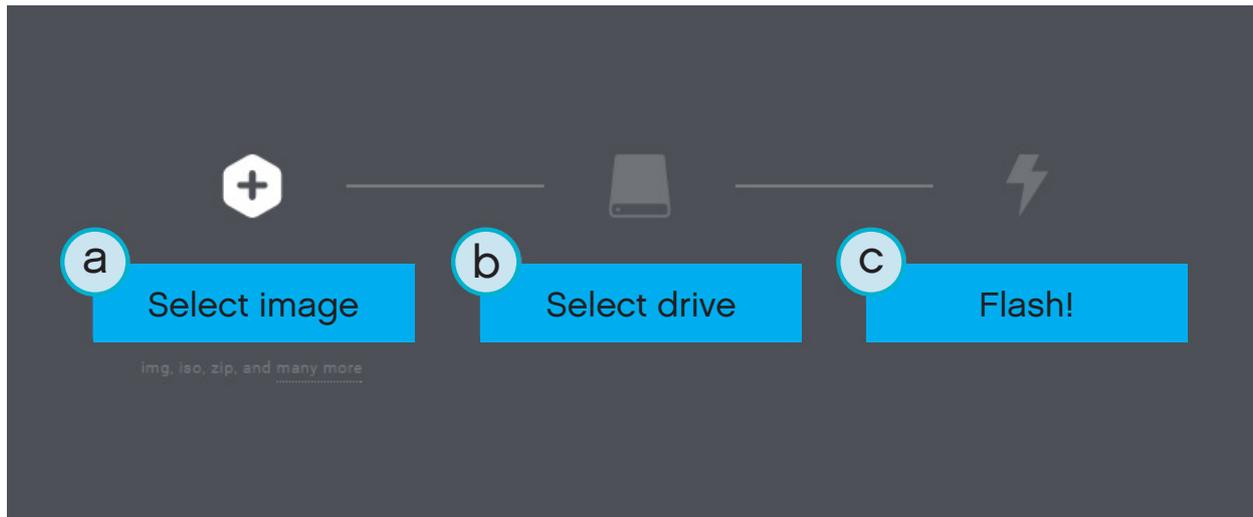


Figure 1.3: Using Etcher to flash the EV3 MicroPython micro SD card image.

1.4 Updating the micro SD card

To update the micro SD card, use the link above to download a new image file and flash it to the micro SD card as described above. Be sure to back up any MicroPython programs that you wish to save.

You do not need to erase the contents of the micro SD 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 switched off. Insert the micro SD card you have prepared into the micro SD card slot on the EV3 Brick, as shown in Figure 1.4.

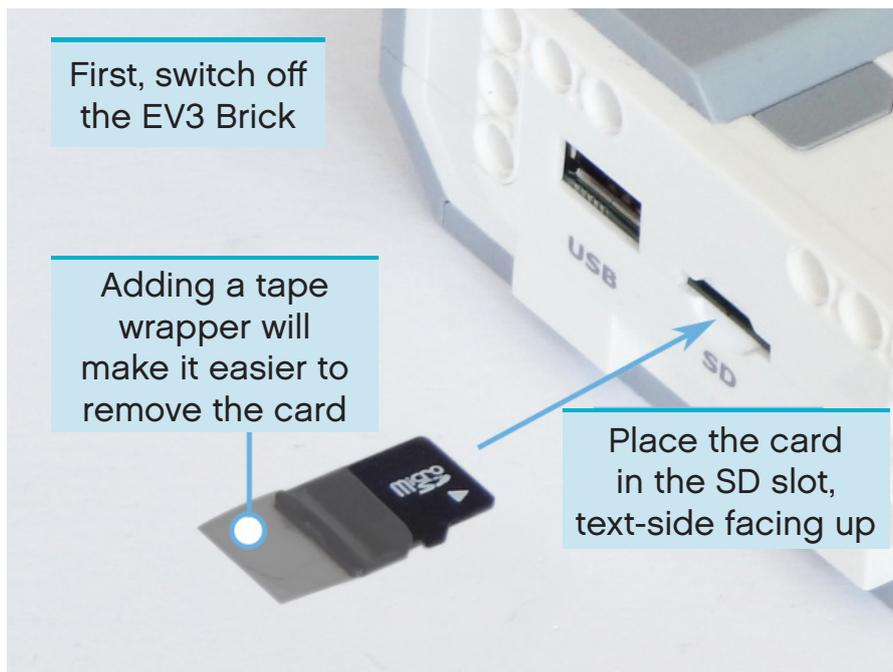


Figure 1.4: Inserting the flashed micro SD card into the EV3 Brick

1.5.1 Switching the EV3 Brick on and off

Switch the EV3 Brick on by pressing the dark grey Centre Button.

The booting up process may take several minutes. While booting, the EV3 Brick Status Light turns orange and blinks intermittently and you'll see quite a bit of text on the EV3 Display. The EV3 Brick is ready for use when the Brick Status Light turns green.

To switch off the EV3 Brick, use the Back Button to open the shutdown menu and then select 'Power Off' using the Centre Button, as shown in Figure 1.5.

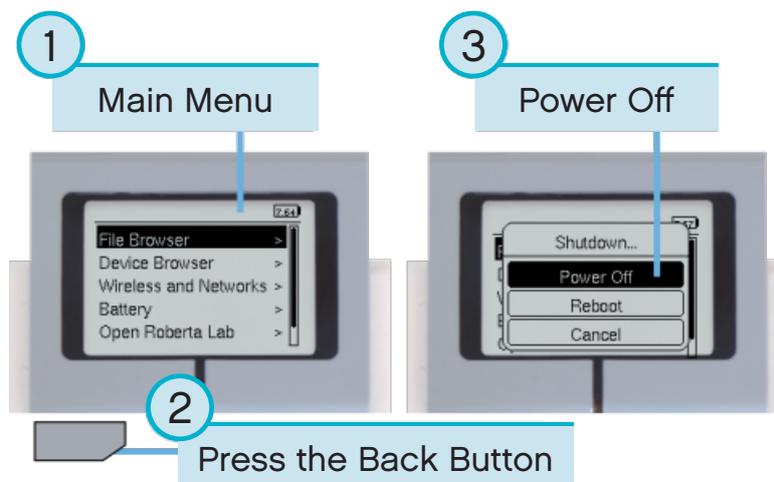


Figure 1.5: Switching off the EV3 Brick

1.5.2 Viewing motor and sensor values

When you're not running a program, you can use the device browser to view the motor and sensor values, as shown in Figure 1.6.

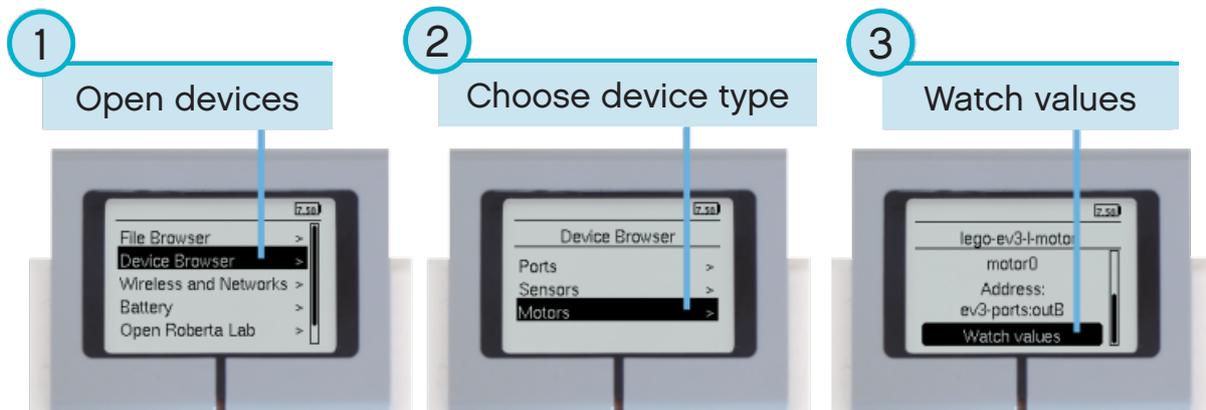


Figure 1.6: Viewing motor and sensor values

1.5.3 Reverting to the original firmware

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

1. Switch off the EV3 Brick as shown above.
2. Wait for the Display and Brick Status Light to switch off.
3. Remove the micro SD card.
4. Switch on the EV3 Brick.

CHAPTER TWO

CREATING AND RUNNING PROGRAMS

Now that you've set up your computer and EV3 Brick, you're ready to start writing programs.

To make it easier to create and manage your programs, let's first have a quick look at how the MicroPython projects and programs for your EV3 robots are organised.

The 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. This project folder and all of its contents will be copied to the EV3 Brick, where the main program will be run.

This page shows you how to create a project and how to transfer it to the EV3 Brick.

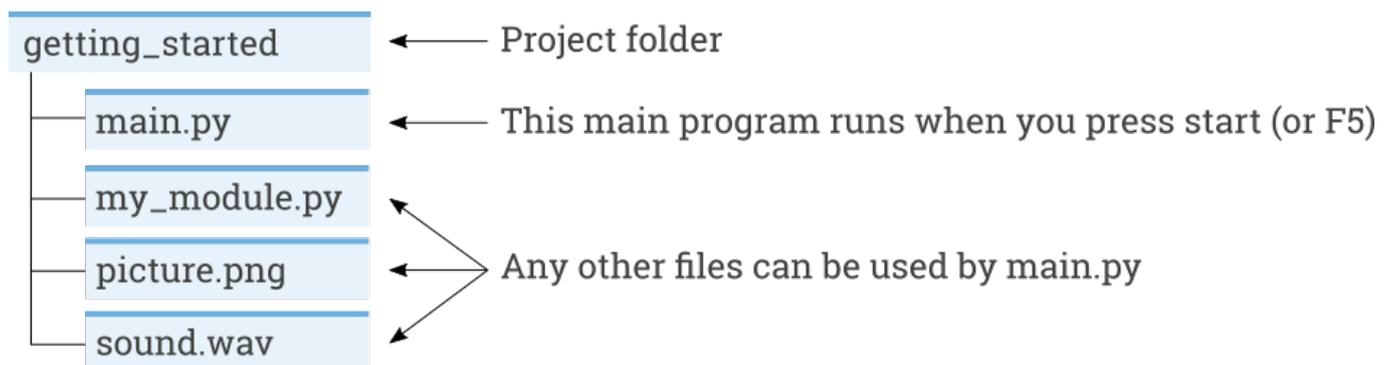


Figure 2.1: A project contains a program called **main.py** and optional resources like sounds or MicroPython modules.

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 the name of the project in the text field that appears and press *Enter*. When prompted, choose a location in which to store this program and confirm by clicking *choose folder*.

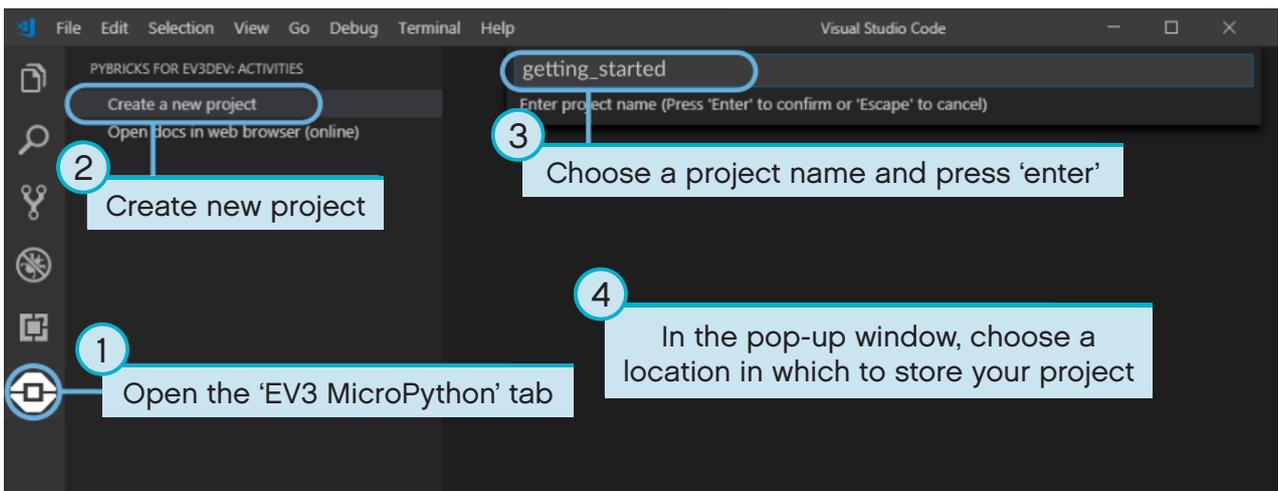


Figure 2.2: Creating a new project. This example is called `getting_started` but you can choose any name.

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'll write your programs.

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

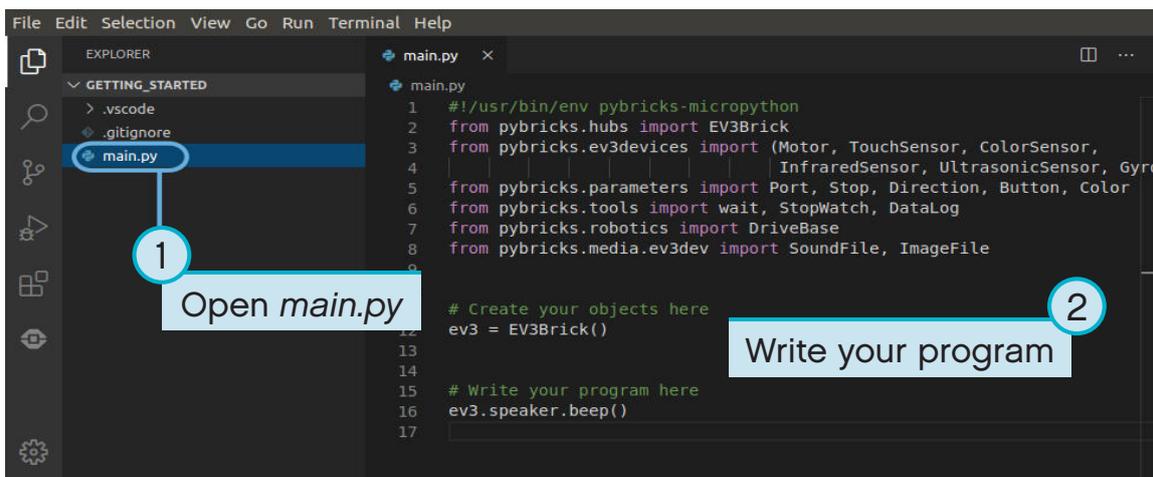


Figure 2.3: Opening the default `main.py` program.

2.2 Opening an existing project

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

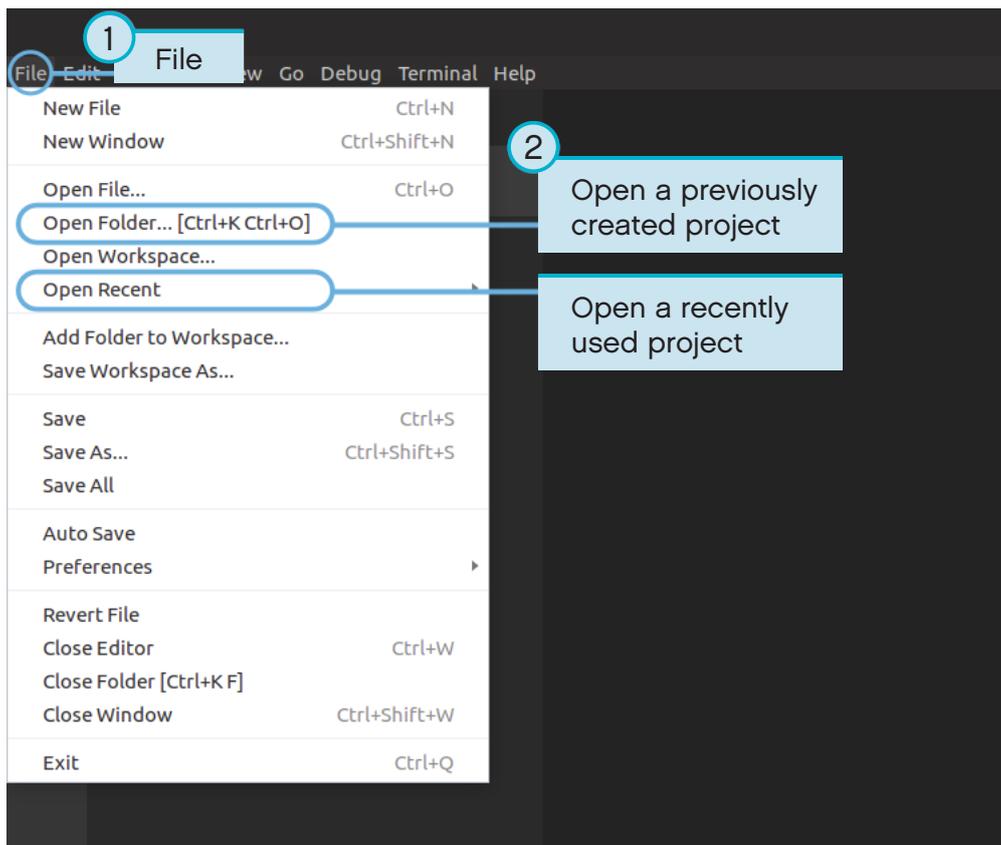


Figure 2.4: Opening a previously created project.

2.3 Connecting to the EV3 Brick with Visual Studio Code

In order to be able to transfer your code to the EV3 Brick, you'll first need to connect the EV3 Brick to your computer using the mini USB cable and configure the connection with Visual Studio Code. To do so:

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

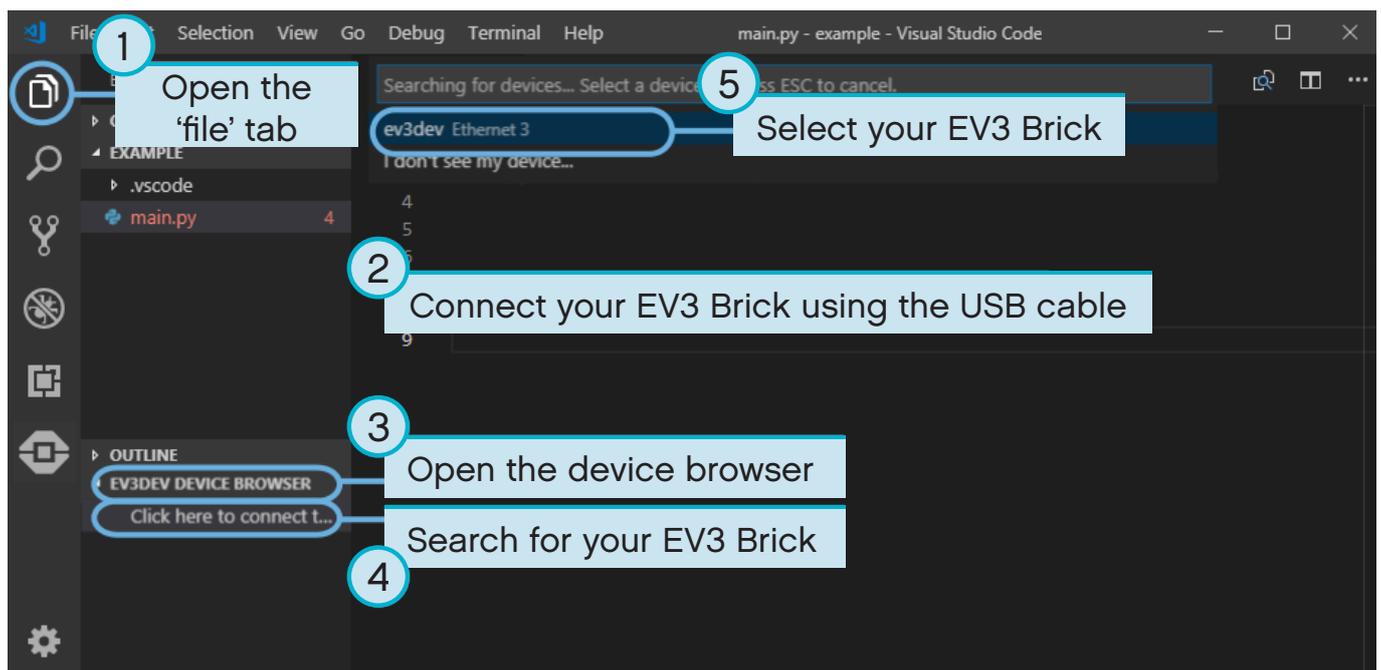


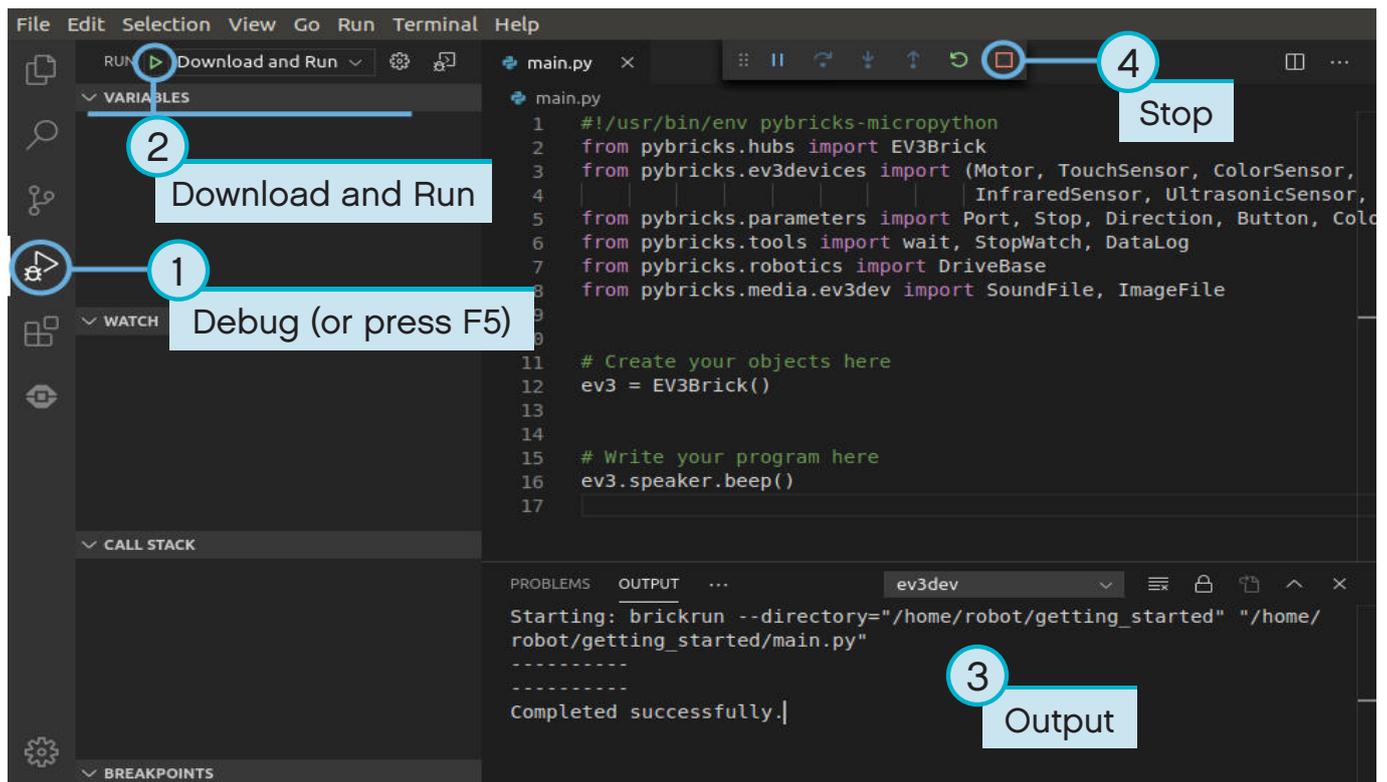
Figure 2.5: Configuring the USB connection between the computer and the EV3 Brick.

2.4 Downloading and running a program

Press the F5 key to run the program. Alternatively, you can start the program 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 allows you to stop the program if necessary. You can also stop the program at any time by 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.



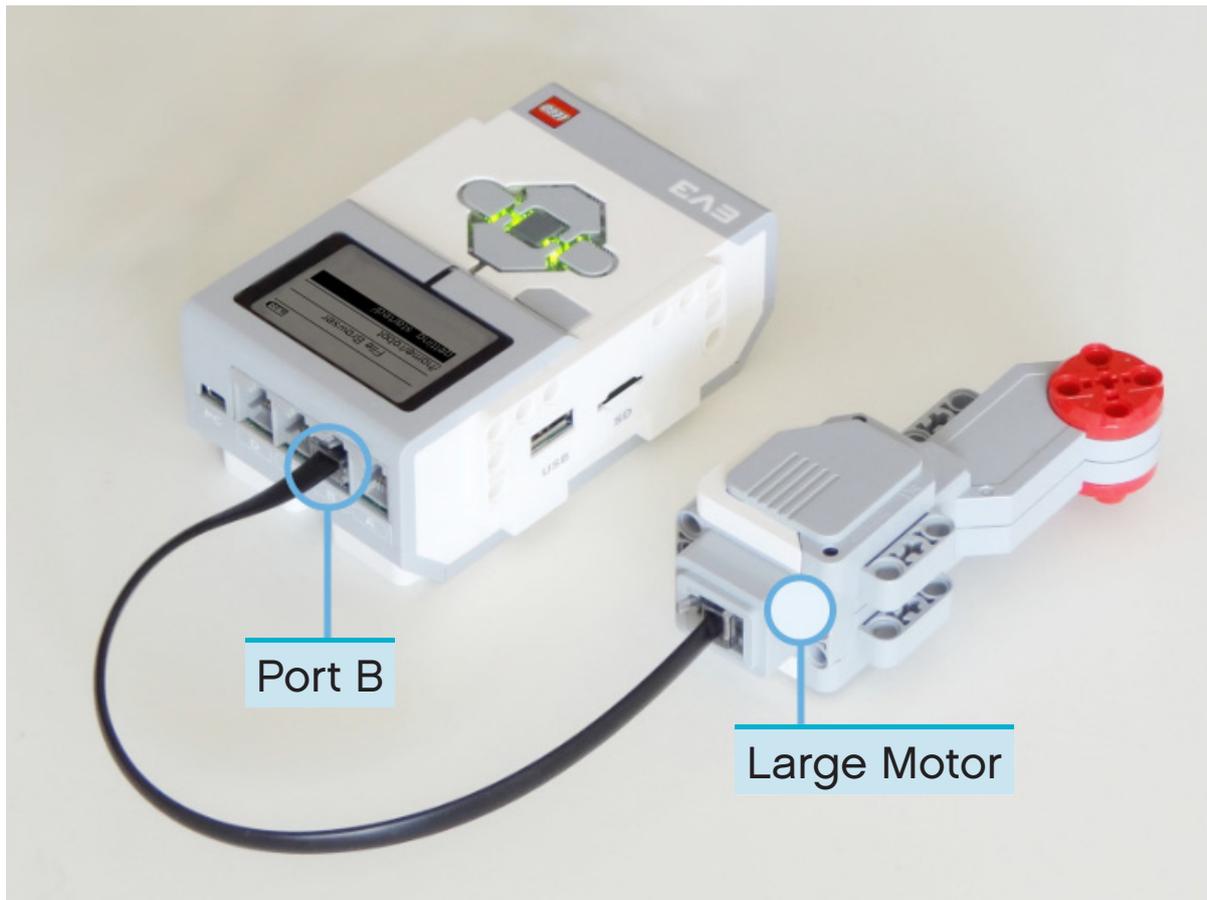


Figure 2.7: The EV3 Brick with a Large Motor attached to Port B.

Next, edit *main.py* so that it looks 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 makes your robot beep, rotate the motor and beep again at a higher-pitched tone. Run the program to make sure it works as you expected.

2.6 Managing files on the EV3 Brick

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

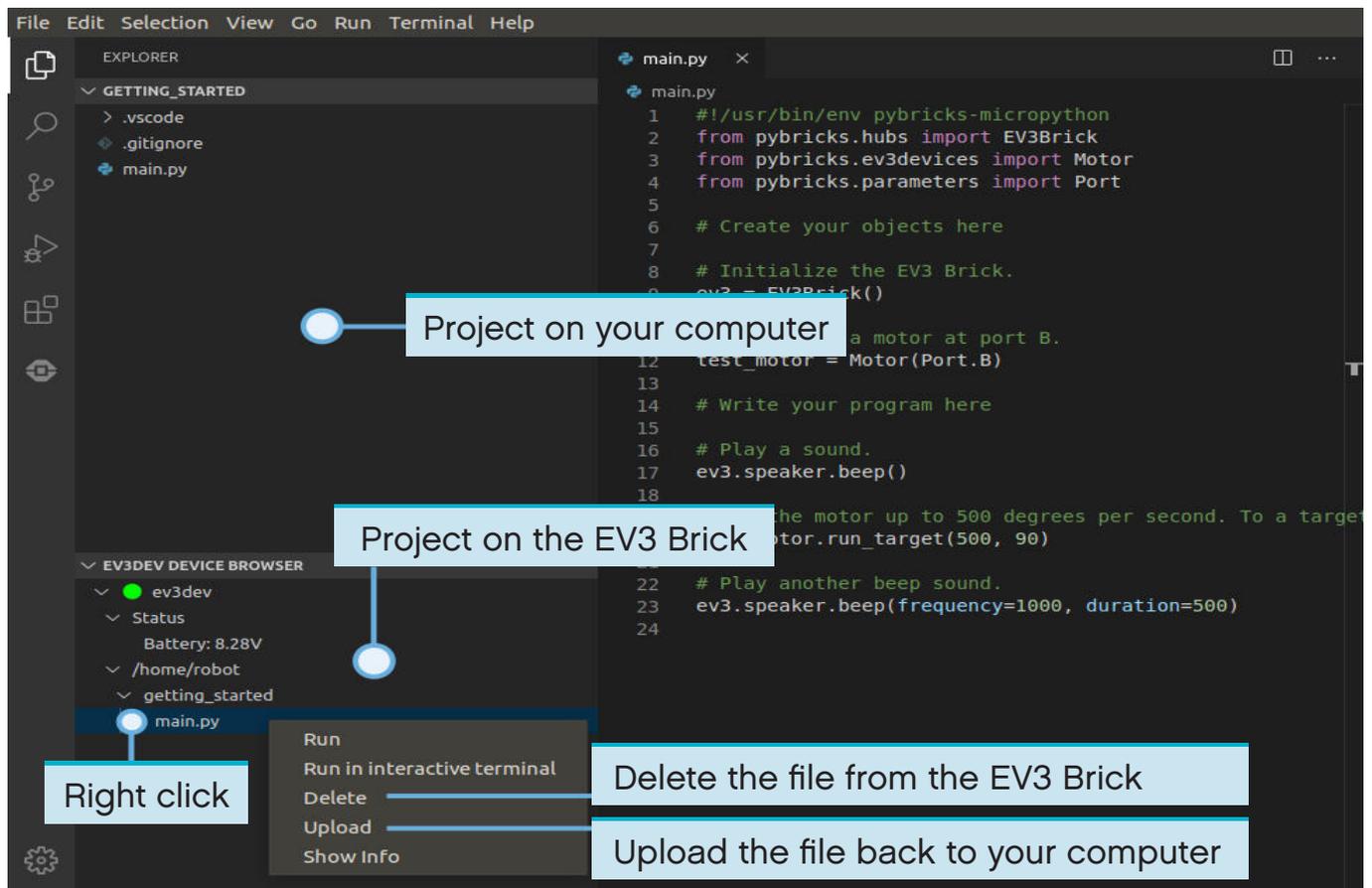


Figure 2.8: Using the EV3 device browser to manage files on your EV3 Brick.

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 to start the program as shown in Figure 2.9.

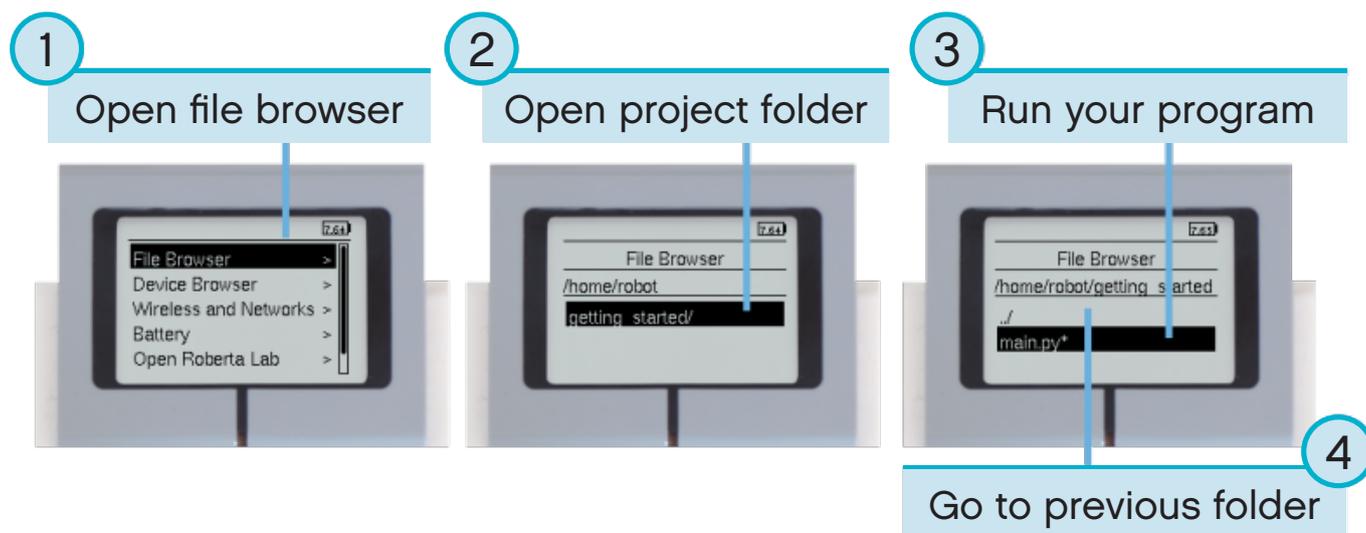


Figure 2.9: Starting a program using the buttons on the EV3 Brick.