

Getting Started with Raspberry Pi

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1 Introduction

1.1 What is a Raspberry Pi?

The Raspberry Pi is an tiny computer, that includes a microprocessor, a bit of memory, a slot for an SD card, input/output (I/O) ports, e.g. HDMI, USB, headphone, camera, and some general purpose input/output (GPIO) pins for various types of electrical connectors.

1.2 Why use the Raspberry Pi?

Generally, Raspberry Pis draw considerably less power than regular computers, are a lot smaller, and are relatively cost-effective. In addition, the GPIO pins allow for connecting and controlling various types of electrical components, such as LEDs and sensors. Raspberry Pis are very flexible devices. They can be used for personal computers, home surveillance systems, weather stations, adblockers for your home network, retro gaming machines, as an AI assistant, and so much more! In this class, we'll be using it as an environmental monitoring device.

2 Unpacking and Connecting the Pi

2.1 Packaging List

2.1.1 “Vilros RP Zero W Basics Kit”

1. Raspberry Pi Zero W board
2. Case, with 3 covers
3. 2.5A power supply
4. Heatsink
5. HDMI to mini-HDMI adapter
6. USB to micro-USB adapter
7. Header pin diagram
8. Camera module adapter (not used)

2.1.2 Other items

1. SD card
2. SD card to USB adapter
3. USB multiport adapter
4. Breadboard

5. Wires
6. Line level converter (LLC)
7. MCP3008
8. MQ-135
9. MQ-XXX
10. MQ-XXX

2.2 Install Raspberry Pi OS on SD card

1. Download Raspberry Pi Imager for your main computer's operating system (OS) at <https://www.raspberrypi.org/downloads/>
2. Install Raspberry Pi Imager
3. Connect the Pi's SD card to your main computer.
4. Use Raspberry Pi Imager to install/write Raspberry Pi OS to SD card.
5. Alternatively, manually copy Raspberry Pi OS and NOOBS to SD card, using the link above.

2.3 Add network configuration file to SD card for a secure shell (SSH) connection.

1. Add a "ssh" file to your boot partition on the SD card.
 - Do this by creating a text file named "ssh".
 - Make sure the file you create has no file extension.
2. Create and add a file called "wpa_supplicant.conf" to the boot partition on the SD card. This can be created with any text editor.
 - Make sure the file you created has the ".conf" file extension in the name.
 - The "wpa_supplicant.conf" needs to have the WiFi network information in it for the Raspberry Pi to connect on boot up.
 - Modify this file with a text editor and include the following information:

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
country=US

network={
```

```
ssid="WIFI NETWORK NAME"  
psk="WIFI PASSWORD"  
}
```

- If you are not in the United States, input your country's ISO code instead of "US" on the "*country=US*" line.
- Make sure to change "WIFI NETWORK NAME" to your WiFi network name.
- Make sure to change "WIFI_PASSWORD" to your WiFi network's password.

2.4 Assemble and Connecting the Pi

2.4.1 Putting the Pi together

1. Safely eject the SD card from your main computer.
2. Place the SD card in the Raspberry Pi Zero W's SD card slot.
3. Attach the Pi to the bottom Vilros case making sure to line the dowels within the case with the mounting holes on the Pi.
4. **Do not** attached the top part of the case yet. Being able to see the Pi's board will help you with pin determination.
5. Attach your peripheral devices, *if you have them*. This includes a monitor, mouse, and keyboard. It is okay to not have them.
 - You will need to use the HDMI to micro-HDMI adapter to hook a monitor up to the Raspberry Pi Zero W.
 - Also, you'll need to use the Anker multiport USB adapter to use a keyboard **and** a mouse. The Raspberry Pi Zero W only has one micro-usb port.
 - You can get away with using just a monitor and keyboard, but if you are not comfortable navigating with a keyboad only, it'll be difficult.
6. Lastly, making sure the the power adapter for the Pi is plugged in to a power source, and verifying the switch on the adapter is in the "off" position, connect the power cable into the Pi.
7. Now, turn the power switch on.

NOTE! Make sure not to turn the device off, or on/off/on, otherwise the "ssh" and "wpa_supplicant.conf" files will not be in your boot directory on the SD card anymore. If, for whatever reason, the Pi loses power after putting those file in the boot directory, you will have to go

back and add them, as in step **2.3**. This is **especially** important for *headless* users (users with no monitor).

NOTE! This is where *headless* users will have to remotely connect to the Pi, while people who have monitors, mice, and keyboards won't have to remotely connect. For those who aren't connecting remotely, skip ahead to step **3.2**

3 Accessing and updating Raspberry Pi OS

Now, there are different ways to remotely connect with the Raspberry Pi if you are a *headless* user. Unfortunately though, you will have to connect to the Pi using **SSH** the **first time**. After that, you can install a remote server on the Pi so you can connect with it using a program with a GUI. I recommend using SSH, though, as it is a *much* quicker connection.

3.1 Remote connection via SSH

3.1.1 Installing Raspberry Pi Finder and finding Pi's IP address

The goal with this step is to find the **local IP address** of the Pi. There are a lot of different ways to do this. If you are computer savvy, go ahead and find the IP address of your Pi and ignore this step.

1. The easiest way to find the IP address of your Pi, if you don't know networking or computers that well, is to use the **Raspberry Pi Finder** by Adafruit.
2. With your main computer, go to this website to download the application for your OS:
<https://github.com/adafruit/Adafruit-Pi-Finder/>
3. Scroll down and click the link that says "**Download the latest release**"
4. Scroll down to "**Assets**" and there you will see the .zip files of the program for the different OSs.
 - "**osx**" is for Mac users.
 - "**win32**" is for Windows user.
5. Download the .zip file for your system and then unzip it when finished downloading.
6. Run Raspberry Pi finder.
7. Click "**Find my Pi!**" for the program to locate your Pi. Wait a few minutes if it doesn't find it immediately. Sometimes it can take quite a while!

8. The IP address should be listed when finished. It should look something like “**192.168.1.XXX**”.
9. Use the IP address to connect to the Pi.

3.1.2 SSH connection

- For Windows users, you will want to use the **Command Prompt**.
 1. Press the **Windows** key on your keyboard, type “**CMD**”, and **Enter**.
 2. In the Command Prompt, type the command below making sure to substitute “192.168.1.XXX” with the IP address found in step 8

```
ssh pi@192.168.1.XXX
```

- For Mac users, you will want to use the **Terminal**.
 1. Press the **Command + Spacebar** keys on your keyboard, type “**Terminal**”, and **Enter**.
 2. In Terminal, type the command below making sure to substitute “192.168.1.XXX” with the IP address found in step 8

```
ssh pi@192.168.1.XXX
```

1. For both Mac and Windows users, you should now see a prompt in the command line asking for the Pi’s password.

By default, the password is “**raspberry**”.

The command line won’t show the password while you are typing it, nor will it show placeholder characters. You will need to just type it and **Enter**.

2. If all went well, you should see that you’ve connected to your Pi via the command line interface (CLI). You should see the text:

```
pi@raspberrypi/:~ $ _
```

3. There will also be a warning that the Pi’s password hasn’t been changed. We will want to change that, but we are not going to do that right now.

3.2 Update and Upgrading Raspberry Pi OS

Here we will be updating the Raspberry Pi. This is the first thing we are going to want to do to make sure there are now errors later on. We will need to implement a few commands into the Pi's command line. Don't be afraid! Its easy!

1. First we are going to want the Pi to talk to the official Raspberry Pi servers to get the latest version list of our programs on the Pi. In your SSH session, type the following command:

```
sudo apt update
```

2. Secondly, we want the Pi to compare the version list with its current packages and programs and update where needed. In your SSH session, type:

```
sudo apt full-upgrade
```

3. You will be asked if you are sure you want to upgrade. Type “y” and **Enter**.

4. Once it is finished, it will show this once again:

```
pi@raspberrypi/:~ $_
```

5. Congratulations! Your Pi has been upgraded!

4 Configuring the Pi