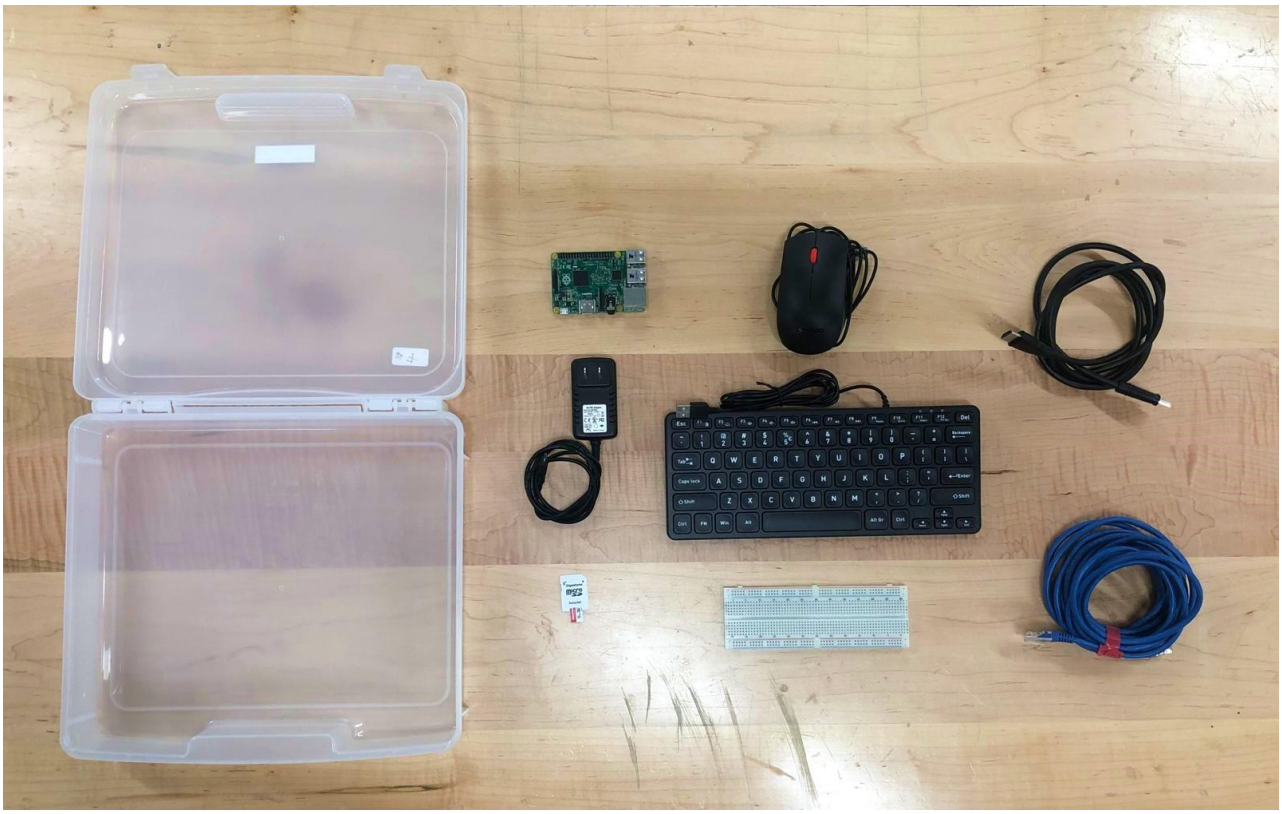
Raspberry Pi Kit Guide



Contents

Getting Started With the Makerspace Pi Kit

This kit can be loaned out for 2 weeks at a time. Please return or renew the kit by this time. When returning the Pi, be sure to save your project contents/files on a separate drive/location off the SD card before returning to Makerspace, as the SD card will be wiped.

What's included with the kit

- Case
- Raspberry Pi 3B
- Micro USB power cable (5V DC, 2.5A)
- MicroSD and SD card adapter
- Long breadboard
- Wired keyboard
- Wired mouse
- HDMI cable
- Ethernet cable

Additional items/software you may need

- Hardware
    - Laptop/computer
    - Wi-Fi
- Software (links and installation steps ahead)
    - Raspberry Pi Imager
    - Real VNC Viewer

Safety

- Before making contact with the Pi, ensure you are not charged with static electricity. Touch unpainted grounded metal like a fridge to discharge yourself, or wear an electrostatic discharge (ESD) bracelet and ground yourself.

- Hold the Pi by the edges when handling it to minimize the risk of ESD damage.

- Place the Pi on a stable, flat, non-conductive surface.

- Keep the Pi away from water, moisture and heat.

- Provide enough space for the Pi to be well ventilated. Ensure that the air flow isn't impeded so the Pi is able to dissipate heat. If the Pi overheats it will shut down, and it may damage the components on the board.

- GPIO Pins
    - Use GPIO pin chart to confirm where pins are inserted onto the Pi
    - Ensure voltage & current input don't exceed the Pi's limits
        - MAX input: 3.3 V, 16 mA each GPIO pin, 51 mA across all (total) GPIO pins
    - Do not connect the 5V and 3.3 V power pins into the ground pins
    - Do not connect GPIO pins into one another
    - Use resistors!

- Connect all peripherals and pins prior to plugging the power into the Pi. Ensure the power supply for the Pi outputs a maximum of 5V DC, and 2.5 A, and is the last cable plugged in.

- Do not unplug the Pi to turn it off. Shutdown the Pi first, wait for the green LED to stop flashing and turn off, then unplug the power cable. Incorrect shutdown can corrupt the SD card.
    - To shutdown: find the Raspberry logo in the upper left of the desktop view, select "Shutdown" from that menu, and then click the "Shutdown" button on the pop-up. Alternatively, type "sudo shutdown" in the terminal.

How To Setup The Pi

The steps below will be covered in the upcoming pages to setup the Pi.

1. Setting up a hotspot
2. Setting up the Pi OS
3. Turning on the Pi
4. Setting up a virtual display for the Pi
    a. PART 1: Using “Command Prompt” to connect your device & the Pi
    b. PART 2: Using “RealVNC Viewer” to see the Pi without an external monitor

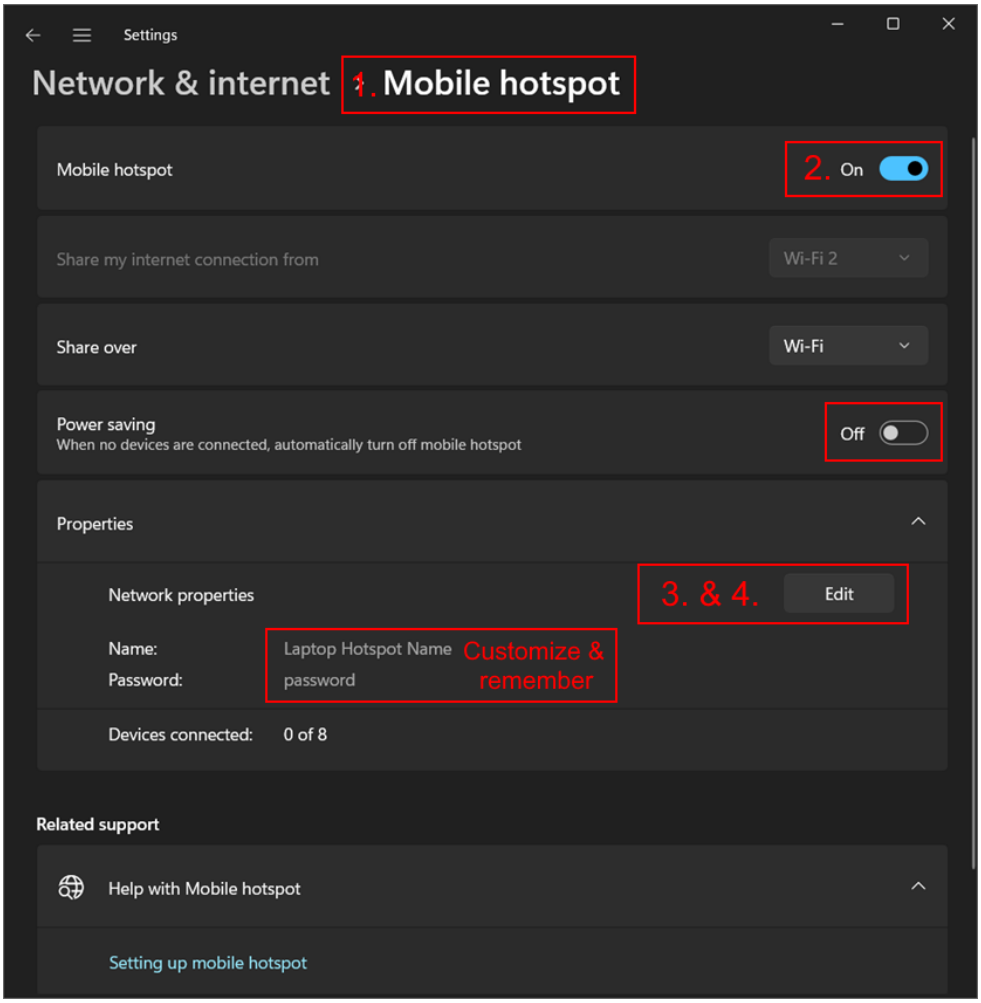
Setting Up A Hotspot

Raspberry Pis cannot connect directly to McMaster Wi-Fi. Use the following steps to work around this issue. If you're using your home/personal Wi-Fi, you can skip this section.

On a Windows device:

1. Connect your Windows device to Wi-Fi.
2. Press the Windows Key, search for "mobile hotspot". A system settings option should appear named "Mobile Hotspot", open this setting.
3. In the setting, enable "Mobile Hotspot" by switching from off to on.
4. In "Properties" click on "Edit" to set your hotspot connection's name and password.
    a. Keep the name and password simple, as you will have to type this information later.
5. If there is an option to select the "Network Band", ensure that it is **"2.4 GHz"**. Click "Save".
6. Keep this window open for later.

The settings should look like this once finished:



Setting Up The Pi OS

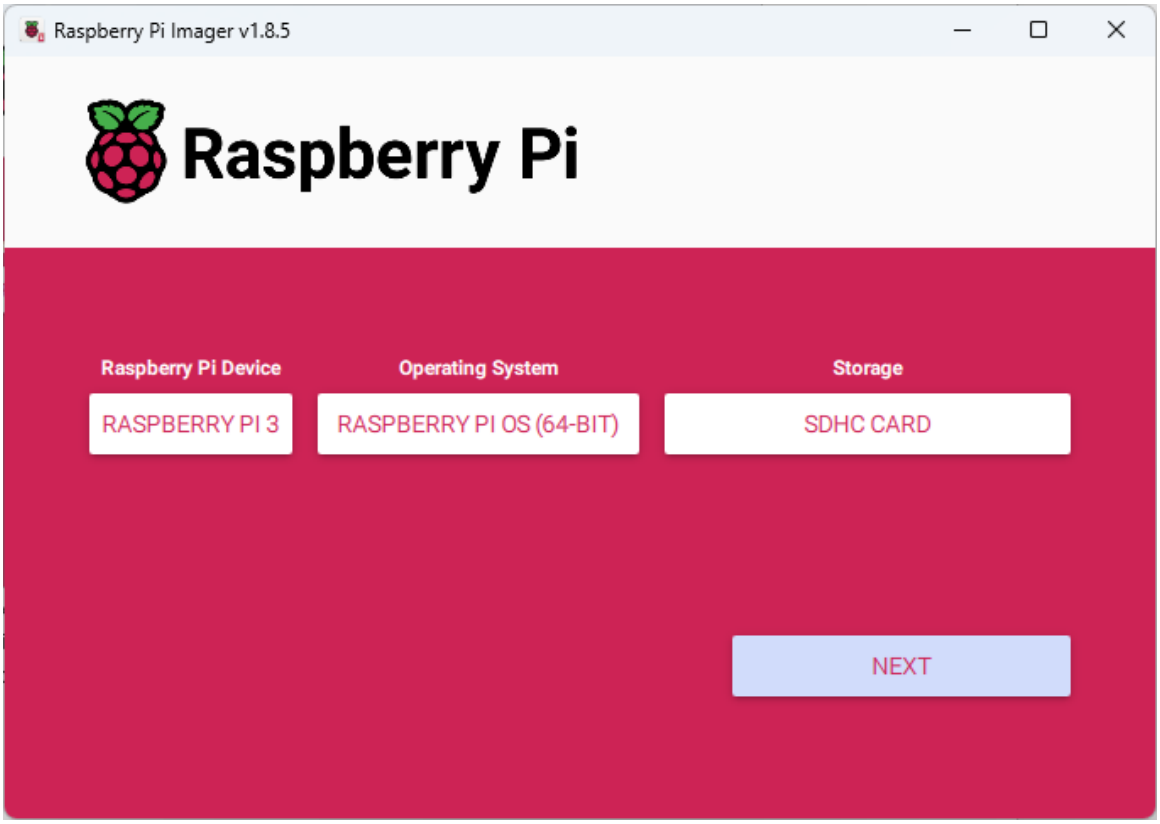
Right now, the Pi has no system loaded on to it, so it won't display anything when plugged into power. An OS must be installed on a microSD card to interact with it.

Please note: The software installed in this guide is to get you started with the Pi. For specific projects you may have to install a different OS and follow different instructions to set them up. Do your own research and follow them at your own risk.

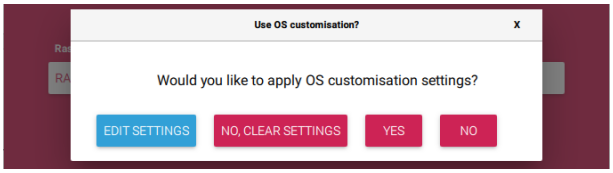
1. Insert the microSD into your personal computer
    a. This process will overwrite and delete any files stored on the microSD card. Be sure to back up any files to prevent losing them permanently.

2. Go to the Raspberry Pi downloads page (https://www.raspberrypi.com/software/) and install the "Raspberry Pi Imager" software on your personal computer.

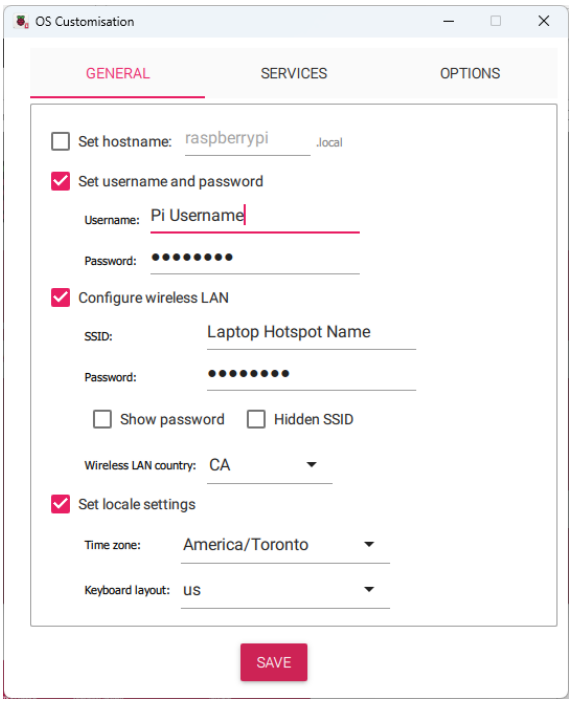
3. Launch the software.
    a. Click "CHOOSE DEVICE" à select "Raspberry Pi 3"
    b. Click "CHOOSE OS" à select the option that has "(Recommended)" in it.
    c. Click "CHOOSE STORAGE" à select & ensure the correct microSD/SD card is chosen



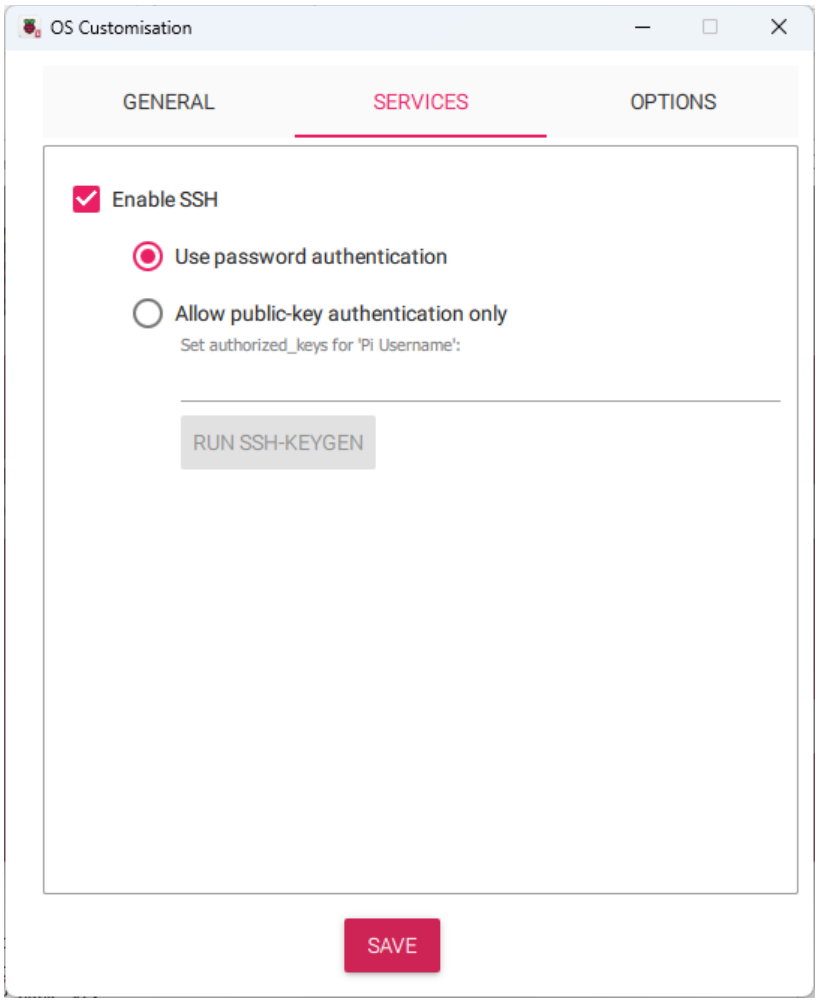
d. Click “NEXT” à a pop-up asking “Would you like to apply OS customization settings?” will appear à click “EDIT SETTINGS”



e. A pop up named “OS Customization” will appear
    i. Click on the “GENERAL” tab at the top.
        1. Check the box beside “Set username and password”.
            a. These are your Pi login credentials. Enter your desired username and password, and remember/write it down for later.
        2. Check the box beside “Configure wireless LAN”.
            a. Enter the name of your hotspot connection you just created or home/private WiFi beside “SSID:”, and the password beside “Password”. Make sure you enter the network name and password correctly.
            b. Enter the country code for the country you are in beside “Wireless LAN country”. It is “CA” for Canada.
        3. Check the box beside “Set locale settings”.
            a. Find and select the time zone in the drop down beside “Time zone:”. It is “America/Toronto” for Toronto.
            b. Find and select the desired keyboard layout in the drop down beside “Keyboard layout:”. “us” is the default and suggested.



ii. Click on the “SERVICES” tab at the top.
    1. Check the box beside “Enable SSH”.
        a. Select “Use password authentication”.
    2. Click “SAVE” at the bottom.



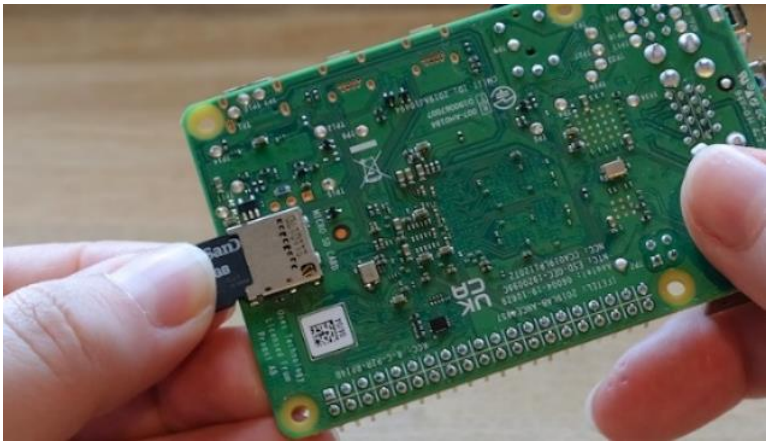
f. The “Use OS Customisation” popup will appear again asking “Would you like to apply OS customization settings?” à click “YES”
g. Pop up will appear asking “All existing data on the SD card will be erased. Are you sure you want to continue?” à Ensure you have backed up any files you want to keep à click “YES”

4. Wait for the OS to be installed onto the SD card. This can take a while. If you get a pop-up from Windows to reformat the SD card, ignore it and let the

5. Once completed, the SD card should be ejected. You may now remove the SD card.

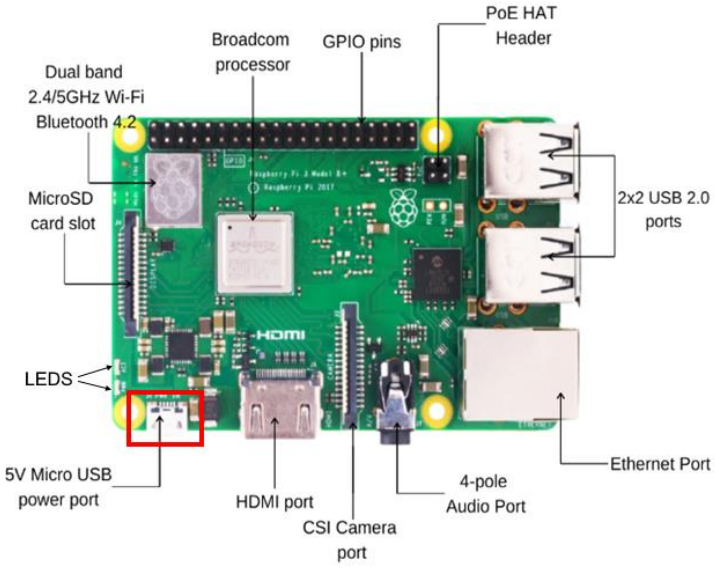
Turning On The Pi

1. Insert the microSD card into the microSD card slot on the underside of the Pi. Gold pins facing into the board.



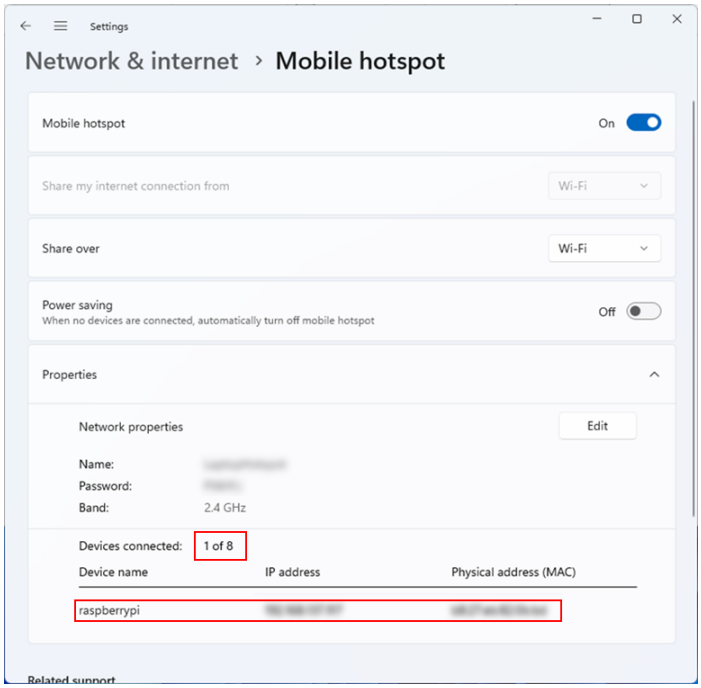
2. If you:
    a. **Do** have an external monitor
        i. Connect the mouse and keyboard into the USB ports
        ii. Connect the HDMI cable to the Pi and monitor
    b. **Don't** have an external monitor
        i. Complete the rest of the steps for this section ("Turning on the Pi")
        ii. Complete the next section ("Setting up a Virtual Display for the Pi")

3. Plug the power supply into an outlet and the other end to the Raspberry Pi's power port



4. A red LED should light up indicating the Pi is powered, and a green LED should flash on and off
    a. <u>If you don't see the LEDs lit up, please connect with staff!</u>

5. Check the “Mobile Hotspot” settings page, the Pi should appear as a device connected to your hotspot. If you don’t see it, give your Pi some time to finish booting up. Once it finishes booting up, the Pi should automatically connect to it.
    a. If it doesn't connect after some time
        i. Unplug the power supply, wait for 30 seconds, plug it back in. Wait for the Pi to boot and appear as a device connected to your hotspot in the hotspot settings.
        ii. Re-install the OS and ensure the hotspot/Wi-Fi name and password are the same in the “Mobile Hotspot” settings and in the Raspberry Pi Imager OS setup.



If you are connected to an external display, you should see the Pi booting & displaying “Welcome to the Raspberry Pi Desktop” and a Raspberry Pi logo in the middle. Then, it will take you to the desktop. You are now done setting up your Pi!

If you aren’t connected to an external display, continue to the next section, “Setting up a Virtual Display for the Pi”.

Setting Up A Virtual Display For The Pi

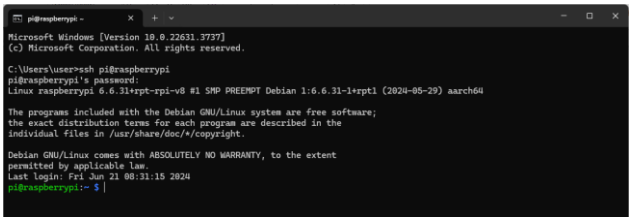
PART 1: Using "Command Prompt" to connect your device & the Pi

1. Press the Windows Key à search for "Command Prompt" à open the application

2. In the application, type "ssh YOURUSERNAME@raspberrypi". Replace YOURUSERNAME with the Pi's login username you entered in setting up the OS à Hit the "Enter" key on your keyboard.
    a. For example: if I set my Pi's username to be "pi", I would type "ssh pi@raspberrypi"

3. The application will prompt you with "YOURUSERNAME@raspberrypi's password: " à enter the Pi's login password you entered in setting up the OS. à Press enter.
    a. When you type in the password, you won't be able to see the letters show up in the application, but the application will still register it

4. If the application asks you for permission, type "yes" à press enter. Now you should be connected to the Pi.



5. Type "sudo raspi-config". A blue screen with a menu should appear. Use the arrow keys to move around and the enter key to select.
    a. Select "3 - Interface Options - Configure connections to peripherals".
        i. Select "I3 – VNC - Enable/disable graphical remote desktop access".
        ii. The screen will ask "Would you like the VNC Server to be enabled?" à Select "Yes" à After some time, the screen should now say "The VNC Server is enabled". Press the enter.
    b. Select "2 - Display Options Configure display settings"
        i. Select "D3 - VNC Resolution - Set resolution for headless use"
        ii. Select the desired display resolution. The screen should now say "The resolution is set to SELECTEDRESOLUTION". SELECTEDSOLUTION would be replaced with the resolution you selected.

6. Select "Finish" à The screen will ask "Would you like to reboot now?" à Select "Yes". The system should now reboot. This may take some time.

7. To know if the Pi has finished rebooting:
    a. Check that your device is detected in the hotspot settings (same as step 5 in "Turning on the Pi").
    b. Use the command prompt application and ssh into the Pi (same as step 2 of this section)
        i. If it doesn't work, you will receive an error of "ssh: Could not resolve hostname raspberrypi: No such host is known"

PART 2: Using "RealVNC Viewer" to see the Pi without an external monitor

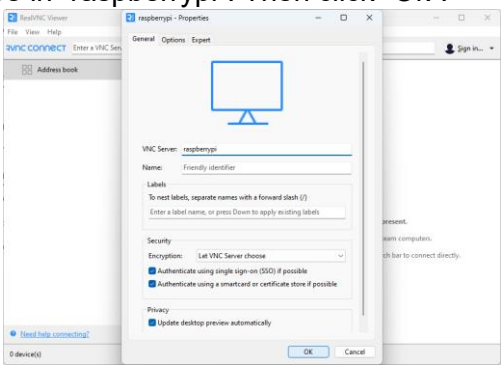
1. Download RealVNC Viewer (https://www.realvnc.com/en/connect/download/viewer/) on your personal laptop/device à run the installer and complete the installation

2. Press the Windows Key and search for the "RealVNC Viewer" application and open it

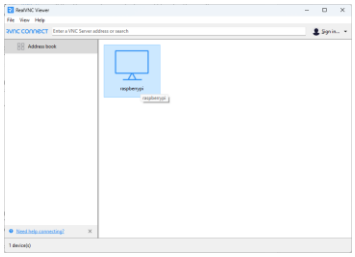
3. The software will boot and a pop up will appear with a blue button asking to "Sign in to get started", don't click on that button. Instead look a little lower and click on "Use RealVNC Viewer without signing in". The popup should close.

4. In the application, press Ctrl and N, or find the "File" tab, then click on "New connection…". A popup should appear.

5. Beside "VNC Server", type in "raspberrypi". Then click "Ok".

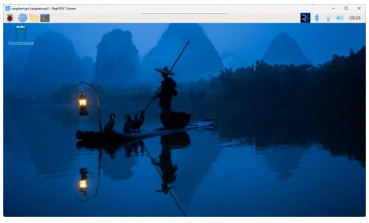


6. In the application, double click on the desktop icon named "raspberrypi" and a pop up will appear "Connecting to raspberrypi". Another popup will appear named "Identity Check", click "Continue".



7. Enter your Pi credentials into the "Username" and "Password". Click "Ok".

8. Now you are graphically connected to your Pi without an external monitor! You are now done setting up your Pi!



Using Your Pi Outside Of The Setup Process

Now that the Pi has been setup, you won't have to run through the setup process again to use your Pi. You may follow these steps instead:

1. Turn on the same hotspot/Wi-Fi you set up the Pi with
2. Plug in peripherals into the Pi, then the power supply Pi
3. Check that the Pi is connected to the hotspot/Wi-Fi
4. Use the Pi through VNC Viewer/external monitor

Tutorial/Projects

- Raspberry Pi For Beginners Pathway
- Beginner Paths, Projects, Hardware
- Advanced Projects