

## Raspberry Pi Tutorial

You will need access to the serial port connector; either remove the deco cover or perform the [\[\[Create® 2 Deco Cover Modification\]\]](#). You will also need to modify the bin to hold the Raspberry Pi; see [\[\[Create® 2 Bin Modification\]\]](#) for instructions. This tutorial also assumes that you have built a 5V to 3.3V logic level shifter as in [\[\[Create® 2 Serial to 3.3V Logic | this tutorial\]\]](#).

1. Procure the following parts:
  - a. Raspberry Pi model A. With the camera, it turns out there is just enough headroom in the on-board thermal resettable fuse to run directly off the serial connector. If you use a model B, you will have to get power elsewhere. A model A+ or B+ should work, but we haven't tried, yet!
  - b. SD card (4GB or larger) with Raspbian installed. Raspbian and directions for downloading are available here: <http://goo.gl/HXkl7>. Alternatively, some vendors sell SD cards with the operating system pre-installed.
  - c. Raspberry Pi camera board. This is optional.
  - d. USB to WiFi module. We have had luck with the D-Link DWA-121, but others could work. Check the Raspberry Pi verified peripherals list to be sure: <http://goo.gl/40Kvo>
  - e. 5V to 3.3V level converter. Since the Create® 2 communicates with 5V serial, and the Raspberry Pi communicates at 3.3V, we need to convert levels so as not to damage any hardware. If you haven't already built one, [\[\[Create® 2 Serial to 3.3V Logic\]\]](#) please do so.]]
  - f. USB micro B male cable. We used an "up-angle" connector to save space – for example, part number CAA-90UMICB-03M from L-com.
  - g. A switching DC to DC converter. The Raspberry Pi requires a regulated 5V input, but the Create 2 serial port provides battery voltage. We use a switching converter because they are much more efficient than a linear converter. If you use a linear converter, the thermal resettable fuse on the robot's serial port may trip. We used the UBEC DC/DC Buck converter, part number 1385 from Adafruit. Any buck converter will work, as long as it can supply at least 1A at 5V, and can handle up to 21V on its input.
  - h. Hook-up wire; 22 through 30 AWG should be fine.
  - i. *Optional:* 4-40 x 5/8" or M3 x 16 mm standoff to support prototyping board if installing above Raspberry Pi.
  - j. *Optional:* at least three 4-40 x 1/4" or M3 x 6 mm standoffs to support the Raspberry Pi.
  - k. A powered USB hub, USB keyboard, USB mouse, and monitor (HDMI or composite) for initial setup.
  - l. A program for connecting to your Raspberry Pi via SSH. On Windows, we recommend PuTTY, which can be found at <http://goo.gl/uPmC>.
2. Plug the Create 2 into its charger, so that it will be ready for experimentation once the Raspberry Pi is ready to go.
3. Install the SD card with Raspbian into the Raspberry Pi.
4. Plug the keyboard, mouse, WiFi to USB dongle, and USB A to Micro B cable into the powered hub.
5. Plug the powered hub into the Raspberry Pi USB A port.
6. Plug the Raspberry Pi into your monitor.
7. If you are using a Raspberry Pi Camera, install it now.
8. Finally, plug the micro B connector into the Raspberry Pi. It should boot. If it does not boot, you may need a different hub, or one that can supply more power to the Raspberry Pi.
9. If this is the first time booting the Raspberry Pi, raspi-config will run. If not, log in and then run raspi-config.
10. Select the options you desire; we suggest expand rootfs, configure\_keyboard, change pass, change timezone, enable SSH, and enable camera (if desired). When complete, the Raspberry Pi may reboot. If so, log back into the Raspberry Pi. The default username is pi and the default password is raspberry.
11. Type **"startx"** (without quotes) to start an X-Windows session. Double-click on the WiFi configuration tool and get the Raspberry Pi on your network. Take note of its IP address; you'll need it later.
12. Log out of the X session by clicking the red logout button in the bottom right hand corner of the interface, and then select **"Logout"** again.
13. Disable the console port on the Raspberry Pi. This is so that you can use the on-board serial port to control Create® 2. We used the following tutorial: <http://goo.gl/cJCrc>. If you use that tutorial, skip the step at the end for testing; we'll get to that later.
14. We use Python to control Create 2 via the serial port. To install the python serial module, type **"sudo apt-get -y install python-pip"** (without quotes); once that completes, then type **"sudo pip install pyserial"** (again, without quotes).
15. We will also take advantage of the general purpose input and output pins (GPIO) with Python. To install this capability, type **"sudo apt-get -y install python-rpi"** (without quotes).



16. If you are interested in setting up the camera for remote streaming over HTTP, we recommend the following tutorial: <http://goo.gl/vIB7xu>
17. Time to get the rest of the hardware ready! First, power down the Raspberry Pi by typing “`sudo halt`” (without quotes) and wait until the machine tells you it is safe to remove power. Then, disconnect all of the peripherals from the Raspberry Pi. Leave the SD card in place. Remove the WiFi to USB module from the hub and install it in the USB A slot in the Raspberry Pi.
18. Connect the input wires of the buck converter as directed in the level shifter tutorial.
19. Cut the USB A to USB Micro B cable in half and put aside the A side for later projects. Cut away the insulation and shield. You may also cut the white and green wires, as they are not used to power the Raspberry Pi. Connect the red wire to the positive voltage output from the buck converter, and the black wire to the zero voltage (ground reference).
20. Connect the Raspberry Pi to the level shifting circuit, either using a ribbon cable or 0.1” pitch pin header.
21. Re-install the Raspberry Pi camera. Optionally, plug the Raspberry Pi back into the monitor.
22. Time to fire things up! Plug the mini-DIN cable into the Create 2. Wait about a minute, and then SSH into the IP address you wrote down in step 11. If you can’t seem to connect to the Raspberry Pi, plugging it into the monitor should help to figure out what is wrong.
23. Install minicom by typing “`sudo apt-get install minicom`” (without quotes). To see if the serial port is working, type the following command: “`minicom -b 115200 -o -D /dev/ttyAMA0`” (without quotes). Text should begin scrolling by regarding the charging state of the Create® 2. If not, you may try a factory reset of the robot, which can be performed by pressing and holding the “Spot” and “Dock” buttons on the robot for ten seconds, and then releasing. If no text appears after this, something is wrong with your hardware (probably on the prototyping board). Once text is scrolling, press **{Control} + {A}** and then **{X}** to exit minicom.
24. Before installing the Raspberry Pi in the Create 2, let’s be sure that both directions are working on the serial port. Create a directory called “Roomba” by typing “`mkdir Roomba`” and then change to that directory by typing “`cd Roomba`” (without quotes in all examples). Create `keepalive.py` and `song_start.py`, linked here. (To create files, you’ll need to use an editor, like “nano”. For example, to create `keepalive.py`, type “`nano keepalive.py`” (without quotes), enter the contents of the file as linked above, and then save and quit by pressing **{Control} + {X}**, then **{Y}**, then **{Enter}**.)

