Dirt Cheap DJ Create® 2 Bin

Summary:
So you want to impress your friends with a roaming, robotic DJ at your next party, but that speaker that you glued on top of your Create® 2 keeps getting knocked off. Well, then follow these instructions to put two speakers and a Bluetooth module into your Create 2 bin for less than $15.

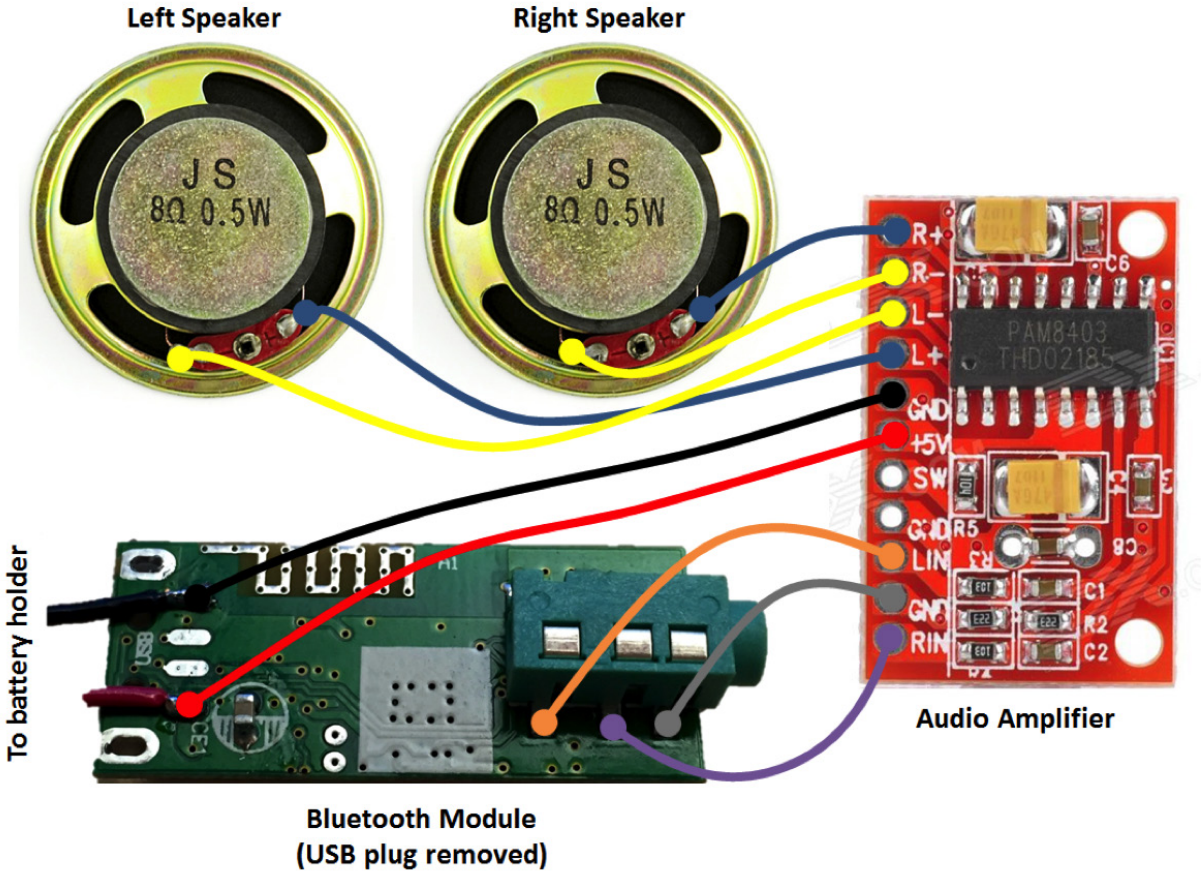
Part Description	Qty	Where to Buy
2-Channel 3W PAM8403 Audio Amplifier Board	1	http://goo.gl/76twRl
Bluetooth V2.0+EDR USB Drive Audio Receiver w/ 3.5mm Audio Male to Male Cable	1	http://goo.gl/AwTd4o
Speaker (2” or smaller in diameter)	2	Here are a couple of options: http://goo.gl/z8K1V3 http://goo.gl/N3pjuc
Battery Holder 4xAA with Cover and Switch	1	http://goo.gl/y6QnHR http://goo.gl/HRDFIz
iRobot Create 2 Vacuum Bin	1	
4x AA batteries		

Tools and other equipment

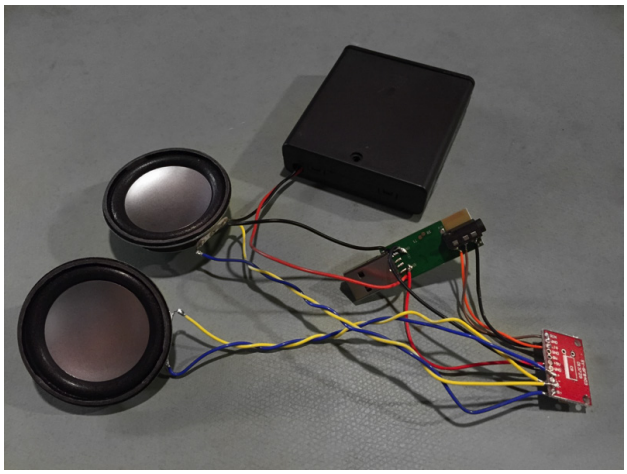
- Soldering Iron
- Hot Glue Gun
- Small Flathead Screwdriver
- #1 Phillips Screwdriver
- Heat shrink tubing or electrical tape
- Flexible wire
- Rotary Cutting Tool
- Hook and loop fastener

Procedure

1. Preparing your electronics
   a. Remove all of your electronics from their packaging and lay them out on your work surface.
   b. Remove the USB cover from the Bluetooth module and carefully use a small flat head screwdriver to pry the plastic housing apart. This won't take much force. Discard the plastic housing pieces.
   c. Choose which speaker will be the left and which will be the right and label them accordingly.
2. Wiring the audio amplifier board
   a. Solder short segments (2" or less) of wires to the + and - terminals on the back of the two speakers.
   b. Solder the other ends of these wires to the matching connections on the audio amplifier board (R+, R-, L+, L-).
   c. Solder short segments (2" or less) of wires to the +5V and Ground connections on the audio amplifier board. Use red and black wire for V+ and Ground connections respectively to avoid confusion later.
   d. Solder short segments (2" or less) of wires to the LIN, GND, and RIN connections at the bottom of the audio amplifier board. Use different colors for each channel.



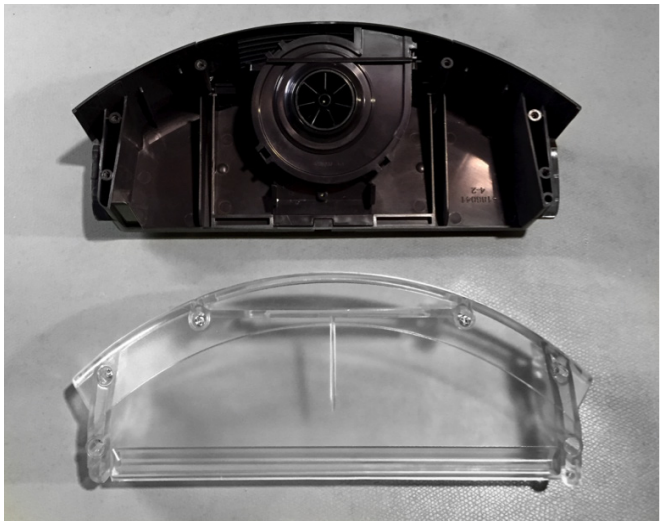
3. Wiring the Bluetooth module board
   a. Solder short segments (2” or less) of wires to the +5V and Ground pads at the back of the USB plug. Again, use red and black wire for V+ and Ground connections respectively.
   b. Solder the LIN, GND, and RIN wires to the corresponding pads next to the audio jack.
4. Connecting your battery holder
   a. Take the red, +5V wires from the audio amplifier board, the Bluetooth module board, and the battery holder and twist the ends together. Apply solder to the bundle to hold them together.
   b. Slip a piece of heat shrink tubing over the connection and hold the tip of your soldering iron close to it to shrink it around the wires.
   c. Do the same with the three black, ground wires.



5. Testing your electronics
   a. Install 4x AA batteries into the battery holder and slide the power switch to ON.
   b. A blue LED on the Bluetooth module should start flashing and the speakers should emit a sequence of start-up tones.
   c. Connect your Bluetooth music player by going to your settings screen, selecting the new Bluetooth device and entering the PIN 0000.
   d. Select a song and make sure your speakers are playing properly.

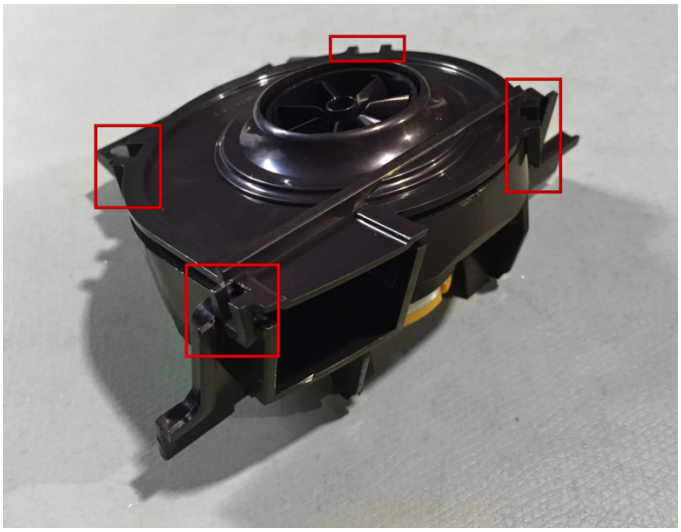
   e. Installing the electronics in your vacuum bin
   Note: This process can be simplified by using a High Capacity Bin, which doesn’t have a vacuum fan in it. This preserves the bin latch assembly and eliminates the need to modify the vacuum fan.
   f. Remove the vacuum bin from your robot and flip it upside down.
   g. Use your #1 Phillips screwdriver to remove the six screws (circled in the image below) holding the bin together and set them aside.

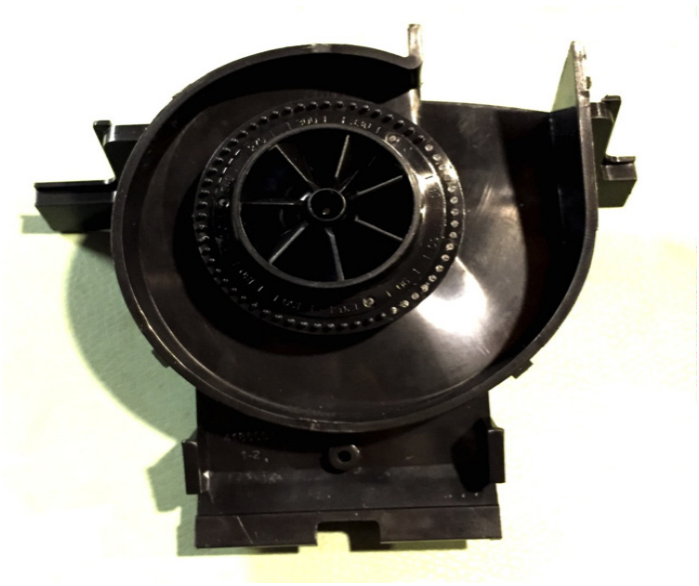
   h. Separate the upper and lower bin housings.



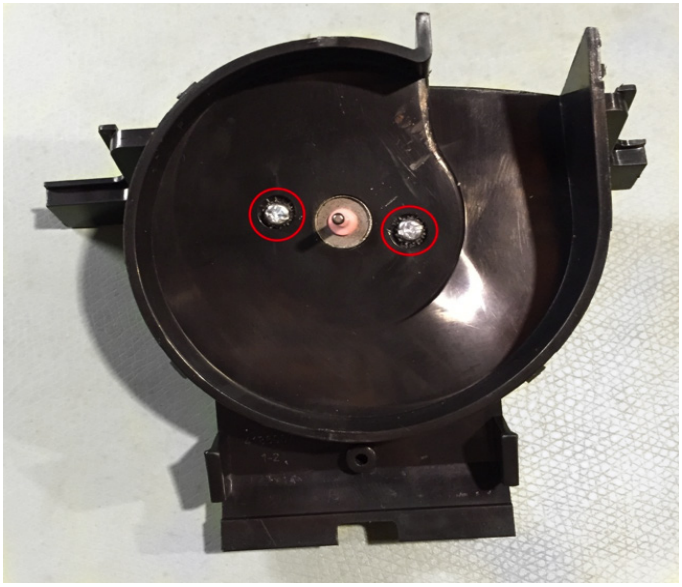
   i. Remove the screws holding the vacuum fan in place and slide it out of the bin.

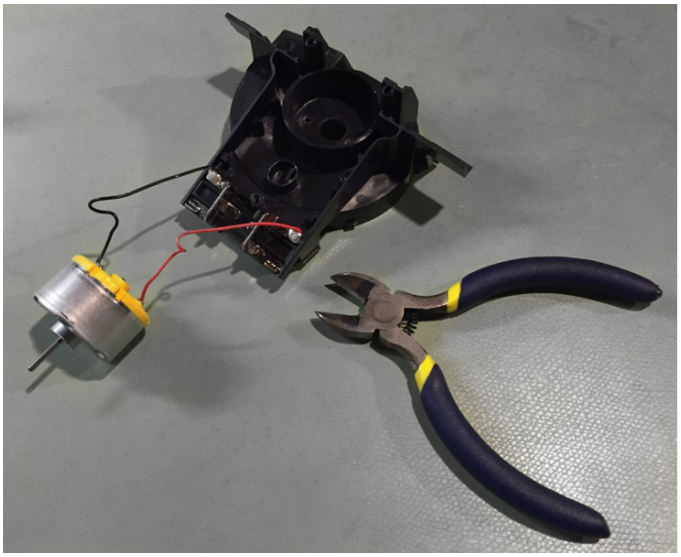
j. Use a flathead screwdriver to release the four snap clips holding the top cover on. Remove the cover and pull the vacuum impeller off of the motor shaft. This can be achieved by twisting and pulling or by prying from underneath with a flathead screwdriver.





k. Remove the two Phillips screws holding the motor in place. Remove the motor from the plastic housing, cut the red and black wires about an inch from the back of the motor, and put it aside for use in a future project.



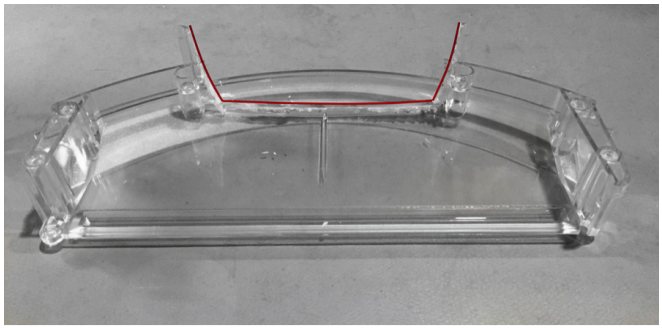


l. Use a rotary cutting tool to trim the vacuum housing pieces in half to create space in the bin for the speakers.

m. Reinstall the smaller plastic piece and the latch spring into the top bin housing and screw it into place. Make sure you have the plastic latch seated properly too.

n. Turn on your hot glue gun and apply glue to the two pivot arms on the latch at the back edge of the bin.

o. Now use your rotary tool to remove the plastic lip at the rear of the bin bottom as shown in the image below.

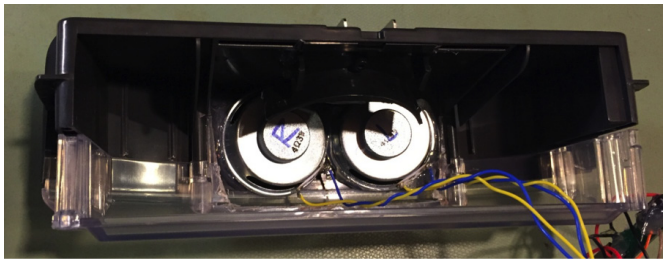


p. Reassemble the bin, being sure to capture the rear grill in place properly. Reinstall the six screws to clamp the bin back together.

q. Grab your hot glue gun again and position the speakers up against the plastic grill at the rear of the bin while you wait for it to heat up. Be sure to position the speakers on the appropriate side of the bin.

r. When ready, tack both speakers in place with dots of hot glue. Then, run a small bead of hot glue around the perimeter of the speakers.

s. While the glue is still hot, clean up any excess glue that may have leaked through the plastic grill to the outside of the bin.



t. Position the electronics in the bin and fixture them in place using Velcro or a similar method. This will prevent the components from rattling around in the bin and possibly shorting against each other.

6. Install your new DJ Create 2 bin into the robot, turn on the power, and enjoy the music!

Optional Upgrades

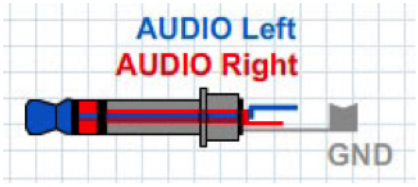
Optional Upgrade #1: Upgrade your battery pack

Replace your 4xAA battery holder with a USB or Lithium Polymer battery pack for rechargeable goodness.

Part Name	Qty	URL
USB Battery Pack - 1800 mAh (Optional)	1	http://goo.gl/n1sl4k
Lithium Polymer USB Charger and Battery (Optional)	1	http://goo.gl/glCfz2

Optional Upgrade #2: Add an audio plug to connect an on-board music player

Connect a 3.5mm audio plug to the L_in, R_in, and Ground connections on your audio amplifier board and connect an audio player (iPod Shuffle, etc.) directly, instead of using the Bluetooth module. Typically, the plug tip is Audio Left, the middle ring is Audio Right, and the sleeve is Ground (as shown in the image below).



Part Name	Qty	URL
Audio Plug - 3.5mm	1	http://goo.gl/PU6ayt

Optional Upgrade #3: Power your electronics using Create's internal battery

Connect a 5V UBEC (Buck) Converter to the dust bin electrical contacts and use power from your Create 2 internal battery to power your electronics.

Part Description	Aprox. Cost	Qty	Manufacturer Part Numbers and/or Source Links
UBEC DC/DC Step-Down (Buck) Converter - 5V @ 3A Output	$5.34	1	• http://goo.gl/aPHMRF • http://goo.gl/ptMfF7
Inductor 2.2mH 500mA	<$5	1	**Here are several inductor options:** • Abraco Corporation AIAP-03-222-K • TDK Corporation TSL1315RA- 222JR55-PF • TDK Corporation SL1720-222KR60-PF • Vishay Dale IHD3EB222L • Bourns Inc. 5900-222-RC

a. Instead of soldering the battery holder wires to the Bluetooth module, cut off the connector on the output of the UBEC, strip the insulation off the wires, and solder the UBEC output wires to the +5V and Ground pads on the Bluetooth module.

b. Solder the red UBEC input wire to the red vacuum motor wire (the left vacuum bin contact).

c. Solder one lead of the inductor to the black vacuum motor wire (the right vacuum bin contact).

d. Solder the black UBEC input wire to the other lead of the inductor.

e. Use hot glue to secure the inductor somewhere in the bin so it doesn't pull on the wires.

f. Plug the bin into the robot and command the robot to drive to apply power to the bin contacts (either by pressing Clean to start a mission or using the Open Interface command Motor – 138). Now your electronics are powered by Create's internal battery!

Why is the inductor necessary?

The motor driver was designed to drive an inductive load (motors have a lot of inductance). The input to the UBEC is a large capacitor. If you were to connect the input directly to the motor driver output then it effectively shorts the UBEC input capacitor to the battery voltage when the motor driver turns on. Since the capacitor is initially discharged, a very large current flows in quickly and causes the motor driver to trip the current limit and turn off to protect itself. Installing the inductor between the motor driver and the UBEC adds the inductance back into the circuit and limits the rate of current rise so that the input capacitor can be charged without tripping the current limit.

How do inductors work?

An inductor obeys the following formula: $V = L * di/dt$

V	Voltage across the inductor (volts)
L	Value of inductance (Henrys)
di	Change in current (amps)
dt	Change in time (seconds)

If a positive voltage is applied across an inductor then the current flowing through it increases over time. There is also energy stored in the inductor. If a negative voltage is applied across the same inductor then the current flowing through the inductor decreases over time and the energy stored in the inductor is transferred to the other circuitry.

Inductors are used in power supplies to control current and store energy.

Acknowledgments

• Thanks to Instructables user ASCAS for the inspiration: http://goo.gl/HnQAP9