

How to Build the Dementia Friendly Music Player

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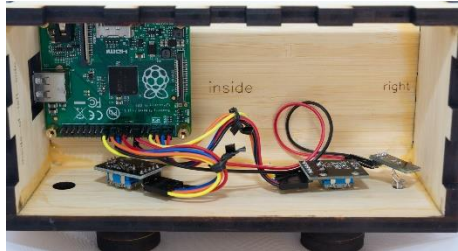
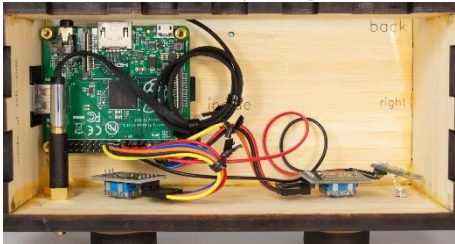

My Dad could not operate normal music players. But he could operate this music player because it operates like a familiar two-knob radio. My son & I were inspired to design this by the documentary [Alive Inside](#) which shows the profound joy felt by some people with dementia when listening to their favorite music.

It's easier than you think to make one. Everything I did (e.g. software, wood case design) is open source. This document contains all the information you need. You can order the parts online. Good project for kids. A 13 year old can do this with minimal assistance. Younger kids with more assistance.

Parts cost	~\$90 + tax + shipping
Music cost	Minimal as you should use the recipient's existing music collection
Build time	About two hours, once you have the parts & music
Parts source	All parts can be mail ordered, links below
Soldering?	No
Woodworking?	No
Laser cutter needed?	No, you can mail order the pre-cut pieces for the wood case
With a friend?	Good idea, especially if your friend has the basic tools required
Beverage?	I recommend a hoppy IPA while you are assembling



1 Preview of the steps

<p>1) Order parts</p> 	<p>2) Assemble recipient's favorite music</p> 	<p>3) Copy software to micro SD card</p> 
<p>4) Receive the parts</p> 	<p>5) Glue</p> 	<p>6) Wire the knobs</p> 
<p>7) Wire everything else</p> 	<p>8) Enjoy</p> 	

2 No warranty

USE THESE DQMUSICBOX PLANS AND SYSTEM AT YOUR OWN RISK. THE DQMUSICBOX PLANS ARE PROVIDED AS IS WITHOUT WARRANTY OF ANY KIND EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PLANS AND SYSTEM IS WITH YOU. SHOULD THE PLANS OR SYSTEM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. IN NO EVENT WILL ANY PARTY BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PLANS OR SYSTEM.

3 Acknowledgements

People were very generous with their time, and I really enjoyed the experience. This is certainly an incomplete list: Alex & Mike & others at [Ada's](#), the super smart staff at [Metrix](#), neighbor Randy, [Stephen Christopher Phillips](#), [Bob Rathbone](#), [Stephen Rusk](#), [Graham Hill](#), support at [Ponoko](#), and my son.

4 What DQMusicBox does

4.1 For the person with dementia

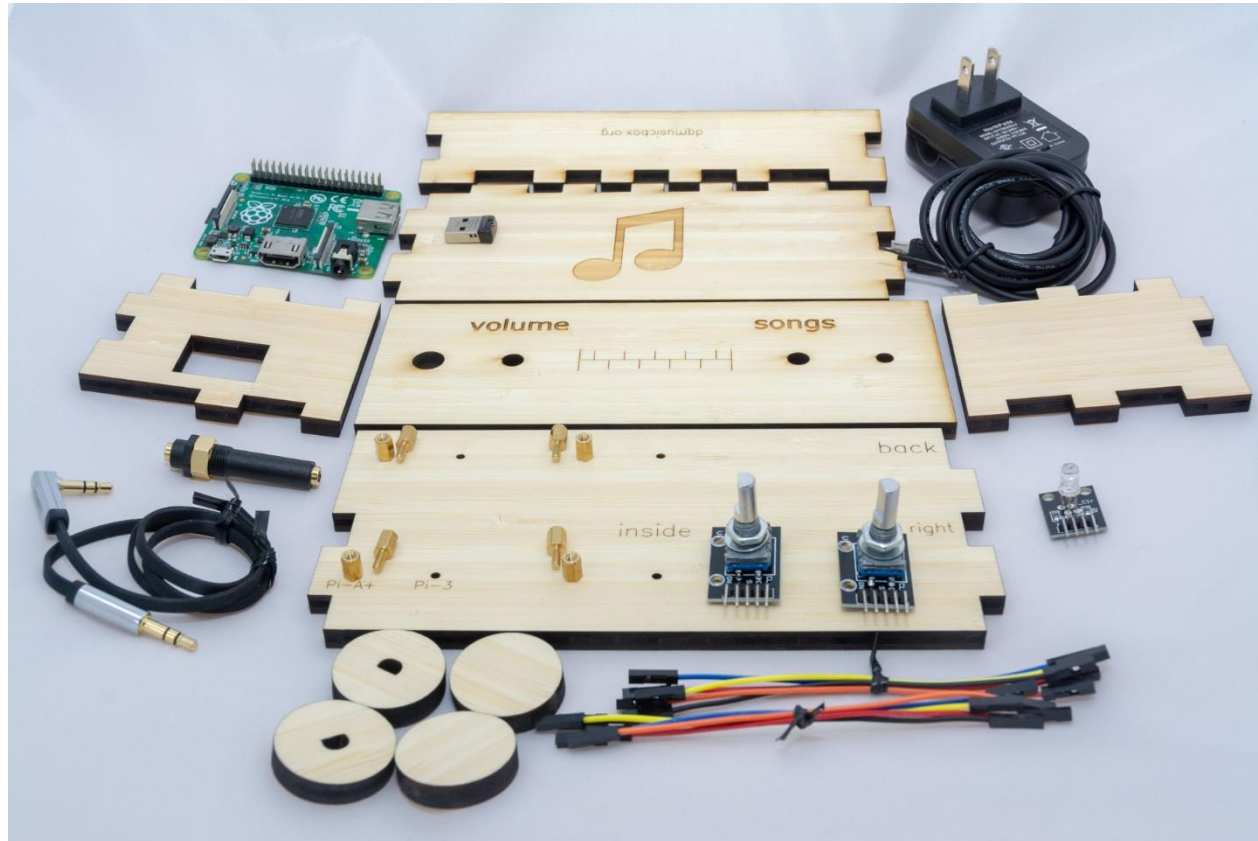
Name	Description & implementation
Start song	Turning either of the knobs will start music playing.
Change song	Turn the songs knob.
Change volume	Turn the volume knob.
Pause	Tap the volume knob. Note that this also happens automatically – music pauses if there are no knob events in one hour.

4.2 For you

Name	Description & implementation
Shut down	Pull the power plug or long hold (15-30 seconds) on the volume knob.
Reboot	Pull the power plug and re-insert or long hold (15-30 seconds) on the songs knob.
Add/remove music	By adding/removing files on the USB memory stick.

5.1 The parts

Here are the parts that you will be using:



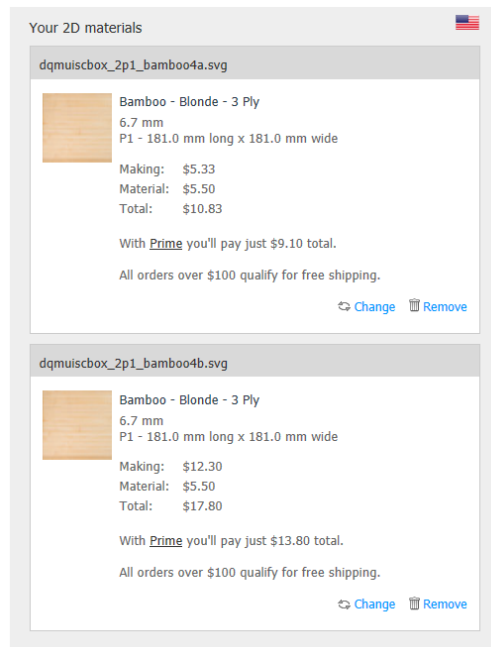
5.2 Create a Ponoko account (optional but convenient)

Ponoko is a company that laser cuts wood and sends you the precisely cut pieces. You don't need to use Ponoko – you are welcome to take [my case design files](#) to your local maker space and use the laser cutter there. Or buy yourself a laser cutter (if you do, will you be my friend?). In other words, Ponoko is convenient but not necessary. I have no affiliation with them, other than being a happy customer. To create a Ponoko account:

1. Go to <https://www.ponoko.com/>
2. Choose “Get Making”

5.3 Order from Ponoko

1. Go to <https://www.ponoko.com/design-your-own/products/case-for-dementia-friendly-music-player-bamboo-14808>
2. Click on “Add to Personal Factory”
3. Login
4. Check to accept the license, click “Add”
5. The result should be:



6. Click “Make it”

5.4 Order the remaining parts - US

Item	Supplier	Cost (2018)	Notes & Alternatives
DQMusicBox bamboo case	Ponoko	\$28.63	See instructions above.
Raspberry Pi 1 A+ single board computer	Newark	\$18.00	Tested with a Raspberry Pi 1A+, 2B, 3A+, 3B, 3B+. Do not use Pi Zero.
Power supply	Newark	\$6.19	This is the US model. Any micro USB 2A or better supply will do.
Female-female jumper wires	Newark	\$3.56	Or buy Amazon B01L5ULRUA
Panel mount 3.5mm headphone jack	Newark	\$2.69	Or buy Amazon B004JX64FE
M2.5 standoffs (screws) – 8 of them	Newark	\$3.84	Or by Amazon B06XXV8RTR
Micro SD card 32GB	Amazon	\$5.99	Any brand name micro SD card that is 8GB or larger will do.
USB thumb drive 16GB	Amazon	\$6.50	While nearly any USB thumb drive will work, I recommend one that is physically tiny so it doesn't protrude much from the case.
Audio cable	Amazon	\$5.88	Or find a short audio cable with a right angle bend.
KY-016 indicator LED (note shipping time)	eBay	\$1.62	The linked seller ships from China, takes 2-3 weeks. Or order as one piece of this kit - Amazon B013UL6LFS , which will arrive in a few days (assuming you live in the US).
KY-040 rotary encoders (knobs)	eBay	\$6.36	Or buy Amazon B074TJ8RSX .
TOTAL		\$89.26	Prices will vary. Does not include tax, shipping.

5.5 About headphones

Item	Cost	Notes and alternatives
The recipient's existing headphone	\$0.00	The best headphones are the headphones that the recipient is already used to.
Monoprice On-Ear headphones	\$10.99	Very good sound.
Monoprice Over-the-Ear headphones	\$15.99	Amazing sound. My musician son rates the sound as better than the ever-popular Sony MDR7506 headphones.
Other		Look for high sensitivity headphones, as the Pi's output is a bit weak.

5.6 Tools & supplies

You probably have some of these tools & supplies. If you don't, you have a spouse or child or friend that does. This project is exactly the sort of thing that a friend would be happy to help you with.

Link to order item	Notes & alternatives
Elmer's wood glue	Any wood glue will do
3/16 th wrench or nut driver	Or needle-nosed pliers. Or really strong fingers

SD card reader/writer	Your computer may have an SD card reader/writer. If not, you probably have a friend that does. Or order a USB SD-card reader for your computer.
Painter's tape	Any tape that comes off easily will do. Painter's tape is great. Regular masking tape is probably fine too. I haven't tried Scotch tape.
Light blocking tape or sticker	The unit's LED is quite bright, so I prefer to block some of the light. You can use the tape above. Or order light blocking stickers such as B009WSJNCW .
Raspberry Pi 3 (optional)	This is in addition to the Pi that goes in the player. This is a completely optional step. If you are nerd like me, or you have nerdy friend, see details in the appendix 1.

6 Assemble the personalized collection of music

6.1 Choosing the music – go for familiar favorites

This is the most important step. The personalized (familiar) music is the fundamental magic. You don't need much music, perhaps 6-10 albums. But only familiar favorites. In my case, my Mom mailed me my Dad's favorite CDs. It will take two weeks for the parts above to arrive, so you have time to do this well. Though it is easy to change the set of music later.

6.2 Put the music on the USB memory stick

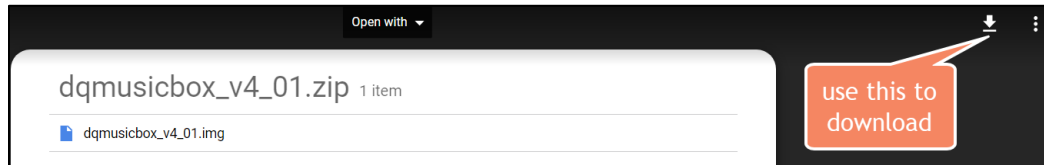
Organize the digitized music into folders on the USB memory stick, one folder per album. MP3, iTunes, and FLAC files are supported i.e. files with extensions .mp3, .m4a, .flac. In the end, you should have a set of folders that looks something like this:

Name	Date modified	Type
A_Beethoven9	10/24/2015 6:25 PM	File folder
B_Eli_Porter_-_Eli_Porter	10/24/2015 6:25 PM	File folder
C_Mozart_-_Overtures	10/24/2015 6:25 PM	File folder
D_Tchaikovsky_-_Concerto for Violin i...	10/24/2015 6:25 PM	File folder
E_Vivaldi_Telemann_Bach_Mercadante...	10/24/2015 6:25 PM	File folder
F_Samuel Barber_-_Barber; Adagio for ...	10/24/2015 6:26 PM	File folder
G_James Galway_-_Serenade	10/24/2015 6:26 PM	File folder
H_Giacomo Puccini_-_Madama Butter...	10/24/2015 6:26 PM	File folder
I_Giacomo Puccini_-_Madama Butterfl...	10/24/2015 6:26 PM	File folder
J_Giacomo Puccini_-_Madama Butterf...	10/24/2015 6:26 PM	File folder
K_Leontyne Price_-_Arias	10/24/2015 6:26 PM	File folder

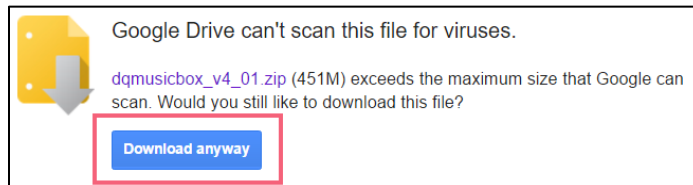
7 Prepare the micro-SD memory card

I prepared a disk image for you. It has all the required software. Your job is to download this disk image and then write it to the micro-SD card. The steps:

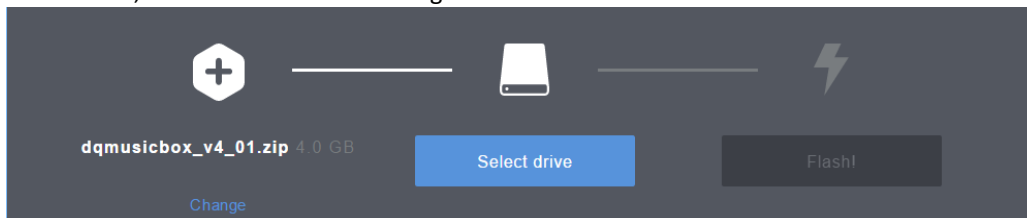
1. Install [Etcher](#) on your PC or Mac or Linux computer. [Win32 Disk Imager](#) also works.
2. Download the [Dementia Friendly Music Player disk image](#).



3. Confirm download – “Download anyway”



4. Put the micro-SD memory card into the SD card adapter that it came with i.e. put the tiny card into the larger card.
5. Put the SD card adapter into the SD reader/writer in your computer.
6. Start Etcher, instruct it to write the image file to the SD card:



7. Wait for the writing to complete, ~10 minutes. This would be a good time to make a sandwich.

8.1 Screw in the standoffs

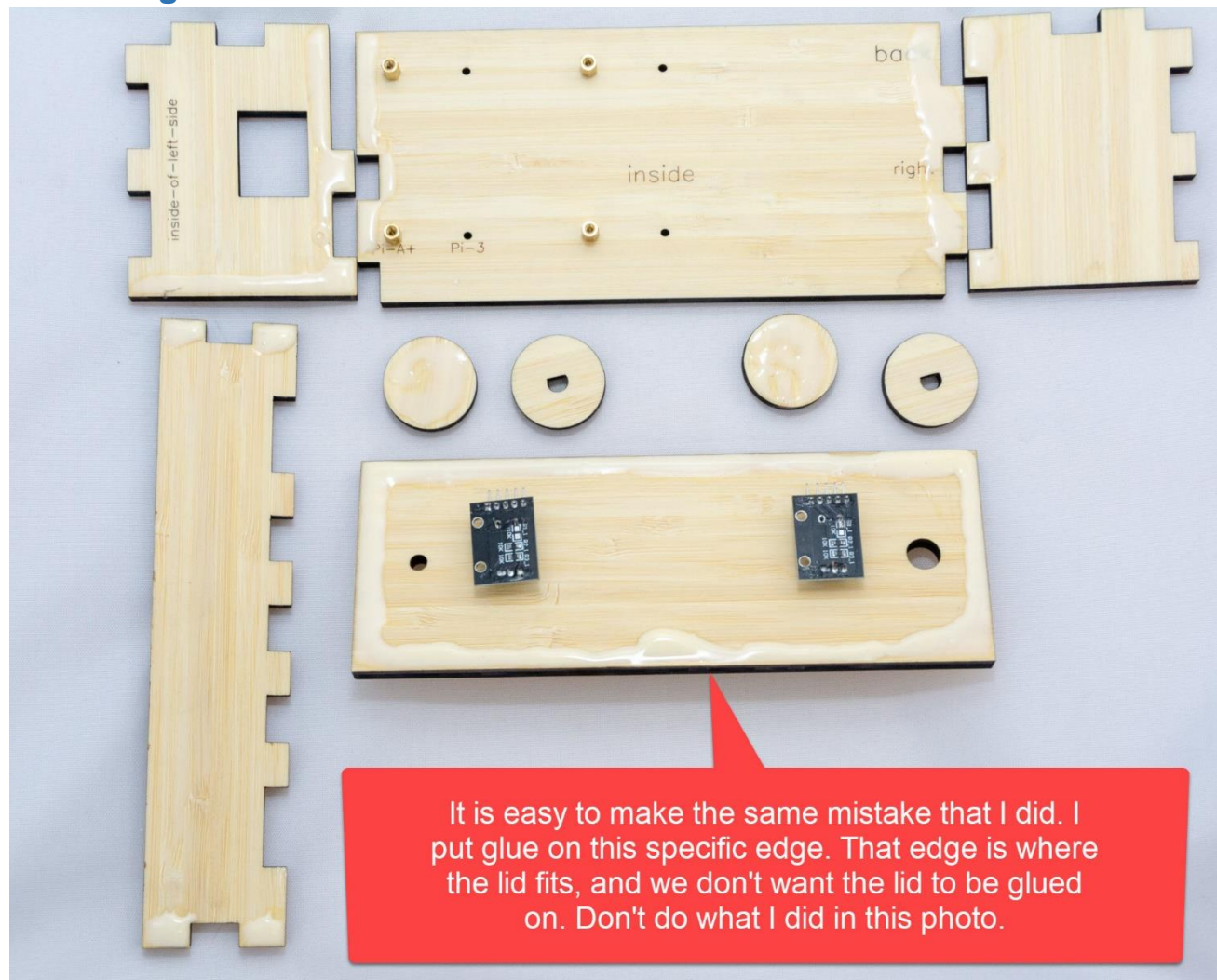


8.2 Screw in knobs (rotary encoders)

Screw in the rotary encoders (knobs). Not pictured, but if you like you can also attach the LED and the audio jack now (some people prefer this method).

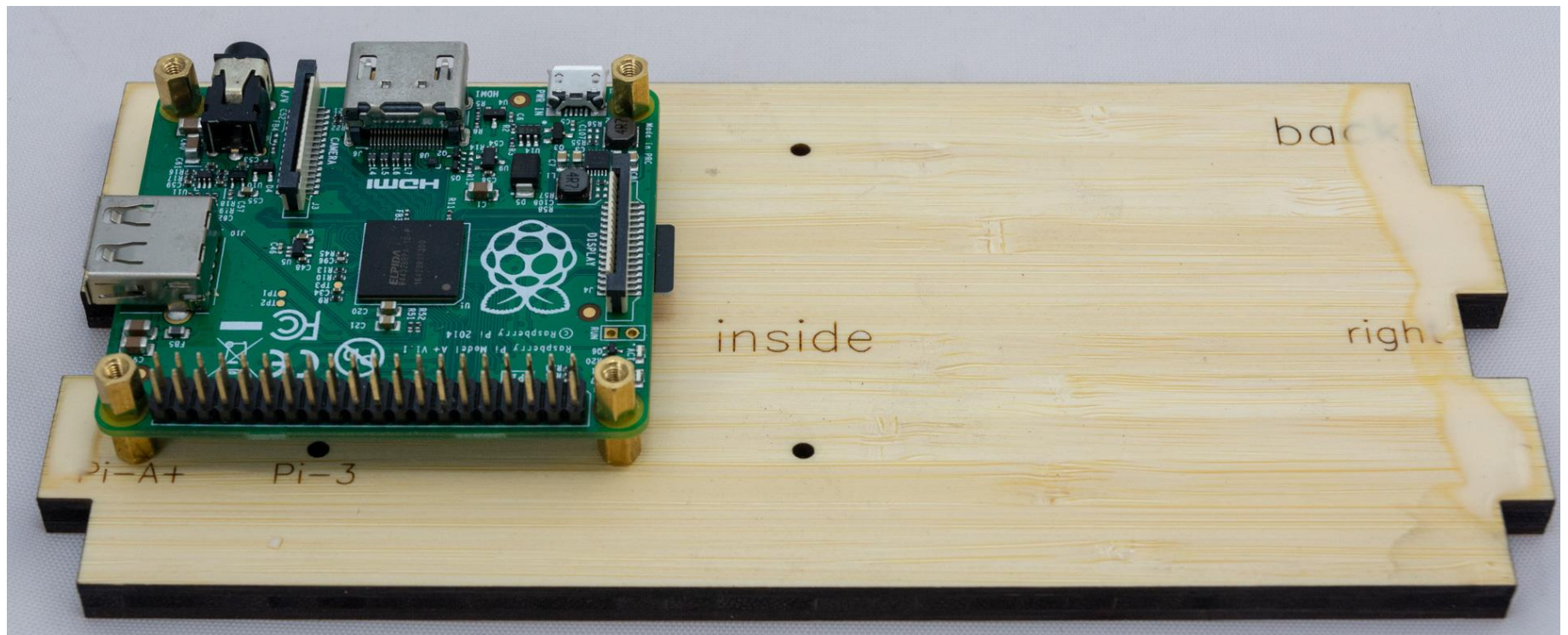


8.3 Add glue



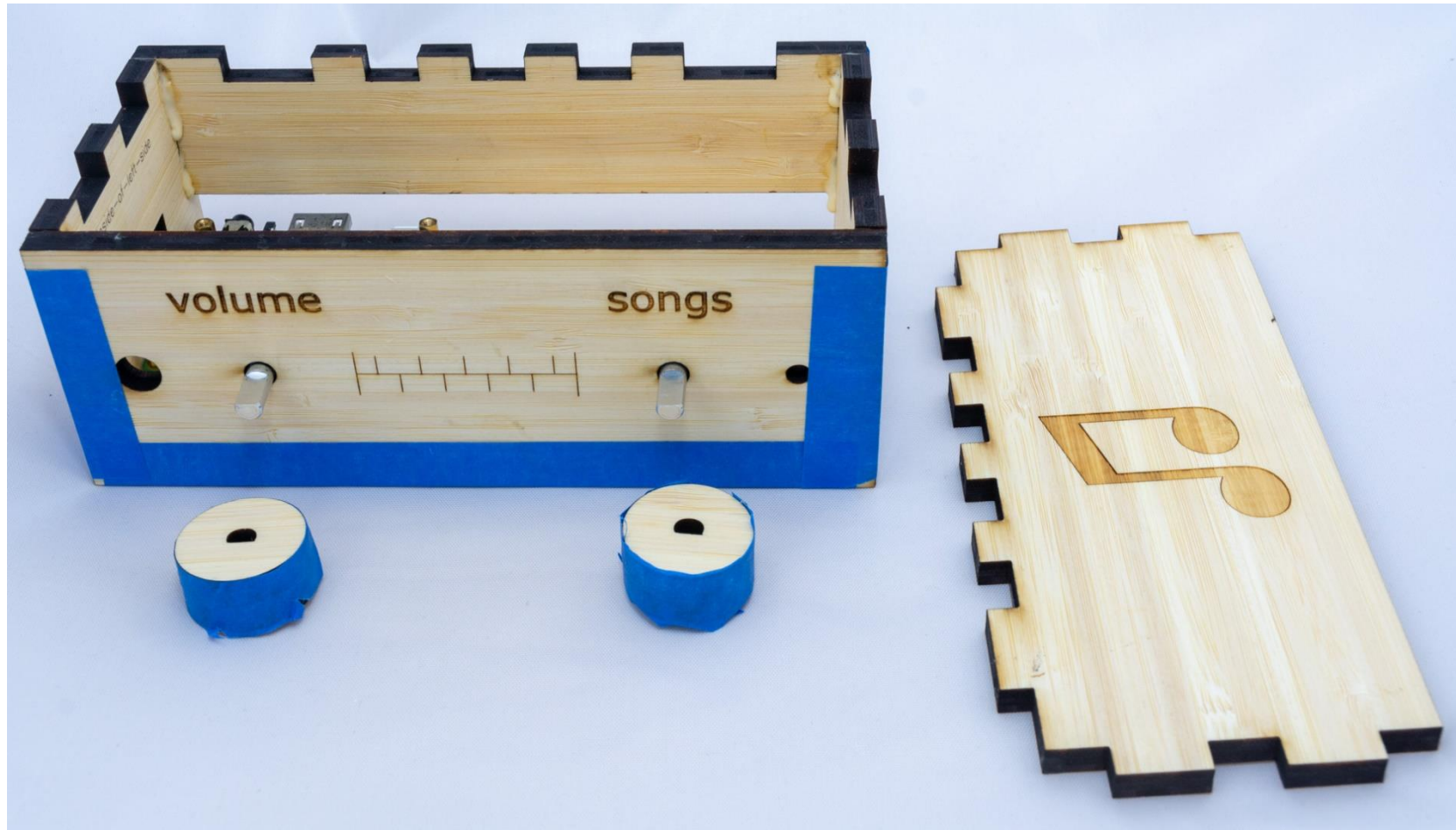
8.4 Add Raspberry Pi

To attach the Raspberry Pi, use four more standoffs.



8.5 Glue all but the lid

Glue all but the lid together. To hold it together while drying, use painter's tape. After you have taped it, make sure that the lid fits. **But don't glue the lid on.** I suggest checking the lid fit again after 30 minutes. The lid should be fit snugly, but come off with a bit of effort. **Again, don't glue the lid on.**



8.6 Let the glue dry overnight OR carefully continue building, attach wood knobs

Now you have a choice:

- Let the glue dry overnight, then continue. This is what I do. OR
- Proceed without letting the glue dry i.e. build the whole thing in one sitting. Just be careful to not get glue on other bits.

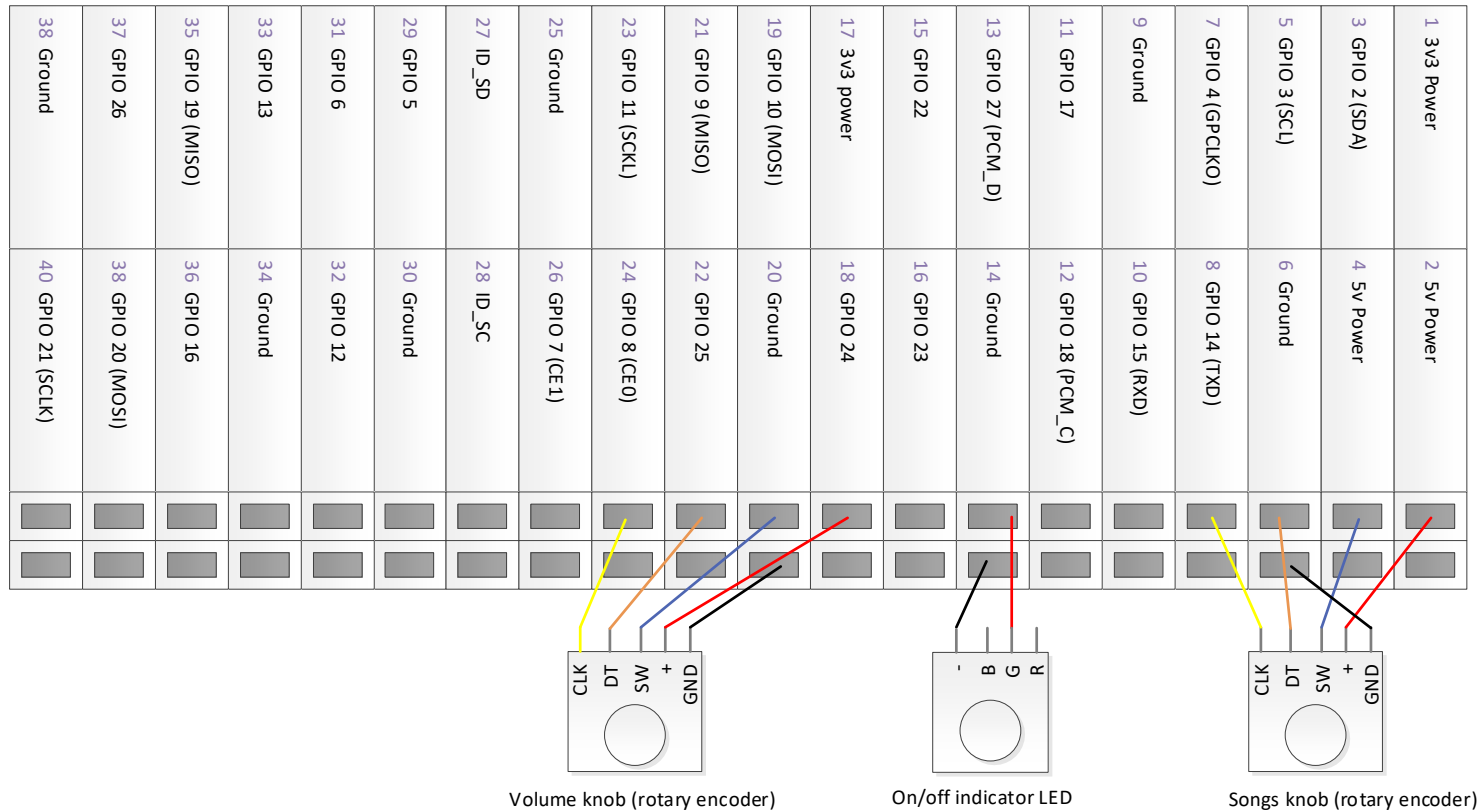
In either case, start by attaching the wood knobs. A few tips about the knobs:

- If the knobs are a bit loose on the metal shafts, just add some glue.
- If knobs don't easily slide on the metal shafts, use a Philips head screwdriver to make the hole ever so slightly larger. And/or put a bit of grease or cooking oil on the metal shaft.

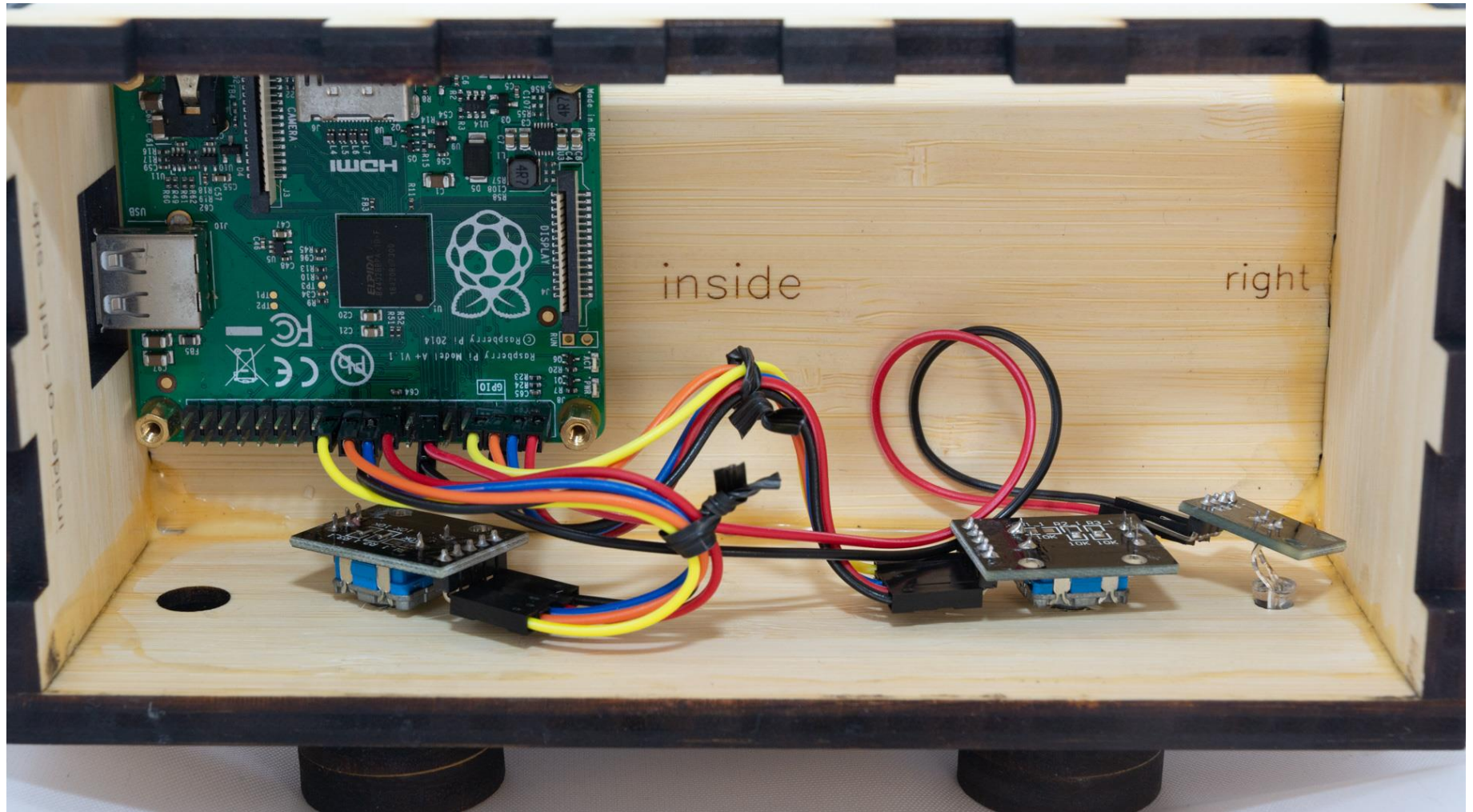


8.7 Wire up the knobs and the LED

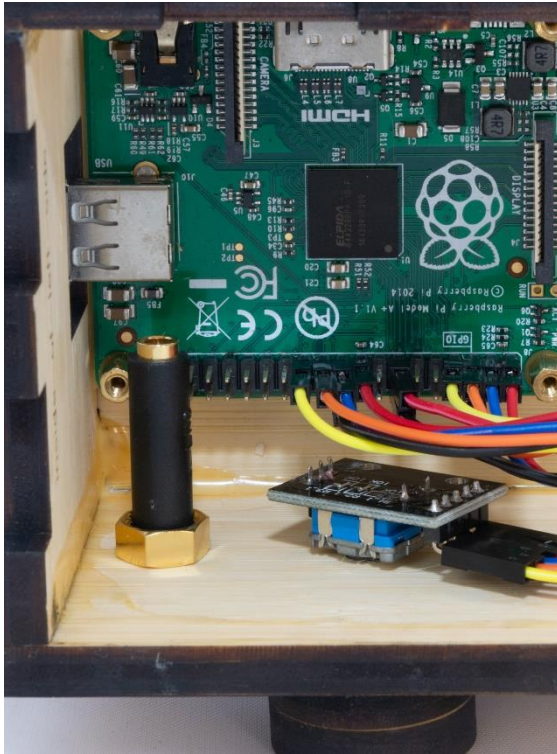
Attach wires from the knobs and the LED to the Raspberry Pi as per the diagram and photos below. No soldering required – just press the wires into place. **This is where most build errors happen, so please carefully check your work.**



For the knobs & LED, the result should be what you see below. The LED will not go all the way through the hole. Which is good, as the LED is rather bright. Use a bit of glue to hold it in place if needed.

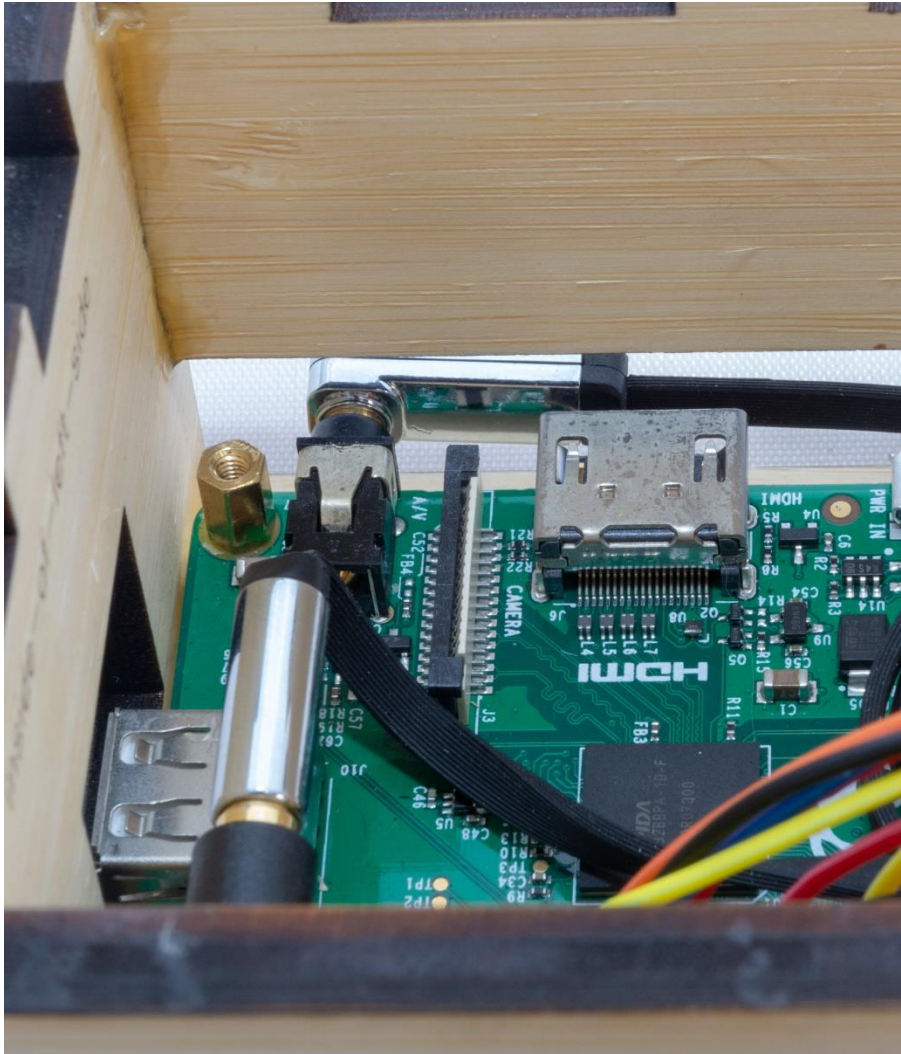


8.8 Screw in the headphone socket



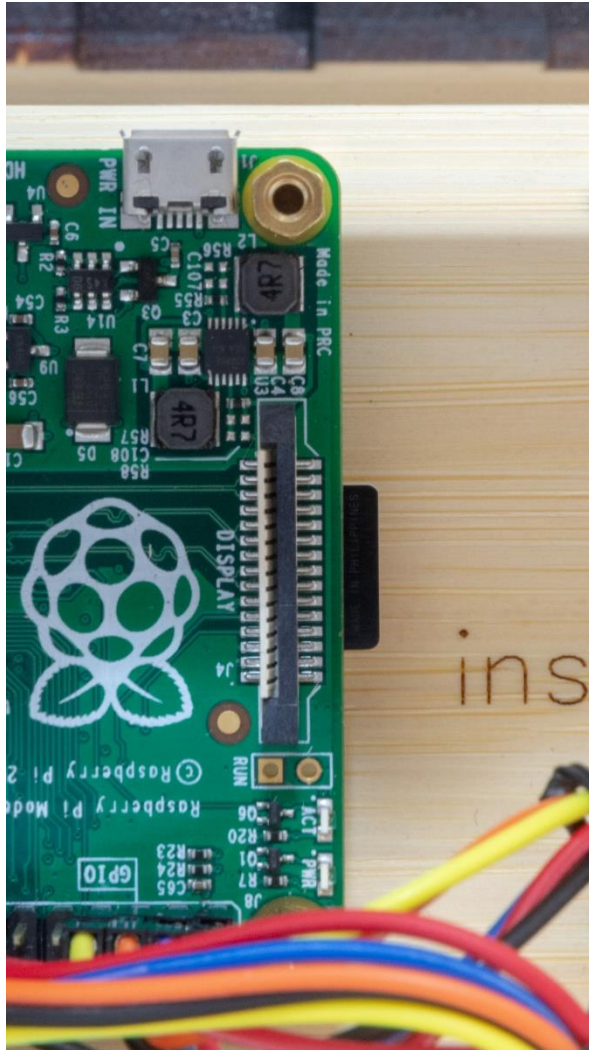
8.9 Connect the audio cable

Connect the audio cable from the headphone socket that you just installed to the headphone socket on the back of the Raspberry Pi, see the silver bits below:

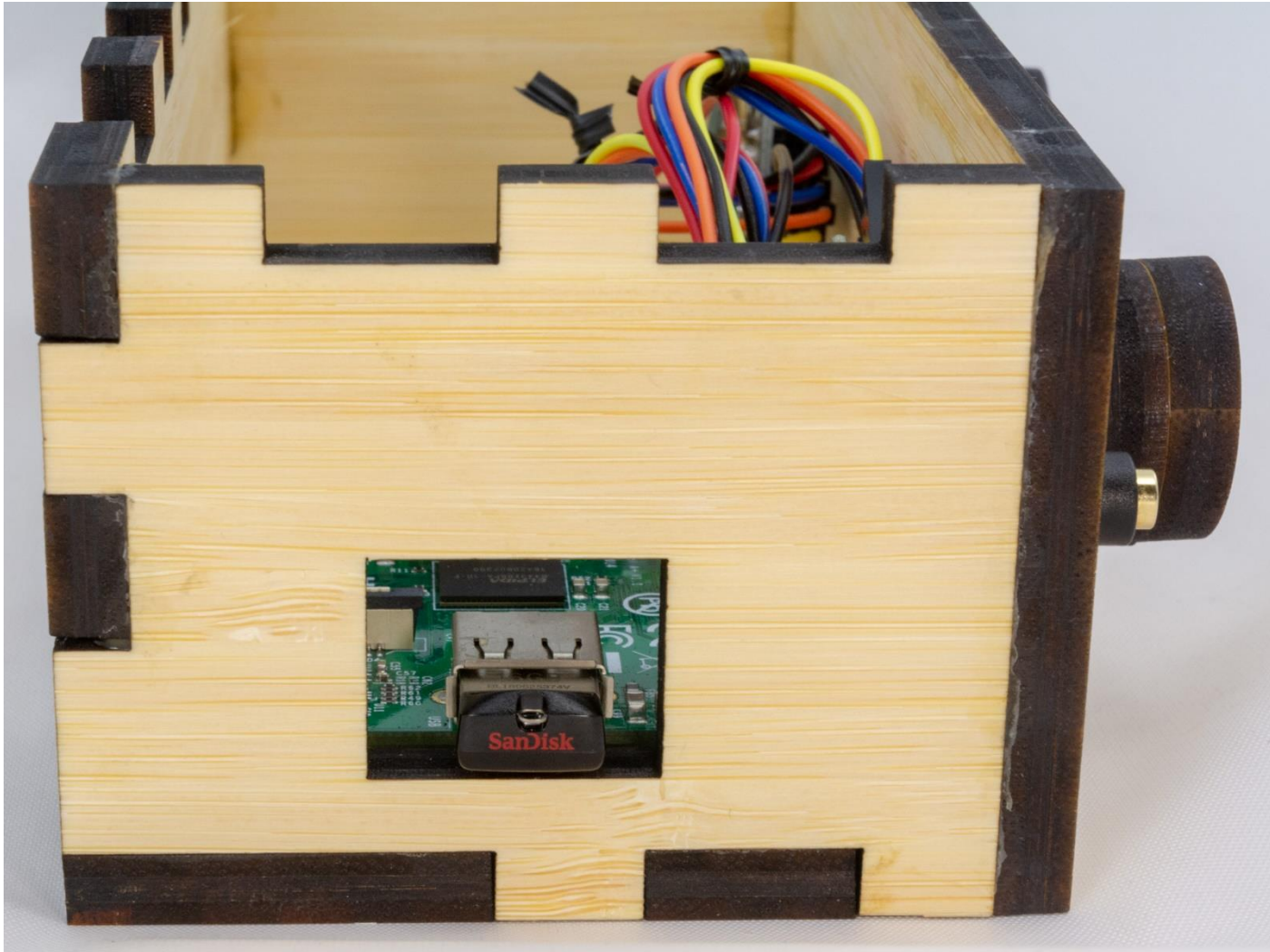


8.10 Insert the micro SD card

The micro SD card goes in a socket on the underside of the Raspberry Pi. Once inserted, only a small portion of the micro SD card is visible. See the photo below showing the micro SD card just above the letters “de”.



8.11 Insert the USB memory stick (the music)



8.12 Put the lid on



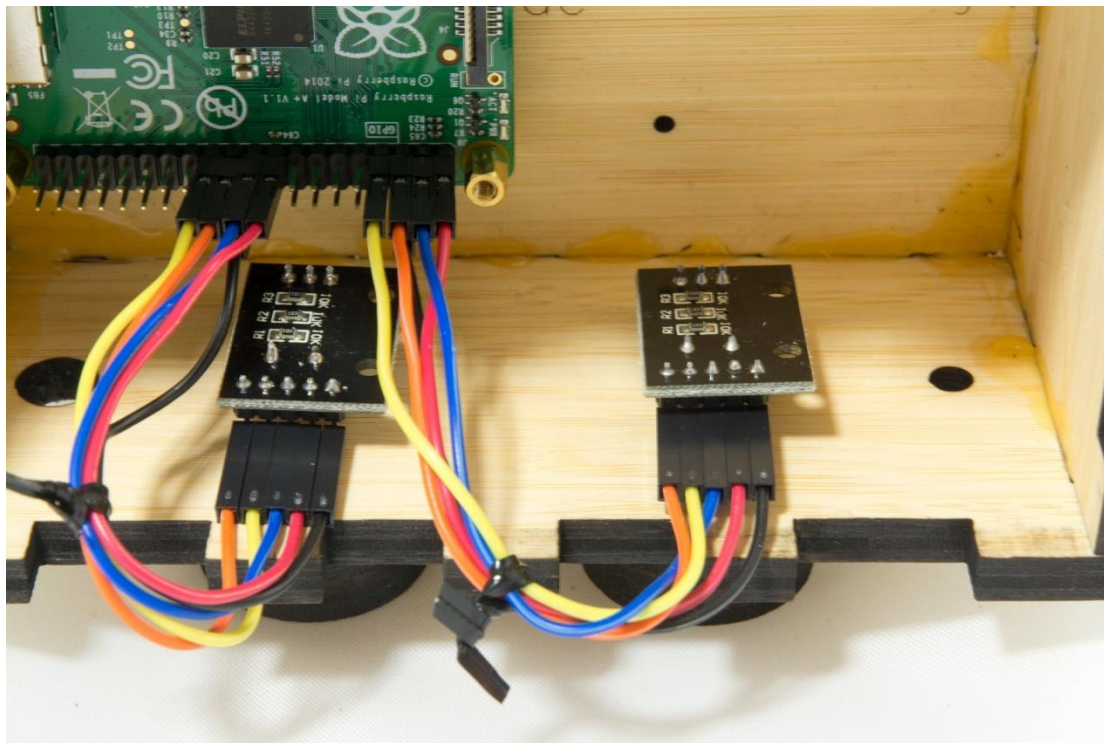
8.13 Test it

Now that you have assembled everything, it is time to test.

Test	Description & Expectation
Light 20sec after power on	The indicator LED turns on when DQMusicBox is ready to play music, which is generally about 15 seconds after power on.
Start song	Turning either of the knobs will start music playing.
Change song	Turn the songs knob. If you go forward and backward through the song list as expected, then all is well.
Change volume	Turn the volume knob. If the volume goes up and down as expected, then all is well.
Pause	Tap the volume knob, song should pause. Tap the songs knob, this should also pause the song.
Unpause	Tap a knob

8.14 If one or both knobs do the opposite of what you expect

Once assembled, you may find your knobs doing the opposite of what you expect e.g. a clockwise turn decreases the volume. This is because there are two kinds of rotary encoders out there. Happy, the fix is easy, just switch the orange and yellow wires on the misbehaving knob(s) (don't touch the Pi itself):



8.15 If the wood knobs are loose on the metal shafts

Just glue the wood knobs to the metal shafts. But only if it is really necessary. Once the knobs & shafts are glued, it's harder to disassemble the box to fix any problems.

8.16 Tape instructions

Print this page and tape the instructions in the box below to the bottom of your new DQMusicBox:

To create personalized music

Organize the music on your computer

- ✓ A_Beethoven_9th
- ✓ B_AndrewsSisters_Hits
- ✓ C_GlennMiller_Hits

One folder per album. Use MP3 files, must have .mp3 file extension. Or iTunes files (.m4a). Or FLAC files (.flac).
Optionally, use folder names prefixes to specify the play order e.g. A_, B_

Copy the music to the USB thumb drive



1. Unplug your DQMusicBox.
2. Remove the USB thumb drive and place in your computer.
3. Copy music files from your computer to the USB thumb drive.
4. Put the USB thumb drive back in the DQMusicBox.
5. Plug in your DQMusicBox.

8.17 Congratulations

Congratulations! You should have a fully functional DQMusicBox.

9 Appendix 1: Change log

v1, November 2015	Original release
v2, September 2016	<ul style="list-style-type: none"> • Changed music storage from a micro-SD memory card to a conventional USB memory stick. • Changed the base Operating System from full Raspbian to DietPi – much smaller, so faster to boot, and less to go wrong.
v3, January 2017	<ul style="list-style-type: none"> • Changed from USB audio to Pi built-in audio, including a firmware update for excellent audio quality.
v4, May 2017	<ul style="list-style-type: none"> • Switched to bamboo for durability and use of standoffs. • Switched to Pi A+ to lower cost. • Made USB thumb drive externally accessible, to make it easier for the caregiver to organize music.
v4.01, 25 June 2017	<ul style="list-style-type: none"> • Minor edits.
v4.01_1, 20 July 2017	<ul style="list-style-type: none"> • Minor edits.
v4.01_2, 11 August 2017	<ul style="list-style-type: none"> • Added links for ordering parts in the UK. • Added detailed instructions for write protecting a micro-SD card.
v4.01_3, 12 August 2017	<ul style="list-style-type: none"> • Minor edits
v4.01_4, 12 August 2017	<ul style="list-style-type: none"> • Minor edits
v4.01_5, 14 October 2017	<ul style="list-style-type: none"> • Edited text and updated photographs to reflect the change from an HDD-style LED to a KY-016 LED module.
v4.01_6, 26 February 2018	<ul style="list-style-type: none"> • Updated the links for purchasing the parts. No changes to the parts themselves, just the links. • Minor change to the instructions, noting how the build can be accomplished in one sitting, if desired.
v4.1, 7 April 2018	<ul style="list-style-type: none"> • Reflects that the software has been updated to support the new Raspberry Pi 3 B+. No new software features.
v4.1_1, 23 April 2018	<ul style="list-style-type: none"> • Updated to reflect the new bamboo case design.
27 January 2019	<ul style="list-style-type: none"> • Noted support for the Raspberry Pi 3A+.
v4.2, 1 March 2019	<ul style="list-style-type: none"> • Switched to pmount for USB drive auto mounting.
v4.2, 7 April 2019	<ul style="list-style-type: none"> • Removed instructions for write protecting the SD card – rarely used and may cause certain rare problems