

# LipSync

## ASSEMBLY MANUAL

---

Version 1.4.2

# CONTENTS

- 2 Part 0a - Obtaining Components and Files
- 3 Part 0b - Component Checklist
- 8 Part 0c - Equipment Checklist
- 9 Electrical Assembly
- 30 Joystick Assembly
- 51 (Optional) Mounting the LipSync
- 54 Setting Up the Device

## PART 0a

### OBTAINING COMPONENTS AND FILES

**Components should be ordered at least 2 weeks in advance to allow for sufficient shipping time. See Part 0b for the full list of components and its purchase links.**

Download all the necessary files and directories to assemble a LipSync:  
<https://github.com/makersmakingchange/LipSync/archive/master.zip>

**LipSync-master\Hardware\Housing\_design:** Contains all 3D printing files in STL format and its respective print settings

**LipSync-master\Hardware\PCB\_design:** Contains schematic and layout for the LipSync printed circuit boards

**LipSync-master\Software\LipSync\_Firmware:** Contains microcontroller code

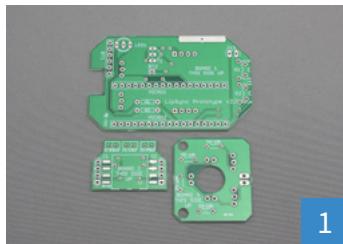
**LipSync-master\LipSync\_BOM.csv:** Contains LipSync Components in CSV format

# PART 0b

## COMPONENT CHECKLIST

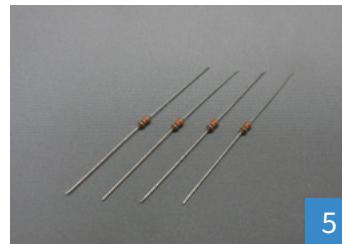
- 1** (1) LipSync Circuit Board Package (3 boards)
- 2** (1) Arduino Micro **OR**  
(1) Genuino Micro
- 3** (2) Right Angle Push Buttons
- 4** (2) 300 Ohm 1/4W T/H Resistors
- 5** (4) 10k Ohm Mini 1/4W T/H Resistors
- 6** (1) NXP Semiconductors Pressure Sensor
- 7** (1) 0.01uF Ceramic T/H Radial Capacitor
- 8** (1) 1.0uF Ceramic T/H Radial Capacitor
- 9** (1) 470pF Ceramic T/H Capacitor

<input type="checkbox"/>	<b>10</b>	(2) 17-Position Straight Female T/H Headers	<input type="checkbox"/>	<b>22</b>	(1) Joystick Rocker	<input type="checkbox"/>	<b>34</b>	(1) Luer Lock Nut
<input type="checkbox"/>	<b>11</b>	(2) 3-Position Right Angle Male Headers	<input type="checkbox"/>	<b>23</b>	(1) Joystick Baseplate	<input type="checkbox"/>	<b>35</b>	(4) Bumpers
<input type="checkbox"/>	<b>12</b>	(2) 3-Position Straight Female Header	<input type="checkbox"/>	<b>24</b>	(1) Rear Housing	<input type="checkbox"/>	<b>36</b>	(4) Nuts M3
<input type="checkbox"/>	<b>13</b>	(2) 4-Position Straight Female T/H Headers	<input type="checkbox"/>	<b>25</b>	(2) Buttons	<input type="checkbox"/>	<b>37</b>	(1) Tubing 3/32" ID x 45mm
<input type="checkbox"/>	<b>14</b>	(1) Break Away Male Headers	<input type="checkbox"/>	<b>26</b>	(1) Mouthpiece	<input type="checkbox"/>	<b>38</b>	(1) Light Pipe
<input type="checkbox"/>	<b>15</b>	(1) 5mm Bi-Color T/H LED	<input type="checkbox"/>	<b>27</b>	(1) Filter	<input type="checkbox"/>	<b>39</b>	(1) Threaded Insert 5/8"-27
<input type="checkbox"/>	<b>16</b>	(1) Shunt Connector	<input type="checkbox"/>	<b>28</b>	(1) Luer Lock Fitting	<input type="checkbox"/>	<b>40</b>	(1) Threaded Adapter 5/8"-27
<input type="checkbox"/>	<b>17</b>	(1) 2N3906 PNP-Type T/H Transistor	<input type="checkbox"/>	<b>29</b>	(4) Force Resistive Sensor	<input type="checkbox"/>	<b>41</b>	(1) USB Cable
<input type="checkbox"/>	<b>18</b>	(1) 6-Position Straight Female T/H Header	<input type="checkbox"/>	<b>30</b>	(4) Screws Phillips Head M3	<input type="checkbox"/>	<b>42</b>	(1) USB Adapter
<input type="checkbox"/>	<b>19</b>	<b>OPTIONAL</b> (1) 1-Position Straight Female T/H Header	<input type="checkbox"/>	<b>31</b>	(6) Compression Springs	<input type="checkbox"/>	<b>43</b>	(1) Cable Tie
<input type="checkbox"/>	<b>20</b>	(1) Front Housing	<input type="checkbox"/>	<b>32</b>	(2) Standoffs M3 10mm	<input type="checkbox"/>	<b>44</b>	(10) Velcro Strap 0.5" x 6"
<input type="checkbox"/>	<b>21</b>	(1) Joystick Front Plate	<input type="checkbox"/>	<b>33</b>	(2) Standoffs M3 15mm	<input type="checkbox"/>	<b>45</b>	<b>OPTIONAL</b> (1) Magic Arm 11" and Clamp



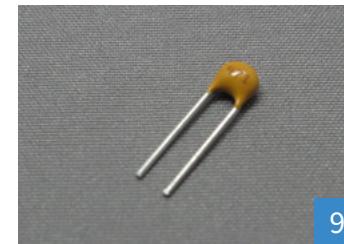
LipSync Circuit Board Pack:  
(1) Main Interface Board  
(1) Pressure Sensor Board  
(1) Joystick Board  
[LipSync Page](#)

1



(4) 10k Ohm Mini Axis  
Through Hole Resistors  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

5



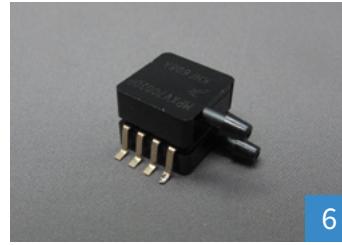
(1) 470pF Ceramic Through  
Hole Radial Capacitor  
[capacitor label: 471]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

9



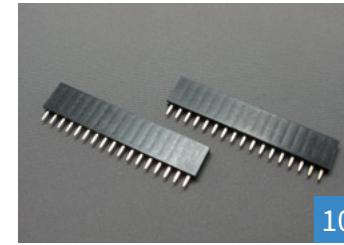
(1) Arduino Micro/ Genuino  
Micro microcontroller  
[Arduino](#) [Digikey](#) [Robotshop](#)  
[Adafruit](#) [Pololu](#)  
**COMPATIBILITY NOTE:** The  
"Arduino Micro" or "Genuino  
Micro" **MUST** be used.

2



(1) NXP Pressure Sensor  
[component label:  
MPXV7002DP]  
[Digikey.ca](#)  
[Digikey.com](#)

6



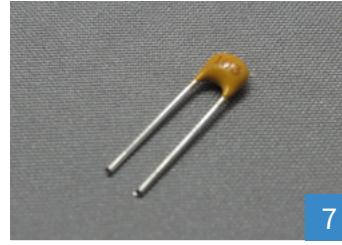
(2) 17-Position Straight  
Female Through Hole  
Headers  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

10



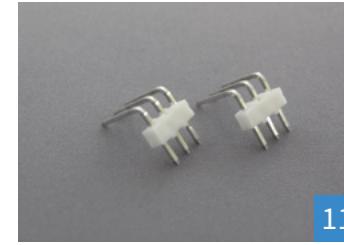
(2) Right Angle Push Buttons  
[Digikey.ca](#)  
[Digikey.com](#)

3



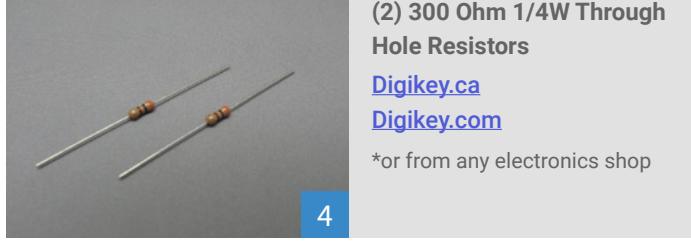
(1) 0.01uF Ceramic Capacitor  
[capacitor label: 103]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

7



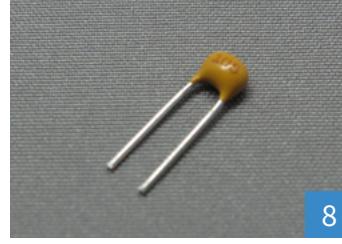
(2) 3-Position Right Angle  
Male Header  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

11



(2) 300 Ohm 1/4W Through  
Hole Resistors  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

4



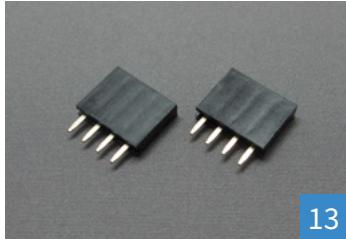
(1) 1.0uF Ceramic Capacitor  
[capacitor label: 105]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

8



(2) 3-Position Straight  
Female Header  
[Digikey.ca](#)  
[Digikey.com](#)  
**\*ONLY from the above source**

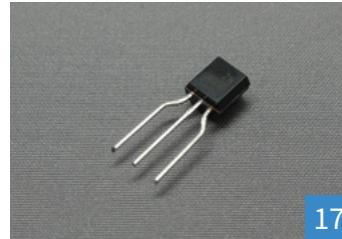
12



(2) 4-Position Straight Female Header  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

13



(1) 2N3906 PNP-Type T/H Transistor  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

17



(1) Joystick Base Plate  
[LipSync Page](#)

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"

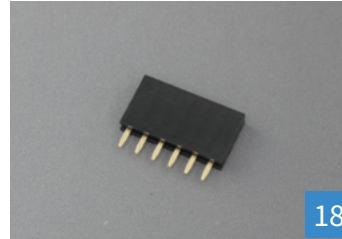
21



(1) Break Away Male Headers  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

14



(1) 6-Position Straight Female T/H Headers  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

18



(1) Joystick Rocker  
[LipSync Page](#)

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"

22



(1) 5mm Bi-Color T/H LED  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

15



(OPTIONAL) (1) 1-Position Straight Female T/H Header  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

19



(1) Joystick Top Plate  
[LipSync Page](#)

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"

23



(1) Shunt Connector  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

16



(1) Front Housing  
[LipSync Page](#)

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"

20



(1) Rear Housing  
[LipSync Page](#)

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"

24



(2) Buttons  
[LipSync Page](#)

25

**NOTE:** 3D printed files and print settings can be found in "LipSync\_STL.zip"



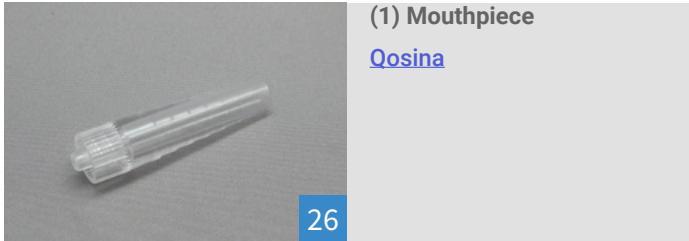
(4) Force Resistive Sensor  
[Digikey.ca](#)  
[Digikey.com](#)

29



(2) Standoffs M3 15mm  
[Digikey.ca](#)  
[Digikey.com](#)

33



(1) Mouthpiece  
[Qosina](#)

26



(4) Screws Phillips Head M3  
[Digikey.ca](#)  
[Digikey.com](#)

30



(1) Luer Lock Nut  
[Cole-Parmer](#)

34



(1) Filter  
[Qosina](#)

27



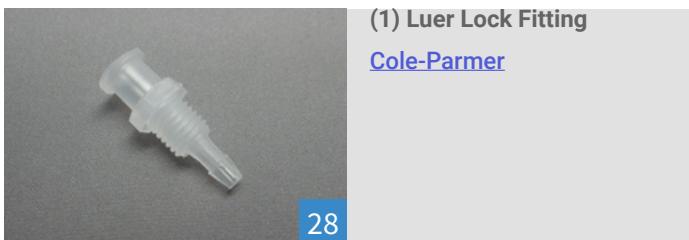
(6) Compression Springs  
[Lee Spring](#)

31



(4) Bumpers  
[Digikey.ca](#)  
[Digikey.com](#)

35



(1) Luer Lock Fitting  
[Cole-Parmer](#)

28



(2) Standoffs M3 10mm  
[Digikey.ca](#)  
[Digikey.com](#)

32



(4) Nuts M3  
[Digikey.ca](#)  
[Digikey.com](#)

36



(1) Tubing 3/32" ID x 45mm  
[US Plastic](#)

37



(1) USB Cable  
[Amazon.com](#)

41



(OPTIONAL) (1) Magic Arm  
11" and Clamp  
[Amazon.com](#)

45



(1) Light pipe  
[Mouser](#)

38



(1) USB Adapter  
[Amazon.com](#)

42



(1) Threaded Insert 5/8"-27  
[B&H Photo Video](#)

39



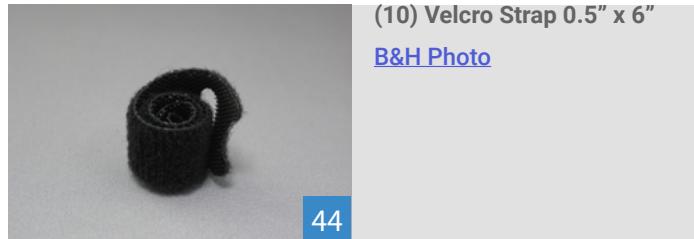
(1) Cable Tie  
[Digikey.ca](#)  
[Digikey.com](#)

43



(1) Threaded Adapter 5/8"-27  
[Amazon.com](#)

40



(10) Velcro Strap 0.5" x 6"  
[B&H Photo](#)

44

# PART 0c

## EQUIPMENT CHECKLIST

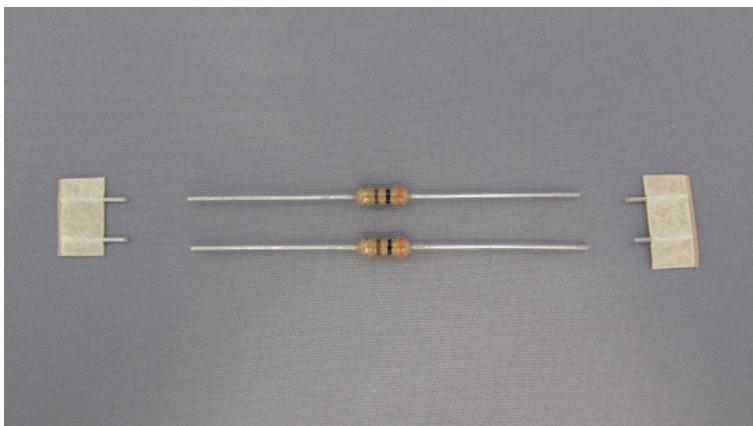
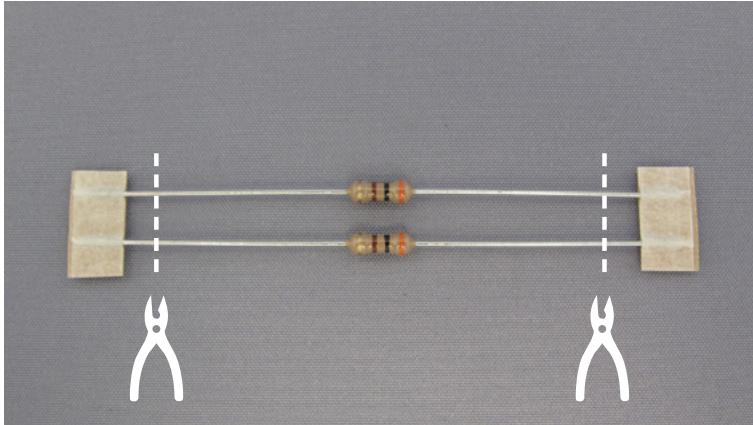
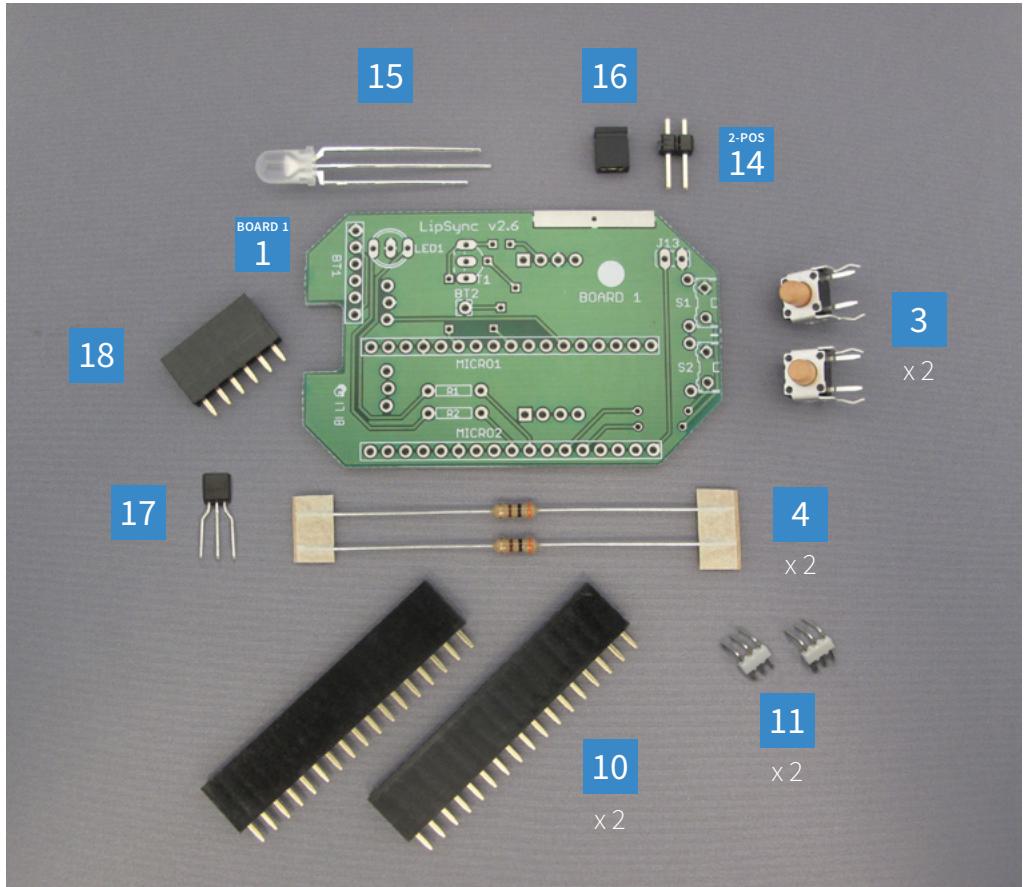
- Small Spool of 60Pb/40Tn Solder Wire
- Desolder Pump (or "solder sucker")
- Temperature Adjustable Soldering Iron (350°C)
- (1) Adjustable Tabletop Vise (if possible, PANAVISE Junior Vise with Base)
- Needle Nose Pliers
- Safety Glasses
- Fine File or Sandpaper
- Small Fan (if possible, fume extractor)
- Baby Powder
- Hobby Knife
- Super Glue
- Flush Cutters
- Medium Strength Threadlocker
- ABS or High Strength PLA Filament 100g



= Solder the part outlined

**CAUTION:** Safety glasses should be worn at all times during the assembly.

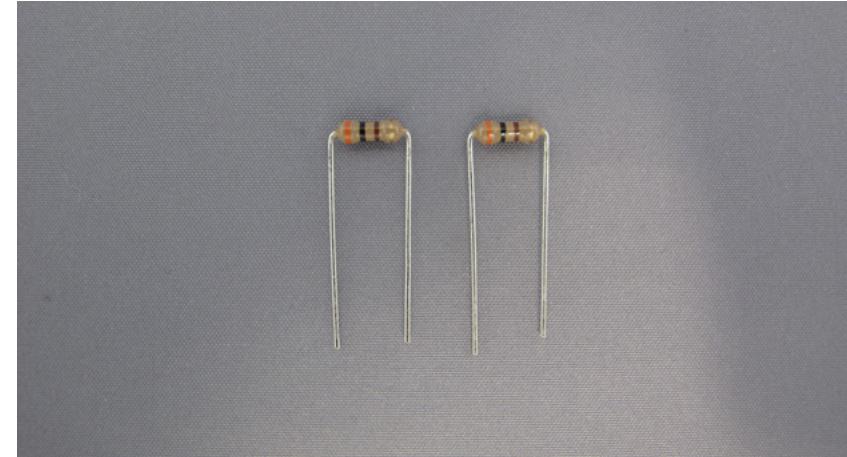
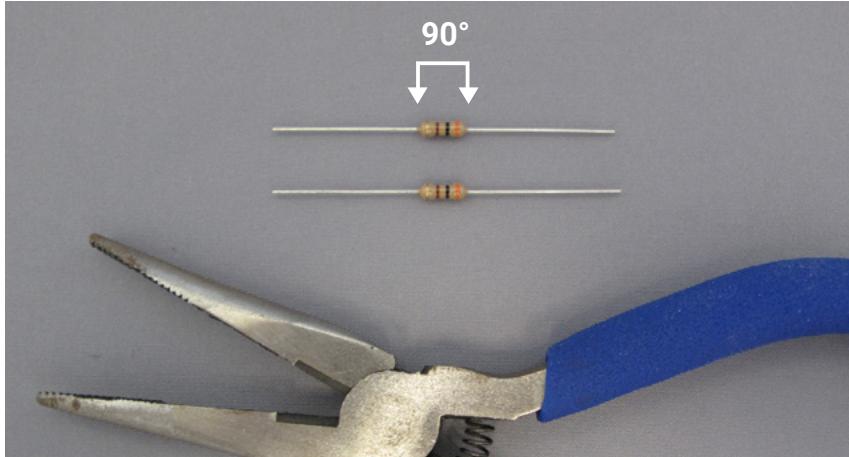
# PART 1



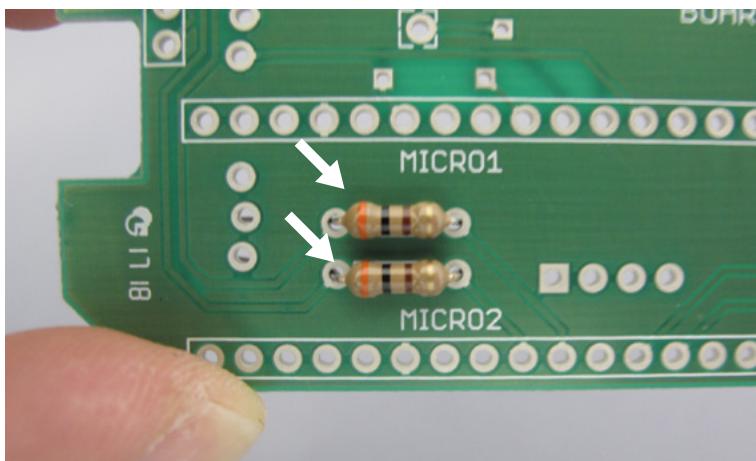
01.

4  
x 2

**02.**

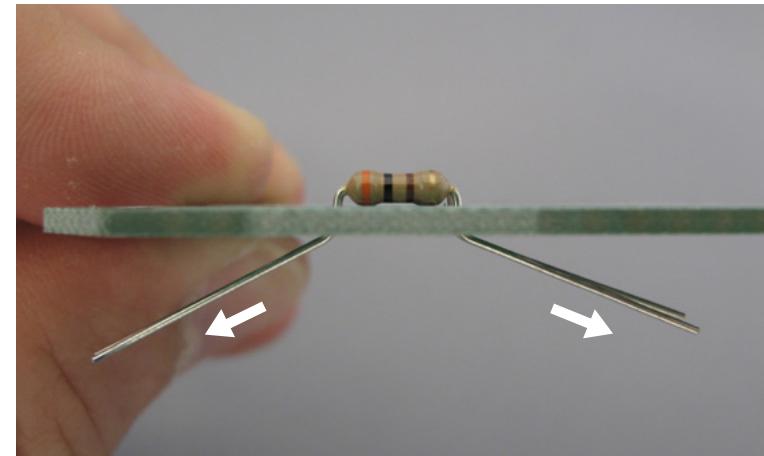


**03.**

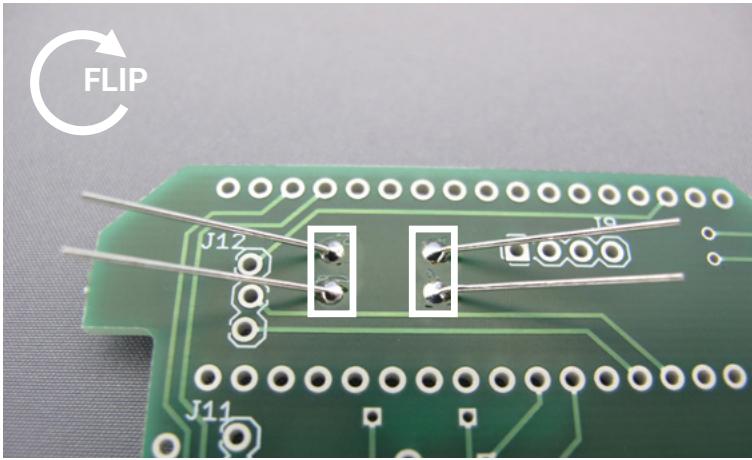


10

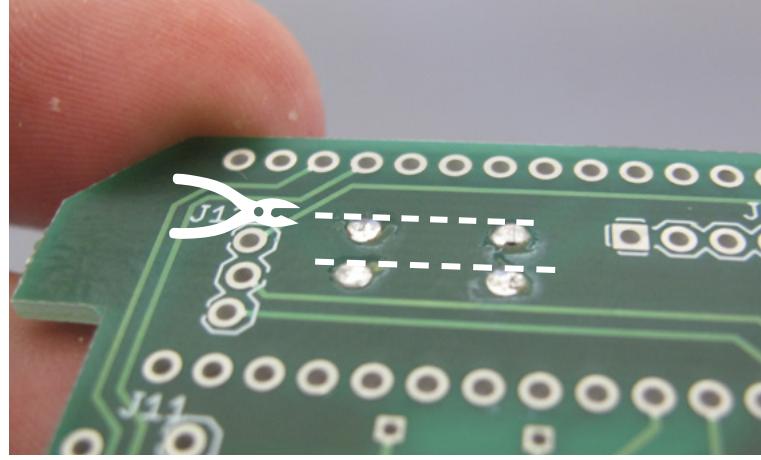
**04.**



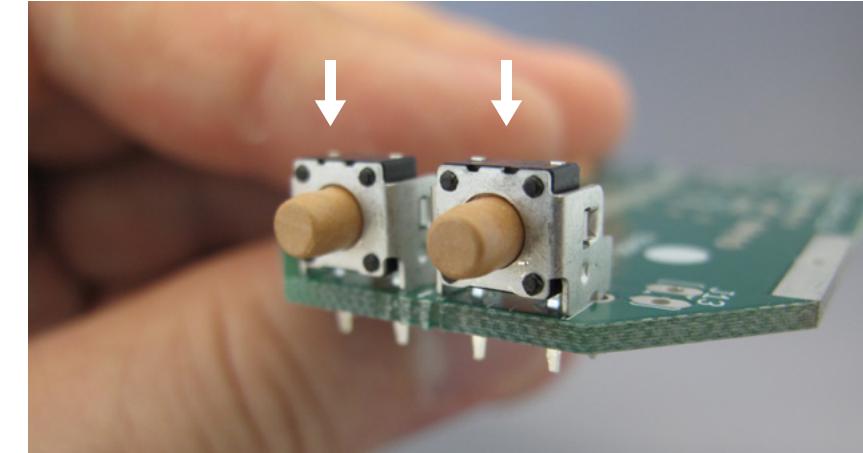
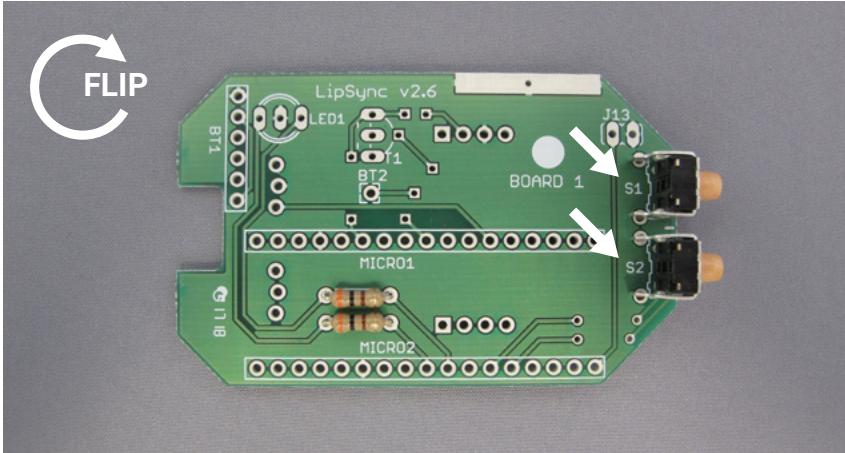
**05.**



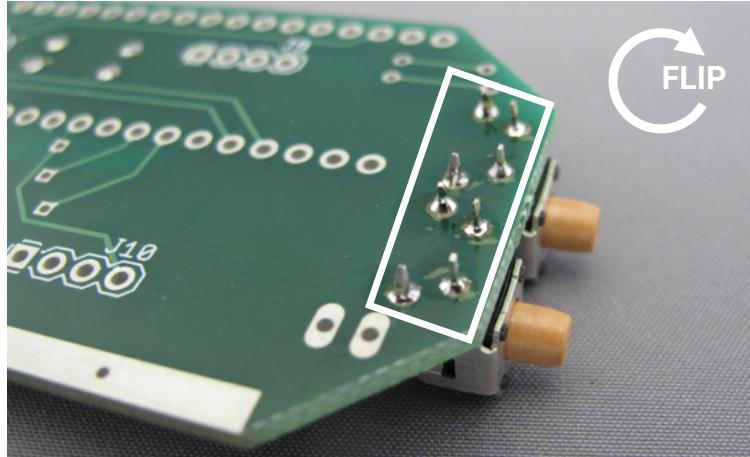
**06.**



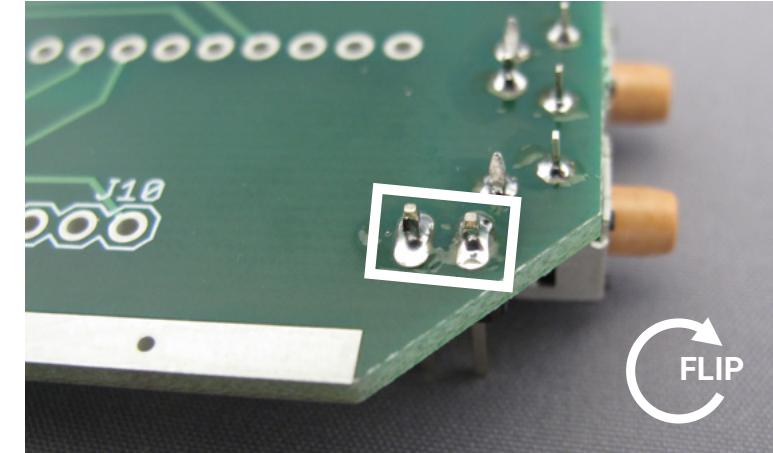
**07.**



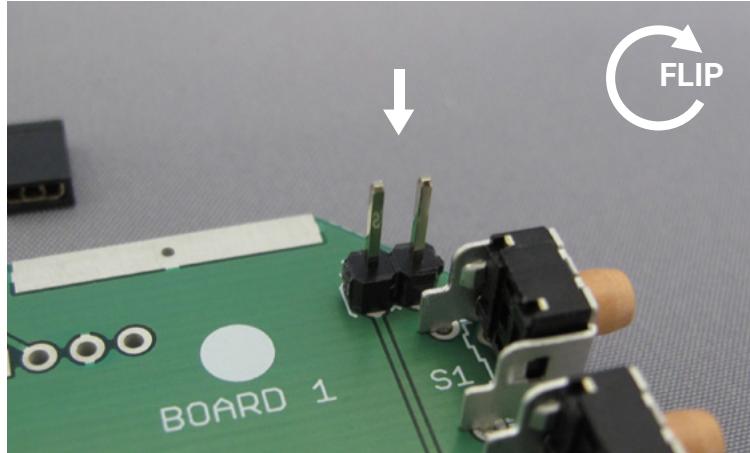
# 08.



# 11.

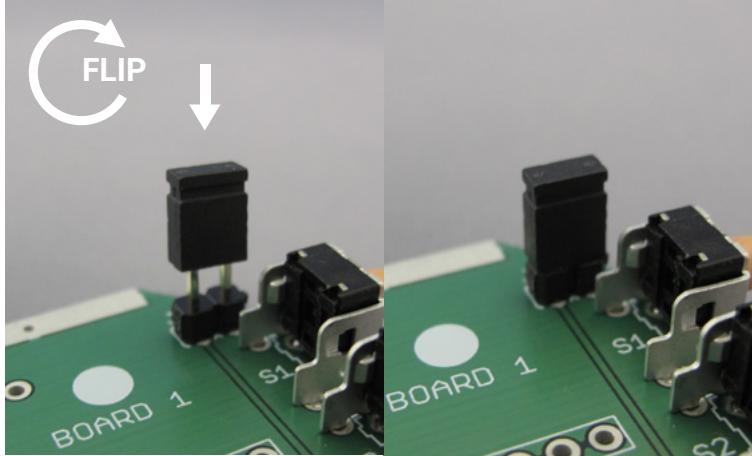


# 10.



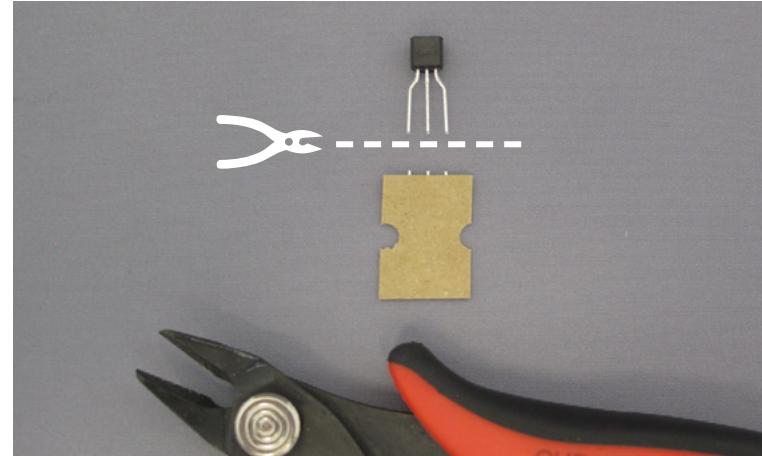
**NOTE:** The short leads are inserted.

12.



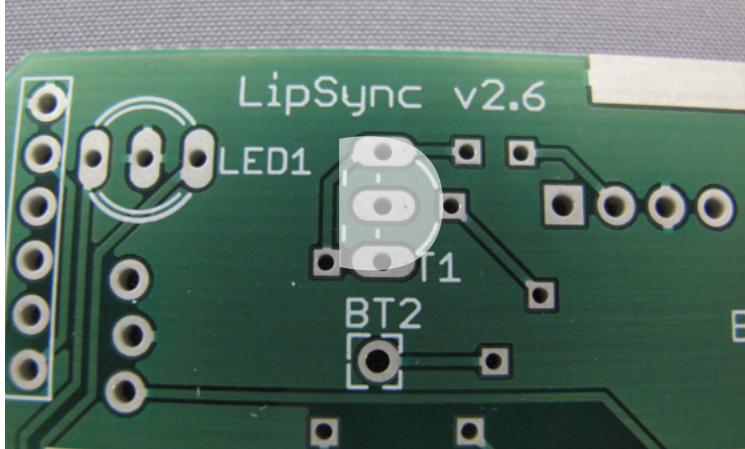
16

13.



17

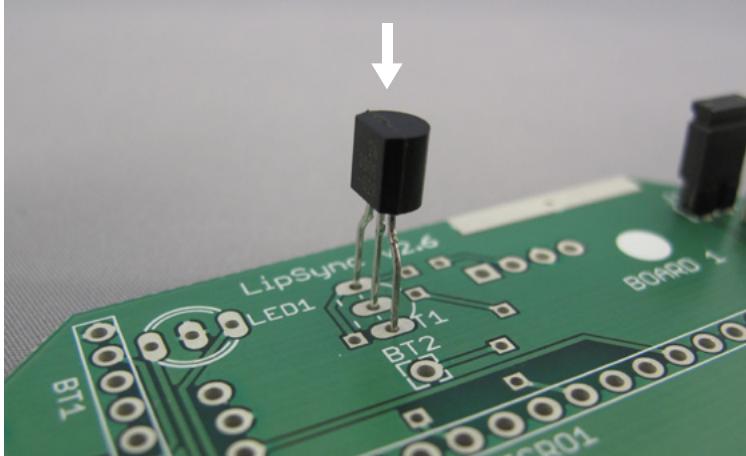
14.



HOLE  
T1

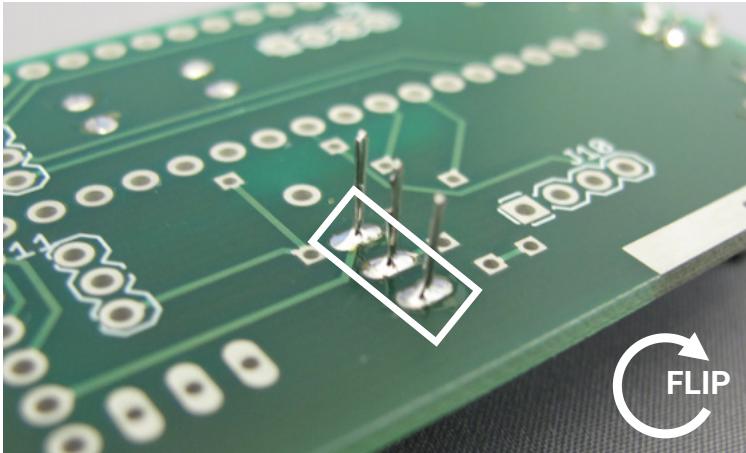
**NOTE:** The silkscreen outline for hole T1 on Board 1 matches the orientation of which the transistor is inserted.

**15.**



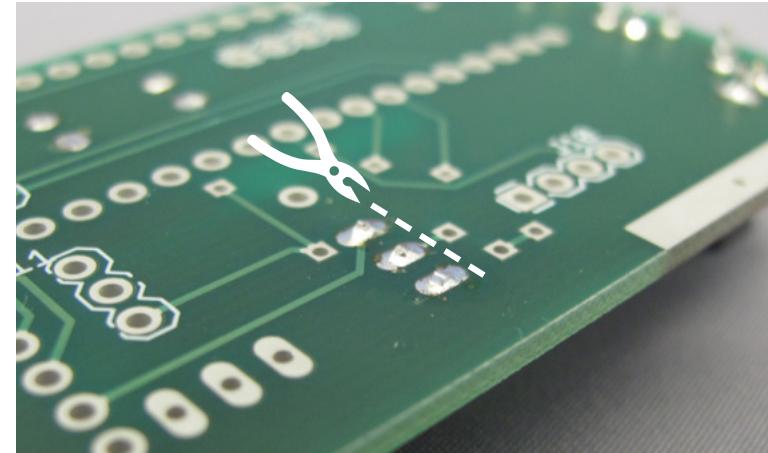
**NOTE:** After inserting the transistor, there will be a gap between the transistor and Board 1

**16.**

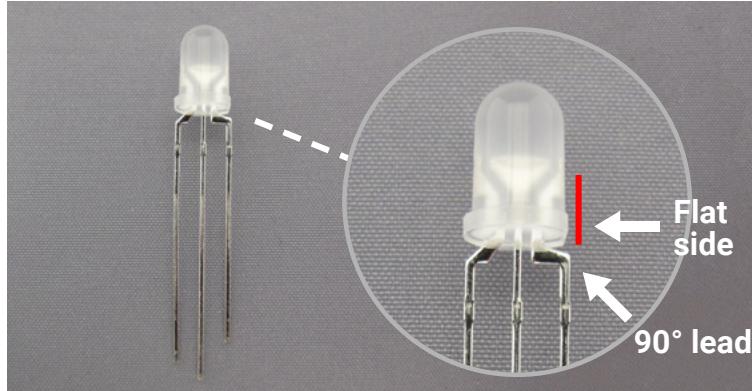


x 3

**17.**



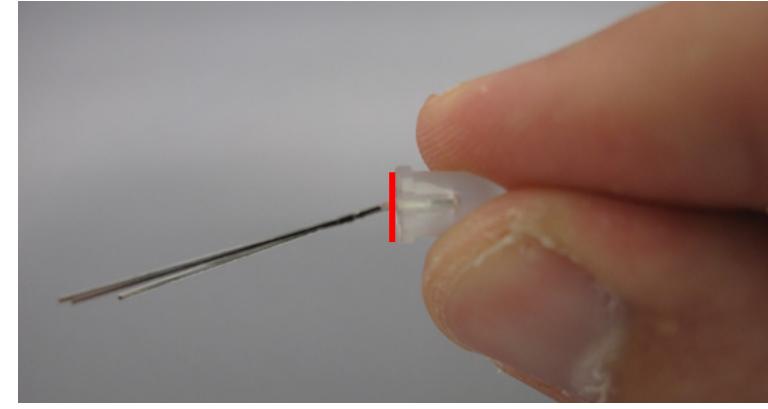
# 18.



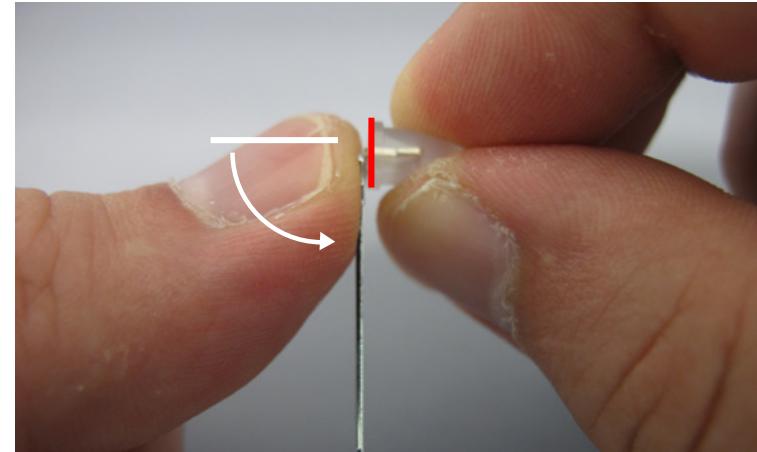
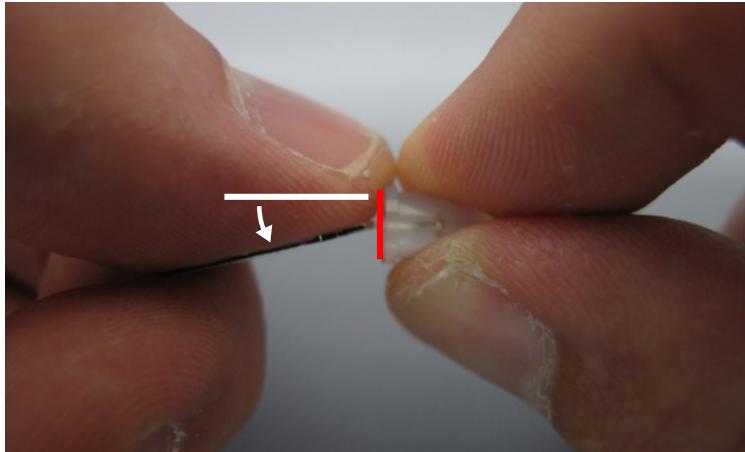
**IMPORTANT:** The flat side of the LED head and the 90° lead should be on the **RIGHT** when installed.

15

# 19.



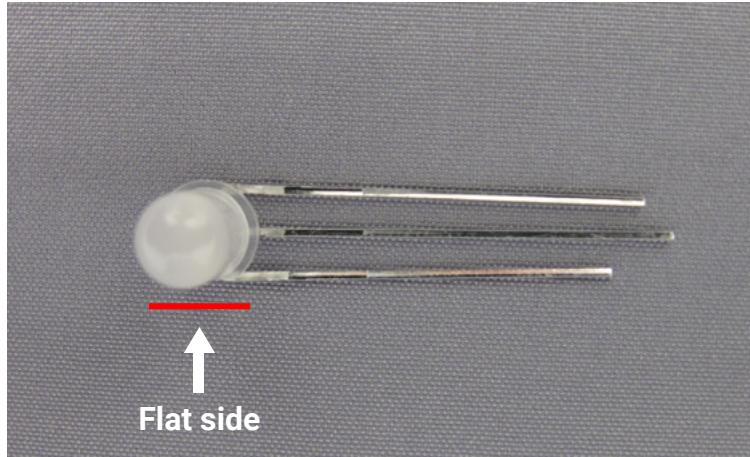
**IMPORTANT:** Hold the LED so that the flat side and the 90° lead is facing **TOWARDS** you.



# 20.

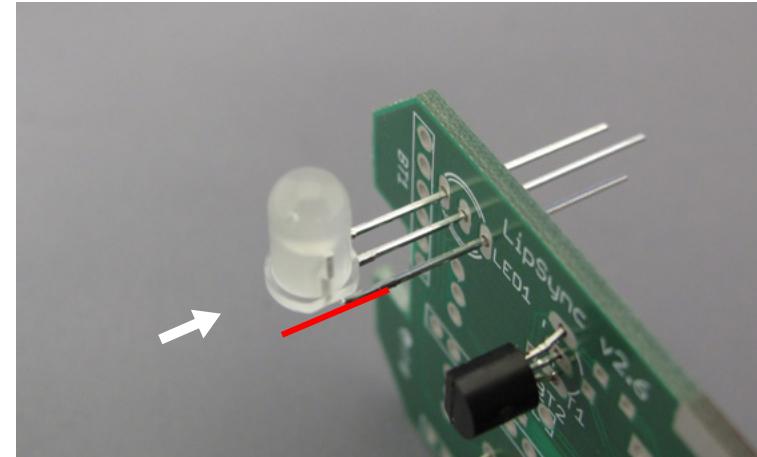
**NOTE:** Using a finger, bend the leads by 90° right at the LED base.

**21.**

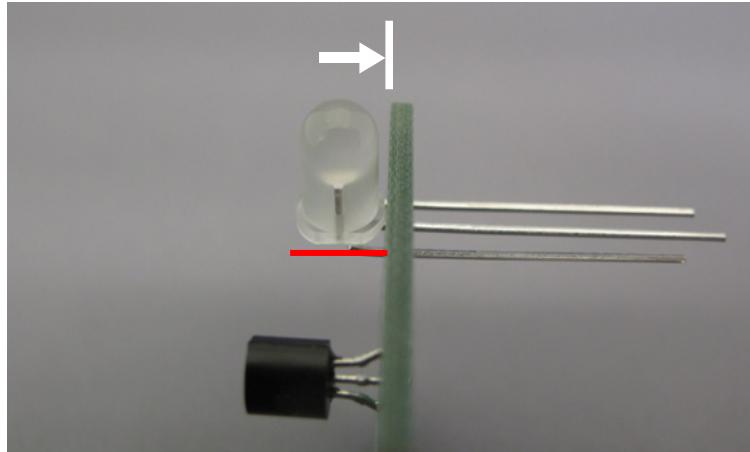


HOLE  
LED1

**22.**

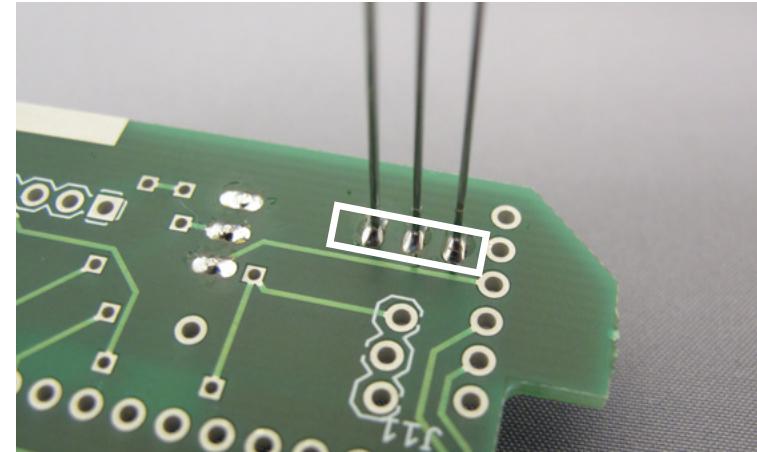


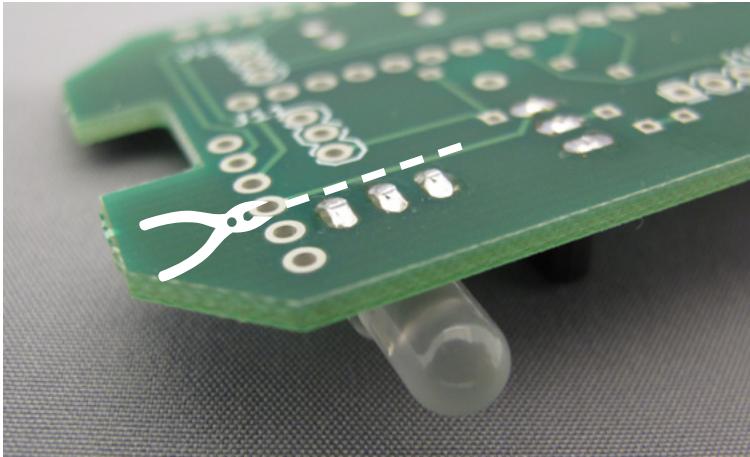
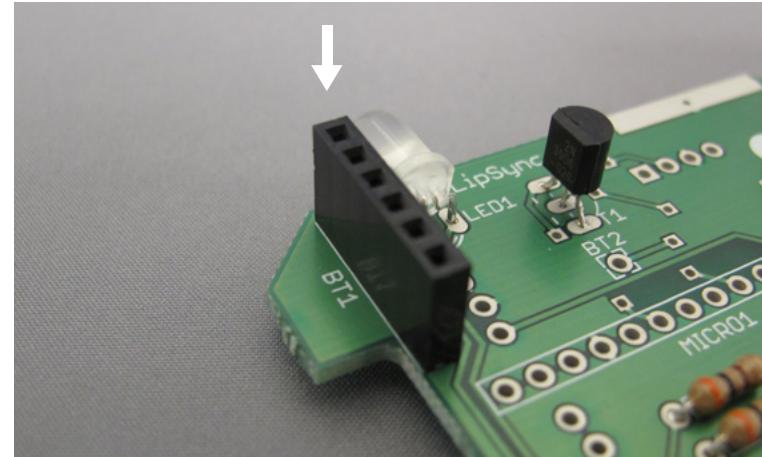
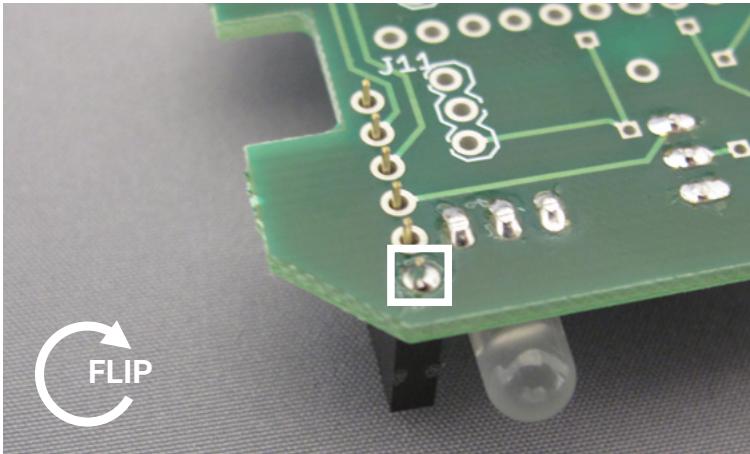
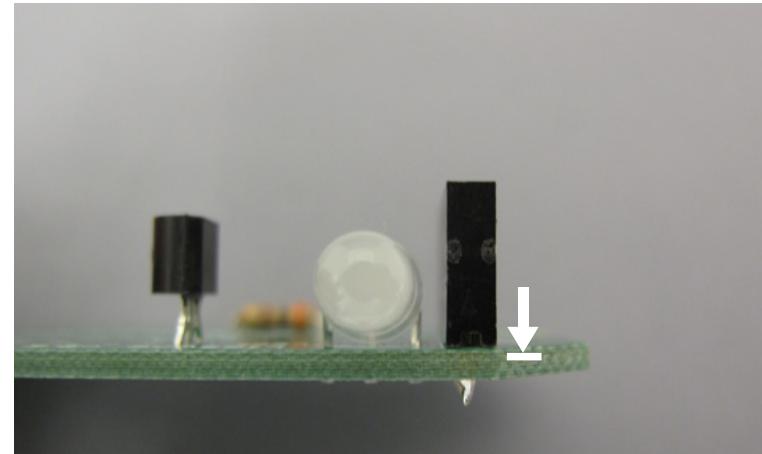
**23.**



x 3

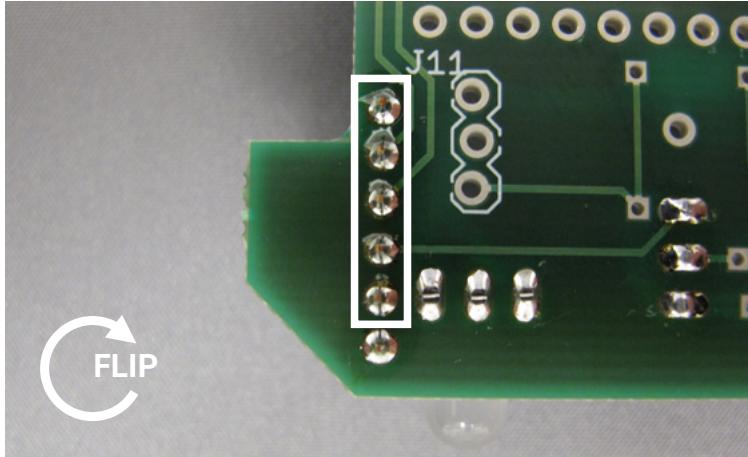
**24.**



**25.****26.****27.****28.**

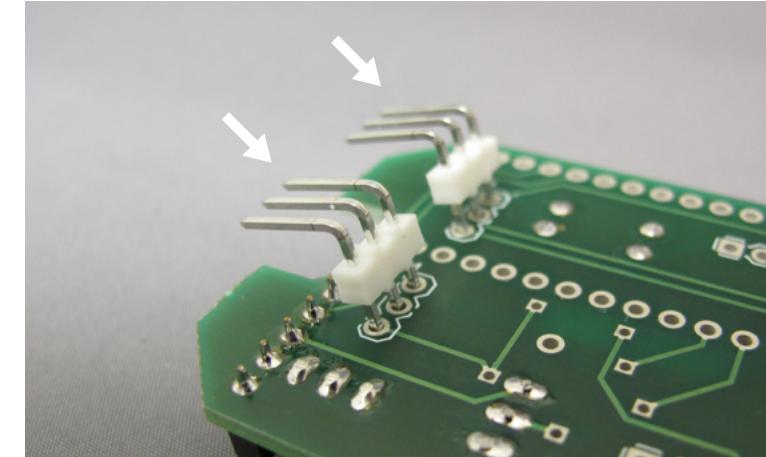
**NOTE:** Check that component is flush to the board

**29.**



x 5

**30.**



**11**

x 2

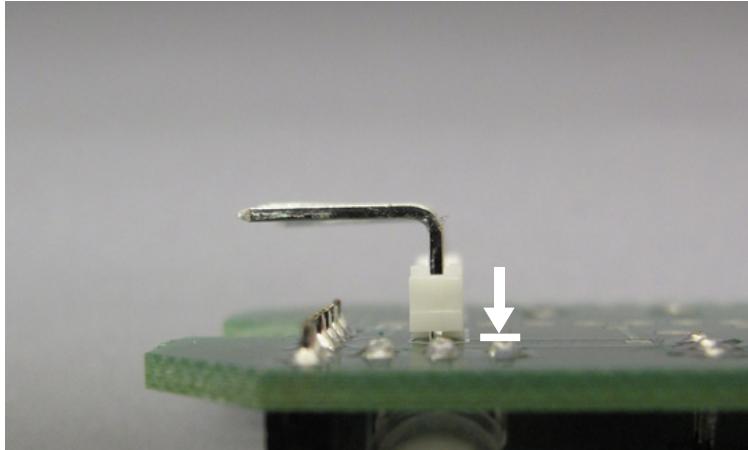
SECTION

**J11**

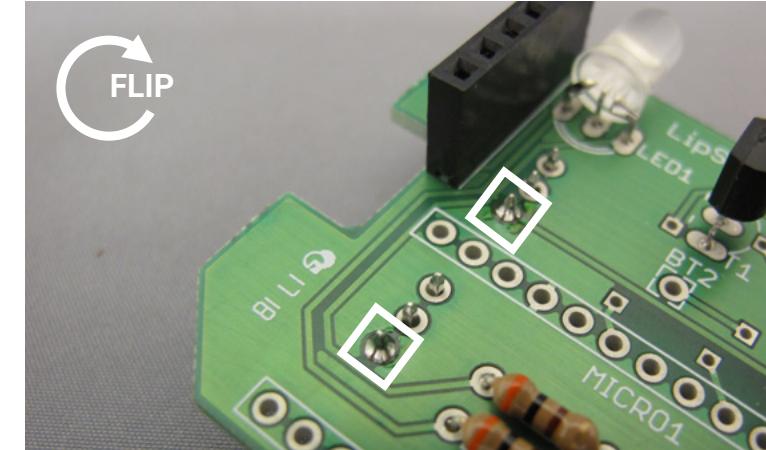
SECTION

**J12**

**31.**



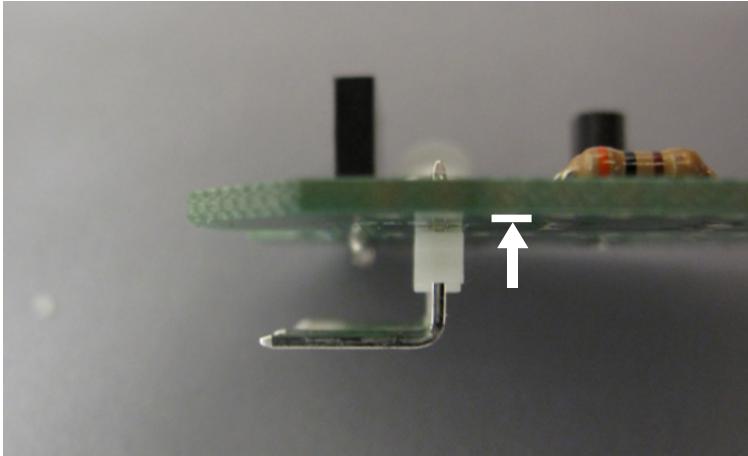
**32.**



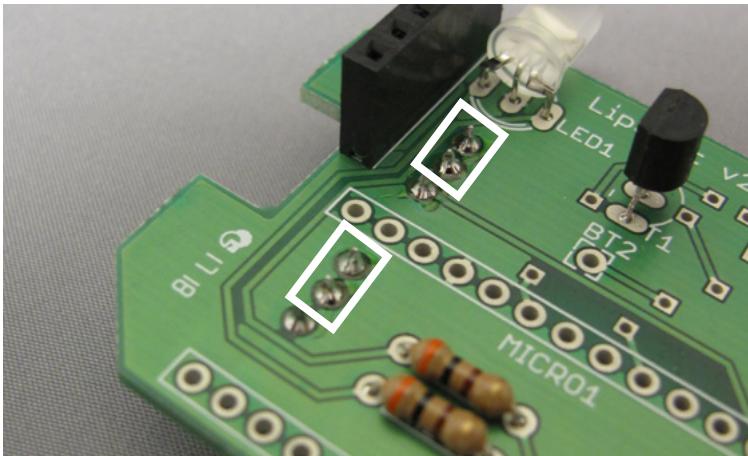
x 2

# PART 2

33.

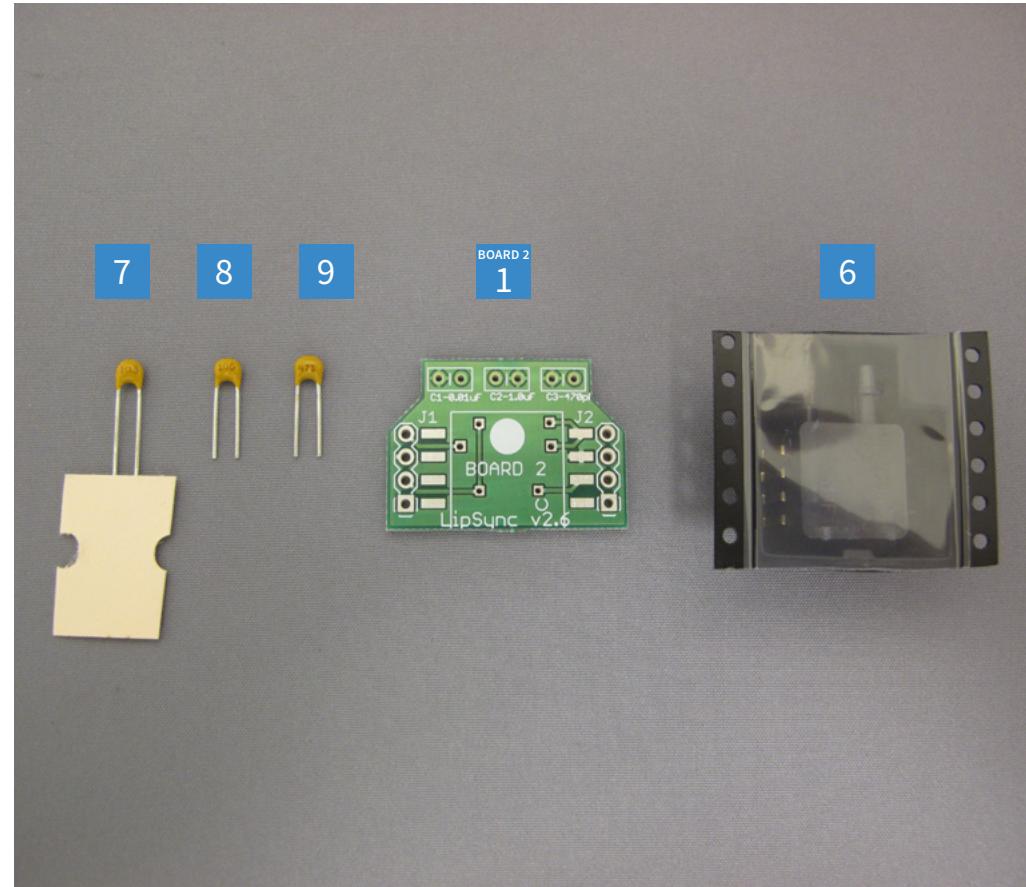


**NOTE:** Check that component is flush to the board

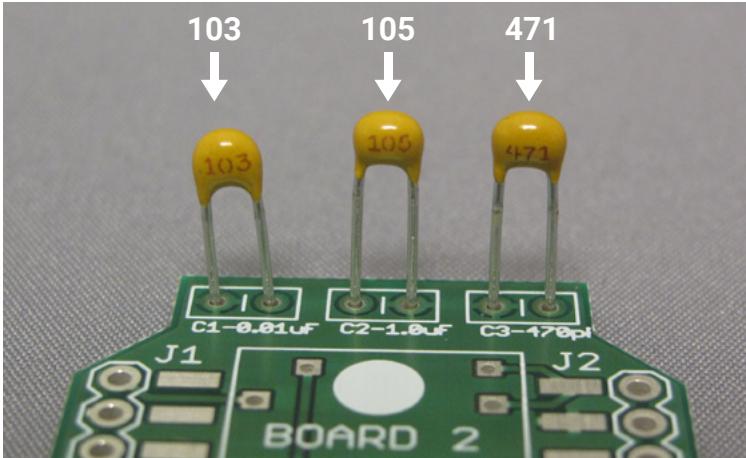


x 4

34.



# 01.

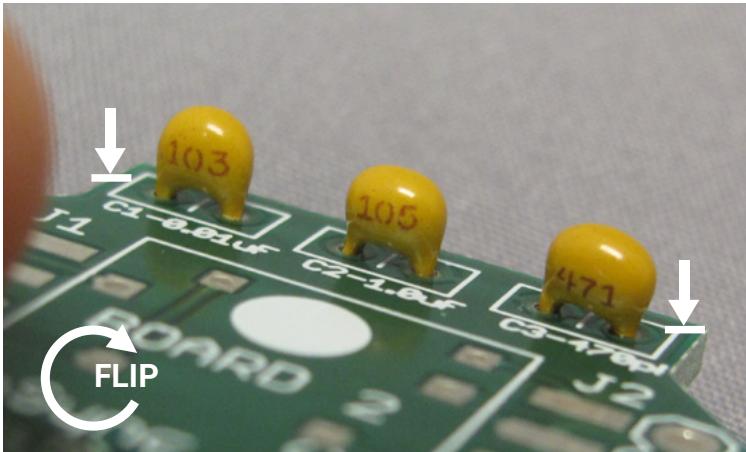


BOARD 2
1
7
8
9

**NOTE:** The capacitors **MUST** be inserted in the order shown.

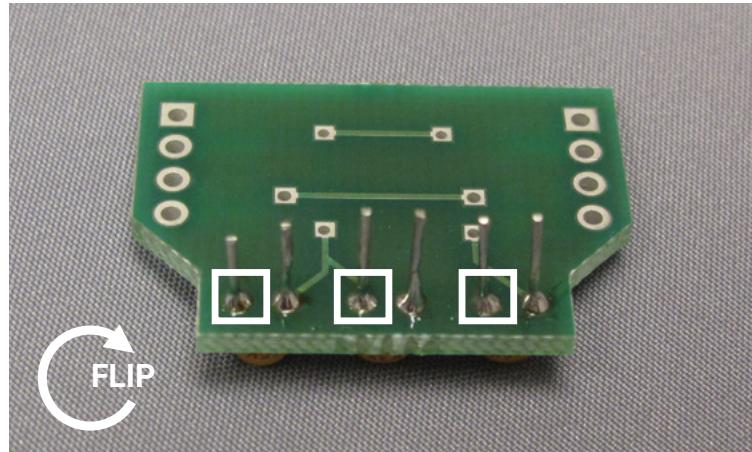
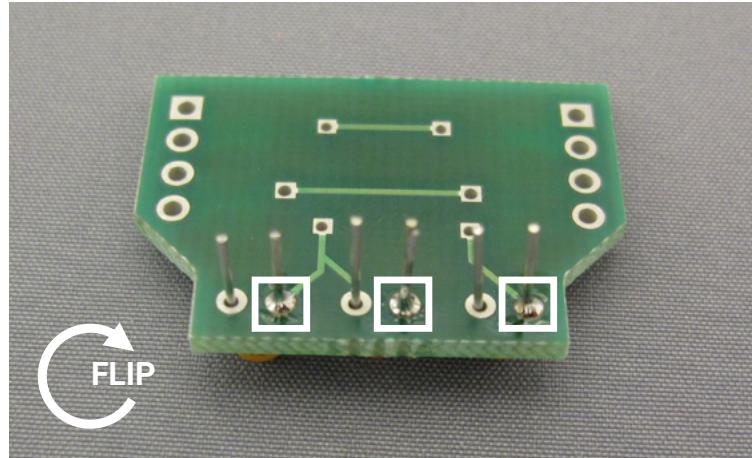


# 03.



**NOTE:** Check that components are flush to the board

# 04.

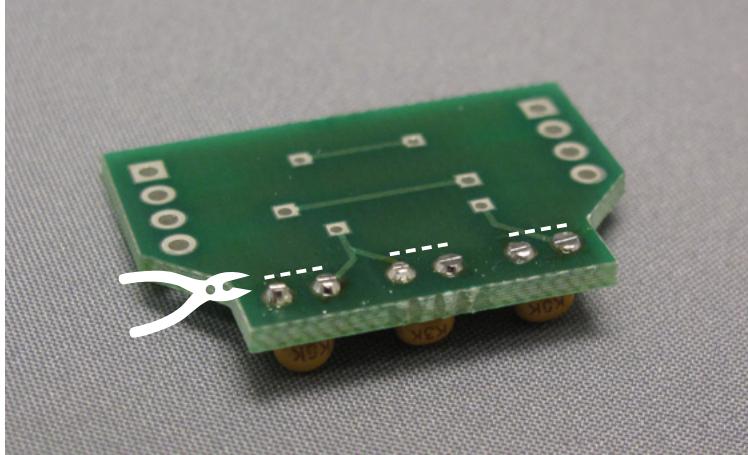


6

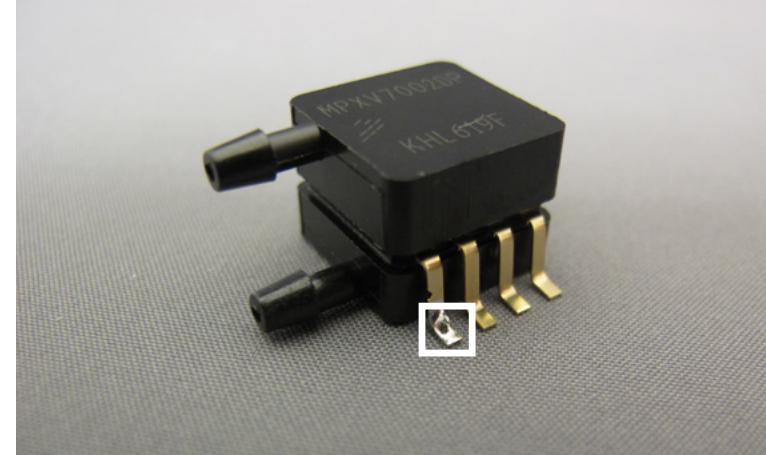


x 1

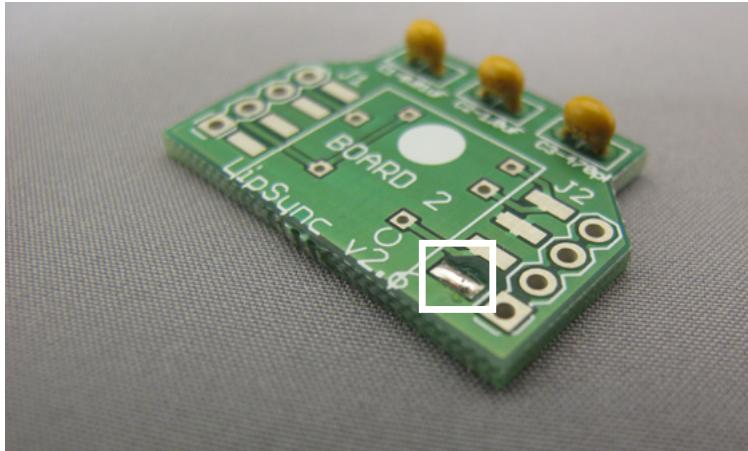
05.



06.

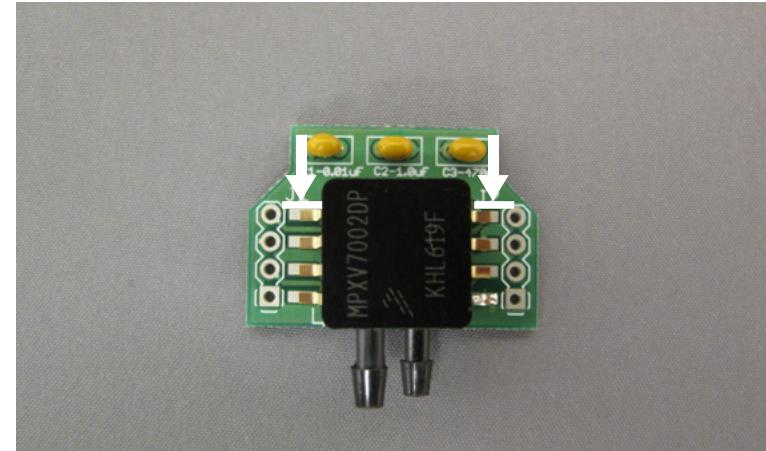


07.

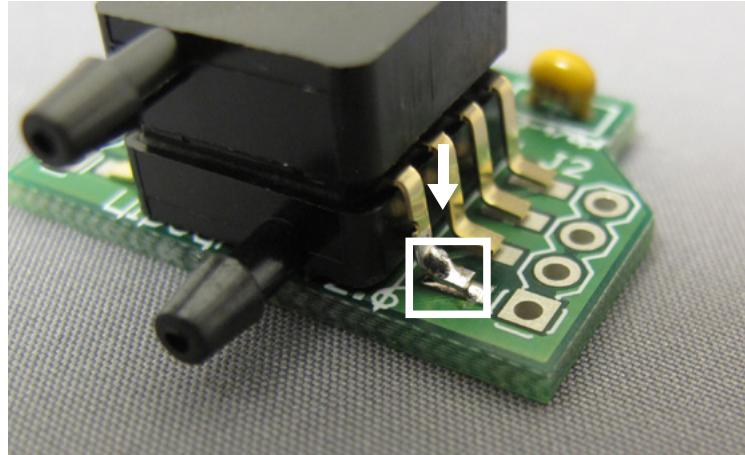
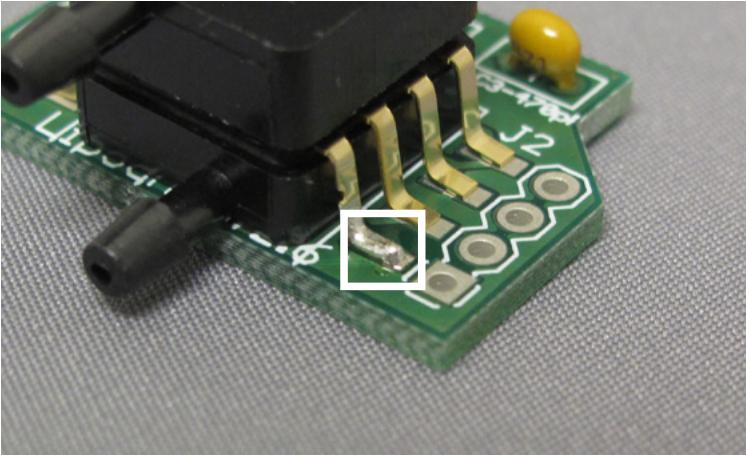


x 1

08.



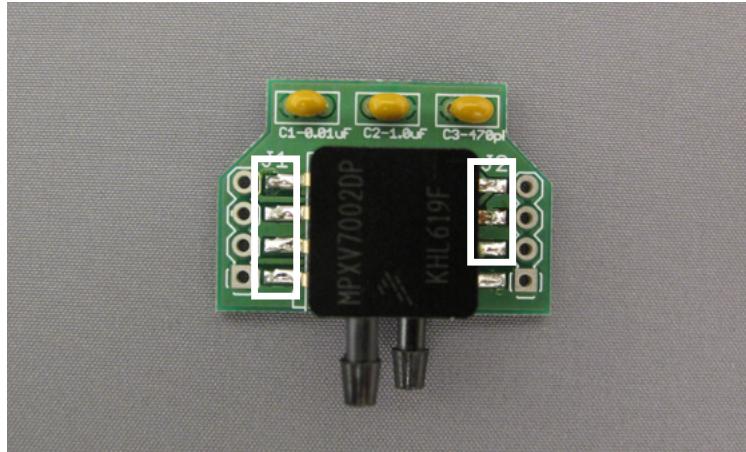
# 09.



**NOTE:** Place the solder tip on the lead to reflow the solder on the two components. The pressure sensor should "drop" onto Board 2.

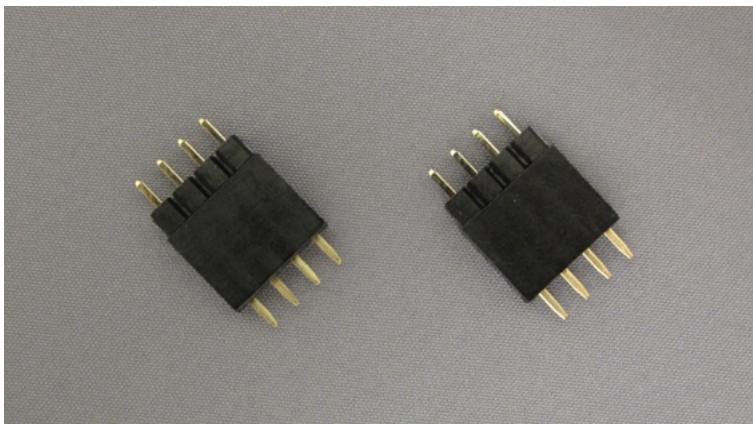
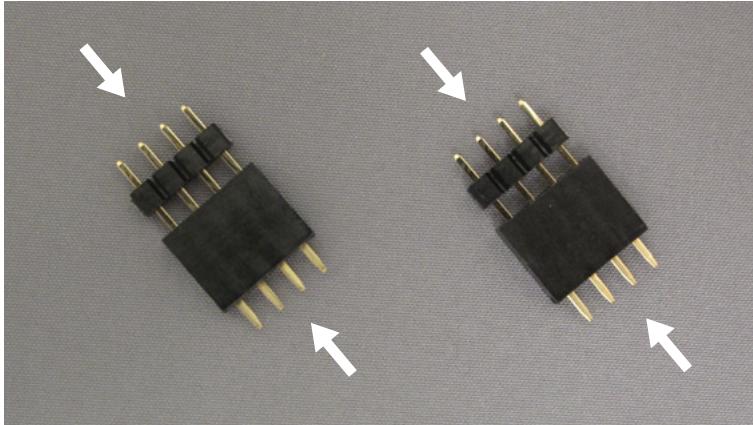
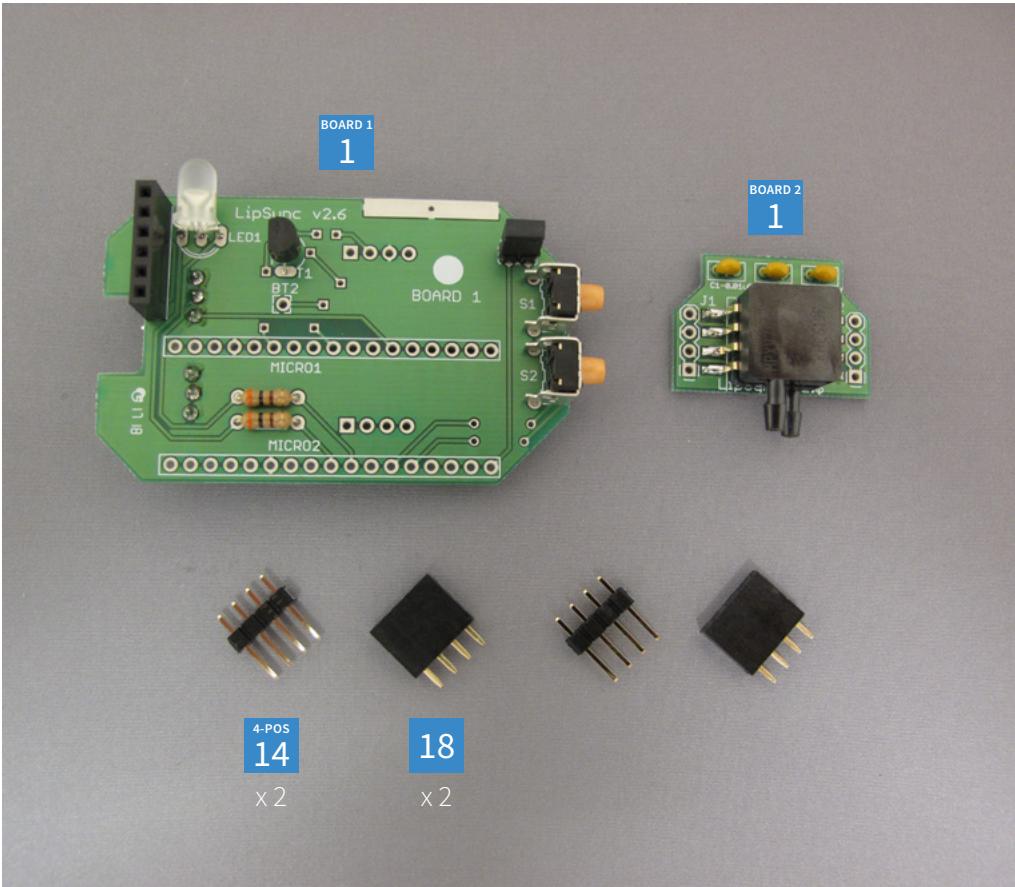
x 1

# 10.



x 7

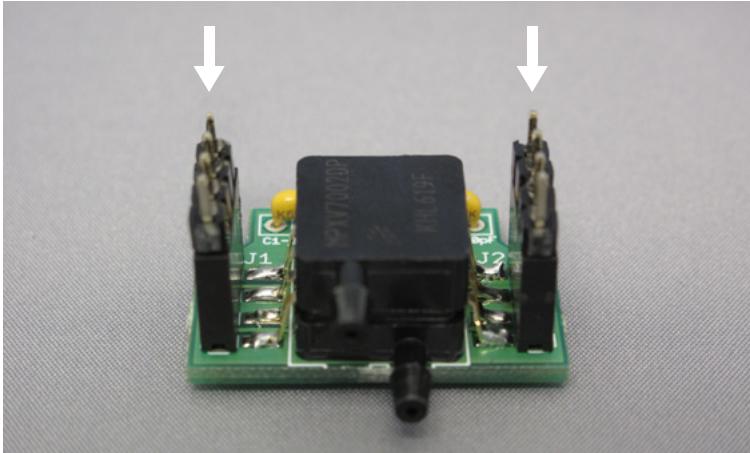
# PART 3



4-POS  
14  
x 2  
18  
x 2

01.

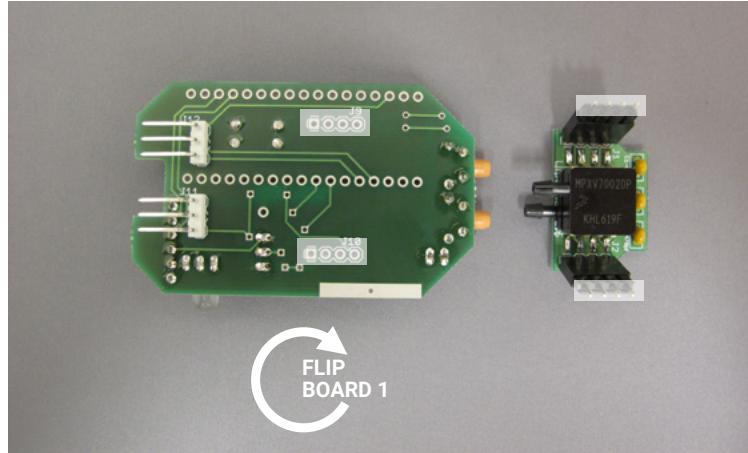
# 02.



BOARD 2  
1

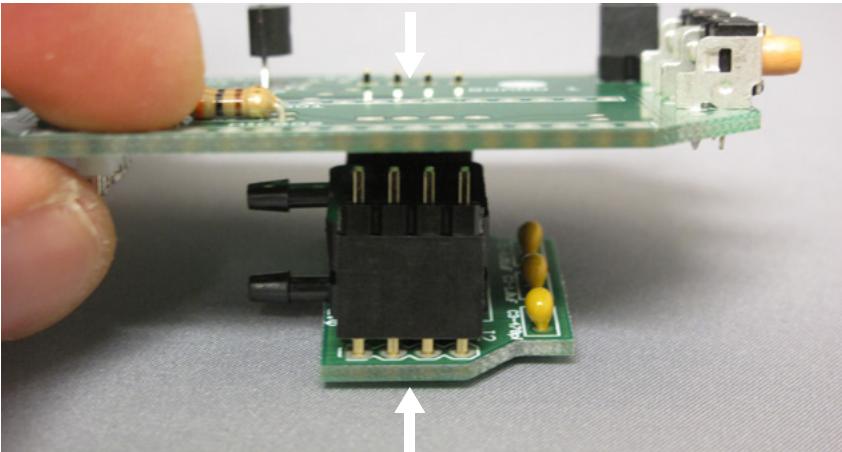
**NOTE:** The 4-position female headers are inserted

# 03.

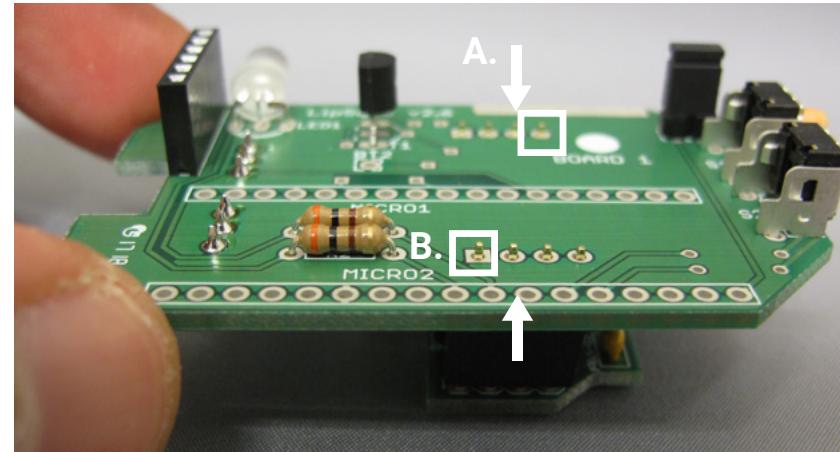


BOARD 1  
1

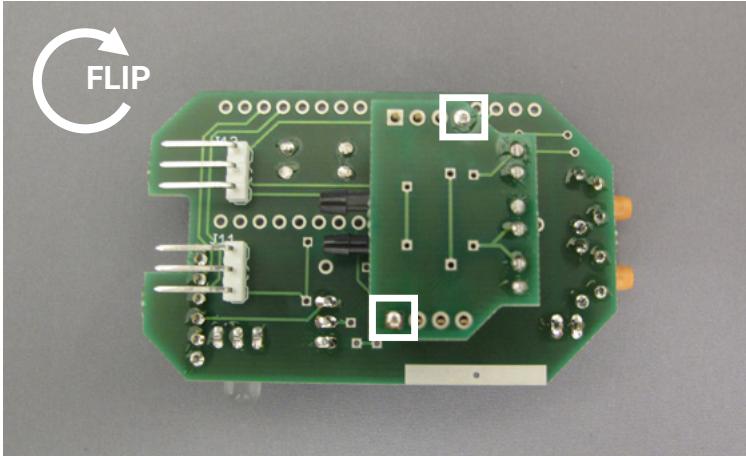
# 04.



x 2

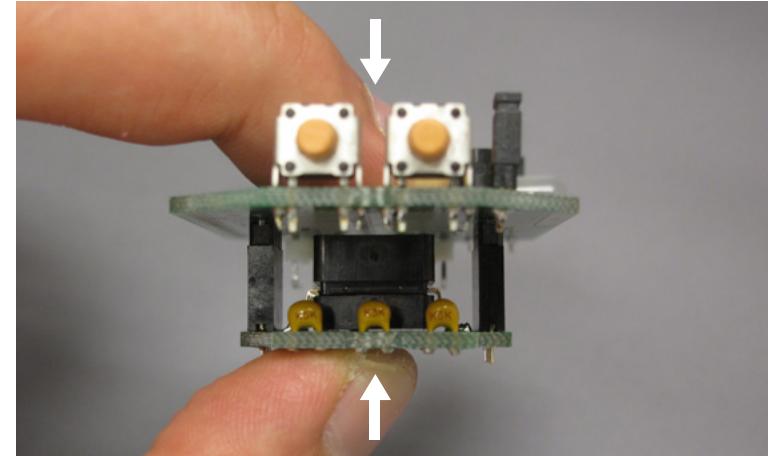


**05.**



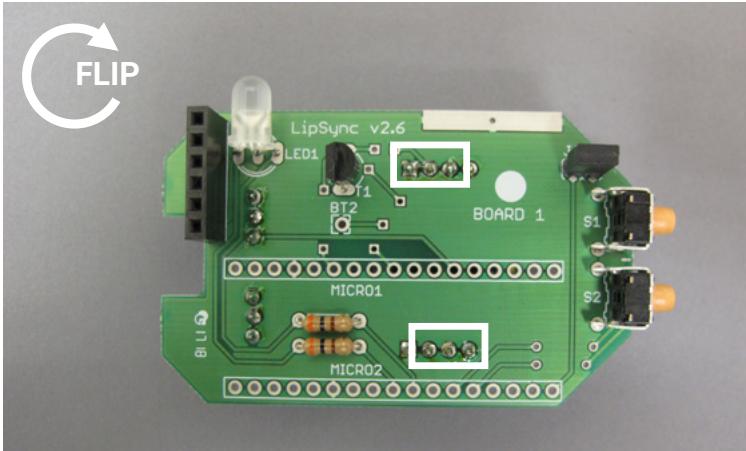
x 2

**06.**



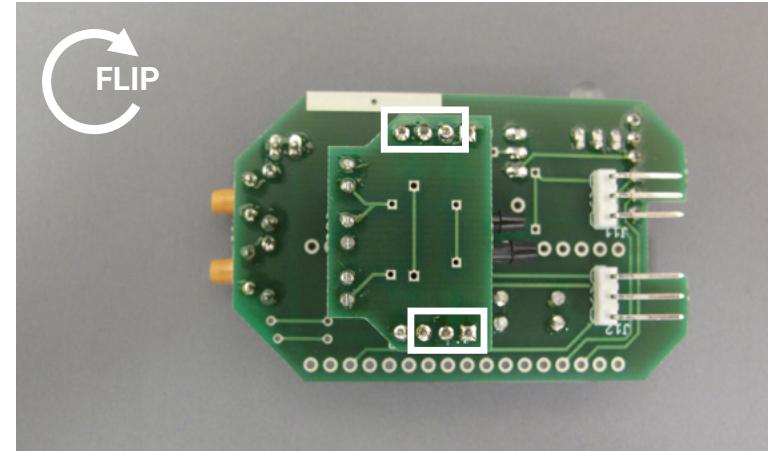
**NOTE:** Check that components are flush to the board

**07.**



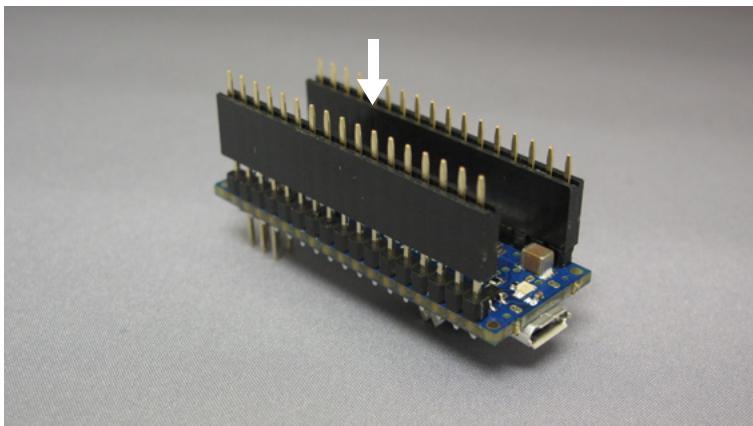
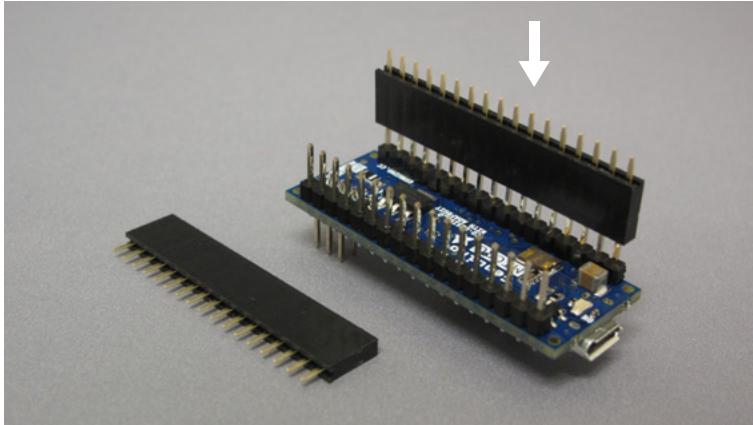
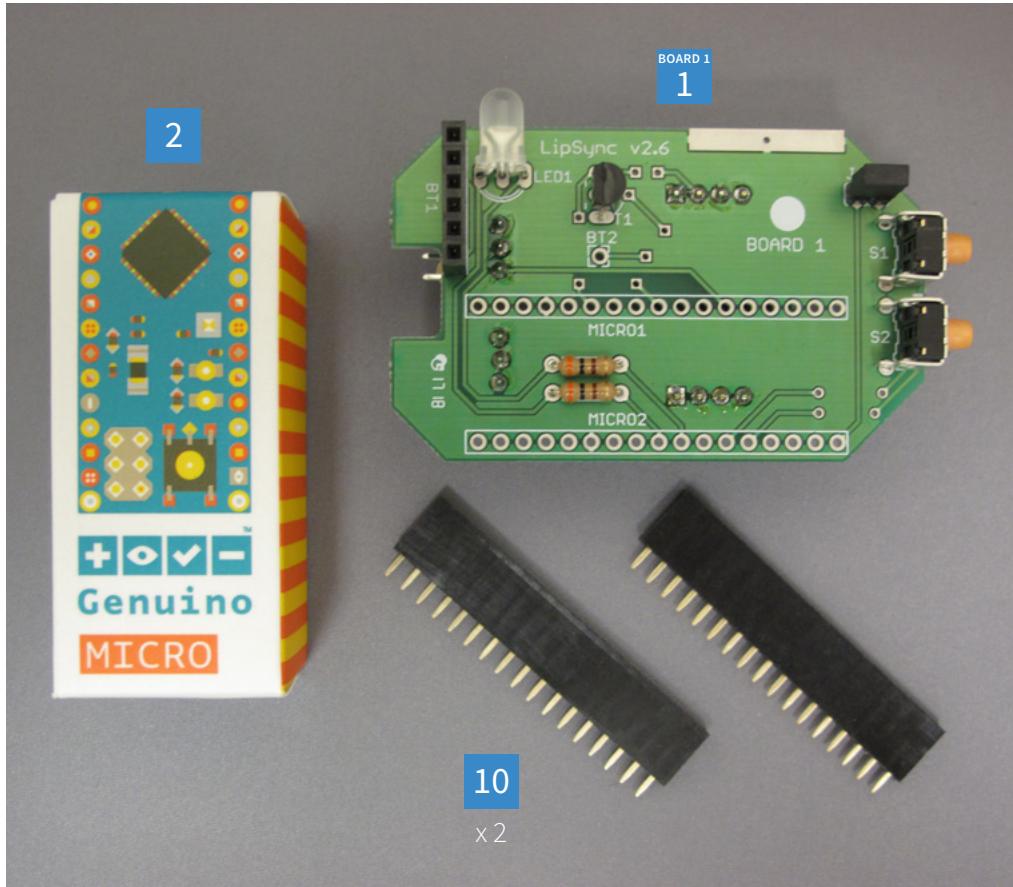
x 6

**08.**



x 6

# PART 4

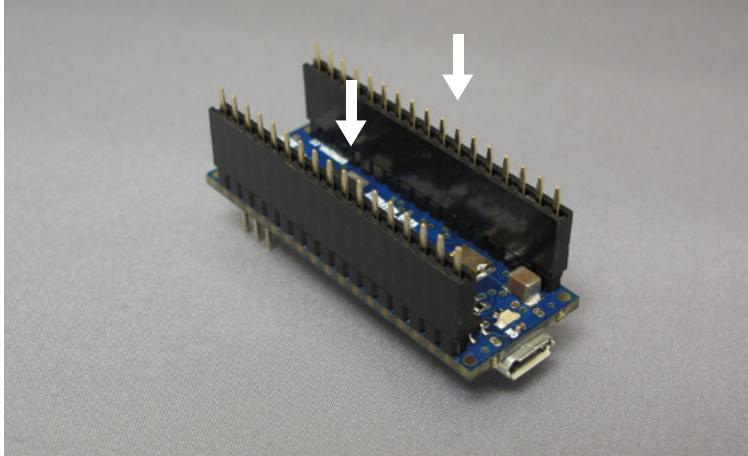
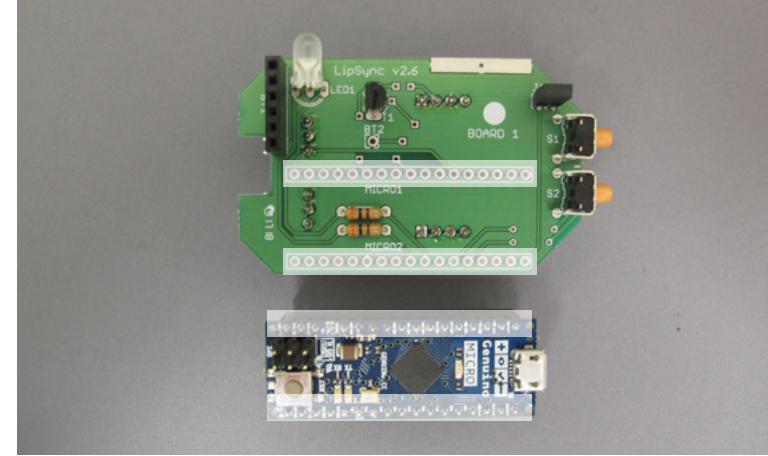
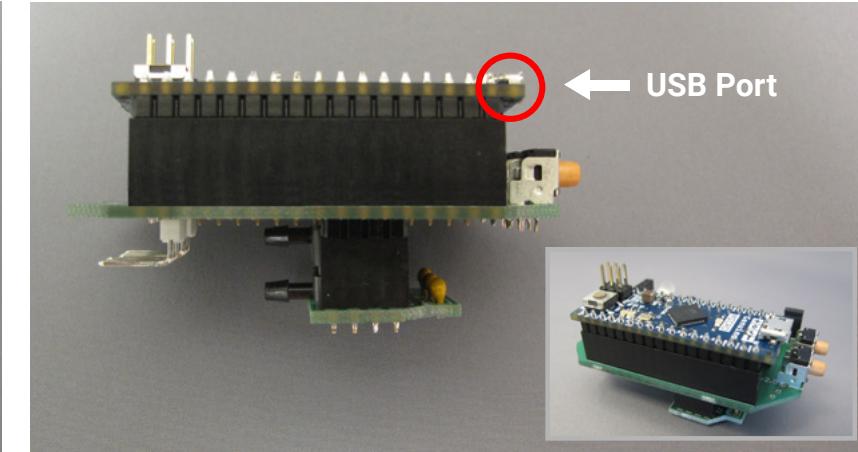
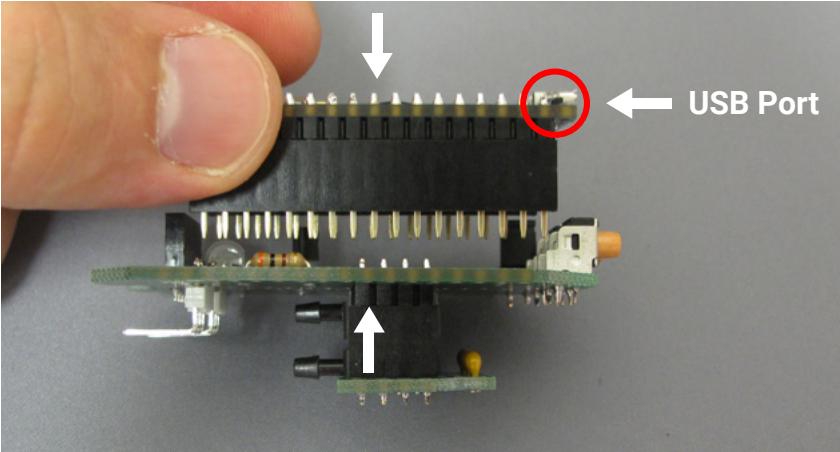


01.

2

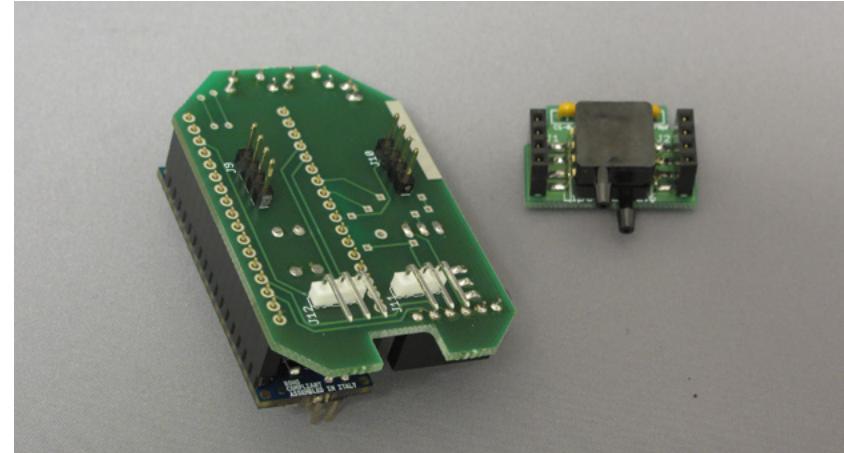
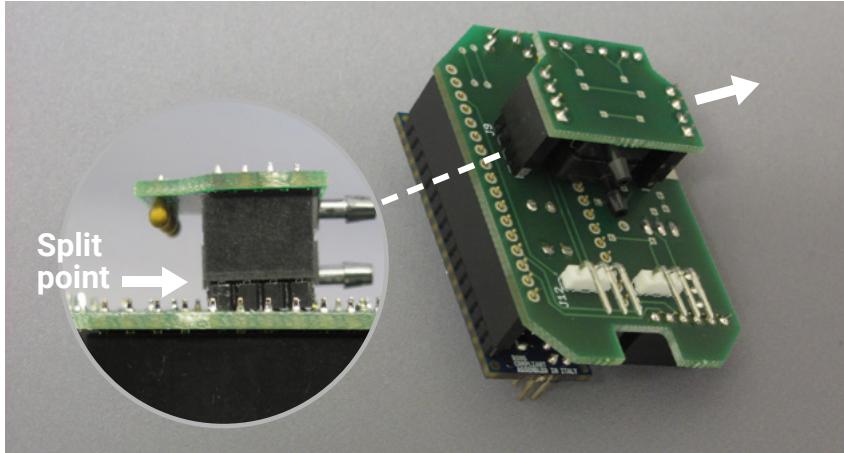
10

x 2

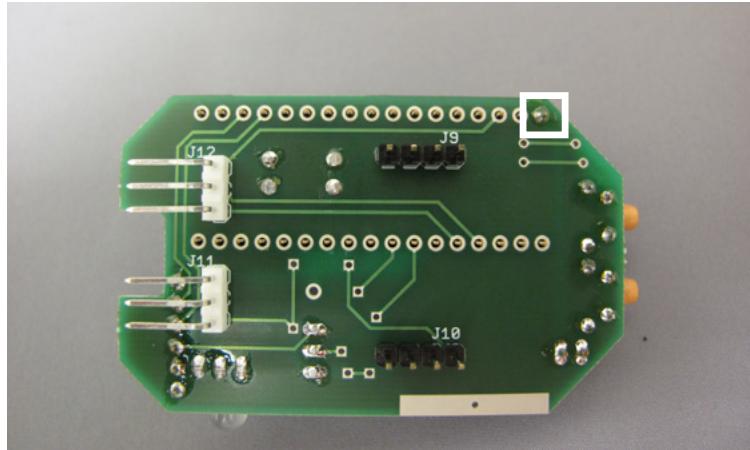
**02.****03.****04.**

**NOTE:** USB Port should be on the right side during installing

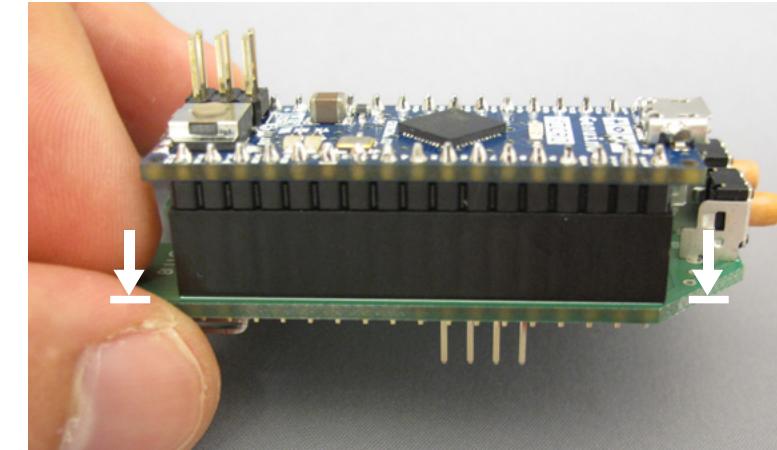
**05.**



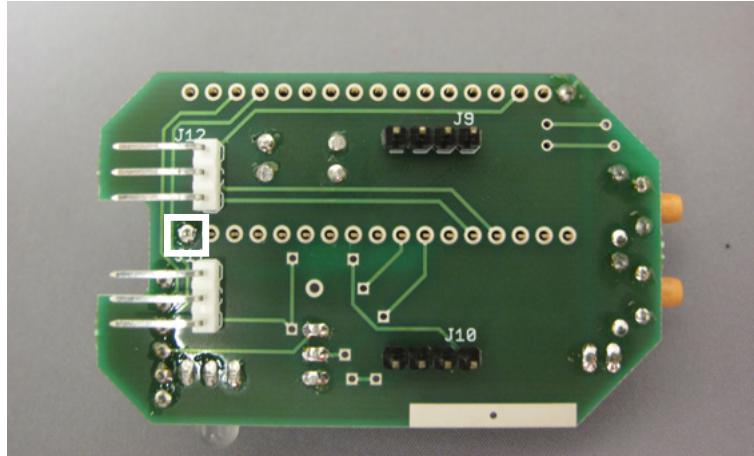
**06.**



**07.**

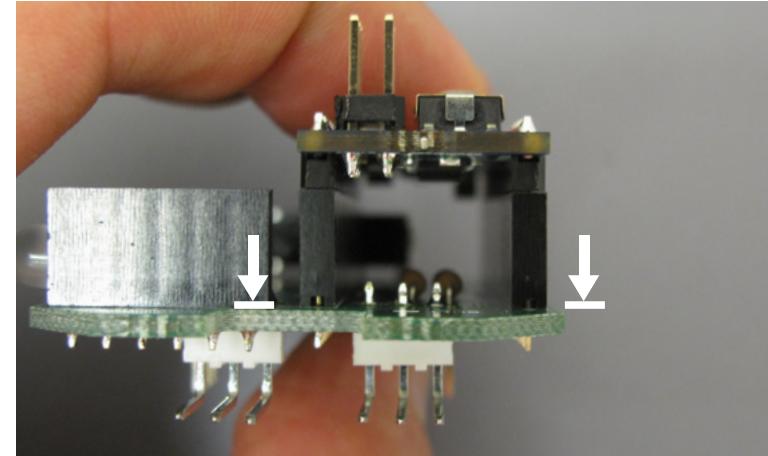


# 08.



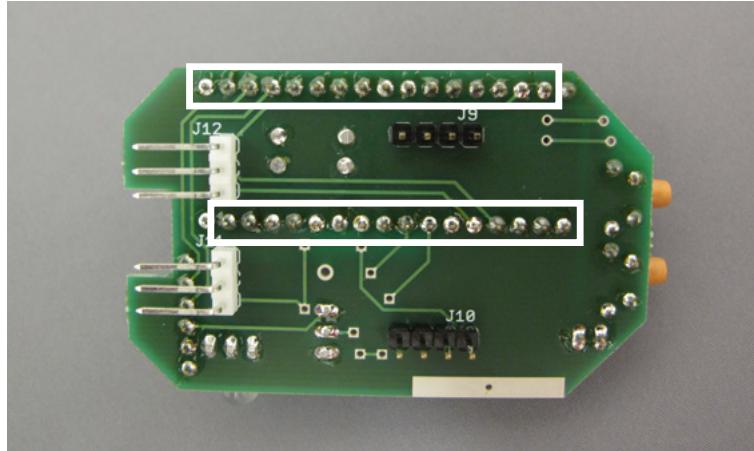
x 1

# 09.



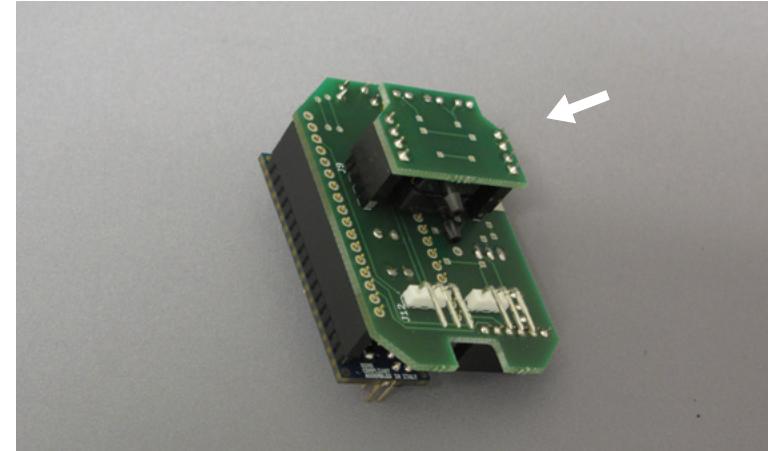
**NOTE:** Check that components are flush to the board

# 10.

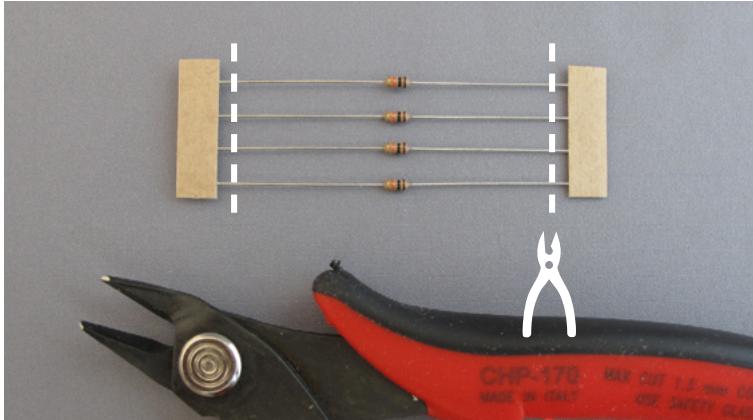
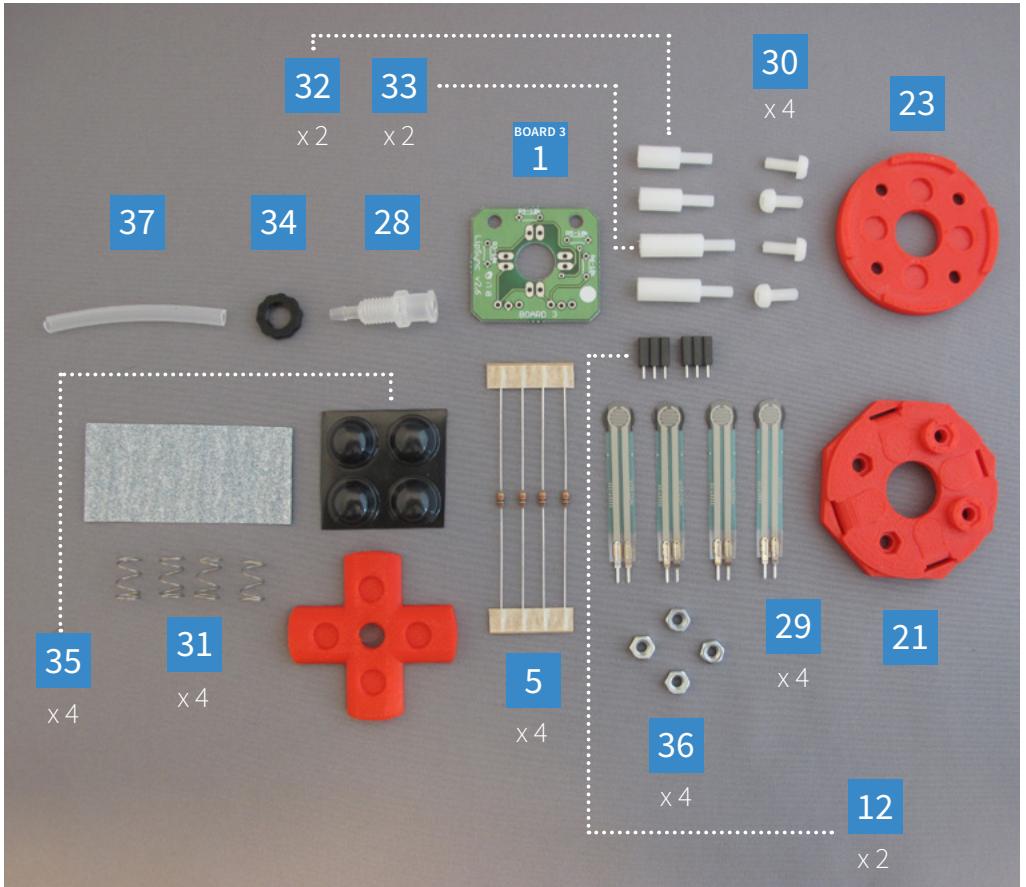


x 32

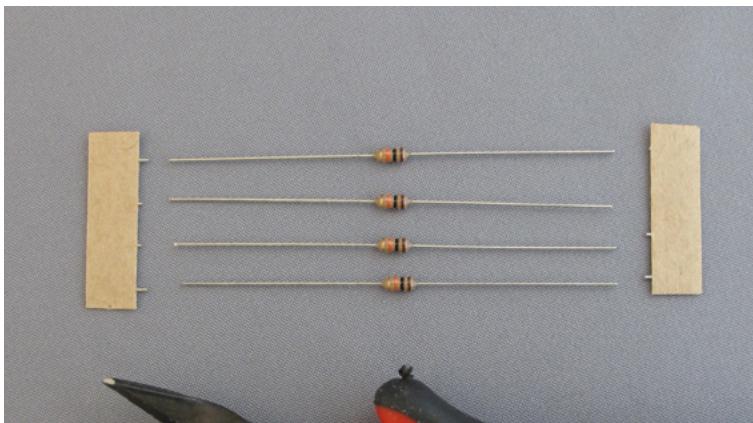
# 11.



# PART 5

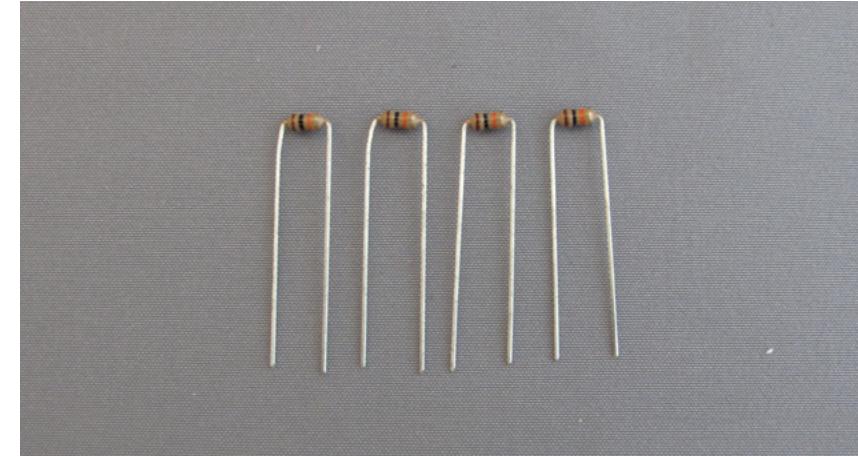
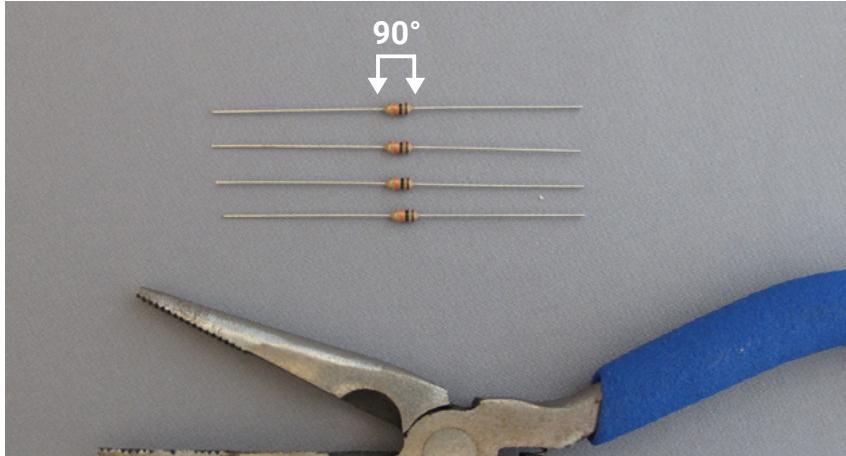


5  
x 4

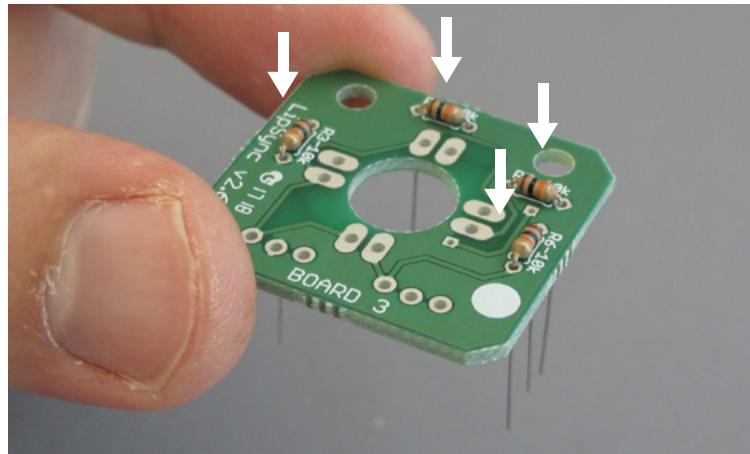


01.

**02.**



**03.**



BOARD 3

1  
x 4

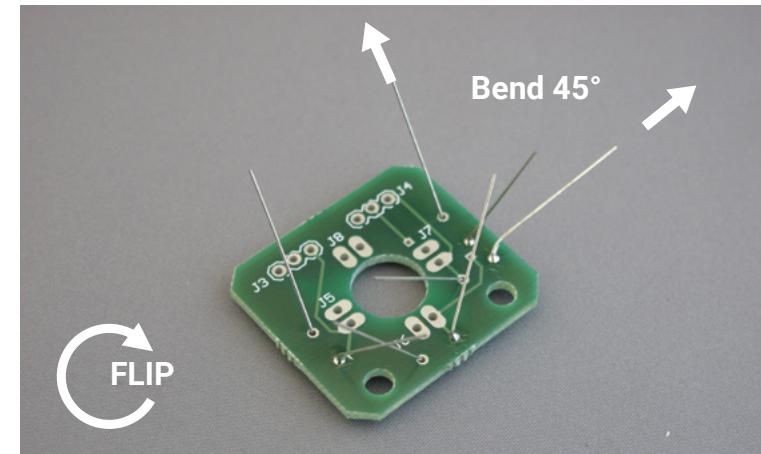
HOLE  
R3

HOLE  
R4

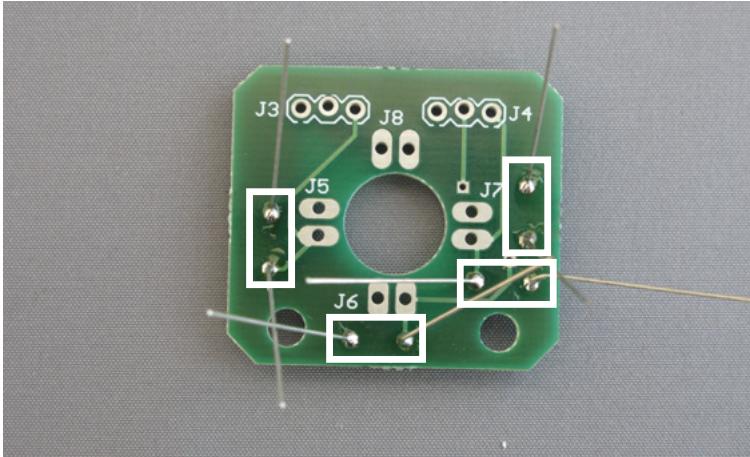
HOLE  
R5

HOLE  
R6

**04.**

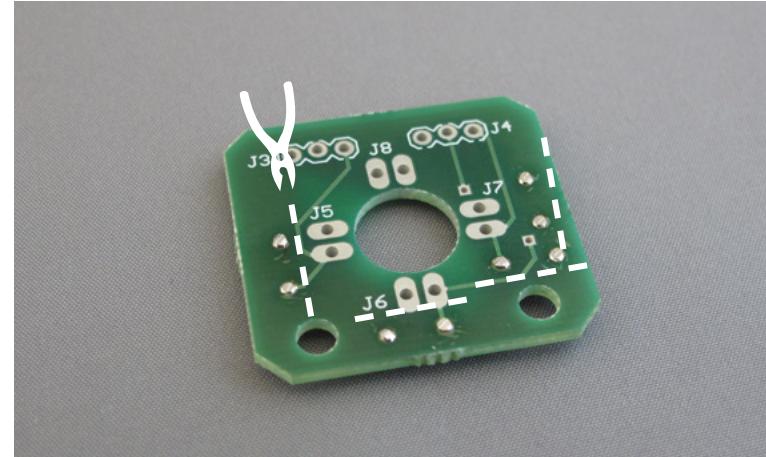


05.

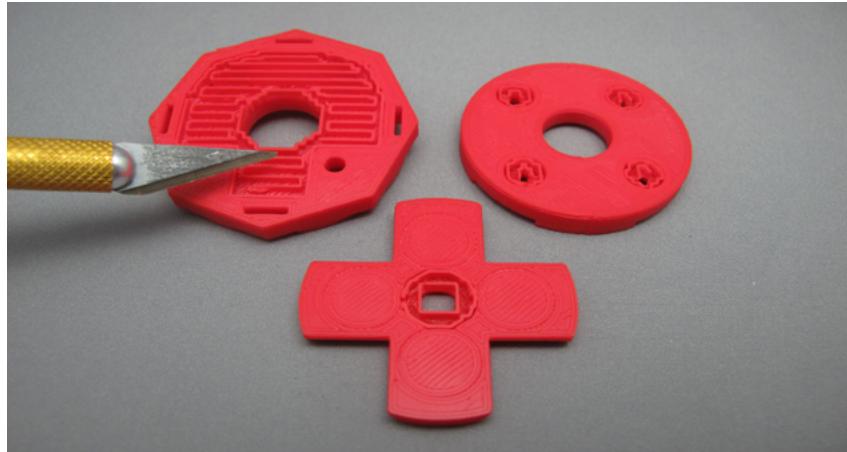


x 8

06.



07.

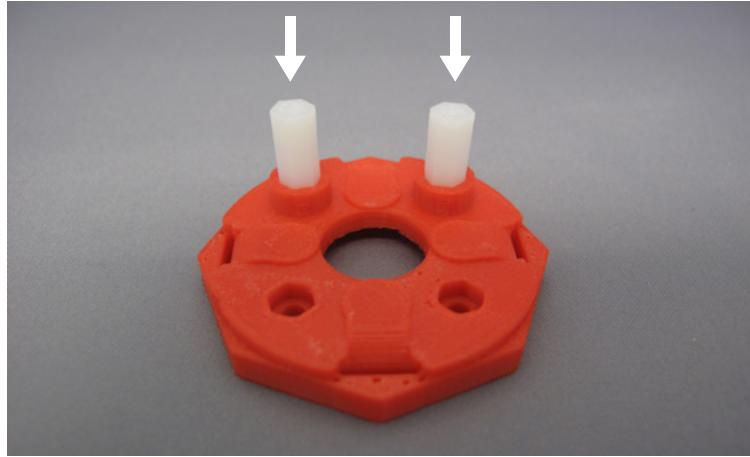


21

22

23

# 08.



**NOTE:** Insert the 10mm standoffs

32

x 2

# 10.



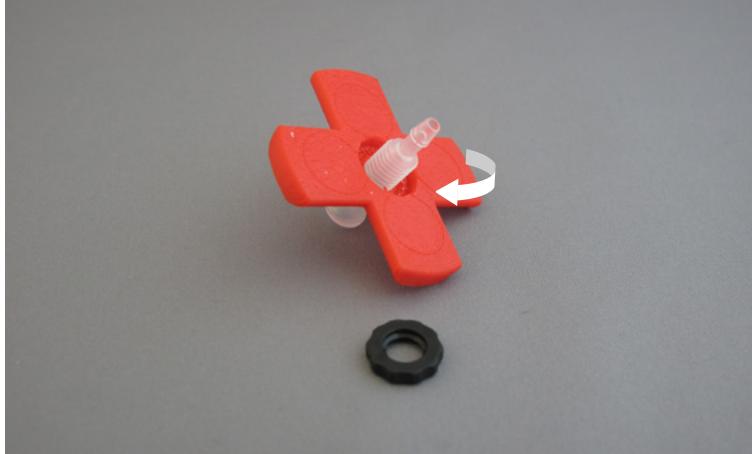
# 09.



36

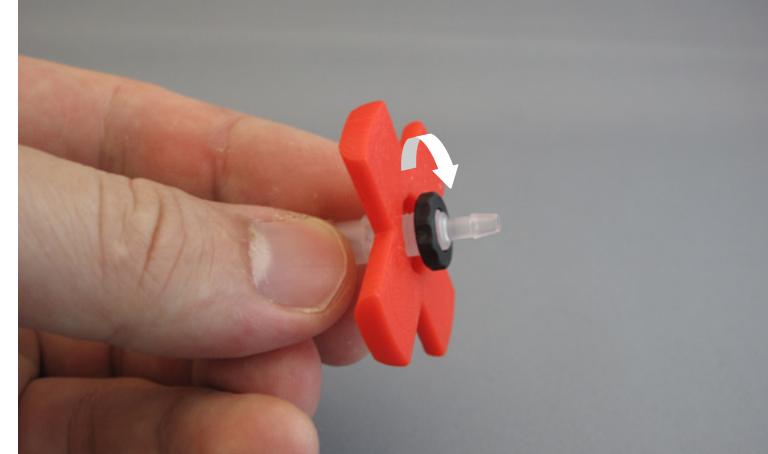
x 2

**11.**

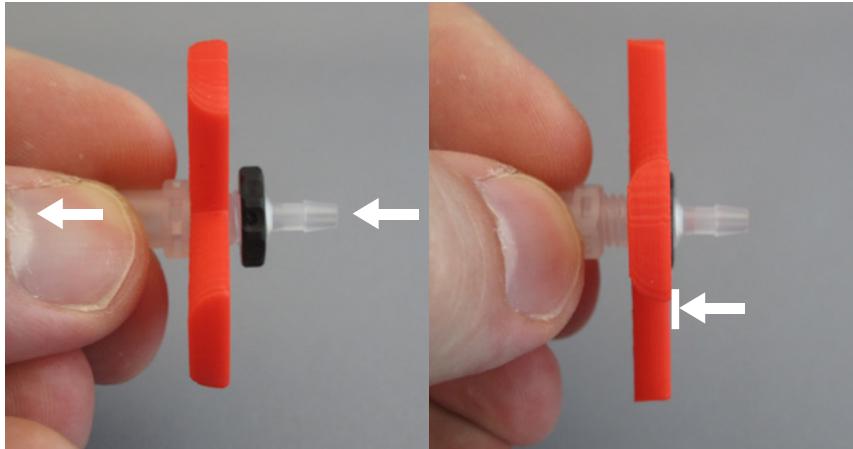


22  
28  
34

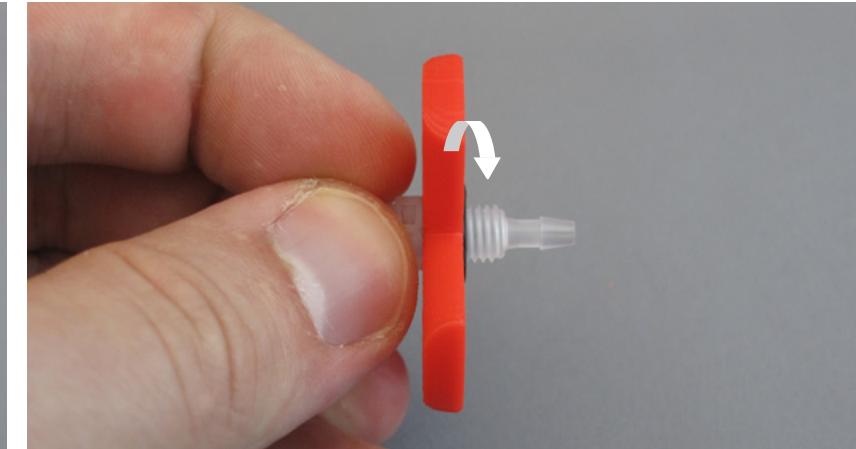
**12.**



**13.**



34

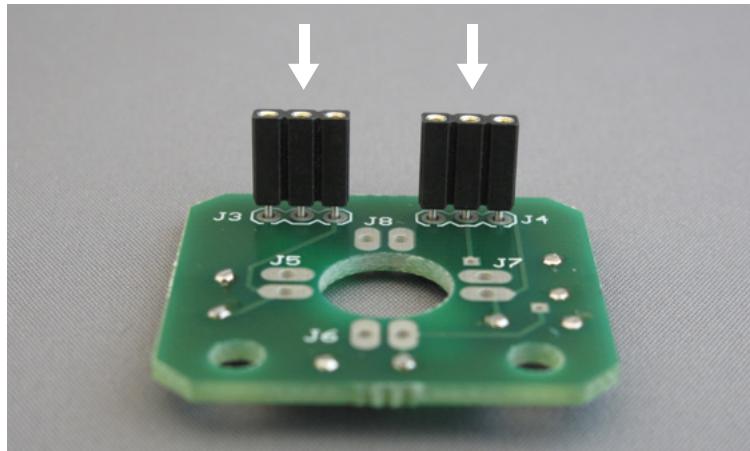


**NOTE:** The luer lock nut should sit flush to the rocker. Once flushed, twist the luer lock fitting the rest of the way.

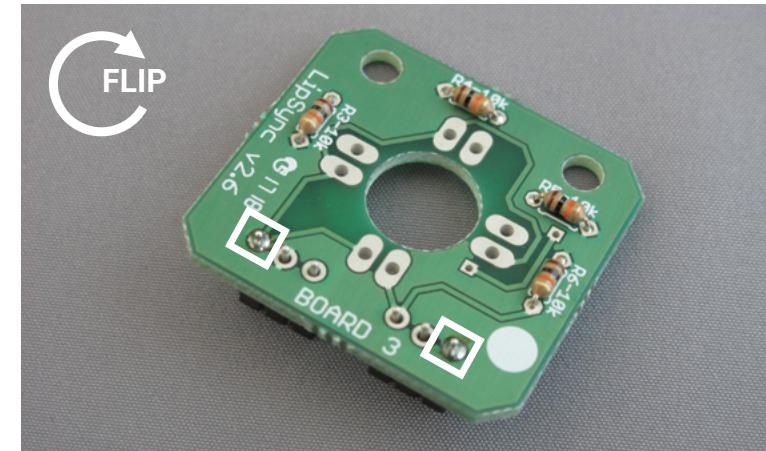
**14.**



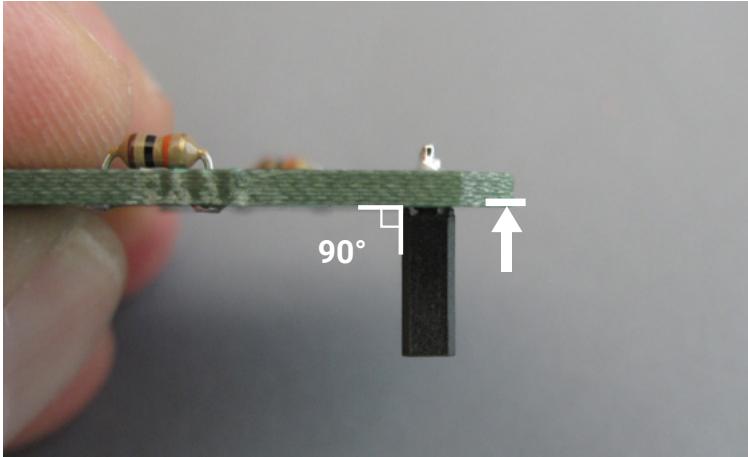
**15.**



**16.**



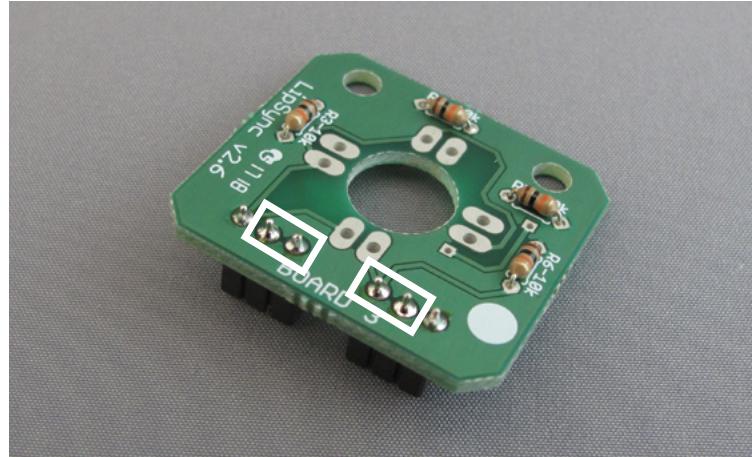
# 17.



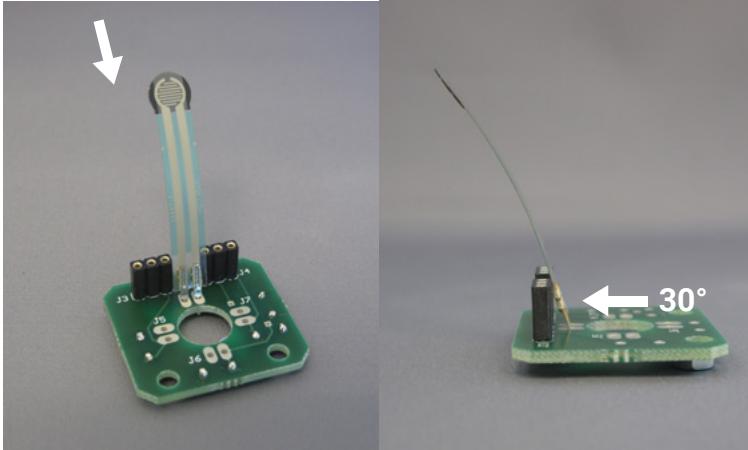
**NOTE:** Check that components are flush to the board

x 4  
Screwdriver icon

# 18.



# 19.

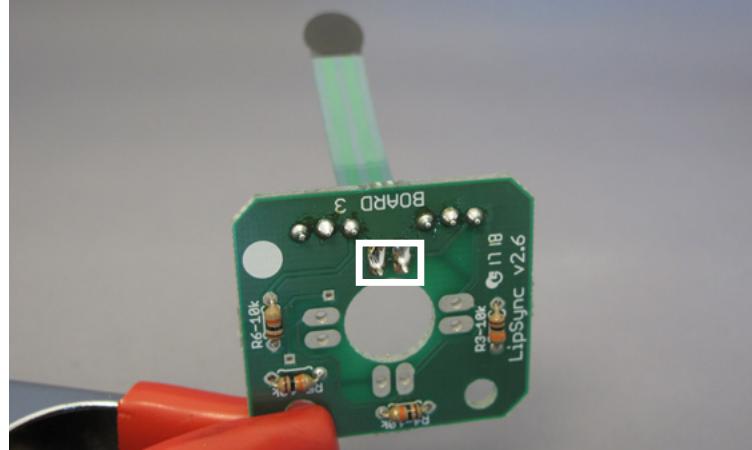


**NOTE:** Insert FSR at a 30° angle away from the centre of the board

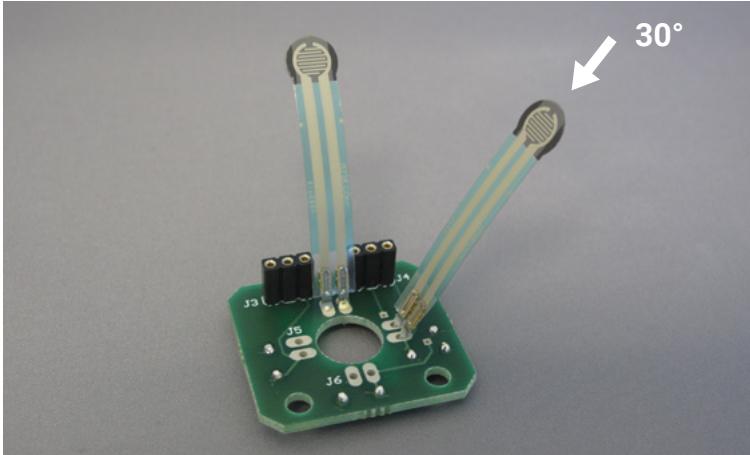
29

x 2  
Screwdriver icon

# 20.



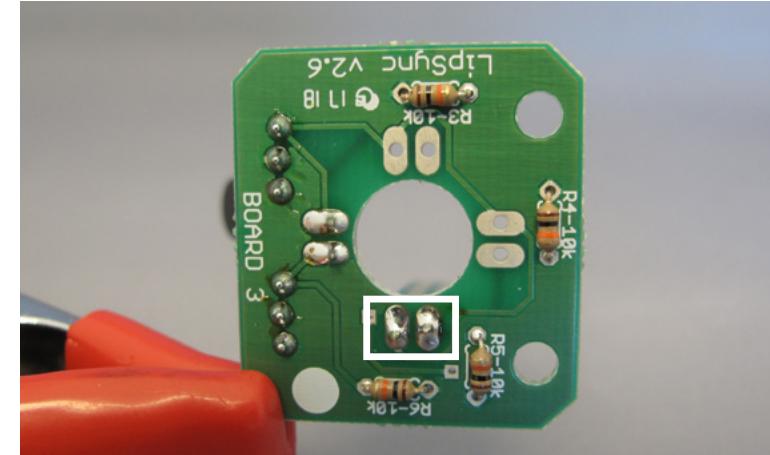
21.



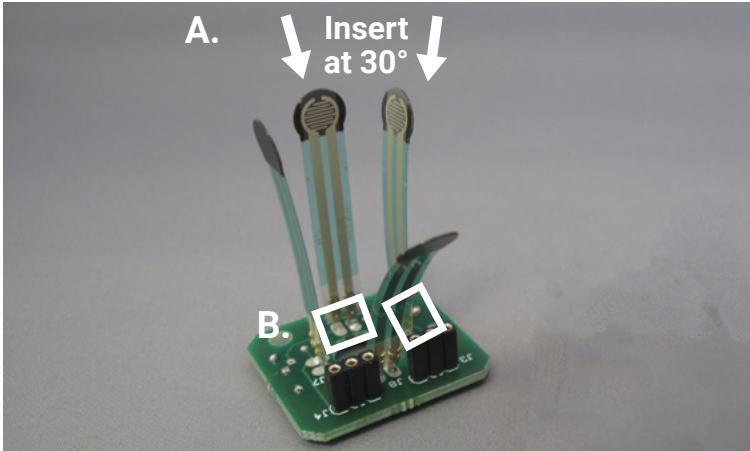
29

x 2

22.



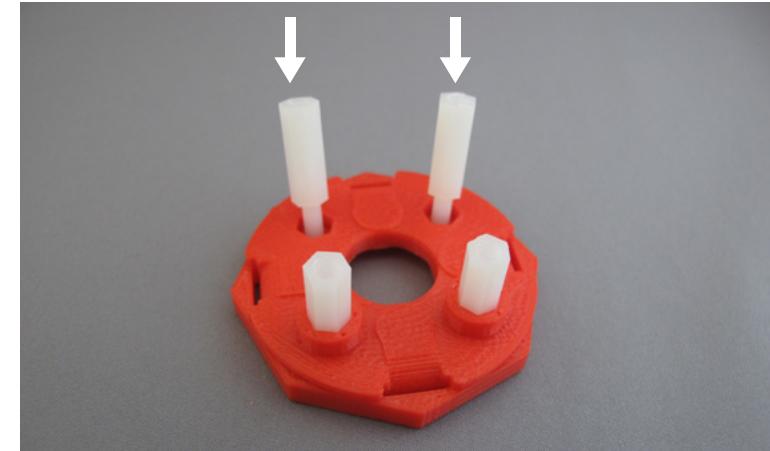
23.



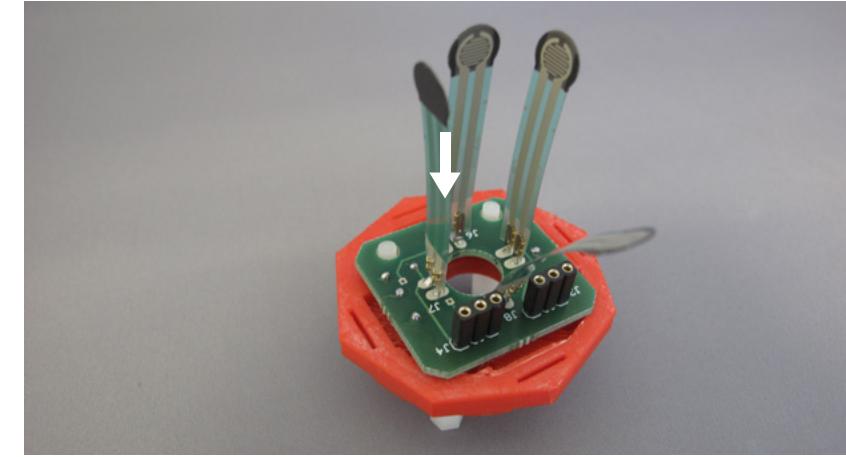
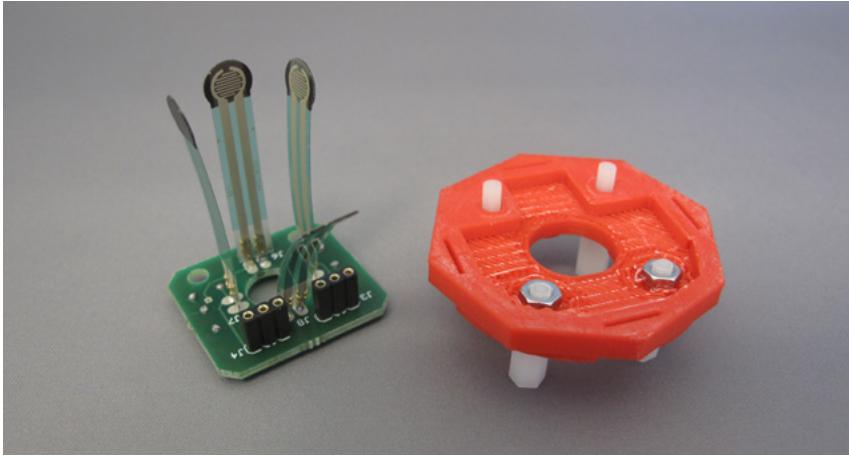
x 4

33  
x 2

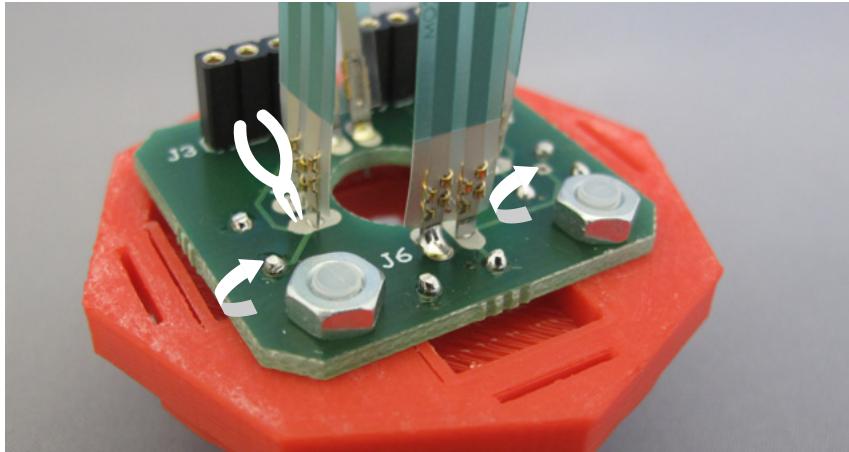
24.



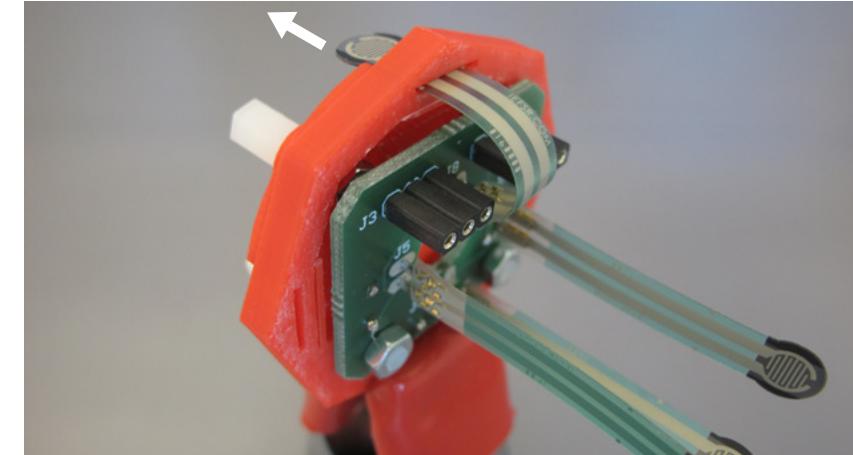
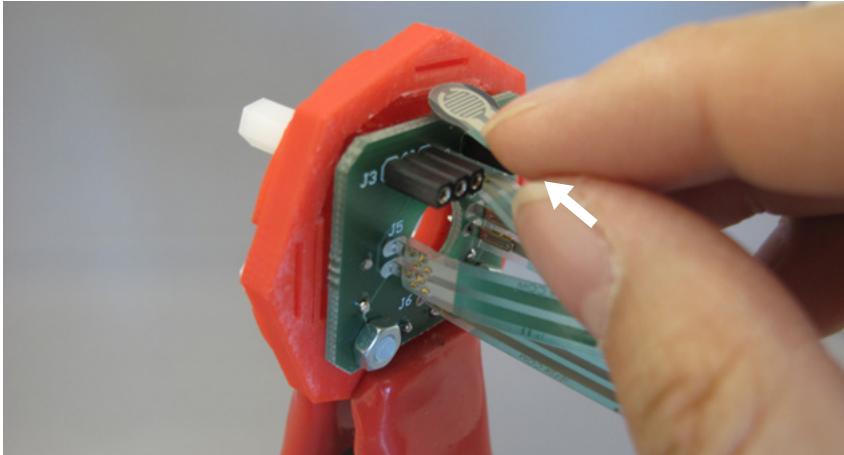
**25.**



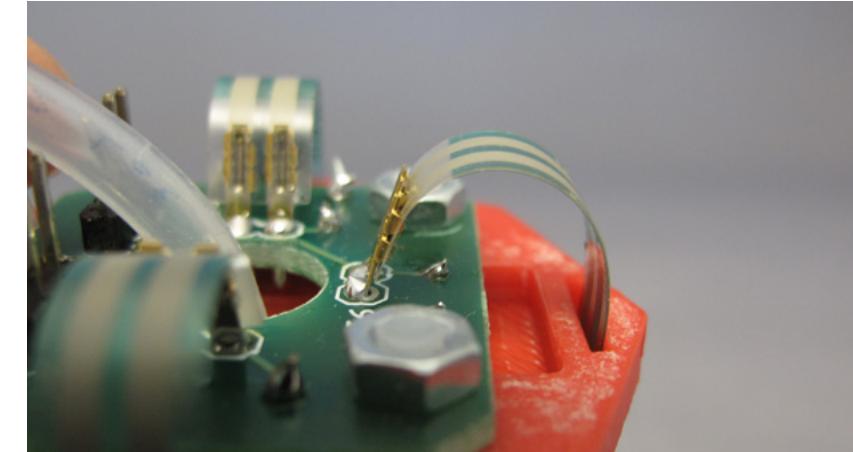
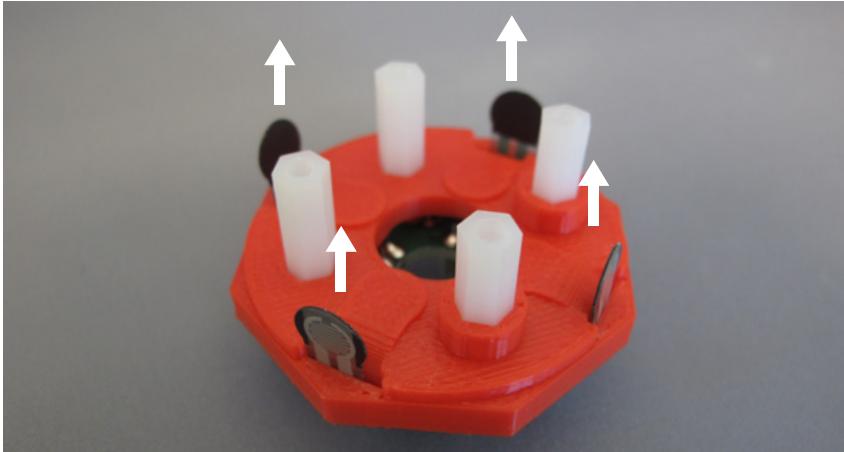
**26.**



**27.**

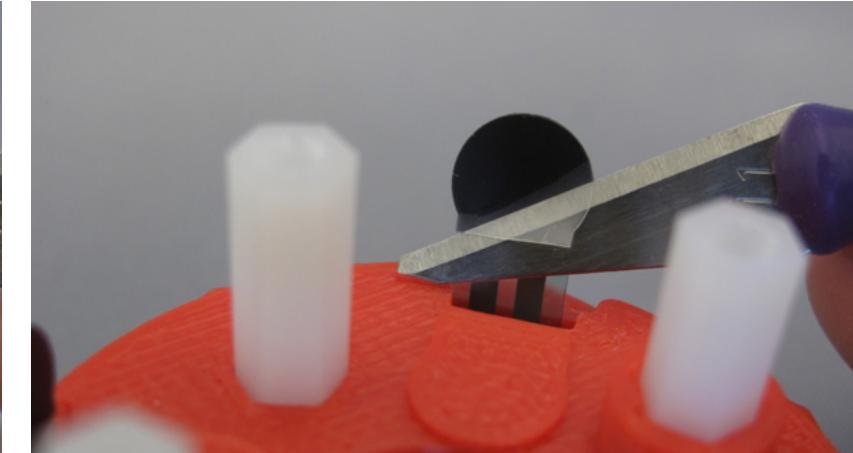
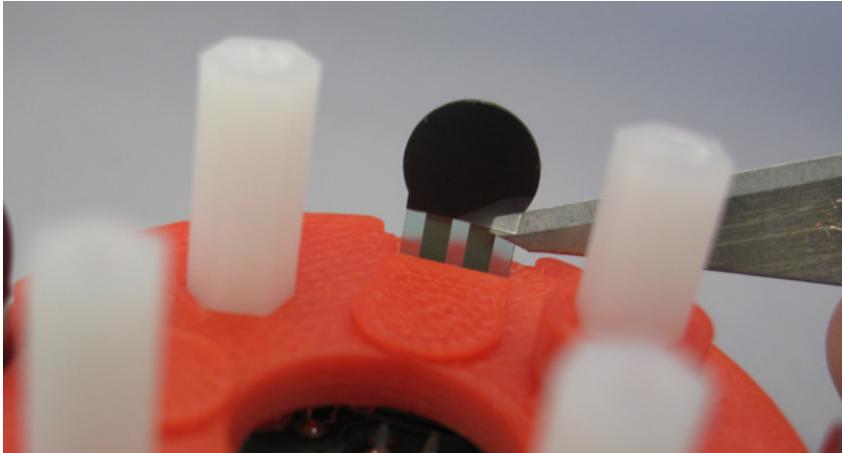


**28.**



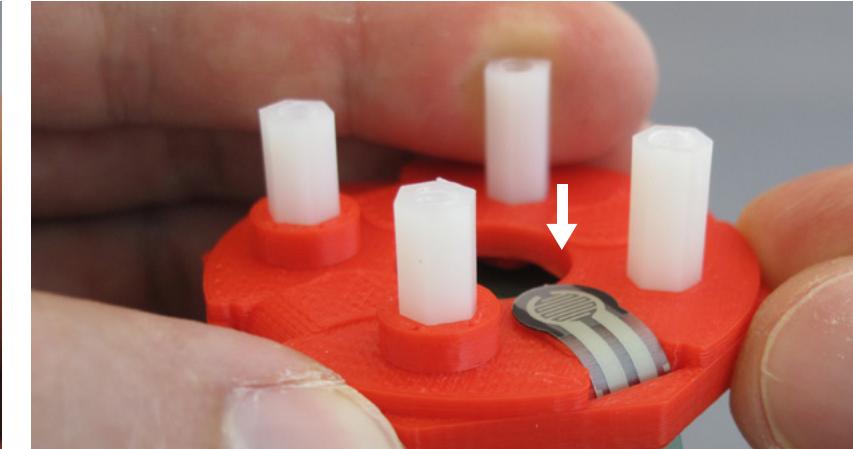
**NOTE:** On the back of each FSR is a clear adhesive lining. Carefully remove with a hobby knife.

**29.**

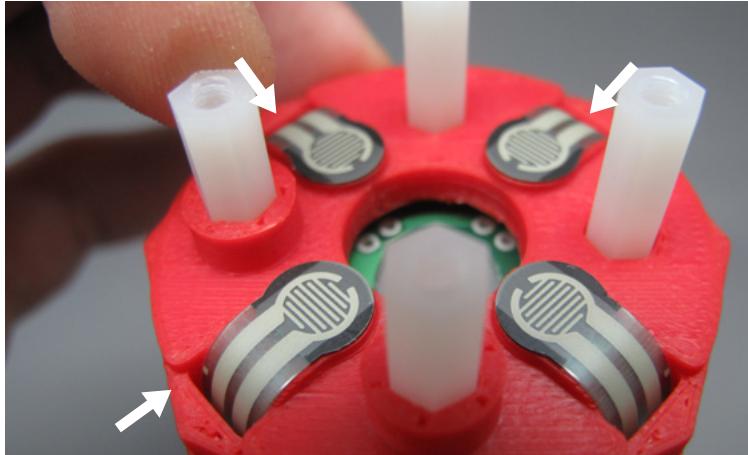


**NOTE:** On the back of each FSR is a clear adhesive lining. Carefully remove with a hobby knife.

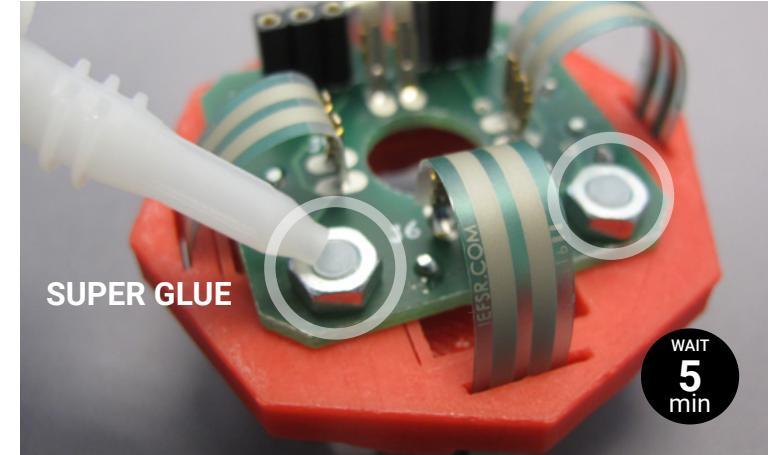
**30.**



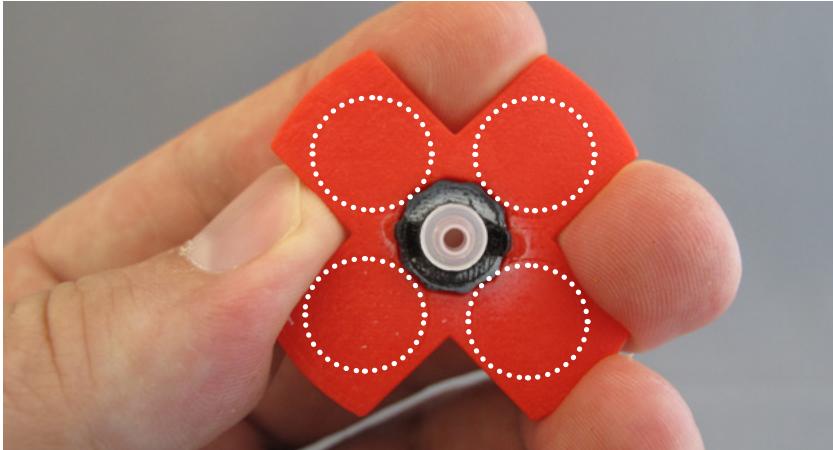
**31.**



**32.**

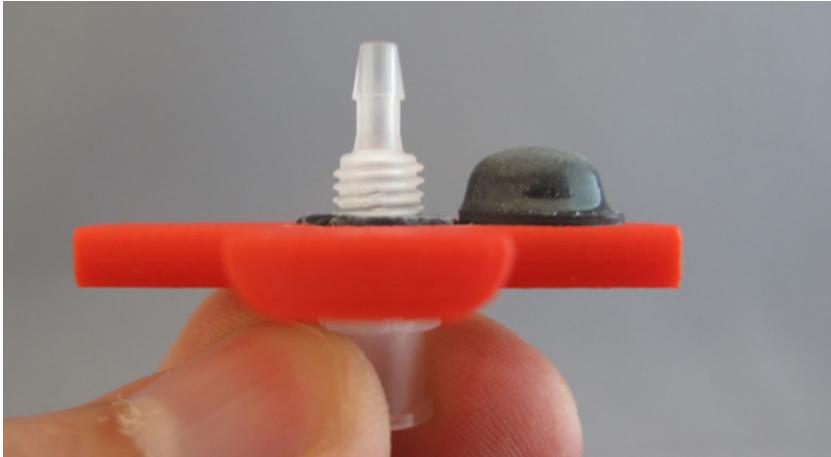


**33.**



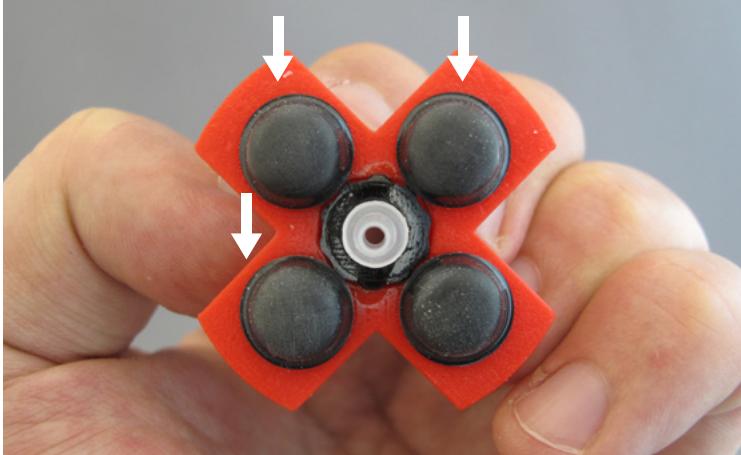
**NOTE:** On the flat side of the rocker are 4 circles. Place one bumper inside each circle.

**34.**

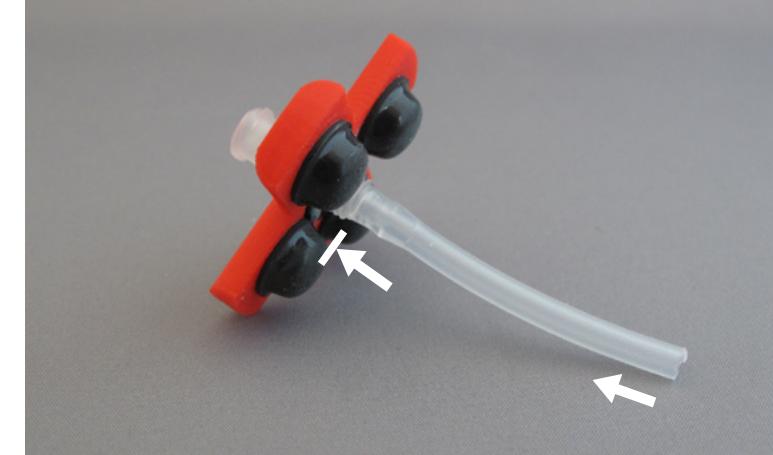


**NOTE:** Ensure the bumpers are oriented with the high point of each bumper pointed towards the centre. Stick them on the four circular outlines on the Joystick Rocker.

**35.**

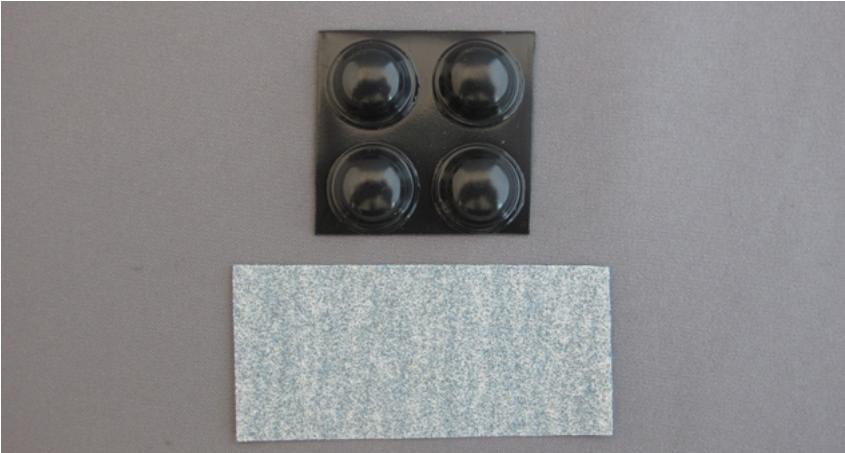


**36.**



**37**

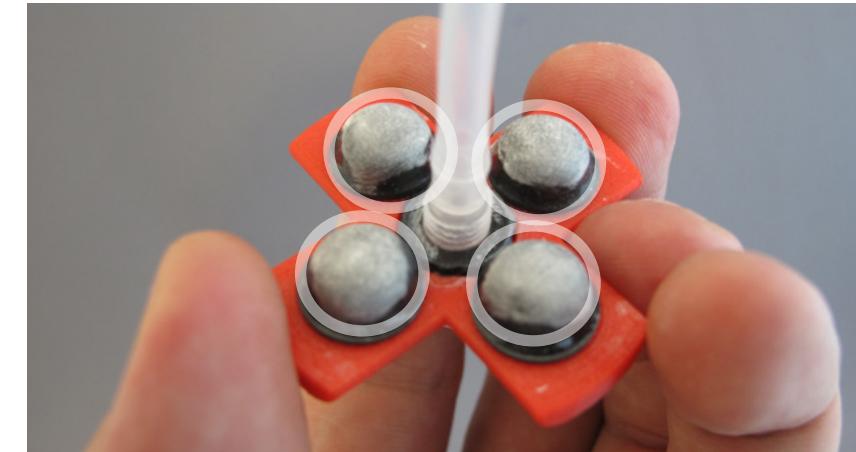
37.



35  
x 4



38.



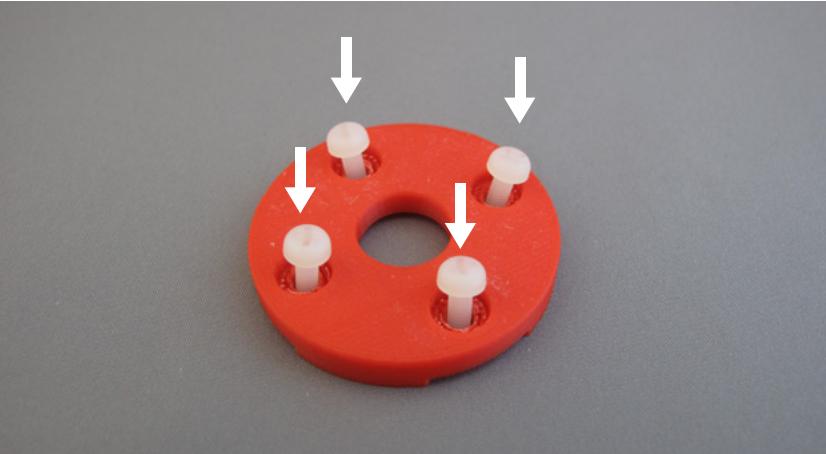
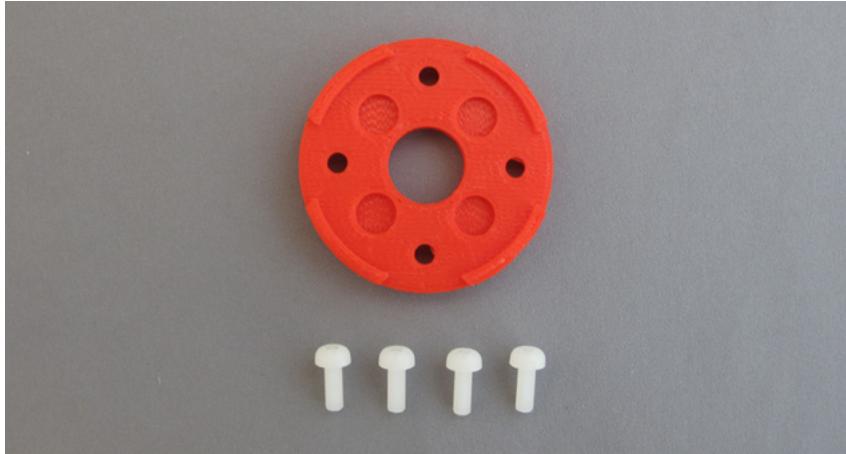
**NOTE:** Apply  
baby powder  
with your finger

23

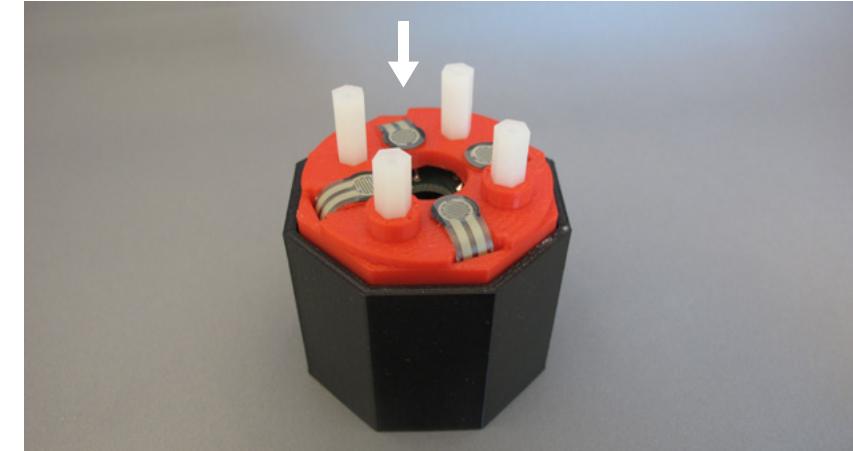
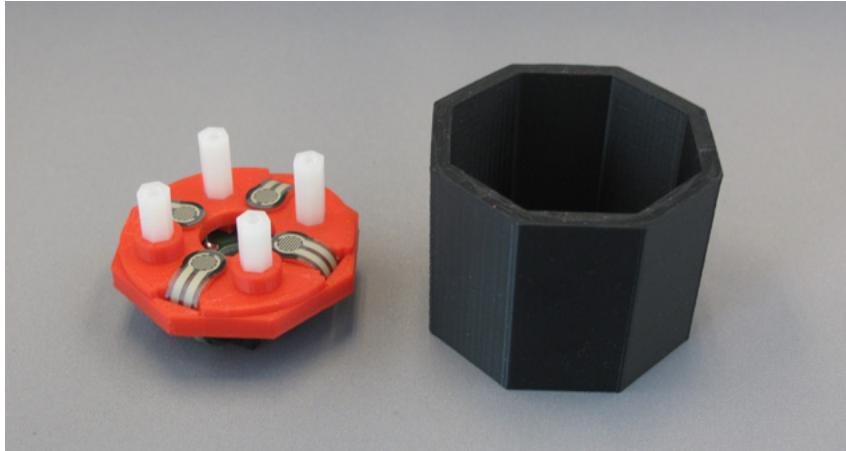
30

x 4

39.

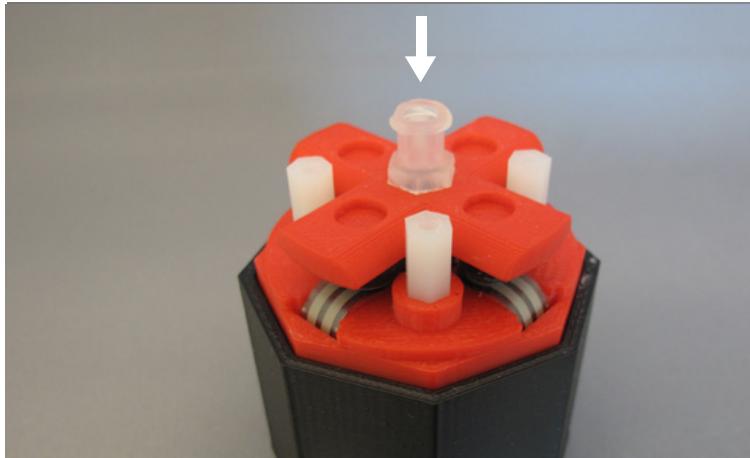


40.

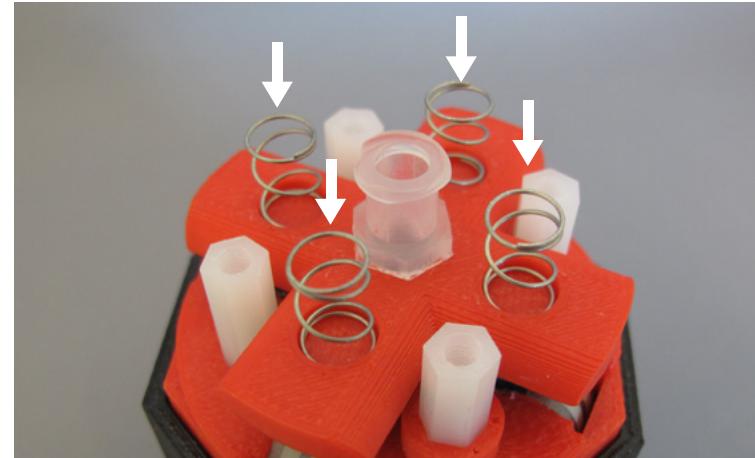


Use the joystick stand holder to assist with assembly for Steps 40 - 45

41.

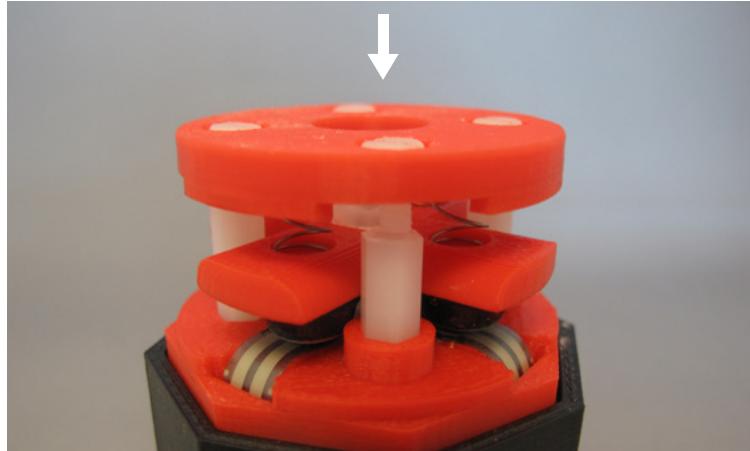


42.

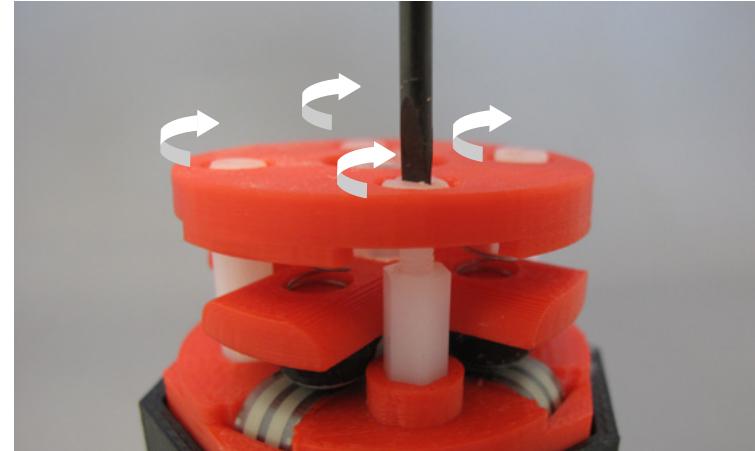


31  
x 4

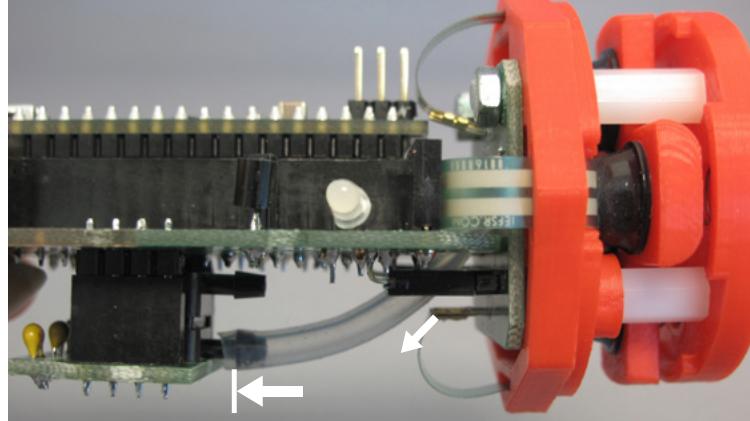
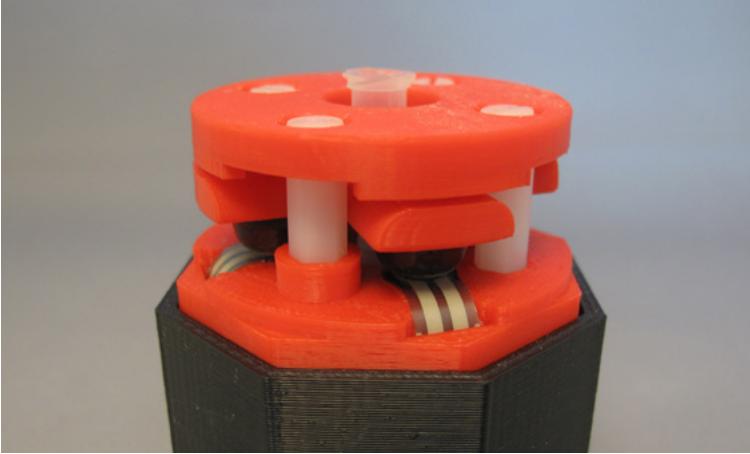
43.



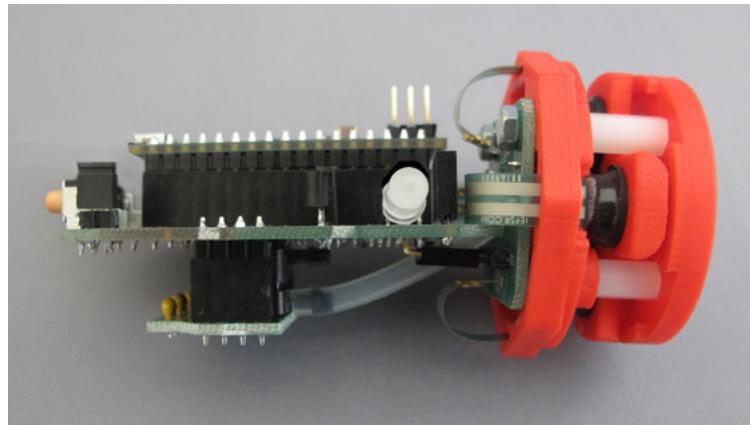
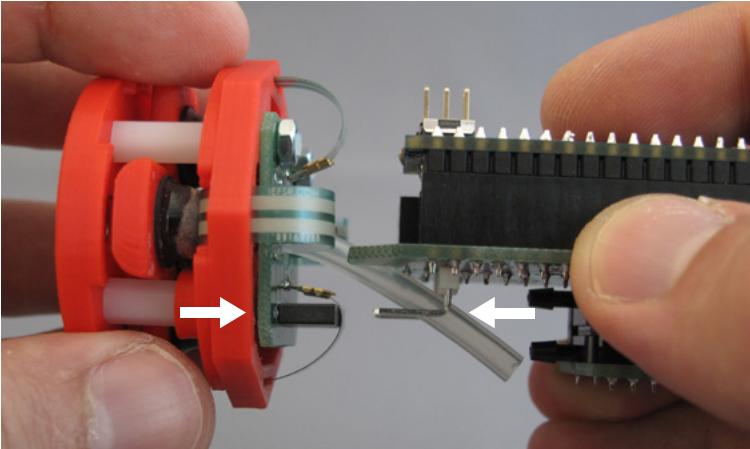
44.



**45.**



**46.**

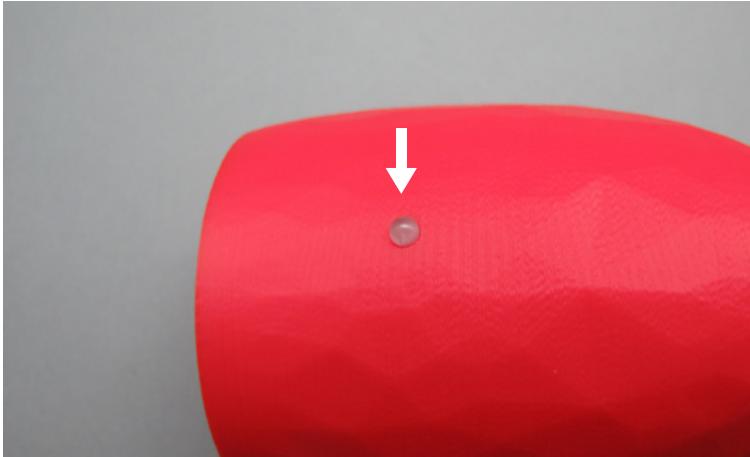


**47.**

# PART 6



01.



24

38

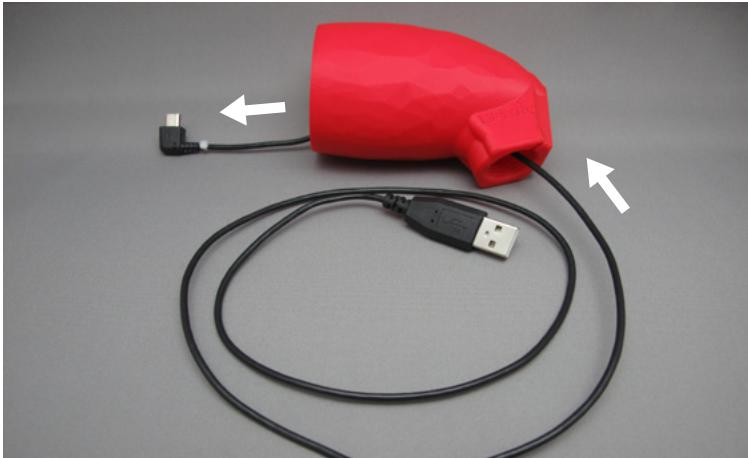
02.



41

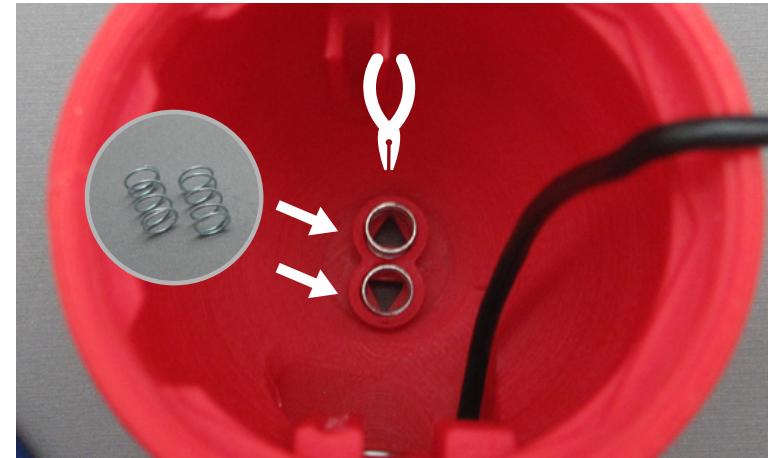
43

**03.**

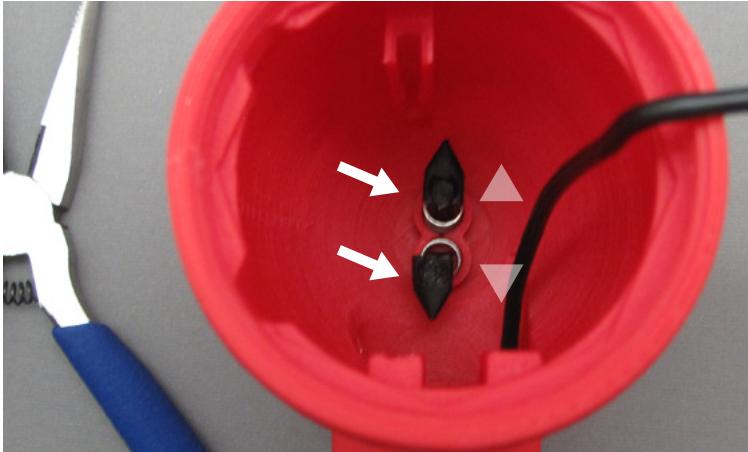


31  
x 2

**04.**

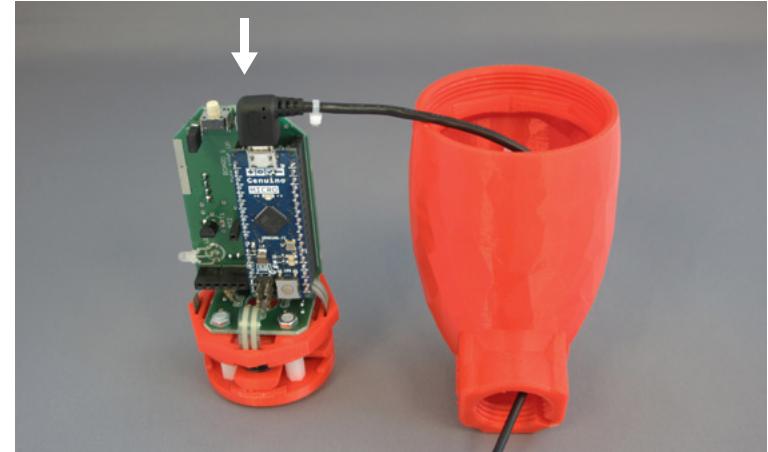


**05.**



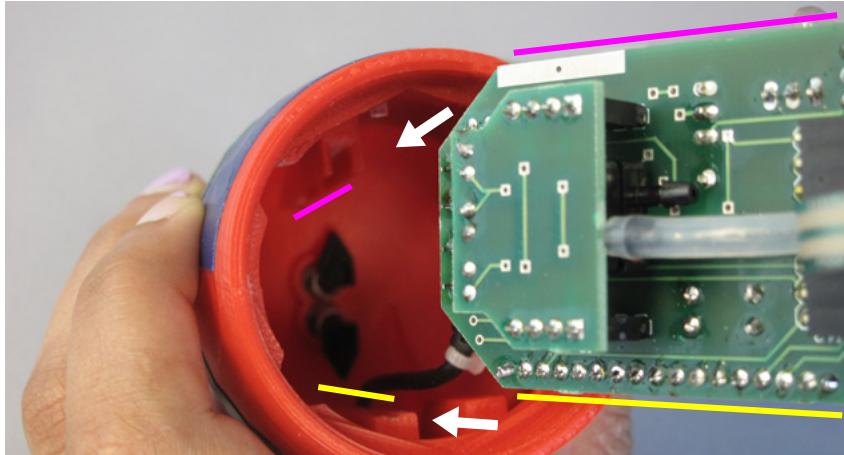
25  
x 2

**06.**

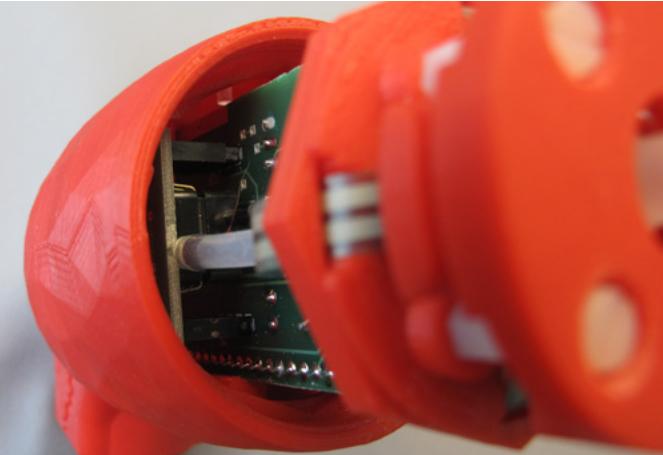


**CAUTION:** If need be, unplug the cable gently while holding onto the port.

**07.**



**NOTE:** Slide the assembly along the internal tracks in the rear chamber housing.



**08.**



**09.**



**CAUTION:** Twist on hand tight

**10.**



**CAUTION:** Twist on hand tight

**11.**



**CAUTION:** Twist on hand tight

**12.**

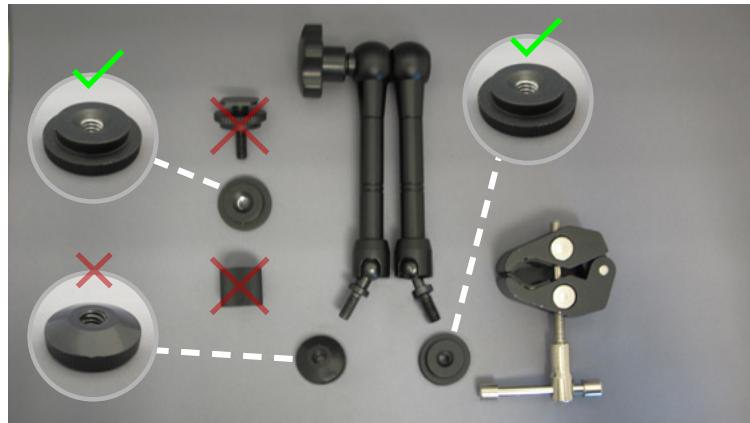
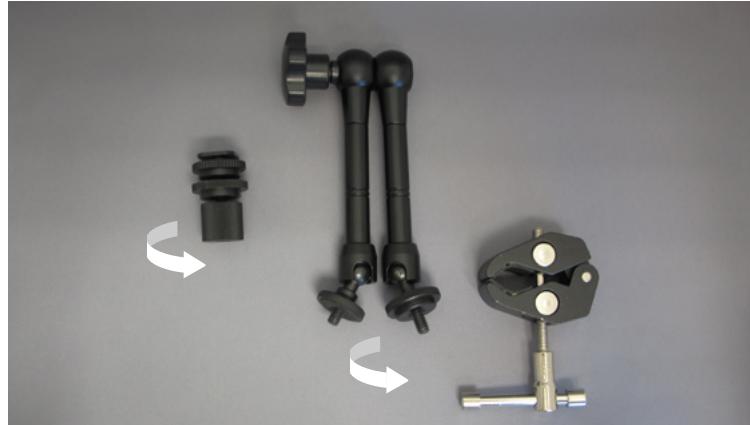


**13.**



# PART 7

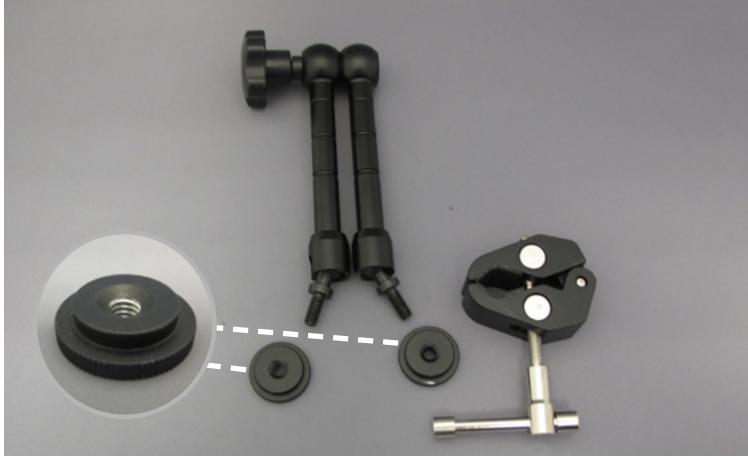
## (OPTIONAL) MOUNTING THE LIPSYNC



**01.**

**NOTE:** Keep the two pieces that are marked with a green checkmark above it. The pieces with a "X" will not be needed.

02.



03.



40

04.



05.



**06.**



**07.**



**08.**



**09.**



# PART 8

## SETTING UP THE DEVICE

**It is essential that the following steps are completed in the listed order to ensure that your device is properly set up before first using**

- A. Upload the microcontroller code.
- B. Calibrate the joystick.
- C. Read through the Startup Guide for complete information on using the LipSync:  
<https://hackaday.io/project/13424/files>

**NOTE:** In the startup guide is information about device compatibility, mounting, sip-and-puff functions, and speed control among others.

### A - UPLOADING THE MICROCONTROLLER CODE

1. Download and install the latest version of Arduino IDE:  
<https://wwwarduino.cc/en/main/software>
2. Download and save the latest LipSync microcontroller code:  
[https://raw.githubusercontent.com/makersmakingchange/LipSync/master/Software/LipSync\\_Firmware/LipSync\\_Firmware.ino](https://raw.githubusercontent.com/makersmakingchange/LipSync/master/Software/LipSync_Firmware/LipSync_Firmware.ino)

Right-click on the hyperlink of microcontroller code, select "Save Target As" (Internet explorer) or "Save Link As" (Chrome or Firefox) and save the microcontroller code (LipSync\_Firmware) to the computer directory or folder of your choice.

3. Open the Arduino IDE and click on **Tools** → **Board** → **Arduino/Genuino Micro**
4. Connect to the PC using the LipSync USB cable.
5. Click on **Tools** → **Port**
6. Click the right arrow at the top left of the Arduino IDE to upload the microcontroller code to the LipSync device.
7. Once upload is complete, a message saying "Upload Successful" will show at the bottom left of the Arduino IDE.

## B - JOYSTICK CALIBRATION

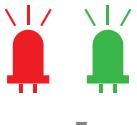
Calibrate your LipSync joystick before first using your device.

**IMPORTANT:** Allow the LipSync to initialize for 3 seconds before moving the mouthpiece each time after it's plugged into a device.



1

Press both speed adjustment buttons on the back of the LipSync for a few seconds until LED comes on



x 5

2

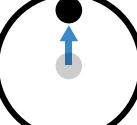
LED slowly blinks red & green 5 times



3 sec.  
pause



x 6



3

While LED blinks green 6 times, move the mouthpiece to the 12 o'clock position (up direction)



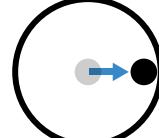
x 1

4

LED blinks red 1 time when position is measured



x 6



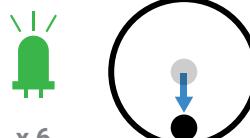
5

While LED blinks green 6 times, move the mouthpiece to the 3 o'clock position (right direction) time when position is measured



x 1

6



7

While LED blinks green 6 times, move the mouthpiece to the 6 o'clock position (down direction) time when position is measured

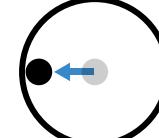


x 1

8



x 6

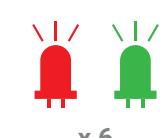


9

While LED blinks green 6 times, move the mouthpiece to the 9 o'clock position (left direction) time when position is measured



x 1



11

LED rapidly blinks red and green 6 times when calibration is complete