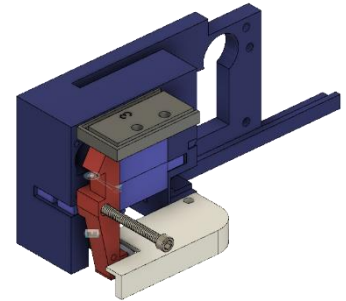
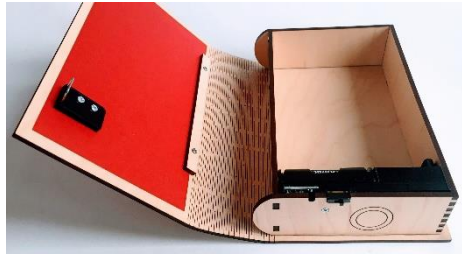
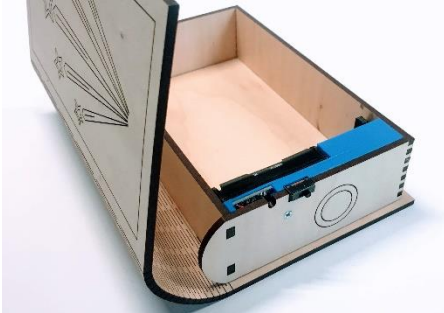


SECRET KNOCK BOX Kit Assembly Tutorial

Version 3.0.0. November 2018

<https://fabforgefive.com/secret-knock>



For Important Stuff

The SECRET KNOCK BOX is a keepsake box that only opens when its owner taps their custom secret knock. The knock can be reprogrammed at any time. The box is powered by 3 AAA batteries, and uses an Arduino Pro Mini, a piezo pickup (knock detector), a sub micro servo (latch release), and custom 3D printed and laser-cut parts.

To open the box

Demonstrated in this [video](#). Slide the power switch to the right. Listen for two buzzes. Now tap your secret knock on or near the circle on the bottom. If your knock is wrong, the book will buzz. If correct, the book will spring open.

To set a new secret knock

Open the book with the old knock. With the power on, push and hold the inside button. Tap your new knock. The box LED will blink the knock back to you, then save your new knock to memory for the next time you use the box. The Arduino will save your new knock into its EEPROM memory, where it will stay unless you change it again.

The Arduino code (sketch) contains code from [Secret-Knock Gumball Machine](#) written by [Steve Hoefler](#), used with permission. Steve's Gumball Machine was the first Arduino project that my kids and I built, and was the gateway to many exciting family projects over the years. Thanks Steve for the inspiration!

Parts List

- Laser-cut Box, 1/8" plywood (included in Fab Forge Five kit, otherwise see file download link below to laser cut your own box)
- 3D Printed Base, Latch, Guard, and Keeper (included in Fab Forge Five kit)
- Vibrating Mini Motor Disc 10mm diameter [Digikey Part # 1597-1245-ND](#)
- Arduino Pro Mini 328 - 3.3V/8MHz (many sources – Sparkfun, Adafruit, Arduino store)
- Piezo Disc Element 27mm diameter with wires (many sources – eBay, Banggood, Amazon)
- Micro Servo SG90 9g (many sources – Amazon, eBay, Tower Hobbies)

- Tactile Button Switch (6mm tall) [Adafruit Part # 1490](#)
- AAx3 battery holder w/9v snaps [Parts Express Part # 140-776](#)
- SPDT sub-mini Slide Switch 3 amp [Adafruit Part # 805](#)
- Screw - #2-56 x 3/4 Pan Head [McMaster-Carr Part # 90272A084](#)
- Screw - #2-56 x 1/4" Flat Head (6) [McMaster-Carr Part # 90273a055](#)
- Screw - #2-56 x 3/8" Flat Head [McMaster-Carr Part # 90273A065](#)
- Paper Clip - Large (1 3/4" – 2" long, [Office Depot](#) and many other sources)
- Safety Pin - Extra Large (1 1/2" – 2" long, [Office Depot](#) and many other sources)
- Brass Sheet – 0.010" thick (many sources – K&S, eBay, Amazon), cut into two strips:
 - 2 Brass Strips – 15mm x 4mm, folded as shown in tutorial
- 470K ohm resistor, 1/8 watt (many sources – eBay, Amazon, Adafruit)


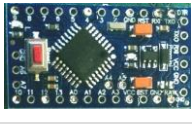
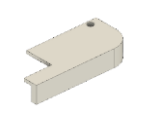

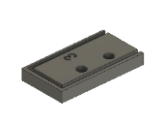

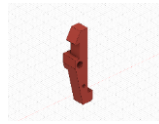















Complete kit (including 3D printed parts, Laser Cut box, and all parts listed above) can be purchased at <https://fabforgefive.com/store>

Tools/Supplies

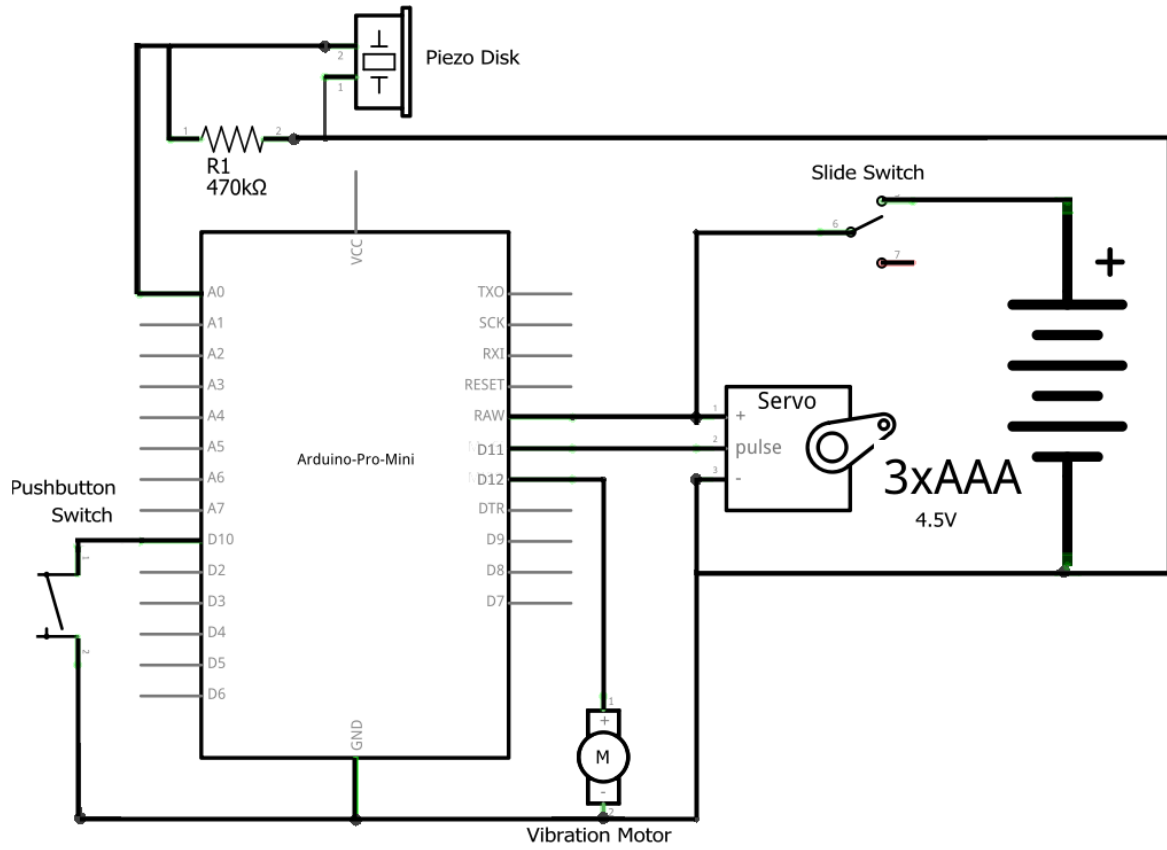
- Small needle nose pliers
- Wire strippers
- Phillips screwdriver - small
- Soldering iron (with fine, pointed tip)
- Magnifying glass (not necessary but often helpful)
- Rosin-core Solder (thin – you'll be soldering small things. We like 0.03 diameter)
- Ruler with millimeter markings
- 3 AAA batteries

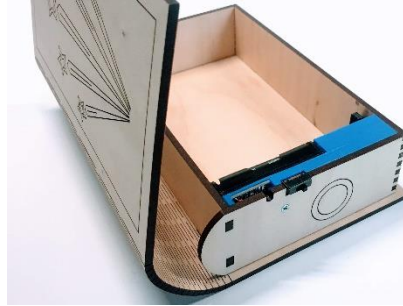
Parts List: SECRET KNOCK Box V3

Version 3.0

Item #	Part Name	Qty	Picture (part colors may vary)	Item #	Part Name	Qty	Picture (part colors may vary)
1	Base	1		12	Arduino Pro Mini 328 - 3.3V/8MHz	1	
2	Guard	1		13	Vibrating Motor Disk 10mm diameter	1	
3	Keeper	1		14	Servo with horn and screw	1	
4	Latch Arm	1		15	Book Box (with add'l small wooden spline part)	1	
5	Pushbutton Switch	1		16	Screw - #2-56 x 3/8" Flat Head	1	
6	Battery Holder 3xAAA	1		17	Screw - #2-56 x 1/4" Flat Head	4	
7	Slide Switch	1		18	Screw - #2-56 x 3/4" Pan Head	1	
8	Piezo Element 27mm	1		19	470K ohm 1/4 watt resistor	1	
9	Safety Pin - Extra Large 1 1/2" - 2" long	1		20	Paper Clip - Large (1 3/4" - 2" long)	1	
10	Kit Insert	1		21	Instruction Card	1	
11	Printed Circuit Board	1		22	Small Brass Strip 15mm x 4mm, bent	2	

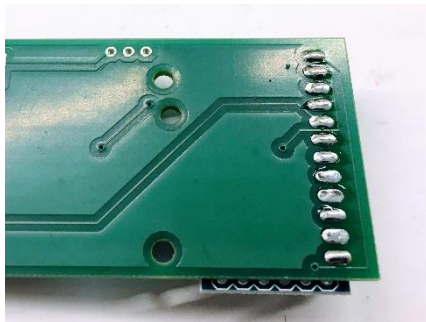
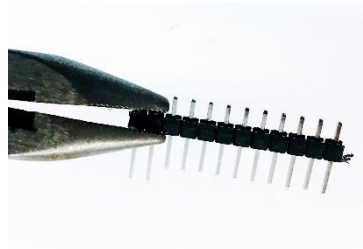
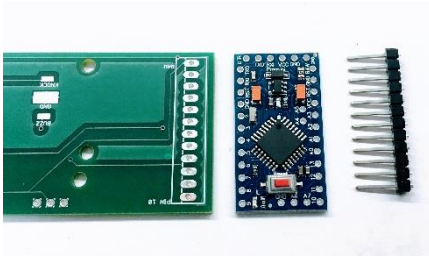
Schematic



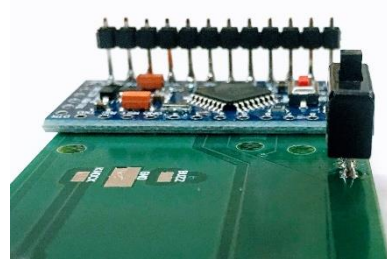
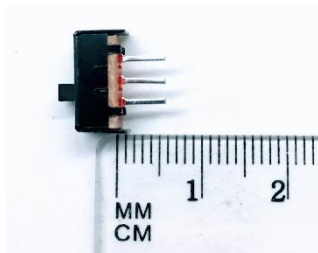


Build Instructions

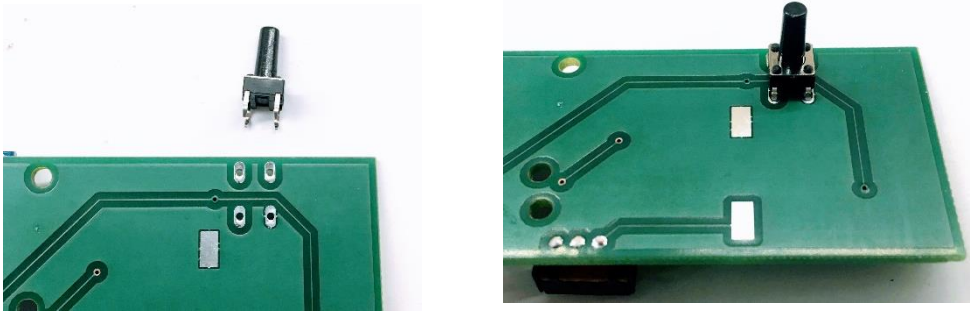
1. Load the Secret Knock Box sketch onto the Arduino Pro Mini, using the Arduino IDE (see this [tutorial](#) for help). NOTE: If you purchased a [kit](#) from Fab Forge Five, this has already been done for you.
2. Using a pair of pliers, slide the connector pin keeper to one end of the pins as shown. Solder the Arduino Pro Mini to the PCB as shown. The Arduino goes on the text side of the PCB. Keep the pins nice and flush on the bottom of the PCB as shown. Best technique is to solder on both sides to make sure the connections are solid.



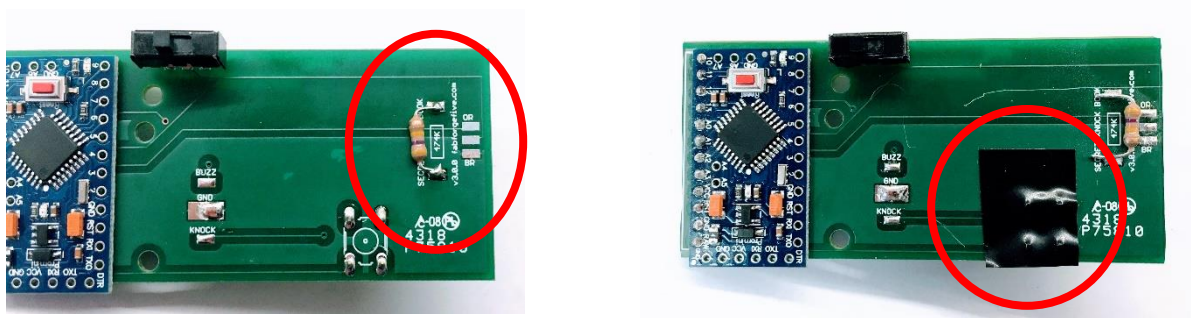
3. Clip the Slide Switch pins to 5mm length. Solder the switch to the PCB as shown. As with the Arduino, keep the switch pins flush with the bottom of the PCB.



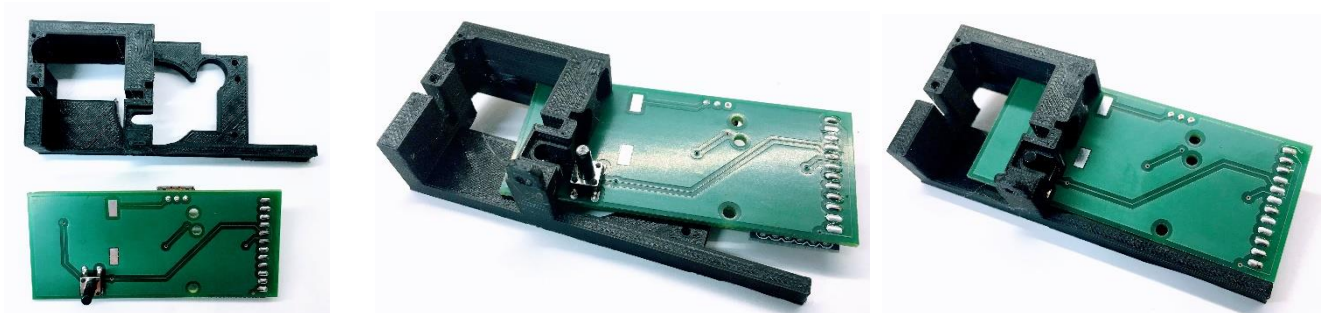
4. Insert the Pushbutton Switch on the bottom side of the PCB (opposite the Arduino and Slide Switch), and solder as shown.



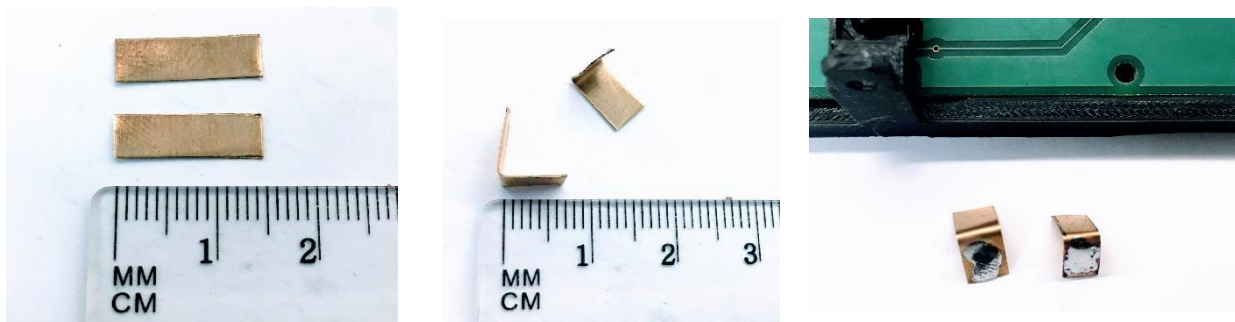
5. Bend and trim the pins of the 470K Ohm Resistor, and solder to the Arduino side of the PCB as shown. Place a small piece of electrical tape (or scotch tape) over the Pushbutton contacts as shown.



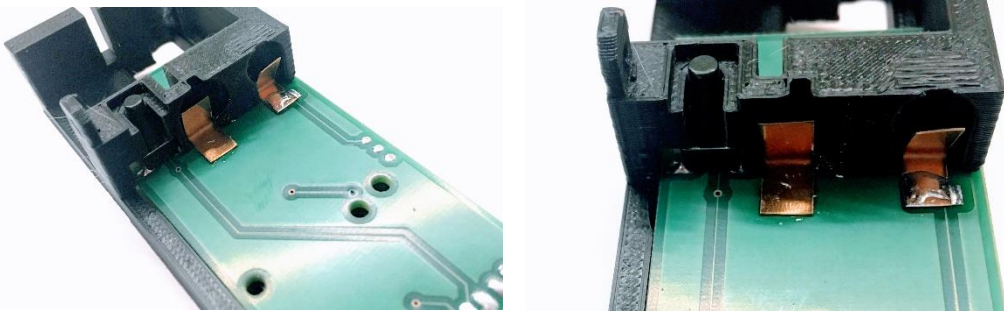
6. Insert the PCB assembly into the 3D printed Base as shown. Start at an angle, then carefully slide the entire assembly into the Base. The right side of the PCB should be flush with the right side of the Base.



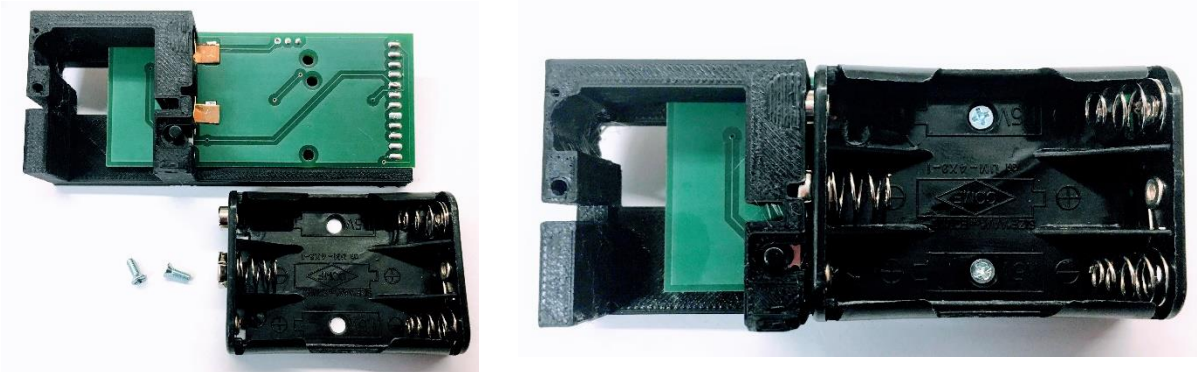
7. Cut two brass strips 4mm x 15mm, and bend into contacts as shown. Solder-tin contact on one side as shown.



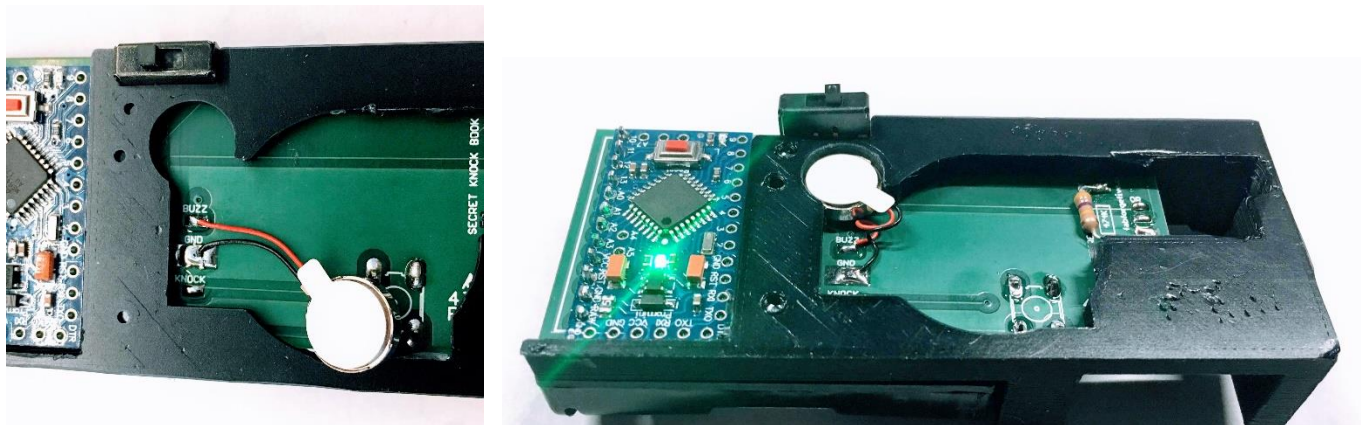
8. Slide the two brass contacts into place on the PCB as shown. Slide them into the recesses on the Base and make sure they're tight against the Base. Solder both contacts to the pads on the PCB.



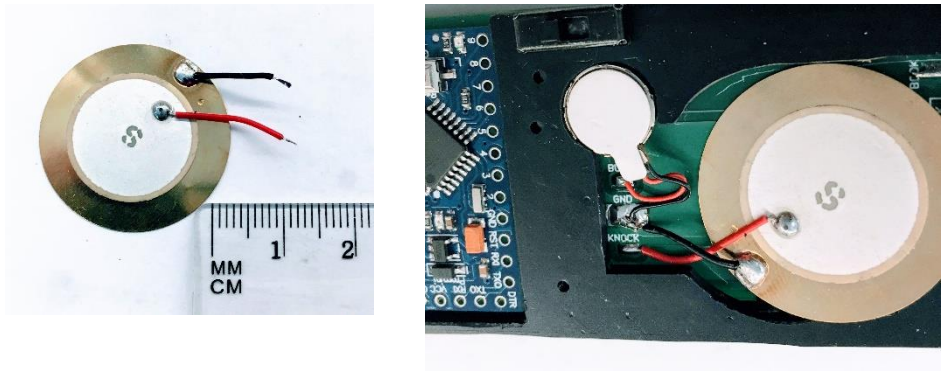
9. Insert the Battery Holder into the Base recesses and use two #2-56 x 1/4" Flat Head screws to mount the Holder (through the PCB holes) to the Base as shown. The screws fasten into the holes on the Base.



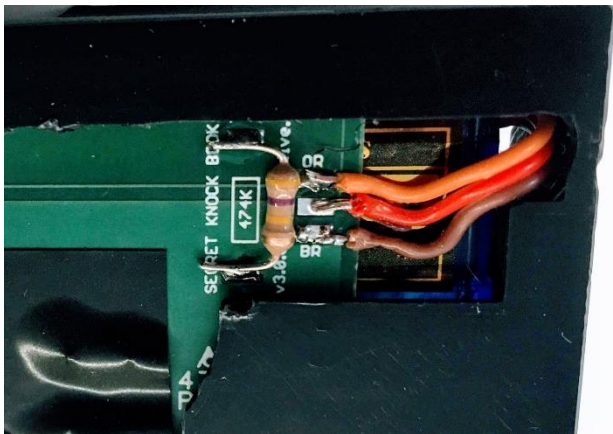
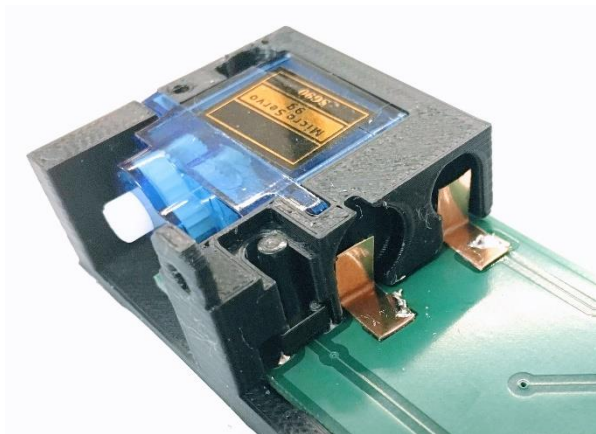
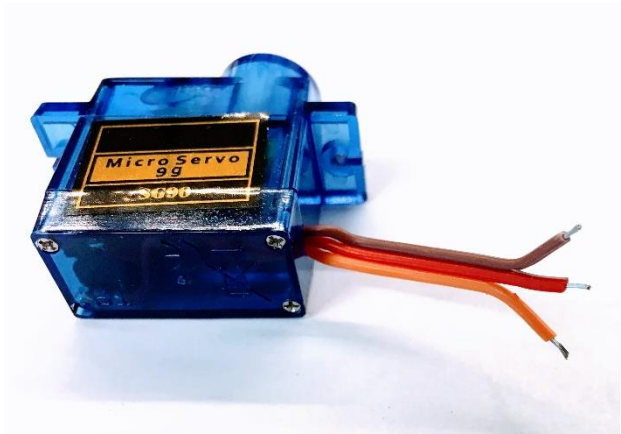
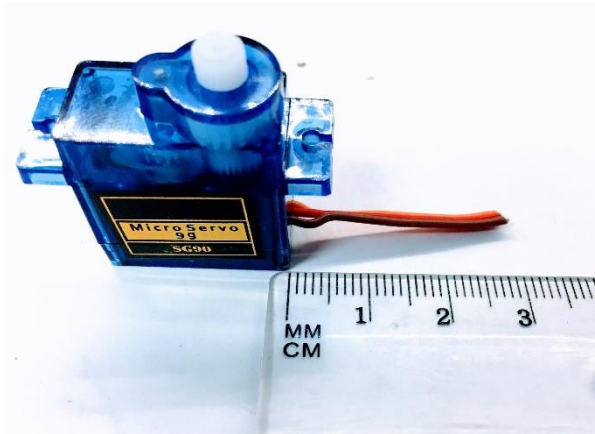
10. Solder the Vibrating Motor Disk to the PCB as shown. The red wire connects to the Buzz pad, the black wire connects to the GND pad. Insert the Disk into the recess in the PCB as shown. This is a good time for a quick self-test. Insert 3 AAA batteries into the Battery Holder, then turn on the Slide Switch. The Arduino power LED should light, and the Disk should buzz. If this doesn't happen, check the Battery Holder contacts to make sure they're touching the Battery Holder connectors. Turn off the power before moving on to the next step.



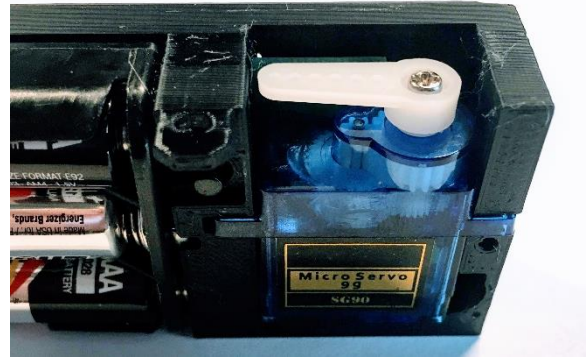
11. Trim the Piezo Element wires as shown, then solder the Piezo to the PCB. The red wire connects to KNOCK. The black wire connects to GND (with the Vibrating Motor Disk wire that was previously connected). Insert the Piezo into the circular recess in the Base. It doesn't matter which side of the Piezo faces out.



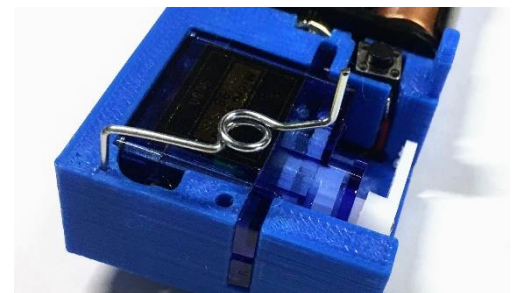
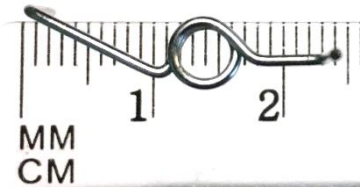
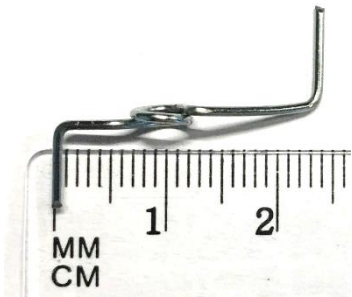
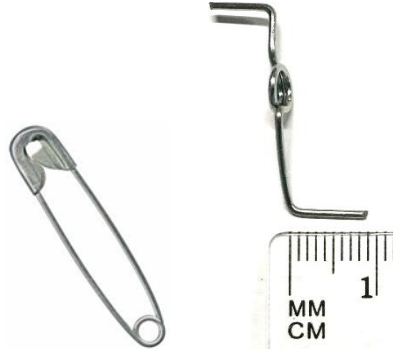
12. Trim and strip the Servo wires as shown. Insert the Servo into the Base, wires first, then slide the Servo down until it sits against the PCB. Solder the Servo wires to the PCB as shown. Be very careful to solder each wire to the correct pad, as shown in the photo.



13. Turn on the power with the Slide Switch. The Servo should set itself to the proper zero (box locked) position. This happens quickly, but you should see (or feel or hear) the servo adjust itself by spinning a few degrees. Make sure this happens – you can turn the power off and on again if you didn't notice the first time. Once the Servo has set its proper position, attach the Servo Horn as shown. If the Servo doesn't set itself, or doesn't spin at all, check your connections.



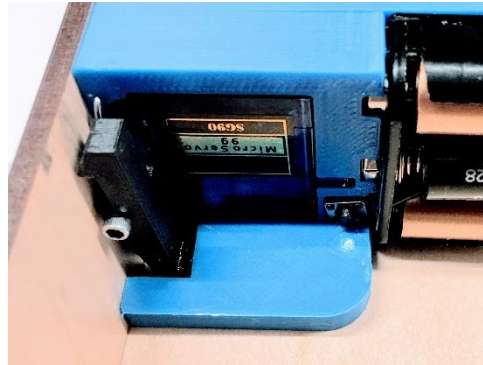
14. Bend and trim the Safety Pin into the shape as shown. Insert one end into the small hole in the Base, then slide the Latch onto the other end (the Latch has a small hole as well). Fasten the Latch to the Base with the #2-56 x 3/4 Pan Head screw. The screw goes through the middle of the Safety Pin ring. Tighten the screw enough to leave a 4mm space between the Latch and the Base. The Latch should pivot freely on the screw.



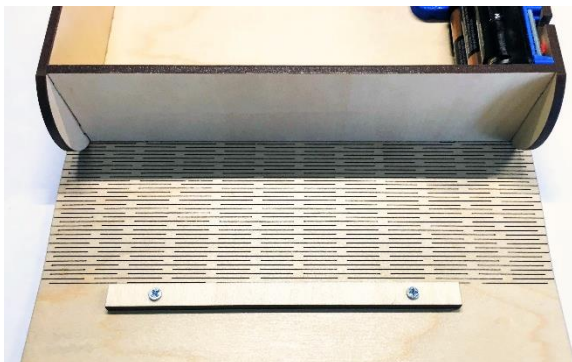
15. You can now test the entire assembly before you mount it into the Box. Power it on and tap a knock on the Piezo Disc with your fingernail. The default knock is “tap...tap tap” as shown in the demo [video](#). That knock should cause the Servo to rotate against the Latch, pushing it enough to release the Box lid. The Servo then returns to its locked position to wait for another knock.
16. Insert the entire assembly into the Box and fasten with a #2-56 x 1/4" Flat Head screw.



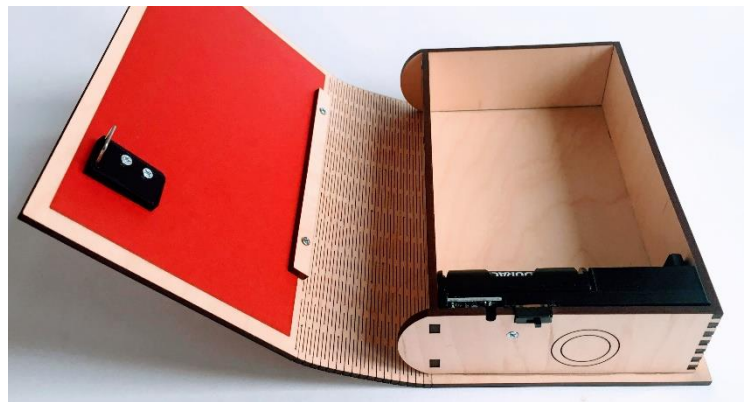
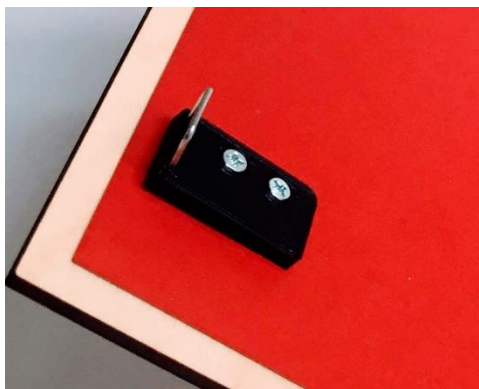
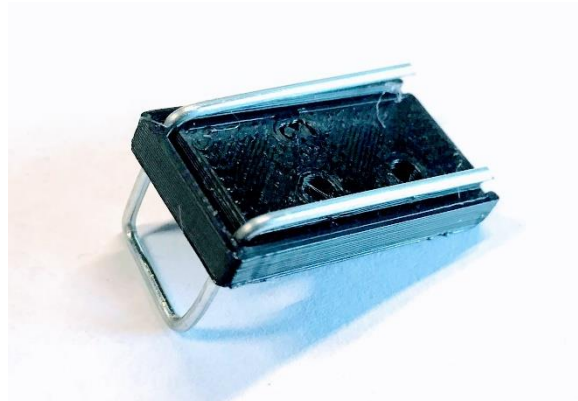
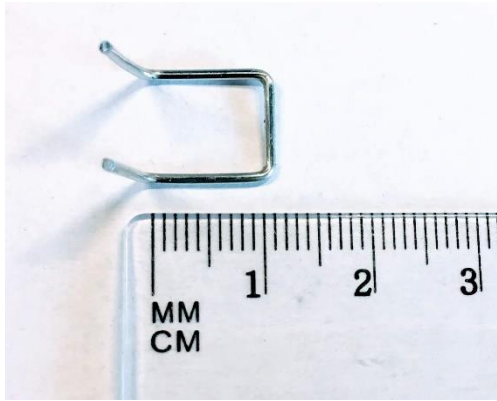
17. Place the Guard as shown and fasten from the bottom of the box with the #2-56 x 3/8" Flat Head screw. The screw goes through the Base lug into the Guard. The Guard makes sure the Servo Horn can rotate, and not get jammed by the important stuff you put in the Box.



18. Fasten the Spline to the Box using two #2-56 x 1/4" Flat Head screws.



19. Bend the Large Paper Clip as shown and insert it into the Keeper. If you purchased the Diamond Box option, insert the backing cardboard by sliding it under the Spline, then tighten the Spline screws. Mount the Keeper assembly to the box cover with two #2-56 x 1/4" Flat Head screws. The Paper Clip acts as the clasp for the Latch to grab onto. Close the box slowly and watch the clasp. Bend it as needed until it catches properly on the Latch when the Box is closed.



20. Congratulations! Your Secret Knock Box is done. Follow the instructions below if you wish to program your own custom knock. When you tap your knock, you can tap loudly almost anywhere on the Box. But tapping in the circle on the end of the Box works best, since that's where the Piezo Disc is.

To open the box

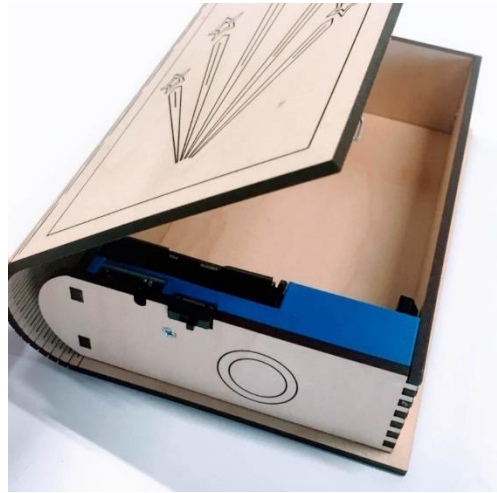
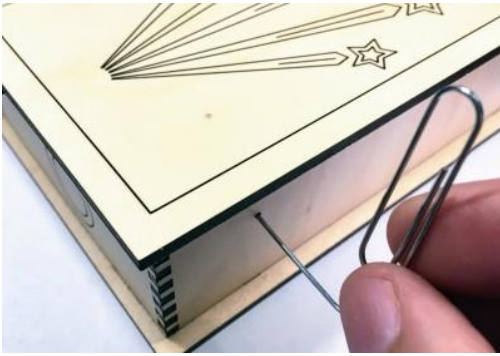
Demonstrated in this [video](#). Slide the power switch to the right. Listen for two buzzes. Now tap your secret knock on or near the circle on the bottom. The default knock is "tap...tap tap". If your knock is wrong, the book will buzz. If correct, the book will spring open (the laser cut living hinge is nice and springy).

To set a new secret knock

Open the book with the old knock. With the power on, push and hold the inside button. Tap your new knock. The box LED will blink the knock back to you, then save your new knock for the next time you use the box. The Arduino saves the knock into its EEPROM memory, where it will stay unless you change it again.

If you forget your knock, or if the batteries are dead

Push a straightened paper clip into the secret hole in the side of the box and push gently. The latch will release.



Troubleshooting

I installed fresh batteries and turned on the Box. But nothing happens.

When the power is on, the power LED on the Arduino should be lit. If it's not, the buttons on the battery holder may not be contacting the brass strips. Remove the battery holder and bend the strips slightly. Replace the holder and try again.

The Arduino power LED is lit, but the box doesn't buzz. Or the Servo doesn't move.

Check the wiring from the Vibrating Disk and the Servo. Are the wires firmly soldered to the Arduino?

The box isn't responding to my knocks.

When you tap the box, the indicator LED on the Arduino should blink. You can see this LED through the small hole to the left of the power switch. If this LED doesn't blink when you tap the end of the box, check the connections on the Piezo Disc (including the 470K ohm resistor). Without the resistor, the piezo signal is very unpredictable. Also check to see that the Piezo Disc is nice and loose in it's hole in the Base. This seems to help.

The Servo rotates when I tap my secret knock, but the box doesn't unlatch.

Adjust the Catch that you fashioned with the paper clip. Try bending it closer to the outside of the box.

The box won't stay closed.

Adjust the Catch that you fashioned with the paper clip. Try bending it closer to the inside of the box.

Still stumped? Email us at admin@fabforgefive.com



<https://fabforgefive.com/>