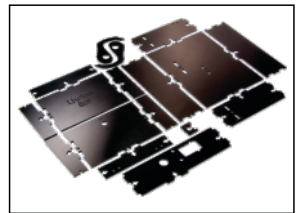
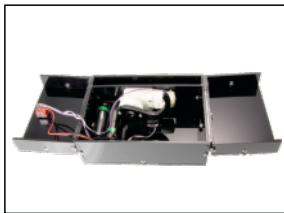


Useless Box

GM3 Hinge Edition



Want to make something Useless?

It's not quite *totally* useless, especially if you like flipping switches. This machine will happily fix your attempts to turn it on. See the feature articles and videos online at Youtube.com and Makezine.com.

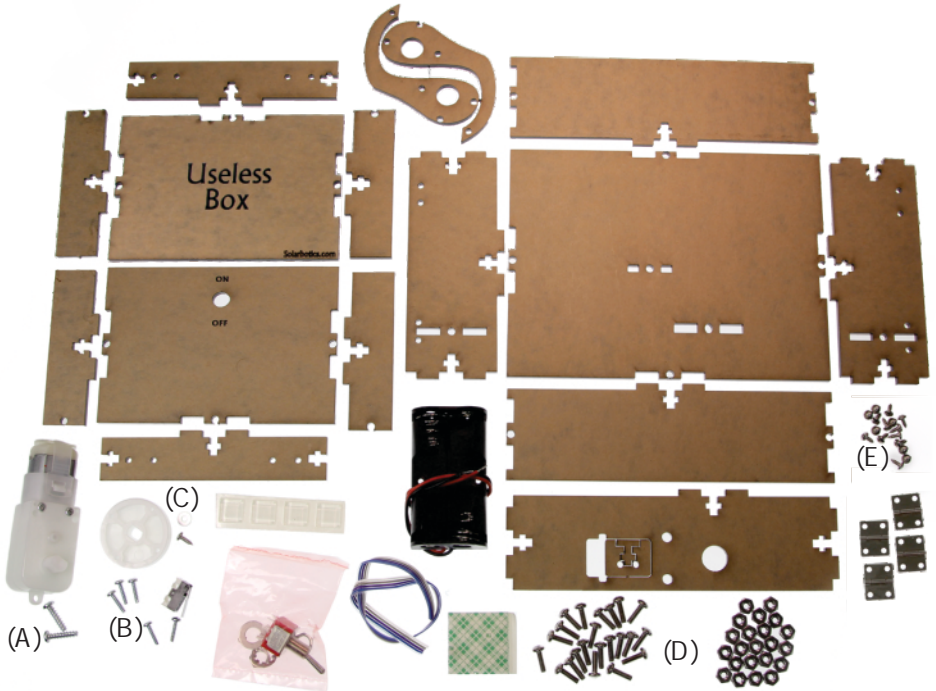


SOLARBOTICS[®]
Ltd

www.solarbotics.com
1-866-276-2687

USELESS BOX

PARTS LIST



- 1x Set of acrylic box parts
- 1x Motor set (GM3 motor and accessory wheel)
- 1x Double-pole, double-throw power switch
- 1x Single-pole, double-throw retract limit switch
- 1x 4-conductor ribbon wire
- 1x 2xAA battery pack
- 1x Double-sided sticky tape
- 4x Miniature hinges
- 4x Rubber feet
- (A) 2x #4 x 1/2" motor-mounting screws
- (B) 5x #2-32 x 3/8" limit switch / finger mounting screws
- (C) 1x #2 x 1/4" and #2 washer set for accessory wheel
- (D) 22x #4 x 3/8" bolts and #4 nut sets
- (E) 16x #2 x 1/4" hinge-mounting screws

Disclaimer of Liability

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TOOLS:

Assembly is quite straightforward, but you'll still need:

- Soldering equipment
- Wire cutters/strippers
- Philips #1 screwdriver
- Tape to assist with construction

WHAT THE HECK IS THIS?!?

Good question.

It is an illustration of the pointlessness of man's existence. A demonstration of the classic Greek sisyphean task (yes, we looked it up. Neat story; check it out) The ultimate in self-defeat.

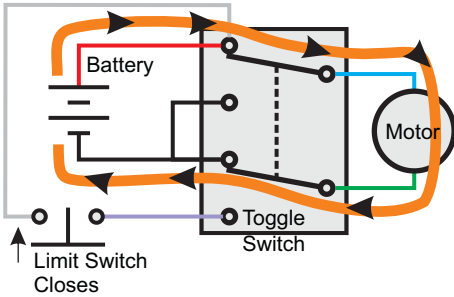
In short, you turn it on; it turns itself off. The ultimate in lazy, where the only energy expended is spent in making it as power-efficient as possible (ie: OFF!). No matter how you try to wake it, it does the equivalent of trying to crawl back into bed (perhaps it should be called the "Teenager-in-a-Box"?).

This circuit uses clever logic wiring to create this effect, which has roots waaay back in relay logic circuits. We're using a limit and "double-pole, double-throw" switch. These two switches route to the motor in a way that... well, make it want to turn itself off!

Yes, your significant-other may think this is a peculiar waste of time, but we'll bet the attraction to the switch will be irresistible. Our experiments have shown that it takes 3 toggles before the user breaks out in a huge grin!

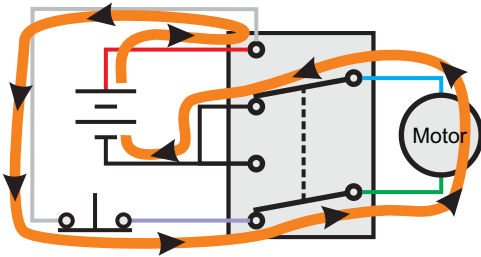
PRINCIPLE OF OPERATION

The circuit is quite straightforward. Follow along with this schematic description:



Motor is toggled on, turning clockwise, moving the arm to the switch.

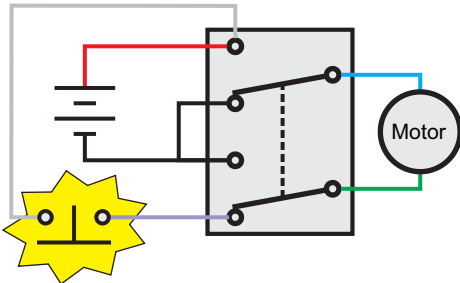
When the arm starts extending, the limit switch inside closes.



CLICK!

The motor successfully toggles the switch, and the power reversed direction.

The arms starts retracting back into the box.



BUMP!

Fully retracted, the limit switch is pushed down, disconnecting power from the motor.

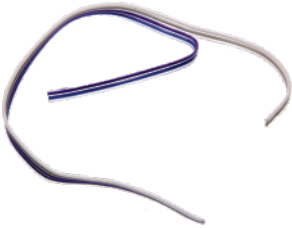
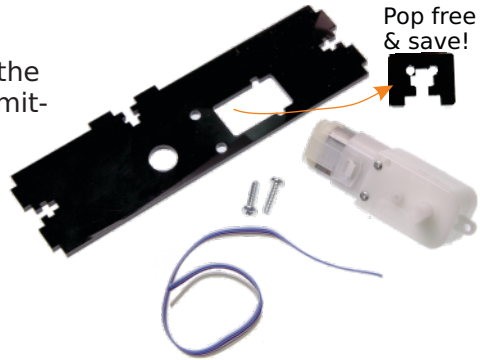
Now it's ready for another cycle!

ASSEMBLY - THE MOTOR

FIRST THING: Remove the protective brown paper from all the acrylic pieces. Yup, it's not brown, but actually shiny plastic!

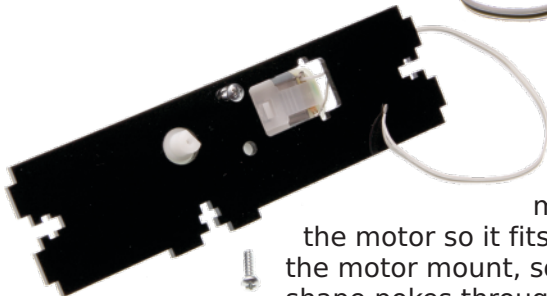
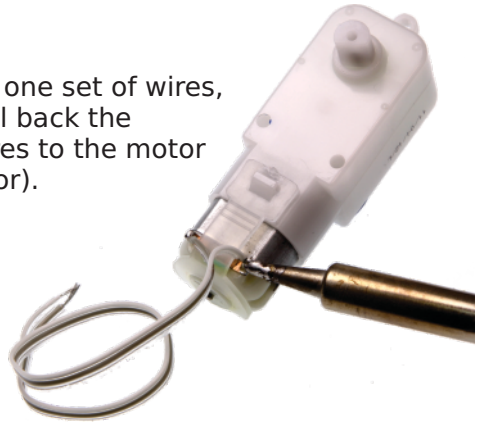
Let's start from the inside and work out. Get the motor, motor mounting bolts, motor mount, the 4-conductor wire, and prepare to build!

Step 1 - Motor Mount: Prepare the motor mount by popping the limit-switch mount out from the center portion - *keep it!*



Step 2 - Split Wire: The ribbon wire actually has 4 wires side by side. Split the ribbon in half by tearing two wires away from the rest.

Step 3 - Solder Motor Wire: Take one set of wires, and split the ends a bit, and peel back the insulation. Solder one pair of wires to the motor tabs (don't worry about wire color).



Step 4 - Motor Installation:

Install the motor using the two #4 x 1/2" motor mounting screws. Arrange the motor so it fits with the wires *face-in* to the motor mount, so the shaft with the "D" shape pokes through the hole.

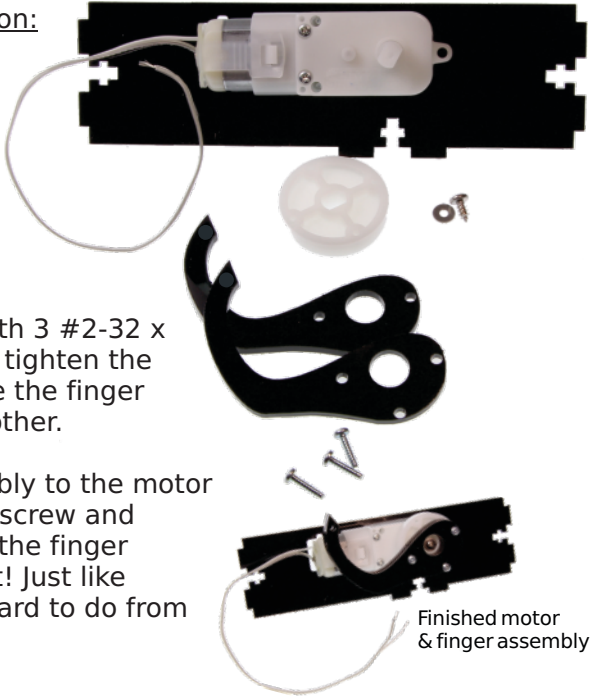
ASSEMBLY - THE FINGER & CIRCUITRY

Step 5 - Finger Installation:

The double-thickness finger makes hitting the switch much easier and more reliable.

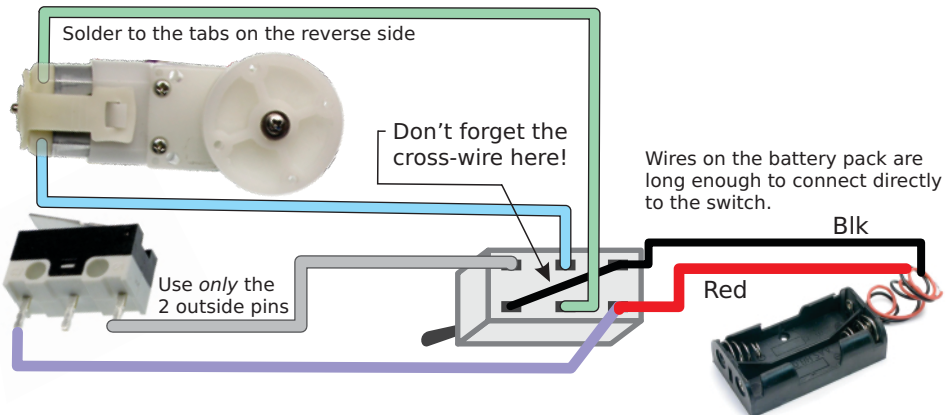
Take the two fingers, and sandwich them together against the white accessory wheel. Screw them together with 3 #2-32 x 3/8" screws. Before you tighten the screws down, make sure the finger tips sit flush with each other.

Mount the whole assembly to the motor shaft with the #2x 1/4" screw and washer, and make sure the finger points top-pointing-right! Just like picking your nose, it's hard to do from the wrong direction...



Step 6 - Circuitry: There really isn't much to the circuitry, as it's just point-to-point soldering some wire bits! Gather your finished motor assembly, the lever switch and limit switches, and the battery pack, and we'll get started!

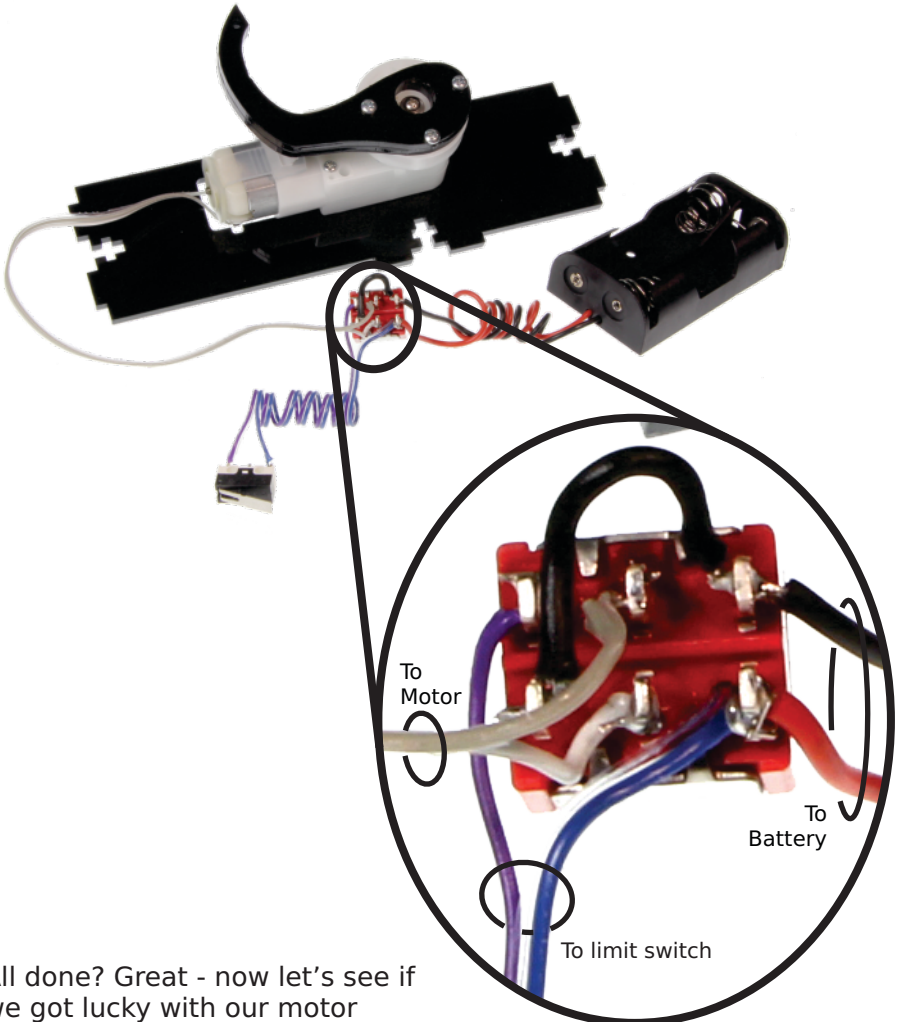
Begin by looking closely at this wiring diagram. The only wire colors that matter are the battery pack's. We'll test and correct shortly.



ASSEMBLY - WIRING UP THE CIRCUITRY

Step 7 - Soldering: This is the hardest part - the niggly wire-stripping and soldering of connections. Here's some tips to make it easier.

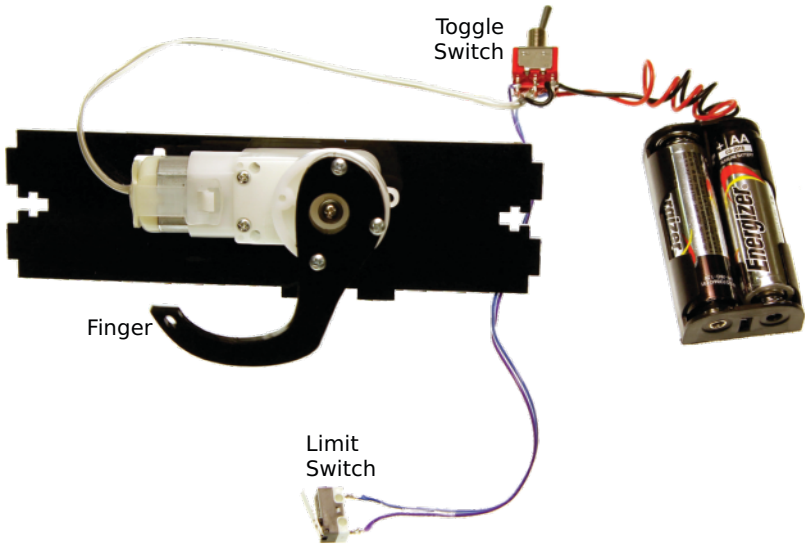
- Secure the switch in a vise, or use some tape to hold it still while soldering. Moving targets are *much* harder to solder.
- Snip 2.5cm (1") off of the black wire from the battery pack to solder the cross-jumper on the switch.
- Don't trim the wires back at all - leave them as long as possible to make installation later easier!



All done? Great - now let's see if we got lucky with our motor connections by running this assembly through a test!

TESTING THE CIRCUIT'S BEHAVIOR

Step 8 - Testing: We're going to pretend there's a box around this assembly *just to see if we got lucky and everything is wired up right.*



Pop in the batteries and the motor should start turning.

Test 1: Hold the limit switch down and toggle the toggle switch. Find the position where the motor stops. **This is the *retract* position.**

If the motor does not stop spinning in one of these two positions with the limit switch down, recheck your wiring, especially to the limit switch's outer two pins.

Test 2: Release the limit switch, and flip the toggle switch to position **extend**. Is the motor rotating the fingertip clockwise (fingertip going to toggle switch)?

Yes: All is well! Carry on!

No: Desolder and reverse wires connecting to the motor

If you have had to modify your circuit, confirm again the operation: 'Extend' toggle position ignores the limit switch, and turns clockwise.

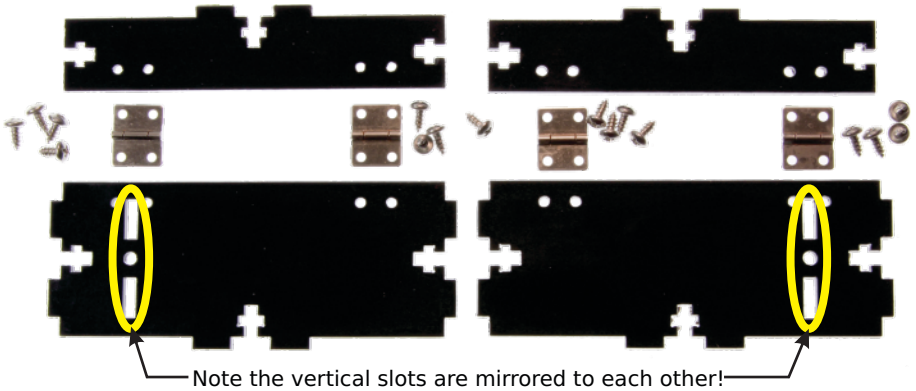
'Retract' toggle position is interrupted by the limit switch, and turns counter-clockwise.

ASSEMBLY OF THE BOX!

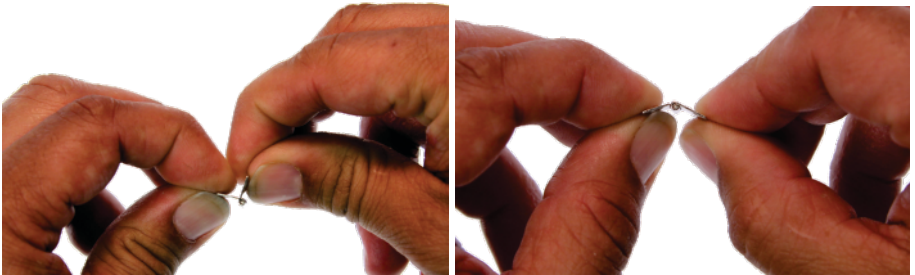
Step 9 - The Hinged Parts: Let's get the more technical box-ends completed first. Gather together:

- 2 narrower acrylic *top* box-ends
- 2 narrower acrylic *bottom* box-ends
- 4 hinges
- 16 #2x1/4" screws

Since we will be building both box ends, make sure you build them opposite to each other so they will mate properly during construction (see below note regarding the vertical slots).



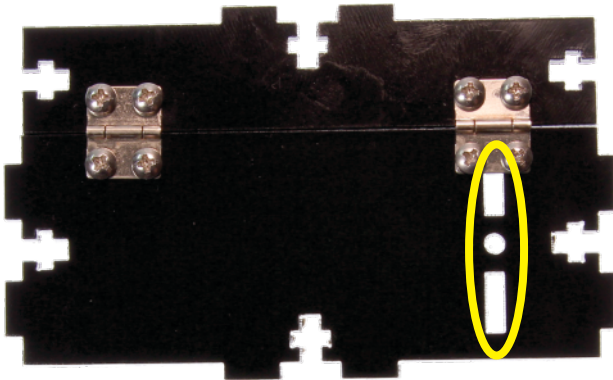
Step 10 - Exercising the Hinges: Before putting the acrylic parts together, we have to loosen up the hinges. They may be a bit too stiff to allow the box lid to fall back properly, so bend them gently (but firmly) fully back and forth 5 to 10 cycles. You *do not* have to try to make it so loose that it “flops” down. Trying to do so may break the hinge. Trust us - just some wiggling will do wonders.



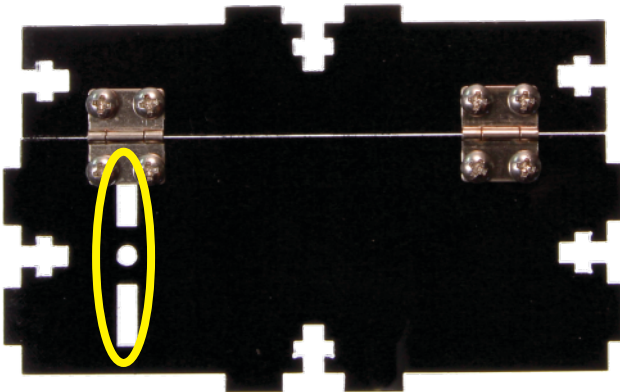
ASSEMBLY OF THE BOX!

Step 11 - Screw the hinges to the end pieces: The parts are cut so the holes are lined up, so all you have to do is screw the hinges to the two halves. Do not snug-down the screws! We want the hinges to sit a bit "sloppy" until the rest of the box is assembled and aligned.

Remember to make the ends mirror each other, so one has a vertical slot on left, and the other has a vertical slot on right.



One has slot on right, the other on the left.



If you accidentally use too much force and strip the plastic (so the screw doesn't "bite" anymore), use this backing plate where the screw comes through to give it more material to bite into.

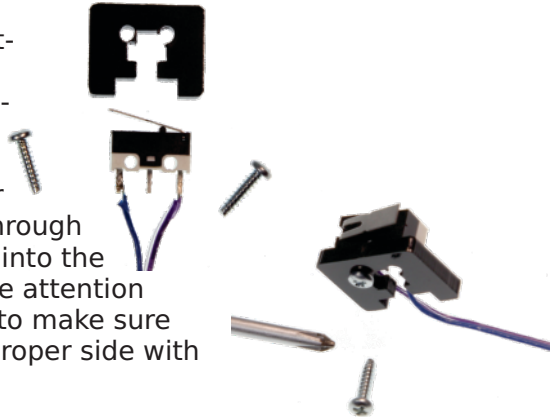
ASSEMBLY OF THE BOX!

Gather the remaining parts, and the motor control circuitry we tested earlier. Time to get it all together!

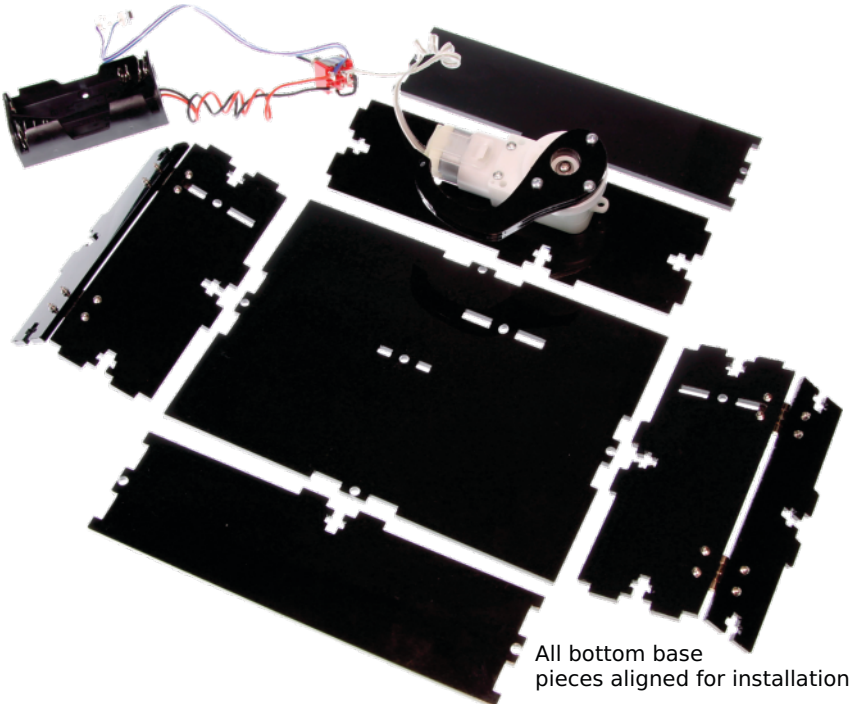
Step 12 - Limit Switch

Mount: Find the small limit-switch mount from step 1, and the two remaining #2-32 x 3/8" screws.

Put the assembly together with the screws passing through the mount, and threading into the limit switch body. Pay close attention to the photo on the right, to make sure that it's mounted on the proper side with the correct orientation.



Step 13 - Arranging Main Box Parts: Let's make sure everything is ready. You've got the tested circuitry & motor mount, two completed box ends with hinges, and the long, large box sides. Good! Let's start final assembly!



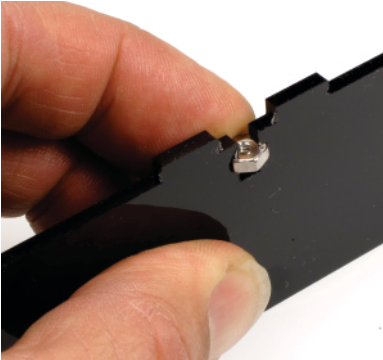
ASSEMBLY OF THE BOX!

About T-Slot Construction: The box is built using the “T-Slot” construction, which is a common technique used with laser-cut profiles (see http://bit.ly/T-slot_laser for more about this method).

General Assembly Technique: Slide a nut into the top slot of the “t”, using a little tape if necessary (mostly for tight spots where you can’t fit your finger). If you still find it hard to press the nut in, try going in from the other side.

The notches in the box are aligned so that mating parts nest together. Align them, and put a #4 3/8” bolt through the hole into the nut. *Be careful* when tightening the screw! Just a ½ turn more than finger-tight is fine! **Do NOT over-torque nuts/bolts.** Use only hand-screwdriver (not powered) for assembly!

We *will* send out a free replacements parts for ones broken during assembly (please send photo of part, if possible).



1. Insert nut



2. Place 2nd part, screw in bolt



3. All secure & tight!

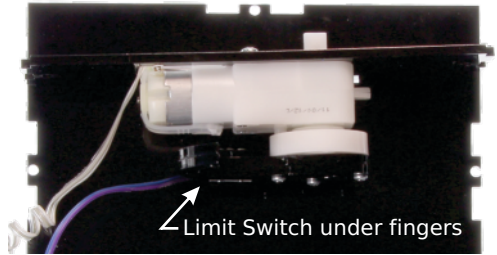


4. Finished Connection

ASSEMBLY OF THE BOX!

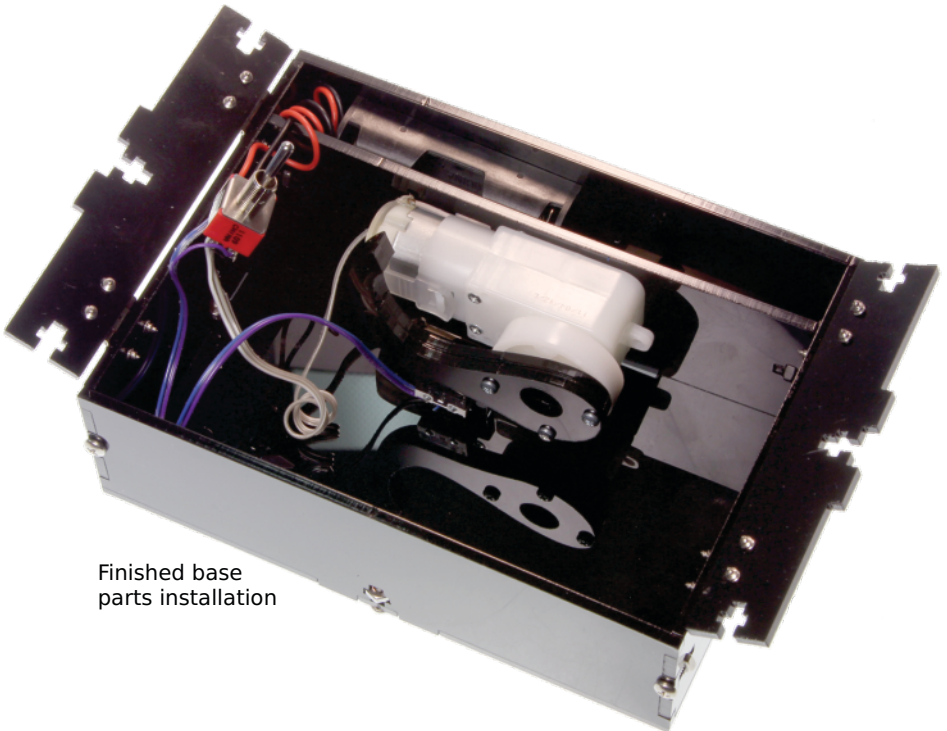
Step 14 - Limit Switch and Motor Mount: Using your new T-slot assembly skills, install the Limit Switch to the mounting holes nearest the center of the box base. Make sure to have the switch body facing towards the motor.

Secondly, install the motor mount behind the limit switch, and screw it to the base. Take a moment, and confirm that the motor fingers squarely hit the limit switch.



Step 15 - Main Box Walls: Start with the hinged end pieces, align and install them to the tabs on the box base and tabs on the motor mounts. Again, use the #4 nuts and bolts and lock them down!

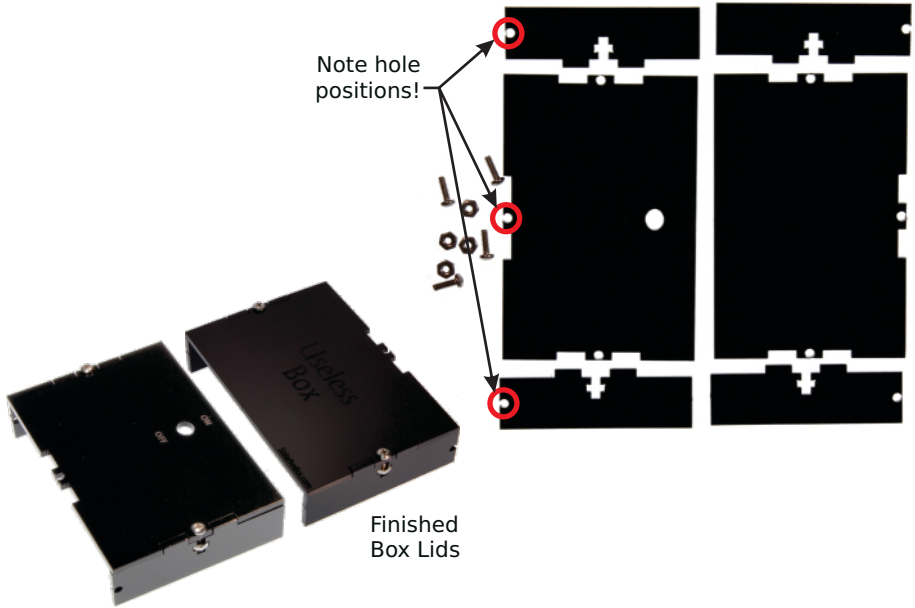
Finish the bottom assembly by adding the big side-pieces, locking them to the base and end pieces with more #4 hardware.



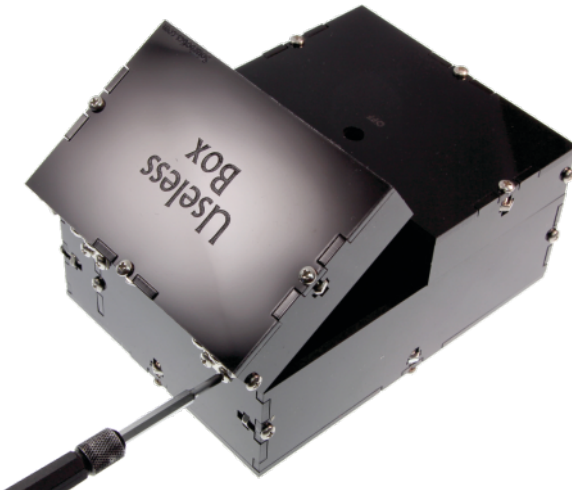
Finished base
parts installation

ASSEMBLY OF THE BOX!

Step 16 - Build the Lids: Let's get the lids built. The only thing to be careful of is to arrange the holes on the end of the side parts to be on the same side as the holes on the lid tops.



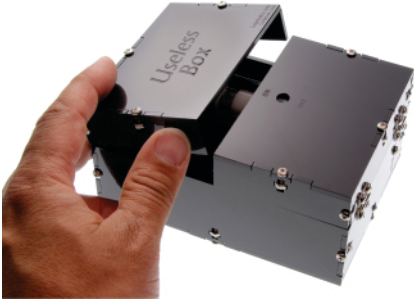
Step 17 - Install the Lids: Mount the lids to the hinged end pieces, with the "On / Off" hole lid to the *right* of the motor, so the finger will swing over top of the hole. When the lids are both installed, make sure they are sitting square to the frame, and tighten down the hinge screws.



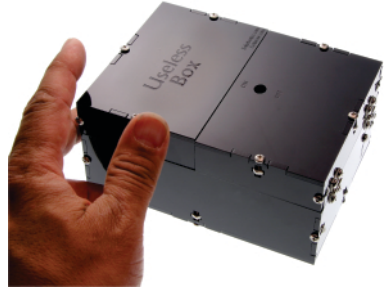
TEST & TUNING

Step 18 - Alignment Check: Lift the lid labeled “Useless Box” 20 degrees, and see if it slaps back down. If not, re-loosen and re-align the hinge screws (loosen, open lid a bit, re-tighten), and repeat until you get a nice closing action.

Open...



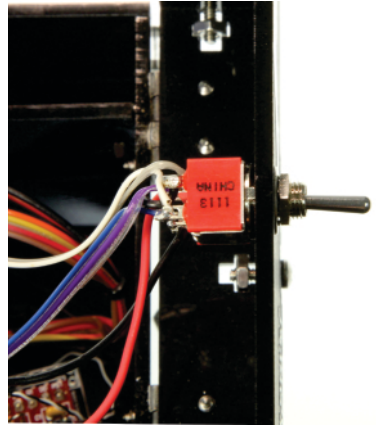
...release, and
thunk!



Step 19 - Toggle Switch Installation: Remove the nut on the switch, and install it to the top plate. Before you tighten it down, close the lid and test the operation.

It has to turn on by flipping the switch toward the middle, so the fingers can push the switch to the “Off” position.

If it's the wrong-way around, simply spin the switch 180 degrees in the hold, and tighten the nut.



Step 20 - Battery: Either tuck your batteries into the pocket next to the motor, or use the included double-sided sticky tape to glue it down to a spot within the box that doesn't bother the fingers.

Step 21 - Final Tuning: Watch the finger come out of the box. If they aren't exactly dead-on to the switch, loosen the toggle switch again, and move it side-to-side to get the alignment right (then tighten it back down).

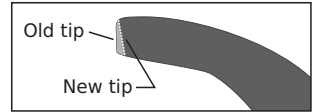
If that isn't enough adjustment, you can loosen the motor mount bolt on the bottom of the box, and shift it left or right to assist in alignment.

TROUBLESHOOTING & WRAP UP

Hopefully, your Useless Box is fully functionally... useless! If not, there are only a few things that might cause problems:

Does the finger push up on the lid while it's trying to turn itself of? Some switches need more force than others, which can make the finger lift the lid with the toggle switch.

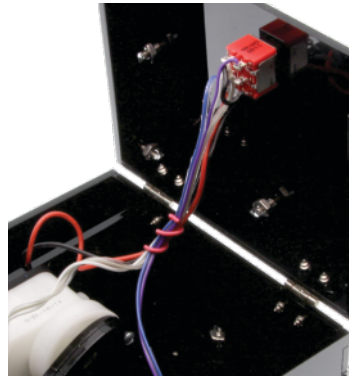
There are 3 solutions. The easiest is to tape the lid closed (on the inside of the box so it looks clean). The next is to use the height nut on the switch to make it a bit shorter, but this is a fiddly process. The *preferred method* we've found is to use a file or sandpaper to shape a more aggressive angle to the fingertip.



Does the finger skip off to one side of the switch? As mentioned before, you can adjust the alignment of both the switch and motor.

Motor is not able to activate switch? Chances are you need a fresh set of batteries!

When you're fully happy with how it's working, use tape, wire or zip-ties to bundle the wires, which will make them less likely to snag and break. Besides, it make the installation look so much cooler when your guests finally open up the box!



As with most things useless, have fun with it!

Visit us online for more info and cool stuff:

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