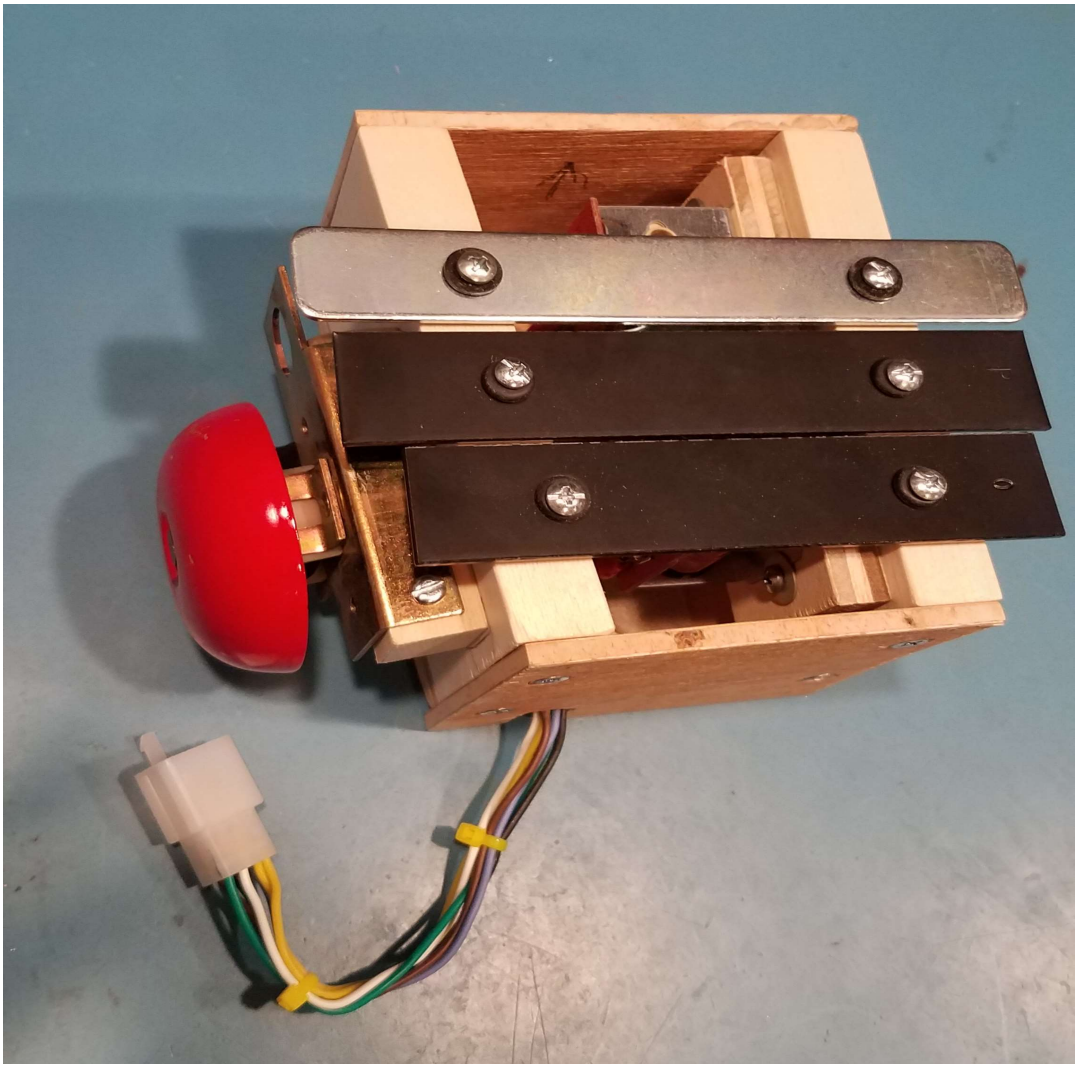
Build a Chime Unit for under $40



by Bulldog4

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Build a Chime Unit for under $40

(If you don't want to read any of the back story about this build, skip to section 2.0 for the build.)

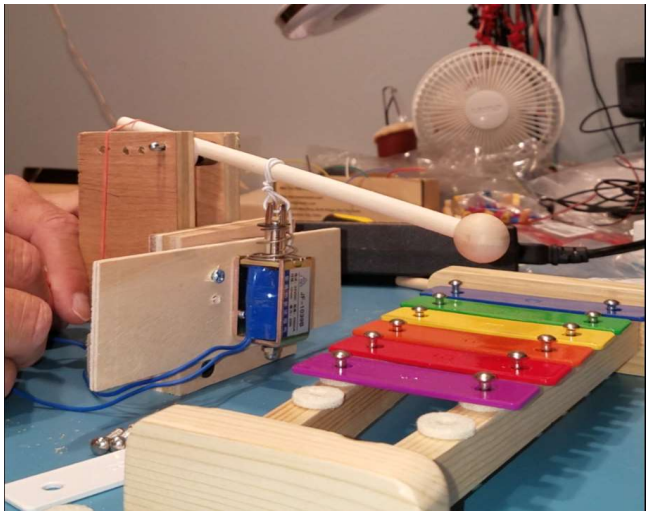
1.0 Background

While I like many of the newer Solid State games, I still like the old EM tables that I grew up with. After adding solenoids, knocker, gear and shaker motors, the chime and bell sounds produced by the speaker seemed quite lacking. I started looking for real chime units and found that they are not manufactured any more and are only available used, but very scarce. Over several months, I saw a few on eBay for an average of $100, but most appeared to need repair and would require me to buy an additional 50 volt power supply.

I'm a retired engineer and like to build things, so I set out to design and build a DIY chime unit.

1.1 First prototype - Xylophone Chimes

I started by purchasing a toy xylophone for $12. I bought a few push-pull solenoids to strike the bars. I tried using the solenoids to strike the bars from below, as in real chime units, but that proved very tricky and the solenoids were basically too powerful. I then jury-rigged one of the wooden hammers that came with the xylophone to some wood blocks and had the solenoid pull the hammer down to strike the bars. This contraption looked much like a catapult but worked in reverse. (See photo below and external mp4 video file). This approach worked but required careful adjustment, was quite large, and the xylophone tones were too high and somewhat tinny. I wasn't satisfied and kept thinking about alternatives.



1.2 Doorbell

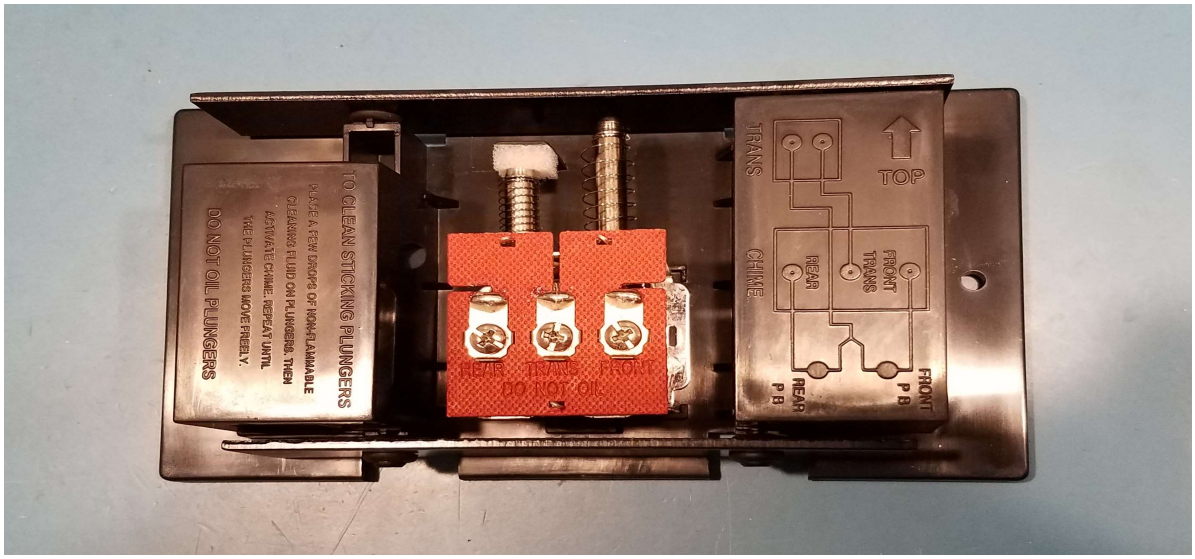
About a month later, I thought about trying to use an old-fashioned, mechanical doorbell unit. They have two bars with different tones and two solenoids to contact them. One solenoid strikes both bars sequentially making the standard “ding dong” sound, while the second solenoid only strikes the higher note and makes the “ding” sound. I ordered a “Heath Zenith Door Chime” from Amazon for about $15. (see the “Links” section at end of document).

This inexpensive unit has a single solenoid assembly that has two coils and two plungers, you cannot separate them and use them independently. One of the solenoid/plungers (left, in photo below) has a

pad that prevents the plunger from hitting the low-tone bar. When energized, the plunger strikes the high-tone bar (bottom, in photo) and then returns to resting against the pad. This makes a “ding” sound.

The other solenoid/plunger (right, in photo), when energized will strike the high-tone bar (bottom) and when de-energized, the spring on the plunger will force the plunger to recoil and strike the low-tone bar (top). This double action creates the “ding dong” sound.

The two rectangular plastic boxes on the left and right sides of the unit are the sound chambers that resonate and amplify the volume of the sound when the bars are struck.



1.3 Doorbell Electrical

These doorbells are intended to be powered from a 16 volt AC transformer and pushbutton door switches. The center terminal on the solenoid assembly is the common terminal for both solenoids and is connected to one side of the power. The right and left terminals are connected to the other side of the power through the door switches. While not designed for DC power, I have found that these work fine when powered for short duration pulses using 12 VDC. You MUST provide reverse-protection diodes across each set of terminals. These diodes protect the driver circuitry and also prevent other unwanted side effects. I once tested a solenoid without a diode and found that this affected my power supply such that several other solenoids powered by the same 12V power were firing simultaneously. More on installing diodes later.

1.4 Second prototype - Doorbell Chimes

I modified the Heath Zenith chime unit to add a bracket with another felt pad (similar to the previous photo) to make the right solenoid operate just like the left one and only strike the bottom chime bar. I wired one solenoid as the “High” chime and the other as the “Medium” chime. In reality, they both struck the same bar and made the same sound. I then used the wooden hammer and solenoid from the xylophone prototype to strike the top chime bar and wired it as the “Low” chime. Everything was mounted on a piece of wood. While this worked, it only had two notes, it was rather large and required occasional adjustment of the hammer and solenoid on top. It was also quite loud (think doorbell in your house), so I put this in a small cardboard box to muffle the sound somewhat. Sorry, no photos of this kludge prototype.

1.5 Third Prototype – Homemade Aluminum chime bars (no photos)

The second prototype only had two chime bars so it sounded OK, but not correct. I wanted a three chime unit. Since the doorbell solenoids were basically in pairs, I planned to use three doorbells and use one double solenoid assembly for each chime bar. I would probably only wire one solenoid in each assembly, though. I ordered two more doorbells to be cannibalized. At this time, the Heath Zenith door chime had gone up to $20 so I ordered the Newhouse CHM1 units, which were around $15.

I searched several forums for information on DIY chime bars and found several posts by people who had used aluminum flat bar stock to cut their own chime bars. Some of them provided dimensions so I went to Home Depot and bought a piece of 1 1/2” x 1/8” x 36” aluminum. I cut three bars of the appropriate length and drilled the mounting holes 22% in from each end (for proper tone and harmonics). I sanded these and mounted them to a simple wooden box.

I used the double solenoid assembly from the doorbell to strike the High and Medium chime bars. Mounting and adjustment was tedious and while the double solenoid worked for the upper two bars, the fact that the bars were 1 1/2” wide and the solenoid plungers were less than an inch apart meant that both plungers were striking the bars near the edge. This worked but did not give as pure a sound as if they struck the center of the bar.

I mounted the push-pull solenoid that previously operated the wooden hammer (in first prototype photo) to strike the Low chime bar. I had replaced the metal cap nut on this solenoid plunger with a nylon nut but I was never happy with this solenoid. It was very tricky to get the height adjustment just right and usually it either missed striking the bar or it struck too hard and made a clanking sound.

1.6 Final Solution – Use Doorbell Chime Bars

At this point, I decided not to use the push-pull solenoid and would steal the solenoids from the other doorbells that I ordered. I opened the two CHM1 chime units to remove their solenoids. I found that these were slightly different from the Heath Zenith, but very similar. The solenoid assemblies were slightly different height and width than my first one so I would need to devise a slightly different mounting solution for each. As I started to disassemble the new units, I tried striking the new chime bars to hear their tone. To my surprise, they were very different from the Heath Zenith chimes. The new ones were smaller and were several notes higher than the original ones. This was a happy coincidence because I found that by using both bars from the CHM1 unit and the largest bar from the Heath Zenith unit, I had 3 bars with tones very much like a real pinball chime unit. The doorbell bars were steel and were less than 1” wide, as opposed to the 1 1/2” wide aluminum bars that I made. The steel bars also had a more pleasant, pure sound than the aluminum ones. The narrower bars would allow me to use a dual solenoid assembly to strike two bars with better sound than the wide aluminum bars.

So, it turns out that I didn't really need the third doorbell and would keep it as spare parts. The following design approach only requires two doorbells, one of each brand, and a few miscellaneous parts.

I purchased both of the required doorbells for around $34 on Amazon and used spare parts, so my cost was under $35. It appears that the doorbell prices have increased slightly but you should still be able to build this for under $40.

2.0 Building the Chime Unit

Note: When I built this and took the photos, I did not build it in exactly the same order as I will describe here. The steps below are a better process than I took. This means that some of the photos may not exactly match your build at that point but but are fairly close.

What you will need:

- 1 – Newhouse Hardware CHM1 door chime (links at end of document)
- 1 – Heath Zenith door chime unit, model SL-2796 (links at end of document)
- 3 – 1N4007 diodes
- 2 – #8 x 1 1/4" sheet metal screws with lockwashers and flat washers (solenoid adjustment)
- 6 – #8 x 3/4" sheet metal screws (chime bar mounts)
- 4 – #8 x 1/2" sheet metal screws with large washers (solenoid mounting)
- 8 – #6 x 1/2" wood screws (box end covers)
- 6 – #6 x 1 1/4" wood screws (box bottom)
- 2 – Adhesive-backed felt furniture foot pads
- 1 – Connector, 4 or 6 pin (optional)
- Wood:
  - 3" x 5" x 3/4" (I cut down a 1x4 to 3" width for this)
  - 3" x 5 1/4" x 3/4" (I cut down a 1x4 to 3" width for this)
  - 1/2" plywood – 5" x 6" approx.
  - 1/2" plywood – 2" x 4 3/4"
  - 1/4" plywood – 3 1/2" x 3 3/4" approx.
  - 1/4" plywood – 3 1/2" x 4 1/2" approx.

Step 1:
Open the CHM1 doorbell. Using a permanent marker, draw an arrow on the reddish plastic solenoid assembly that points to the smaller of the chime bars. This should be the bar closest to the solenoid assembly. This arrow will indicate "UP", when mounting the solenoids later. I also marked a "+" on the center terminal to show where to attach the positive supply wire later. Mark this solenoid as "LO" to identify which unit it came from because the two solenoids will be easily confused. I will refer to them as "LO" and "HI" from here forward. Note: I did not do this, so the photos do not show these markings.

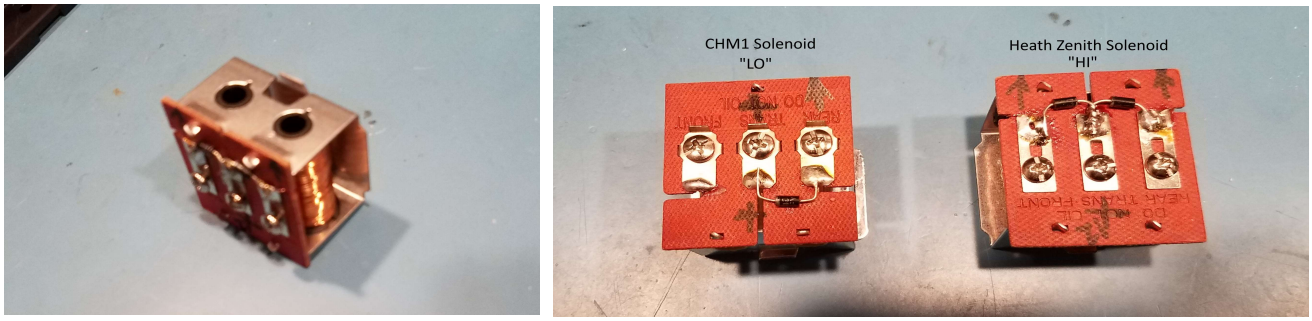
Step 2:
Open the Heath Zenith doorbell. Repeat step 1 for this unit, except mark this solenoid as "HI".

Step 3:
Remove both chime bars from the CHM1 unit by gently rocking and pulling them from their mounting pins. Keep the rubber grommets in the bar holes. Remove the larger chime bar from the Heath Zenith unit in the same manner.

Step 4:
Remove the solenoids from both doorbell assemblies. There are two metal tabs on the rear of each solenoid assembly. The one closest to the center of the doorbell unit engages a plastic tab to hold it into the base plastic. Find the rectangular hole in the rear plastic, just about dead center. Insert a small flat blade screwdriver and pry the plastic tab away from the solenoid frame as you gently pull the solenoid away from the plastic base. Once the tab is free, the solenoid should slide off the plastic base. Be

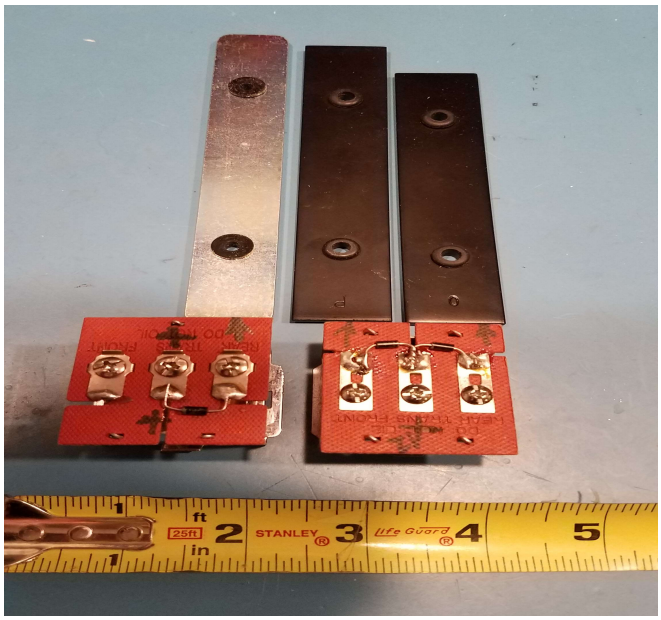
careful not to lose the plungers or their springs. Set the plungers aside and identify whether they came from the “LO” or “HI” solenoid; they are different sizes.

Note: The two solenoids are different sizes. The “HI” solenoid will need to be mounted approximately 1/4” farther below the chime bars than the “LO” solenoid. We will account for this later.



Solenoid assemblies after removal from base (you will add diodes later)

Step 5:
In this step, I laid out the bars and solenoids to see how large the wood box needs to be. I tried to get the plungers to be as close as possible to the center of the bar while still maintaining at least 1/8” between bars to allow for bar movement when struck. I allowed about 1/2” on each end to accommodate mounting screws, as you will see in later steps. I made my box 5” long, on the square side.

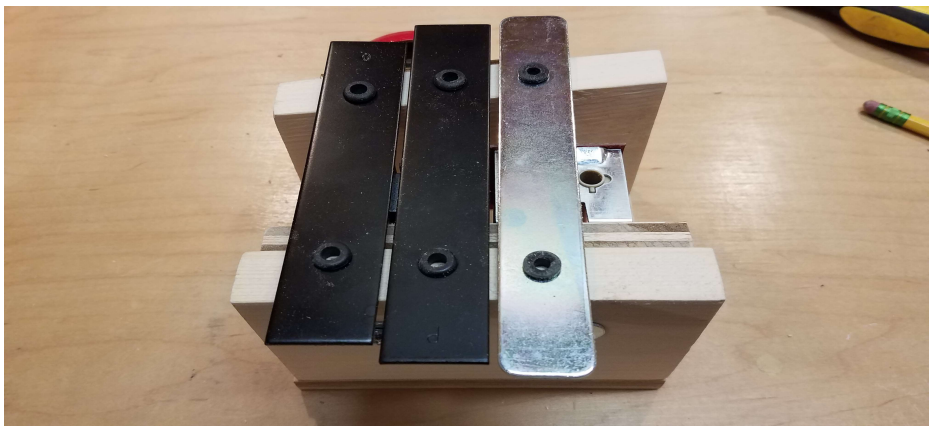


Step 6:
I used 1x4 boards for the side walls, ripped down to 3”. You can use the full width 1x4, which is 3 1/2” but in that case, you will need to have another 1/2” board beneath the plungers to keep them from falling out the bottom of the solenoids. I used the full width 1x4 in my previous prototype and found that I needed the additional 1/2” board below the plungers. You can do that if you wish to use a full width 1x4 but you will need to add another 1/2” thick floor on top of the plywood base of the box.

A 1x4 is actually 3/4” thick and allows sufficient thickness for the screws that hold the chime bars to the side walls. If you use anything thinner, you may have trouble locating the screws for the bars.

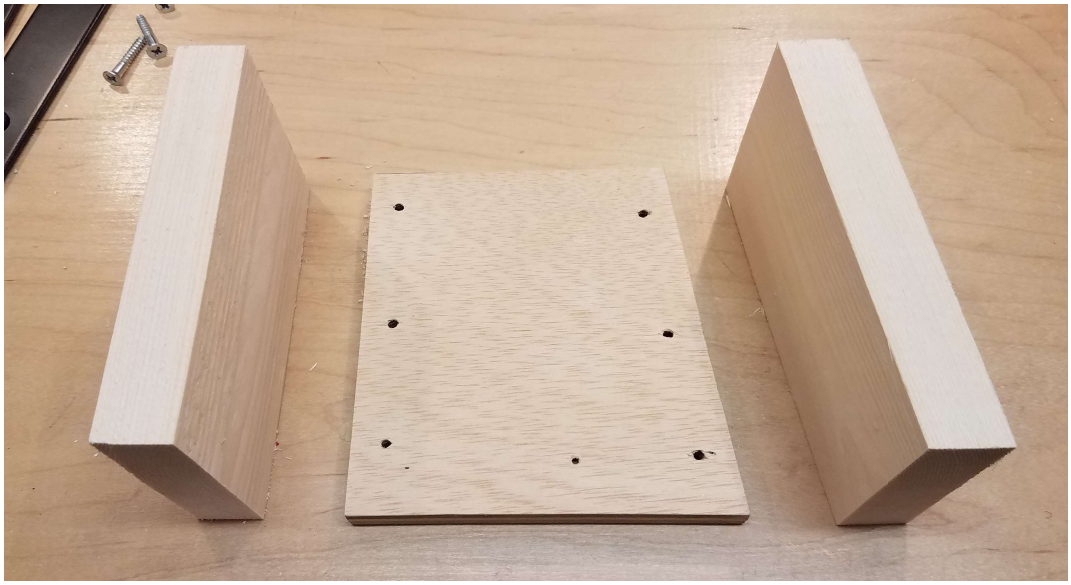
After cutting the 5” long board for the square side, cut a 5” by approx. 6” piece of 1/2” plywood for the base. Stand the square side wall on top of the plywood base and align 3 edges, as shown in the photo below. Take another ripped 1x4 and stand it up as the opposite wall, angling it slightly, as shown. Lay the bars out on the two boards, roughly as shown. Move and adjust the angled wall until you are satisfied that all 6 holes for mounting the bars will be in solid wood. They will not all be in the center of the walls, so you need to compromise to come up with the angle for the side wall.

When you are happy with the angle of the wall, trace the outside edge of the angled wall onto the base plywood. Cut the plywood along this line. On my unit, this was a 7 degree angle.

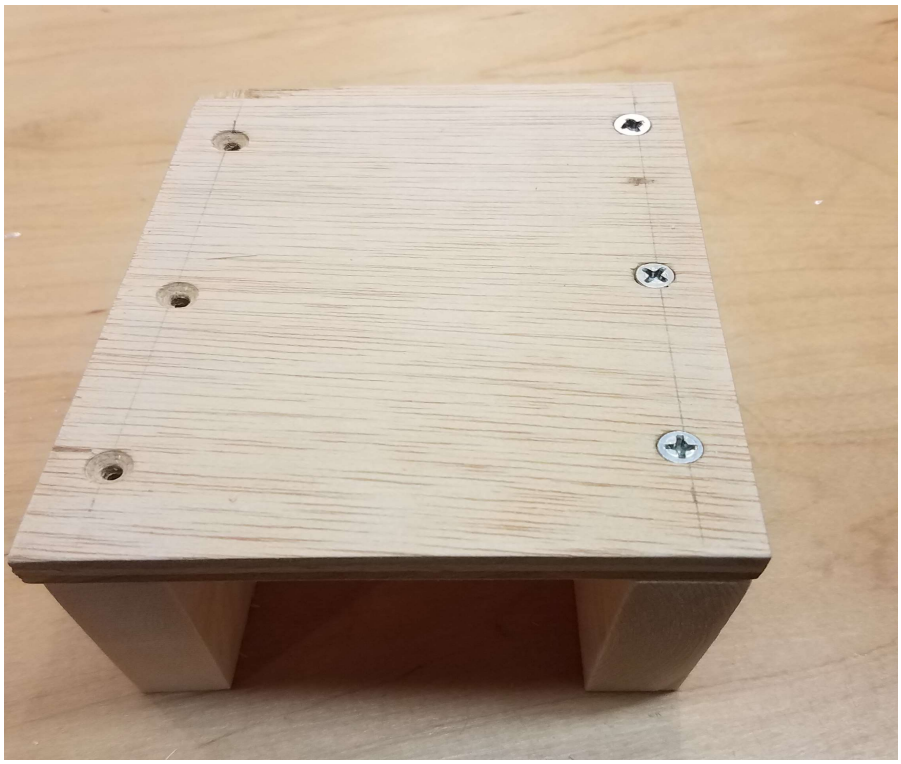


Lay out bars to determine angle of non-square side

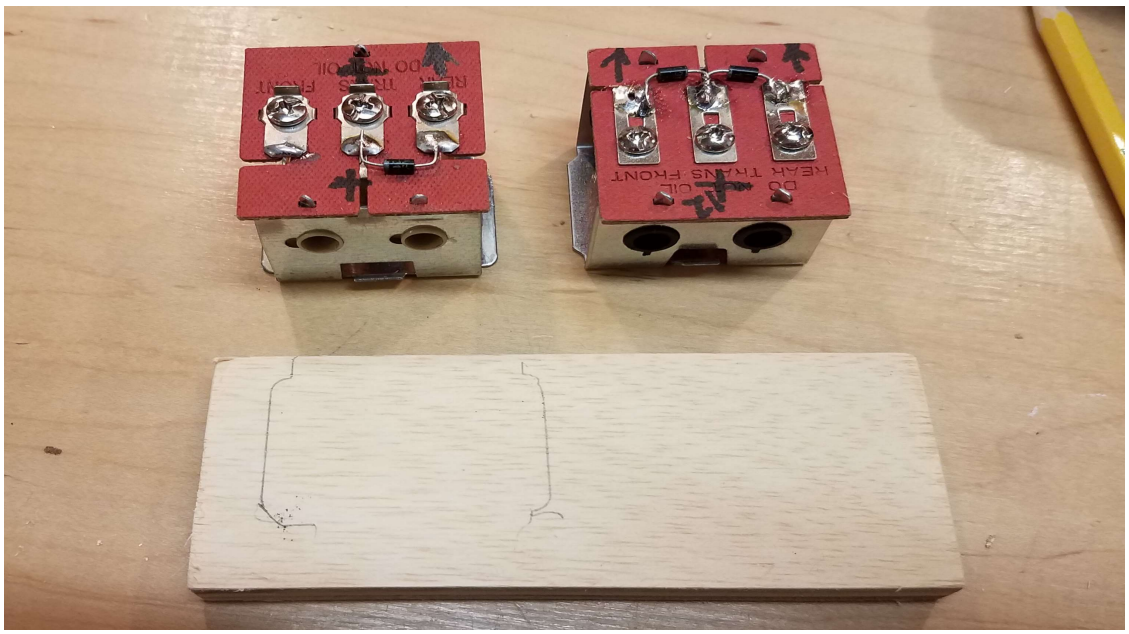
Once you have the base cut, you can measure and cut the angled side wall to match the angle on the plywood. If you have a miter saw, you can cut the ends of this wall to a 7 degree angle so you can attach end panels flush to this wall. It's not really critical if you don't miter the ends because no one will really see this anyway, once it's inside your pincab.



Step 7:
Drill and countersink holes for #6 x 1 1/4” screws from the underside of the base plywood. Attach ONLY the square side wall to the base with 3 screws. The other side will be attached after mounting the solenoids.

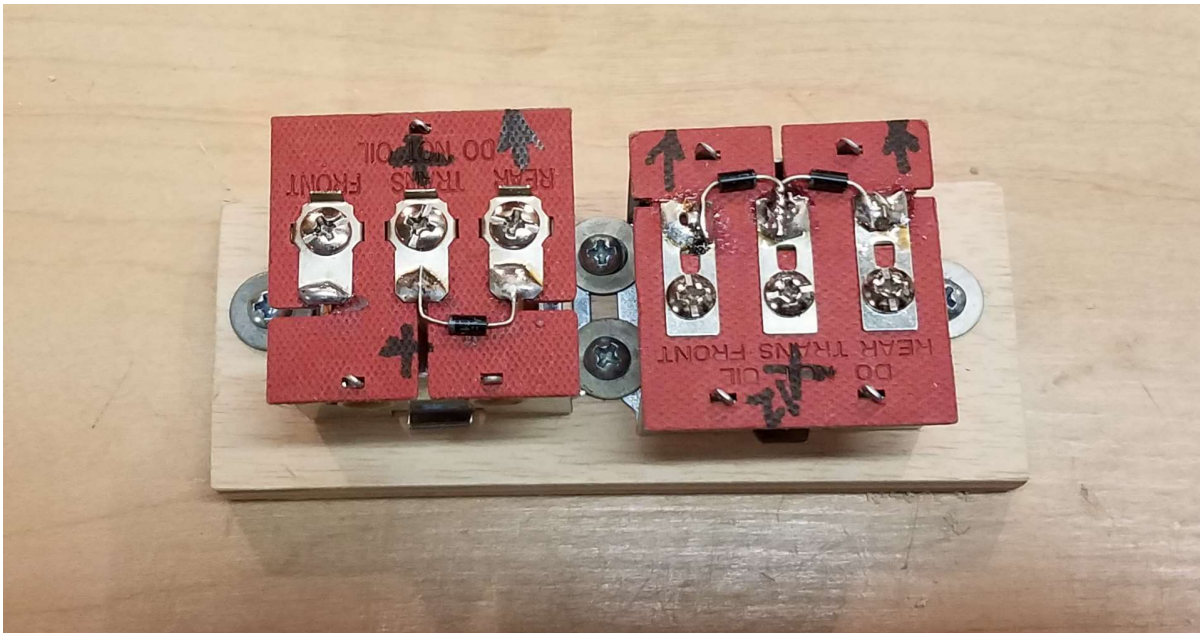


Step 8:
Cut a piece of 1/2” plywood 4 3/4” wide x 2” tall. The solenoids will be mounted to this board. Lay the “LO” solenoid with the metal frame approximately 1/2” from the left edge of the board. Align the top surface of the solenoid approximately 1/8” from the top edge of the board. Trace the outline of the solenoid, as shown below.



Drill 3 pilot holes for the screws to attach the “LO” solenoid, as shown below. Mount the “LO” solenoid using three #8 x 1/2” screws and flat washers.

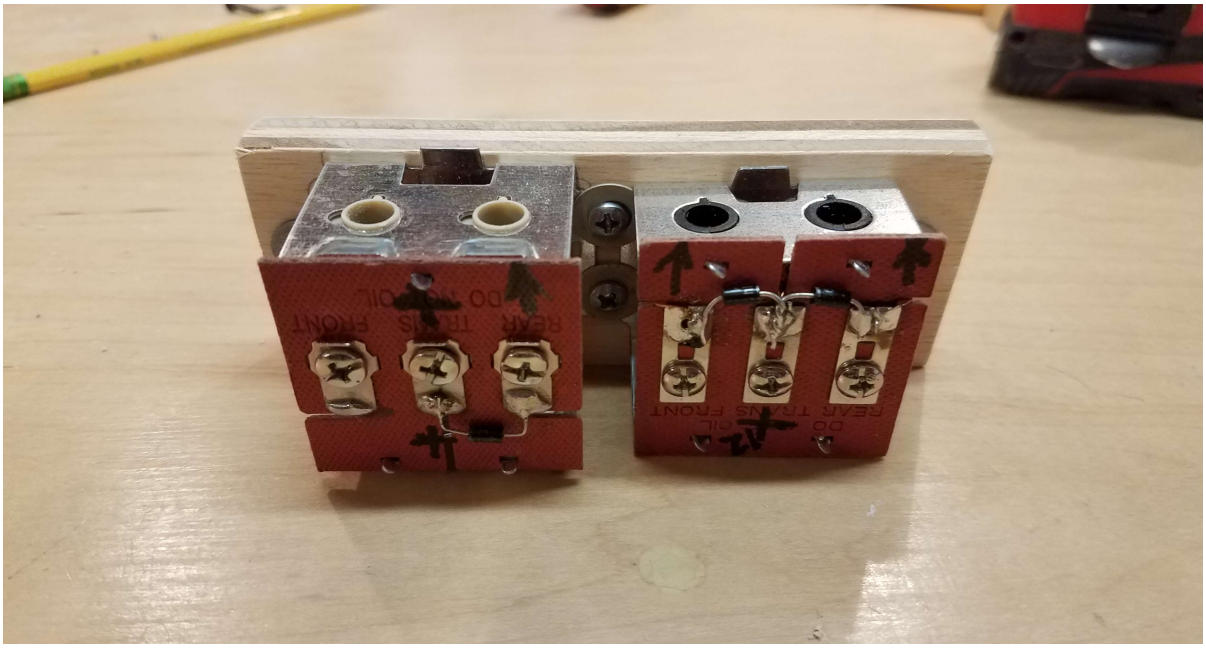
Loosen the two screws in the middle so that you can place the “HI” solenoid frame under the washers, as shown below. Mark a screw hole location 1/8” from right edge of solenoid frame. Remove the “HI” solenoid, drill a pilot hole at the marked location. Slide the “HI” solenoid under the middle washers and then secure with the fourth screw and washer on the right side.



Step 9:
Loosen all mounting screws slightly. Adjust the “LO” solenoid so that the top of the metal frame is just below the top surface of the wood mounting plate. Make sure the solenoid is square. Tighten the left mounting screw.

Adjust the height of the “HI” solenoid to be approximately 1/4” below the “LO” solenoid. Make sure the solenoid is square. Tighten all screws and re-check proper heights.

Make sure the arrows on both solenoids point to the top of the mounting plate, as shown.



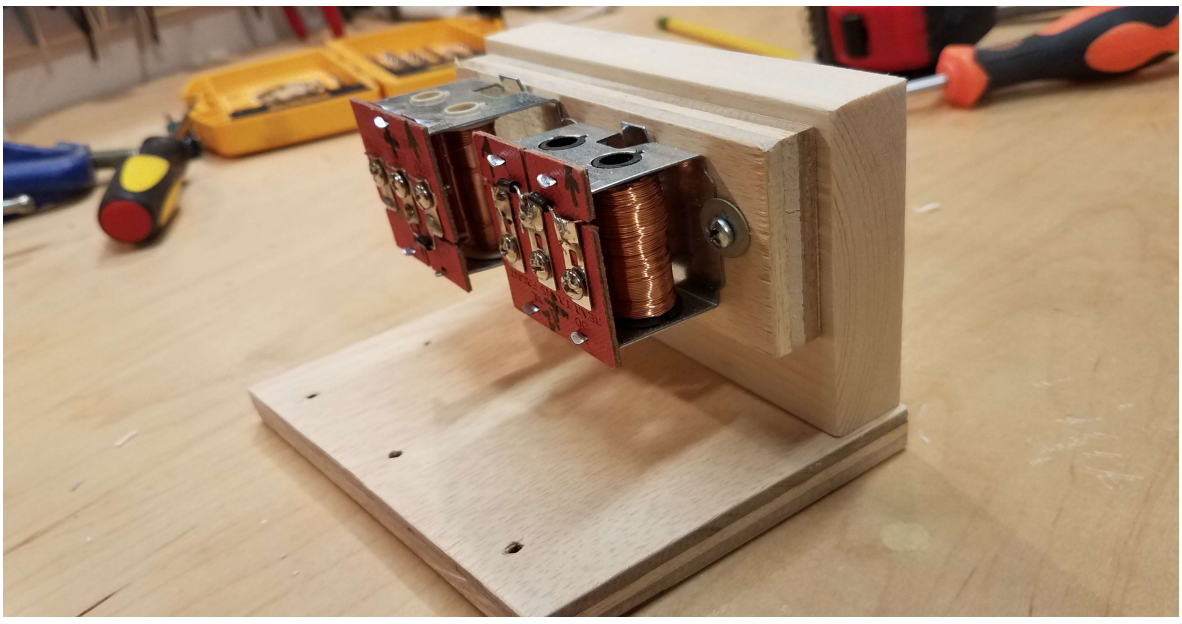
Step 10:
Solder the diodes to the solenoids. This is the best way to do this, because the diodes should be as close to the coils as possible. If you are going to mount the diodes elsewhere, skip this step.

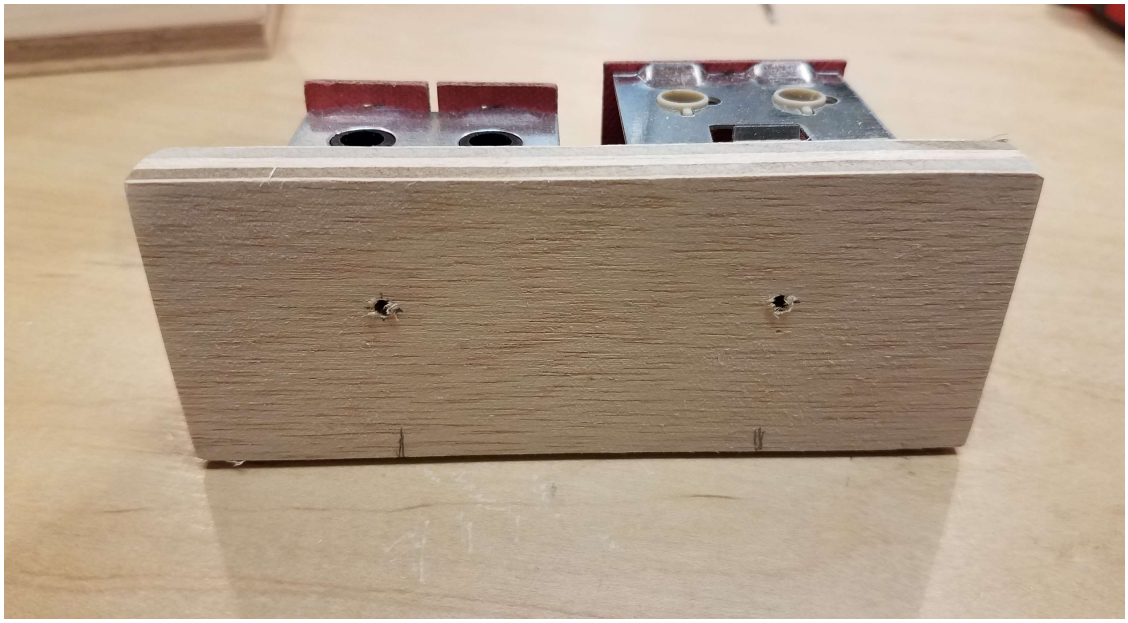
Solder one 1N4007 diode to the “LO” solenoid on the right two terminals, as shown. Make sure the band (white stripe) on the diode is on the center (“+”) terminal.

Take two 1N4007 diodes and twist the banded ends together to within about 1/4” of the diode bodies. Trim the twisted leads so that about 1/2” of twist remains. Solder the twisted pair to the center terminal of the “HI” solenoid. Solder and trim the remaining ends of the diodes to the two outside terminals, see previous photos.

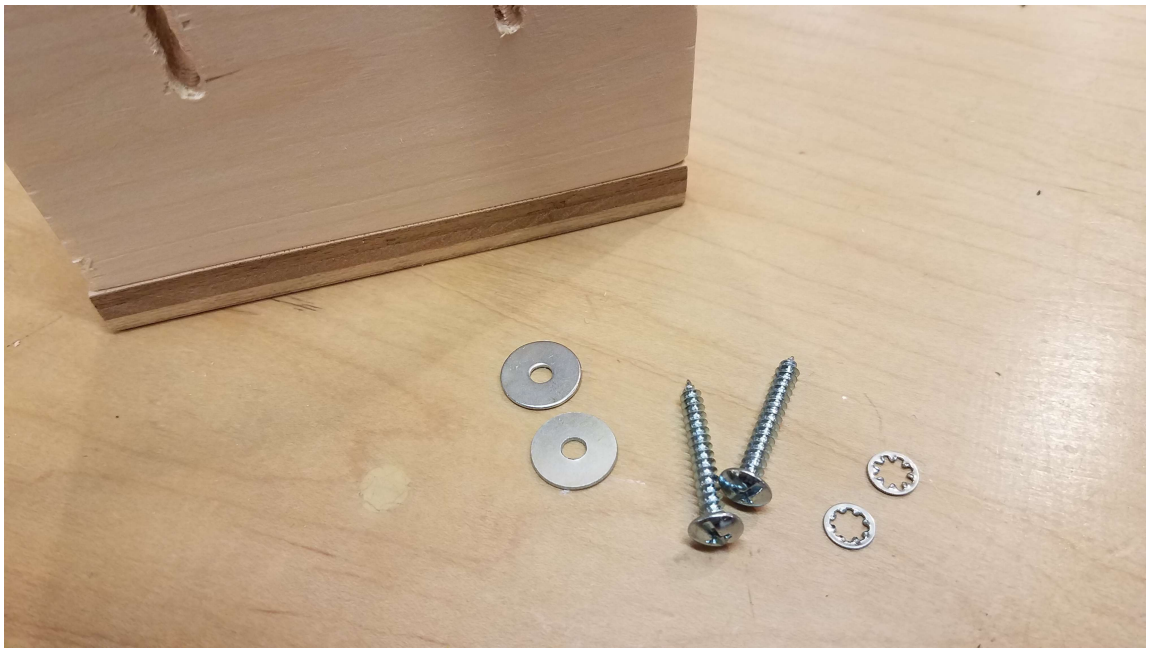
Step 11:
Create adjustment slots in square side wall, as shown below. The slots should be approximately 1 1/2” in from each end, about 1” from the top of the wall, and the slot should be about 1” long. You can drill 4-5 holes, close together and then use a drill bit to mill out the remaining wood. The size and location of these slots does not need to be precise.

Step 12:
Hold the solenoid mounting plate against the square side wall. Center it left-to-right. Set the top edge about 1/4” below the top of the side wall. Make a mark through the center of each slot and onto the back of the mounting plate. It's best to use an awl, nail, or small screwdriver to make the mark, as a pencil will not fit through the slot. Drill pilot holes for two #8 screws at these marks.





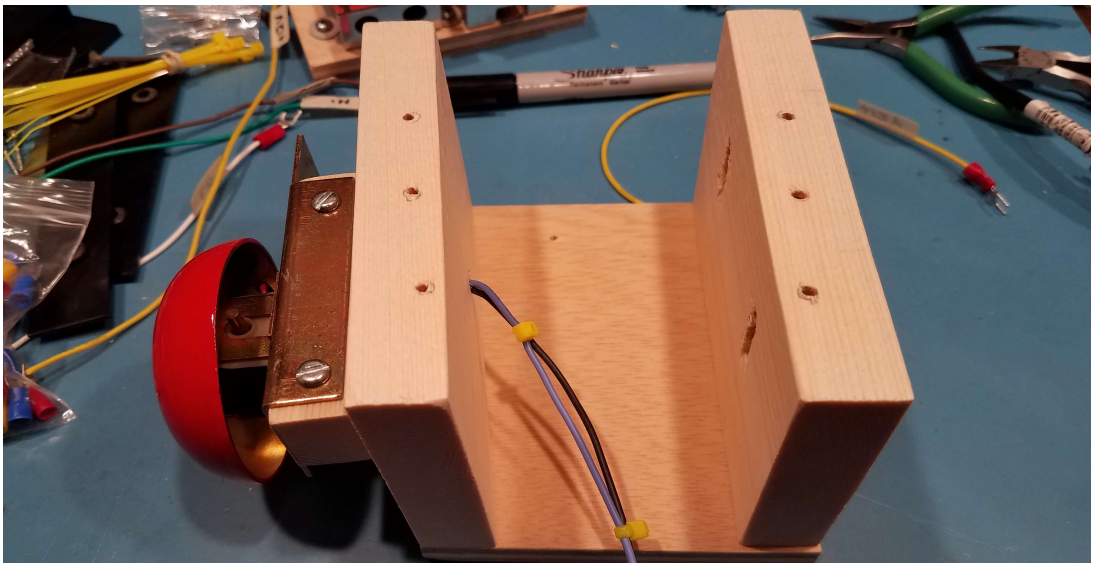
Step 13:
Hold the solenoid mounting plate against the square side wall. Attach with two #8 x 1 1/4” screws with lockwashers and flat washers, as shown below. Align the top of the mounting plate to be about 1/4” below top of side wall. Tighten screws. Loosen the screws slightly and insure that the mounting plate can be adjusted up and down. Remove the screws and mounting plate with the solenoids and set it aside. The wires will be attached later.

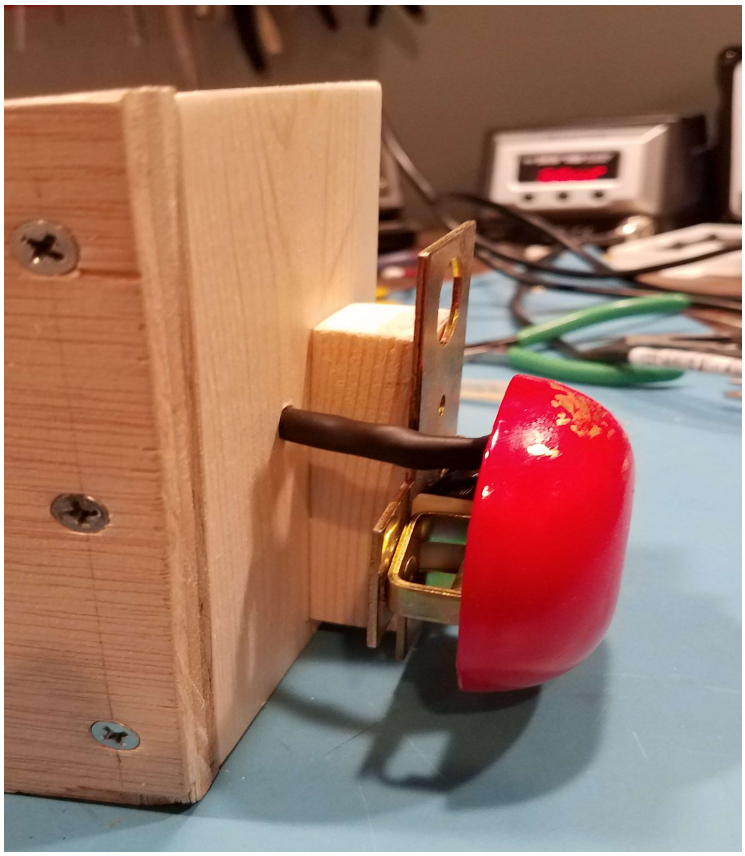


Step 14:
Attach the angled side wall. Align the side wall with the edge of the plywood base and secure with three #6 x 1 1/4” wood screws in the holes drilled in Step 7.

Step 15 **(optional)**:
If you have a bell you want to use, you should figure out how to mount it at this point. If not, just skip this step.

I mounted a small bell with solenoid on the outside of the angled wall. This was an old bell that I had in my parts box for 40 years and finally had a good use for it. It had a bracket so I just mounted a small strip of wood so I could screw the bracket into it. I drilled a hole in the wall and ran the two wires through the hole to join with the other wires for the chime solenoids. The protection diode was soldered between the leads, close to the bell. The chime solenoids require 12 V while the bell solenoid requires 24V, so two separate power wires are required. More on wiring later.





Step 16:
Wire the chime solenoids. I used 20 gauge stranded hookup wire with silicone insulation. This is very flexible and easy to work with. I cut 5 wires about a foot long. You can use any color you like or have, but I follow my own color code which helps in wire identification later. My color code is:

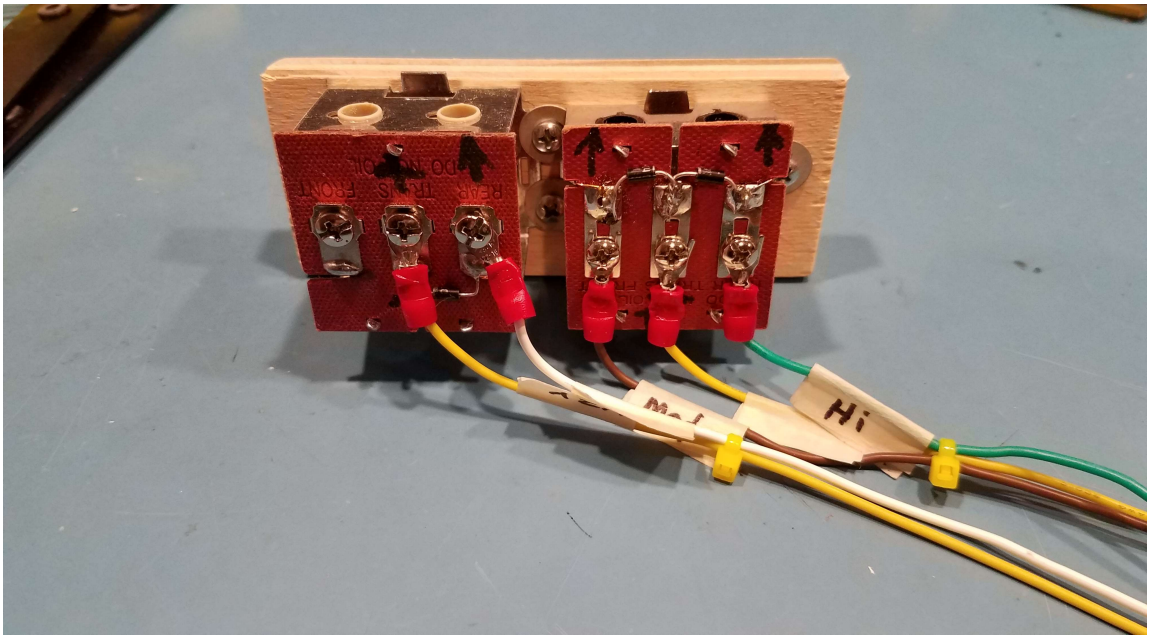
- +24 V supply – Blue
- +12 V supply – Yellow
- +5 V supply – Red
- Ground (power/logic) – Black
- Any other colors are general signals, as desired

I crimped spade terminals on one end of each wire to attach to the solenoid screw terminals. If you don't have these connectors or a crimping tool, you can omit them. An alternative would be to strip about 1/2” of insulation from the wire and tin the wire with a small amount of solder. This will keep all the strands together when wrapping around the screw terminal so you don't have stray strands protruding and possibly shorting to adjacent terminals.

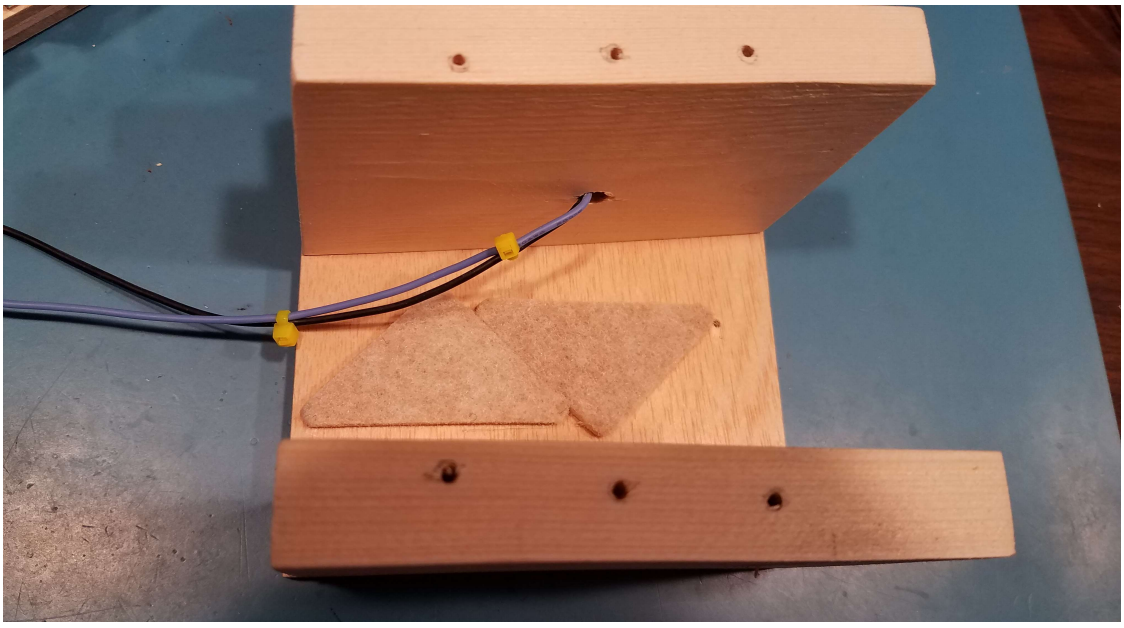
I left the other end of each wire unterminated as I will attach a 6-pin connector to these ends later. I highly recommend using a connector of some sort because it makes it super easy to disconnect the chime unit if it is necessary to adjust, re-wire, or fix it later. If you don't use a connector, you will need to make your wires longer than a foot to reach wherever your connection point is.

NOTE: I ran a +12V supply wire to each solenoid center terminal. You may be tempted to 'cheat' and

use one wire to power both. Since solenoids require a substantial amount of current, and it is possible for all of the solenoids to be driven simultaneously, I don't feel that one 20 gauge wire is sufficient. You can get away with it but I ran both wires in parallel to the connector pin, which is rated for 8 amps, and have two wires on the other side of the connector, in parallel, going to the +12V supply.



Step 17:
Mount the felt plunger pads. Hold the solenoid mounting plate against the square side wall and make a mark on the plywood base below each plunger hole in the solenoids. Remove the mounting plate. Place one or more felt pads to sufficiently cover the marked locations on the plywood base. You may use any shape pads as long as the plunger will be prevented from hitting the wood. Without the pads, the plungers will make a very unpleasant clacking sound against the wood. I used two triangular pads that came in an assortment pack to cover the area, see photo.

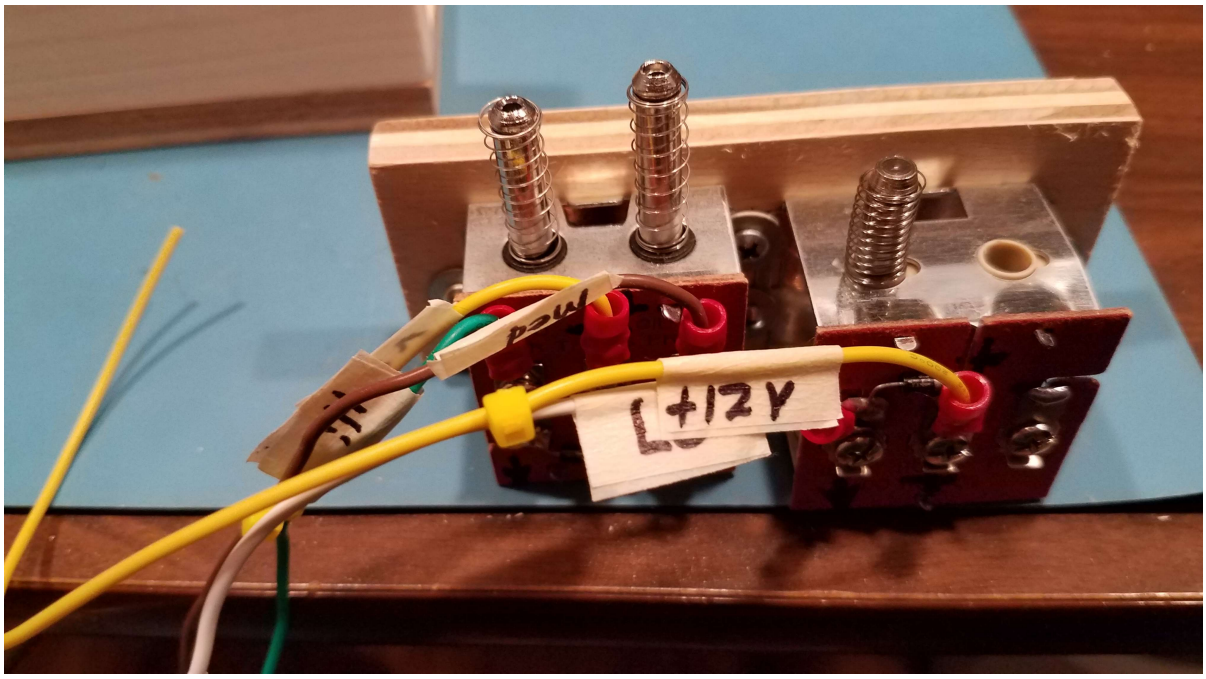


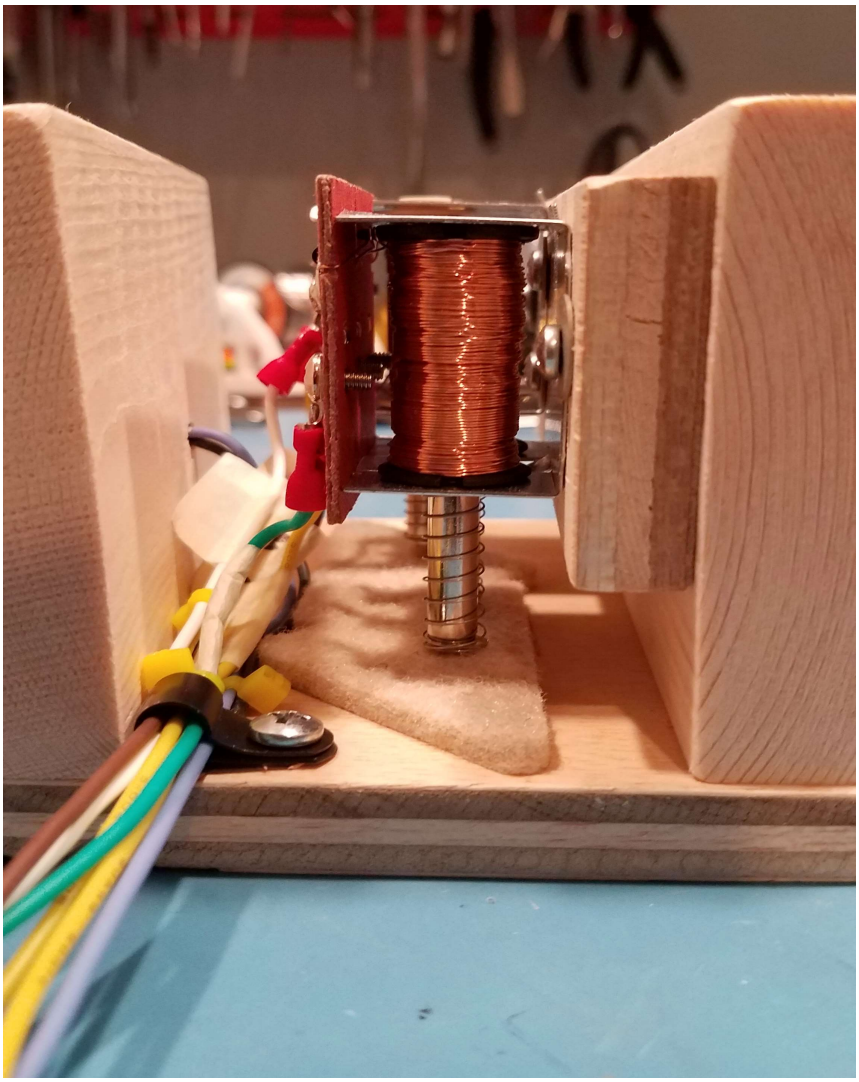
Step 18:
For this step, it is easiest if you turn the solenoid assembly and the wood housing upside down. If not, you will be fighting gravity to keep the plungers in place while mounting the solenoids.

Place the 3 plungers into the correct solenoids, as shown below. Remember, the plungers are different sizes. They should drop into the solenoid tubes easily and should move up and down freely. If not, check that you have the correct plunger in each solenoid and/or check for dirt or sawdust that may have gotten into the tube.

Place the inverted housing over the solenoid assembly and line up the two mounting holes in the plate with the slots in the housing. Attach the mounting plate to the wall using the two #8 x 1 1/4" screws with lockwashers and flat washers, as shown in Step 13. Align the top of the mounting plate to be about 1/4" below the top of the side wall. Tighten the screws.

These may need to be loosened later to adjust the height of the plungers to properly strike the chime bars. By setting the height as shown in the photo below, my solenoids were the proper height and did not require any adjustment, to my surprise!



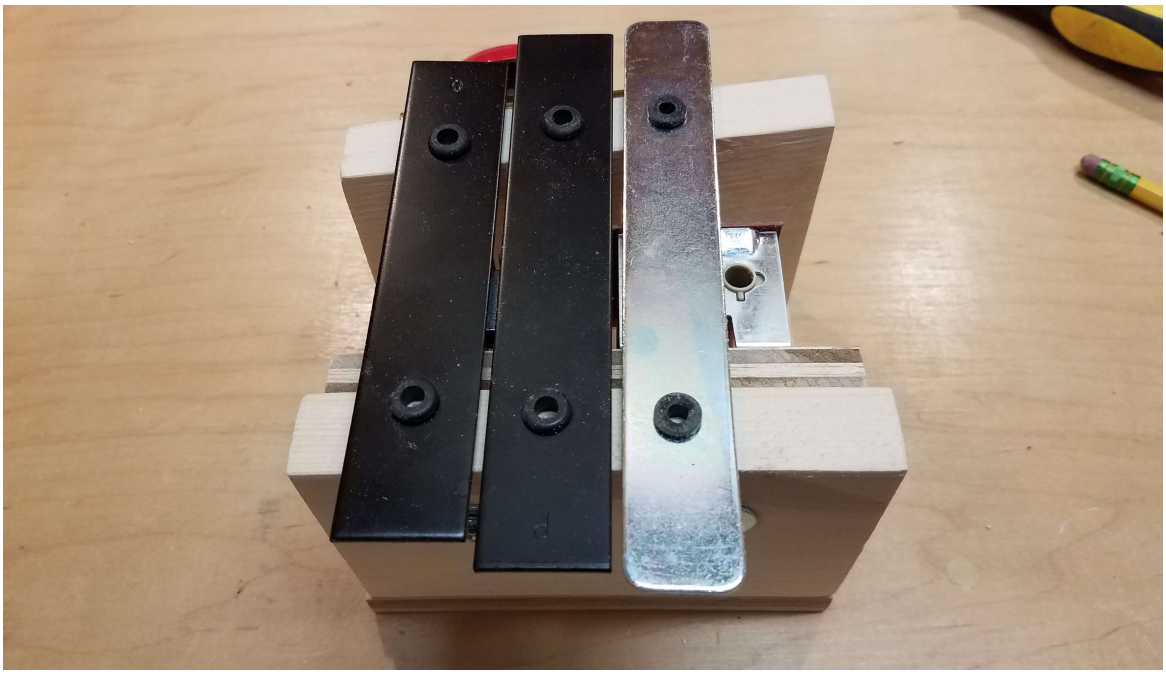


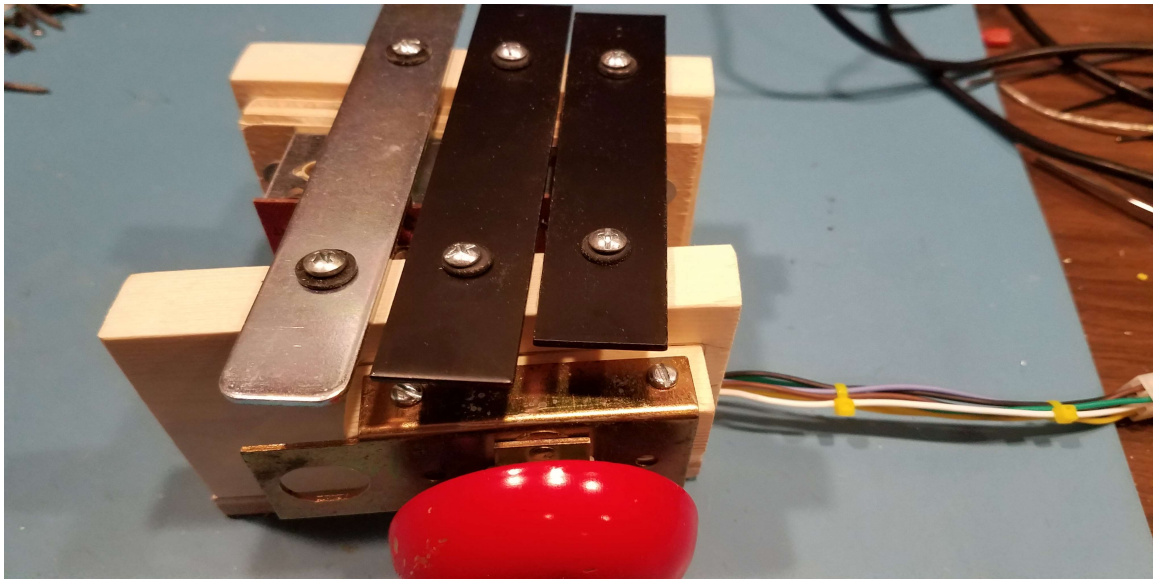
Step 19:
Mount the chime bars. Carefully layout the bars across the top of the box, as shown below. You need to adjust both the X and Y directions repeatedly to get the optimal location. Start by attempting to center each bar over each plunger, as much as possible. Be sure to leave at least 1/8” between bars because they will move when struck. Next, move them in the Y direction until there is sufficient wood beneath each mounting hole so the bar can be mounted with a screw. Note: the screw holes will not necessarily be in a straight line with each other.

Now, re-check the X location and re-adjust, if necessary. Re-check and adjust Y direction until satisfied. Use a pencil to trace the hole locations, inside the grommets. Remove the bars and drill pilot holes for the #8 sheet metal screws.

Attach the bars using six #8 x 3/4” sheet metal screws. Do not tighten them all the way down. Leave 1/16” to 1/8” between the screw head and the grommet.

Note: on mine, the LO bar had non-symmetrical grommets where one side was thicker than the other. If yours is like this, place the thicker side down, toward the wood.

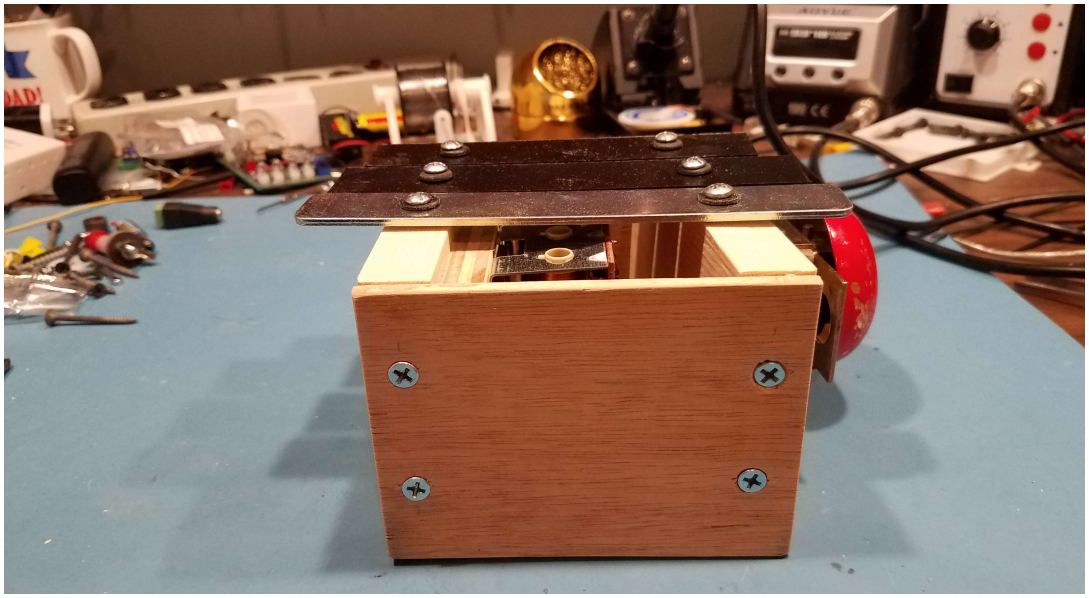


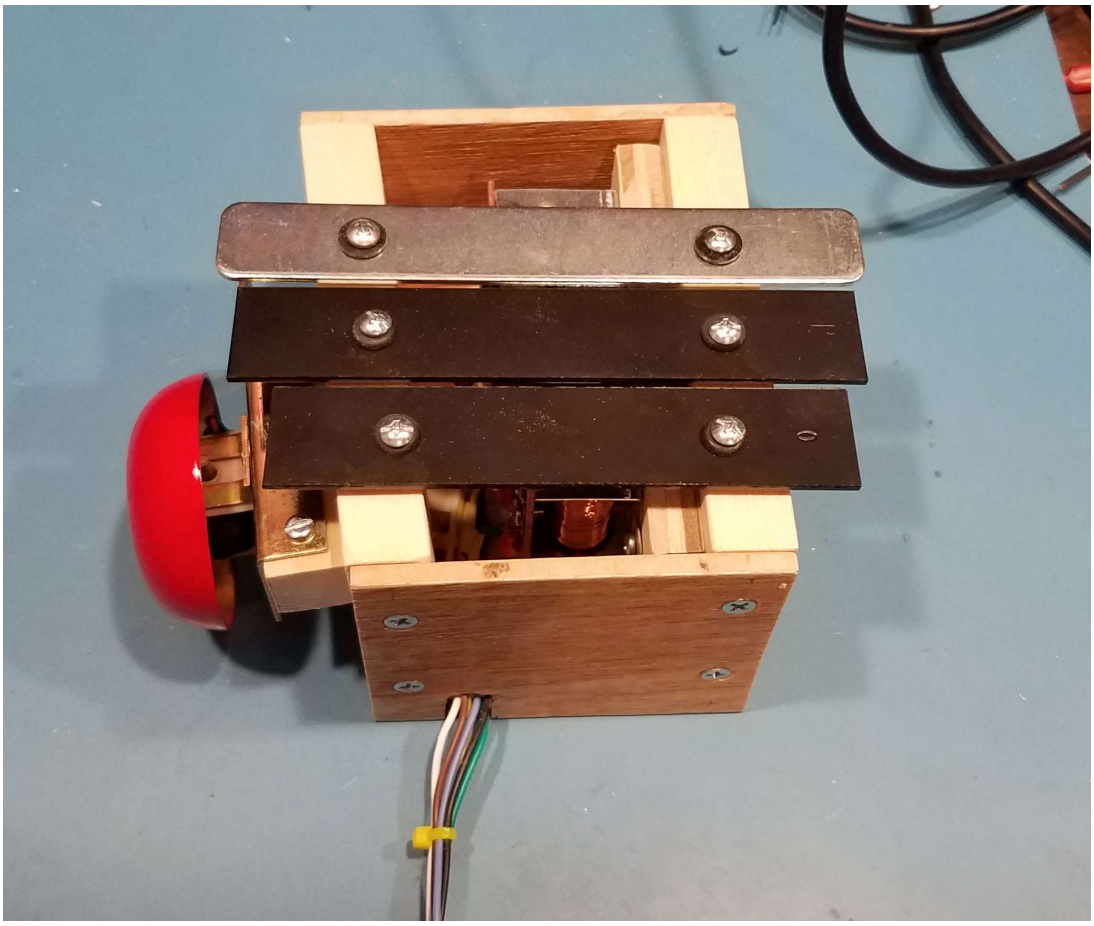


Step 20 (optional):
If desired, cut end panels for the wooden box. These are not necessary but they do add a little volume and tone to the chime sound by providing a better resonating chamber. They also help protect the internals of the unit.

I simply cut two rectangles from 1/4” plywood to fit the ends of the unit. I cut one U-shaped hole on the end with the cable to allow the panel to be slipped over the cable, see photo.

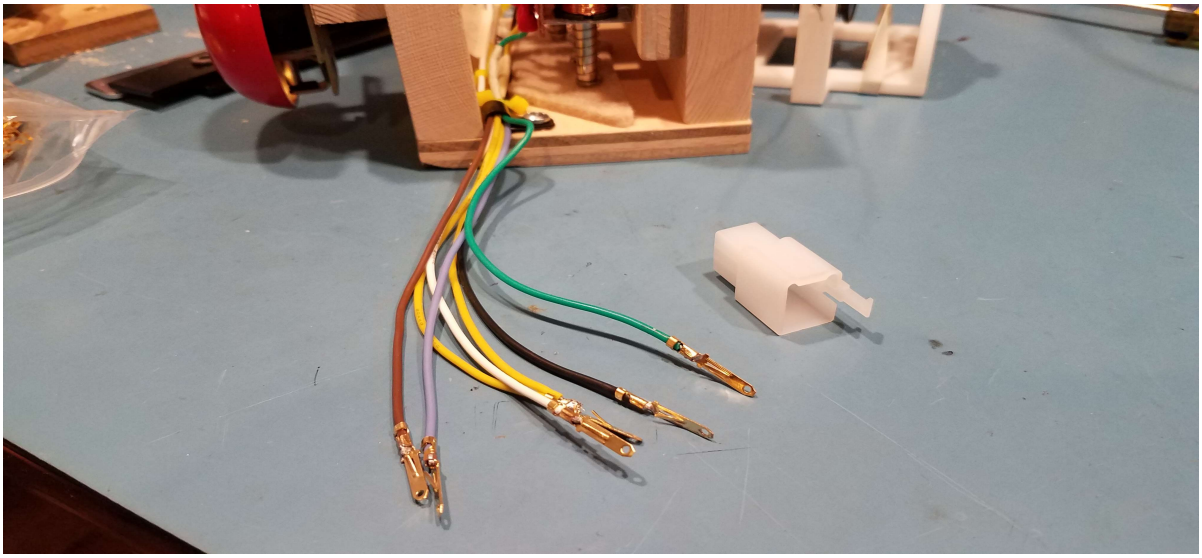
Since my pincab has not been built yet, the simple box ends work for me now. Real chime units have a metal bracket on one end to mount the chime unit on the side wall of the pincab. If you want to mount this in a pincab the same as a real chime unit, you could fashion a bracket or simply replace the panel on the wider end with a taller panel that extends a few inches above the chime unit. This would allow for attachment to the side of a cabinet. If you are using this method, you should use longer screws for attaching this end panel to the chime box since it will be supporting the weight of the entire unit.

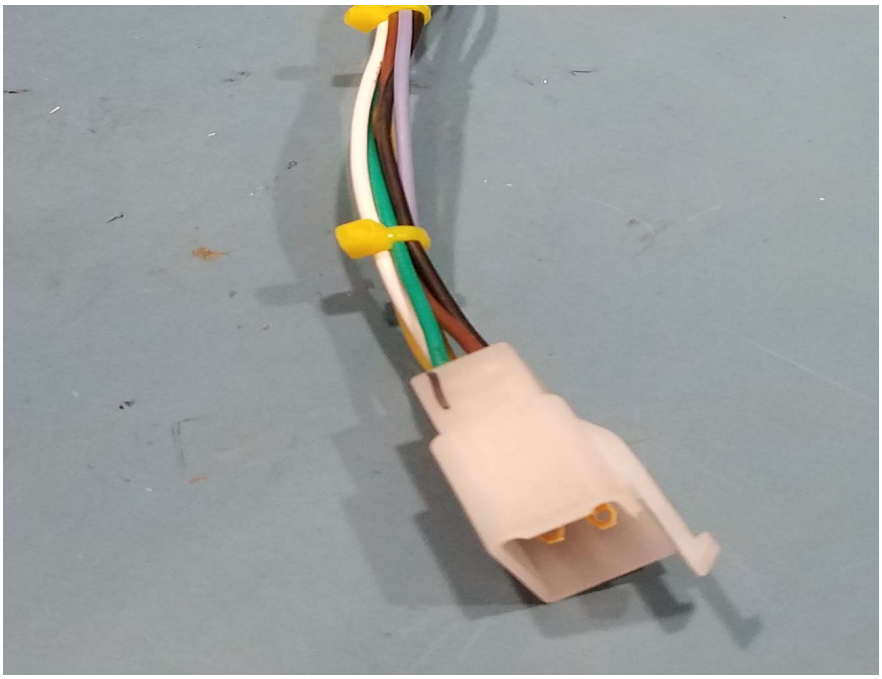




Step 21 (optional):
Install connector on wire ends. Use a connector with at least 4 pins. I used 6 pins because of my additional bell. Select a connector that is rated for at least several amps per contact and preferably has a locking mechanism. Small JST or Dupont-type connectors will not carry sufficient current. I have been using the pins and connectors shown in the photo below (see 'Links' for the ones I bought). Each contact is rated at 8 amps. I have used them on several motors and solenoids and they make things so much easier if you need to move or repair a toy. In my case, since I have not yet built my cabinet enclosure, I will be relocating my toys later and being able to unplug them will make this much easier.

Install a mating connector on the cable to your driver circuitry, and you're done... except for configuring software.

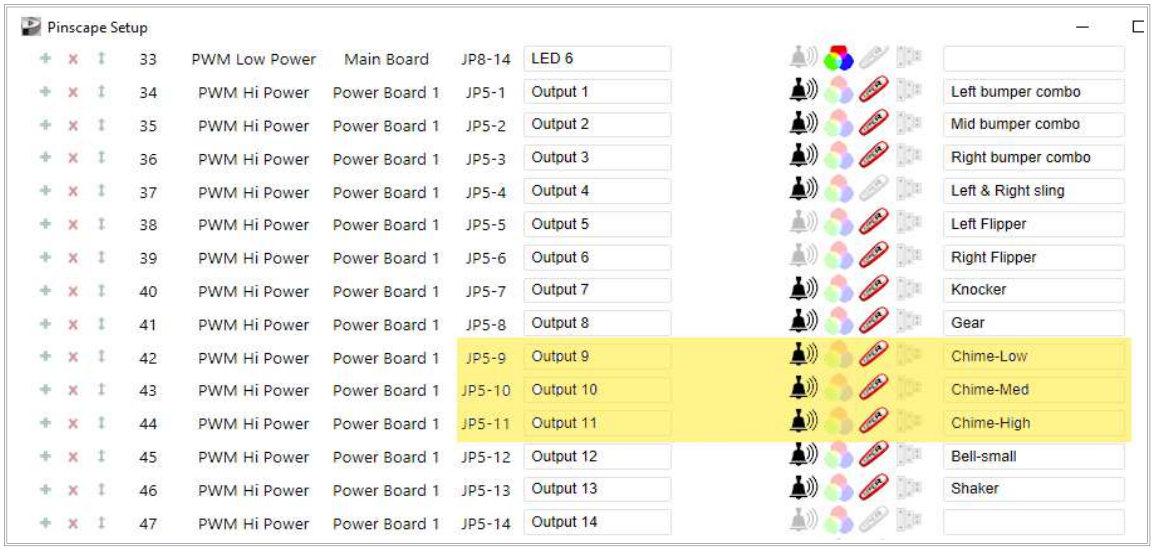




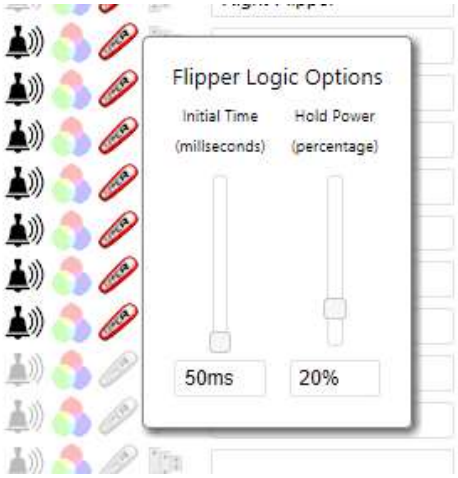
Step 22:
Configure your output driver software.

Note: I use a Pinscape-compatible driver board (designed/modified by me), so my descriptions will apply to using Pinscape software and DOF ConfigTool. If you use other software, you will need to adapt to your use.

Wire three high-power outputs from your Pinscape board to the three chime solenoids. Use Pinscape software to configure the output settings, as shown below.



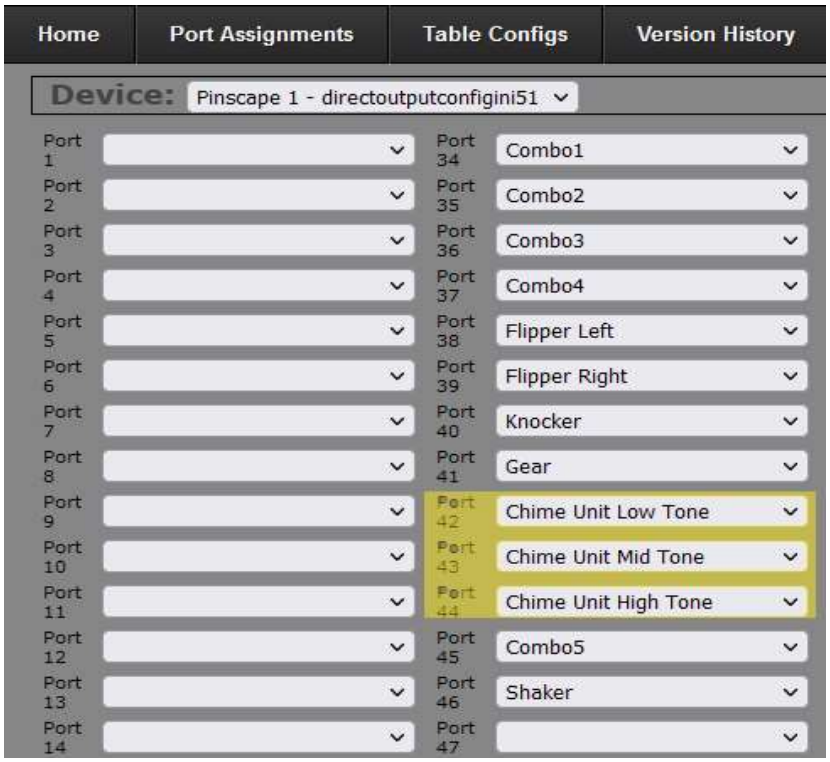
For each of the three outputs, click the 'Flipper Logic" icon to set the power level. I have found the settings shown below to work well. Do this for each of the chime outputs.



Use the Pinscape option to 'Test Outputs' to insure each chime works before proceeding. Find the appropriate output for your chimes and click the button for that output to change it from 'Off' to 'On'. This will leave the coil engaged, so immediately click the button again to turn it off. You should have heard the solenoid engage for each of these outputs. If you did, proceed to the next step, even if the plunger did not strike the chime bar properly. We will adjust that later. If you heard nothing for an output, then check your wiring and output configuration.

Step 23:
Configure DOF. Use your browser to bring up the DOF ConfigTool. Go to 'Port Assignments' and add your chimes to the outputs that correspond to the driver outputs you selected in the previous step. Click 'Save Config'.

Click 'Generate Config' and wait a minute while your new config file is being created and zip'ed. Download the file. Backup your 'DirectOutput' folder and then unzip the new config file to that folder. This will replace your previous .ini file.



Step 24:
Test your chimes with DOF. Run Visual Pinball X and load 'dof_test_table.vpx'. Run the table. There is a keyboard legend at the bottom of the playfield. Pressing the 'X' key should sound the high chime, 'C' the mid chime, and 'V' the low chime. If that works, congratulations, you are done and ready to play games!

If any of the solenoids fired but did not strike the chime bar properly, you may need to adjust the height of the solenoids. If the plungers strike the bars too hard and lift the bars, you need to lower the solenoids. If the plungers do not hit the bars, you need to raise the solenoids.

Make adjustments by loosening the two screws that hold the solenoid mounting plate and moving the plate up or down slightly. Re-tighten and test. Repeat, as needed.

Step 25:
Play Time! Try some EM games and see how they sound. Be aware that not all EM games that support DOF use the chimes. If you encounter one of these games, see section 3.0 'Fixing DOF Table Configurations'.

Note: I found my chime unit to be a little louder than expected. Since I have not built my pincab enclosure yet, the chime unit is sitting on a table, next to my playfield. I assume that when it is built into a cabinet, the volume level will be about right. For now, mine is in a cardboard box to muffle the sound a little.

3.0 Fixing DOF Table Configurations

Not all EM games that support DOF are configured to use the chimes. You may find games that have DOF for flippers, bumpers, slings, etc. but don't seem to work with the chimes, or bells. What I have found is that most of these games actually do have DOF commands for the chimes in the game script but the problem is that a number of the table configs in DOF ConfigTool do not have entries for the chimes. This means that the script is sending the commands for the chimes but DOF does not understand them and drops them on the floor.

Fixing this may be a little daunting at first, but after you've fixed a few tables, it is pretty simple.

Find the DOF Table Config

Start by browsing to the DOF ConfigTool site. Select 'Table Configs' and find your game in the drop-down list. If your game is not in the list but does work with some DOF devices, e.g. flippers, then the game is in the list but maybe under a different name. Open the script editor for the game and look near the beginning of the script for a line that defines the game name. It is often in the form:

`cGameName = myName,` where `myName` is what you need to look for in the list of table configs.

Once you find the table config for your game, scroll down near the bottom of the window and you should see entries for 'Chime Unit High Tone', 'Chime Unit Mid Tone', and 'Chime Unit Low Tone'. Often these are blank and, if so, you will have no chimes until you fix this.

Find the DOF Commands in the Table Script

Using Visual Pinball X, open the table and click the icon to open the script editor. In the script editor window, press Ctrl-F to bring up a search box and search for 'chime', without the quotes. You will find multiple occurrences. Keep clicking on 'Find Next' until you see some code that is similar to the following:

```
Sub PlayChime(x)
      if ChimesOn=0 then
            Select Case x
                  Case 10
                        PlaySound SoundFXDOF("10a",132,DOFPulse,DOFChimes)

                  Case 100
                        PlaySound SoundFXDOF("100a",133,DOFPulse,DOFChimes)

                  Case 1000
                        PlaySound SoundFXDOF("1000a",134,DOFPulse,DOFChimes)
            End Select
```

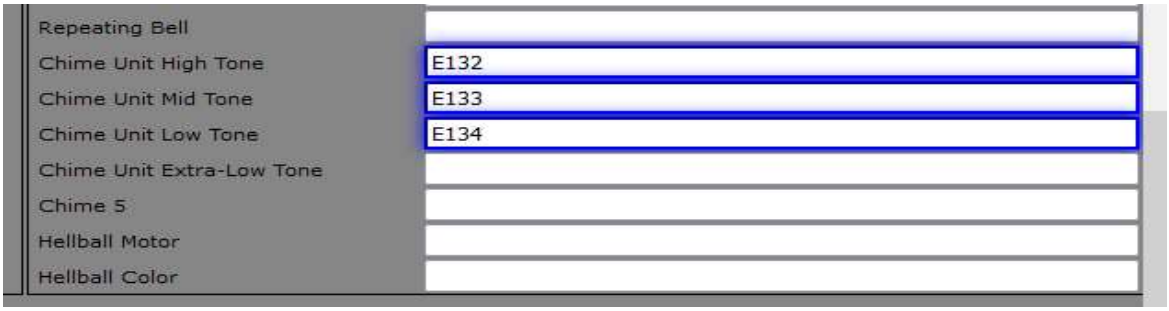
The code will likely be different from this but it will be similar. This code determines which chime to ring, based on the point value of the target hit. The first 'PlaySound' line plays a sound file '10a' through the speaker and also sends a DOF trigger of 132 if the point value is 10. Likewise, the second line will send DOF trigger 133 for a point value of 100, and the third sends a DOF trigger of 134 for a value of 1000 points. Almost all table will use the high chime for the smallest point value, the mid chime for the middle point value and the low chime for the largest point value. So in this example:

DOF trigger 132 = high chime
DOF trigger 133 = mid chime
DOF trigger 134 = low chime

Modify the DOF Table Config

With the trigger information, you can now modify the DOF Table Config to control the chimes. Go back to DOF ConfigTool, find your table, scroll down to the bottom and find the Chime Unit entries on the right-hand side. For each chime, enter the corresponding DOF trigger value you found in the script. Precede each number with 'E'. For example the high chime, in our example, would have the value “E132”, the mid would be “E133', and the low would be “E134'.

When you modify fields on the right side, they will be highlighted with a blue border, after saving. This highlight indicates that you have entered a value that differs from the default config shown in the left-hand column. Scroll down to the bottom and click on 'Save Changes'. This will save your new values to your personal database and cause the three fields to be highlighted, as shown below. Any time in the future that you click on 'Generate Config' and download a new config file, it will contain the changes you entered in the blue fields. If you want to undo those changes in the future, you can click the 'Revert to Default' button and the values in the left column will be copied to the right column. You will need to 'Generate Config' again after you make any changes.



4.0 Links

Heath Zenith Door Chime links:
I ordered from Amazon months ago but the price increased a few dollars since then:
https://www.amazon.com/Heath-Zenith-SL-2796-02-Basic-Wired/dp/B000BPHIK4/ref=sr_1_1?crid=37SC7BPXACD51&keywords=sl-2796-03&qid=1642384919&sprefix=sl-2796-03%2Caps%2C54&sr=8-1

Many Ace Hardware stores carry this model and, as of this writing, are slightly cheaper than Amazon:
https://www.acehardware.com/departments/hardware/safety-and-security/doorbell-and-accessories/36450

Newhouse Hardware CHM1 Door Bell Chime (Amazon):
https://www.amazon.com/Newhouse-Hardware-CHM1-Chime-White/dp/B019BW9TX6/ref=sr_1_2?crid=2ZHXEM0M1HKV5&keywords=chm1%2Bchime&qid=1642696407&s=hi&sprefix=chm1%2Bchime%2Ctools%2C56&sr=1-2&th=1

Wire connector assortment kit (Amazon):
https://www.amazon.com/dp/B07DB7X9R9?psc=1&ref=ppx_yo2_dt_b_product_details

I have purchased both of the wire assortments below and I am pleased with them (Amazon):

Hookup wire, 20 AWG, silicone insulation – 7 colors, 23 ft. each:
https://www.amazon.com/gp/product/B07TGJGJGD/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1

Hookup wire, 20 AWG, silicone insulation – 10 colors, 30 ft. each:
https://www.amazon.com/gp/product/B0881H3J4Y/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1