Building a Line Input Selector for Vintage Audio Systems

Introducing techniques for applying nice graphics on panels and for making clean, accurate holes

Introduction

This is the second in a series of articles covering special switching for vintage audio systems. The previous article, "Switching and Grounding in Vintage Audio Systems.pdf," discussed the factors which motivate building special switches. Vintage systems might have multiple amplifiers (amps) and an unusual number of sources, owing to the need to demo and enjoy a collection of audio equipment. Among the reasons given for needing a Line Input Selector (aside from having a lot of sources) are:

- Difficulty of routing all sources to multiple amplifiers.
- Loading that causes on sources.
- Problems with ground loops caused by interconnecting all those grounds.

A line input selector (**hereafter "LIS"**) is a switch which selects between multiple line-level sources, such as CD, iPod, Tape, Tuner, etc. It provides a single output which may be routed to all amps or switched among them. A later article will cover an automatic amplifier switch.

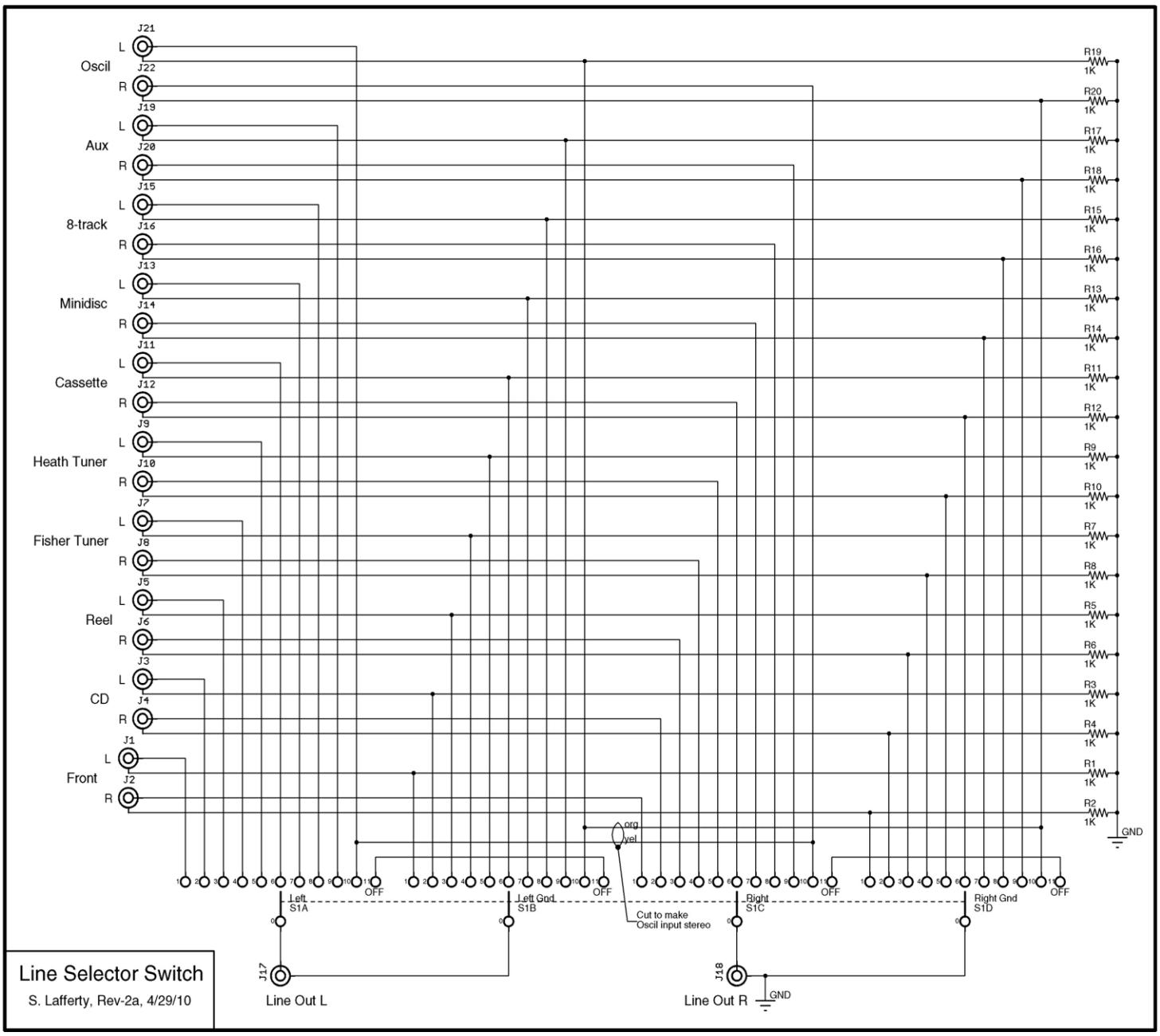
Design of the LIS

You might think that an LIS would be a simple switch and that there is little design needed. While it's true that the circuit is pretty simple, I found that there are some interesting questions to consider about what it should be. Getting one wrong could lead to problems.

- **Number of inputs -** Of course, this would vary with your requirements. My current list of sources includes CD, two tuners, reel-to-reel tape deck, 8-track and a minidisc. I will add my Nakamichi cassette deck from the main system when I finally admit that it's obsolete there :) There is also an oscillator dedicated to the system. Plus, I wanted Aux for future additions.
- **Front panel input -** This is needed for use with an iPod or other portables.
- **Oscillator -** I have a dedicated oscillator in the system to complement the Heath audio scope. The left and right oscillator inputs are bridged by jumpers so that a single cable drives both channels. However, the jumpers can be cut to use the selection as a general purpose input. Since tones can be annoying, we need an Off-position next to the oscillator selection.
- **Switches grounds as well as signals -** To reduce the possibility of ground loops, source grounds are to be switched, leaving them disconnected when unused.

- **Unused grounds tied down but without ground loops -** Since deselected sources will be floating, the wiring from their jacks could potentially introduce hum into the box. To combat this, input grounds are also connected to the (right) output ground by 1kohm resistors. This value is sufficiently low to suppress hum on the lines while remaining high enough to mitigate the effects of ground loops.
- **Internal wires shielded -** To minimize the possibility of residual hum or crosstalk, internal audio wiring is all shielded.
- **Attractive packaging -** As this device becomes a major component in the vintage system, it's important for it to be visually pleasing and congruous with the other components.
- **Substantial weight -** With potentially 22-shielded cables connecting to the LIS, it must have sufficient mass so that they do not pull it around. Rotating the switch knob must not move it.

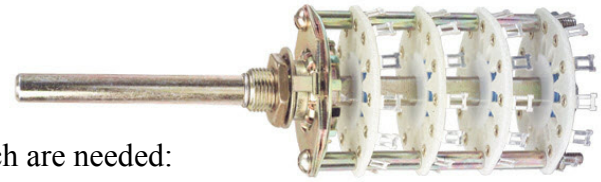
The schematic of the LIS is shown **below**.



Parts

You can find a complete parts list at the end of the article but we will discuss the switch, enclosure and connectors here. The highest, readily obtainable number of positions that I could find for the switch was eleven. That provides for all of the input requirements I have but only one Aux input for expansion. Four poles are required to handle stereo signals and grounds.

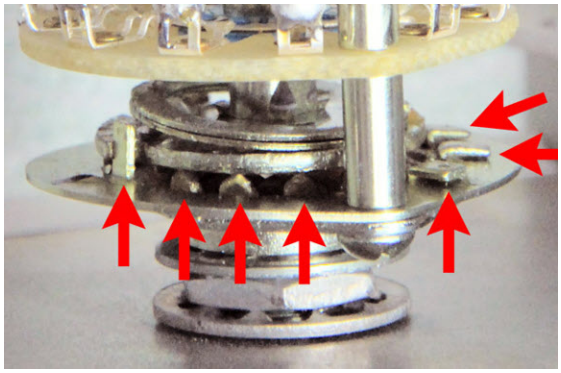
Modifying the Switch

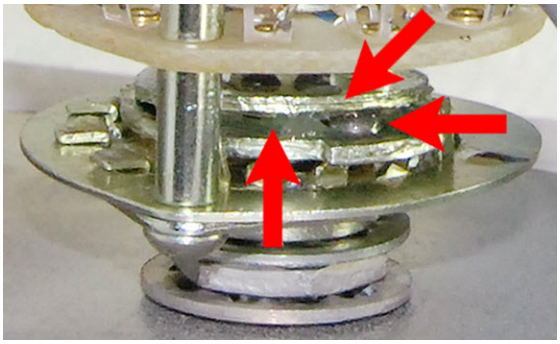


The switch I used is shown **at right**. It came from Mouser and costs about $50. It does seem to be a well-built switch but there were a few changes which are needed:

- **Cut the shaft to the proper length**. It does not seem to be aluminum or brass but I was able to cut it with a hacksaw. The method I use is to mount the shaft in the chuck of a drill press. I then turn on the drill and hold the hacksaw at the point I want to cut. This yields a cut which is square to the axis of the shaft. It's important to use blocks to brace your hand at the proper level for this operation. It will take a good bit of force (30-lbs?) to hold the hacksaw in place. Hold the hacksaw so that the teeth oppose the direction of turn. After cutting slightly longer than needed, use a grinder to set the exact length and to dress the end of the shaft. Allowing for a nut and two lockwashers behind the panel, the length for the specified knob should be 0.45-inches. That will put the skirt of the specified knob a minimum of 0.08-inches above the front panel.

- **Bending tabs -** As shown **at right**, the switch has tabs which let you choose from 2-11 active positions. Bend down all except the primary tab (depending on your requirements). In the photo, only the primary tab on the left is still standing. To identify it, rotate the switch fully CCW. The tab which stops the rotor arm is the primary. The next three arrows point to tabs which I snipped with cutters. As you can see, the nubs which were left seemed pretty high. It was better to use needle-nose pliers to bend them down as the next three are shown.





- **Loosening the spring and greasing the stops** - I found that the click-stops were much too stiff, due to the spring being too tight. In the photo **at left**, the horizontal arrow points out the ball which falls into click-stops. The slanted arrow points to the circular spring and the vertical arrow indicates where you can insert a screw driver to loosen the spring.

  Apply upward pressure, moving the spring away from the ball, to loosen it. Do that by carefully twisting the screwdriver. The farther away from the ball horizontally that you position the pry point, the more drastic an effect the pressure will have. With the screwdriver inserted at the point shown in the picture, twisting CW will bend the spring more than twisting CCW. That's because CW pushes the spring up with

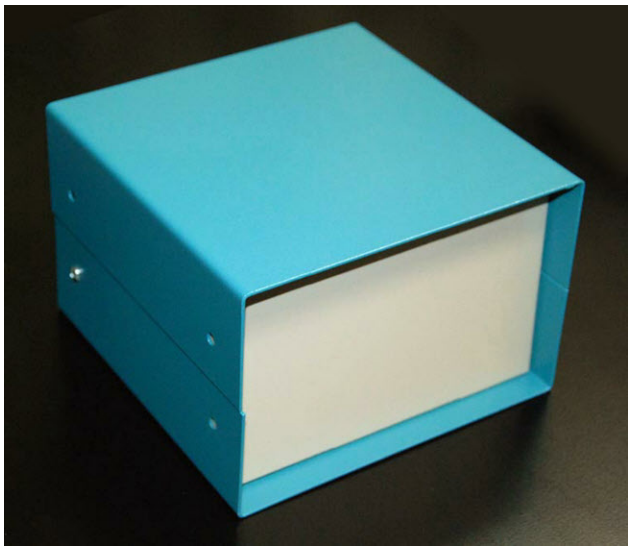
the left corner of the screwdriver, which is farther from the ball. Alternately pry on both sides of the ball, balancing the effect. Be very careful not to push too far. You can't undo it. Start with very small deviations. Check the difficulty of rotation (with a knob on the switch), after each pry.

Remember that you need to leave it tight enough so that the frictional drag on the switch is still swamped by the click-stops. If it starts feeling a little mushy or the stops aren't quickly snapping into place, STOP. After doing what you can with the bending, use silicone grease to lubricate the ball and click-stops. It isn't easy to get the grease in there. I used the stick of a cotton swab, cut at an angle, as an applicator. Rotate the switch to spread the grease. After a few minutes of tweaking, my switch became quite comfortable to use and has a nice feel.

- **Using a smaller nut on the front**. I found that the 3/8-inch nut supplied with the switch was too large for my nut driver set. Substituting a smaller one from my collection made it easy to tighten the front nut. You can still use the supplied nut behind the panel.

Enclosure

In keeping with the design requirements of attractive packaging and substantial weight, I decided to spend the money to buy the nice, Hammond enclosure seen **at right**. The steel top and bottom pieces add weight, while the aluminum front and back make it easy to drill. The overall size is chosen to provide plenty of space for the 20-connectors needed on the back. It's important that the enclosure be metal, to shield the switch from hum.



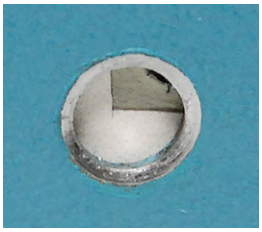
By chance, I was able to find new units of the part number I had chosen, available on eBay for only $30, including shipping. (Search for Hammond 1458C4B)

I was quite happy with the enclosure. It's very nicely powder-coated. Fit is very good, allowing the clamshell pieces to come together almost seamlessly. (In the pic, the pieces aren't screwed together, so the fit looks a little off.) I think is has a very nice, modern look. One person commented that it ties-in well with the vacuum tube equipment.

Besides adding the holes to the front and back panels and affixing the panel artwork, the only modification I needed to make was scraping-away a bit of paint near a couple of screws to insure that the entire enclosure is electrically grounded. As you can see above, the top and bottom covers are affixed to the front and back panels with four self-tapping screws on each side. Holes in the top and bottom are oversize. To insure contact with the covers, I removed a ring of paint at three holes in the covers on the left side. Those are the holes in the bottom and back. A ground terminal will be attached to the rear panel.

The task of cleanly removing the ring of paint is surprisingly tricky. It must be removed far enough out so that no part of the screw is separated from the chassis by paint, else there could be an air gap insulating the part of the screw head which isn't resting on paint. Yet, removing paint

outside the diameter of the screw head risks making it visible. So the removal must be accurate and visually clean. Attempts using a Dremel with a wire brush tool and an outer washer to define the perimeter were unsatisfactory and difficult.



The solution is to put a split lockwasher on a #10 Phillips machine screw, put it through the hole and drive it with an electric screwdriver for maybe 20-seconds. Make sure it's turning in the direction which causes the sharp washer edge to dig into the paint. Push hard. As you can see in the pic **at left**, it works well. After the scrape, coat the exposed steel with oil to prevent rust. Do the process to both holes on the left side of the bottom and the rear hole on the left side of the top.

Phono Connectors

I have not been very happy with gang-mounted phono connectors, in the past. They seem flimsy and the plastic bases do not provide full shielding against hum. These days I use individually-mounted phono connectors and specifically, ones with a hex base. Those allow you to tighten the connector from the outside, without marring the surface of the connector's contact area.

Unfortunately, gold plated versions are hard to find. Given the fact that most connectors on vintage equipment are not gold plated, it wouldn't make much difference, anyway. The fact is, nickel-plated connectors work fine. Heck, even HP test equipment uses them.

Since we are switching ground connections and keeping them separate, we must provide a way to insulate the connectors from the chassis. For that, I use a nylon shoulder washer and a nylon flat washer. Of course, you have to remember to allow for the shoulder washer when making the holes in the chassis.

Fabrication

The only fabrication operations are making holes in the front and rear panels. We are also going to be using a special technique to get excellent panel graphics. For that to look its best, it's important to place the holes as accurately as possible, relative to the graphics. The methods described below worked admirably in this regard. As a matter of fact, alignment for this project came out the best I have ever done. For me, that is a special triumph. Since I was a kid making things out of wood, I have always struggled with getting holes exactly where they should be. I was always at least a little dissatisfied with the results, until now. Hey, it only took 45-years :)

Overview

The plan is to use an inkjet printer to produce the panel graphics. They do an excellent job and the results with good ink and paper are archival. With the right coating, the surface is reasonably tough and water resistant. To get really good alignment, we will print two copies of the artwork. The first one will be taped-on and used as a template to place the holes. (The shop work will soil it, of course.) After the machining, we affix the second copy, using a spray adhesive and a special alignment method, to produce the actual graphics.

Note that the front and back panels from the factory are physically identical (except for paint). *We will use the same process on both of them, so we will describe it only once.*

Template

Note that these instructions will be reused to prepare the final art.

Printing

We need to print a copy of the front and rear panel artwork to use as a template to align the holes. The artwork files for the panels are posted with this article, **here**. Unpacking the Zip file, you should have these files:

- Line Selector Sw FP.cdr - Front Panel in CorelDraw-12 format.
- Line Selector Sw FP.png - Front Panel in graphics format.
- Line Selector Sw RP.cdr - Rear Panel in CorelDraw-12 format.
- Line Selector Sw RP.png - Rear Panel in graphics format.

If you have CorelDraw-12 or later, you can use those files to adjust color or make other changes to the artwork. If you just want to print the files as-is, you can do that with either format. The graphics files print well from IrfanView 4.1 (a free graphics viewer).

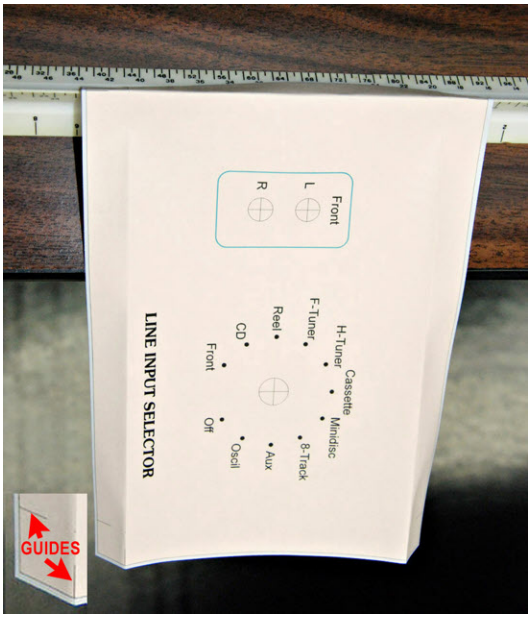
> ***A Note about Color***
> The background color of the panels is supposed to be a yellowish off-white. However, computers and printers have trouble with it, showing anything from green to pink pastels. You may need to use CorelDraw or a bitmap editor (like PhotoShop) to adjust the supplied files to suit your printer and taste.

To print from IrfanView:

1. With the file open, press Ctrl-P to print.
2. Select Original size.
3. Click Printer Setup, select Landscape and...
4. Set printer properties for Best quality and Other Inkjet papers (for HP 952C printer on Hammermill Laserprint, which I highly recommend). Click Print.

To print from CorelDraw:

1. Open the cdr file.
2. In the Object Manager panel, make sure that the Alignment layer and Layer-1 are visible and enabled for printing.
3. Press Ctrl-P to print.
4. Say Yes to orienting the paper.
5. Set printer properties for Best quality and Other Inkjet papers (for HP 952C printer on Hammermill Laserprint, which I highly recommend). Click Print.



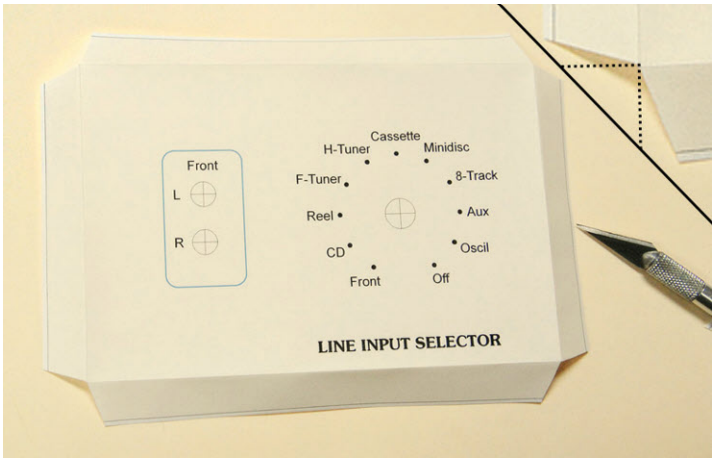
Attaching the Template to the Panel

We will use masking tape to attach the template to the panel. Here are the steps:

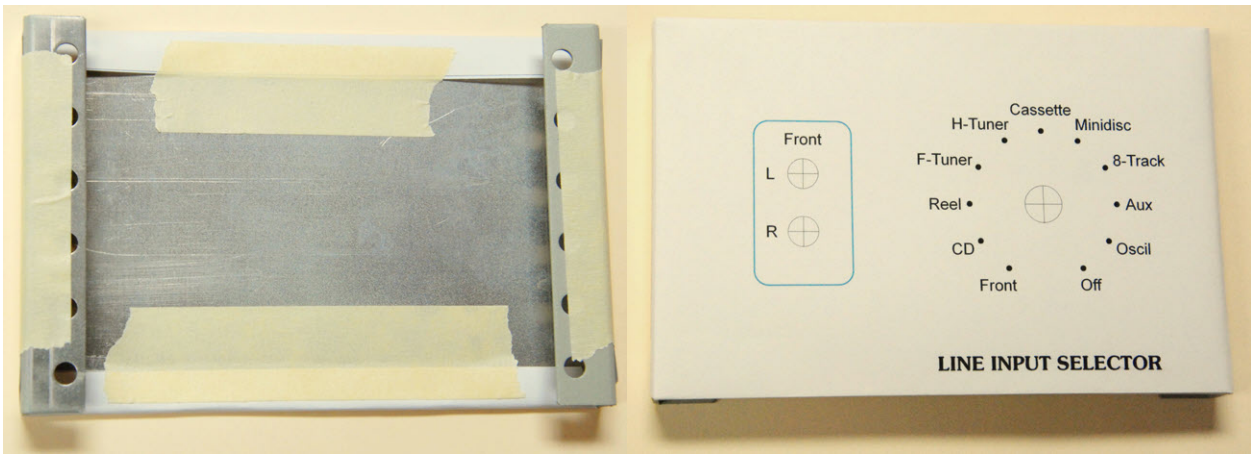
- **Trim the template print -** Cut the template out of the print, leaving about 1/16th inch beyond the outside edges.
- **Fold the template on the guides** - (**See inset.**) This part might sound complicated but I am just describing details of the artistry in folding. That is so you can make the fold very accurately, insuring good positioning and alignment.
  - Arrange for a vertical edge, such as the triangular ruler shown **at right**. I refer to it as the "**edge**."
  - Lay the trimmed template over the edge and align

the guides with the edge. Begin by gently pinching the template around the edge, just at the guides. The key to this is gradually sharpening the bend, while adjusting alignment.

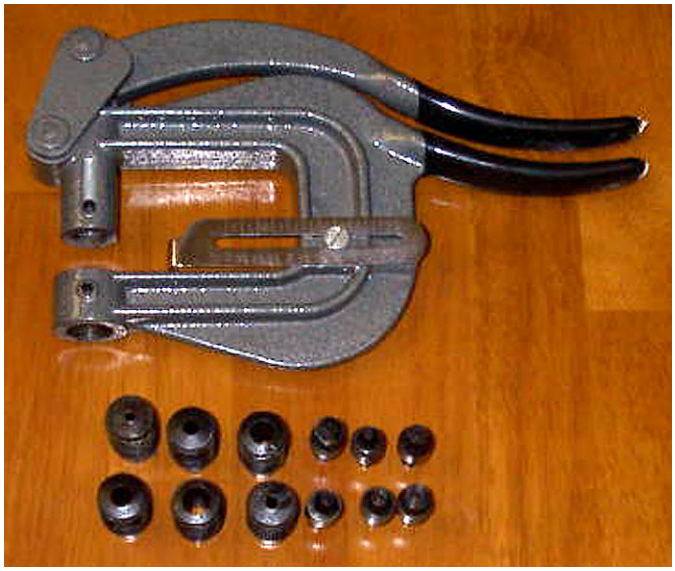
- While holding both guides in place above the edge with outer fingers, use inner fingers to press down on the template at the center and then all along the edge, thereby creasing the template.
- While still holding the guides in place with outer fingers, use thumb and forefinger to pinch the template around the edge.
- Take the template off of the edge and micro-tweak the position of the fold at the guides. Do that by gradually pinching the fold at the guides. As you're tightening the pinch, slide your thumb and forefinger slightly in opposite directions to roll the guide mark closer to the exact edge of the fold. Pinch it tight, when it's perfect.
- Lay the template down on a hard surface, face-down, so the short part of the fold is up. While holding the sides of the fold down by pressing down on the pinched guide areas, press down on the middle part of the fold to close it fairly tightly.
- Finally, cinch the fold by rubbing the back of your fingernail across it.
- Inspect the guide lines. If you can't see them on either side of the fold, it's perfect! If they are visible but within 0.03-inches of the edge, that should be okay. Lay the fold next to a ruler to check straightness. There should not be a visible deviation.
- Apply the same folding procedure to the other three sides of the template. Gently stretch-out completed folds, while others are done, as shown in the photo above.



- **Notching the template -** Use an X-Acto knife to cut broad notches in the corners as shown **at left**. You should use a new blade. Clean it with alcohol to remove oil. As you can see in the **inset**, the cut lines are outside of the projected fold lines (shown dotted) by about 0.15-inches at the outside edge lines. Start the cuts at a corner defined by the folds. Ignore the single-pixel corner dots.
- **Attaching template to the panel -** Use masking tape to affix the template to the panel, as shown **below**. Before taping, make



sure that the folds are aligned with the edges as accurately as possible. The paper should be pulled moderately taut but not extremely tight.

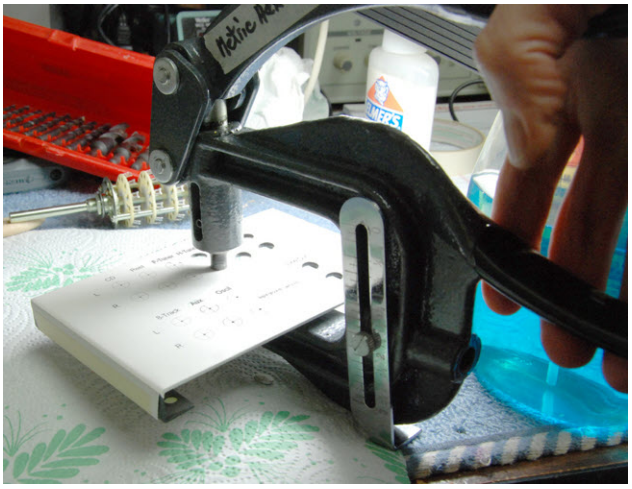


Making the Holes

The hole sizes are 5/16” for the connectors and 3/8” for the switch.

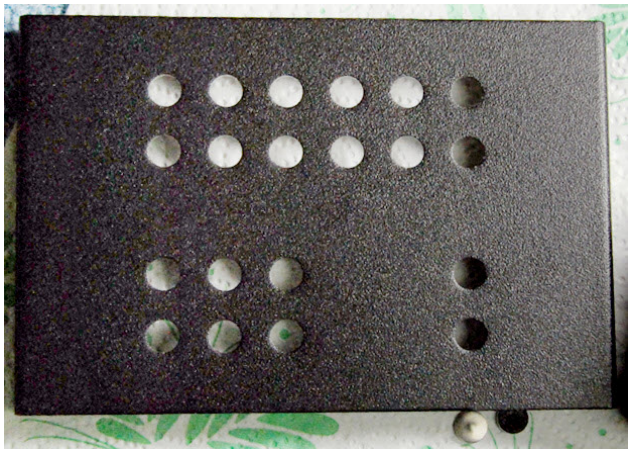
Using a Punch

With the template in place, we are ready to make the holes. You can use either a drill or a punch but I have found the punch to be a lot faster, more accurate and less messy. The punch which I use is shown **at right** and **below left**. The set I bought on eBay in 2010 for about $30 included dies in 1/16” increments to 7/16. However, updating this in 2015, I see that particular product is no longer offered by that seller but there are plenty of other hand punches there. Just make sure that 5/16” and 3/8” dies are included or buy them separately.



To be fair, I should point out that there are applications which this punch cannot handle. It’s limited by the 3-inch throat depth and by the 0.6” clearance which it requires around center of the hole. Due to the clearance issue, the flanges on the sides of the front and rear panels limited how close the holes of the back panel could be to the sides.

When it can be used though, it produces very clean and accurate holes, as you can **see below**. There is a sharp center pin on the surface of each punch tool. It’s short though, so it’s hard to visually align it to the template. To align the punch most accurately with the template, use a sharp point like a scriber to make a hole at the center of the “X” on the template. I recommend using a magnifying visor. Press hard to make it bite into the aluminum, too. Align the template by holding the panel up against the punch center pin and moving it about until the pin slips into the scribed hole. It’s quite easy and very accurate.



Operating this way, I found that all of the holes were precisely aligned with the drawn circles. In most cases, you could not find the circles after punching, even though they were drawn exact size. For the first time in my life, I was more than satisfied with the accuracy of holes I made.

Using a Drill Press (or a hand drill)
If you cannot use a punch, the next best thing is a drill press. More maximum accuracy, start with center-punching at the "X" on the template. Then begin with a drill bit no larger than 1/8." Work your way up in size by re-drilling in steps of about 2X, to get to the size you need. Of course, it makes sense to drill all of the smaller holes first, before changing bits for the next larger size.

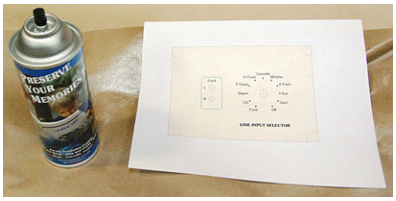
Completing the Holes
Do the same template procedure for the front and rear panels, except for using the different artwork files. If you used a drill, after making all the holes, be sure that they are free of burrs. I use a handheld oversize drill bit for that. I find that it works much better than a "real" reamer.

Installing the Artwork

Preparation
Now we are ready to print and attach the artwork for the front and rear panel graphics. The procedures for front and rear are the same, so we will cover it only once for both:

- First, use the exact same instructions as for the template (starting on page-6), to *Print, Trim, Fold and Notch* the art for the panel. It should look identical to the template. Recall that the reason we did not want to use the template for the final artwork is that it was likely to be soiled in the fabrication operations. Even if you think you can avoid blemishes, you will find yourself taking extra effort and time to avoid them, if you try to use just the template.

- Spray the artwork with two coats of a clear coat called "Preserve Your Memories II."You can find an instructional video and the product here: http://www.precision-blue.com/ The spray (**shown below**) does a good job of protecting the art from water and UV fading, while keeping the surface matte. It's compatible with inkjet prints and does not substantially change the stiffness of the paper. It also dries quickly and has low VOCs.

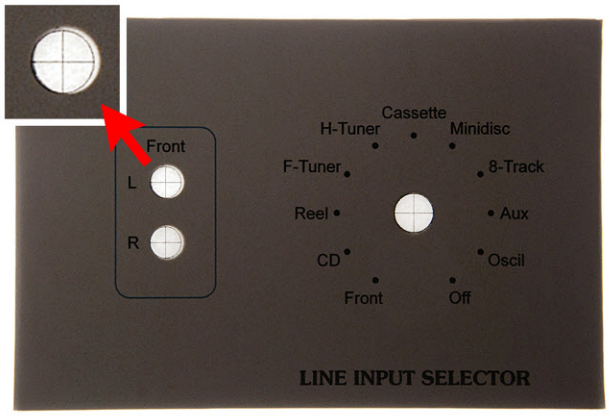


- Clean the panel surface thoroughly, using window cleaner.

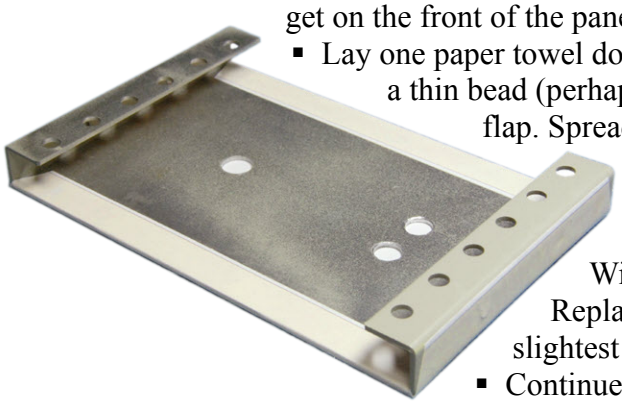
Affixing the Artwork to the Panel
We will use 3M Super-77 spray adhesive to do the bonding. If you are not familiar with Super-77, I recommend that you try some experiments with a rectangle of paper representing the artwork and cardboard representing the panel, before attempting to do the LIS. It bonds very quickly and doesn't allow much repositioning. With the holes having already been made, misregistration between the labeling and the panel parts will be visible, so it's important that the artwork be positioned accurately. This could be difficult to achieve.

However, I have a simple technique to offer you which will insure good positioning. The idea is to put the artwork on the panel without the adhesive and tape one flap. It's like we did for the template but just the left flap gets taped. You can fold the art over to the left, using the tape as a hinge. Spray the panel with adhesive. Then fold the art back over on top of it. The tape will help insure that the art gets positioned correctly.

Now, there are some details which you need to be careful about, so we will go over the steps:

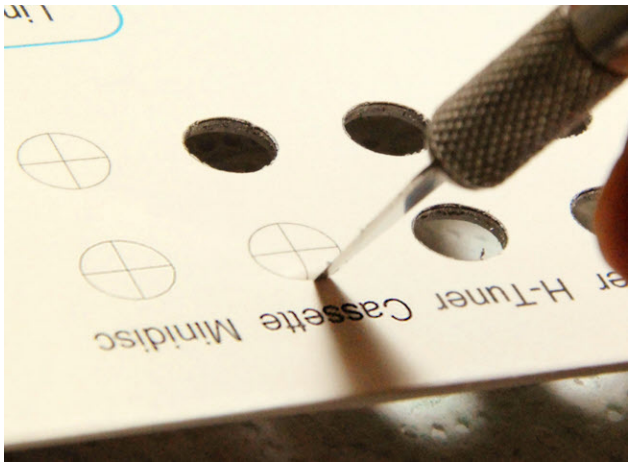


- Carefully position the artwork on the panel. Use a lightbox or other light source behind the panel to show where the holes are, as seen **at right**. Align with the holes and also make sure that the folds are even with the edges of the panel.
- When you have it right, attach the left flap to the panel with masking tape. Make sure that the tape is well affixed to the panel and the paper.
- Practice folding the the art out of the way and back over the panel (without adhesive), being aware that once it touches, the position will be pretty much fixed. You need to get a feel for how to hold the art (how hard to pull to the right) to bring it into alignment. Also get the feel of how to lay it down so that it remains in alignment as it touches.
- Cover a table with newspaper sheets to catch sticky overspray. Be aware that this stuff gets around. Clean up later with Goo-Gone, if necessary.
- Place the panel and art in the center of the newspaper. Fold the art back to the left. Cover the art with a piece of letter size paper, covering up to the side of the panel.
- Spray two light passes of Super-77 over the panel, according to directions.
- Without delay, carefully fold the art back over the panel, as you practiced.
- Begin pressing down lightly, radiating out from the left side. Smooth out any undulations.
- Check the alignment, using the light source behind the panel. If it's within say, 0.05", that's good. If it's 0.1" or more off, you may need to try again.
- If you didn't get it right the first time, don't get discouraged. Just pull the art from the panel quickly, before the bond sets. I don't advise trying to reposition at this point. You will need to clean the adhesive off of the panel thoroughly. Goo-Gone should take it off fairly easily. Just print another copy and try again. You'll get better with each try. When you have it right, congratulations! That's a tough operation.
- If there is no problem, cover the art with a clean sheet of paper (not the piece used to shield it from spray) and roll over it with a rubber roller to set the bond.
- Now we need to glue down the flaps to the sides and around to the back of the panel, as shown **below**. I first tried to use Elmer's Glue-All for that but found that the paper wrinkles as it dries. Lineco Neutral pH Adhesive worked better. That came from the Dick Blick art supply store. It looks just like Elmer's but doesn't wrinkle the paper.
- Have several paper towels ready. You need to be very careful to make sure that glue does not get on the front of the panel, which will be facing down.
  - Lay one paper towel down to work on. Apply the glue to the back of the flap in a thin bead (perhaps 3/32"wide). Start and end 1/4" from the ends of the flap. Spread the glue using a 2" piece of office tape, folded to 1" so that the sticky part is inside.
  - Press the flap against the panel, keeping modest tension from the front side. Rub tightly to seal the bond. Wipe your hands to make sure there is no glue on them. Replace the paper towel on the work surface if there is the slightest suspicion that glue might have gotten on any part of it.
  - Continue with the other flaps.



Finishing the Artwork

Repeat the Artwork Installation procedure with the rear panel (if you started with the front).



Cutting Out the Holes

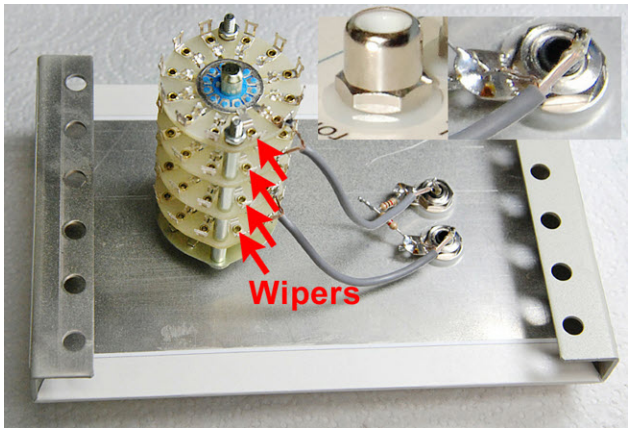
The main thing left with the artwork is to cut out the holes of the front and rear panels. Use the X-Acto knife. Plunge the blade in, with it turned parallel to edge as shown **at right**. Tilt the knife slightly outward. To get a clean, circular cut: While sawing downward, apply a gentle, inward turning pressure to the knife. That is, if you are cutting clockwise around the hole, put a gentle, clockwise torque on the blade, while at the same time, applying an outward lateral force. In summary: Simultaneously apply a downward cutting motion, outward pressure and clockwise torque.

Clearing the Panel Mounting Holes

The flaps from the front panel art are covering the mounting holes on the sides of the flanges of the front and rear panels. Those are the holes where the top and bottom covers attach. You will need to cut away the paper from around the holes, **as shown at left**.

Ta dah! That completes the work on the LIS enclosure. The tough part is done!

Assembling and Wiring the Unit



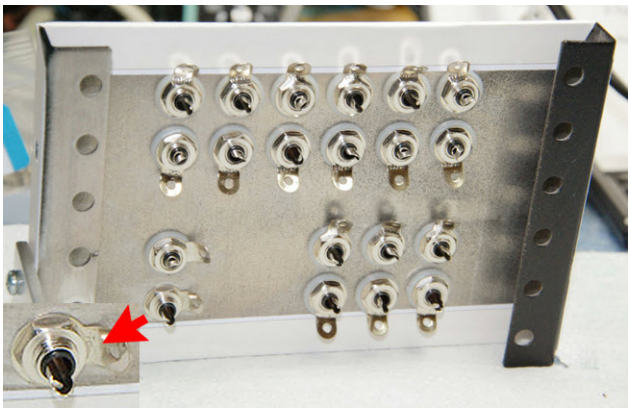
Front Panel

Mount the rotary switch and the two phono jacks on the front panel, as shown **at right**. Put a nut, sandwiched between two lockwashers on the switch bushing behind the panel. (See photos, page-3.) The nut relieves stress from the collar. The lockwashers keep the switch secured, in spite of turning forces. Orient the switch with the wipers at the positions pointed-out by the arrows. You can recognize the wipers as the lugs which make continuous contact with the inner ring of the wafers. The phono connectors require nylon washers to keep the grounds apart. In the **left inset**, you can see the nylon shoulder washer needed in front. The nylon flat washer and the supplied ground lug are used in back as seen in the **right inset**.

Do the preliminary wiring shown, which includes the Front switch connections and the ground resistors. Leave the junction of the ground resistors floating, for the moment.

Switch Organization

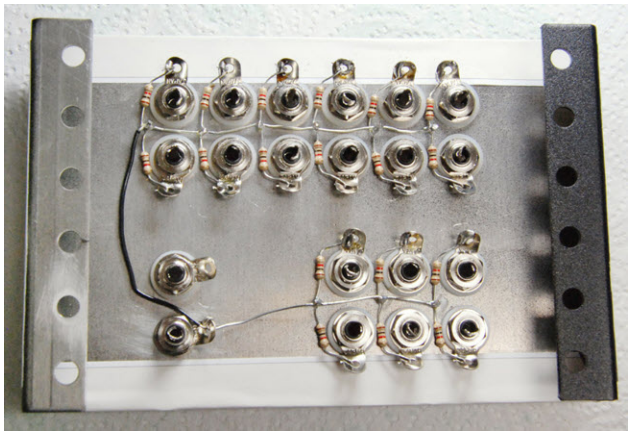
Each wafer of the switch handles one of the four poles. I assigned the left signal to the front wafer (wafer-A), left ground to the next wafer-B, right signal to wafer-C and right ground to wafer-D. Looking from the back, the first lug counterclockwise from the wiper is the position selected when the knob is max counterclockwise. That would be the Front Inputs. The wipers will go to the Line Outputs. The various inputs will go to the other lugs of the switch.



Rear Panel

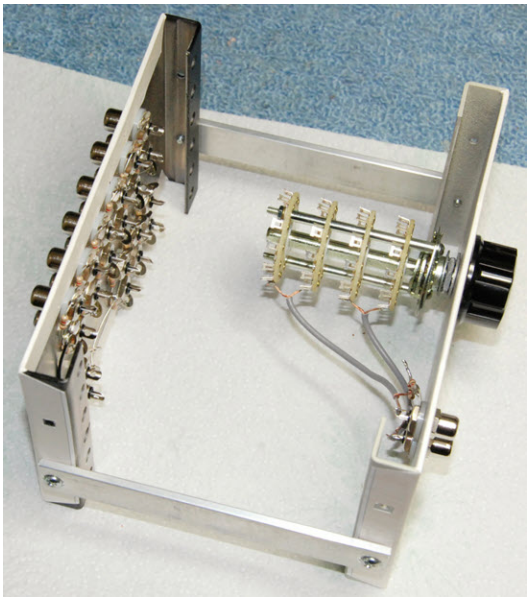
Install the connectors on the rear panel just like the ones on the front panel (except for one), as seen **at left**. The exception is the one on the lower left (right Line Output). It should *not* have the nylon washers (as shown in the **inset**), since it will be the chassis contact. Before installing that one, use 600-grit sandpaper or similar to prepare the rear of the panel where the lug will make contact.

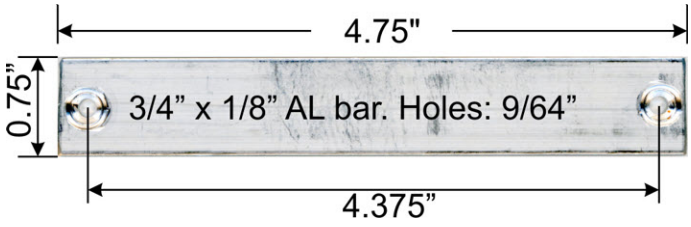
Prewire the rear panel by installing the ground resistors, using a bus structure as **at right**. The grounds come together at the right Line Out ground lug. The resistor leads soldered to the individual input connectors should not touch the chassis.



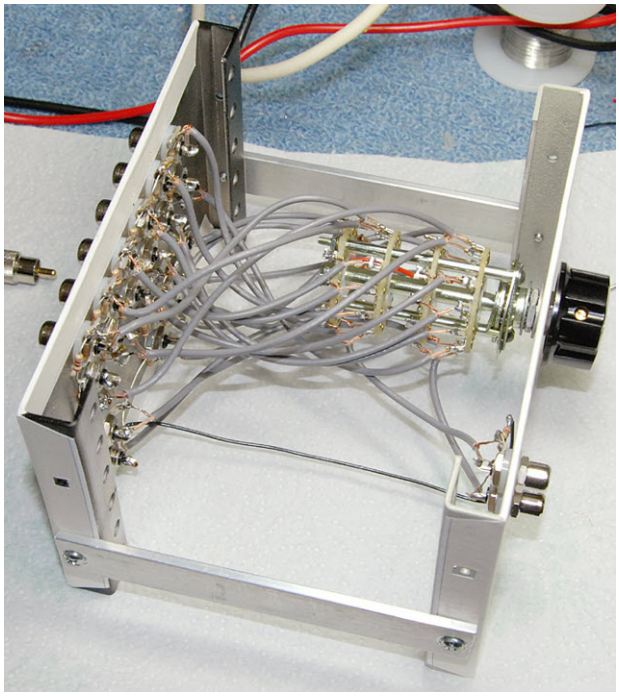
Brackets for the Wiring Operation

I recommend that you make a pair of brackets as **shown below**. These will hold the front and rear panels together at the proper spacing and orientation, during wiring. If you try to use the bottom or top cover for this, you will find that they block access to parts of the switch and connectors, making wiring difficult. Without anything to hold the units together, it would be nearly impossible to judge the individual lengths of cable with which to make the connections. These brackets did a great job. Fabrication details are **below**.





You will need to countersink the holes because the supplied metric screws are not long enough to reliably get purchase through the 1/8” bar stock. (I didn’t have longer metric screws and didn’t want to spoil the threadings.)



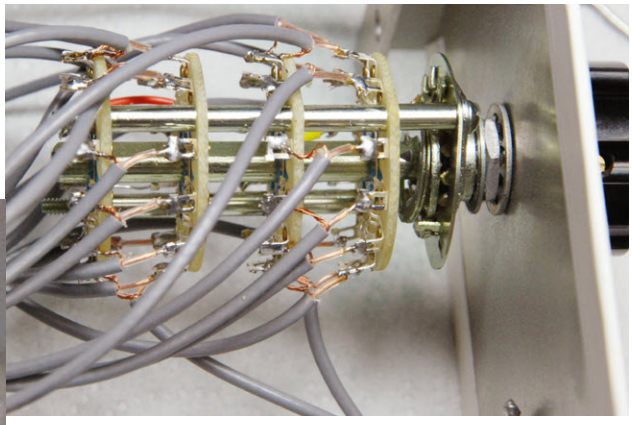
Doing the Wiring

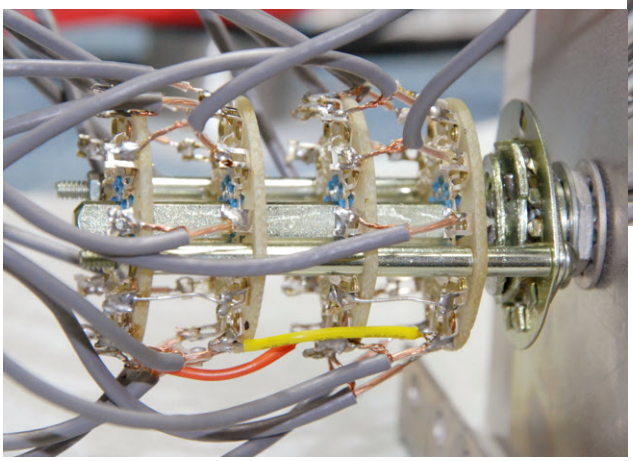
The reason that you need to be careful about the spacing of the panels can be seen **at right**. The large number of shielded cables becomes a rather stiff mechanical connection and is also quite bulky. As a result, we need to get the spacing right and avoid adding-in unneeded cable length. For similar reasons, it’s best to use miniature, single-signal shielded cable.

The Front connection is already done, so you can begin with the “CD” connectors on the back. Proceed in sequence through the inputs, ending with “Oscil”. For each connection, I suggest that you stretch the cable between the farthest two points, visually leaving about 1/4” extra on each end for stripping and bare wire. Then, lump-in about 1/2” extra for slack. That yielded the wiring seen here. After cutting the cable to length, strip and dress each end. The wiring tasks are:

- Connect each connector’s signal and ground to the cable and the other end, to the switch.
- Connect the Line Output ground lug to the resistors on the front panel.
- At the switch lugs for the Oscil position, connect an orange wire between the left and right ground lugs. Connect a yellow wire between the left and right signal lugs.
- At the switch lugs for the Off position, connect a bare wire from the left signal lug to the left ground lug. Connect another bare wire from the right signal lug to the right ground lug.

A top view of the switch wiring is **at right**. In the view from the bottom, **below**, you can see the orange and yellow wires used to bridge the signal and ground lines of the Oscillator input.





That lets the oscillator drive both stereo channels. Should you need to use it as a regular input in the future, you can just cut the orange and yellow wires. If you look carefully above the yellow wire, you can see the jumper wires for the off-position.

Final Assembly and Testing

Bottom Cover

Before testing, we need to attach the bottom cover so that grounding of the bottom and front panel can be verified. As you recall from page-5, we removed a ring of paint around the holes on the left side of the covers to insure ground contact. Take off the two temporary brackets which are holding the front and back panels together. Attach the bottom cover with four of the supplied self-tapping screws. The paint-free ring should be around both holes on the left side of the cover.

Testing and Top Cover

It is a very good idea to do complete testing, to detect any wiring errors. *Do each check for both the left and the right channels*. I did the following checks using an ohmmeter:

- Verify continuity from the ground of the right Line Output connector to the back side of the front panel.
- Verify 1000-ohms from each input ground to the right Line Output ground, when the input is not selected. (The Oscillator input will show 500-ohms, due to the bridge.)
- Verify continuity from each selected input to Line Output. Do this separately for signal and ground. I found typically 0.05-ohms of resistance.
- With the ohmmeter from signal to ground at the Line Output, verify that each input shows an open (no leakage).
- Check at the Line Outputs to see that in Off position, the signal is tied to ground.

If everything checks out, congratulations! Attach the top cover with four supplied, self-tapping screws. The paint-free ring should be around the rear hole on the left side of the cover. Attach the four supplied rubber feet to the bottom. Enjoy your new Line Input Selector!

Contact

If you have questions, comments, compliments or problems with the project, I would like to hear from you and will try to help. You can reach me at the email address given here: http://www.tronola.com/html/about___.html

Parts List

Qty	Reference	Description	Notes
1		enclosure, Hammond 1458C4B 6x6x4"	Mouser. Some on eBay.
11	odd J1-J21	connector, phono white hex base Kobiconn 161-1055	Mouser
11	even J2-J22	connector, phono red hex base Kobiconn 161-1053	Mouser
1	S1	switch, rotary 11-posn 4-pole Electroswitch D4G0411N	Digikey 451-1102-ND
20	R1-R20	resistor, 1K 1/4W 5%	Mouser
1		knob, fluted 1.3" Tyco PKES120B1/4	Mouser
15'		cable, shielded miniature single-signal ~1/8" diam.	
12"		barstock, aluminum 1/8" x 3/4" for temp brackets	Home Depot
1		nut, 3/8"-32 thread. additional for switch	
1		lockwasher, 3/8" additional for switch	
21		washer, nylon flat 0.257" ID, 561-D2562	Mouser
21		washer, nylon shoulder 0.25" ID, 534-7688	Mouser
		coating, spray Preserve Your Memories II	precision-blue.com
		adhesive, spray 3M Super-77	Home Depot

The Completed Line Input Switch