

Amplifying your Hammered Dulcimer (installing pickups)

By Jon Weinberg

Revised January 2017 to include experience with Schatten pickups in a new Song of the Wood hammered dulcimer

I have two dulcimers, both of which have dual pickups installed, wired for stereo:

- A Cloud Nine 17/16/8 dulcimer with dual Pick-up-the-World (PUTW) pickups - <http://www.pick-uptheworld.com/ecommerce/hammered-dulcimer-pickup.html>
- A Jerry Read Smith (JRS) 4.5 octave Song of the Wood Concertmaster dulcimer with dual Schatten Design pickups - <http://schattendesign.com/hamdulc.htm>

I am often asked about how these pickups sound and how difficult were they to install. I'll attempt to answer both these questions in this document, as well as make recommendations for people looking to install pickups in their hammered dulcimer.

Issues Amplifying a Hammered Dulcimer

Trying to mic a hammered dulcimer for live sound applications can be very problematic. To get good gain (volume relative to noise) the microphone needs to be very sensitive (condenser or large diaphragm mic) and close to the instrument without interfering with your hammering. Too close and you can hear too much percussiveness of the hammers hitting the strings/bridges/soundboard, and it's too easy to hammer the microphone by mistake (talk about waking up the audience!). To capture all the nuances of a hammered dulcimer you really need a large diaphragm omni-directional microphone which is too sensitive for live sound applications (feedback), and for studio work it can even pickup your breathing if you're not careful.

Pickups solve many of these problems but many don't sound good. Many change the sound of the instrument making it sound un-natural: muddy, metallic, overdriven, or too percussive. I've found that PUTW and Schatten pickups have none of these problems, and make the instrument sound the same as it does acoustically, only amplified.

At one point every instrument in a band I was in had PUTW pickups installed in them. Besides my dulcimer this included the fiddle, guitar, mandolin, and acoustic stand-up bass. When first installed in those instruments, the musicians playing them didn't think they were working because they thought they couldn't hear their own instrument in the mix. They couldn't tell the difference between hearing themselves acoustically and hearing themselves amplified in the monitors because they were so used to hearing themselves sound different in the monitors.

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My History with Pickups

In 1997 I mounted a single PUTW pickup on the top surface of the soundboard on my Cloud Nine 17/16/8 dulcimer, primarily for playing through a PA system at contra dances, and occasionally for recording. In 2013 when the instrument was refurbished with new strings, dampers, and upgraded internal bracing I replaced this setup with a set of internally mounted PUTW stereo pickups. In 2014 I received a new Concertmaster dulcimer in which I also installed dual PUTW pickups. This instrument was replaced by a newer Concertmaster in late 2016 that came with dual Schatten pickups installed by the builder. In all three cases the dual pickups were wired to a single stereo output jack.

Stereo vs. Mono Pickup Installation Considerations

In all my dulcimers both stereo pickups were/are wired to a single stereo jack. The stereo output from this jack goes through a short stereo cable (with stereo ¼ inch stereo TRS plugs at both ends) into a stereo input jack on a small external preamp module. The preamp I am using is flexible and can output either 2 stereo signals (on separate mono channels/cables) or combine them into a single mono signal/cable.

For live sound applications (dances and concerts and large weddings mostly) I output a mono signal/cable to the PA system, where both stereo channels/pickups are combined together. For recording I usually output two separate stereo channels (one for each pickup) on separate mono cables which are plugged in two corresponding channels in the mixer or recorder. I'm usually also simultaneously recording with one or two studio mics. I can later separately EQ and mix these 3 or 4 channels to get the sound I want.

The location in your instrument where each pickup is mounted (as well as other factors) will have a big effect on the relative volume (or balance) of the two stereo signals. In the two instruments where I installed PUTW pickups (the Cloud Nine and my first Concertmaster where the pickups are mounted as described below) the signals from both pickups are quite even/balanced. In use, I set the gain and volume of both channels in the preamp the same for both pickups/channels.

My second Concertmaster with the Schatten pickups has a more pronounced bass response (acoustically), plus the placement of the lower pickup nearer the bass bridge makes the bass pickup signal considerably stronger (by design according to the builder). I have to lower the gain and volume of that channel in the preamp to avoid overdriving the preamp, recorder or PA amplifier.

For simplicity, I used to recommend wiring both dual pickups to a single mono jack. This works fine with the PUTW pickups mounted at the locations described below which seemed to have very balanced output levels. However with the bass-heavy Concertmaster with the Schatten installation, the bass pickup can easily overdrive the electronics resulting in the

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combined sound being terrible. With a stereo installation through a 2 channel preamp I am able to compensate for this by turning down the gain and the volume on the bottom pickup so they are both balanced. So these days I'm recommending:

My Recommendation: If you are absolutely sure both your pickups will output a equal sound/levels, avoid the extra cost and complexity of a stereo setup and use a dual pickup installation wired to a single mono jack (#2 below). The stereo effect you get when recording is not very apparent and separation can be achieved by altering the EQ of the same mono signal on different channels.

However even with PUTW pickups you cannot guarantee this until after you've installed them and tested your installation. So to be safe I recommend going with a stereo setup that gives you more flexibility to adjust for pickup sensitivity and installation locations and allow you to separately balance the output of the two pickups.

Schatten vs. PUTW Pickups

Which do I prefer? They are both very good and both cost about the same. Here are some differences I've found that might help you decide which one is best for you:

Schattens

- Maybe a little easier to install for external mountings
- Outputs a slightly stronger signal (but not significantly so)
- The wooden blocks that contain the pickups may not fit easily in some dulcimers, or in the position within the dulcimer that might give the best sound

PUTW

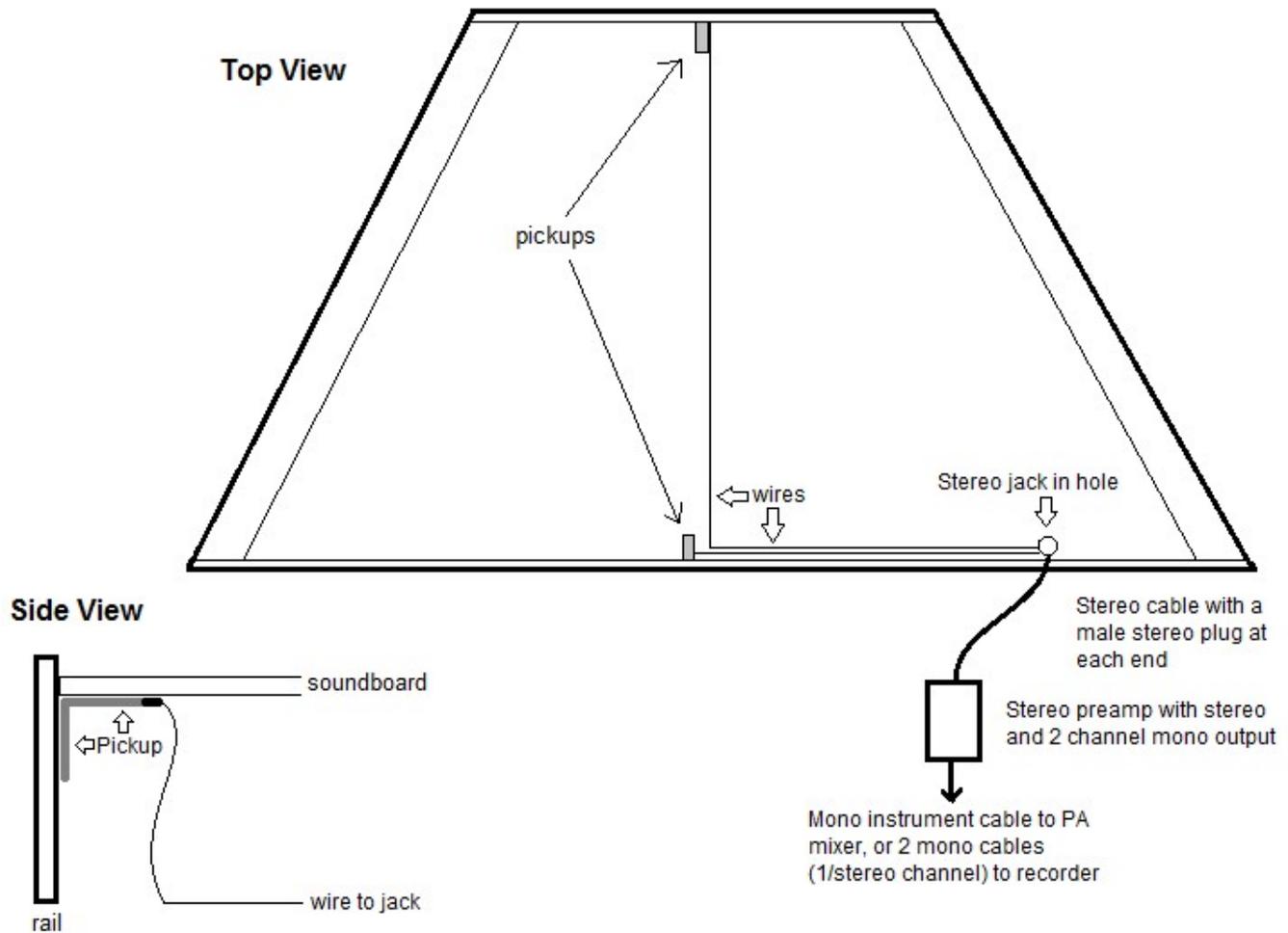
- Easier to install internally after-the-fact if you have handholds on the back by both the bottom and top rails (assuming you are using a dual pickup installation), and possibly easier to position to get the best sound (because each pickup is smaller than the Schattens)
- With each pickup attached half to the underside of the soundboard and half on the rail it seems easier to get more balanced signal strength from the two pickups

If you are having a new dulcimer made for you have the builder install whichever one you want internally while the interior is exposed. The builder will also know where the jack hole should be drilled so the jack will not hit the soundboard or interfere with any critical internal bracing.

PUTW Installation

Here's a diagram of what my stereo PUTW pickup setup looks like. It is the same for my Cloud Nine and my first Concertmaster instruments:

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Schatten Installation

These pickups appear to be designed to be attached to the back of a dulcimer for external installations where you do not have access to the inside of the instrument.

Mine came internally installed by the builder – the upper pickup is attached (with glue or tape) to the inside of the top rail and the bottom pickup is glued to the underside of the soundboard by the bass bridge. They are wired to a single stereo jack, the same as with the PUTW setup.

The Schatten pickups are attached to a wood block which is in turn attached to the dulcimer. Each block actually contains two pickups, which I imagine are optimized for different frequencies or other sonic attributes. I suspect the mass of the wood block helps temper the percussiveness of the hammers, which is often the case when attaching pickups directly to the soundboard or the bridges.

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Alternative Setups

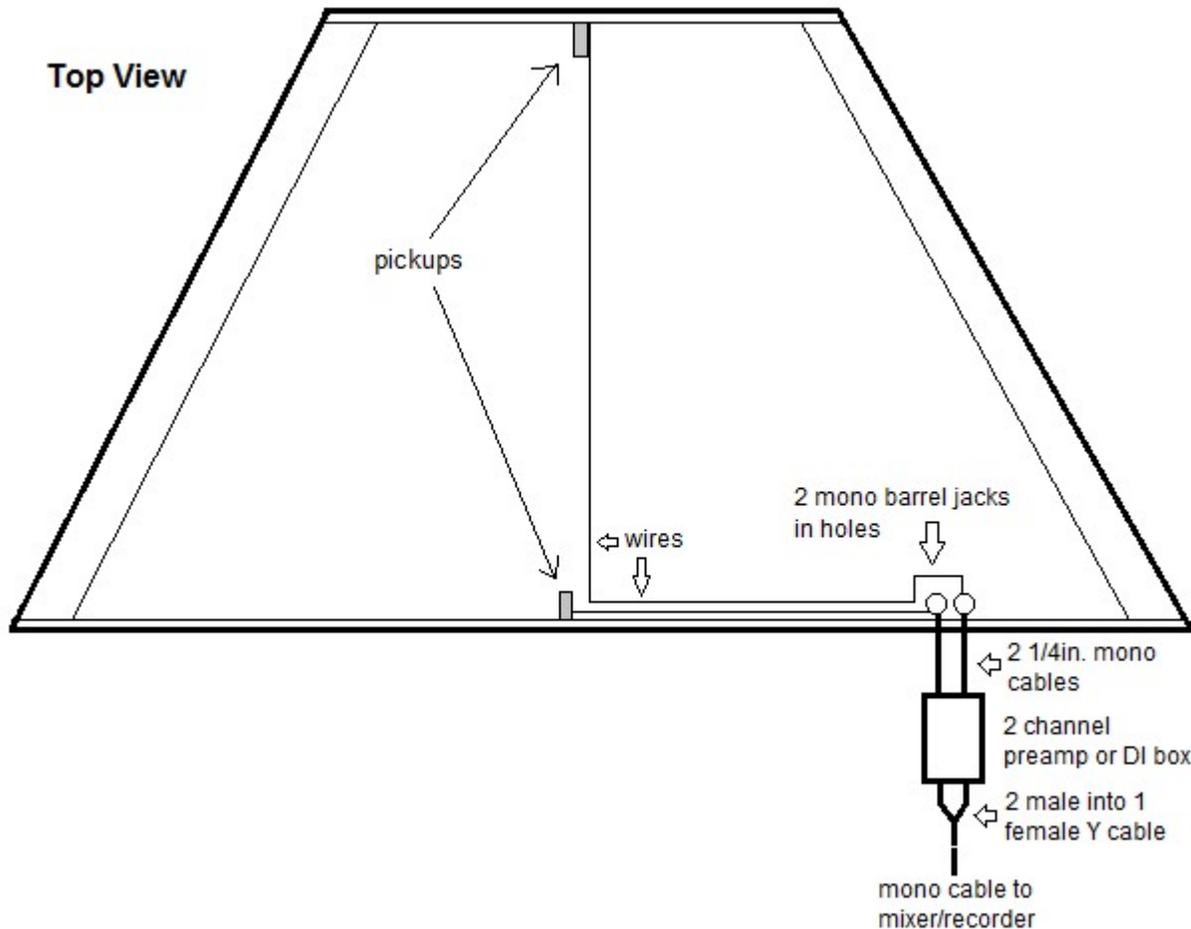
If you can't get or don't need a stereo preamp, here are some alternative setups you could use:

1. Install a single mono pickup wired to a single mono jack. You should determine which rail on your instrument on which to install the pickup that gives the best sound for both high and low notes. Advantages of this setup are simplicity, everything is mono (no separate types of cables to keep track of), and you will only need a single channel preamp or active DI box which is easier to find and will cost less (than a stereo or 2 channel one).
2. Install dual pickups (one on each rail as above) but have them wired to a single mono output jack. Installation looks similar to the stereo diagram above except that the output jack is mono. PUTW offers this option with their dual pickup HD setup. This has all the advantages listed for #1 above but eliminates any possibility of making adjustments to compensate for any mis-matched levels between the two pickups.
3. Install 2 mono pickups (one on each rail as above) wired to 2 mono jacks instead of one stereo jack. For stereo purposes you could use two mono cables into a two channel preamp or active DI box. For mono you can pick which pickup sounds best by itself, or utilize a Y cable to combine the two pickup signals into a single mono signal/cable to plug into a one channel preamp or active DI (direct input) box.

Note that this would require drilling two holes in your dulcimer and getting two jack plates.

Here's what this setup would look like:

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NOTE that a simpler version of this is to use a single stereo jack and the Schatten stereo preamp (which only outputs a combined mono signal).

Preamps

In order to get good sound PUTW, Schatten, and many other contact pickups require a preamp to be as close as possible to the pickups. This can be an internal installation with the battery and preamp inside your dulcimer (usually using a guitar end-pin system) or an external module (on a short 1 or 2 foot cord) between the output jack and your PA mixer or recording device.

External Preamp Modules

I use an external mini-preamp module. I've attached some sticky-back velcro to the preamp and a leg on my dulcimer stand. This holds the module in a convenient position close to the output jack on



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the dulcimer. I stick it on when needed and remove it when packing up.

For a mono output jack (for either a single or double pickup installation) you simply need a preamp with mono input and output jacks (one each) and that holds a battery (usually one or two 9V batteries). Other useful options are:

- A volume control knob that you can use to turn yourself off from the mix when tuning, practicing between medleys at dances, etc.
- An on/off switch. Note that some units automatically turn themselves on and off when a plug is inserted in its input jack (to help save battery life), negating the need for an on/off switch

Mono preamp modules like this are available from a number of manufacturers and available online (including PUTW and Schatten) and at many music stores.

For stereo pickups a preamp that will give you the most flexibility should have:

- A stereo input jack so both pickups will be on separate channels on the same jack and a single cable
- An on/off switch, and/or a preamp that switches off when one of the plugs is removed (to save battery life)
- Separate gain and volume controls for each pickup/channel
- Output jacks for each channel (for recording in stereo, for example)
- The ability to combine both pickups/channels into a single mono output cable (so you'll only take up one channel in a PA system)

I use a PUTW Stereo Line Driver mini-preamp that has all these features but is no longer made or sold by PUTW. I also use a comparable unit from K&K Sound called a Dual Channel Pro ST Preamp (pictured on the right):

<http://kksound.com/products/dualchannelpreamp.php#simple2>



Schatten also sells a Mini Pre 2 stereo that only outputs a combined mono signal (pictured at right) - <http://schattendesign.com/mini-pre.htm>



A good source for these and various other preamps (and pickups) is Blue Star Music: <http://www.bluestarmusic.com/>

As an alternative to a stereo preamp you can use a 2 channel active DI (direct input) box. When using a stereo output jack on your dulcimer you would need a 1 into 2 stereo to mono Y cable to split each stereo channel into a mono signals to feed the two channels on your DI box. Here are a couple of examples of these from Google-ing “2 channel active DI box”:

- ART DualXDirect - http://artproaudio.com/artcessories/di_boxes/product/dualxdirect/

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- Behringer Ultra-DI D120 - <http://www.behringer.com/EN/Products/DI20.aspx>

If you installed dual stereo pickups (to get even sound from the bottom to the top of your instrument) but don't need stereo or two channel output, you might be able to get by (if the signals from both pickups have the same gain/volume) with a single channel preamp or DI box and a stereo to mono cable (with a stereo plug on one end and mono on the other). This cable combines the two channels from the stereo jack on your instrument into a single mono plug to then plug into a single mono input jack on your preamp or DI box. There are lots of these – Google “active DI box” or “Fishman preamp”

End Pin Jack Preamps

Some acoustic guitars with internally installed pickups these days are wired to an endpin jack that contains a preamp circuit board, and holds an AA or AAA battery or has wiring to a 9V battery holder that is mounted elsewhere else inside the instrument. I've seen these used in dulcimers. What is nice about them is that they are self-contained and always inside your instrument, and all you need is a simple mono cable from the output jack to your PA mixer or recorder. Their downsides are:

- They are often longer than a normal jack so you need to mount it where you have enough depth inside your instrument where it won't interfere with the soundboard or any bracing
- It (or the battery mounting) needs to be near a handhold hole that allows access to the battery so you can change it when needed
- If it uses AA/AAA batteries, they usually won't last as long as a unit that has one or two 9 volt batteries
- If the battery(s) leak you'll probably need to replace the whole unit. What is worse is that they might damage your instrument.

Several guitar makers seem to be moving away from having all these components inside their instruments, instead opting for a passive end pin jack that can be cabled to a nearby external preamp box. I think this is smart.

My recommendation: Use a small, external mini-preamp module that you can mount to your stand (or dulcimer) close to the pickup output jack. Or...

A very recent development is an internally mounted preamp/jack that does not use batteries by Mi-Si Electronics (shown at right). It contains a capacitor that powers the preamp for 8 hours after being charged up from house current for one or two minutes. It's convenient, reasonably priced and very intriguing. PUTW now offers these, and if you order one with your pickup(s) ask them to wire the pickups to the preamp instead of a barrel jack. Blue Star Music also sells them.



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However, this preamp and jack combination must be installed from the inside of the instrument. If your jack hole is not next to a handhold then this is something only your builder can install during construction.

How To Install Dual PUTW Pickups

The easiest way to install internal pickups is to have the builder do it when building a new dulcimer for you. Feel free to give your builder this document if they find it helpful.

Here is how I installed dual PUTW pickups after-the-fact.

PUTW pickups are made of flexible material about the size of a small band-aid, and like a band-aid they have self-stick adhesive on their backside. You just stick them where you want them, and with some care you can unstick them to move them somewhere else and re-attach them. Recommended installation for hammered dulcimers by PUTW (and me) is to attach half of each pickup to the back of the soundboard and the other half to the adjacent rail. Because the pickups are flexible they bend easily to do this.

It doesn't make a difference if your instrument is a fixed or floating soundboard dulcimer. The installation is the same even if there is a small gap between your soundboard and rail on a floating soundboard instrument.

NOTE that PUTW pickups come wired to a barrel jack that can be used for a guitar endpin jack or for temporarily plugging into to hear how the pickup will sound in different places before deciding on the best place to attach it. I added a guitar flange plate to this barrel jack and used it for the jack on my dulcimer (see below). I would recommend also using a flange plate for any endpin type installation (including the Mi-Si preamp described below).

Advance/prep work:

- You will need to purchase a guitar jack plate or flange that fits on the front of the jack that will be attached on the outside of your instrument so that the jack will be surface mounted. These are often used on electric guitars and can be found online (Google: "guitar jack plates") or in stores that sell guitar parts. These are the round plates in the pictures below that the jacks are mounted on. They come in other shapes as well – just make sure they are flat, and not curved to match a curved side of a guitar.

Surface mounting like this will allow you to easily remove and replace the jack should there later be a problem with it. I once had a plug break off in one of my jacks that required the jack to be replaced...

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- If your instrument doesn't already have them, have your builder cut handhold holes in the bottom/back of your instrument by the rail(s) you will be installing the pickups on. For dual/stereo installations this will be both the top and bottom rails. This will give you access to the back of the soundboard and the inside surface of the rails on which to mount the pickups. I recommend having your builder do this since s/he knows what's inside your instrument and where they can be safely cut to not damage any internal bracing or such.
- Have your builder also drill a half inch round hole where the jack will be mounted. Note that you may need a slightly larger hole for endpin installation that have a preamp circuit board attached – the manufacturer will indicate the proper hole size needed. Depending upon where the bracing is and the depth of the soundbox this will either be on the bottom rail or on the underside of the instrument, as in these pictures:



If you choose a bottom mount (as in the picture on the right) there must be enough space below the soundboard for the jack to fit and wires to come out of it without hitting the underside of the soundboard.

In either case you want to make sure the position of the jack will not interfere with how your instrument rests on your stand. This usually means placing it either just off-center next to or near the handhold, usually on the right.

- You will need a stiff piece of wire or an elongated piece of thin clothes hanger wire for running through the inside or bracing of your dulcimer to feed the top pickup to the top rail. I also recommend having a flexible grabber tool (looks like a flexible spring with a thumb button on top) for grabbing and feeding wire along the bottom rail. You won't need to solder any wires unless you break them.
- Any surface to which the pickups will be stuck/attached must be smooth and sealed. If stuck to bare wood the pickups will eventually fall off. Using a small piece of 220 grit sandpaper lightly sand the inside rail and soundboard back surfaces where the pickups

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will go and then wipe any sawdust off with a damp cloth. If bare wood, then seal the spots you sanded with a little glue or polyurethane so the surfaces will be non-porous.

Now you're ready. Here are the steps to mount your pickups:

1. For stereo installations determine which pickup is wired to the tip on the jack (either use a continuity tester or unscrew the cover on the barrel jack to see which wire is soldered to the center pin). Mark the wire by that pickup with a piece of tape or something. This will be the pickup for your top rail (tip=top). For mono installations you do not need to do this.
2. Curl the **top rail pickup** slightly along its longitudinal axis and feed it through the jack hole. Use the grabber through the bottom rail handhold to grab the pickup/wire inside the soundbox and gently pull the pickup and wire over to the bottom handhold hole
3. Run your stiff feed wire or elongated coat hanger from the top rail handhold to the bottom rail handhold hole along the path the wire will go. Depending upon the construction of your instrument this might be through holes cut in the internal braces or along a space between the bracing and the back of the instrument
4. Attach the top rail pickup to the feed wire (tape usually works best) and carefully pull the top pickup to the top handhold. Then carefully un-tape it from the feed wire
5. As in the picture to the right, without removing the paper backing bend the top pickup into a 90 degree angle with the covered sticky tape surface to the outside. Remove the paper backing from the bottom half (that does not have the wire attached to it) and stick it to the inside surface of the top rail so the crease from the fold aligns with where the soundboard meets the rail. Then remove the remainder of the paper backing and stick the other half of the pickup to the underside of the soundboard



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6. Curl the **bottom pickup** slightly along its longitudinal axis and feed it through the jack hole, and use the grabber through the bottom rail handhold to grab the wire inside the soundbox and gently pull the pickup and wire over to the bottom handhold hole
7. In the area around the soundhole attach the bottom pickup to the inside surface of the bottom rail and the underside of the soundboard the same way the top pickup was attached
8. Mount the flange to the barrel jack and carefully push the jack with the wiring into the hole. Mark where the flange screw holes are and drill the screw holes in the bottom rail. Now just screw down the flange to hold the jack in place. I also cut out and mount a gasket (piece of rubberized shelf liner) between the flange plate and the dulcimer to help isolate any vibrations and possible buzzing. You can see this in the pictures of the flange plates above.
9. Plug in your preamp and test out that both pickups are working properly and independently. If not, check your wiring and connections, and make sure you didn't pinch or break a wire
10. Once everything is working, curl up the excess wiring and tie it up with a cable tie, twist tie, or manufacturer-provided tape and then tape it to the rail or bottom/back surface near the bottom pickup.
11. If there was any excess wire from the top pickup do the same for it and stick it in either place (top or bottom). Leave a little excess slack for expansion/contraction, etc.



Playing When Amplified

If you are used to playing with other musicians and not being heard unless you really beat on your instrument, playing with a mic or especially pickups can be a real revelation. Back off the pounding and play moderately, fluidly, and with varied dynamics. Let the preamp and amplifier do their job of making you louder.