

ELECTRONIC PARTS FROM EXPERIMENTAL MUSICAL INSTRUMENTS

Wiring Information

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These sheets tell you how to make basic electrical connections for musical instrument pickups using components from Experimental Musical Instruments. Instructions are included for the following options:

Option 1: Run the output from a pickup to a plug (male) which can be plugged into an amplifier or mixer input.

Option 2: Run the output from a pickup to a jack (female). This allows you to plug a regular musical instrument lead cord into the jack while plugging the other end of the lead cord into an amplifier or mixer.

Option 3: Run the output from a pickup to a volume control, and from there to a jack or plug as described above.

Option 4: Run the output from a pickup to a local preamp, after which it can be sent to a mixer or amplifier.

On the following pages you'll find instructions and diagrams for each of these options. On the last page are illustrations of the various components identifying their hot and ground terminals. But first, some preliminary information.

TWO TYPES OF PICKUPS — MAGNETIC AND PIEZO

The information on this sheet is good for magnetic pickups (the sort used on electric guitars) and for contact pickups, also known as piezos. The components we sell at Experimental Musical Instruments are suitable for both of these types. Microphones are another story . . . the information provided here doesn't necessarily apply to them.

HOT AND GROUND CONNECTIONS

In both types of pickups — magnetic and piezo — the output comes in the form of two wires. One of these wires carries what is considered to be the "hot" side of the signal, while the other is the "ground" connection. How do you know which is hot and which is ground? See the diagrams on the last page.

Signals from pickups are carried in shielded cables. (The idea of shielding is explained below.) In shielded cables there are two conductors. One is an insulated wire at the center. The other usually takes the form of a stranded, braided sleeve that surrounds the center wire.

The center wire is to be used as the hot lead.

This braided sleeve is to be used as the ground connector.

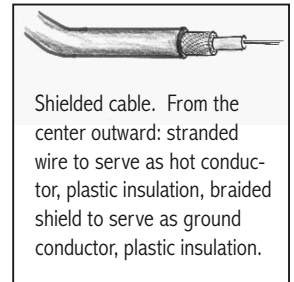
If your pickup already has an attached output wire in the form of a shielded cable, you should treat the center as hot and the braided sleeve as ground.

WHAT IS SHIELDING?

As they travel through the wiring, audio signals can pick up stray noise from the atmosphere in the manner of a radio antenna. This problem is greatly reduced when the wires containing the hot side of the signal are surrounded by a shield of steel or other conductive material which

is connected to ground.

In shielded cable, the ground conductor in the form of a braided sleeve surrounds the hot conductor, and thus provides shielding. Other electrical components such as jacks, plugs and potentiometers (volume controls) can be made with steel casings which are connected to ground. The steel casings, like the braided sleeve, provide shielding.

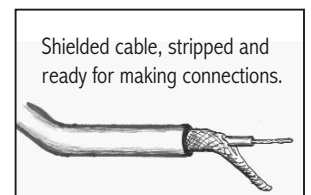


HOW TO STRIP SHIELDED WIRE

1. Remove the outer layer of insulation over about the last inch of the cable. In doing so, try not to cut through or remove any of the underlying braided shield wire at the same time. For this job you can use a good pair of wire strippers. Alternatively, cut through the outer insulation layer with a sharp utility knife, being careful not to cut into the braided shield underneath. After cutting through the insulation all the way around, carefully pull the insulation off, exposing the braided shield.

2. Next, you need to pull the exposed portion of the braided shield off to one side, revealing the insulated center conductor. Use a needle to unbraid the strands of the exposed portion of the shield. This makes it possible to pull the strands off to one side, away from the center conductor. Do this, and twist the strands together.

3. Remove the insulation from the center conductor over its last half inch. Once again you can use a wire stripper or a utility knife, being careful not to damage the stranded wire beneath. Twist the newly exposed strands together.



SOLDERING TOOL WATTAGE AND SOLDERING TRICKS

Different soldering jobs call for different amounts of heat. It's most convenient to use a soldering tool that has different wattage settings available. Here are suggested wattages for different applications:

When soldering wires to terminals on jacks, plugs or volume controls, or when attaching wires to wires: use medium-low heat — 15-20 watts. Graduate to 30 watts when you've developed the skill to do the job quickly.

When soldering to very small components: use very low heat — 10 - 15 watts. This includes 1) soldering directly to magnet wire (the very fine wire used in winding magnetic pickups) 2) soldering to the very small terminals on the piezo film tabs we sell. Use a heat sink to prevent heat build-up that could damage components. A heat sink is a

more massive metal object clamped to the wires or other components to draw away excessive heat. For this purpose you can use a hemostat, a binder clip or a large paper clip.

When soldering ground wires to a potentiometer casing, use high heat — 40-60 watts. Making this connection is tricky. Suggested procedure: 1) twist the strands of the ground wire together and tin them (melt a light coating of solder over them). 2) Position the pot casing with the shaft facing downward and place a small snip of solder on the casing. 3) Place the soldering tool, on high heat, against the casing close to but not touching the solder snippet. Hold it there until the solder melts and bonds to the casing. 4) Touch the ground wire to the mound of solder now bonded to the casing, and hold the soldering tool to them just long enough to melt the wire into the solder mound.

THE CONNECTIONS

CONNECTING A PICKUP TO AN INLINE JACK (FEMALE)

(See the diagram on the following page)

You need:

Pickup (piezo or magnetic)

Inline Jack

Shielded cable to run from the pickup to the jack.

For a magnetic pickup, either light or heavy cable is OK, but heavy cable has the advantage of being sturdier.

For piezo pickup, either light or heavy cable is OK but lightweight cable is preferable because it doesn't weigh down or rigidify the pickup.

Step 1. Cut the length of shielded cable you want and strip the ends to expose the wires, as described above.

Step 2. Solder the hot lead from the pickup to the inner conductor on the shielded wire. See page 5 if you're not sure which conductor from the pickup should be treated as the hot lead.

Step 3. The other conductor from the pickup will be your ground conductor. Solder it to your cable's braided sleeve.

Step 4. Unscrew the casing on the jack. Slide the empty casing up onto the cable you've attached to the pickup. Don't forget this step!

Step 5. Solder the center conductor (hot lead) from the shielded cable to the hot terminal on the jack, as shown.

Step 6. Solder the braided shield (ground conductor) from the cable to the ground terminal on the jack.

Step 7. Inspect your work. Make sure all connections are good. No stray wires from the hot lead should stick out where they could contact other wires or the jack's casing when it's screwed on. If need be, bend stray wires out of the way or snip them off. Make sure there are no big lumps of solder that will get in the way when you slide the casing back down and screw it in on.

8. Use pliers to pinch the arms of the jack's ground terminal around the cable, grabbing it over the outer insulation layer. This takes the strain off of

the solder joints should anyone pull the plug by yanking on the cable. If you're using very narrow cable, you may wish to wrap the cable once around one arm of the jack's ground terminal before pinching.

Step 9. Slide the jack casing back down onto the jack and screw it on.

CONNECTING A PICKUP TO A PANEL-MOUNT JACK (FEMALE)

(See the diagram on the following page)

You need:

Pickup (piezo or magnetic)

Panel-mount Jack

Shielded cable to run from the pickup to the jack. Either light or heavy cable will work, but lightweight is preferable especially if you're wiring to a piezo pickup.

Step 1. Cut the length of shielded cable you need to run from the pickup to the jack. Strip the ends to expose the wires, as described above.

Step 2. Solder the hot lead from the pickup to the inner conductor on the shielded wire. See page 5 if you're not sure which conductor from the pickup should be treated as the hot lead.

Step 3. The other conductor from the pickup will be your ground conductor. Solder it to your cable's braided sleeve.

Step 4. At the other end of the cable, solder the center conductor (hot lead) to the hot terminal on the jack.

Step 5. Solder the braided shield (ground conductor) from the cable to the ground terminal on the jack.

Step 6. Inspect your work. Make sure all connections are good and make sure no stray wires from the hot lead are sticking out where they could contact other wires or anything connected to ground. Bend wires out of the way or snip them off if need be.

CONNECTING A PICKUP DIRECTLY TO A PLUG (MALE)

(See the diagram below)

You need:

Pickup (piezo or magnetic)

Plug

Shielded cable to run from the pickup to the plug.

For a magnetic pickup, either light or heavy cable is OK, but heavy cable has the advantage of being sturdier.

For piezo pickup, either light or heavy cable will work but lightweight cable is preferable because it doesn't weigh down or rigidify the pickup.

Step 1. Cut the length of shielded cable you want to run from the pickup to the plug. Strip the ends to expose the wires, as described on page 1.

Step 2. Solder the hot lead from the pickup to the inner conductor on the shielded wire. See page 5 if you're not sure which conductor from the pickup should be treated as the hot lead.

Step 3. The other conductor from the pickup will be your ground conductor. Solder it to the cable's braided sleeve.

Step 4. Unscrew the casing on the plug. Slide the empty casing and the soft plastic insulation tube up onto the cable you've attached to the pickup. This step is easily overlooked or forgotten — don't forget to do it!

Step 5. Solder the center conductor (hot lead) from the shielded cable to the hot terminal on the plug.

Step 6. Solder the braided shield (ground conductor) from the cable to the ground terminal on the plug, as shown.

Step 7. Inspect your work. Make sure all connections are good. Make sure no stray wires from the hot lead are sticking out where they could contact the ground wire or the plug's casing when it's screwed on. Bend any stray wires out of the way or snip them off. Make sure there are no big lumps of solder that will get in the way when you go to slide the casing back down and screw it in on.

8. Use pliers to pinch the arms of the jack's ground terminal around the shielded wire. This takes the strain off of the solder joints should anyone pull the plug by yanking on the cable. If you're using very narrow cable, you may wish to wrap the cable once around one arm of the jack's ground terminal before pinching.

Step 9. Slide the plastic insulation tube down over the terminals. Slide the jack casing back down onto the jack and screw it on.

CONNECTING A PICKUP TO A VOLUME CONTROL AND FROM THERE TO A PLUG (MALE) OR JACK (FEMALE)

(See the diagram on the following page)

You need:

Pickup (piezo or magnetic)

Volume control (Potentiometer)

Plug or Jack

Shielded cable to run from the pickup to the volume control. Either light or heavy cable will work, but lightweight cable is preferable, especially for piezo pickups.

Shielded cable to run from the volume control to the jack or plug.

For connecting to an inline jack or plug, either light or heavy cable will work but heavy is preferable because it's sturdier.

For connecting to a panel-mount jack, either light or heavy cable will work but lightweight cable is preferable because it's more flexible and less obtrusive for interior wiring.

A couple of inches of lightweight hookup wire (single-conductor insulated wire). If you ordered your volume control (potentiometer) from us, we will have included the needed short snippet of this wire with your order. If you don't have hookup wire on hand, you can use a bit of shielded wire instead.

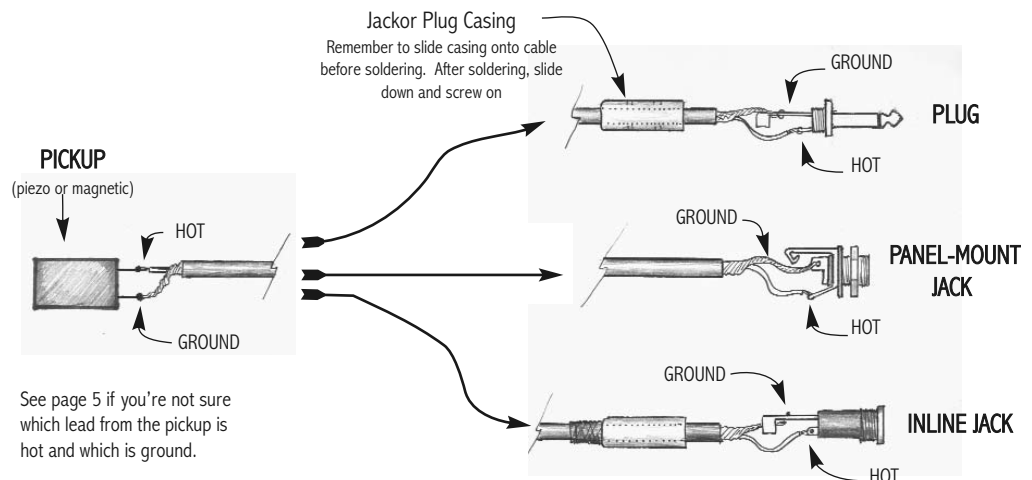
Step 1. Cut the length of shielded cable needed to reach from the pickup to the volume control. Strip the ends to expose the wires as described on page 1.

Step 2. Solder the hot lead from the pickup to the inner conductor on the shielded wire. See page 5 if you're unsure which conductor from the pickup should be treated as the hot lead.

FROM PICKUP TO JACK OR PLUG

These drawings are so expanded for clarity. Normally the fully insulated portion of the shielded cable extends in closer to the jack or plug. This way, on inline jacks and plugs, the casing covers any exposed wires, and the arms of the ground terminal can be pinched firmly over the insulation for security.

In positioning the wires, make sure there's no chance of inadvertant contact between hot and ground.



Step 3. The other conductor from the pickup will be the ground conductor. Solder it to the cable's braided sleeve.

Step 4. With the potentiometer positioned with the shaft down and the three terminals toward you, solder the center conductor (hot) of the shielded wire from the pickup to the left hand terminal on the volume control. (This terminal is labeled #3 on the pots we sell. See the illustration to make sure you're connecting to the correct terminal).

Step 5. Solder the ground conductor from the pickup to the potentiometer casing. See the notes above under "Soldering tool wattage and soldering tips" for hints on soldering to the casing.

Step 6. Cut a short piece (1" - 2") of hookup wire and strip the insulation off of 1/2" at each end. If you don't have hookup wire on hand, remove the center conductor from a short piece of shielded cable and use it.

Step 7. Solder one end of the hookup wire to the potentiometer casing.

Step 8. Hook the other end of the hookup wire to the right hand terminal of the potentiometer. (This is the terminal opposite the one you already soldered to, labeled #1 on the pots we sell. See the drawing to be sure you're making the correct connection.) Don't solder it yet.

Step 8. Cut the length of shielded cable needed to reach from the volume control to the jack or plug. Strip the ends to expose the wires as described on page 1.

Step 9. Hook the braided shield wire of this cable to the right hand terminal on the pot, the same terminal where you already put the hookup wire. Solder both of these wires to the terminal.

Step 10. Solder the center conductor (hot lead) of this shielded cable to the center terminal on the potentiometer, labeled #2.

Step 11. Solder the other end of this shielded cable (hot and ground conductors) to the hot and ground terminals for the jack or plug. To do that, follow the instructions above for whatever sort of jack or plug you're using.

CONNECTING A PICKUP TO A LOCAL PREAMP

The procedure for hooking up to a preamp is different for different preamps. Instructions are given here for the two kinds of preamps that we sell here at Experimental Musical Instruments.

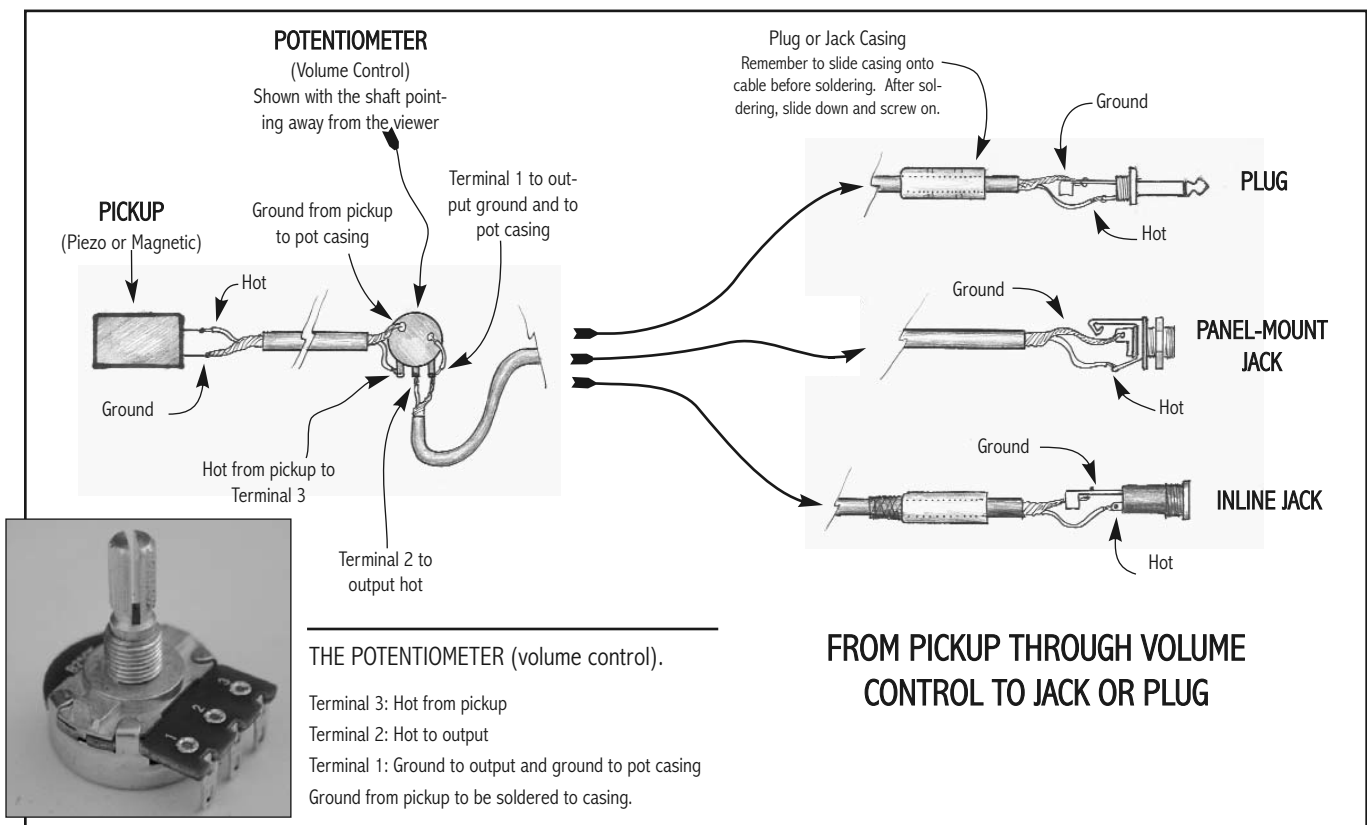
For K&K Pure Preamp

This preamp (like many others) has a quarter-inch input jack. There are two ways you can get the signal from your pickup into this input:

- Attach a cable to the pickup with a quarter inch plug on the end. Follow the instructions above for wiring from the pickup to the plug.
- Wire the pickup to a quarter-inch jack (female), and then use a standard musical instrument cable to run from there to the preamp input. Follow the instructions above for wiring from the pickup to either an inline jack or a panel-mount jack.

For Fishman Power Jack Preamp

With this preamp, you run a cable from the pickup to a pair of solder terminals in the preamp. Follow the first three steps of any of the procedures above to attach a lightweight shielded cable to the pickup. Then follow the instructions that come with the preamp to connect the other end of that cable to the preamp.



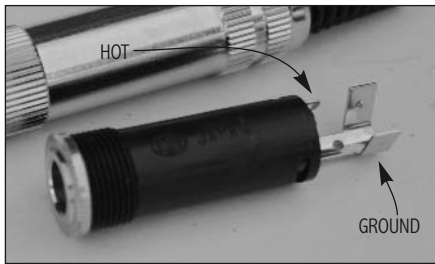
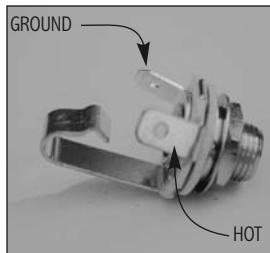
HOT AND GROUND CONECTIONS FOR PICKUPS, JACKS AND PLUGS

Jacks and Plugs

The jacks and plugs shown here are the models sold by Experimental Musical Instruments, shown with the casing removed to reveal the wiring terminals.

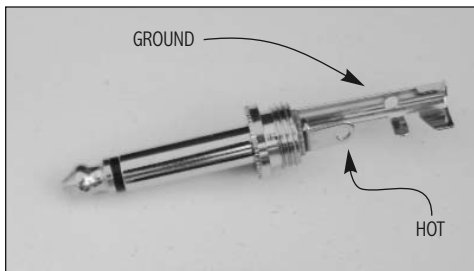
Quarter-Inch Panel-Mount Jack

The hot terminal is the one that is of a piece with the upright contact. The other terminal is the ground terminal.



Quarter-Inch Inline Jack

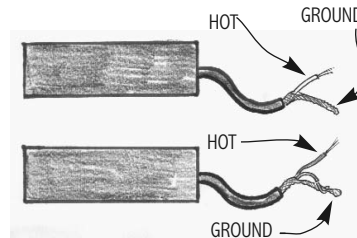
The hot terminal is the small, short terminal. The ground terminal is the larger, longer one.



Quarter-Inch Plug

The hot terminal is the small, short terminal. The ground terminal is the tall one.

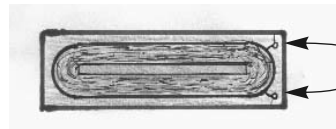
Magnetic Pickups and Piezo Pickups



Magnetic Pickups with Shielded Cable Already Attached

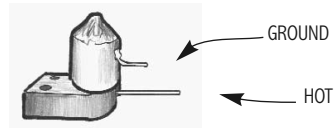
Upper drawing: If there is a single center conductor surrounded by a braided shield, the center conductor is the hot connection and the surrounding braided wire is the ground.

Lower drawing: If there are two center conductors surrounded by a braided shield, choose one of the center wires to be the hot conductor. Join the other center conductor to the surrounding braided wire and treat the two of them together as the ground conductor.



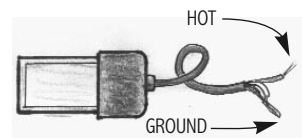
Magnetic Pickups without a Shielded Cable Attached

There should be two wires exiting the pickup coil. These may be extremely fine wires. Either can serve for either hot or ground connection.



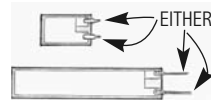
The EMI Spot Pickup

The upper, shorter protruding wire is ground. The lower, longer one is hot.



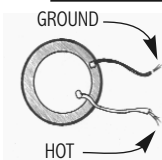
SDT1 Shielded Piezo Film

The red wire is the hot connection. The white wire attached to the braided copper wire is ground.



2.5" Piezo Films, 6" Piezo films, and Piezo Tabs

Either connection can serve as hot or ground. With the tabs: solder directly to the tiny terminals; avoid excessive heat (see suggestions on page 2 for soldering to very small components). For the 2.5" and 6" films: shorten the existing wires to less than an inch, remove 1/2" of insulation from the ends and solder to the exposed stranded wire.



Rigid Piezo Disks

If wires are already attached, use the one attached to the piezo material for hot. Use the one attached to the metal disk for ground. If there are two separate regions of piezo material, use the wire attached to the larger region for hot, smaller for ground. If wires are not already attached, attach your wires as just described. Soldering to these disks is often difficult; try attaching with conductive epoxy instead (available at electronics stores).