

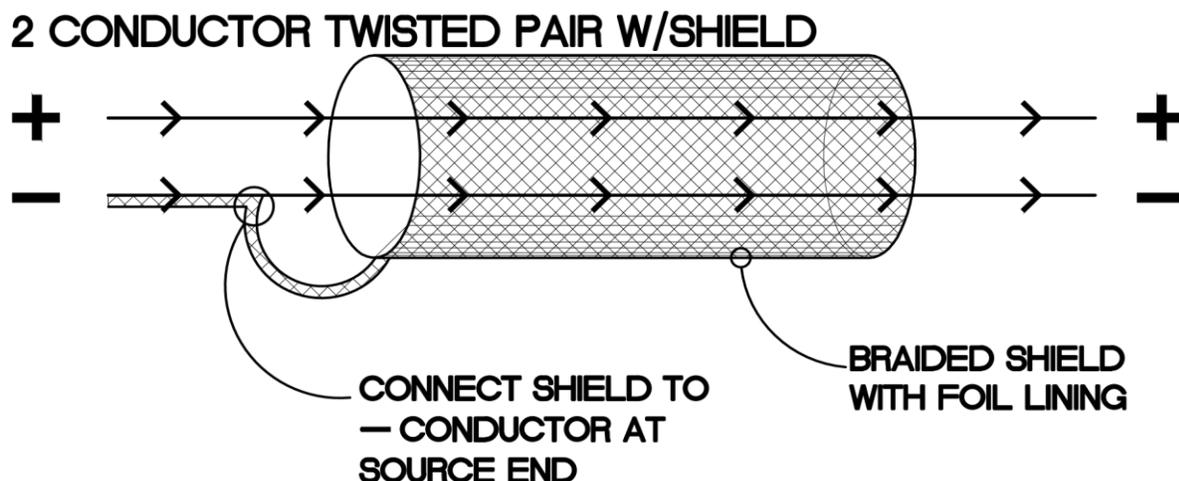
Bob Sattin, PE
(910) 612-8666
bob@bobsdevices.com

Grounding and Installing your Bob's Devices SUT

Each Bob's Devices SUT includes a grounding post that can be used to connect your turntable ground and your preamplifier ground. It also includes a ground "lift" switch. In all modes, the transformer cases and faraday shield internal to the transformers are connected to the ground screw. In the "GROUND" mode, the minus or negative side of both output cables are connected to the grounding lug. This configuration works well for those systems where the turntable ground is connected to the negative leads coming from the phono cartridge or where the negative inputs to the preamp are internally connected to ground. In the "LIFT" mode, none of the conductors in the RCA jacks are connected to the case, ground, or shield and there is no electrical connection between channels. This design avoids any transformer induced ground loops regardless of the configuration of your other equipment. It can be said that LIFT mode is the same electrically as a balanced configuration.

To properly install the Bob's Devices SUT into your system:

- Step 1 - Connect the leads from your turntable to the input connectors on the SUT.
- Step 2 - Connect the ground lead from the turntable to the ground lug on the SUT.
- Step 3 - Use a short pair of interconnect cables to connect the output of the SUT to the input of your Phono Preamplifier or Phono Inputs. This set of cables should be Properly Shielded as shown in this DIAGRAM:



- Step 4 - Turn everything on and listen to the background noise. Move the ground / lift switch to whichever position is quietest. Then move the transformer around to find the quietest location.

If you are continuing to have problems with hum, start from your cartridge and follow the wires, looking carefully for any places where the negative terminals of the cartridge (let's call them system ground) are connected to equipment grounds (let's call them chassis ground, sometimes referred to as drain wires). We only want one chassis ground connection between pieces of equipment. When there is more than one chassis ground connection, there is the possibility of a ground loop (it doesn't know which way to go, so it keeps on moving and generates noise.)

The other type of noise is interference (you get that from any parts of your system wires running too close to power transformers, power cords, or any kind of AC power.)

Now, since we all use RCA cables from the turntable to the phono preamp, the negative (system ground) wires have to be shielded with a chassis ground. (Read that sentence twice). Some turntables connect the shield of the RCA cables to the chassis ground wire at the turntable, and some do not.

The next 2 paragraphs repeat the initial steps above, but written differently, and in more detail:

If your turntable has a pigtail along with the RCA connectors, then that is the chassis ground from the turntable. Connect that pigtail to the ground lug on the step up transformer. Then connect everything else, without connecting the ground to the phono preamp. Try the ground / lift switch in both positions and see which is quietest. Then, additionally, connect a separate wire between the ground lug on the step up transformer and the ground screw on the phono preamp and see if that is quieter or noisier in either of the ground / lift switch positions. Then you can determine whether you need to ground the phono preamp to the step-up transformer or not. Regardless, you need the proper interconnect as shown in the diagram above to go between the step-up transformer and the phono preamp.

You only want them connected that way at one end, hence the ground / lift switch. So, here is the short answer. Remove the ground wire connecting the turntable from the phono preamp. Connect ONLY the ground from the turntable to the SUT. Don't connect the wire from the SUT to the Phono Preamp just yet. Now, make sure that you use a properly constructed interconnect cable between the transformer and the Phono Preamp that has 2 wires inside (positive and negative) and the shield is connected to the outside (chassis ground of the cable) at only one end. (The cable will have the negative lead and the ground attached to the outside of the RCA connector at one end. The cable will only have the negative lead (Not the ground) attached at the other end.) With everything hooked up, turn it on and listen for the hum. Then move the ground/lift switch to whichever position offers less hum. Then touch the preamp ground wire to the ground lug and

see if it is less or more noisy. Then remove the wire from the phono and see if it is quieter or not. Then touch the phono wire to the preamp wire and see if that is quieter.

Sounds like trial and error. It basically is, but the idea is to make sure that everything is grounded, and only grounded once, and the all the audio cables' shields are grounded, and only grounded once.

You will find that the transformers are very susceptible to Electro-Magnetic Radiation, and you may need to move them around a bit to find the quietest location. For me, it is just below my turntable and on top of my preamp.

If you want more information, check out

<http://www.rane.com/note110.html>

Included on their site are some diagrams on wiring that may be helpful.

Here is another way of looking at the situation:

Your cartridge has 4 connectors: + and – for each channel. None of those is a ground wire. After the wires leave the tone arm, there is usually a block or a connection point on the turntable where the tone arm wires are connected to the RCA cables.

Find that point and look to see electrically how that connection is made. Look to see if the connections go directly to RCA + and – on the cable and look to see if there is a ground connection. It may be hard to tell since the RCA connectors may or may not be insulated from the enclosure (you will see a Teflon or other insulated washer on both sides of the connector). If they are not insulated, there is inherently a ground connection there, and the – sides of both cables are also inherently connected together at that point.

The cables from the turntable go to the SUT. The SUT is constructed so that in the LIFT mode, all 4 wires pass independently through the SUT without being connected to ground. The RCA output cables continue to the phono stage.

We don't know how the wiring is set up inside the phono stage. Things we don't know are whether the – sides are grounded to the chassis and whether the + and – signals are inverted. This is nearly impossible to determine without a schematic and there is no industry standard. The best way to check for inversion is to switch the + and – wires on the cartridge and see if that fixes the problem or makes it worse.

To top all that off, the signal wires are all subject to stray electromagnetic (EM) interference. That is the main reason why cables are shielded and why we twist the wires. If the wires are not twisted, they act like an antenna and pick up EM. If we twist them, it confuses the EM and makes

it a worse antenna. So the best setup is one where the signal wires are twisted and there is a shield around them that is attached to a chassis ground, not to any of the signal cables.

Some tone arm manufacturers take one of the – wires from the cartridge and connect it to chassis ground. I don't know why, but they sometimes do.

I try to take all this into account with my design which when you move the switch from lift to ground, it connects all the – signal wires to the chassis ground. That takes care of a lot of problems with the inconsistencies in wiring both with tone arms and with phono stages.

You need to understand all of this and clearly look at your system. Take into account that there should only be one chassis ground connection at each unit. If there are multiple connections you get what is known as a ground loop where it also acts like an antenna but the EM signal keeps looping and gets amplified. So you are better off without a ground than with an extra ground.

One of the main challenges is with the interconnect cables. RCA connectors only have a + and – and the – is sometimes connected to chassis ground. So it is important to use cables that have 2 conductors and a shield, with the shield connected to the – conductor on one end only.