

HUM-FIXING CHECKLIST

Copyright 2011 by Bruce Bartlett

You patch in a piece of audio equipment, and there it is- HUM! It's a low-pitched tone or buzz. This annoying sound is a tone at 60 Hz (50 Hz outside the U.S.) and multiples of that frequency.

Hum is caused mainly by ground loops. A ground loop is a closed loop made of ground wires, made of two separated pieces of audio equipment each connected to power ground through a 3-prong power cord, and also connected to each other through a cable shield. The ground voltage may be slightly different at each piece of equipment, so a 50- or 60-Hz hum signal flows between the components along the cable shield.

Another cause of hum: guitar pickups, cables, and mics can pick up hum fields radiated by power wiring -- especially if the cable shield connection is broken.

These are the most important points to remember about hum prevention:

- To prevent ground loops, plug all equipment into outlet strips powered by the same AC outlet. First make sure that the sum of the current draws of the equipment does not exceed the breaker's amperage rating (typically 15 or 20 amps).
- NEVER use an AC (electrical) 3-to-2 adapter to disconnect the power ground -- it causes a safety hazard.
- Use short cables.
- Some power amps create hum if they don't get enough AC current. So connect the power amp (or powered speakers) AC plug to its own wall outlet socket -- the same outlet that feeds the outlet strips for the recording equipment.
- If possible, use balanced cables going into balanced equipment. Balanced cables have XLR or TRS connectors and two conductors surrounded by a shield. The cable should use twisted-pair wires to reject magnetic hum fields, and should have heavy braided copper shields to reject electrostatic hum fields.
- Optional: At both ends of the balanced cable, connect the shield to a screw in the chassis, not to XLR pin 1. Or use modern audio gear whose XLR connectors are wired with pin 1 to chassis ground, not to signal ground. There should be a continuous connection from one chassis to another through the cable shields.
- Transformer-isolate unbalanced connections. To stop a ground loop when connecting two devices, connect between them a 1:1 isolation transformer, direct box or hum eliminator (such as Jensen Iso-Max CI-2RR, Behringer HD400, Rolls HE18 or Ebtech He2PKG).



Ebtech Hum Eliminators



Jensen Iso-Max CI-2RR

- Don't use fluorescent lights. Don't use conventional SCR dimmers to change the studio lighting levels. They clip the AC waveform and generate lots of harmonics. Use Luxtrol[®] variable-transformer dimmers or multi-way incandescent bulbs instead.
- If you are working with a recording that already has hum on it, apply narrow notch filters at 60 Hz, 120 Hz, and 180 Hz (or 50, 100, 150 Hz outside the U.S.). Raise and lower those frequencies slightly to find the best hum-rejection points. Some equalizer plug-ins include a hum filter preset.

Even if your system is wired properly, a hum or buzz may appear when you make a connection. Follow these tips to stop the hum:

- If the hum is coming from a direct box, flip its ground-lift switch. Usually, but not always, you need to lift ground if the musical instrument has a power cord or is connected to an amplifier. You should NOT lift ground when recording an electric guitar or a pickup without an amp.
- Check cables and connectors for broken leads and shields.
- Unplug all equipment from each other. Start by listening just to the powered monitor speakers. Connect a component to the system one at a time, and see when the hum starts.
- Remove audio cables from your devices and monitor each device by itself. It may be defective.
- Lower the volume on your power amp (or powered monitors), and feed them a higher-level signal from your mixer or audio interface.
- Use a direct box instead of a guitar cord between instrument and mic preamp.
- Make sure that the snake box is not touching metal, which can cause a ground loop.
- To prevent accidental ground loops, do not connect XLR pin 1 to the connector shell.
- Try another mic. Dynamic mics have a coil of wire which can pick up hum radiated from power wiring. Some dynamics have a hum-bucking construction.
- Turn down the high-frequency EQ on a buzzing bass-guitar track.
- To reduce buzzing between phrases on an electric-guitar track, apply a noise gate.
- Route mic cables and patch cords away from power cords; separate them vertically where they cross. Also keep recording equipment, instruments and cables away from computer monitors, power amplifiers and wall warts.
- If you hear a hum or buzz from an electric guitar, have the player move to a different location or aim in a different direction. That works because the guitar pickup is sensitive to magnetic hum fields, which are directional. Try a guitar with a hum-bucking pickup.
- If the electric-guitar hum stops when the player touches the strings, that indicates the player is picking up hum radiated from the AC wiring and is re-radiating it into the pickup. When they touch the grounded strings, their body becomes grounded and they no longer radiate hum. You might ask them to keep at least one hand in contact with the strings while playing.
- When you're recording a live concert, power all instrument amps and audio gear from the same AC distribution outlets. Let's explain.

Electric-guitar players can receive a shock or cause hum when they touch their guitar and a mic simultaneously. This occurs when the guitar amp is plugged into an electrical outlet on stage, and the mixing console (to which the mics are grounded) is plugged into a separate outlet across the room. If you're not using a power distro, these two power points may be at widely different ground voltages. So a current can flow between the grounded mic housing and the grounded guitar strings. Electric guitar shock is especially dangerous when the guitar amp and the console are on different phases of the AC mains.

If you lack a power distro, run a heavy extension cord from a stage outlet back to the mixing console (or vice versa). Plug all the power-cord ground pins into grounded outlets. That way, you prevent shocks and hum at the same time.

Using a neon tester or voltmeter, measure the voltage between the electric-guitar strings and the metal grille of the microphones. If there is a voltage, flip the polarity switch on the amp (if any). Use foam windscreens or hoop pop filters for additional protection against shocks.

I recommend Rane's excellent article on sound system interconnections at www.rane.com/note110.html. Also see www.ebtechaudio.com/findloop.pdf and www.jensen-transformers.com/an/ts_guide.pdf.

By following all these tips, you should be able to connect audio equipment without introducing any hum. Good luck!

#