

How to fix all your hums and buzzes

ROCK-tech Training Series

Sources of hum and buzz

Bad gain structure

Unbalanced or broken cables

Inappropriate bodgery (line signals in mic inputs etc)

Earthing problems and ground loops

Bad power supplies

Gain structure

Anything with an amplifier in it creates “self noise” (e.g. a mic preamp, or a DI box)

We want to maximise signal and minimise noise - hence Signal to Noise Ratio, or SNR

If you attenuate the signal too much, you have to apply gain somewhere else, which results in increased noise.

Demonstration: DI box





Balanced vs unbalanced

An unbalanced signal is susceptible to interference, hum and buzz, especially over longer distances. It uses only one line to carry the signal. The audio signal is derived from the difference between the (+) line and the ground.

A balanced line utilises an additional inverted 'noise canceling' signal. This is run alongside the main signal, making the "balanced line" pair (+/-).

At the mic preamp, the audio signal is derived from the difference between the two balanced lines (+/-), which 'cancels out' unwanted noise picked up along the way.

Signal Transmission

Type	Cable	Note	XLR	Jack
Balanced		Ground	1	1
		Hot +	2	2
		Cold -	3	3
Unbalanced		Ground	1	1
		Hot +	2	2
Stereo		Ground		1
		Left +		2
		Right +		3
Insert		Ground		1
		Send +		2
		Return +		3

Bodgery

er, I mean **Problem Solving**

Signal Level

Mic Level (1mV to 10mV)

Phono Level (Turntables) (100mv)

Line Level (0.9V)

Speaker / AMP (40V to 100V)

Connectors

XLR
Jack (Mono)
Jack (TRS / Stereo)
RCA / Phono

Signal Types on an XLR Connector...

Microphone Level (balanced and unbalanced)

Line Level (insert, mono and stereo)

AES/EBU Digital

Speaker Signal

DMX

Remote Controls (i.e. smoke machine)

Comms Belt-packs

RIAA EQ - record deck

Chinese electric bicycle mains charger!



Mains Charger -> XLR

Ground loops/Earth problems

Mains earth is there for safety

Audio ground is usually connected to mains earth

Mains voltage is enormous in comparison to audio voltage

Therefore a tiny fluctuation on mains earth can be very audible on audio ground

Loops pick up interference. Break the loop with a DI box

Ground loops and earth problems

NEVER remove the earth pin/wire from a mains power cable!

Any loop of wire is susceptible to current being induced from electromagnetic radiation. Due to the resistance in the wire this current creates a small voltage which you hear as a hum.

Try to have only one source of 'ground' to each device

Avoid loops wherever possible

Stereo devices often need one lift / one ground

Use extension leads to create a 'star' style power distribution network

Choose your power sources wisely

Bad power supplies (usually laptops)

A laptop power supply may or may not have an earth connection

Therefore the PSU may form part of a ground loop

Some power supplies simply create noise themselves, in which case there isn't much you can do...

...apart from try a USB soundcard rather than the built-in sound

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Active or Passive DI?

Active	Passive
Require power (phantom is best)	No power needed
Wide bandwidth	Limited bandwidth
Clip when overloaded	Saturate when overloaded
No loss of signal strength	Small loss of signal strength
Kinder to the source	More demanding of the source

Direct Injection (DI) Boxes Summary

2 Types:

Active

Passive

4 Main Uses:

Used to convert from one signal type to another

Can be used to 'break' earth loops (a cause of hum & buzz)

Split the signal. i.e. Bass guitar split to: FoH Desk and Bass Amp

Attenuates the signal, to avoid clipping and distortion

DI Boxes - Things to be careful of:

Active DIs can be 'clipped'

Don't use batteries in an active DI box, they run out when you least expect it.

Cheap Passive DIs have a limited frequency response

Cheap Active DIs are noisy and clip easily

Accidentally switched PAD attenuators can cause extra noise.

DI Boxes can do four things...

Adjust the input sound level.

Distortion / Clipping

Hiss / Noise

Convert an unbalanced signal to a balanced one.

Break

Amp

signal.

a Ground Loop

D.I. Box

Mixing Console

