**Optimizing your phono/tape and Complete System**

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It is only fair to judge noise at your typical listening level and listening position (not max volume control nor with your ear to the speaker). I have made systems where you can put your ear to the speaker, volume down and hear nothing, however that is achieved with a low gain power amp, low noise preamp and low sensitivity speakers. If you have a high power amp, high gain preamp or unusually sensitive speakers the *only* cure is an attenuator between the pre and power amps. Attenuators, attenuated cables and shorting plugs are available from Ram Labs. Shorting plugs are an essential tool for hunting down noise. NEVER judge a pre or power amplifier with an open input or turning up a preamp past it's normal volume control setting. It is ok to fully advance the volume as long as things don't get out of hand and one is aware of how many more dB he is adding to the system by doing such. More on that later. **Here is the correct way to go about noise evaluation.**

Adjust your volume to your high listening level and cue up the arm, pause the tape or CD, then judge the noise. If your system is noisy turn the volume all the way down, if still noisy start at **Step 1**. If it's quiet with the volume down go to **Step 2**. If it noisy with typical volume settings, go to **Step 3**. Noise can be hiss or hum, but not distortion.

**Step 1**. Start at the power amplifier. Remove cables from the power amp input jacks and install shorting plugs at inputs. If the power amp is quiet reconnect the preamp. With volume control down is there noise? (Preamps produce a small amount of noise as their line stage follows the volume control and it is normal to hear this close to the speaker. If your amplifier has high gain and you have sensitive speakers this can be cured by an attenuator available from Ram Labs. If there is hum try other cables and lift the preamp ground. In a proper system ONLY THE POWER AMPLIFIER SHOULD BE GROUNDED and all sources are unplugged from the wall or disconnected from the preamp. They will be added in one at a time later. If you have mono power amps only one should be grounded.

**Step 2**. If things are quiet with the volume down, choose only one source and advance the volume to a typical listening position, not full. Listen to some music. Is the noise louder than the music, is the music faint, is the situation the same in both channels? An open input will produce a lot of hum and noise and there may be faint music. It is important to be able to listen to one channel at a time by going up to the speaker or even disconnecting the other. If your preamp has a balance control that goes to off on each side you can use that as long as you have passed the previous quiet preamp test. In most cases every control you can touch on your preamp is BEFORE the line amp. So don't expect volume, balance or input to make any difference if the line amp is noisy.

**Step 3**. If your phono is noisy disconnect the turntable and install shorting plugs into the phono input. Do not listen to an open input, it is meaningless. If you are chasing down subtle hiss make a shorting plug with a resistor equal to your cartridge resistance. If you are chasing down hum connect one channel at a time (shorting plug in the other) and compare channels. You should be able to get the connected channel close to the shorted one. If you have a mono cartridge with 4 pins use only one cable and Y it into your two inputs. Disconnect the cartridge at the pins on the other channel so the unused cable won't load it. It's a mistake to make a cartridge with one coil and 4 pins (sad).

Keep in mind that volume control position is determined by many things. It's best if your loudest settings are well above noon. *If your system is loud at low volume control positions you need an attenuator!* 12 o'clock noon is 20 dB down on most volume controls and a 22 click control will be 2 dB per step above noon,with larger steps below noon making it hard to set. Most line stages have 20 dB gain so at noon you are unity through the line amp. If you are well below that setting for maximum listening you have too much overall system gain which has not advantage unless believe that the unused rotation is headroom.

High-power amps have higher gain than low-power amps and will amplify the output of your preamp line stage regardless of the volume control setting. Low-power amps that have enough power for your listening volume generally sound better than high power amps and have less gain. Playing a 100 watt amplifier at 1 watt is not a good idea and most systems have too much power due to incorrect knowledge. To determine the right size amplifier, *you must know your listening level*. Measure your peak level at one meter with a SPL meter on your smart phone (its way more accurate than guessing and most people overestimate by at least 10-20 db). Subtract your speaker sensitivity from listening level (98 db on a 88 dB/watt speaker) and we get 10 dB which corresponds to 10 watts peak and warrants a 20-50 watt amplifier, 100 watts would be ok but not 800! There are sins committed in designing large amplifiers. Each 10 dB of listening level requires 10 times the power, 20dB is 100 times and 30 is 1000 times.

Another kind of listener I often encounter has a speaker that is 95 dB sensitivity and listens at 85 dB. Subtracting 95 from 85 gives negative 10 dB which is 0.1 watt. He can use a single ended tube amp of a few watts. Just remember, if per chance, you listen at your speaker's sensitivity rating then you are using ONE WATT. If your speaker is 4 ohms and the maker has rated it with 2.85 volts then subtract 3 dB from the sensitivity for tube amps where you match impedance. For solid state amps this can be ignored however it is incorrect for a speaker maker to do this as John Atkinson points out in his measurements.

Some listeners like to turn it up when nobody is home, however in my experience I can't listen at levels above 85 dB for very long. I have observed clipping on a scope and I do recommend one invests $50 on eBay at learn to use it, then you will be able to check all sorts of things. We can have a class on that. I have found clipping needs to reach about 10% of the time to be noticed. For these brief occasions I don't mind a little clipping. The speaker is probably making more distortion at this point than the amplifier. As long as it gets loud enough at full volume setting you have enough gain.

Promoters of large amplifiers push the idea of power reserve or headroom. This is not like the reserve on your fuel gauge! These concepts do not apply to audio amplifiers unless that peak is reached and can be reproduced by the speaker. With digital we are even more limited by Full Scale Level on a CD or download. While some argue that there are 20 dB peaks on some recordings that also implies that the average level of the file must be -20 dB which is unlikely given how things are compressed these days. Keep in mind that a 12 watt amplifier typically has a gain of only 10 (20 dB) while a 200 watt amplifier has a gain of 40 (26 dB), 800 watts is 32 dB. I make a 2.5 watt amplifier that has a gain of *two (12 dB)*. ***Too much gain causes nothing but trouble and most systems have too much gain.***

As a side note, many of us like vinyl because it is not as compressed as modern recordings and re-mixes. As long as your cartridge can track the peak they can be quite large. With variable grove spacing and a good cartridge modern records can have great peaks which would give some reason for a larger amplifier. This is a matter for some thought among vinyl producers. However if the cartridge cannot track the peak the distortion will be quite noticeable. For these large peaks the phono preamp must have great overload capability, another thing that JA measures in his excellent Stereophile Reviews. In general active EQ will have better headroom than passive. The new Music Reference Phono/Tape preamp uses a combination of active and passive EQ to optimize this.

When I put on a recording that requires a higher than usual volume control setting, which means its average level is below typical, I am hoping the recording engineer is leaving room for some dynamics and peaks. Sadly, because of lack of education, many producers just want their recording LOUD. With the dynamic range of digital this is a horrible mistake. We desire digital that has lower average level so we can use the dynamic range avaliable.

Please don't just guess at which component is making noise or distortion and call that manufacturer. Do your homework, find out which component is the problem and call with information and use the following language. *Hum* is 60 Hz pure tone from unshielded cables or ground loops, *Buzz* is hum with harmonics usually in the unit itself. 120 Hz is power supply ripple (bad filter cap) 180 Hz is transformer radiation (don't put a sensitive unit on top of another units or its own power supply. Be clear to state if the offending hum is coming from the speaker of mechanical from the amplifier. *Noise* is hiss or crackling much like a thunderstorm on an AM ratio. It persists regardless of the music. *Distortion* is not noise. Distortion stops when the music stops.

You will have a more successful conversation with a tech, engineer or manufacturer if you get right to the point. There is no need to recite your whole system, list of your treasured vacuum tubes, cables or power cords. If he wants to know those he will ask. A skilled technical person would rather ask you his questions than hear what you think he needs to know. Technical people like to talk to technical people and you will be more welcome next time and have a better conversation if you can speak proper language and not brag on your system. You don't want to get on the list of people he doesn't want to talk to and we all have a list!

When I was 16 I worked for a clever man in a TV repair business. Often the customer wants to tell you what he/she thinks is wrong. After awhile of that he would simply say... “Madam, Please tell me why you cannot enjoy your television”.