AUDIO TALK

by LEO SIMPSON

LOUDNESS CONTROLS

Some years ago now, in July 1974, I wrote a short article on the subject of Loudness controls on amplifiers. As might be expected, the article was not in favour of these controls. The reason for returning to the subject is not that I have changed my opinion, but that we now have a whole new bunch of readers who have not yet developed the right attitude towards Loudness controls. Indeed, many people even believe that the Loudness control should be used!

Well let's start out objectively and discuss what Loudness controls do. Then we can perhaps define what they should do, which will lead us to see why they can't.

The idea behind the Loudness control is that it is supposed to compensate for hearing losses at low sound levels. It is well known that the sensitivity of human ears is reduced at low and high frequencies when the sound level is low. This was first documented in 1933 by Fletcher and Munson, who produced a graph of "equal loudness contours". We have reproduced a later version of these curves, to illustrate the effect.

What the equal loudness contours show is the typical frequency response of the human ear at various sound levels. The first thing that is apparent from these curves is that nowhere within the range of bearable sound pressure levels is the human ear frequency response actually flat. At very intense sound levels, for example, the curves show that the response of the ear has a pronounced peak in the region of 3 to 4kHz, of about 15dB.

At lower sound levels we see that the 3 to 4kHz peak is less pronounced but the response at frequencies below about 200Hz becomes markedly reduced. To a lesser extent, the high frequency response of the ear is also reduced at low sound levels.

To compensate for this effect, amplifier designers have given us the Loudness control. This is usually arranged to provide about 10dB of boost at 100Hz and, on some of the more pretentious amplifiers, about 6dB of boost at around 10kHz; midrange frequencies are held at reference.

This degree of boost is usually based on the "equal loudness contour" level of about 30 phons. Just as an aside, the phon is a logarithmic measure of subjective loudness level.

The other premise which is used to justify the loudness control is that, in the normal home listening situation, listeners are often force to keep the volume down out of consideration for other members of the household. In this situation, the reproduction is supposed to be effectively lacking in bass and extreme treble, in comparison with "normal" sound levels.

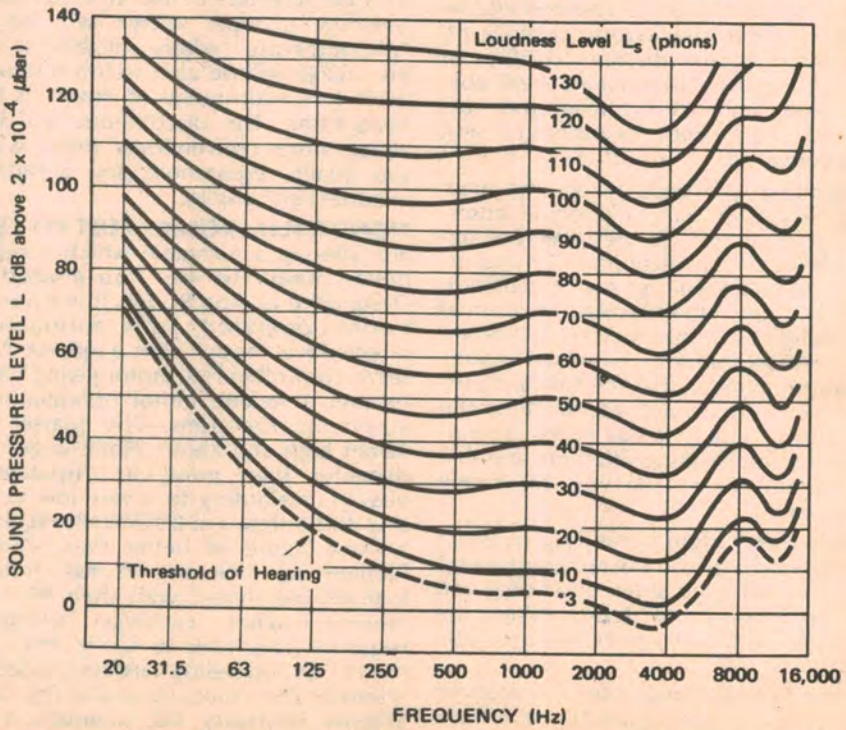
Well let us accept, for the moment, that the amount of boost provided by the typical loudness control is at least a partial compensation for the low level characteristics of the ear. Now in most amplifiers with a loudness facility, the boost is applied at low settings of the volume control and is gradually reduced to zero as the volume control is advanced to the 12 o'clock setting.

But the logic begins to fall down at this point because, with typical cartridges and records, most amplifiers will deliver maximum power with the volume control set to 12 o'clock or less. This is partly because many amplifiers are over-sensitive and partly because their volume control characteristic is too rapid in the first half.

Whatever the reason, most amplifiers are quite loud even at the quarter-on setting of the volume control; yet the loudness facility is applying bass and maybe treble boost, to compensate for supposed hearing losses which are apparent at much lower sound levels.

The real problem is that the designer cannot predict just how loud the system will be at a particular volume control setting; the actual loudness will depend on the signal source, type of music being played, the loudspeakers and the listening room. But even if the designer could predict how loud the system would be at a given control setting, the fixed loudness compensation approach makes no allowances for the dynamic range of the material to which you are listening.

So if the listener is playing a record with wide dynamic range, he will be forced to set the volume control at a low setting in order to accommodate that wide dynamic range; otherwise, if the volume control was advanced, the amplifier or the loudspeakers would overload on signal peaks. If the listener elects to use the loudness facility in this



These curves relate human ear frequency response to sound pressure level.

situation, he will be applying bass and treble boost at all times, even on the very loud peaks, where it is quite inappropriate.

I should mention at this stage, that some designers have attempted to overcome the problem of not being able to predict the system loudness. They do this by providing two controls instead of the single volume-cum-loudness control. Typically one control will be labelled "Master Volume", while the other is labelled "Contour" or something similar.

The idea with this arrangement is that you initially set the Contour control fully clockwise and then advance the Master control to the loudest level that you will normally wish to use. From then on you use the Contour control and it varies the amount of boost applied, dependant on its setting. This and other variations on the Loudness theme are at least a step in the right direction, but they fail to take account of the dynamic range of the program.

Really, the only method by which an audio system could be precisely compensated to suit the hearing characteristic of a given listener would be to have a dynamic feedback system whereby the overall sound level was monitored and the bass and treble boost varied accordingly. The resulting compensation would vary from moment to moment, according to the dynamic range of the program.

You would need a computer programmed with the full hearing characteristic of the listener, to do the job properly. Who knows, maybe some keen microprocessor nut is working on just such a scheme right now! But even the most brilliant programmer would be baffled by the problem of providing loudness compensation to suit two or more listeners at the one time. Each listener has a different hearing characteristic, which can vary markedly from the average curves produced by Fletcher and Munson. (Even your own two ears are not identical).

Really, the loudness facility found on most amplifiers functions mainly as a preset bass boost control. But, as such, it tends to apply a fair amount of boost at the upper bass frequencies around 400Hz and this tends to "muddy up" the sound. If that's not bad enough, many users apply boost with the tone controls too. Some even use the Loudness control when listening at quite high levels with headphones.

Some may say that if the listeners enjoy it, well that's that. But the end result is not high fidelity sound. Why spend a lot of money on a high performance audio system and then spoil it by using the Loudness facility? As far as I am concerned, the best feature of the Loudness facility on an amplifier is the switch to disable it.