

Technical background to our dynamic range/power claims.

This section is slightly technical and may take you a few minutes to read. We would like to take you through to the basic technical elements that make up a hi-fi system and explain how they go together.

Loudspeaker sensitivity

Loudspeaker sensitivity is a measure of how much sound a loudspeaker will give for 1 watt at 1 metre. It is *critical* to note that the basic measure of sensitivity is at 1 metre and *not* at a typical listening distance of about 10 feet or 3½ metres.

Sound attenuates (reduces) over distance at the rate of 6dB with each doubling of the distance. At 2 metres distance from the loudspeaker its *perceived* sensitivity is reduced by 6dB. At a normal listening distance of about 10 or 11 feet from the loudspeaker its perceived sensitivity will be reduced by approximately 10dB.

This is the *factual* basis for our claims about how much power a system would need for a decent hi-fi dynamic range. We reiterate that this is not made up or marketing hype, it is scientific fact.

Loudspeaker sensitivity – is it real?

Regrettably, most loudspeaker sensitivity ratings are not particularly accurate and are regularly overstated by 2 or 3dB. We have seen several examples of respected manufacturers' products specifications overstating their sensitivity by 5dB or more.

This does not sound like a big deal, but it has tremendous implications for the power required by the loudspeaker to deliver proper dynamic range.

Amplifier power – confusion reigns.

This is the source of much misunderstanding. Amplifier power is specified in watts, which are a measure of heating power. They have no apparent relationship to what we hear, as they are a linear measure. Loudspeakers (and our ears) perceive things in dB (decibel) steps. These are based on a *logarithmic* relationship.

This is the fundamental mismatch between what your ears perceive and how amplifiers are specified. The solution to the problem is to recalibrate watts into dB steps. The results are below, in a chart of watts converted to dB steps. For convenience we have started our chart at 50 watts. These figures are not made up they are *fact*.

<u>dBW</u>	<u>Watts</u>	<u>dBW</u>	<u>Watts</u>
17	50	24	251
18	63	25	316
19	79	26	400
20	100	27	500
21	126	28	630
22	156	29	795
23	200	30	1000

As you can see, as soon as you calibrate amplifier power in dB watts, you get a dramatically different view of what amplifier power *really* means.

First off, you can see that what looks like a large increase in amplifier power, for example from 50 watts to 100 watts, only gives an increase of 3dB.

Things get really interesting as when you get to higher powers. You start needing vast amounts of power for each dB step. For example, only 1dB (remember 1dB is the smallest change in sound pressure level that the human ear can perceive UNDER IDEAL LISTENING CONDITIONS) is the difference between 400 watts and 500 watts. If you really wanted to hear a difference above 400 watts you'd probably need to go to 800 watts (3dB) which *should* be audible.

You can see why amplifier manufacturers want to sweep these figures under the nearest carpet; they make most of their claims look ridiculous as they predict that most loudspeaker/amplifier combinations will have only limited dynamic range.

How much dynamic range do I need?

Some years ago John Atkinson (current editor of the Stereophile) made some measurements of live music using accurate equipment. He recorded 109dB peaks (brass and percussion) and the quietest was 63dB (solo violin) a variation of 46dB from the quietest to the loudest moments – a huge dynamic range.

The question is what sort of dynamic range a really good hi-fi system should have.

In our opinion, an ability to produce unclipped peaks of 105dB is the minimum starting point for a really good hi-fi system. You are welcome to debate different figures, but that is our basic position.

If you listen to small scale chamber music or usually listen at quiet levels, you will not need the peak capacity we deem necessary. But if you are trying to recreate the listening experience at reasonable levels, 105dB peak is not overly generous.

How do you put all this together.

Assuming that you have accepted the *scientific facts* this is how you determine what your system can produce.

1. Take your loudspeaker sensitivity (better yet check back to a technical review to find out what its sensitivity really is). Deduct around 10dB for the SPL (sound pressure level) attenuation over distance. And then add back 3dB because there are two loudspeakers in the room.

Now you have arrived at the *practical*, real world, in-room sensitivity of your loudspeaker system.

2. Decide what peak level you want to achieve. We think 105dB is about right. Some people think 110dB is more appropriate. It's up to you.
3. Deduct the result of 1 above from your decision about 2. This is how much amplifier power you require in dB watts.

4. Use the chart above to translate your dB watts result in to ordinary watts.

General overview.

None of this is intended as criticism of amplifier or loudspeaker manufacturers. You could regard it as a criticism of magazines and shops for not bringing it to your attention. We have been banging on about this for about ten years and many people have reacted adversely because they believed it was just marketing hype. This is not marketing hype, this is scientific fact. Many people do not like the result of a scientific analysis of their equipment but that does not alter the scientific facts.

People have objected to our position claiming that their system sounds great. It might. However, you can't escape the fact that, if they have a low powered amplifier and relatively insensitive loudspeakers, the system must be clipping, distorting and limiting regularly, which *must* dominate the listening experience. Maybe the listeners like distortion clipping. Well, each to his own and good luck to them. If you want your hi-fi system to produce as close an approximation to the real live performance as you can get, then you *must* ensure, for a start, that your amplifier is not clipping.