But This Goes to 11...

'Why don't you just make 10 louder and make 10 be the top number and make that a little louder?' 'These go to 11.'

Although Nigel Tufnel entirely misses the point, it's obvious to us that the numbers on the dial are no more than numbers and that full clockwise is full power whether it's 10 or 11. Or is it? Sadly the answer is no. Full clockwise is full gain, but that doesn't always get you full power, and on the vast majority of amps many positions that are way short of all the way up will get you full power.

Last time we looked at how voltage comes from your instrument and through your amp, finally hitting the speaker and making sound come out. We saw that each knob controls gain, which is simply the increase (or decrease) of voltage in the system. We also saw that each stage in the system has a maximum voltage it can handle or generate. In the final part of your amp, the power amp, the maximum voltage is proportional to the maximum power of the amp. Some equations (don't panic!): P=VI and V=IR therefore P=V2/R therefore V=√(PR).

So an amp with 300 W into 8 Ω output can generate √(300x8) = 49 V.

How this works in essence is that this amplifier has a 49 V power supply driving the power amp. If you turn the voltage up so that the gain times the voltage entering that stage equals more than 49 V, then your amplifier will fail to reproduce the signal at this voltage and you will hear this as distortion. This distortion is often termed 'clipping' because the peaks of the waveform are clipped off.

So this knob that goes to 11 or not can have a wide range of gain available. Most volume knobs give 0 x(times) gain at 0, so no sound comes out. At full gain our 300 W amp might give 100 x gain (40 dB). This means that if the preamp stage delivers 0.5 V to the power amp, then full gain gets 50 V out, so you've hit the 49 V limit and got full power.

But what happens if your pickups are a bit hotter, or your strings are closer to your pickups, or you're plucking harder, or you turn up your pre-gain a bit more or boost some lows or highs with your EQ? Then more volts come out of the preamp, and those last few numbers on the volume knob become pointless, as all they give you is increasing distortion but no more power.

Let's take a step back and consider the typical beginner trying to choose his or her first amp. Both small combos are the same price, look the same, cost the same and have very similar specs. But when newbie #1 plugs into amp A and turns all the knobs to 12 o'clock (5 on the dials) it's quieter than amp B with all the knobs in the same positions. So obviously he buys amp B because it's louder, or moar rawk in modern parlance. Then newbie #2 comes in and she's read this column and is feeling a bit savvy. She turns up amp A until it's just starting to distort when she plays with typical plucking hardness. She then does the same with amp B and she finds she can't turn the knobs as high before it complains. She then plugs back into amp A and is thrilled to realise it's noticeably louder at full volume than amp B. What's wrong with this picture? Newbie #2 is so rare as to be practically extinct. So anyone designing an amp will make it like amp B because 99.9 per cent of players think the loudest amp is the one which you only have to turn up to 3 to get loud, even if that makes 4–10 on the knob redundant.

The numbers don't tell you how loud it is, nor do the knob positions – push it until it complains, that's the only way to find out how loud it can play. If someone tells you that their new amp is better than their old amp because it's as loud on 4 as the other was on 7, then all that actually tells you is they don't understand this concept. It might even be the case that the old amp could be turned up to 10 without distortion while the new amp starts distorting at 5, so the old amp is actually louder!

As we have some space left, let's touch on a big new concept: the decibel. In the 1920s, Bell Telephone Laboratories came up with a handy unit for describing changes of quantity in a logarithmic manner to help them with the challenges of sending signals down long phone lines, where the voltage dropped hugely over these hundreds of miles of cable. It was soon applied to describing sound and it's proven ideal for this. Why? Because human senses work in a logarithmic manner – we can hear sounds with a loudness ratio of 1:1,000,000,000,000 without discomfort. If we describe this ratio in bels it is 12 bels (12 zeros ie 12 orders of magnitude) or 120 dB (as a decibel is a tenth of a bel). Much more manageable than all those noughts!

A nice home stereo playing at a good level for enjoying music but not offending the neighbours might be running at about 90 dB. A small bass cab might put out about 95 dB when 1 W goes in, while a large bass cab might put out about 100 dB from 1 W input. Increase the input power to 10 W and you get 10 dB more. Increase it to 100 W and you get another 10 dB. So a small rig being pushed hard (I realise 100 W doesn't sound like much but it's more than you think – something for a future column) will be putting out 115 dB and the big rig 120 dB. 10 dB increase in SPL sounds twice as loud, so our big rig running at pretty high volume sounds about eight times as loud as a home stereo. The depressing thing with bass rigs, though, is that if our small rig's output peaks at 118 dB (200 W into a 95 dB speaker), to get twice as loud we need to reach 128 dB. That would require 630 W into a 100 dB speaker, which sounds fine when you look at typical large-cab power ratings. However, few bass cabs can handle 630 W without distortion, even though their power-handling spec may say as much as 1200 W, which means we'd need an even bigger speaker to get more sensitivity (dB per watt) and more power handling. Life is much easier if you play one of those small guitars!

Next time we'll look at the final part of our sample practice combo, the speaker, a most misunderstood beast as I'm sure that gentleman from that Glaswegian steelworks via the Palace of Westminster would agree. No! Not that kind of speaker…

About The Author
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Alex first picked up a bass when studying engineering at university, and his quest for sonic perfection led him to found Barefaced Audio, while also leading The Reluctant, an alt-ska/funk outfit.