

Percept Monitor Placement



How to handle bass in the control room...

It's amazing how some home and professional users alike can spend hours and hours tweaking sounds, programming a reverb, or editing in Pro Tools, but only about five minutes flat to set up their monitors on a couple of breeze blocks or tea chests.

It sounds amusing now, but if your livelihood depends on the music or sound you're producing, then your Heath-Robinson antics won't seem quite so funny when the TV soundtrack you've been commissioned to write sounds completely awful when played through the Director's system, and you get the sack.

This is the kind of scenario that might await you if you don't sort out any problems with the set-up of your studio monitoring system. You think I'm scaremongering? Well, maybe, but why take a chance on something that's so easy to fix? In this instalment, we're going to look at how to deal with bass frequencies in the studio, but first let's have a recap of the points we covered last time (for those of you who missed it!).

(1) **Nearfield positioning:** make sure that both speakers are pointing directly at the spot where you'll be mixing. Ideally you need a 60° angle between the monitors, and if they are above the height of your head, make sure they're pointing down towards your ears. Remember that for critical work (such as mixing) you need to be sitting in the sweet spot to get the correct impression of the music you're listening to. Moving out of the sweet spot will detrimentally affect the sound you're listening to, so don't make any major decisions while away from your desk. Also, make sure that your nearfields are, indeed, in the nearfield; anything between 0.7 and 2 metres between your speakers and your ears is okay.

(2) **Nearfields, in most cases, should be mounted on stands.** Mounting them on the meterbridge may be convenient, but you'll get a whole load of reflected sound off the panel of the mixing desk, whereas you really only want to listen to direct sound. Mounting them on stands will avoid this, and is also a solution to problems caused by mixing in front of a computer monitor. It's also preferable to mount nearfields vertically, though of course some models are designed specifically for horizontal use.

(3) **Symmetry of installation:** it goes without saying (I hope) that your monitors should be the same distance from the listening point, but they should also be symmetrical within the room (i.e. the same distance from the side walls). Why? Because you'll hear reflected sound off these walls, and you need to hear the same on either side, or it'll mess up your stereo imaging. The same goes for gear in front of the monitors, which should also, if possible, be symmetrical, so if you have a rack in front of the desk on one side, try to have an identical one on the other side. Okay then, let's move onto some more issues, this time regarding bass.

Bring on the bass

Why is it that you always seem to hear people talking about problems with bass in their studio, and rarely with high frequencies? Why does it seem to be that those low frequencies are so problematic? Or is it just myth? Well, it is true that low frequencies are more problematic, and the reason has to do with the radiation space in a room.

The radiation space is the geometrical surroundings of a speaker, and is frequency dependent. If the speaker is in the middle of a field (for example), there are no limitations to its radiation space and it's known as 'free standing'. As soon as you place it in a room, however, the radiation space starts to be limited. If your speakers are soffit (wall) mounted, or right next to the wall, they can 'see' only half the space now, and if placed by two walls, the radiation space is divided by four. A typical corner, with two walls and a floor would cut this to an eighth of the radiation space of our monitor in the middle of a field. But what does this mean in practise?

A decrease in the radiation space means an increase in energy density in that immediate area (i.e. higher SPL levels), and the theoretical value is 6dB for every time the space is halved. So soffit-mounting your speakers will give 6dB of boost, and in a corner (with two walls plus floor) this will give 18dB of boost. But remember that we said earlier that this is frequency dependent, and the way it works is that the radiation space is limited by 'reflecting surfaces that are large compared to the wavelengths'. So for low frequencies this means the walls, the

floor and the ceiling, for mid frequencies it's mainly the speaker baffle and objects near the speaker, while for high frequencies it's entirely the speaker baffle and driver itself. Now you understand why it's the bass frequencies that cause all the trouble?

4. +6dB bass boost at boundaries: Now we've understood the effects of limiting the radiation space of a speaker (i.e. placing it in a room), and that it's the low frequency effects that are most apparent, let's look at some practical examples. Many big studios choose to soffit-mount their monitors (more of which next month), and by doing this they will experience a 6dB boost in the low frequencies, since the radiation space is halved. In this case, the bass response of the speaker should be cut by at least 6dB to compensate. Placing a speaker very close to the back wall will also have a similar result, and the same action should be taken.

If your speakers are in the corners of a room, you'll experience a bass boost of between 12dB and 18dB, depending on how close they are to the floor (above about 1.3m the floor won't have a significant effect). Again, this needs to be rectified by cutting the bass response of the speaker. Great - your bass frequencies are under control? Or are they? There's another factor that has to be taken into account when deciding how far away from the walls you place them...

5. Frequency cancellation caused by wall reflections: Another reason why many studios wallmount their speakers is to avoid cancellation of frequencies caused by wall reflections. This effect is easy to explain: if a speaker is a quarter wave-length away from a reflective wall, the reflected wave returns to the speaker with a half-cycle phase difference ($2 \times 1/4$ cycle, kapiche?) - i.e it's in antiphase.

If this is a perfect reflection then the cancellation will be complete, though in reality this is unlikely to be the case (due to absorption by the surface). Nevertheless, the effect can be very audible indeed, and a problem that needs to be solved. Naturally, this will occur in more than one direction too, so several frequencies may experience cancellation.

The solution? Apart from flush mounting (which eliminates reflections) you can either place the speaker very close to the wall, or considerably away from the wall. In the first case, the cancellation frequency is so high (work it out yourself using the following equation: $\text{wavelength} = \text{velocity of sound (343m/s)} / \text{frequency}$) that the effect is overlapped by higher directivity and higher density of room resonance modes.

If you take this option, remember that placing your speaker close to the wall will result in 6dB of bass boost (covered in point 4) and you'll need to take corrective action.

The other solution is to move your speakers well away from the walls, where the cancellation frequency is so low that it'll have little effect on the music anyway. But just how far away? Well, using the above equation, a distance of three metres will give a cancellation frequency of 29Hz, which isn't going to cause anyone problems. Even at two metres, the cancellation frequency is an acceptable 43Hz ($2 \times 4 = 8$, $343/8 = 42.875$), but of course this all depends on how much space you have to spare.

6. Positioning of subwoofers: Subwoofers have been used increasingly in recent years in conjunction with nearfields to give an extended frequency response in the absence of (a) a large room (b) budget for a pair of full-range speakers and (c) both of the former. But does it really matter where you place the subwoofer?

Frequencies in this bandwidth are omni-directional anyway, so surely it doesn't matter where they're placed? Well, not quite... (you knew I was going to say that, didn't you?). Firstly we should look at the +6dB effect at boundaries (covered in point 4). If you have a large room, you can place the subwoofer 3m away from the closest walls, and you'll avoid the $1/4$ wavelength frequency cancellations covered in point 5.

The subwoofer can be either facing the floor, or into the room, but you will have to adjust the unit's response to take into account the effect of the boundary (the floor) by taking off 6dB of gain. In a smaller room, the unit should be placed close to the front wall(s) (between 20 and 80 cm) to avoid any frequency cancellation due to the $1/4$ wavelength phenomenon. If this is in the centre of the room, with two boundaries (floor and wall) then the response of the unit should be adjusted by 12dB, and in a corner (three boundaries) it should be adjusted by 18dB.

There is another factor to take into account, and that's the general room behaviour, its standing waves and axial modes. We will be covering these issues in next month's instalment, so we won't go into too much detail here. However, a quick explanation would be that by placing the subwoofer in a pressure minima (which, coincidentally, would generally be the case if you placed the unit on the floor behind the mixing desk and between the nearfields in a small room) it causes the subwoofer problems in generating high enough SPLs. One solution is to move the sub slightly off the centre line, which puts it in a more balanced sound pressure zone.

In reality, experimentation will help you get the right sub position, and this means moving it around the studio and listening closely to the result. It should be quite obvious if there is 'something missing' or if you indeed have a full low-frequency response. Whatever you do, don't just shove the unit anywhere and expect to get a satisfactory result.

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