



## TEN MINUTE MASTER No146

# Room correction



ERGO is one of the most advanced room-correction systems available. It's packaged as an integrated FireWire audio interface/monitor controller with more than 1,000 filter adjustments to 'correct' the output.



## Why struggle with egg boxes and bass traps when there's another way to address acoustic issues? Mark Cousins stands corrected.

When it comes to the design of monitor speakers, the widely accepted ideal is a frequency response that is as flat as technically possible. However, even the flattest and most neutral-sounding set of monitors won't deliver the performance you'd expect or want if placed in an untreated room.

Put simply, rooms distort the frequency response of music played in them, wreaking havoc on the decisions you make as you record, mix and master. A simple solution is to acoustically treat the room, but is it the only one?

### Stand and wave

Most people tend to associate the 'acoustics' of a room with the phenomena of reverb, whereby

reflections from the walls build up to create a distinct tail at the end of a sound. Although a studio's control room won't be big enough (or reflective enough) to build up a discernible reverb tail, there will be some degree of sound reflection. These reflections – despite being barely discernible to the ear – actually have a significant effect on

the sound in the room, colouring the once pure output of your monitors and distorting your perception of sound based on your listening position.

One of the principal ways in which sound is coloured in a room is by so-called modes or standing

waves. Room modes are created when a soundwave is reflected off a wall, interfering with the sound coming from the speaker. Modes, therefore, are directly linked to the dimensions of the room, and most rooms will exhibit predictable peaks and troughs in the 20–200Hz region. The effect of these is uneven bass that might be louder

course, to use some form of acoustic treatment. However, achieving a satisfactory outcome requires a significant amount of skill and experience, matching a variety of different acoustic control devices (including bass traps, absorbers and diffusers) with the acoustic qualities of the room.

All too often the results are only partially effective (bass traps, for example, are usually effective only down to around 100Hz), while over-correction can degrade a once workable studio environment,

## Proper acoustic treatment isn't always a practical solution to the problem in hand.

in some parts of the room than others, as well as a general lack of tightness and definition in the bottom end of the mix.

In addition to the impact of room modes, it's also important to consider how other reflections (those not directly related to the resonant modes in the room) also colour and affect the sound. Small timing delays from the reflected sound, for example, make it easy for comb-filtering artefacts to build up, while flutter echoes (sound bouncing around a few more times) lead to poor distinction and imaging. As a result, therefore, it's just as likely that the midrange and high end of your mix also become coloured, although perhaps to not the same degree as the bass.

making it more reminiscent of the claustrophobic listening experience you'd get in an anechoic chamber.

Alongside the sonic issues of acoustic treatment, it's also important to remember that proper acoustic treatment sometimes isn't always a pragmatic or practical solution to the problem in hand – perhaps the studio is a temporary fixture, for example, or it would be simply too expensive (especially for a hobbyist) to properly fit it out.

### Room for improvement

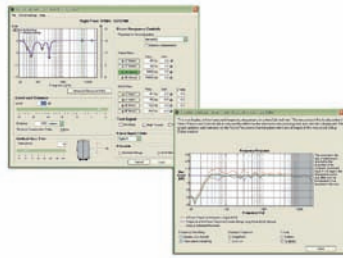
Rather than ineffectually treating the room, therefore, room correction is an alternative solution whereby the output of the monitors is deliberately altered to best account for the behaviour of sound in the room. Of course, it has been common practice for many years to tailor the performance of monitors by ear using a simple equaliser or the

### Under control

The most common way of controlling unnecessary colouration in the room is, of



Acoustic treatment is still regarded as the best way of improving the listening experience throughout the entirety of the room rather than in a specific spot.



Genelec's latest monitors feature DSP processing that enables you to analyse a room's response and contour the output of the monitors accordingly.

bass and treble tilt controls included on most active monitors. However, room correction – as addressed by an increasing range of products from the likes of IK Multimedia, KRK, JBL and Genelec – takes this concept a scientific leap forward.

Current commercial room-correction systems begin by analysing the room in question. The system will be supplied with a calibration microphone, usually a small-diaphragm condenser. A series of test tones is then played in the room, either in the form of long sweeps across the audio spectrum or, in the case of KRK's ERGO, a 'multi-tone' comprising a collection of spaced harmonics.

The tones are designed to excite the room's modes as well as highlight any other colouring influences. By moving the mic around the room and making a series of tests, more sophisticated analysers can build up a complete 3D representation of a room's acoustic properties.

### Correction facility

Once the analysis is complete, the room-correction system can then go about modifying the output

from the monitors accordingly. In this respect you'll find some big differences between the various different products available and the means in which they apply the correction. The solutions from JBL and Genelec, for example, embed the correction technology in the monitor mix. KRK's ERGO, on the other hand, uses a form of monitoring controller/FireWire audio interface so the correction isn't tied to specific pair of monitors, while IK Multimedia's ARC system applies the correction as a plug-in across your stereo buss (you need to remember to turn it off when you bounce your mix).

The way in which correction is applied can also vary between systems. Some will simply have a few strategically placed notch filters, addressing the principal room modes that have been uncovered. More complex systems, though, use complex Finite Impulse Response (FIR) equalisers with more than 1,000 correction points to build up a complex curve relating to the room's acoustics. As well as changing the relative gain at various frequencies, these

correction systems will also apply frequency-specific phase adjustment to best account for phase issues that occur once sound has entered the room.

Hopefully, if the correction is good you shouldn't notice any major differences in the tone or colour of your monitors, but a generally tighter sound with improved imaging between the two speakers. Room correction, therefore, isn't a tool for simply flattening the response curve of your speakers, but a method of ensuring that the output the monitor's designers originally envisaged is the sound that finally reaches your ears.

### Sweet spot

One important point to remember about room-correction technologies is that the results are often very much tied to a particular sweet spot, as the correction is always directed at the listening conditions in a specific part of the room. If you're working by yourself in a fixed listening position, this isn't too much of an issue, but if you start to move about or if other people join you to critically listen to the mix, you'll soon find that this perfect reproduction doesn't translate fully around the room.

In an attempt to rectify these issues it's interesting to see KRK's ERGO providing two listening modes: Focus, for the principal listening spot; and Global, which provides more generalised improvements that can be appreciated from several positions throughout the room. Ultimately, though, it highlights the principal

flaw of room correction by comparison to acoustic treatment in that it's somewhat location-specific. Although perfect for a project or bedroom studio, therefore, the merits of room correction become somewhat dubious in the context of large-scale commercial studios.

### Balancing act

Although it's easy to see the argument between room correction and acoustic treatment in a polarised way, it's interesting to note that in reality the best solution (for most projects studios) will be a combination of both.

Although acoustic treatment will certainly help to improve the overall sound of a room, few people will be able to fully achieve the critical-listening environment they desire. Room correction, therefore, offers a fantastic opportunity to take your sound that important 'next step' forwards, ultimately providing you with the tools for creating a more transferable and sonically effective mix. **MTM**

## Tech Terms

#### ■ Comb filtering

Comb filtering is created when a sound is doubled by a displaced copy of itself (the interval between them is usually in the order of a few milliseconds). The displacement creates sharp notches across the frequency spectrum, making the sound appear hollow.

#### ■ Flutter echoes

Flutter echoes are short, discernible reflections that 'flutter' for a few milliseconds after the start of the note. They're particularly noticeable when you clap your hands in a small space.

#### ■ FIR equalizer

Digital finite impulse response equalizers are designed to remove the phase and time shifts that can occur as a result of using conventional analogue equalizers.

## FURTHER INFO

- For more information on room modes, visit: [www.musictechmag.co.uk/mtm/features/room-modes](http://www.musictechmag.co.uk/mtm/features/room-modes)
- More information on sound absorbers and acoustic treatment can be found at: [www.musictechmag.co.uk/mtm/features/sound-absorbers](http://www.musictechmag.co.uk/mtm/features/sound-absorbers) [www.musictechmag.co.uk/mtm/features/studio-acoustics](http://www.musictechmag.co.uk/mtm/features/studio-acoustics)



IK Multimedia's ARC system is a software-based solution to room correction. Once the room has been analysed, a plug-in is used to apply the necessary equalisation.