RoomPerfect™

Product Description

LYNGDORF

The room – the weakest link in the chain

Most high-end products are developed in sonically ideal – or near ideal – listening rooms with optimized dimensions and acoustic treatment.

However, in reality we all place our audio system in different rooms. Unlike sterile lab rooms we also typically fill our listening rooms full of furniture, curtains, bookshelves etc because we also want to use them as living rooms!

The actual performance of a speaker is known to be highly dependent on the acoustics of your listening room and your listening and speaker positions. To put this into perspective our extensive measurements in different rooms show that even when you put a high-end system in a well-controlled room, peaks and dips between +10 to –20 dB in the frequency response are more the rule than the exception! So, creating a "linear" sounding audio system by improving the linearity of each component 0.2dB doesn't actually help much.

Also, it is quite obvious that even if the greatest of care is taken over tweaking the system with cables, interconnects, power stabilizers etc. none of that will never compensate for 10 – 20dB peaks and dips in the frequency response.

So, it's clear that the room is the weakest link in the chain which is why we decided to do something about it. We believe in the principle that if you 'strengthen' the weakest link you have the biggest potential for making an improvement!

Room correction so far

Today most room correction is carried out based on a single measurement at the listening position, i.e. you are trying to solve problems in a 3 dimensional sound field with a 1 dimensional measurement – obviously that it requires acoustical skills and possibly also some luck to reach the right conclusions based on that methodology. Even if you measure in a number of positions around the listening position and then take an average, our tests have shown that moving the microphone just 10cm/4in relative to the listening position easily results in 20 - 40dB deviations. So, unless you are a very skilled in acoustics, the chances of making a wrong decision are huge.

Another crucial decision is how to define on the ideal target response – logically, if you don't know what the target is, it is impossible to get there!

Instead of making measurements at the listening position, some systems measure the way the loudspeaker couples to the room (the acoustic impedance). And very often such a power response measurement can correct the issues you have 'globally' in the room, i.e. across the room. However, it will never perfectly solve the problems at the listening position.

Our goals with RoomPerfect™

"The ideal response is flat and without reflections" is very often the statement you'll hear if you ask people what the perfect sound would be for them.

However, for various reasons it is not our goal to create that… just take a look at the frequency response examples cited later in this document – they are not flat as a mathematician would like them and not smoothed to look nice. However, they represent sound in the real world! To an acoustic engineer they look extremely good!

So, why not flat and without reflections?
First of all, we are used to listening to music inside a room – everyone knows that if you listen to your preferred audio system outdoors something is missing – bass and impact. In other words what we define as the generic in-room bass enhancement sounds natural to us, which is precisely why this shouldn't be compensated for.

Secondly, listening to a speaker with a flat in-room power response would sound terribly bright. Measuring the direct on-axis response will look flat, but at the listening position the sound will roll off towards the high frequencies – due to distance, directivity, off-axis listening and general high frequency absorption and reflections in the room.

Thirdly, reflections are a big part of how we determine directionality and ambience – i.e. if there are no reflections, a lot of the 3-dimensional information would be lost. If you are trying to simulate how something will sound in a given position in a room, you need to simulate a minimum of 100.000 reflections – otherwise it just doesn't reflect a real life situation.

Therefore the challenge is not to remove the room and the reflections – but to adapt to them.

The speaker designer obviously had an idea of how he wanted his loudspeaker to sound when he was designing the speaker - it has an identity we want to preserve, no matter in which room or how the speaker is placed. **This is what RoomPerfect™ is all about**.

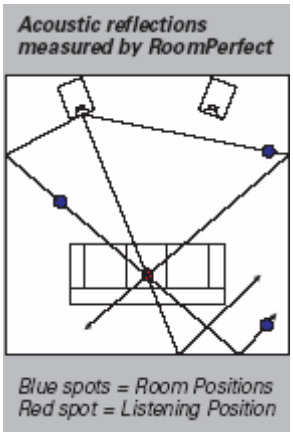
In other words, since we assume that you bought your speakers because you liked the sound of them, our goal is not to make every audio system sound the same. The tonal balance of your speakers will be kept intact – but we will then match them to your room by compensating for the room's influence.

Generally, room influence can be defined as peaks and dips in the frequency response. Some can – and should - be compensated for, other can – and should – NOT be compensated for.

So, it was indeed a challenge to create a room correction system that would maintain the tonality of your system and only compensate for problems that could be solved. And not least, create a correction system with which everyone could achieve the same huge improvement – regardless of their level of acoustical knowledge.

Nevertheless, it's a challenge that has been solved in the Lyngdorf Audio-developed and patented RoomPerfect™ system

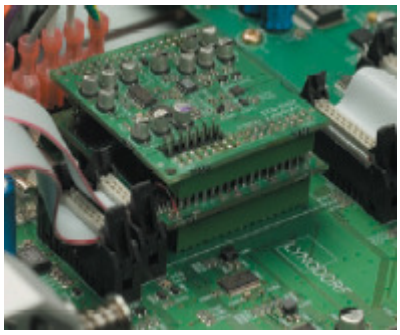
The solution



In Lyngdorf Audio, we solved the problem with getting 3-dimensional room knowledge in a very unique way. By combining global measurements (room positions) with measurement(s) at the listening position(s) you can actually create 8 different listening positions (if you want!)

The RoomPerfect™ system is capable of combining the information about the listening position(s) with the information about the energy transport into the sound-field in a wholly new and innovative way. The measurement at the listening position holds information about the listener's access to the sound-field while the room positions hold information about the 3-dimensional sound-field in the entire listening room.

Thus we can ensure that you achieve perfect sound, irrespective of your listening room, speaker position and listening position. In fact, the vast amount of information gathered about the sound-field allows you to enjoy the benefits of room correction in *any* position throughout the room.



The development efforts involved in creating RoomPerfect™ have been enormous, vastly more involved than any previous implementation of room correction. For the first time you will see and hear a system with all the required knowledge and operation already embedded in it.

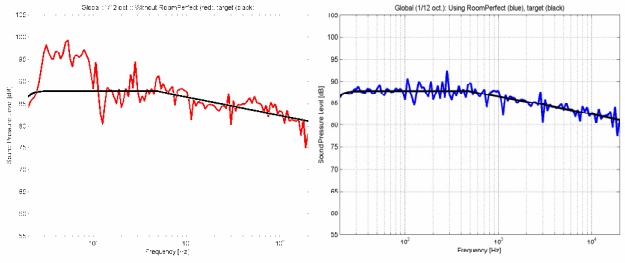
Amongst other things RoomPerfect™ can - as the only system in the market - derive information about:

- Room Acoustic properties, modes (peaks and dips in the room)
- Power response throughout the room
- Loudspeaker directivity
- High frequency roll-off
- Characteristics of low frequency roll-off

From the acquired measurements RoomPerfect™ processes the information and sets up amplitude targets and limiters for the different filters in an all automated process.
The most challenging task for a room correction system is the automated correction of an already near ideal system – but RoomPerfect™ is capable of solving even this challenge and leaving the system with only minor corrections.

RoomPerfect™ automatically identifies the optimal target curve from the information in the measurements and everything is thereafter controlled by the guided setup in the menu system. On an 'empty' amplifier the menu system will guide you through the set-up sequence, tell you when to move the microphone, oversee the quality of the measurements, and continue the process until the necessary information is retrieved and the filters for 'global' and 'focused' correction can be calculated.

In normal rooms a listening position measurement and a minimum of 3-4 additional measurements will be enough to get a RoomKnowledge of more than 90%, i.e. more than 90% of the information about the acoustic properties of the room. Of course you can continue, or revert to the taken measurements and add information at a later stage. When setting up the system with the guided process the measurements are analyzed in real-time. The knowledge about the room is calculated and if the measurement positions have not gathered enough information you are asked to continue to a further measurement until there's enough information present for a proper analysis.



When sufficient RoomKnowledge has been obtained target curves and focus- and global filters (listening position(s) filter(s) and the general room filter) are generated automatically. When this is done the system will display a RoomCorrection index per filter, giving you an indication of the level of correction carried out. A high number indicates big corrections and vice versa. However, this number doesn't necessarily indicate anything about the quality of your system! For example a Lyngdorf 2+2 speaker configuration requires lots of correction – simply because we created the system this way because we know that actually CAN make the necessary corrections and that the final result will be even better!

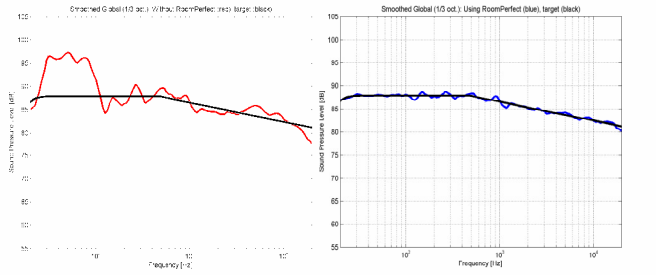
Loudspeaker placement

When it comes to placement of traditional box loudspeakers it is actually possible to think differently with RoomPerfect™, i.e. to break away from conventional 'free space' placement. Normally, you need to choose a loudspeaker placement well away from rear and side walls to secure the best possible frequency response. Due to the fact that a traditional box loudspeaker has omnipolar dispersion in the bass region, this 'free space' placement has a big disadvantage namely that you actually risk 'destroying' the impulse response. The reason for this is that you hear both the direct sound from the speaker and later all the reflections from the walls. The reflections are delayed as a consequence of the distance to the walls and will therefore arrive later thus smearing the 'attack' of e.g. a drum beat. Typically back wall reflections are the most annoying because they arrive from the same direction as the direct sound from the loudspeaker. Side wall reflections are easier for the brain to cope with simply because they arrive from another direction. Therefore they are often regarded as adding ambience and localization clues.
If you place the loudspeaker close to the back wall the bass reflections from the wall and the direct sound will arrive simultaneously at the listening position – i.e. the impulse response in the bass region can be improved considerably and RoomPerfect™ can easily compensate for the uneven frequency response as a consequence of the placement. So, with RoomPerfect™, it can actually be an advantage to choose what's normally regarded as a less ideal 'close wall' loudspeaker placement as this will not only improve the impulse response. Also, when compensating for the increased efficiency, the load on both amplifier and loudspeaker is decreased whereby less distortion and better headroom is achieved. And taking energy out of the system also has another advantage since pumping less energy into the room means that room modes are less excited. Thus you achieve a much more even power response across the room – i.e. the differences between peaks and dips in the response are reduced dramatically. In a case like this the RoomCorrection index will also be quite high since correction in the bass region is needed. However, the index number is not high because you have a 'poor' system – it's high just because you have chosen a loudspeaker position that improves the impulse response but then requires compensation for the increased efficiency in the bass region.
Try it out and see what works for you – near wall or 'free space' placement - RoomPerfect™ works in both cases.

Test signal and measuring techniques

To be able to get the necessary room knowledge for our ambitious goals, we also had to invent new ways of measuring.

Using traditional test signals e.g. pink noise, normally means a trade-off between S/N (signal to noise) ratio and frequency resolution. Long analysis windows lead to high frequency resolution but poor S/N due to the low number of averages. But using multiple pure tones means long analysis windows (5.5 sec. for low frequency test signal) leading to both high frequency resolution (0.2 Hz) AND an excellent S/N ratio due to very narrow analysis bandwidth in the frequency domain, something which is almost insensitive to normal broadband background noise. Another way of describing the advantage of this measurement signal is that we only generate energy at the very same frequencies, where the analysis takes place, i.e. we don't waste energy and S/N ratio measuring the spaces in-between the analysis frequencies. We have found that the usual frequency resolution in acoustic measurements of 1/3 octave (3 frequencies for each doubling of frequency) is not sufficient for room correction. Many years of experience with many different loudspeakers in numerous listening rooms have shown that 1/12 octave is what is required – this corresponds to no less than 121 pure tone for covering the range from 20 Hz to 20 kHz.



To put this in perspective, we have taken the above frequency responses and used 1/3rd octave band smoothing – and as can be seen this is – even though very commonly used – not very useful for making serious room correction.

The first 50 tones (covering from 20 Hz to 350 Hz) forms the "low frequency test signal" while the remaining 71 pure tones form the "high frequency test signal". The first 50 tones are on for approximately 25 sec. in each loudspeaker and the 71 tones are on for approximately 5 sec in each loudspeaker due to lower background noise levels at higher frequencies.