CHALLENGER II

Challenger II: Mastering Room Acoustics for Optimal Sound

Room acoustics have a significant impact on the performance of any speaker system. Even the best-designed speakers can suffer from reflections and resonances, leading to uneven sound distribution and distorted audio. The Challenger II is engineered to overcome these challenges by leveraging advanced technologies that precisely control sound dispersion and minimize the negative effects of room interactions.

The Problem: How Room Acoustics Affect Sound Quality

When a speaker emits sound, it radiates energy not only towards the listener but also to the room's boundaries—walls, ceiling, and floor. This leads to three primary acoustic issues:

1. **Reflections and Sound Level Fluctuations**
   Reflections from room surfaces amplify or cancel certain frequencies, leading to sound level increases of up to **10 times (20 dB)** in specific frequency ranges. This amplification or cancellation causes significant distortion and masks the original audio details, making it difficult to perceive sound accurately.
2. **Room Modes and Resonance**
   Resonances occur between parallel surfaces (e.g., walls) in the room, creating an uneven distribution of sound energy. This results in certain areas experiencing exaggerated or diminished bass response, causing boomy or weak bass depending on the listener's position.
3. **Delayed Reflections and Soundstage Distortion**
   Delayed reflections interfere with direct sound, causing **comb filtering**, which results in phase interference and a loss of spatial clarity. This makes the soundstage appear less defined and reduces localization accuracy.

The Challenger II Solution: Precision and Control

The Challenger II addresses these issues using advanced design elements that shape the way sound interacts with the room. The system is built around two core design philosophies: **Interaction with Room Environment** and **Acoustic Precision and Dynamic Response**.

A. Interaction with Room Environment

The Challenger II minimizes the negative impact of room acoustics through its unique approach to sound dispersion:

- **Gradient Low-Frequency Control**
  The gradient low-frequency module focuses bass energy toward the listener and reduces lateral radiation to walls and ceilings. This design minimizes the excitation of room modes and reduces resonance buildup, ensuring a cleaner and more controlled bass response. With up to **three times less low-frequency radiation**, which is directly proportional to **three times less room resonance**, the Challenger II effectively minimizes the typical bass boominess and muddiness caused by room interactions.
- **Constant Directivity Technology**
  Unlike conventional speakers, the Challenger II achieves **consistent directivity** from the lowest bass frequencies to the highest treble. Most speakers exhibit variable directivity, meaning that their sound dispersion patterns change drastically at different frequencies. This lack of constant directivity leads to poor sound performance both on-axis and off-axis, as the uneven dispersion results in unbalanced and unclear audio throughout the listening area.

  The Challenger II achieves constant directivity by **fusing multiple design concepts**, such as dipole, cardioid, and horn configurations. The smooth transition between these designs ensures that the directivity remains nearly uniform throughout the entire frequency range, maintaining clarity and balance. This fusion of technologies minimizes unwanted reflections and phase anomalies and reduces the need for additional acoustic treatments.

  What sets the Challenger II apart is that it is the **only commercial product in the market** that offers such a high level of constant directivity control across **the entire frequency spectrum—from deep bass to the highest treble frequencies**. This level of precision eliminates the need for extensive room treatments, which are often as expensive as the audio system itself and can negatively impact the aesthetics of a room.

- **Advanced Asymmetric Crossover Design**
  The crossover network in the Challenger II is a highly specialized asymmetric design that integrates both acoustic and electrical slopes. This configuration leverages the low-frequency gradient configuration to achieve high SPL levels while maintaining accurate sound separation across all drivers. High-order slopes in the crossover filter eliminate unwanted frequencies and avoid driver operation in the ranges where cone break-up occurs, which is not possible to achieve with lower-order slopes. This design ensures seamless integration across the entire frequency range and maintains precise control over the sound's directivity.

B. Acoustic Precision and Dynamic Response

The Challenger II's design focuses on achieving outstanding dynamic range, transient response, and tonal balance by utilizing advanced midrange and low-frequency driver technologies that minimize acoustic loading:

- **Midrange Acoustic Enclosure with Reduced Acoustic Loading**
  The Challenger II's patented midrange acoustic enclosure features an innovative open-front design with strategically placed openings, allowing the **enclosure design to equalize internal and external pressures**. This unique configuration eliminates the "acoustic loading" effect that typically restricts driver movement in conventional closed or vented enclosures, where internal pressure buildup can compress the driver's motion and distort the sound. By allowing the driver to operate with minimal resistance, the enclosure significantly reduces harmonic distortion, improves impulse response, and enhances dynamic range.

  The open-front structure maintains directional control, ensuring that energy is focused where it's needed, while reducing unwanted reflections. By avoiding dipole radiation and rear reflections at mid and high frequencies, this design significantly reduces interaction with the rear wall, leading to improved soundstage depth and imaging.

- **Compact Horn Integration**
  A mathematically modeled compact horn is used for the high frequencies to ensure natural sound dispersion and clarity. The horn's design is optimized to match the midrange directivity, allowing for seamless integration and reducing unwanted reflections. This approach avoids the typical harshness found in poorly designed horns while maintaining consistent sound quality across the room.
- **High-Frequency Compression Driver with Specialized Coating**
  The high-frequency compression driver features a lightweight titanium membrane that retains the dynamic response and speed characteristic of titanium diaphragms. A specialized coating is applied to the membrane to prevent cone break-up, which suppresses harshness while preserving the speed and dynamics of the material. This allows the driver to deliver a smooth, detailed, and non-aggressive high-frequency response, even at high SPL levels.
- **Open-Back Low-Frequency Configuration**
  The open-back configuration for the low-frequency driver eliminates the constraints of traditional closed or vented enclosures, allowing the driver to operate more freely and reducing harmonic distortion with less box coloration. This setup also reduces the energy storage that typically occurs in closed enclosures, improving the impulse response and creating a more articulate bass reproduction.
- **Optimized Wave Alignment**
  The **patented midrange enclosure** design ensures that front and rear sound waves propagate in the same direction, minimizing phase differences and

preventing destructive interference. This alignment creates a cohesive and immersive soundstage that remains stable across a wide listening area.

- **Increased System Sensitivity**
  By utilizing mutual coupling between the front and rear waves of the midrange driver, the system's sensitivity is increased by up to **3 dB**, allowing it to achieve higher sound pressure levels without additional power consumption. This improves dynamics and reduces power requirements while maintaining sound quality at all listening levels.

Technical Innovations for Uncompromised Sound

The Challenger II's technical advancements deliver tangible improvements in sound quality, regardless of the acoustic environment. Key innovations include:

- **Midrange Acoustic Enclosure**
  This patent-pending design minimizes internal reflections and controls sound propagation, allowing the driver to operate with minimal distortion and high linearity.
- **High-Frequency Compression Driver**
  The lightweight titanium membrane, with a specialized coating, prevents cone break-up and maintains the dynamics and speed of titanium diaphragms while eliminating the harshness typically associated with this material.
- **Open-Back Low-Frequency Configuration**
  The open-back configuration for the low-frequency driver eliminates the constraints of traditional closed or vented enclosures, allowing the driver to operate more freely and reducing harmonic distortion with less box coloration. This results in a cleaner, more natural bass that integrates seamlessly with mid and high frequencies, providing an enhanced sense of depth and realism.

Summary and Technical Specifications

The Challenger II is engineered to minimize room interactions and provide a clear, accurate, and balanced sound. It offers the following technical benefits:

- **Frequency Response**: 30 Hz – 18 kHz (±2.5 dB), 28 Hz – 24 kHz (±5 dB)s
- **Sensitivity**: 88 dB
- **Recommended Amplifier Power**: 100–400 W per channel
- **Dimensions**: 124 cm (H) x 36 cm (W) x 35 cm (D)
- **Weight**: 60 kg per unit
- **Price**: Starting at €27,999

Experience Unmatched Realism and Clarity

Creating the Challenger II took over three years of research and development in collaboration with leading acoustic physicists. During this period, hundreds of different iterations and tests were conducted using advanced mathematical acoustic modeling to perfect the design. The result is a loudspeaker that stands out not only for its performance but also for its precision and control over sound dispersion.

With its innovative technologies and physics-based design principles, the Challenger II overcomes the limitations imposed by room acoustics. Its **constant directivity technology**—a unique feature unmatched by any other product on the market—provides consistent sound dispersion across all frequencies, ensuring that listeners experience balanced and accurate audio whether they are in the ideal sweet spot or in off-axis positions. This synergy between room interaction and acoustic precision eliminates the need for costly room treatments, which can often equal the price of a high-end audio system and disrupt the aesthetics of a listening room.

The Challenger II's precise control over sound waves results in a highly realistic soundstage where instrument placement and vocal positioning are vivid and lifelike. The immersive sound experience it creates makes the speakers disappear in the room, leaving behind a clear, detailed, and spacious presentation. Once you experience this level of realism and presence, it's difficult to return to conventional systems without noticing a loss in naturalism and depth.

The Challenger II is an ideal choice for those seeking unparalleled precision and clarity in any listening environment.

Design: Aesthetic Meets Precision

The Challenger II model seamlessly blends cutting-edge acoustics with a striking yet minimal design, allowing it to subtly complement any interior. Built on a robust steel frame, it makes a bold visual statement while maintaining a compact footprint. The crossover, elegantly displayed through tinted tempered glass, showcases meticulous craftsmanship and attention to detail.

The steel frame is available in standard black or white, with additional color options like Pearl Gentian Blue and Grey Metallic Atlas. For the façade, a refined oak finish adds a touch of natural elegance.

Designed in collaboration with award-winning industrial designer Moses Kang, the Challenger II is as visually refined as it is acoustically exceptional. Proudly designed and assembled in Lithuania.