THÖRESS

1D66 . Underhung Motor. Loudspeaker

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(91dB/W/m)

PRODUCT DESCRIPTION

The 1D66 Loudspeaker (1D66-LSP) is a floor-standing two-way loudspeaker with medium efficiency (91dB/W/m) which combines balanced response, thrilling resolution and outstanding imaging with stable and effortless bass reproduction inspite a modestly sized cabinet (236 x 416 x 1170 mm). It is an ultimate component that will easily measure up to the highest expectations of even the most critical and experienced music enthusiast, especially when driven by our EHT Mono Blocks or the EHT Integrated Amplifier. In view of its medium efficiency and tame impedance, the 1D66-LSP will also deliver fantastic sound quality when it is driven by an ultimate all-tube amplifier of modest power output such as our SE300B or SE845 Mono Amplifier.

The loudspeaker has been specifically designed to be used in modestly sized listening environments where our larger 2CD12 loudspeaker model might overload the listening room in terms of bass response. Thanks to their wide and consistent dispersion characteristics, the 1D66-LSP maintain an outstandingly revealing sound image even at low loudness levels but also an astonishingly realistic performance when they are driven to elevated loudness levels. A consistent dispersion characteristic is not only desirable in order to avoid a narrow sweet spot, as it is often believed. It ensures that the timbre of the early reflections (bounced back from the six room boundaries) follow the timbre of the direct/on-axis loudspeaker output. An irregular dispersion characteristic leads to serious sound coloration, which cannot be overcome by smart crossover design or DSP manipulations. In fact, this is the very reason why commonly designed horn loudspeakers, full-range drivers or foil transducers are often perceived as colored or sometimes odd sounding even when they exhibit a flat on-axis response and are auditioned in an environment with impeccable acoustic properties.

In spite of its rather conventional appearance, the 1D66 loudspeaker features several distinguishing design principles which set it far apart from normal loudspeaker components of comparable size and efficiency.

UNDERHUNG MOTOR TRANSCUDERS

The 1D66-LSP features a pair of series connected 6-inch UNDERHUNG-MOTOR woofers with carbon-fiber-rohacell sandwich cone. Cone drivers of the highest grade which are certainly among the best 6-inch drivers in existence, in our estimation.

The voice coil of an underhung-motor transducer is considerably shorter than the magnetic gap in which it is suspended such that the coil remains permanently immersed in the driving field (as long as the motor is not over-driven). Underhung-motor transducers are rarely employed in loudspeakers inspite of their indisputable superiority over the widely used overhang-motor components, for two reasons. At first, such drivers require higher precision in the manufacturing process. Secondly, since the voice coil height is smaller than the gap height, a certain portion of the driving field does not penetrate the coil and hence an inordinately magnet is required to ensure a reasonably good efficiency and useful dynamic characteristics of the transducer. Hence underhung-motor drivers are expensive. A classic underhung-motor woofer is the JBL 1500Al, one famous example from this very small family of outstanding transducers. By contrast, the voice coil of an overhang-motor driver extends well above and below the magnetic gap in order to make the most use of the magnetic energy and to simplify the manufacturing process. Which leads to a relatively good transducer efficiency even when the motor is powered by a modest magnet structure. However, this is achieved at the expenses of increased distortion and unwanted effects due to the condition that the voice coil is not acted upon symmetrically by the magnetic field once it is displaced from the rest position.

Carefully mated to the two woofers is a 1-inch dome tweeter, which covers the upper three octaves of the audio band. As in case of the woofers, the tweeter features an UNDERHUNG-MOTOR arrangement driven by an extraordinary multi-layer sandwich magnet assembly. The tweeter also distinguishes itself with an exceptionally large area of linear excursion which ensures ultra-low distortion figures (and allows for the use of low-order filters in the crossover network). These excellent transducers are to a large extent responsible for the amazing resolution and imaging capabilities of the 1D66 loudspeaker.

CABINET

Thanks to a unique TRANSMISSION LINE driver loading, the 1D66-LSP is capable of powerful, extremely fast and airy bass response. This specific design choice allowed us to avoid the more or less pronounced boxy sound characteristic known from loudspeakers of the sealed or vented type (which constitute the vast majority of loudspeakers available on the market today). The cabinet in principle acts as an open baffle shaped as a (short) undamped transmission (time delay) line, whereas the drivers are placed about in the middle of the time delay tube. There is no air spring

behind the cones which could affect the linearity of the cone suspension! The rear sound is allowed to propagate into the room and to naturally contribute to the wanted acoustical output of the loudspeaker! The length of the time delay tube has been chosen in such a way that this (6-dB, response doubling) superposition of soundwaves happens right in the region where the infinite baffle roll-off of the bass transducer occurs. The free-air resonance frequency and the respective (naturally high) damping behavior of the transducers remain completely unaltered! Acoustical filtering which could impair the transient response of the inbuilt transducer, as in case of conventionally designed sealed or vented loudspeakers, is avoided!

DRIVER LOADING AND TRANSIENT RESPONSE

There are mainly two reasons why sealed/vented loudspeakers tend to sound boxy.

At first, a low frequency driver loaded by a sealed or vented cabinet obviously radiates the same amount of acoustical energy in the cavity of the cabinet as it radiates in the listening room. While the front output of the woofer propagates into the a (SPACIOUS) room the rear output remains trapped in the (SMALL) inner life of the cabinet until it is absorbed (transferred into heat via acoustical friction) after consecutive reflections at the cabinet walls. This obviously causes excessive cavity noise and ringing which oozes out through the driver cone (and the cabinet walls) and such blurr the wanted loudspeaker output, even when the inner life of the cabinet is heavily dampened with absorbing material. Curiously, an effect which has been widely if not completely ignored by conventional loudspeaker design wisdom, probably because it is rather tricky to analyze via acoustical measurement (yet, it is easily revealed by the human sense of hearing).

The second reason why conventional driver loading leads to a boxy sound characteristic is much less subtle and related to TRANSIENT/IMPULSE RESPONSE. Transient response is an essential matter in loudspeaker design as it inevitably involves acoustic and electric filtering! And this does not come as a big wonder since the nature of music is nothing else than a (highly organized) universe of acoustical transient events, after all (If music was a static phenomenon audio science would be a most trivial discipline).

When a cone transducer is loaded by a small, sealed cabinet (small compared to the so called equivalent air volume of the transducer) the air cushion behind the cone forms a spring which has a strong influence on the performance of the inbuilt transducer. From the perspective of technical acoustics, the air-filled cabinet imposes an acoustical second-order high pass filter on the transducer (12dB roll-off of the response below resonance) as a vibrating system. The resonance frequency of the loaded transducer rises while the resonance damping described by the so-called total quality factor Q of the respective filter system decreases (compared to the respective free air conditions). The total quality factor of the high pass filter is

unambiguously determined by the magnitude of the air chamber behind the cone in superposition with the free-air transducer parameters (neglecting eventually applied porous filling of the air chamber). Low Q values (large cabinets, high resonance damping, Q around 0.5, Bessel Characteristic) ensure an impeccable transient/impulse response of the system yet the bass response rolls off rather early and is meager. Higher Q values (medium sized cabinets, Q around 0.7) lead to a more pronounced and extended bass response, yet at the expenses of a compromised transient response (Butterworth Characteristic of the filter). Furthermore, Q values approaching or surpassing 1.0 go along with miserable transient response and ripple response at pass band frequencies (Tschebyschev like filters). So the designer of a (passive) sealed box loudspeaker is spoilt for choice. Either he goes for favorable transient response (low Q) and creates a bass slim sounding loudspeaker. Or he chooses a higher Q in view of an extended bass response and accepts compromised impulse response as a penalty. In the latter case the air cushion also tends to behave like a non-linear spring and such forces the driver motor into additional distortion, but this is another story.

Conditions are even worse with vented cabinet loading (bass reflex design). Here the air chamber behind the transducer cone is coupled to a Helmholtz resonator given by a passive cone radiator or an additional (small) air cushion in a port. The rear output of the transducer triggers the Helmholtz resonator to sound radiation which is used to enhance the wanted acoustical output of the loudspeaker. In this case the cabinet imposes a FOURTH-order acoustical high pass filter onto the transducer (24-dB steep roll off below resonance!) which results in further degradation of the transient response of the sound radiating system compared to the sealed box situation. The Q value of the respective high pass filter again determines the frequency and transient response of the swinging system. The design principles for the vented box scenario are considerably more complicated than the sealed box criteria and are exhaustingly covered by the widely applied (but rarely deeply understood) Thiele-Small Theory. There are good and bad vented box implementations, certainly. But they all suffer from a more or less crippled transient response. A hard fact which is admitted even by conventional loudspeaker design wisdom.

CABINET AND CROSSOVER NETWORK

The 1D66 cabinet is made of poplar plywood. A rather light but stiff sandwich material with high internal damping, making it an ideal choice for cabinet construction. Dark brown oak veneer gives the speakers a neutral appearance, which is believed to match well with all kinds of interior styles. A speaker grill is not supplied with our 1D66 loudspeaker. However, as the black transducers optically blend into the dark veneer, a technical look is avoided in favor of an elegant wooden furniture like appearance.

The 1D66 crossover network is based on low-order filters which have been specifically designed and optimised for maximally linear phase response (maximally flat group delay). This is to say that the various frequency components of the signal experience the SAME delay times as the signal runs through the filter from pass band to stop band. Thus, the signal remains consistent and intact in the TIME DOMAIN, overshot and ringing is avoided, near ideal transient response is the result! The crossover network is executed with point-to-point wiring techniques and potted in a (non-magnetic) die-cast case via sealing compound.

FEATURE OVERVIEW

- Floor-standing two-way loudspeaker with 91 dB/W/m efficiency.
- Two 6-inch UNDERHUNG-MOTOR woofers, 1-inch UNDERHUNG-MOTOR silk dome tweeter, cost-no-object transducers.
- Excellent frequency response and dispersion characteristics.
- Powerful, extremely fast and airy bass response due to unique OPEN-CABINET woofer loading.
- Crossover network built with point-to-point wiring techniques potted in a non-magnetic diecast case with sealing compound.
- Modestly sized cabinet (236 x 416 x 1170 mm) made of poplar plywood, weight 14Kg.
- Neutral dark smoked oak veneer.

THÖRESS...

A Tribute to Professional Audio Components from the Golden Age of the Electronic Tube !