THÖRESS

FR20CD . Three-Cone . One-Way . Loudspeaker

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(96dB/W/m)

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P R O D U C T   D E S C R I P T I O N

Our highly efficient FR20CD full-range point source reproducer...

combines thrilling dynamics and balanced tonality with stable, effortless and well extended bass reproduction featuring a modestly sized cabinet, 236 x 416 x 1170 mm. Several unique design principles not only ensure an excellent sound dispersion but also an amazingly flat on-axis response which is certainly up to par with the uniform response of monitor loudspeakers. Thanks to these attributes, which are by no means a matter of course with full-range driver based loudspeaker concepts, full benefit can be gained from the point source principle. Therefore our small loudspeaker model can measure up to the expectations of even the most critical and experienced music enthusiast, even when placed in a large listening environment.

DESIGN PRICIPLES

A front-mounted high-grade 8-inch full-range cone transducer is connected in series with a 12-inch woofer mounted in the side wall of the cabinet, both of which drivers feature light paper cones and are used in full-range mode without any crossover filtering. The flat on-axis response of the full-range driver is achieved solely by the impedance rise of the woofer without the help of additional LCR correction artifices, whereas on the other hand the series connected full range transducer symbiotically flattens the response of the woofer. So in an extended sense the loudspeaker indeed can be claimed to be a full-range point source reproducer. Both divers are loaded by the same short undamped TIME DELAY (TRANSMISSION) LINE. Due to this unique open-cabinet driver loading the loudspeaker is capable of powerful, extremely fast and airy bass response. Whereas 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) is avoided. There is no air spring behind the cones which could impair the linearity of the cone suspensions! The rear sound output of the drivers is not trapped in the cabinet but allowed to propagate into the listening room so as to naturally contribute to the wanted acoustical output of the loudspeaker! The free-air resonance frequency and the respective (high) damping behavior of the transducers remain completely unaltered! Acoustical filtering, as involved in case of conventionally designed sealed or vented loudspeakers, which inavoidably impairs the transient response of the in-built transducers is avoided!

DRIVER LOADING AND TRANSIENT RESPONSE

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

At first, a the driver 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 causes excessive cavity noise and ringing which oozes out through the driver cone (and the cabinet walls) and such blur and impair 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 RESPONSE. Transient response is a crucial matter in loudspeaker desgin because it almost always relies on some form of ACOUSTICAL and ELECTRONICAL filtering!

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 exerts a strong influence on the preformance of the built-in driver. From the perspective of technical acoustics the sealed 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 of the vibrating compound decreases (compared to the respective free air conditions). The lower the damping, the less control the transducer motor has upon the cone the worse the transient response of the compound. It is that simple. The damping behavior of the driver-in-cabinet-filter-compound is indexed by the so called total quality factor Q, which for the sealed box scenario is unambigously 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). Q values below or equal to 0.5 (large cabinet, high damping, Bessel filter characteristic) ensure an impecable transient response of the system, but then the bass response rolls off rather early and is meager. Higher Q values (medium sized cabinet, Q around 0.7) lead to a more pronounced and an extended linear low end response, yet this is achieved at the expenses of a fairly compromised transient response (Butterworth characteristic of the compound). Q values approaching or surpassing 1.0 (small cabinet) go along with miserable transient response and ripply response at pass band frequencies (Tschebyschev filter) and as such are definitely not suitable for ambitious loudspeakers design. So the designer of a (passive) sealed box loudspeaker is spoiled for choice. Either, he goes for favorable transient response (low Q) and creates a slim sounding loudspeaker. Or, he chooses a higher Q in view of an extended bass response and accepts a compromised transient performance as a penalty. In the later case the tight air cushion also tends to behave like a non-linear spring and such forces the driver motor into nonlinear distortion, but this is another story.

Conditions are even worse with vented cabinet loading. Here the air chamber behind the transducer cone is coupled to a Helmholtz resonator given by a passive cone radiator or an additional (smal) air cushion in a port. A portion of 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 on the transducer (24-dB steep roll off below resonance!) which results in further degradation of the transient response compared to the sealed box situation. Again, the Q value of the of the respective driver-in-cabinet-filter determines the frequency and transient response of the sound radiating compound. 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 theorie. There are good and bad vented box implementations, certainly. But they all suffer from a more or less crippled transient response. A hard fact admited even by conventional loudspeaker design wisdom. Nevertheless, curiously 99% of all speaker components on our planet are of the vented type!

CONSTANT DIRECTIONALITY TWEETER

A further major element of the design is the wide-dispersion constant directivity super tweeter treble horn radiating from the top of the cabinet (connected in parallel (!!!) with the woofer via a simple one-capacitor (first-order high pass filter)) This unit serves to counteract the (unavoidable) directionality of the full-range driver in the treble range above 5 kHz. The point-source coherency remains completely intact, as the super-tweeter horn radiates off-axis without a crossover point to the main driver.

A wide and frequency 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 (coming from the six room boundaries) follow the timbre of the direct loudspeaker output. An irregular dispersion characteristic leads to serious sound coloration which cannot be overcome, nor by smart crossover design nor via DSP manipulations. In fact, an irregular sound dispersion is the very reason why commonly designed horn loudspeakers, full-range driver or foil transducer based speakers 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.

CABINET

The FR20CD 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.

FEATURE OVERVIEW

- Floor-standing highly-efficient one-way loudspeaker, 96 dB/W/m efficiency.
- Unique one-way triple-transducer principle.
- 8-inch full rage transdzcer, 12-inch Woofer indirectly radiating super tweeter horn with constant directionality.
- Powerful, extremely fast and airy bass response due to unique OPEN-CABINET driver loading.
- Excellent frequency response and dispersion characteristics.
- Modestly sized cabinet (236 x 416 x 1170 mm) made of poplar plywood, walnut veneer, weight 14Kg.

THÖRESS...

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