Supplemental Technical Information for model

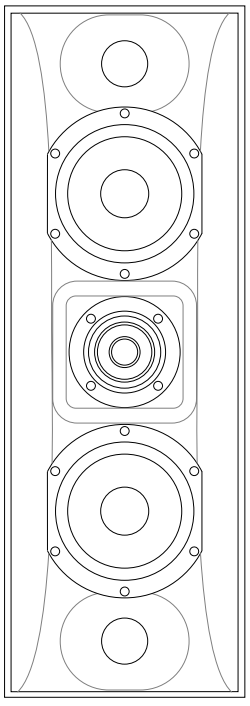
THIEL MCS1

Coherent Source® Loudspeaker

This paper contains only information specific to the MCS1 speaker system. It is intended to supplement the general technical information paper which explains our engineering philosophy, goals and techniques.

THIEL MCS1 SPECIFICATIONS

Bandwidth (-3 dB)	47 Hz - 23 kHz
Amplitude response	50 Hz - 20 KHz ±2 dB
Phase response	minimum ±5°
Sensitivity	90 dB @ 2.8 v-1m
Impedance	4Ω, 3Ω minimum
Recommended Power	50-300 watts
Size (W x D x H)	10 x 12 x 28.5 inches
Weight	61 lb



Driver Complement:

Woofer

Two woofers; diameter 6.5" (5.1" radiating area) with anodized aluminum cone, cast frame, 1.7" dia voice coil. Underhung coil (short coil/long gap) motor system. Linear travel 1/4" pk-pk, 5 in^3 linear displacement. 2.5 lb. magnet, 6 lb total magnet structure plus 1.2 lb. shielding magnet. Copper pole sleeve, copper magnet ring. Made by THIEL.

Midrange

4.5" (2.7" radiating area) with anodized aluminum diaphragm, cast frame, 1" dia voice coil. Underhung coil (short coil/long gap) motor system. Linear travel 1/8" pk-pk. Magnet weight of 1 lb. plus 1 lb. shielding magnet plus .4 oz. neodymium magnet powers midrange and tweeter. Copper pole sleeve. Ferrofluid. Made by THIEL.

Tweeter

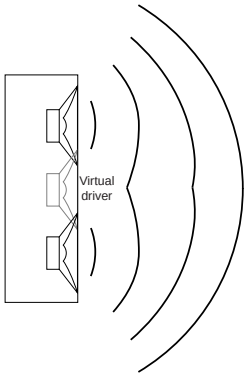
1" (1.2" radiating area) with anodized aluminum dome. Powered by midrange motor. Coincident with midrange.

Time coherent topology

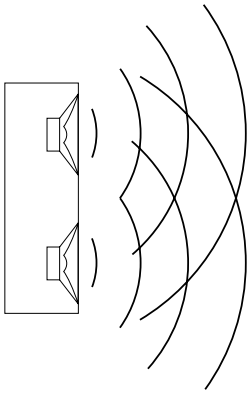
An important design goal for the MCS1 which is not shared with our floor-standing products is placement flexibility. The requirement that the speaker provide time coherence while placed either vertically or horizontally and at any height poses its own technical challenge. This requirement necessitates that the speaker be symmetrical both horizontally and vertically and, therefore, that it use either coincident or D'Appolito driver configuration. Since the limited woofer area of a 2-way coincident system would not satisfy the design goal of very high output ability, a double woofer D'Appolito configuration is used.

In a D'Appolito configuration, two larger drivers flank a higher frequency driver. The benefit is that the outputs from the two drivers blend into a coherent wave as if they were produced by a virtual driver positioned between the two actual drivers. If a higher frequency driver is positioned coincident with the virtual driver the high frequencies will be time coherent with the low frequencies from the flanking woofers.

However, since the virtual driver operates properly only for frequencies where the driver spacing is not larger than the wavelength being reproduced, the commonly used topology of two woofers with a center mounted tweeter cannot provide coherent reproduction through the midrange. At these frequencies an off-axis listener would hear two separate sound sources, the closer woofer being heard before the farther driver.



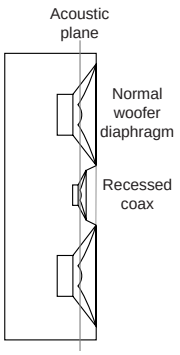
D'Appolito drivers' performance at low frequencies is equivalent to a center located virtual driver.

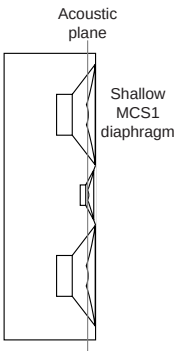


At mid frequencies where the driver spacing is greater than the wavelength coherence is not maintained.

To maintain a coherent wavefront through the mid frequencies the MCS1 utilizes a 3-way configuration which allows the woofers to operate only below 800 Hz. Coherence of the high frequencies with the mid (and low) frequencies is provided by coaxially mounting the tweeter with the mid driver.

So, by utilizing the topology of coaxially mounted tweeter and mid drivers flanked by a pair of woofers, the MCS1 provides a time coherent wavefront at all frequencies and in all directions. In other words, even an off-axis listener will always hear the sound from each of the drivers at the same time.





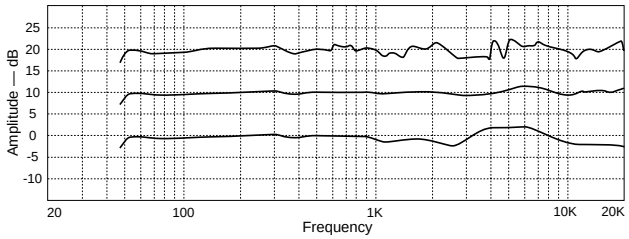
To maintain time coherence the coaxially mounted drivers must be aligned with the woofers. Usual woofers are deep enough that the coaxial drivers would need to be recessed to a degree that would cause substantial diffraction and horn loading effects. To avoid this problem woofer diaphragms of a very shallow shape were developed for the MCS1. The diaphragms use polystyrene reinforcement to maintain high strength with a very shallow profile.

Frequency response

The graphs below show the frequency response of the MCS1. The upper graph shows the (normal) on-axis response and illustrates the very high degree of accuracy; no frequency is under or over emphasized more than 2 dB.

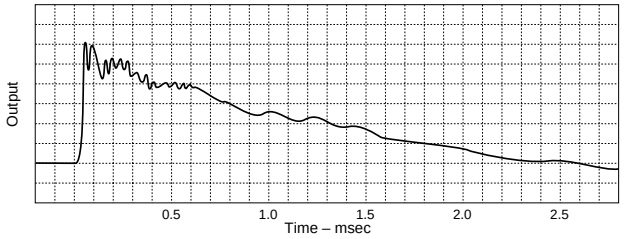
The second graph shows the on-axis, octave-averaged response. This curve is representative of the speaker's tonal balance and shows that the MCS1 is very accurately balanced, especially through the midrange where any over or under emphasis is less than 0.5 dB.

The third graph shows the 30° off-axis, octave averaged response and illustrates that the speaker's overall energy response is well balanced, with no large depressions in any area of the spectrum. This high degree of uniformity is in part the result of the MCS1's first order crossover system.



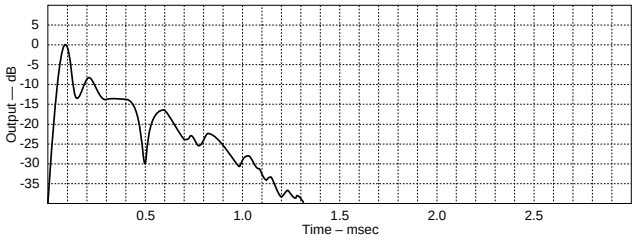
Step response

This graph shows the MCS1's response to a step signal. Notice that the overall triangular shape is very well preserved with the output remaining smoothly positive until 2.6 ms when it finally crosses zero due to the fact that the bass response extends to 50 Hz rather than DC. The irregularities seen in the first few hundred microseconds are due to the tweeter diaphragm resonance at the ultrasonic frequency of about 23 KHz. Waveform accuracy this good can only be achieved with first order crossovers and time coherent driver positioning.



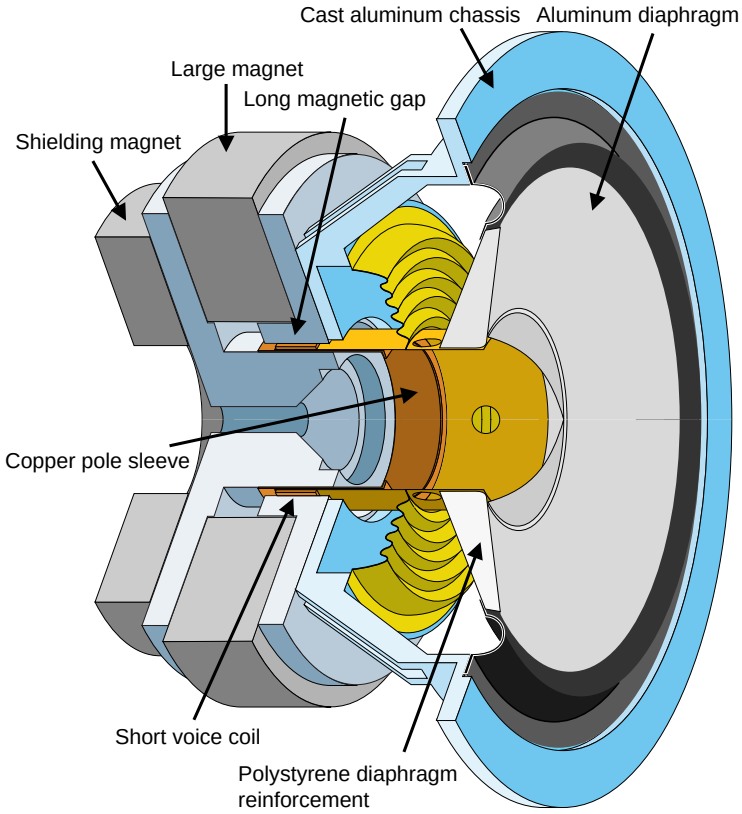
Time response

The energy-time response of the MCS1 shows that the speaker's output quickly decays to -40 dB in less than 1.5 milliseconds, indicating very clean inter-transient silence. Such performance is the result of metal diaphragms that have no resonances within their operating frequency range and very strong cabinet construction.

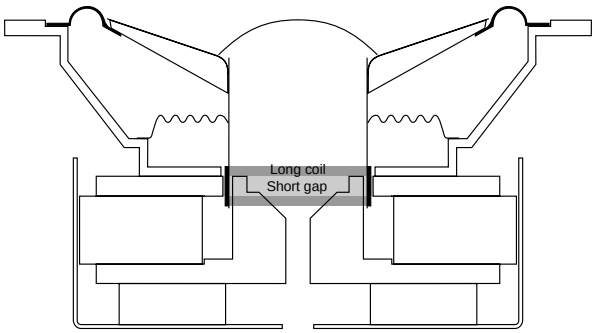


THIEL MCS1 woofer

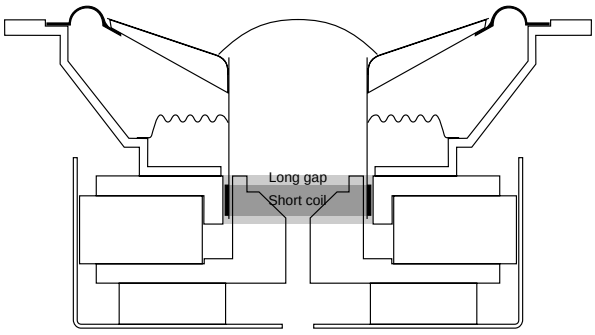
(shielding cup not shown)



Conventional overhung coil



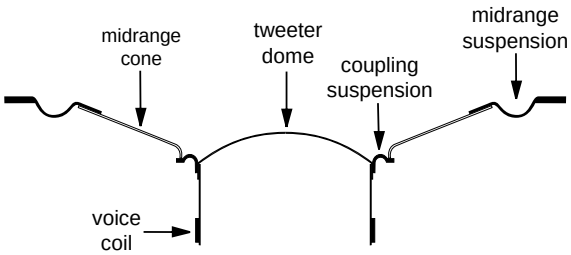
THIEL underhung coil



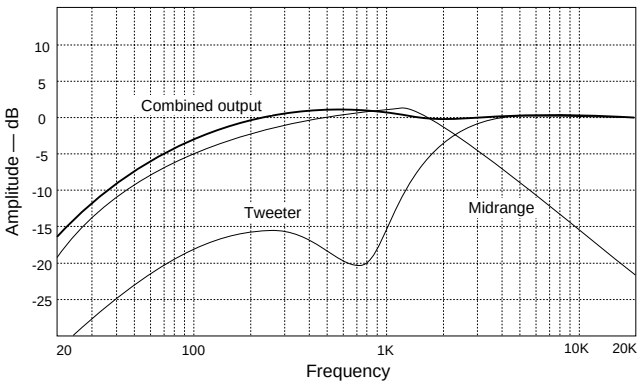
Compound driver

The most unusual technical feature of the MCS1 is its use of a compound driver where the tweeter dome and the midrange cone are both driven by a single voice coil. The advantages of this unique driver are that perfectly time-coherent performance is achieved without the cost and complexity of two magnet structures or an electrical crossover network for the mid-to-tweeter transition. The design is implemented with a mechanical crossover – a “coupling” suspension between the coil and the midrange cone. By optimizing the compliance and damping of the coupling suspension and the ratios of area and mass of the two diaphragms, the driver exhibits extremely uniform response from 100 Hz to 20 KHz.

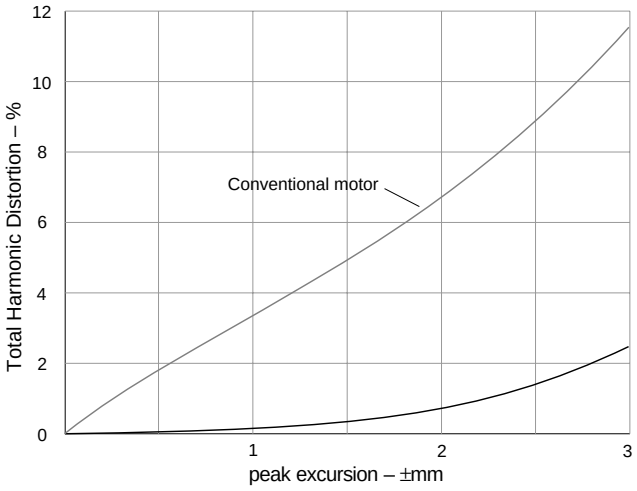
Moving system



Mechanical crossover



THIEL MCS1 woofer distortion



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