

Rectilinear III

A FLOOR-STANDING SPEAKER SYSTEM OF MONITOR QUALITY

Design Goals

The Rectilinear III was designed as a reference standard for the audio professional or high-fidelity enthusiast who seeks completely objective reproduction of the input without the slightest alteration attributable to the loudspeaker. Any size within reason was considered permissible, and neither complexity nor cost was a design limitation except for a general desire to avoid unnecessarily expensive driving systems of the more exotic types. Special emphasis was placed on the widest possible dispersion of sound and on unimpaired performance in unusually large rooms.

Basic Configuration

The Rectilinear III is a four-way speaker system utilizing a woofer, a midrange driver, two tweeters and two supertweeters, all of the moving-coil principle but of somewhat unconventional design. The four high-frequency drivers are widely separated from one another on the front panel, the two supertweeters being in diametrically opposite corners. The floor-standing enclosure is of the tube-vented bass reflex type.

Woofer

A heavy-duty woofer of unusual capabilities was designed especially for this speaker system. Its diameter is 12 inches, a size considered by Rectilinear engineers to be greatly preferable to 15 or 18 inches even in the largest systems. A 12-inch unit has inherently faster transient response than larger woofers and can be designed to move sufficient air for solid fundamental output down to 20 Hz in the proper enclosure. The woofer of the Rectilinear III accomplishes this by means of a butylized surround that permits one-inch cone excursions without running into nonlinearity.

The operating range of the woofer is from 20 to 500 Hz, above which its response is rolled off at the rate of 6 dB per octave to keep it out of the sensitive part of the midrange where coloration could become

apparent.

Voice coil diameter of the woofer is 1 1/2 inches; total magnet weight is 7 1/2 lbs.

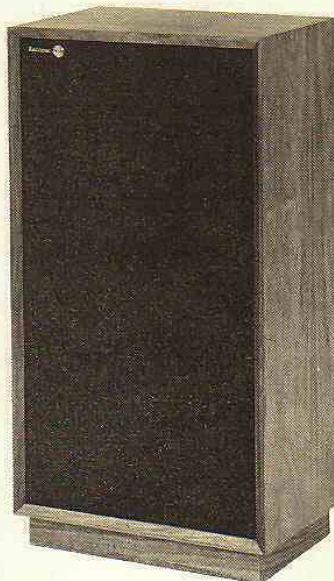
Midrange Driver

This is a 5-inch unit with a 2-inch "whizzer" cone. The entire dual cone structure moves as a rigid piston at the lower mid-frequencies; at the higher frequencies a gradual decoupling takes place and only the whizzer cone moves. Thanks to a unique European paper used in fabricating the cone structure, plus an unusually light self-supporting voice coil, transient response is exceptional throughout the driver's operating range and beyond.

Below 500 and above 3000 Hz, the crossover network of the Rectilinear III rolls off the response of the midrange driver at the rate of 6 dB per octave. This leaves three important octaves to be covered by this unit, in the range containing most of the specific frequency characteristics that differentiate the various musical instruments and voices. Thus the exceptionally smooth and neutral character of the speaker system's response is in large measure attributable to its midrange design.

Voice coil diameter of the midrange driver is 3/4 in.; total magnet weight is 3/4 lb.

FIGURE 1:
Rectilinear III in oiled walnut.



OPEN
FLAP

Rectilinear III floor-standing speaker

Tweeters

Two 2½-inch units and two 2-inch units cover the range from 3000 Hz up. The slightly larger tweeters contribute more to the response up to 11,000 Hz; the smaller tweeters contribute more above 11,000 Hz. Thus there exists a virtual acoustic crossover at 11,000 Hz, even though all four drivers are connected together in series-parallel.

The tweeters are of classically simple design, with extremely light cone and voice coil structures, and they surpass in smoothness, transient response and dispersion characteristics all other moving-coil tweeters thus far tested by Rectilinear engineers, regardless of cost or complexity.

Voice coil diameter is ½ in. and total magnet weight is 1 oz. in both types.

Crossover Network

Feeding the proper frequencies in correct proportion to the six different drivers of the Rectilinear III requires a network of considerable sophistication. Rectilinear considers air-core coils in crossover networks to be not only unwieldy but actually obsolete; in the Rectilinear III only air-gapped iron-core chokes are used, which, contrary to popular superstition about solid-core inductive devices, do not introduce the slightest distortion. Their precisely controlled tolerances permit crossover points of great accuracy and repeatability, further assured by capacitive elements of the highest quality.

The midrange and treble channels are each provided with a level control, accessible on a recessed panel in back of the speaker, so that a judicious amount of deviation from flat response may be applied to suit the acoustic environment.

Cabinet

The outside dimensions of the Rectilinear III cabinet are 35" by 18" by 12" deep. It is of extremely rigid construction, in ¾" stock, with elaborate internal bracing. All six drivers are solidly bonded to the front panel with silicone rubber, eliminating all possibility of vibration. The midrange driver is separately encapsulated in a special

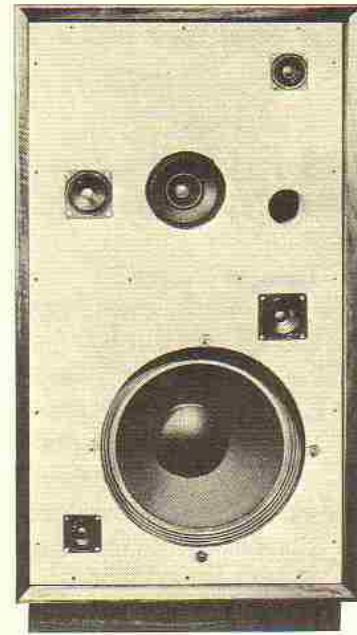


FIGURE 2:
Rectilinear III with grill cloth removed.

nonresonant polyethylene chamber to isolate it from the back radiation of the woofer. The tweeters are in widely separated positions chosen for the best possible radiation pattern. The finish is oiled walnut; the grill cloth is of polyester fiber, so that it may be cleaned with a damp cloth.

The enclosure is tuned to the woofer by means of tube venting, in what is probably the most refined application of the bass reflex principle. An optimally operating bass reflex enclosure is somewhat difficult to design but well worth the trouble, as it can extend the bottom range of the woofer by nearly an octave and at the same time increase its efficiency by about 3 dB. The use of a tube instead of a simple opening helps keep the size of the enclosure within reasonable limits without any sacrifice in performance.

Rectilinear III floor-standing speaker

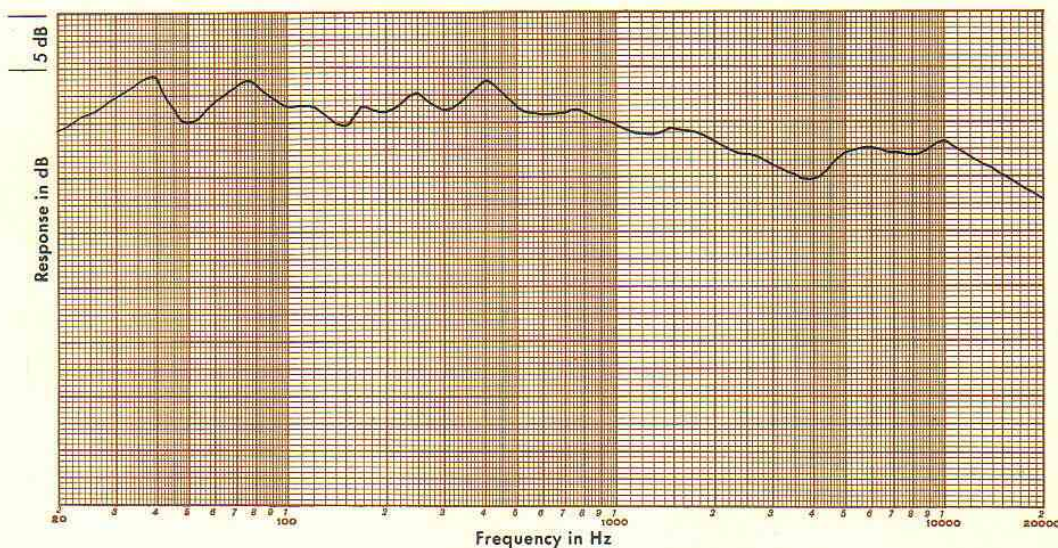


FIGURE 3: Rectilinear III frequency response (see text for test conditions). Midrange and tweeter controls in flat position.

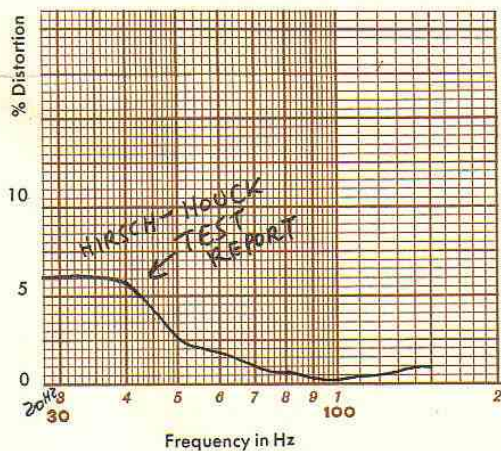


FIGURE 4: Harmonic distortion with 1 watt input.

Impedance and Efficiency

The nominal impedance of the Rectilinear III is 8 ohms. Despite the bass reflex cabinet, it is a relatively low-efficiency system requiring a fair amount of clean amplifier power. Amplifiers of less than 20 watts rms power capability per channel are not recommended, and in large rooms 50 or even 100 watts rms per channel may be preferred by critical listeners for the reproduc-

tion of heavy program material at high levels.

Frequency Response

It is virtually impossible to measure accurately the frequency response of a speaker system having six widely separated drivers. A single uninterrupted run from a frontal microphone position would show misleading interference patterns and give no idea

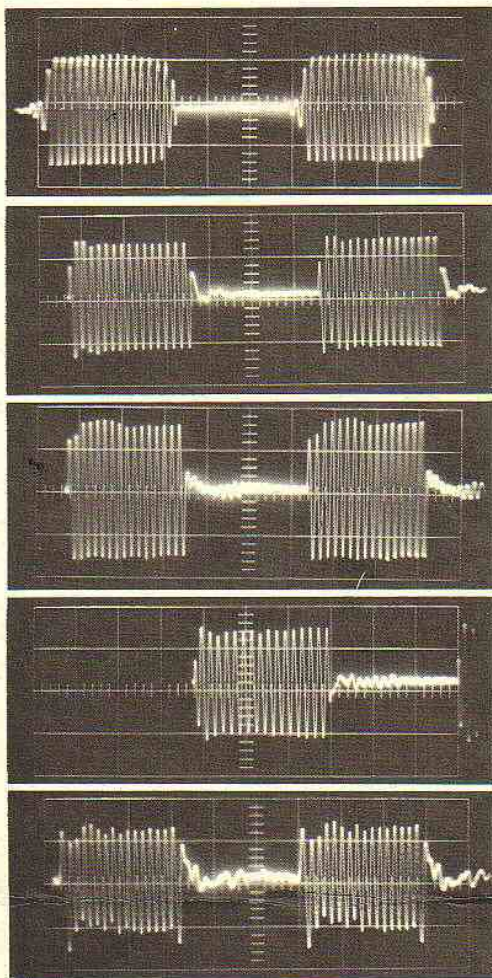


FIGURE 5:
Tone-burst tests for transient response and ringing.
(From top to bottom) 200 Hz, 700 Hz, 2000 Hz,
2500 Hz, 18,500 Hz.

of the actual sound energy radiated by the total system. On the other hand, a reconstructed composite of the separate frequency response curves of the drivers would present a fictitious speaker, even though the method is quite common in the high fidelity industry.

The curve shown in Figure 3 is therefore an average of 8 different 20 to 20,000 Hz sweeps recorded from 8 different microphone positions. The unavoidable inaccuracies of each individual run can be expected to cancel out in the average, and the curve is a reasonably fair picture of the audible frequency characteristics of the Rectilinear III.

As can be seen, the system is exceptionally smooth throughout the entire audio spectrum, without significant peaks or dips

and with undiminished bass response all the way down to 20 Hz.

Dispersion

The unusual design of the midrange driver and the unorthodox spacing of the inherently nondirectional tweeters result in a superior sound radiation pattern up to the highest frequencies. Dispersion is so wide that the subtlest high-frequency transients are fully audible off axis.

Harmonic Distortion

As the curve in Figure 4 indicates, harmonic distortion is virtually nonexistent down to about 70 Hz and is very low even at 40 Hz, which is the bottom limit of nearly all music.

Transient Response

Tone-burst tests show that the Rectilinear III reproduces transients with exceptional fidelity and freedom from ringing throughout its frequency range. The tone-burst photographs in Figure 5 present an unusually complete picture of transient performance and indicate startlingly accurate response even at the upper limit of the audio spectrum.

Summary of Specifications

Size:	35" by 18" by 12" deep
Drivers:	12" woofer, 5" midrange, two 2½" tweeters, two 2" tweeters
Crossover Frequencies:	500 Hz, 3000 Hz and 11,000 Hz
Nominal Impedance:	8 ohms
Minimum Power Requirement:	20 watts rms
Maximum Power Handling Capacity:	100 watts rms
Frequency Response:	20 to 18,500 Hz, ± 4 db
Controls:	midrange level, tweeter level
Connection to Amplifier:	banana jacks
Cabinet:	oiled walnut
Shipping Weight:	74
Price:	\$299.00

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