

# Rectilinear<sup>®</sup>

A LOW-COST BOOKSHELF SPEAKER  
SYSTEM FOR CRITICAL LISTENING

## Basic Configuration

The Rectilinear X1b is a two-way speaker system utilizing an extended-range woofer and an extended-range tweeter, both of the moving-coil principle. The cabinet is of normal bookshelf size but somewhat unconventional in that it is a tube-vented bass reflex enclosure instead of being completely enclosed.

## Design Goals

The Rectilinear X1b was designed to make available to critical listeners a budget-priced bookshelf speaker of genuinely accurate re-

## Classic Series BOOKSHELF SPEAKER

sponse and very low distortion, including low *time delay distortion*. The utmost simplicity of design was sought in order to eliminate unessential parts and keep labor costs down, as long as no compromise in performance would result. Particular emphasis was placed on high efficiency without loss of bass response, as well as on relatively constant impedance across the frequency spectrum. These characteristics were considered necessary to

# X1b

make the speaker compatible with receivers and amplifiers of moderate price and therefore of modest power output. The subjective listening quality of the Rectilinear X1b was to be judged by the same standards as that of the higher-priced speakers in the Rectilinear line.



RECTILINEAR RESEARCH CORPORATION • 107 BRUCKNER BOULEVARD • BRONX, NEW YORK 10454 • Telephone: (212) 585-9400  
MILITARY AND INTERNATIONAL INQUIRIES TO: RECTILINEAR INTERNATIONAL CORPORATION • 107 BRUCKNER BOULEVARD  
BRONX, NEW YORK 10454 • Telephone: (212) 585-9400 • Cable: RECOCO NEWYORK • Telex: 235383 NEAR UR

## Woofers

The most sophisticated woofer ever used in a low-priced speaker system is the heart of the Rectilinear Xlb. Its diameter is 10 inches, which is optimum size for a two-way bookshelf speaker. The butylized cloth surround, in combination with the spider and voice coil construction used, permits unusually large cone excursions without distortion.

Since the operating range of the woofer is from 45 to 2000 Hz, provision must be made for unimpaired response far up into the midrange. This cannot be accomplished with a small-diameter voice coil driving a large diaphragm; therefore a large voice coil of 1½-inch diameter is used. It is remarkable that this massive bass driver approaches the lighter and more specialized midrange speakers used in three-way systems as far as lack of coloration and low time delay are concerned.

Since high efficiency is essential to the design concept of the Rectilinear Xlb, the woofer requires less power to drive than most competitive models. An extra-long magnetic path is provided so that maximum electrical damping is applied to the moving mechanism. This results in unusually low distortion at high output levels, which is not an easy feat in a bass reflex design.

The response of the woofer begins to roll off naturally (i.e. mechanically) at 2000 Hz. This facilitates steep attenuation by means of an extremely simple filter network.

# Rectilinear<sup>®</sup> Xlb

## Tweeter

This is a 3½-inch unit that covers the range from 2000 to 20,000 Hz, a span of more than four octaves. To avoid breakup at the bottom of this range requires a relatively large voice coil with a 9/16-inch diameter. Low moving mass is assured, however, by the special paper used in fabricating the cone and by the characteristics of the surround material. The resulting response is exceptionally flat, smooth and free from distortion. Total flux density of better than 11,000 gauss assures an extremely efficient, low distortion and linear response curve.

## Filter Network

The Network could not be simpler. A high pass filter of 6 microfarads in the tweeter circuit compliments the natural roll off of the woofer. The lack of a complicated network results in superb transient response. Actual attenuation, though, is not far from 18 dB per octave below the crossover point, since the latter was selected to coincide with the natural roll-off point of each driver. This is a case of eating your cake and having it, too: a sharp-cutoff crossover with a minimal network.

A wide-range tweeter level control is provided, accessible on a recessed panel in back of the speaker, so that the high-frequency output may be adjusted to suit the acoustic environment.

## Cabinet

The outside dimensions of the Rectilinear Xlb are 23" by 12" by 10½" deep. The cabinet is of extremely rigid one-piece construction, in 5/8-inch stock, with heavily damped walls. It is filled with sound-absorbent material. The cabinet edge is only 3/8-inch deep to eliminate diffraction effects. The finish is vinyl walnut.

The enclosure is tuned for optimum bass response by means of tube venting, in a sophisticated application of the bass reflex

principle. Bass reflex cabinets are seldom used in bookshelf speaker systems, but in the case of an unusually efficient speaker like the Rectilinear Xlb this is the best technique for maintaining efficiency down into the low bass without roll-off. (In a completely enclosed cabinet, response could drop 6 dB from 120 Hz to the fundamental resonance of 60 Hz. Or, alternately, midbass efficiency would have to be sacrificed.)

## Impedance and Efficiency

The nominal impedance of the Rectilinear Xlb is 8 ohms. Impedance never drops below 6.5 ohms, assuring that the speaker cannot overload solid-state amplifiers of limited power capability. Maximum impedance is at 65 Hz, where the woofer and tube-vented cabinet show a single impedance peak of 29.4 ohms. This relatively low figure is an indication of the excellent damping (low Q) of the bass reflex design used.

Efficiency is close to the ultimate achievable in a low-cost bookshelf system. Any amplifier capable of about 10 clean watts per channel will drive the speaker to window-rattling levels.

## Frequency Response

Although Rectilinear engineers strongly believe that there are more important speaker specifications than pressure amplitude response (the conventionally cited "frequency response"), the curve of the Rectilinear Xlb happens to be spectacularly flat.

## Dispersion

The superior design of the tweeter and the shallow edge of the enclosure assure an excellent radiation pattern right up to the highest frequencies. Dispersion is wide enough to make high-frequency transients fully audible off axis, without loss of quality.

## Time Delay Distortion

It is becoming increasingly apparent that phase response (phase angle plotted against frequency) is a more significant criterion of speaker performance than what is ordinarily called frequency response (pressure amplitude plotted against frequency). Between two reasonably advanced speaker systems, the one with the better amplitude response is not necessarily the one that sounds better (i.e., more natural or lifelike). But the one with the better phase response will be almost invariably preferred by the critical listener.

Superior phase response is dependent on low time delay distortion. Time delay distortion occurs when a speaker does not produce an acoustical output the instant an electrical input is applied to it. There is a measurable split second of delay between input and output. The delay is nearly always frequency-dependent, being greater at low frequencies as a result of higher inertial mass. The consequent disturbance of phase relationships is now suspected to be the chief cause of "canned," unnatural speaker sound.

All speakers produce some time delay distortion, but the Rectilinear Xlb is superior in this respect to any other two-way system. The tight acoustic coupling of the woofer, the simplicity of the filter network and the unusually low mass of the tweeter all contribute to outstandingly low time delay figures throughout the frequency range.

## SUMMARY OF SPECIFICATIONS:

**Size:** 23" x 12" x 10" deep  
(584mm x 305mm x 254mm)

**Drivers:** 10" woofer, 3½" tweeter

**Filter Frequency:** 2000 Hz

**Nominal Impedance:** 8 ohms

**Minimum Power Requirements:** 10 watts RMS

**Maximum Power Handling Capabilities:**  
50 watts RMS

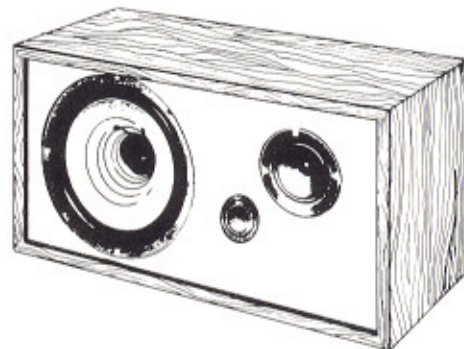
**Frequency Response:** 45 Hz to 18,500 Hz  
± 2 dB

**Controls:** Treble adjustment

**Connection to Amplifier:** Binding posts

**Cabinet:** Vinyl walnut

**Shipping Weight:** 32 lb. (14.40 kg)



## DISTRIBUTED BY: