

**Electro-Voice®**

a MARK IV company

## Model ST350B 120° Radial Horn Tweeter

### SPECIFICATIONS

(All acoustic measurements were made in an anechoic environment with tweeter free standing)

Frequency Response, with X36 Crossover and Suggested Equalization Network (see "Crossovers and Equalization" section), 1 Meter on Axis, Swept One-Third-Octave Random Noise:  
± 3 dB 3000-15,000 Hz

Sound Pressure Level at 1 Meter, 1 Watt into Nominal Impedance, Averaged over Rated Frequency Response Range using Suggested Equalization Network:  
101 dB

Dispersion Angles Included by 6-dB-Down Points on the Polar Responses, Indicated Octave Bands of Random Noise,

Horizontal,  
4,000 Hz: 120°  
8,000 Hz: 120°  
16,000 Hz: 110°

Vertical,  
4,000 Hz: 90°  
8,000 Hz: 70°  
16,000 Hz: 50°

Power Capacity above 3000 Hz at Tweeter Terminals (8-ohm load),  
Long-Term Average:  
5 watts  
Short-Term (10 ms):  
50 watts

Minimum Crossover Frequency:

3000 Hz

Impedance,

Nominal:

8 ohms

Minimum (above 3000 Hz):

7 ohms

Voice Coil,

Diameter:

25.4 mm (1.00 in.)

Material:

Aluminum

Resistance, dc:

6.2 ohms

Polarity:

A positive (+) dc voltage applied to the red terminal produces a positive pressure at the throat of the tweeter horn

Magnet,

Material:

Ceramic

Weight:

454 g (1 lb)

Optional Accessory:

STR tweeter protector

Dimensions:

152.4 mm (6.00 in.) wide

127.0 mm (5.00 in.) high

116.8 mm (4.60 in.) deep

Net Weight:

1.19 kg (2.63 lb)

### DESCRIPTION AND APPLICATIONS

The ST350B is a wide-angle constant-directivity tweeter. The constant-directivity characteristic of this tweeter ensures the ability to cover a zone essentially 120° wide horizontally by 70° wide vertically at virtually any frequency within its intended operational range. This tweeter, originally introduced in EV monitor systems in 1972, represents a pioneering effort by EV engineering to design and offer a high-frequency transducer employing the unique advantages of constant-directivity operation.

The ST350B will normally be used in conjunction with other loudspeakers (cone or horn loaded) to create a wide-range two- or three-way system. Such a system will need to employ an electrical crossover/equalizer and may, at the user's option, include a tweeter protector (such as the EV STR) and an "L-pad" form of attenuator (such as the EV AT38). Because of the ST350B's high level of efficiency, its acoustical output for a given electrical input will generally exceed that of almost all direct-radiator (cone) loudspeakers, making output level adjustment necessary by appropriate "padding" of the tweeter input.

### FREQUENCY RESPONSE

As with any horn tweeter that combines high quality with constant-directivity characteristics, the "raw" or

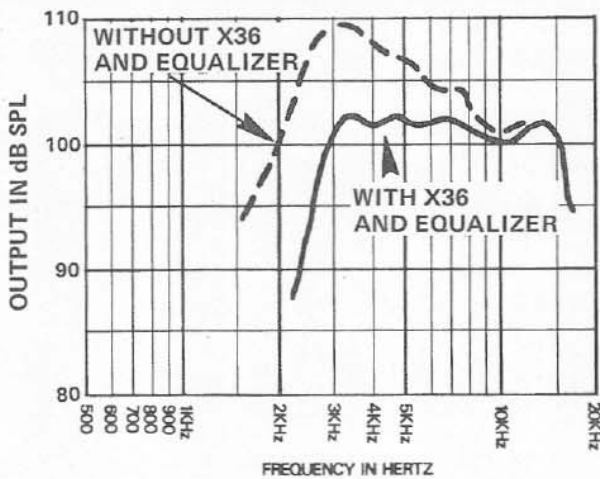


FIGURE 1 — Axial Frequency Response, 1 Watt, 1 Meter, (see text for details)

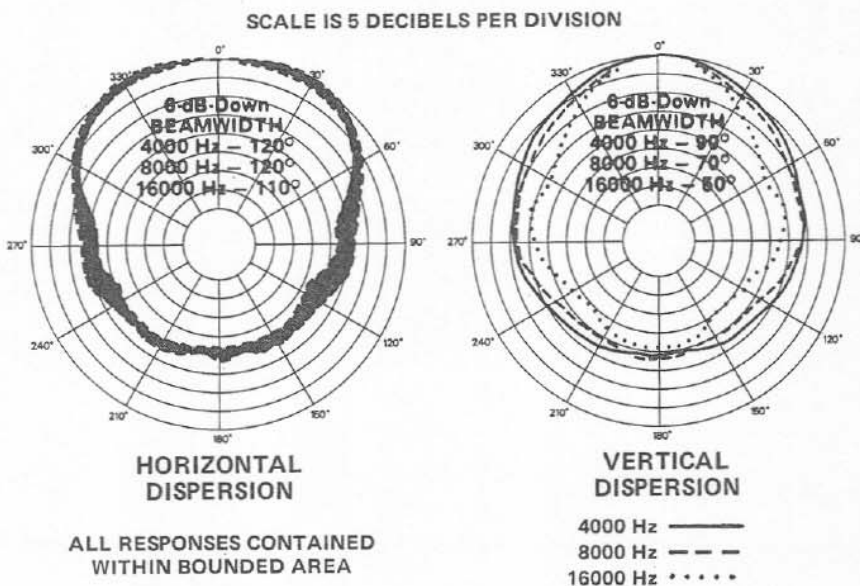


FIGURE 2 — Octave-Band Polar Response and 6-dB-Down Beamwidth (see text for detailed test conditions)

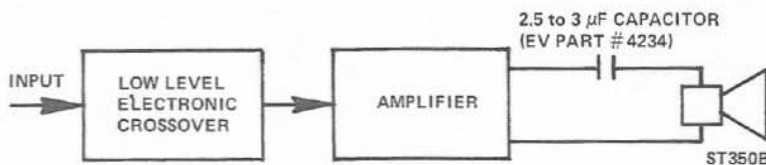


FIGURE 3 — Equalization for a Low Level Form of Electronic Crossover (see text for details)

unequalized sound pressure level will roll off above about 3000 Hz at 6 dB per octave. The unequalized tweeter response is shown in Figure 1. Also shown in this figure is the adjusted or equalized response of the tweeter as obtained by the use of a simple electrical network discussed in the "Crossovers and Equalization" section. Measurements were made with the tweeter unbaffled in an anechoic (echoless) environment with a swept 1/3-octave random-noise input and a microphone distance of one meter. Frequency response aberrations caused by baffle mounting are minimal when the ST350B is "front mounted" (see "Installation" section) and obstructions are kept outside of the unit's coverage zone.

#### DISPERSION

The ST350B's unusually uniform directional characteristics are displayed in Figure 2. Measurements were made on an unbaffled tweeter in an anechoic environment with octave-band-limited random noise at 4000, 8000, and 16,000 Hz with a microphone distance of 10 feet. The left-hand chart shows the horizontal (side-to-side) dispersion with the tweeters 120° sector angle contained in a horizontal plane. The right hand chart shows the vertical (up-and-down) dispersion with the same tweeter orientation.

#### CROSSOVERS AND EQUALIZATION

Constant directivity allows for the unique possibility of flat response on or off axis coupled with constant total acoustical power output versus frequency. This means truly constant audience coverage at all frequencies. However, due to the inevitable response rolloff at very high frequencies caused by the effects of even very small moving diaphragm and voice coil masses, response equalization is needed for best performance from constant-directivity transducers. This can be simply accomplished through several methods that tailor the electrical input to the transducer in an appropriate manner. It is significant to point out that it would not be possible to correct for the effects of non-constant-directivity in any simple manner as directional characteristics are a function of the basic geometrical makeup of the transducer and this cannot be simply altered.

Several methods of providing suitable electrical equalization will illustrate approaches that may be tailored to particular applications and components available.

If a low-level electronic form of crossover (such as the EV XEQ series) is used to feed a high-frequency amplifier specifically intended for the ST350B, equalization may be accomplished by simply inserting a 2.5-to-3  $\mu$ F capacitor in series with the tweeter as is shown in Figure 3. The capacitor should be of a metalized film or non-polarized electrolytic type. Crossover frequencies should be at or above 3000 Hz. The slope rate of the crossover should be 12 dB per octave or higher. This prevents the entrance of lower frequencies which will damage the tweeter voice coil.

If a high level form of crossover (such as the EV X36) is to be used after the amplifier, an equalization network such as that shown in Figure 4 will provide suitable electrical input tailoring to the ST350B as well as ensuring that the impedance seen by the crossover is of a suitable 8-ohm value. The resistor indicated should be capable of dissipating 20 watts. Crossover frequencies should be at or above 3000 Hz and crossover slopes should be at least 12 dB per octave. When using a high-level crossover, it will usually be necessary to use an attenuator, inserted ahead of the ST350B, to match the sensitivity of the tweeter to that of the other loudspeaker components. The attenuator should be of the 8-ohm L-pad type (such as the EV AT38) in order to preserve an input impedance level of 8 ohms at all attenuation level settings. The correct location for an attenuator is shown in Figure 4.

Under some circumstances it may be desirable to construct high-level, high-pass crossover/equalizer networks. Figures 5 and 6 show two networks in which the equalizer and crossover functions have been combined using a reduced number of electrical components. These crossover/equalizers are for acoustical crossover frequencies of 3000 and 6000 Hz and feature rapid electrical attenuation of input below the intended crossover frequency. The capacitors should be of a metalized film or non-polarized electrolytic type and all components should have tolerances within about 10% of indicated values.

The crossovers shown in Figures 5 and 6 may be constructed using the EV part numbers shown. Contact the Electro-Voice Service Department for prices and availability (see "Warranty" section for address and telephone information).

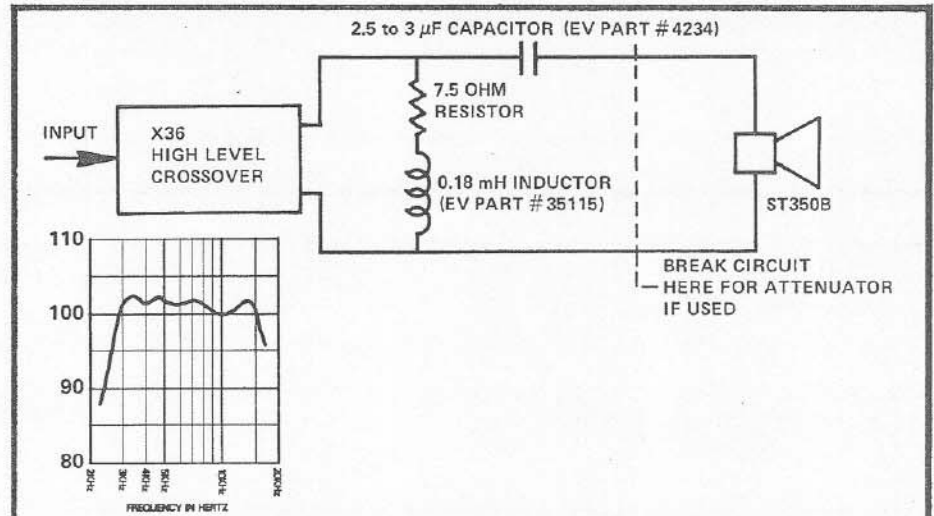


FIGURE 4 — Equalization for a High Level Form of Crossover such as the X36 with Associated Axial Frequency Response, 1 Watt, 1 Meter (see text for details)

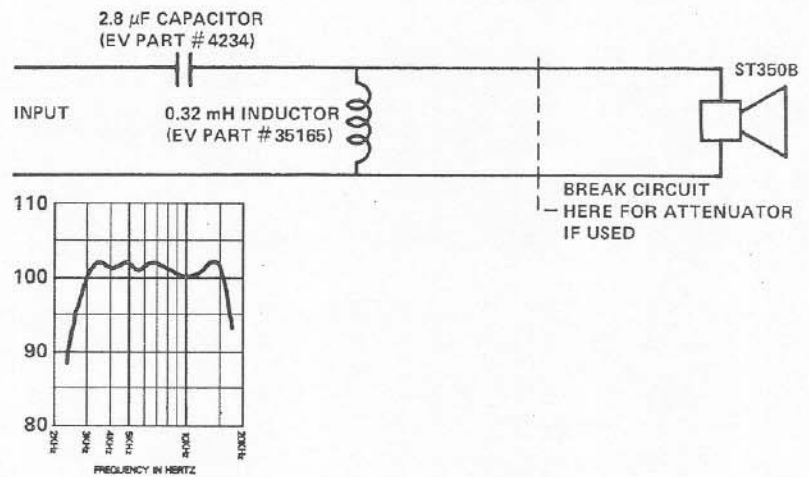


FIGURE 5 — Combined Crossover/Equalizer for a 3000 Hz Crossover Frequency with Associated Axial Frequency Response, 1 Watt, 1 Meter (see text for details)

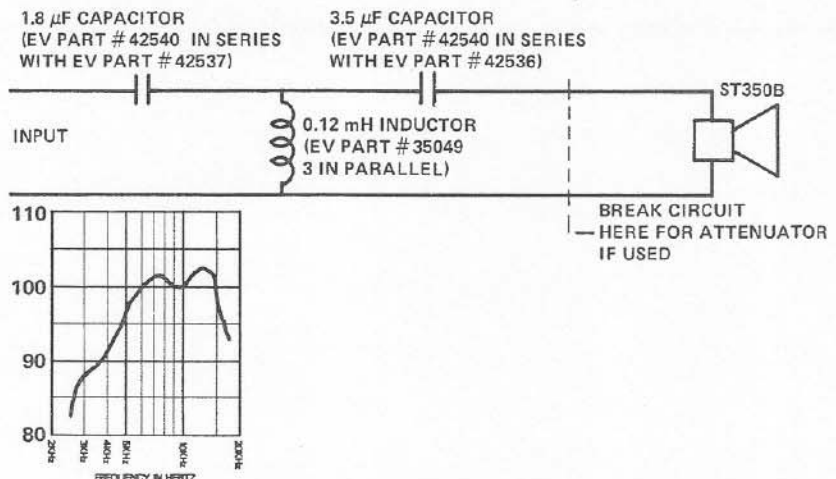


FIGURE 6 — Combined Crossover/Equalizer for a 6000 Hz Crossover Frequency with Associated Axial Frequency Response, 1 Watt, 1 Meter (see text for details)

## INSTALLATION

The ST350B may be mounted free standing without being affixed to a baffle board. When this is done it is recommended that any substantial obstructions be kept out of the 120° horizontal by 70° vertical coverage zone of the tweeter.

The ST350B may be "front mounted" from the outside of a baffle board through an opening measuring 124 mm (4.9 in.) horizontally by 95.3 mm (3.75 in.) vertically. The tweeter can be used as a template to locate the positions for wood screws or bolts used to affix it to the baffle.

## RELATIVE POLARITY OF SYSTEM COMPONENTS

The relative polarity of the low-frequency, mid-frequency and high-frequency system elements can influence system response in the crossover regions. This is so because in the crossover region two components are operating and their combined output can range from additive ("in phase") to cancelling ("out of phase"). A general polarity rule is not possible because system response is influenced not only by phase shift which is related to the crossover slope rate but also by phase shifts which are unique to the particular loudspeaker components and their physical placement. Also, for relatively high crossover frequencies such as those appropriate for the ST350B, the wavelengths (distance between sound pressure maxima) are short relative to typical component dimensions so that the relative polarity of a woofer and tweeter usually makes little or no difference in the frequency response near crossover. However, when systems are used in stereo pairs, the relative polarity of each system should be identical to provide a stable stereo image.

## SETTING THE TWEETER LEVEL CONTROL

If an attenuator (such as the EV AT38 level control) is used in conjunction with the ST350B in order to match the output of the tweeter to the sensitivity of a midrange or woofer, the following information may prove useful.

One of the best ways to adjust the level control is to advance it to the point where a well recorded or live human voice sounds natural: not too "dull" or

lacking in "liveness" yet without a "harsh" quality or excessive sibilance. Familiarity with the sound of live unamplified concert music is also helpful.

## POWER HANDLING CAPACITY

The light moving system required for good high-frequency reproduction limits tweeter power capacity to about 5 watts long-term average and 50 watts short term (10 ms). Therefore, any sine-wave test signal should not exceed 6.3 volts RMS at the tweeter terminals (5 watts into the ST350B's 8-ohm nominal impedance). However, when the tweeter level control is adjusted for flat response in multi-way systems and normal program material is played (including contemporary rock music), the portion of the power which actually reaches the tweeter is a small fraction of the total power to the system. In addition to this, the reduction of electrical input at the tweeter's terminals caused by the equalization process (described in the "Crossovers and Equalization" section) increases the apparent power-handling ability of the ST350B. Approximately 5 dB of reduction occurs in the 3000 to 6000 Hz octave, for instance, causing the apparent long-term power-handling ability in this range of the tweeter plus equalizer to appear to be about 15 watts. Thus, the limiting factor on system power capacity is almost always the woofer. This is so because (1) program material has an energy content that declines rapidly above 1000 Hz or so, (2) the level control, as it is turned down, reduces substantially the power at the system's input terminals that reaches the tweeter itself and (3) the equalization process reduces system input power appearing at the tweeter terminals at lower tweeter frequencies.

Where unusual conditions might overpower the ST350B, the optional STR tweeter protector is useful. Its electronic circuit temporarily interrupts power to the tweeter if the long-term average exceeds 5 watts but will pass the much higher short-term peaks which do not harm the tweeter but are necessary for realistic reproduction. Situations where the STR is appropriate include:

1. Extremely high-level playback of program material with unusually heavy high-frequency content.
2. Applications where the system amplifier is operated beyond its

capacity in an effort to get the desired loudness. As the amplifier's capability is exceeded, its output waveform is "clipped," producing high-frequency distortion products which not only sound harsh but also are fed directly to the tweeter and can exceed its power capacity. Note that such damaging clipping distortion is more likely to occur with smaller amplifiers, so that a larger power amplifier which avoids clipping of the musical signal is actually safer for the tweeter.

3. High-speed winding of a recorded tape on a deck without tape lifters and with the volume at normal playback levels. The high-frequency energy generated is extreme and can easily exceed tweeter power capacity.

## WARRANTY (Limited) —

Electro-Voice Professional Sound Reinforcement Loudspeakers and Accessories are guaranteed for five years from date of original purchase against malfunction due to defects in workmanship and materials. If such malfunction occurs, unit will be repaired or replaced (at our option) without charge for materials or labor if delivered prepaid to the proper Electro-Voice service facility. Unit will be returned prepaid. Warranty does not cover finish or appearance items or malfunction due to abuse or operation at other than specified conditions. Repair by other than Electro-Voice or its authorized service agencies will void this guarantee.

For shipping address and instructions on return of Electro-Voice products for repair and locations of authorized service agencies, please write: Service Department, Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 (Phone 616/695-6831) or 8234 Doe Avenue, Visalia, CA 93277 (209/651-7777).

Electro-Voice also maintains complete facilities for non-warranty service.

Service and repair address for this product: Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 or its authorized service centers.

Specifications subject to change without notice.



**ELECTRO-VOICE, INC., 600 Cecil Street, Buchanan, Michigan 49107**

MANUFACTURING PLANTS AT ■ BUCHANAN, MI ■ NEWPORT, TN ■ SEVIERVILLE, TN ■ REDMOND, WA ■ GANANOQUE, ONT.  
© Electro-Voice, Inc. 1987 ■ Litho In U.S.A. Part Number 530321-320

a MARK IV company