

## T251i

### Trapezoidal Speaker System

- HS-style suspension hardware is preinstalled, eyebolts are included and may be suspended vertically or horizontally
- Enclosure is paintable (supplied with white textured paint)
- Ring-Mode Decoupling (RMD™) for increased intelligibility
- PRO™ circuit provides HF driver protection
- Rotatable constant-directivity 60° x 40° horn
- High-excursion, 400 W, DL15ST 15-in. woofer
- Biampable, passive network included

#### Description

The compact, trapezoidal-shaped Electro-Voice T251i is a 400-watt, two-way, biampable, constant-directivity speaker system. The system combines professional-quality components, arranged in a time-coherent vertical array, with an unusually robust, installation-friendly, vented enclosure. The result is clear and articulate, high-quality sound for permanent installation.

The enclosure is constructed of 13-ply void-free, birch plywood. This high-strength shell is painted with a textured, neutral, white paint. Suspension hardware is preinstalled and three eyebolts are included in the shipping carton. Small rubber feet and mounting screws are also included but not attached to each system for the less likely situation where the system will not be suspended.

The high-frequency section of the T251i utilizes a 60° x 40° constant-directivity horn driven by a wide-bandwidth, two-inch titanium-diaphragm DH2T driver. This driver uses a unique convex-drive phasing plug structure for smooth and extended high-frequency performance. The voice coil is coupled to the diaphragm with EV's exclusive Resonant Drive™ technology. This in-

creases and smooths the high-frequency response and reduces the amount of internal equalization required for flat frequency response.

EV's self-resetting PRO™ circuit is built into the crossover network to guard the compression driver from damage. If input power to the driver exceeds the nominal rating, the PRO™ circuit is activated, reducing the power delivered to the driver by 6 dB. The system will remain in this mode of operation until input power is reduced to a safe level.

#### Ring-Mode Decoupling (RMD™)

The T251i controls both acoustical and mechanical ring modes to provide dramatically increased intelligibility, using techniques learned from the development of the Electro-Voice X-Array™ concert speakers. There is much less coloration of the sound from resonating sources, leaving only the intended sound to be heard by the audience. The optimally vented bass section of the T251i is designed using Thiele-Small parameters for efficient performance to below 50 Hz. The DL15ST high-excursion 15-inch woofer features beryllium copper lead wires with a low-mass,

extended-length, edge-wound voice coil and high-temperature materials. EV's unique Thermo Inductive Ring (TIR™) is placed on top of the pole piece, where the extended-length voice coil would normally be exposed, placing metal in close proximity to the coil and providing a major heat-transfer path that helps keep the voice coil cool.

#### Notes on Installation

Any suspension system is only as strong as its weakest link. The installer must ensure the top mounting points have sufficient load bearing capability to safely suspend the cabinet. The initial support cables or chains should be as close to vertical as possible and never more than 30° from vertical. Once the system is installed none of the chains or cables should touch or rub against the cabinet. Local codes and regulations, if they exceed Electro-Voice's recommendations, should be followed at all times. Electro-Voice recommends that a safety factor of at least 8:1 be adopted. The Electro-Voice HS-style suspension components supplied in the T251i exceed this recommended safety factor when the system is installed in compliance with Electro-Voice recommendations.

## T251i Trapezoidal Speaker System

**It is the installer's responsibility to ensure the speaker system has been installed correctly. Electro-Voice strongly recommends that all suspended items be inspected at least once a year and any damaged parts be replaced immediately.**

All Electro-Voice HS- and HST- systems follow the same principles. Put minimum stress on the cabinet and make each cabinet hang independently of any other device.

### Suspending the Electro-Voice T251i Speaker System

Part of the T251i's versatility is that it can be mounted either vertically or horizontally, and has a rotatable horn. The mounting system is conceptually very simple. Two aluminum tubes pass vertically through the cabinet and each is secured via two oversize cast brackets (threaded flanges). The enclosure is sandwiched between the four (two on each end) brackets. The enclosure is essentially resting between the brackets.

When installing the T251i, two of the three supplied forged eyebolts are screwed into the upper two brackets. The third eyebolt should be screwed into the appropriate T-nut on the rear panel of the enclosure. When mounting the enclosure vertically, use the lower T-nut. When mounting the enclosure horizontally, use the T-nut located in the center of the rear panel of the enclosure. This is necessary for aiming the system. The center of gravity is arranged so the enclosure is directed towards the ceiling. In order to provide a downward or horizontal projection angle, the pull-up point must be used.

If multiple cabinets are to be suspended, each system requires its own rigging points. **Systems should not be suspended from each other.** The eyebolts must be connected using suitably rated chain with connectors such as shackles or threaded chain connectors, or suitably rated aircraft cables to suspend and aim the system.

### Constant-Directivity Speaker System

The crossover frequency and speaker component geometries have been selected so that the directional characteristics of the woofer and constant-directivity horn match at the

crossover frequency (approximately 90° circular coverage patterns for each) to create a special system type—the constant-directivity system. At higher frequencies the horizontal coverage pattern remains constant and the vertical pattern smoothly transitions to a 40° angle above 4,000 Hz. Response within the 60° x 40° rated coverage angle is uniform, which means dependable audience coverage without hot spots or dead zones at certain frequencies. The 60° x 40° dispersion characteristic also helps avoid early reflections from nearby floor or side wall surfaces which could degrade intelligibility. The controlled directivity of the high- and low-frequency transducers also eliminates response irregularities caused by diffraction off nearby enclosure edges and, in combination with an essentially flat on-axis frequency response, produces a total acoustic power output that is uniform with frequency.

### Enclosure Construction

A combination of dado-cut joints, tough adhesives and proper bracing ensures a sonically dead enclosure free from panel resonances. The flying hardware is preinstalled in the T251i. The exterior of the T251i is covered with a white textured paint that is also paintable if the installer desires.

### Rotating the High-Frequency Horn

The T251i high-frequency horn may be easily rotated about its major axis, providing coverage independent of enclosure orientation. First remove the enclosure grille, then the horn. Both are affixed with #2 Phillips-head screws. Rotate the horn 90° about its axis and reinstall the components.

### Connections

Biamped or passive crossover with Neutrik Speakon® connectors. Pins 1+ and 1- are used in passive crossover.

### Biamped Operation

The T251i is shipped from the factory in "full range mode" with its passive crossover utilized. If biamp operation is desired, this is easily achieved. The input panel/crossover assembly (on the back of the system) must first be removed using a #2 Phillips screw-

driver. After removing the input panel/crossover assembly, notice the crossover instruction label on the side of the panel. There are four automotive fuses on the printed circuit board. These fuses are not functioning as fuses, but rather are functioning together as a four pole switch. To convert the T251i to biamp operation, move each fuse over one position. The fuses should, once again, all be in one column and nearest the word BI-AMP on the printed circuit board. Replace the input panel/crossover assembly in the enclosure and carefully replace the screws—being careful not to strip the holes. To return the system to full-range operation, repeat the steps in a similar manner. Remember, **all fuses must be arranged in a vertical column for safe, proper operation.**

Neutrik Speakon® connectors are used. Pins 1+/1- are wired to the low-frequency driver and pins 2+/2- to the high-frequency section. The high-frequency section incorporates a low-frequency blocking capacitor with a 3-dB-down point of 800 Hz and PRO™ circuit auto resetting overload protection.

### Frequency Response

The combination of a 15-inch woofer, wide-bandwidth high-frequency driver and an equalized crossover results in the wide and smooth overall response shown in Figure 1. The T251i's axial frequency response was measured in Electro-Voice's large anechoic chamber at a distance of 10 feet with a swept sine-wave input of 4 volts. Figure 1 has been averaged and corrected for 1 watt/1 meter.

### Directivity

A unique feature of the T251i is the constant-directivity dispersion provided by the 60° x 40° horn. The polar response of the system at selected one-third-octave bandwidths is shown in Figure 2. These polar responses were measured in an anechoic environment at 10 feet using one-third-octave pink-noise inputs. The frequencies selected are fully representative of the polar response of the system. Beamwidth of the system utilizing the complete one-third-octave polar data is shown in Figure 3.  $R_w$  and directivity index (DI) are plotted in Figure 4.

# T25 1i Trapezoidal Speaker System

Figure 1—T251i Frequency Response

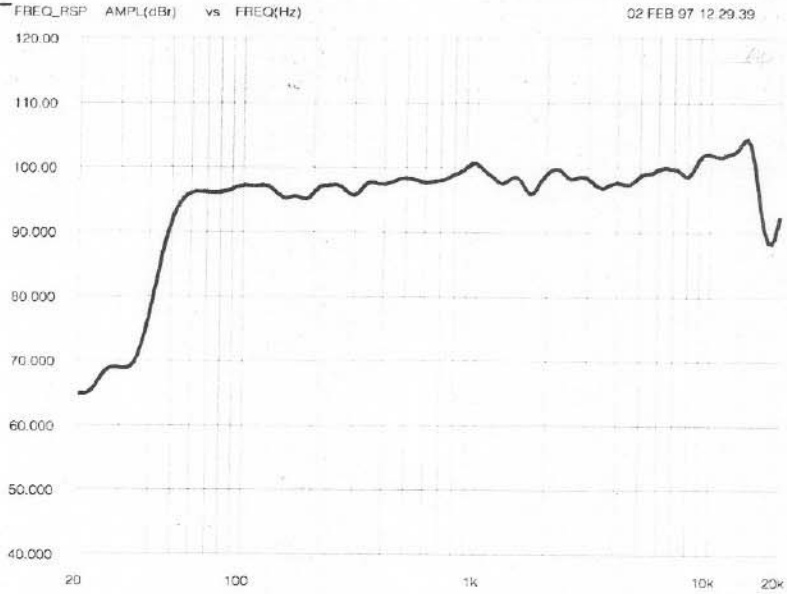
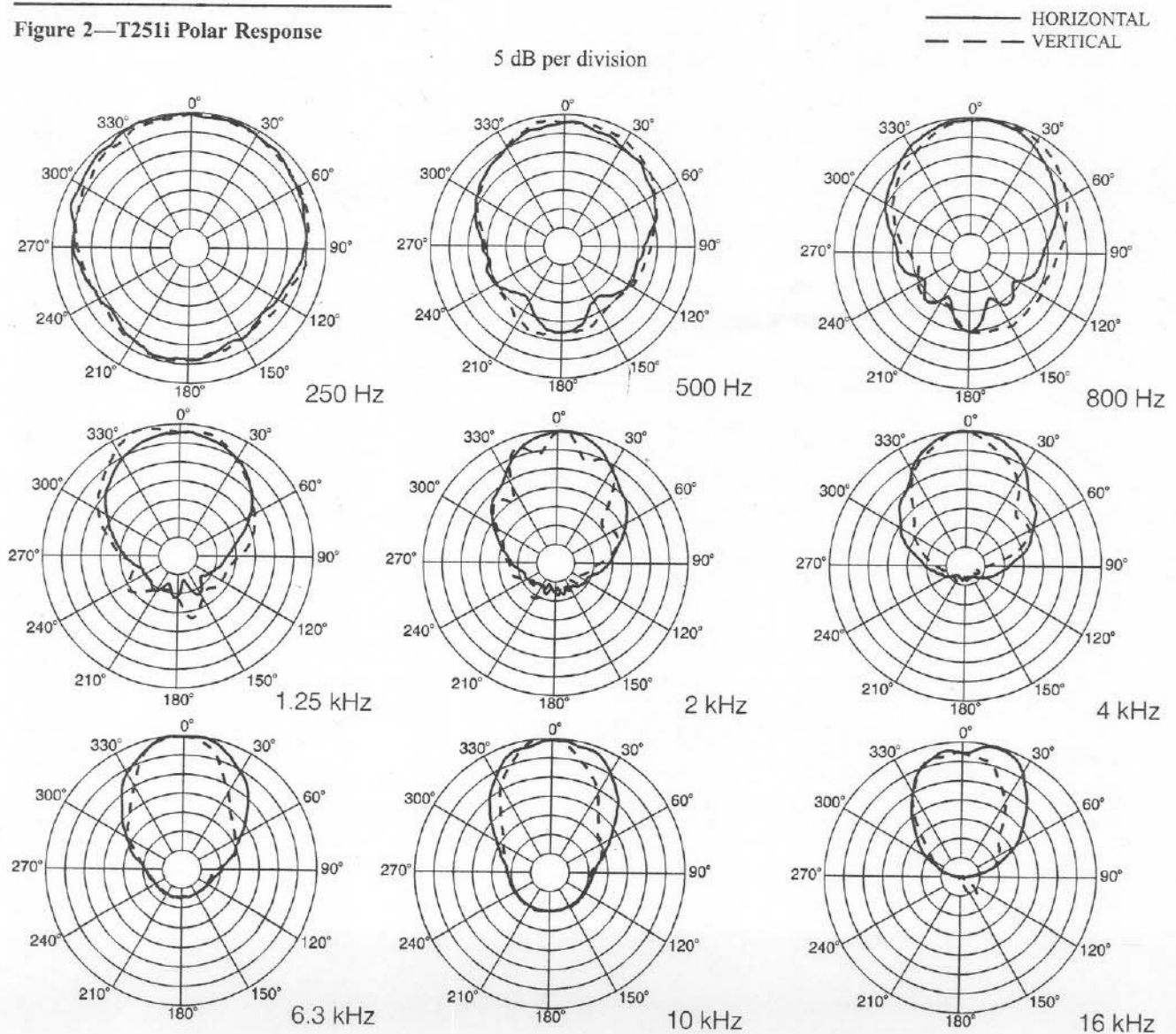


Figure 2—T251i Polar Response





## T251i Trapezoidal Speaker System

### Power-Handling Capacity

To our knowledge, Electro-Voice was the first U.S. manufacturer to develop and publish a power test closely related to real-life conditions. First, we use a random-noise input signal because it contains many frequencies simultaneously, just like real voice or instrument program. Second, our signal contains more energy at extremely high and low frequencies than typical actual program, adding an extra measure of reliability. Third, the test signal includes not only the overall "long term average" or "continuous" level—which our ears interpret as loudness—but also short-duration peaks which are many times higher than the average, just like actual program. The long-term average level stresses the speaker thermally (heat). The instantaneous peaks test mechanical reliability (cone and diaphragm excursion). Note that the sine-wave test signals sometimes used have a much less demanding peak value relative to their average level. In actual use, long-term average levels exist from several seconds on up, but we apply the long-term average for several hours, adding another extra measure of reliability.

Specifically, the T251i is designed to withstand the power test described in EIA Standard RS-426-A 1980. The EIA test spectrum is applied for eight hours. To obtain the spectrum, the output of a white-noise generator (white noise is a particular type of random noise with equal energy per bandwidth in Hz) is fed to a shaping filter with 6-dB-per-octave slopes below 40 Hz and above 318 Hz. When measured with an analyzer having the usual constant-percentage bandwidth (one-third octave), this shaping filter produces a spectrum whose 3-dB-down points are at 100 Hz and 1,200 Hz with a 3-dB-per-octave slope above 1,200 Hz. This shaped signal is sent to the power amplifier with the continuous power set at 400 watts into the 5.175-ohm EIA equivalent impedance (45.5 volts true rms). Amplifier clipping sets instantaneous peaks at 6 dB above the continuous power, or 1,600 watts peak (91.0 volts peak). This procedure provides a rigorous test of both thermal and mechanical failure modes.

### Architects' and Engineers' Specifications

The loudspeaker system shall be a two-way, full-range design consisting of a 381-mm (15-inch) woofer in a vented, trapezoidal-shaped enclosure, a high-frequency compression driver mounted on a rotatable 60° x 40° constant-directivity horn and a passive crossover/equalizer network. The loudspeaker shall meet the following performance criteria: frequency response of 50-16,000 Hz, -3 dB; power handling of 400 watts long term and 1,600 watts short term with a shaped random-noise input per EIA Standard RS-426-A 1980; sensitivity of 101 dB SPL at 1 meter with a 1-watt, 300-2,000-Hz pink-noise input; 6-dB-down horizontal coverage angle of 60° ±10° in the 2,500-20,000-Hz range; 6-dB-down vertical coverage angle of 40° ±4° in the 3,150-16,000-Hz range; crossover frequency of 2,200 Hz; nominal impedance of 8 ohms; and minimum impedance of 5.9 ohms. Input connections shall be two paralleled Neutrik Speakon® connectors. The enclosure shall be constructed of 13-ply void-free plywood, covered with a white textured paint with a black steel grille. Hardware required to suspend the system overhead will be preinstalled. Suspension will be accomplished by a total of three 3/8-in. eyebolts (included). Two are mounted to the top of the enclosure and one in the back panel for aiming purposes. Dimensions shall be 822 mm (32.35 in.) high x 476 mm (18.75 in.) wide at front x 272 mm (10.71 in.) wide at rear x 591 mm (23.25 in.) deep. Net weight shall be 35.5 kg (78 lb), estimated.

The loudspeaker system shall be the Electro-Voice T251i.

### Limited Warranty

Electro-Voice products are guaranteed against malfunction due to defects in materials or workmanship for a specified period, as noted in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual, beginning with the date of original purchase. If such malfunction occurs during the specified period, the product will be repaired or replaced (at our option) without charge. The product will be returned to the customer prepaid. Exclusions and Limitations: The Limited

Warranty does not apply to: (a) exterior finish or appearance; (b) certain specific items described in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual; (c) malfunction resulting from use or operation of the product other than as specified in the product data sheet or owner's manual; (d) malfunction resulting from misuse or abuse of the product; or (e) malfunction occurring at any time after repairs have been made to the product by anyone other than Electro-Voice or any of its authorized service representatives. Obtaining Warranty Service: To obtain warranty service, a customer must deliver the product, prepaid, to Electro-Voice or any of its authorized service representatives together with proof of purchase of the product in the form of a bill of sale or receipted invoice. A list of authorized service representatives is available from Electro-Voice at 600 Cecil Street, Buchanan, MI 49107 (616/695-6831 or 800/234-6831) and/or Electro-Voice West, at 8234 Doe Avenue, Visalia, CA 93291 (209/651-7777 or 800/825-1242). Incidental and Consequential Damages Excluded: Product repair or replacement and return to the customer are the only remedies provided to the customer. Electro-Voice shall not be liable for any incidental or consequential damages including, without limitation, injury to persons or property or loss of use. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. Other Rights: This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Electro-Voice Speakers and Speaker Systems are guaranteed against malfunction due to defects in materials or workmanship for a period of five (5) years from the date of original purchase. The Limited Warranty does not apply to burned voice coils. Electro-Voice active electronics associated with the speaker systems are guaranteed for three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

Service and repair address for this product: Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 (616/695-6831 or 800/234-6831).

Specifications subject to change without notice.

# T25 1i Trapezoidal Speaker System

Figure 3—T251i Beamwidth vs. Frequency, Whole Space (anechoic)

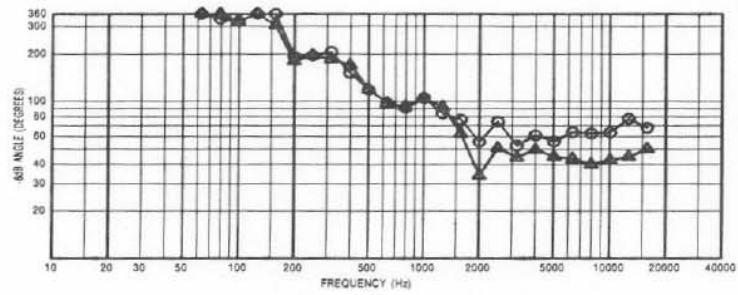


Figure 4—T251i Directivity vs. Frequency, Whole Space (anechoic)

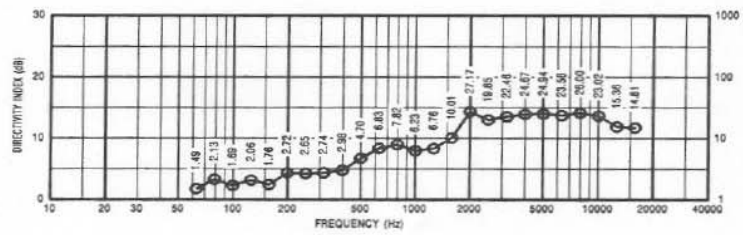
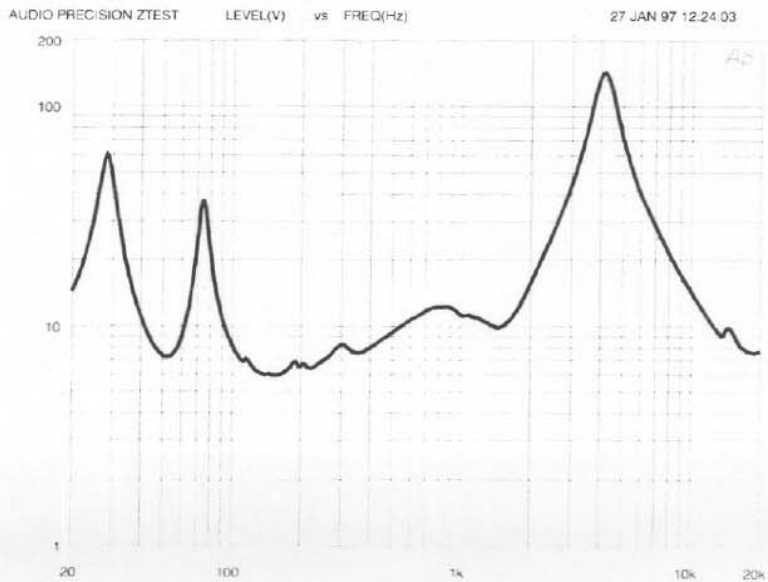


Figure 5—T251i Impedance



## T251i Trapezoidal Speaker System

T251i Trapezoidal Speaker System

### Specifications

**Frequency Response, Measured at 10 Feet on Axis, Swept 1/3-octave, Half-Space Anechoic Environment (see Figure 1. Curve shown has been normalized for 1 watt/1 meter):**

50-16,000 Hz

**Low-Frequency 3-dB-Down Point:**  
50 Hz

**Usable Low-Frequency Limit (10-dB-down point):**

45 Hz

**Half-Space Reference Efficiency:**  
3.0%

**Full range operation:**

**Long-Term Average Power-Handling Capacity per EIA Standard RS-426A, (see Power-Handling Capacity section):**

400 watts

**Biamp operation:**

**Recommended Crossover Frequency:**  
1,200 Hz

**Crossover Slopes,**

**Recommended:**

24 dB per octave

**Minimum:**

12 dB per octave

**Long-Term Average Power-Handling Capacity (see Power-Handling Test section),**

**Low Frequency**

(per EIA RS-426-A 1980):

400 watts

**High Frequency (per AES2-1984/ANSI S4.26-1984):**

60 watts

**Sensitivity (far-field SPL referred to 1 meter, 1-watt (2.83 volts) input, anechoic environment, band-limited pink noise),**

**Low Frequency (100-800 Hz):**

98 dB

**High Frequency (500-5,000 Hz):**

112 dB

**SPL at Full Power (far-field SPL at 1 watt/1 meter referred to full power, anechoic environment, band-limited**

**pink noise), Long-Term Average/Peak,**

**Low Frequency (100-1,200 Hz):**

124 dB/130 dB

**High Frequency (1,200-5,000 Hz):**

129 dB/135 dB

**Impedance,**

**Nominal (low frequency/high frequency):**

8 ohms/8 ohms

**Minimum (low frequency/ high frequency):**

6.0 ohms/6.3 ohms

**Nominal Efficiency,**

**Low Frequency: 3.0%**

**High Frequency: 25%**

**General operation:**

**Nominal Coverage Angle,**

**Horizontal: 60°**

**Vertical: 40°**

**Beamwidth (angle included by 6-dB-down points on polar responses, indicated one-third-octave bands of pink noise, see Figure 4)**

**2,500 to 16,000 Hz Horizontal:**

60° (+12°, -1°)

**500 to 16,000 Hz Vertical:**

40° (+2, -12°)

**Directivity Factor  $R_0(Q)$ , 500- to 16,000-Hz Median (see Figure 5):**

18.0 (+8.7, -8.5)

**Directivity Index  $D_i$ , 500- to 16,000-Hz Median (see Figure 5):**

12.6 dB (+9.4 dB, -9.3 dB)

**Distortion (4 W), 1% Rated Input**

**Power (on axis at 1 meter from system),**

**Second Harmonic,**

**100 Hz: 0.3%**

**1,000 Hz: 0.4%**

**10,000 Hz: 1.3%**

**Third Harmonic,**

**100 Hz: 0.1%**

**1,000 Hz: 0.4%**

**10,000 Hz: 0.6%**

**Distortion Response (40 W), 10%**

**Rated Input Power (on axis at 1 meter from system; see Figure 5),**

**Second Harmonic,**

**100 Hz: 0.7%**

**1,000 Hz: 1.0%**

**10,000 Hz: 10.0%**

**Third Harmonic,**

**100 Hz: 0.3%**

**1,000 Hz: 0.6%**

**10,000 Hz: 1.6%**

**Transducer Complement,**

**Low Frequency:**

DL15ST 381-mm (15-in.)

woofer in a vented enclosure

**High Frequency:**

HP64M 60° x 40° horn

mounted to DH2T compression driver

**Enclosure Tuning Frequency:**

55 Hz

**Enclosure Internal Volume:**

137 liters (4.84 cu. ft.)

**Driver Protection, High Frequency:**

(in biamp mode) blocking capacitor with 800-Hz corner frequency and 6-dB-per-octave slope; (in biamp and full-range mode) Solid-state self-resetting circuit (PRO™ circuit) drops input 6 dB

**Enclosure Materials and Color:**

White, 13-ply void-free Russian birch plywood covered with a neutral white textured paint

**Grille:**

Black, powder coated steel, removable

**Dimensions, overall (w/o rubber feet attached),**

**Height:**

822 mm (32.35 in.)

**Width at Front:**

476 mm (18.75 in.)

**Width at Rear:**

272 mm (10.71 in.)

**Depth:**

591 mm (23.25 in.)

**Side-Wall Draft Angle:**

10°

**Net Weight:**

35.5 kg (78 lb) (estimated)

**Shipping Weight:**

41.5 kg (91 lb) (estimated)

# Electro-Voice®

600 Cecil Street, Buchanan, MI 49107

616/695-6831, 616/695-1304 Fax

©EVI Audio 1997 • Litho in U.S.A.