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## MTH-2.5/22BT Manifold Technology® Mid-bass/High-Frequency Sound Reinforcement System

- 20° x 20° constant-directivity pattern
- Smaller MT trapezoidal enclosure
- Rotatable MB and HF horns
- High acoustic output, low distortion
- Manifold Technology® enables smaller and lighter loudspeaker arrays
- MT systems with different coverage patterns and output capabilities may be mixed and matched
- Unique rigging scheme for flexible array design and quick assembly
- Available without rigging hardware

### SPECIFICATIONS

**Frequency Response** (measured in far field, calculated to one meter on axis, swept sine wave, one watt into mid-bass section, anechoic environment; see Figure 1):

150-20,000 Hz

**Recommended Crossover Frequencies:**

160 Hz, 1,600 Hz

**Efficiency, MB/HF:**

16/25%

**Long-Term Average Power-Handling Capacity** (per EIA RS-426-A 1980; see Power Handling Section),

MB/HF: 600/150 watts

**Maximum Long-Term Average Mid-Band Acoustic Output:**

130 watts

**Sensitivity (SPL at one meter, indicated input power, anechoic environment, band-limited pink-noise signal), MB/HF,**

1/1 Watt: 105.5/116 dB

600/150 Watts: 133.5/138 dB

**Beamwidth** (angle included by 6-dB-down points on polar responses, indicated one-third-octave bands of pink noise; see Figures 3 and 4),

1,200-20,000 Hz, Horizontal:

20° (+25°, -0°)

1,200-20,000 Hz, Vertical:

20° (+25°, -5°)

**Directivity Factor  $R_0$  (Q)**, 1,200- to 20,000-Hz Median (see Figure 5):

45.0 (+58.5, -22.7)

**Directivity Index D<sub>i</sub>**, 1,200- to 20,000-Hz Median (see Figure 5):

17.0 dB (+2.5 dB, -4.0 dB)

**Distortion, 120 dB SPL at 1 Meter, Shaped Spectrum** (see Figure 6),

**Second Harmonic,**

200 Hz: 2.2%

1,000 Hz: 1.2%

3,000 Hz: 1.1%

10,000 Hz: 1.9%

**Third Harmonic,**

200 Hz: 0.8%

1,000 Hz: 1.1%

3,000 Hz: 0.2%

10,000 Hz: 0.8%

**Transducer Complement,**

**MB:** Two DL10X 10-inch drivers;

40° x 40° fiberglass horn

**HF:** Two DH1A variant compression

drivers; HP22S, 20° x 20° horn

**Impedance** (see Figures 2 & 7),

**Nominal, MB/HF:**

8/8 ohms

**Minimum, MB/HF:**

4.6/7.0 ohms

**Input Connections:**

Two Neutrik Speakon® NL4MP

**Enclosure Materials, Structural, All**

**Versions:**

14-ply birch plywood

**Finish:**

Black carpet

**Hanging:**

Two-point flying system (tracks accept New Haven NH 32102-1 fittings)

**Dimensions,**

**Height:** 91.4 cm (36.00 in.)

**Width at Front:** 57.2 cm (22.50 in.)

**Width at Back:** 28.3 cm (11.13 in.)

**Depth:** 75.9 cm (29.88 in.)

**Side Angles:** 15° each (30° wedge)

**Net Weight:**

93.0 kg (205 lb)

**Shipping Weight:**

97.5 kg (215 lb)

### DESCRIPTION

The Electro-Voice MTH-2.5/22BT mid-bass/high-frequency loudspeaker system is a member of the family of Manifold Technology® MT loudspeaker systems designed for high-level sound reinforcement in concert-sound touring and permanent-installation applications. The MTH-2.5/22BT is an active, two-way, horn-

loaded, 20° x 20° constant-directivity system with a trapezoidal enclosure, utilizing two high-power mid-bass drivers in the mid-bass frequency band and two high-power compression drivers in the high-frequency band. Both the mid-bass and high-frequency horns may be rotated in the enclosure. This configuration results in remarkably high acoustic output from a small enclosure. The MTH-2.5/22BT may be combined with other members of the MT-2 and MT-4 loudspeaker family. The combination of the MTH-2.5/22BT loudspeaker system and the MTL-2BT low-frequency loudspeaker system form the MT-2.5/22BT full-range system. There are two models in the MTH-2.5/22BT series: the MTH-2.5/22BTCF (carpeted finish with flying hardware), and the MTH-2.5/22BTC (carpeted finish without flying hardware).

The MTH-2.5/22BT mid-bass section utilizes two high-efficiency, low-distortion DL10X 10-inch mid-bass drivers coupled to a unique phase plug (U.S. Patent No. 4,718,517). An Aperiodic Enhancer™, this phase plug extends the upper-end response by making use of the fact that only the apex area of the cone near the voice coil is in motion at the higher frequencies, and automatically adjusts the acoustic loading to maximize acoustic output. The output of the four drivers is summed through a mid-bass manifold (U.S. Patent No. 4,923,021) and coupled to a 40° x 40° constant-directivity horn. The square mid-bass horn may be rotated to tailor the directionality of the system to match specific acoustic requirements.

The MTH-2.5/22BT high-frequency section contains two modified DH1Amt-16 compression drivers manifolded onto a 20° x 20° constant-directivity horn. The modified DH1Amt-16 (1.375-inch bolt-on version of the DH1A, with a modified magnetic structure) features a powerful motor structure and titanium diaphragm for

MTH-2.5/22BT SPECIFICATION GRAPHICS

FIGURE 1 — MTH-2.5/22BT Axial Frequency Response

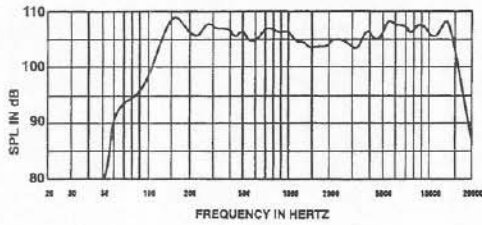


FIGURE 4 — MTH-2.5/22BT Beamwidth vs. Frequency

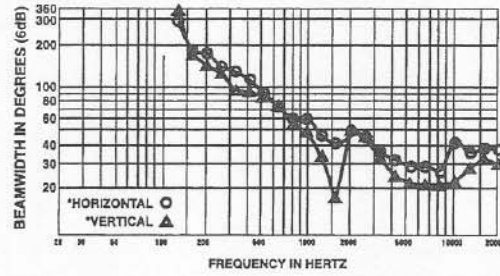


FIGURE 2 — MTH-2.5/22BT Impedance vs. Frequency

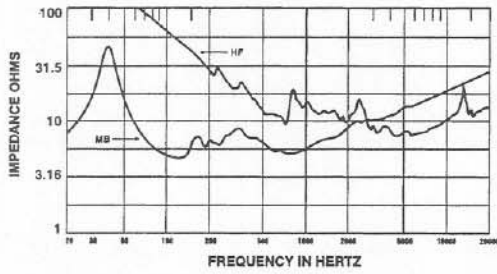


FIGURE 5 — MTH-2.5/22BT Directivity vs. Frequency

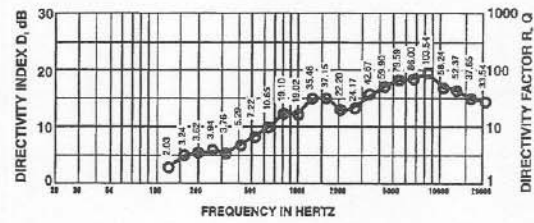


FIGURE 3 — MTH-2.5/22BT Polar Response

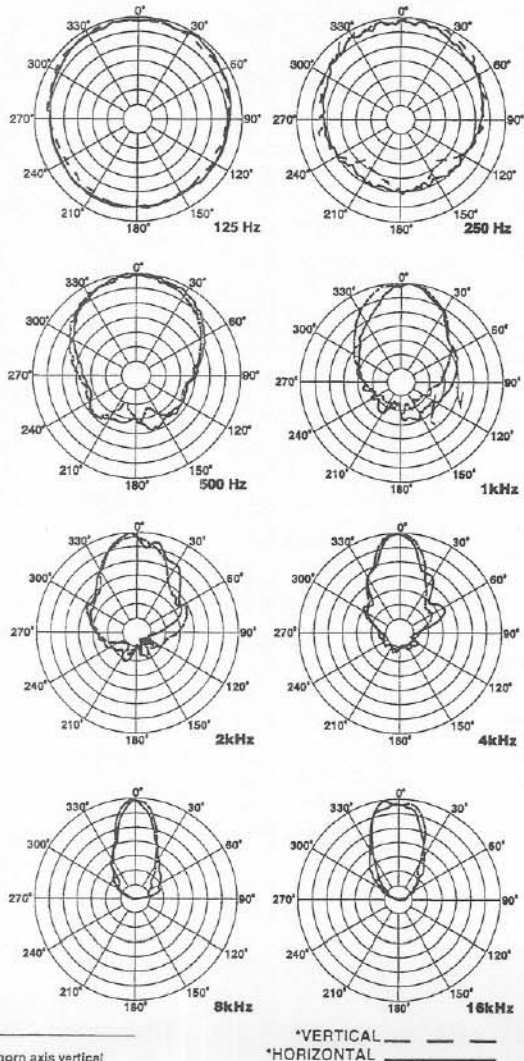


FIGURE 6 — MTH-2.5/22BT Harmonic Distortion

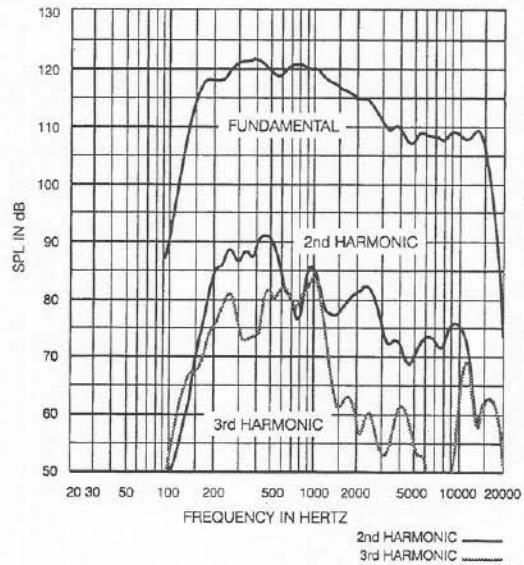
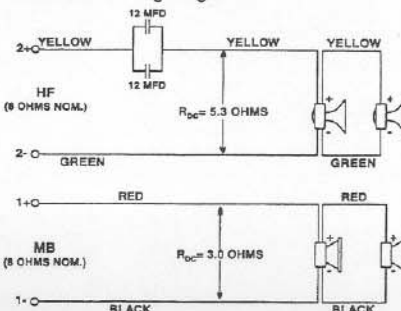


FIGURE 7 — MTH-2.5/22BT Wiring Diagram



maximum linear acoustic output, extended high-frequency response and accurate transient response. The outputs of the two drivers are summed through the MTA-22 high-frequency manifold (U.S. Patent No. 4,629,029) and coupled to an HP22S horn. The HP22S is a member of the HP TransPlanar™ horn series (U.S. Patent No. 4,685,532) that features beamwidth-control vanes as part of the waveguide to correct the very-high-frequency beamwidth anomalies that typically plague 2.0-inch-throat horns. The square high-frequency horns may be rotated to tailor the directionality of the system to match specific acoustic requirements.

All versions of the MTH-2.5/22BT are constructed of 0.75-inch thick, 14-ply birch plywood and are extremely well braced to survive the rigors of the road. The MTH-2.5/22BT (flying) and MTH-2.5/22BTCF (nonflying) systems are covered with black Ozite Super TNT carpeting, the most rugged in the industry. The MTH-2.5/22BT system incorporates a two-point flying system. All models feature a black nylon cloth grille.

#### APPLICATIONS

The MTH-2.5/22BT is ideal for any professional concert-sound touring or permanent-installation application requiring high sound pressure levels with low distortion from a compact enclosure. The Manifold Technology® design maximizes the acoustic output per enclosure frontal area, acoustic output per enclosure bulk volume, and acoustic output per enclosure weight of the loudspeaker system. This enables loudspeaker arrays to be constructed that are significantly smaller and lighter than would be obtainable with conventional loudspeaker systems. The MTH-2.5/22BT may be combined with other members of the MT-2 and MT-4 loudspeaker family, providing the array designer a variety of coverage angles, acoustic output and enclosure sizes from which to choose. For full-range applications, the MTH-2.5/22BT may be combined with any of the MTL-2B or MTL-4B low-frequency sound reinforcement systems. (The MTL-2BT is a low-frequency system with a trapezoidal enclosure that is dimensionally identical to the MTH-2.5/22BT.) For optimal acoustic performance of the MT loudspeaker systems, the Electro-Voice Dx34 digital electronic crossover/equalization/signal-delay/limiter unit is recommended.

Careful attention was paid to details to provide both the touring company and sound contractor a convenient and time-saving sound reinforcement package. The MTH-2.5/22BT dimensions were chosen for efficient truck pack and high-density array design. The systems may be stacked three high and four wide (or four high and three wide) in a standard truck box, enabling 12,000 watts of sound system to be accommodated in only three feet of truck-floor length. The two-point rigging system offers flexible array design and efficient assembly. To facilitate service, a variety of screws, washers and hex key wrenches are provided with each loudspeaker system. In addition, there are wiring diagram labels in convenient locations inside the enclosure.

#### FREQUENCY RESPONSE

The MTH-2.5/22BT frequency response (shown in Figure 1) was measured on axis in the far field

in an anechoic environment using a swept sine-wave signal. The Dx34 digital electronic unit was used to provide the necessary crossover filters, equalization and signal delay. No high-pass crossover filters were applied to the low end of the mid-bass section. One watt of power (2.83 volts rms at 500 Hz) was applied to the mid band of the mid-bass section. The sound pressure level was normalized for an equivalent one-meter distance.

#### DIRECTIVITY

The directional response of the MTH-2.5/22BT was measured in an anechoic environment at a distance of 6.1 meters (20 feet) using 1/3-octave filtered pink noise. A full spherical measurement system was used. The Dx34 digital electronic unit was used to provide the necessary crossover filters, equalization and signal delay. The polar response of the loudspeaker system at selected 1/3-octave frequencies is shown in Figure 3. The frequencies selected are fully representative of the polar response of the system. The beamwidth of the system utilizing the complete 1/3-octave polar data is shown in Figure 4. The directivity factor,  $R_0$  (Q), and directivity index,  $D_1$ , are shown in Figure 5. Complete AcoustaCADD™ data is available for the MTH-2.5/22BT loudspeaker system.

#### DISTORTION

Distortion for the MTH-2.5/22BT (shown in Figure 6) was measured on axis in the far field in an anechoic environment with an input signal that would result in a sound pressure level of 120 dB at one meter. The Dx34 digital electronic unit was used to provide the necessary crossover filters, equalization and signal delay. A 24-dB-per-octave high-pass crossover filter at 160 Hz was applied to the low end of the mid-bass section. A frequency spectrum typical of close-miked rock music was employed. The sound pressure level was normalized for an equivalent one-meter distance. Plots of second- and third-harmonic distortion are shown referenced to the fundamental.

#### POWER-HANDLING CAPACITY

Electro-Voice components and systems are manufactured to exacting standards to ensure reliability in continuous use in arduous real-life conditions. Besides utilizing industry-standard power tests, extreme in-house power tests which push the performance boundaries of the loudspeakers are also performed for an extra measure of reliability. The MT systems are rated per the EIA Loudspeaker Power Rating, Full Range (ANSI/EIA RS-426-A 1980), which uses a shaped random-noise signal to simulate typical music to test the mechanical and thermal capabilities of the loudspeakers. The Dx34 digital electronic unit was used to provide the necessary crossover filters and equalization during power testing. Specifically, the MTH-2.5/22BT passes the EIA RS-426-A 1980 power test with the following test parameters:

##### Mid-bass Section:

$P_{E(MAX)}$ :	600 watts
Test Voltages:	45.5 volts rms 91.0 volts peak
$R_{SR}$ (1.15 x $R_E$ ):	3.45 ohms each input

##### High-Frequency Section:

$P_{E(MAX)}$ :	150 watts
Test Voltages:	30.2 volts rms 60.4 volts peak

$$R_{SR} (1.15 \times R_E): 6.10 \text{ ohms}$$

#### CROSSOVER, EQ AND SIGNAL DELAY

The usable frequency ranges of the individual MTH-2.5/22BT sections are 150-2,000 Hz for the mid-bass section and 1,200-20,000 Hz for the high-frequency section. Crossover frequencies of 160 and 1,600 Hz with 24-dB-per-octave slopes are recommended. For full-range applications, one of the MTL-2B low-frequency loudspeaker systems is recommended for use with the MTH-2.5/22BT. For optimal acoustic performance, the Electro-Voice Dx34 digital electronic crossover/equalization/signal-delay unit is recommended.

The Dx34 is a programmable, two-in/four-out digital electronic unit which may be configured for stereo two-way, mono three-way plus subwoofer, or mono four-way operation. Each output section includes crossover filters, equalization, limiting, signal delay, polarity and gain adjustment; the parameters of which all may be programmed and stored by the user. In the mono three-way configuration, the Dx34 includes a factory preset for optimal performance of the MTH-2.5/22BT and MTL-2BT systems combined that utilizes Linkwitz-Riley 24-dB-per-octave crossover filters at 160 and 1,600 Hz. Each output section has equalization specifically matched to the loudspeaker system, and signal delay set to achieve zero lobing error and time alignment between frequency bands. In addition, the output levels of each frequency band are set so that, with the output level controls set in the zero dB position, the loudspeaker system will have a flat frequency response in an anechoic environment when used with amplifiers having identical gain.

#### ELECTRICAL CONNECTION AND SYSTEM WIRING

Electrical connections to the MTH-2.5/22BT are made on the back of the enclosure via a 4-pin connector. There are two connectors on the input panel to allow paralleling of other MTH-2.5/22BT systems. The Neutrik Speakon® NL4MPR is used for both connections. One mating Neutrik Speakon® NL4FC cable-end connector is supplied with each loudspeaker system. The pin assignments are as follows:

Pin 1+:	MB (+)	Pin 1-:	MB (-)
Pin 2+:	HF (+)	Pin 2-:	HF (-)

The mid-bass section has two 8-ohm drivers; however, the acoustic loading of the phase plugs and horn increases their electrical impedance to a nominal 16 ohms each. These two drivers are wired in parallel, resulting in a single 8-ohm nominal load connected to Pins 1+/1-. The high-frequency section has two 16-ohm drivers wired in parallel, resulting in a single 8-ohm nominal load connected to Pins 2+/2-. A wiring diagram of the loudspeaker system is shown in Figure 7. The electrical impedance versus frequency is shown in Figure 2.

#### FLYING THE MT SYSTEMS

A manual entitled the *MT Flying Manual* is available from Electro-Voice, and is included with each flying MT loudspeaker system. A brief introductory overview is included here. The *MT Flying Manual* should be consulted for complete structural specifications and detailed information on safely suspending and using the MT systems.



The MTH-2.5/22BTCF (carpeted) is the version of the MTH-2.5/22BT loudspeaker system that includes flying hardware. The MT systems incorporate a unique two-point flying system that permits a wide range of vertical angle adjustment, and offers maximum flexibility in array design and implementation for both touring sound and permanent installations. The quick-release, aircraft L-track-type hardware design allows arrays of loudspeakers to be assembled (and disassembled) very quickly, and offers such flexibility in the vertical angling of cabinets that pull-up points are usually unnecessary. Furthermore, all of the flying MT-2 and MT-4 loudspeaker models include the same rigging hardware, allowing the different models to be mixed as necessary throughout an array.

The rigging track accepts New Haven NH 32102-1 type double-stud ring fittings. Individual rigging points have typical break-strength ratings of 3,750-4,000 pounds, which translates to working-load ratings of 750-800 pounds for a 5:1 safety factor. (Consult the *MT Flying Manual* for specific structural strength ratings and limitations.) The enclosures may be oriented with the rigging track on the sides of the enclosure, or on the top and bottom, and may be daisy chained together as long as the safety factor is 5:1 or greater, and local regulations are met. Electro-Voice offers a line of flying-hardware accessories for use with the MT loudspeaker systems.

**CAUTION:** The MT loudspeaker systems should be suspended overhead only in accordance with the procedures and limitations specified in the *MT Flying Manual* and manual update notices.

#### ROTATING THE HORNS

To rotate the mid-bass and high-frequency horns, turn the enclosure face up and remove the grille using a #2 Phillips screwdriver. Remove the screws securing the two horns using a 1/8-inch hex-key wrench, lift the horns and rotate 90°. Lower the horns back into the enclosure, making sure that the rear flanges of the horns are correctly seated. Special care must be taken to locate the rear flanges of the horns into the sealing gaskets. Replace all screws that secure the front flange of the horns. The screws should be firmly tightened, but care should be taken not to overtighten.

#### FIELD SERVICE

In the unlikely event that the MTH-2.5/22BT should require service, both the mid-bass and high-frequency drivers can be accessed from the front of the enclosure by removing the grille using a #2 Phillips screwdriver, and the horns using a 1/8-inch hex-key wrench. The mid-bass manifold assembly can be removed from the enclosure after removing the two screws on the back of the enclosure (below the input panel), and the drivers can be unbolted from the mid-bass manifold using a 5/32-inch hex-key wrench. There is a wiring diagram label for the mid-bass section located on the bottom of the enclosure near the drivers. The high-frequency drivers can be unbolted from the manifold using a 5/32-inch hex-key wrench. In addition, the high-frequency-driver diaphragms can be replaced through the top handle holes using a #2 Phillips screwdriver. There is a wiring diagram label for the high-frequency section located on

the HF-driver support shelf near the drivers. Note that, when replacing the mid-bass and high-frequency horns, special care must be taken to locate the rear flanges of the horns into the sealing gaskets. The screws securing the horns should be firmly tightened, but not overtightened. As a service convenience, a hardware kit that includes 1/8-inch and 5/32-inch hex-key wrenches and an assortment of spare screws and washers are included with every MTH-2.5/22BT loudspeaker system.

Failure of the 10-inch mid-bass driver will require the entire driver to be returned to an authorized Electro-Voice service center for repair. A high-frequency-driver failure can be repaired in the field by replacing the diaphragm assembly; or, if desired, the entire driver can be returned to an authorized service center for repair. The following service parts are available from the Service Department in Buchanan, Michigan:

MTH-2.5/22BT Service Data Sheet: #532484  
HF: #81138-XX 16-ohm DH1A Diaphragm Kit  
#827-1431 Modified DH1 Amt-16 Driver  
MB: #810-1491 DL10X Driver

#### ARCHITECTS' AND ENGINEERS' SPECIFICATIONS

The loudspeaker system shall be a two-way active mid-bass/high-frequency system. The mid-bass section shall operate from 150-2,000 Hz with a sensitivity of 105.5 dB for one watt at one meter, and consist of two 10-inch cone drivers, each individually coupled to a mid-bass phase plug, then collectively manifolded and coupled to a 40° x 40° constant-directivity horn, have a total input impedance of 8 ohms, and have a power rating of 600 watts as per ANSI/EIA RS-426-A 1980. The high-frequency section shall operate from 1,200-20,000 Hz with a sensitivity of 116 dB for one watt at one meter, and consist of two compression drivers collectively manifolded and coupled to a 20° x 20° constant-directivity horn, have a total input impedance of 8 ohms, and have a power rating of 150 watts as per ANSI/EIA RS-426-A 1980. The overall system shall have a uniform on-axis frequency response from 150-20,000 Hz, and shall have a nominal horizontal beamwidth of 20° and a nominal vertical beamwidth of 20°. The loudspeaker system shall have a trapezoidal enclosure with 15° angled sides forming a 30° wedge, shall be constructed from 0.75-inch thick, 14-ply birch plywood, shall be finished with a black carpet, shall have a black nylon grille, and shall have a two-point rigging system that will accept New Haven NH 32102-1 type double-stud ring fittings (if applicable). The loudspeaker enclosure shall be 91.4 cm (36.00 in.) high, 57.2 cm (22.50 in.) wide at the front, 28.3 cm (11.13 in.) wide at the back and 75.9 cm (29.88 in.) deep, and shall weigh 93.0 kg (205 lb). The loudspeaker system shall be the Electro-Voice MTH-2.5/22BT (MTH-2.5/22BTCF or MTH-2.5/22BTC).

#### UNIFORM 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). **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 or malfunctions such as cone and/or coil damage resulting from improperly designed enclosures. 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.

**Electro-Voice Flying Hardware** (including enclosure-mounted hardware and rigging accessories) is guaranteed against malfunction due to defects in materials or workmanship for a period of one (1) year from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

**Electro-Voice Accessories** are guaranteed against malfunction due to defects in materials or workmanship for a period of one (1) year 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.



**ELECTRO-VOICE** a MARK IV company **600 Cecil Street, Buchanan, Michigan 49107**

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