

MH4020C Constant-Directivity Manifold Technology® Horn System

- For high-performance speech and music systems in large venues, indoors and out
- High acoustic output over a wide bandwidth (100-20,000 Hz)
- Includes HP420 high-frequency horn and mounting brackets
- Use with EV 2-inch high-frequency drivers in single or manifolded configurations (not included)
- Midrange covered by four 10-inch DL10X-SH drivers manifolded on a 40° x 20° constant-directivity horn.
- Response to 100 Hz eliminates supplemental low-frequency systems in many applications
- Large mouth has high directivity at low frequencies
- Increased intelligibility

SPECIFICATIONS:

The following specifications are in accordance with or exceed the AES Recommended Practice for Specifications of Loudspeaker Components Used in Professional Audio and Sound Reinforcement Systems (AES2-1984; ANSI S4.26-1984).

Frequency Response, Measured in Far Field, Calculated to One Watt at One Meter on Axis, Swept One-Third-Octave Pink Noise, Anechoic Environment,

Coaxial Version (see Figure 1):

100-20,000 Hz

Noncoaxial Version (see Figure 2):

100-4,000 Hz

Low-Frequency 3-dB-Down Point:

150 Hz

Usable Low-Frequency Limit (10-dB-Down Point):

100 Hz

Average Efficiency:

25%

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

1,200 watts

Maximum Long-Term Mid-Band Acoustic Output:

300 watts

Sound Pressure Level at 1 Meter, 2.83 Volts Input, Anechoic Environment, Band-Limited Pink-Noise Signal:

109 dB

Dispersion Angle Included by 6-dB-Down Points on Polar Responses, Indicated One-Third-Octave Bands of Pink Noise, 350 Hz to 20,000 Hz, Horizontal (see Figure 6):

40° (+20°, -5°)

350 Hz to 20,000 Hz, Vertical (see Figure 6):

20° (+30°, -5°)

Directivity Factor R_0 (Q), 500-to-20,000-Hz Median (see Figure 7):

52.0

Directivity Index D_i (10 log R_0), 500-to-20,000-Hz Median (see Figure 7):

17.1 dB (+2.8, -4.7 dB)

Transducer Complement:

Four DL10X-SH manifold drivers with Kevlar® epoxy composite cones¹

Mid-Bass Impedance, Drivers in Two Sets of Paralleled Pairs, Nominal/Minimum (see Connections section):

8.0/5.9 ohms per pair

Polarity:

A positive voltage applied to the positive (+) sides of the DL10X-SH input cables produces a positive acoustic pressure in the horn throat

Construction,

Main Horn Bell and Driver Back Covers:

One-piece black polyester and fiberglass laminate with composite reinforcement

Hanging Hardware:

Integral black 10-gauge polyester powder-coated steel

Mechanical Driver Protection:

Integral grille/protection screen built into the manifold chamber

Coaxial Horn Supplied (mounted in horn mouth on two steel rails):

HP420

High-Frequency Drivers and Driver-Manifold Systems for Coaxial HP940 Horn (contractor selected and installed):

DH1A, DH1A/2MT, DH2A, DH2A/4MT, N/DYM®1 and N/DYM®1/2MT

Input Connections,

DL10X-SH:

Heavy-duty 12-AWG oxygen-free copper cable, unterminated, in exterior grade UV-stabilized flexible conduit

High-Frequency Driver(s):

Heavy-duty 12-AWG oxygen-free copper cable, unterminated, in exterior grade UV-stabilized flexible conduit

Recommended Crossover,

Frequency:

1,600 Hz

Slope:

24 dB per octave

Recommended High-Frequency Driver

Delay:

2.96 msec ±0.3 ms

Dimensions (see Figure 3):

Height: 150.0 cm (59.0 in.)

Width: 99.1 cm (39.0 in.)

Length: 188.0 cm (73.9 in.)

Packed Length: 203.0 cm (80.0 in.)

Weight:

108 kg (237 lb)²

Shipping Weight:

113 kg (248 lb)

Packing:

Wooden pallet

DESCRIPTION

The Electro-Voice MH4020C is a wide-range, 40° x 20° mid-bass/high-frequency constant-directivity horn-and-driver system. With a contractor-installed high-frequency driver, it covers the frequency range of 100 Hz to 20,000 Hz with minimal equalization. The MH4020C combines two world-pioneering concepts developed by Electro-Voice: constant-directivity horns and Manifold Technology®. The MH4020C's potentially high acoustic output, stable directional characteristics, and extended low-fre-

1. Kevlar® is a registered trademark of DuPont.

2. Without high-frequency drivers (see Installation section).

FIGURE 1 — Axial Frequency Response
(1,600-Hz crossover, 2.96-ms delay,
with broadband equalization)

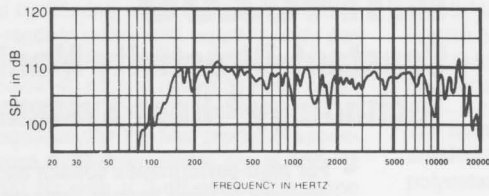


FIGURE 2 — Axial Frequency Response,
Mid-Band Section Only (1 W/1 m)

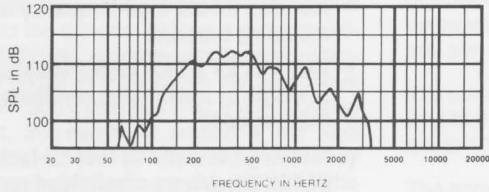


FIGURE 3 — Dimensions

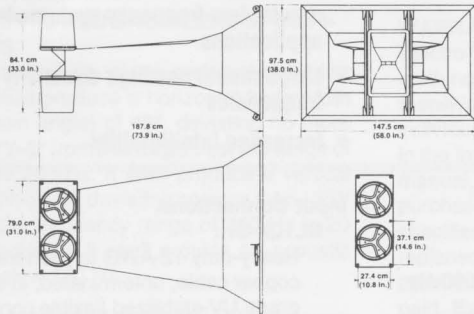


FIGURE 4 — Impedance Response
(one paralleled pair of drivers)

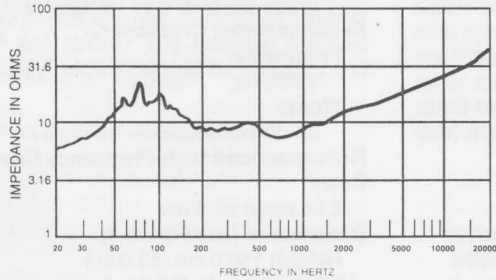


FIGURE 5 — Distortion Response, 10% Power

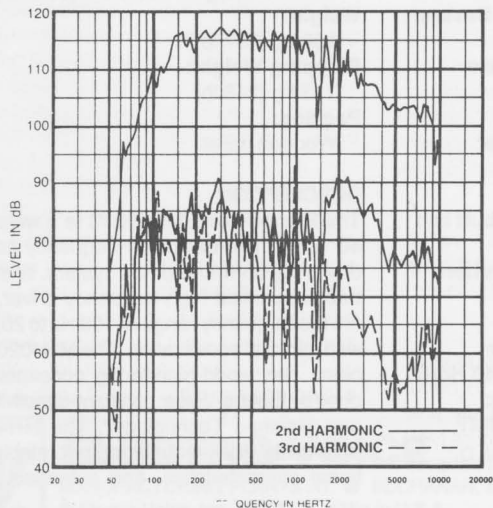


FIGURE 6 — Beamwidth Response

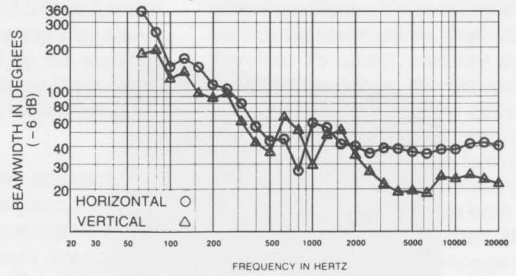


FIGURE 7 — Directivity Response

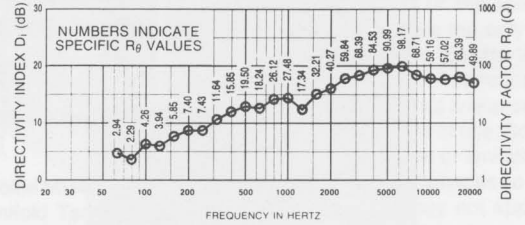


FIGURE 8 — Polar Response

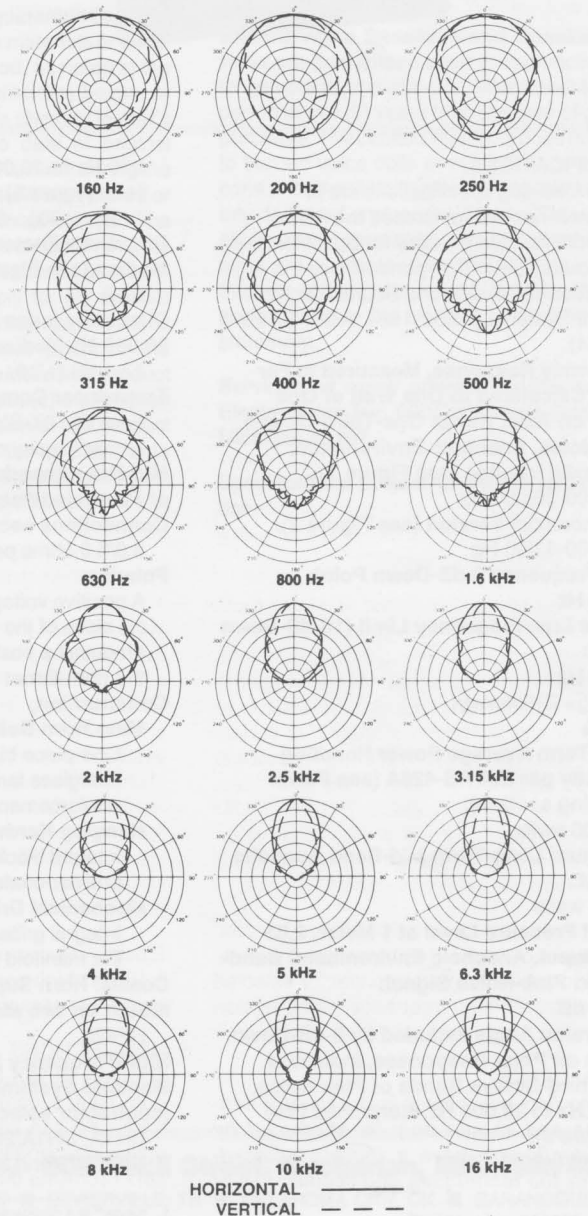
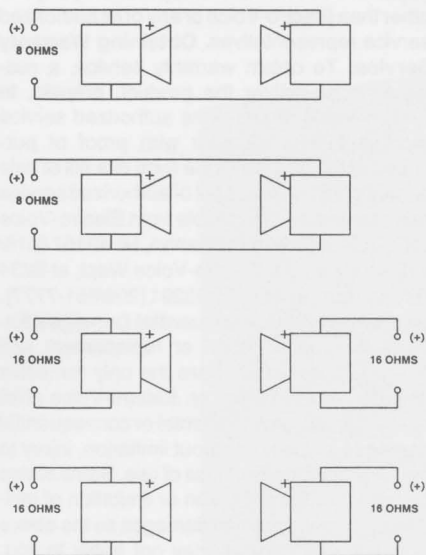


FIGURE 9 — Wiring Options



quency performance make it highly suitable for music and speech reinforcement in large indoor and outdoor venues.

At the heart of the MH4020C are four DL10X-SH 10-inch water-resistant drivers (U.S. Patent No. 4,547,632). The driver has been specially developed for the MH series of horns. It incorporates a unique diaphragm construction of Kevlar® and epoxy.¹ This combination of high-technology materials produces a diaphragm with a strength-to-weight ratio on the order of twice that of conventional materials. Each driver is integrally mounted to the fiberglass horn bell via a heavy-duty mounting bracket and proprietary Aperiodic Enhancer™ phase plug (U.S. Patent No. 4,718,517). The Aperiodic Enhancer™ is responsible for the extended high-frequency response of the MH4020C's mid-band section. It makes use of the fact that only the apex of the cone (near the voice coil) is in motion at higher frequencies, and automatically adjusts the acoustic loading to maximize acoustic output.

Manifolding allows the output of two or more drivers to be summed without the usual detrimental interference problems in the pass-band. There are a number of additional advantages to manifolding, including reduced distortion (see Figure 5) and increased efficiency at certain frequencies. There is also redundancy built into the system; in the unlikely event of a driver failure, one remains available. The DLX10-SH drivers are contained and sealed within fiberglass covers optimally tuned for maximum low-end performance and displacement control.

The frequencies above 1,600 Hz are handled by the Electro-Voice HP420 constant-directivity horn, in combination with a contractor-selected and -installed high-frequency compression driver.

INSTALLATION

Suspending any object is potentially dangerous and should only be attempted by individuals who have a thorough knowledge of the techniques and regulations of

rigging items overhead. Electro-Voice strongly recommends that the MH4020C be suspended in accordance with all current national, federal, state and local regulations. It is the responsibility of the installer to ensure that the MH4020C is safely installed in accordance with all such regulations.

The MH4020C is designed to be suspended safely and easily. The integral mounting brackets at the rear should be used as the main structural hanging location. There are also two structural hanging locations on the rear of the front flange to aim and stabilize the device. Electro-Voice recommends that each MH4020C be independently supported. The MH4020C can be easily suspended with either the 40° or the 20° coverage pattern horizontal. Note: the contractor-selected high-frequency drivers contribute to the overall weight of the MH4020C. In the worst case (DH2A/4MT) an additional 48 lb is added. This should be taken into consideration when suspending the system.

Electrical connections can be made using standard electrical boxes or weather-resistant boxes if used in adverse conditions. The mounting brackets incorporate a predrilled flange to aid electrical box mounting.

If the MH4020C is suspended, it is recommended that the unit be inspected at least once a year. If any sign of weakness is detected, remedial action should be taken immediately.

EQUALIZATION AND SUBPASSBAND PROTECTION

The MH4020C's mid-bass section exhibits typical constant-directivity horn characteristics, i.e., roll-off at the frequency extremes. At higher frequencies, the roll-off approximately matches the power-response of the DL10X-SH (6 dB per octave). At lower frequencies, directivity is lost when the mouth is no longer large enough to maintain directional control. These two consequences can be observed in the "humped" response in Figure 2. Equalization can be easily applied with a graphic equalizer to give a flat response.

The high-frequency compression driver can be equalized with a graphic equalizer or an EQ module inserted into the Electro-Voice XEQ-2 (two-way) or XEQ-3 (two-way or three-way) active crossover/equalizer. The EQ module should be selected to suit the particular compression driver and the HP420 horn (see relevant data sheet). Because of its use in large arenas, where air loss can be significant, it is recommended that the system be equalized "on site" for optimum results. The XEQ-3 and the mid-bass EQ module from the EQMT-2 can be used to provide a good starting point for the equalization.

Electro-Voice strongly recommends the use of a 100-Hz high-pass filter to protect the drivers from unnecessary excursion and thermal stress.

CONNECTIONS

The four DL10X-SH drivers in the MH4020C horn have a nominal impedance of 16 ohms each and can be accessed individually and driven independently. However, it is more typical to combine the drivers. Figure 9 illustrates

some different combinations. It is particularly important to bear in mind the impedance of any cabling and specifications of the amplifier before selecting a specific combination. Whatever the combination selected, the polarity of the drivers must be considered (see Figure 9 and Polarity of the DL10X-SH Drivers section).

DIRECTIVITY

The axial directivity factor R_0 of the MH4020C was computed at each of the one-third-octave center frequencies over the frequency range noted from the horizontal/vertical polars shown in Figure 7. Directivity index (D_i) was taken over the same frequency range.

BEAMWIDTH

Plots of the MH4020C's 6-dB-down total included beamwidth angles are shown in Figure 6 for each of the one-third-octave center frequencies noted.

POLAR RESPONSE

The directional characteristics of the MH4020C were obtained by selecting the horizontal and vertical details from a full set of polar data measured in EV's large anechoic chamber. The measurement microphone was placed 6.1 m (20 ft) from the center of rotation of the horn which, in turn, was 0.94 m (3.08 ft) behind the mouth of the horn. See Figure 8.

POLARITY OF THE DL10X-SH DRIVERS

For Manifold Technology® to operate correctly, the drivers must be operated "in phase." In other words, for parallel connection, the DL10X-SH's must be connected so the negative terminals of the drivers are connected together, and the positive terminals are connected together.

SERVICE

In the unlikely event the MH4020C requires service, each DL10X-SH easily can be replaced or serviced by removing the back cover and then removing the driver. A service data sheet is available from Electro-Voice.

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. A random-noise input signal is used because it contains many frequencies simultaneously, just like real voice or instrument program. The signal contains more energy at extremely high and low frequencies than typical actual program, adding an extra margin of reliability. The test combines 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 average, just like actual program. The long-term average level stresses the speaker thermally (heat). The instantaneous peaks test mechanical reliability (cone 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. The test performed lasts for eight hours, adding another extra level of confidence.

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Specifically, the MH4020C mid-band section is designed to withstand the power test described in EIA Standard RS-426A. The EIA test spectrum is applied for eight hours. The spectrum is obtained by filtering white noise (a particular type of random noise with equal energy per bandwidth). The filter applies 6-dB-per-octave slopes below 40 Hz and above 318 Hz. When measured with a one-third-octave constant-percentage analyzer, this 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 then further filtered with an 80-Hz, 12-dB-per-octave high-pass filter to prevent out-of-passband displacement. The amplifier is set to provide 1,200 watts into the 6.9-ohm EIA equivalent impedance (91.0 volts). Amplifier clipping sets instantaneous peaks at 6 dB above the continuous power or 4,800 watts peak (182.0 volts). During this test, the mid-band section is not high passed at 1,600 Hz. The high-frequency section's power handling is dependent on the selected driver combination. Please refer to the relevant engineering data sheet.

ARCHITECTS AND ENGINEERS SPECIFICATIONS

The horn shall be of the constant-directivity type. It shall produce a horizontal beamwidth (6-dB-down angle) of 40°, deviating no more than +20°/-5° from this angle over the range of 350 Hz to 20 kHz. It shall produce a vertical beamwidth of 20°, deviating no more than +30°/-5° over the frequency range of 350 Hz to 20 kHz. In addition, it shall provide an acoustic load to below 100 Hz.

The MH4020C mid-bass section shall operate over the range of 100 Hz to 4,000 Hz, with a recommended crossover frequency of 1,600 Hz, and be driven by four 10-inch, weather-resistant drivers with high-technology cones of Kevlar® and epoxy.¹ The patented Manifold Technology® technique shall be exploited and

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result in a power-handling capacity of 1,200 watts per EIA Standard RS-426A. The average axial sensitivity shall be 109 dB SPL at 1 meter with 2.83 volts applied. The frequencies above 1,600 Hz shall be produced by the supplied Electro-Voice HP420 TransPlanar™ constant-directivity horn with user-selectable driver combinations.

The horn bell manifold chamber and back covers shall be constructed of fiberglass, foam and polyester resin. Two steel mounting rails shall be provided to coaxially mount the Electro-Voice HP420 horn. The horn shall have an integral rear mounting bracket made of black powder-coated 10-gauge steel. Brackets shall be provided at the front of the horn to stabilize and aim the MH4020C.

The horn shall be 150.0 cm (59.0 in.) high, 99.1 cm (39.0 in.) wide, 188.0 cm (80.0 in.) long and weigh 108 kg (237 lb).

The horn shall be the Electro-Voice MH4020C coaxial constant-directivity Manifold Technology® horn.

WARRANTY (Limited)

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) and/or Electro-Voice West, at 8234 Doe Avenue, Visalia, CA 93291 (209/651-7777). **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.

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

Specifications subject to change without notice.



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

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