

# PRO-12A

## Wide-Range Two-Way Speaker

### SPECIFICATIONS

Frequency Response, Front-Mounted in Recommended Sealed Enclosure, 10 Feet on Axis, Anechoic Environment, Swept One-Third Octave Random Noise (See Figure 1)

- ± 3 dB — 70-8000 Hz
- ± 6 dB — 50-14,000 Hz

Dispersion Angle Included by 6-dB-Down Points, Front-Mounted in Recommended Sealed Enclosure, 10 Foot Microphone Distance, Anechoic Environment, Octave Bands of Random Noise

- 500-4000 Hz Octave Bands  
134° ± 8°
- 8000-16000 Hz Octave Bands  
65° ± 9°

Sound Pressure Level, Anechoic Environment, Average, 100-5000 Hz Octave Bands

- 10 Feet, 1 watt into Nominal Impedance  
88 dB
- 4 Feet, 30 watts into Nominal Impedance  
111 dB

Long-Term Average Power Capacity, Shaped Random Noise Input (see Power Handling Capacity Section)

- 30 watts (15.5 volts RMS applied to nominal impedance)

Impedance (see Figure 5)

- Nominal  
8 ohms
- Minimum  
6.1 ohms

Thiele-Small Driver Parameters, Nominal (see Special Note on Low-Frequency Performance section)

- $f_s$   
Free-Air Resonance Frequency  
50 Hz

- $Q_{ES}$   
Electro-Magnetic Q at  $f_s$   
0.65

- $Q_{MS}$   
Mechanical Q at  $f_s$   
8.0

- $Q_{TS}$   
Total Q at  $f_s$   $\left[ \frac{Q_{ES} Q_{MS}}{Q_{ES} + Q_{MS}} \right]$   
0.60

- $V_{AS}$   
Volume of Air Having Same Acoustic Compliance as Driver Suspension  
3.9 ft<sup>3</sup>

- $\eta_o$   
Half-Space Reference Efficiency  
2.0%

- $V_D$   
Peak Displacement Volume of Diaphragm (=  $S_D \times x_{max}$ )  
9.4 in<sup>3</sup>

- $S_D$   
Effective Diaphragm Area  
78.5 in<sup>2</sup>

- $x_{max}$   
Peak Linear Displacement of Diaphragm  
0.12 in

- $P_{E(max)}$   
Thermally Limited Maximum Input Power  
30 watts

- $R_E$   
DC Resistance of Voice Coil  
5.5 ohms

### Dimensions

- Overall Diameter  
12-3/16 in (30.95 cm)
- Overall Depth  
6 in (15.24 cm)
- Depth Behind Mounting Baffle, Front Mounted  
5-3/8 in (13.65 cm)
- Mounting Bolt Circle  
11-9/16 in (29.4 cm)
- Mounting Hole Diameter, Eight Evenly Spaced Holes  
9/32 in (0.71 cm)
- Baffle Opening Diameter, Front or Rear Mounting  
11 in (27.9 cm)

- Net Weight  
11.5 lb (5.2 kg)

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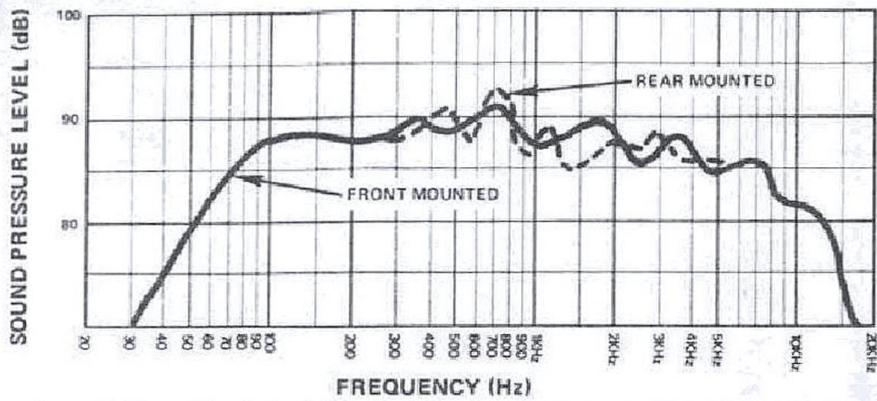


FIGURE 1 — On-Axis Frequency Response Using 1 Watt or 2.8 Volts RMS of Swept One-Third Octave Random Noise Under Anechoic Conditions in a 2.5 Cu. Ft. (3/4 in. Ply) Box with Test Mike at 10 Ft.

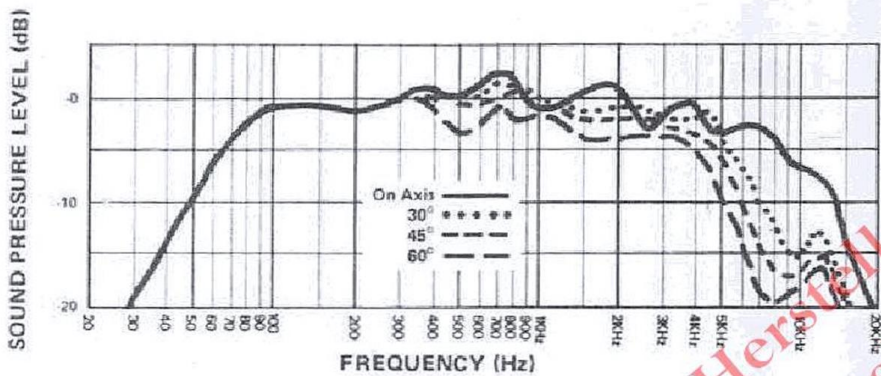


FIGURE 2 — Frequency Response at various Angles Under Anechoic Conditions Using Swept One-Third Octave Random Noise in a 2.5 Cu.Ft. Box with Test Mike at 10 Ft.

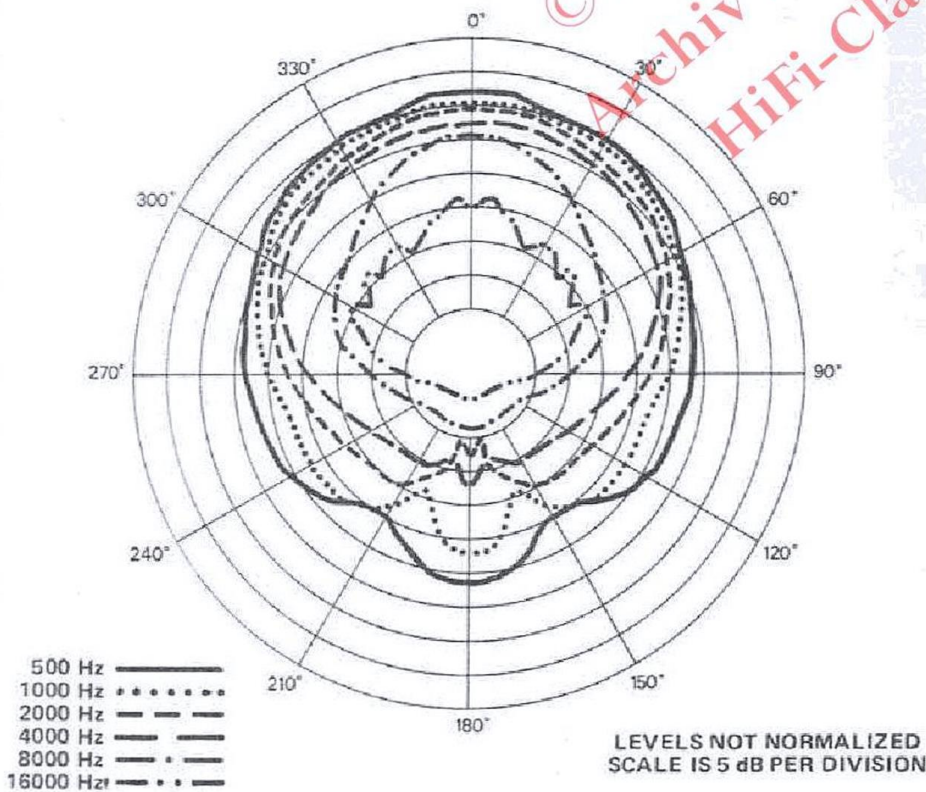


FIGURE 3 — Polar Response Using 4 Volts RMS of Octave Band-Limited Pink Noise Under Anechoic Conditions in a 2.5 Cu. Ft. Box with Test Mike at 10 Ft.

## DESCRIPTION

The PRO-12A is a 2-way, 12-inch speaker designed for professional high-level, high-quality distributed sound systems. With its newly improved frame, the speaker may now be front or rear mounted without the need of an adapter.

The PRO-12A fills an important void between low-cost 8-inch speakers, suitable only for short throws, and the expensive 15-inch speakers previously required for long throws from 40-foot ceilings. Yet the PRO-12A has a substantially smoother frequency response and a more uniform dispersion at mid and high frequencies than any other speakers, of its type, available.

## SYSTEM LAYOUT

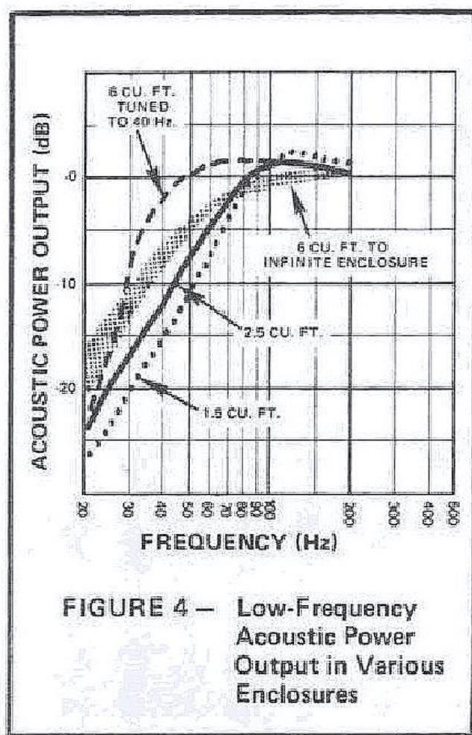
The PRO-12A was designed to provide maximum sound pressure levels in the direct field of approximately 95 to 100 dB when used in distributed systems installed in ceilings ranging from 20 to 30 feet in height. Polar response has circular symmetry and sufficient beam width at 10 kHz so that speaker spacings nearly equal to ceiling height may be used with excellent uniformity of high-frequency response, even along diagonal lines between speaker centers (note Figure 3). Off-axis frequency response at different angles may be noted in Figure 2.

The directional characteristics of the PRO-12A in the recommended 2.5 cubic feet sealed enclosure were measured by running a set of polar responses, in E-V's large anechoic chamber, at each octave center frequency. The test signal was octave bandwidth-limited pseudo-random pink noise centered at the indicated frequencies in Figure 3.

## RECOMMENDED ENCLOSURES

### Sealed

It has been determined that for the best combination of low-frequency response and sealed-box size, a 2.5 cubic foot enclosure should be used. A larger enclosure will provide additional low-frequency response below 70 Hz at the sacrifice of response in the 70 to 200 Hz range with no increase in maximum acoustic output at any frequency (note Figure 4). Reduced low-frequency response and bass peaking will result in using a smaller enclosure as indicated on the same graph.



**FIGURE 4 — Low-Frequency Acoustic Power Output in Various Enclosures**

#### Vented Systems

If additional low-frequency response is desired with a given box size, a vented box may be used. A 2.5 cubic foot vented enclosure tuned to 35 Hz will have essentially the same low-frequency response as a 6 cubic foot sealed enclosure. Box tuning may be accomplished by using a vent with an area of 6.6 square inches and a length of 3.9 inches.

An additional 3/4 of an octave of low-frequency response may be realized by tuning a 6 cubic foot enclosure to 40 Hz (note Figure 4). Tuning may be accomplished by using a vent with a depth of 0.75 inches and an area of 14 square inches.

#### POWER HANDLING CAPACITY

In an effort to provide a meaningful power rating, a filter was designed to shape random noise to a frequency spectrum that is far more demanding at the frequency extremes than voice or conventional music materials, yet is not as unrealistically demanding as unmodified white noise. It was determined that the PRO-12A could handle 30 watts of this shaped random noise (pink noise rolled off at 12 dB per octave below 40 Hz and 6 dB per octave above 4 kHz).

Sine-wave power handling capacity at various frequency segments should be examined if unusual program material with substantial high-frequency energy is anticipated. The sine-wave power

handling capacity of the PRO-12A is 30 watts from 50 to 900 Hz, 20 watts from 900 to 2000 Hz, and 10 watts from 2000 to 20,000 Hz. For peaks of 10 millisecond or less duration, the PRO-12A will handle ten times (10 dB) the long-term rating (300 watts from 50 to 900 Hz, 200 watts from 900 to 2000 Hz, and 100 watts from 2000 to 20,000 Hz).

#### SPEAKER MOUNTING

For a more uniform frequency response, front mounting is recommended if the speaker baffle material is in excess of 0.25 inches (note Figure 1). The difference in response is reduced above 1000 Hz as one moves off axis.

For front mounting, the bolts must have fillister heads to seat down in the recess of the speaker frame. Tee-nuts are recommended to facilitate mounting. Sealing is accomplished by using the adhesive-backed foam gasket segments that are packed with the speaker. Remove the protective paper and apply the gasket to the rear mounting surface of the speaker rim, making certain that the holes in the gasket line up with the mounting holes in the speaker frame.

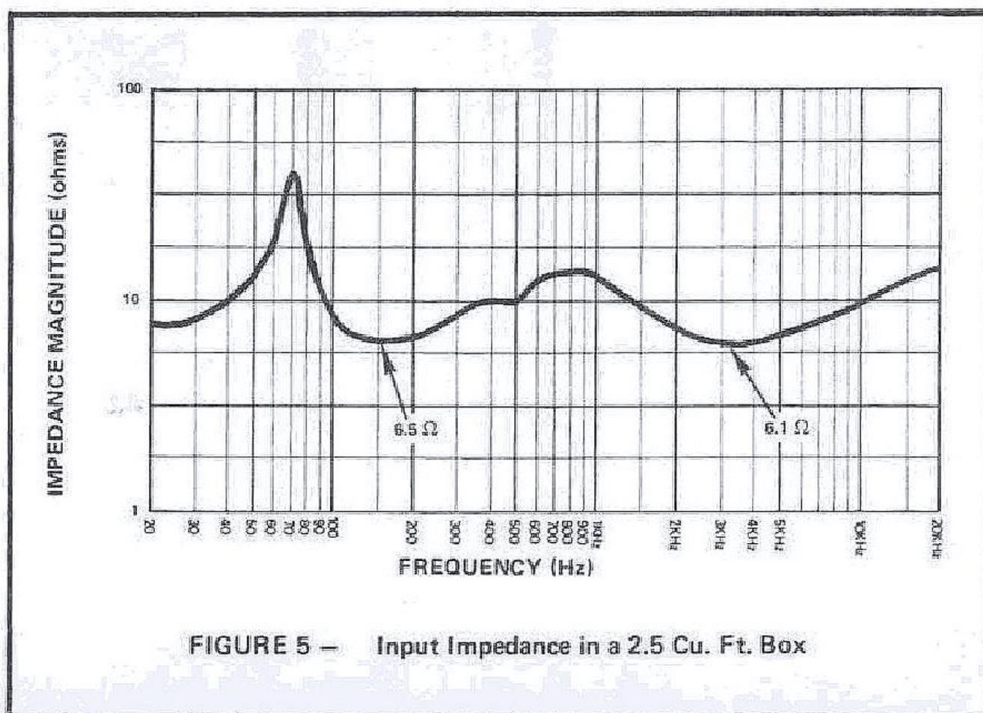
#### SPECIAL NOTE ON LOW-FREQUENCY PERFORMANCE

The recommended enclosures and associated performance specifications shown earlier were determined in

accordance with the definitive analysis of A. N. Thiele, R. H. Small, and others (for example, see A. N. Thiele, "Loudspeakers in Vented Boxes," J. Audio Eng. Soc., Part I, vol. 19, May 1971, pp. 382-391; Part II, vol. 19, June 1971, pp. 471-483). Other vented box sizes and tunings are quite feasible and may give performance more suitable for a particular application. For more information on this subject ask for Bulletin 10B.

By applying the work of Thiele and Small, Electro-Voice engineers developed a computer program which easily, quickly, and accurately predicts the performance of any speaker-box combination at the frequency range where the diaphragm is acting as a simple piston. The Thiele-Small Driver Parameters shown in the Specification Section include the speaker characteristics required by the computer program to develop the small and large signal performance of a given speaker and enclosure combination.

Given the PRO-12A Thiele-Small Driver Parameters, Bulletin 10B shows how to choose the size and tuning of vented enclosures and how to determine the low-frequency response of vented and sealed speaker systems, using scientific pocket calculators. Bulletin 10B also includes enclosure recommendations for all Electro-Voice component speakers and a detailed bibliography of the work of Thiele, Small, and others.



**FIGURE 5 — Input Impedance in a 2.5 Cu. Ft. Box**

**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).

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

Specifications subject to change without notice.

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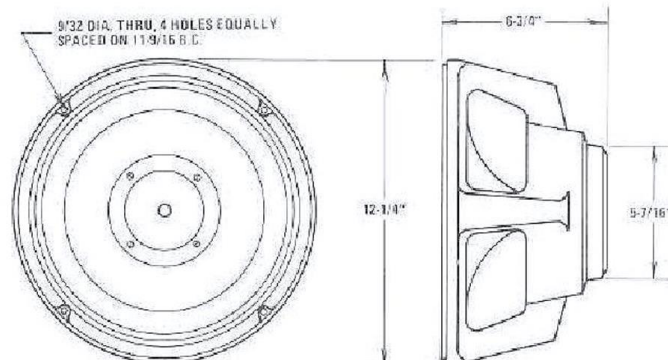
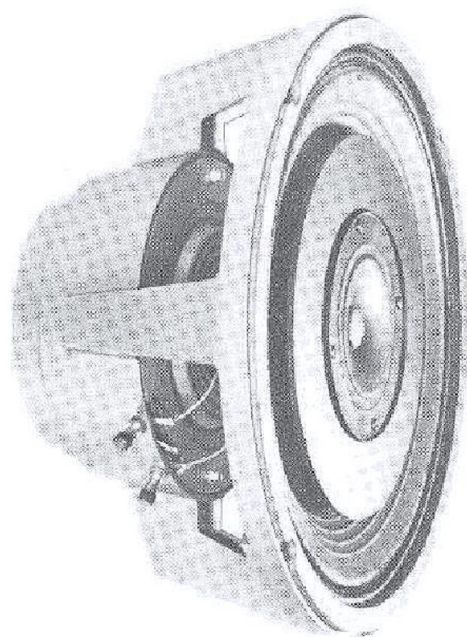


FIGURE 1 — Dimensions

**DESCRIPTION**

The Electro-Voice Model PRO-12 is a new two-way speaker intended for professional sound reinforcement use. The PRO-12 offers adequate power handling, excellent dispersion, and extremely smooth and wide frequency response for a reasonable price.

High efficiency is possible through the use of ceramic magnets in both tweeter and woofer construction. Mounting the tweeter assembly closer to the woofer cone reduces reflections between cone and back of tweeter, thus smoothing midrange response. The design of the tweeter extends high frequency response past 16,000 Hz.

In distributed systems the broad, smooth response and excellent dispersion give definite advantages in terms of gain before feedback and overall unequalized tonal quality.

**SPECIFICATIONS**

Frequency Response, (in suggested enclosure, Fig. 2):	60 – 16,000 Hz
Nominal Resonance:	47 Hz
EIA Sensitivity:	48 dB
Crossover, electrical:	1,000 Hz
Power Handling,	
Program:	60 watts
Average:	20 watts (Figure 4)
Sound Pressure Level (4' at 60 watts, 1200-2400 Hz octave band random noise)	114 dB
Nominal Impedance:	8 ohms
Magnets,	
Woofer:	1 lb., 6 oz. ceramic
Tweeter:	4.15 oz. ceramic
Dispersion:	120° nominal (Figure 3)
Size:	12¼" diameter, 6¾" deep
Mounting:	Four 9/32" holes equally spaced on an 11-9/16" circle (Figure 1)
Baffle Opening:	11-inches
Net Weight:	14 pounds.

**INSTALLATION AND MOUNTING**

The PRO-12 was designed to provide a sound pressure level of approximately 100 dB when used in distributed systems installed in ceilings ranging from 20 to 30 feet in height. Polar response has circular symmetry and sufficient beam width at 10 kHz so that speaker spacings nearly equal to ceiling height can be used with excellent uniformity of high frequency response, even along diagonal lines between speaker centers.

Optimum bass response with the Model PRO-12 will be obtained by using the recommended six cubic foot enclosure volume. A sealed box must be used for best bass results. Cut an 11-inch diameter circular hole in the mounting baffle. Four 9/16-inch holes are provided on the periphery of the speaker frame for mounting. Use No. 12 x 1½-inch wood screws or preferably, drill four ¼-inch holes spaced 90-degrees apart on an 11-9/16-inch circle and use four 3/16-inch carriage bolts, 2-inches long, with nuts and washers. Tighten the carriage bolts just enough to compress the speaker gasket.

**IMPORTANT**

If the speaker baffle becomes too thick, i.e. in excess of ¾-inch, undesirable peaks are generated in the on-axis response between 1.5 and 4 kHz. This is due in large part to diffraction from the tweeter off the edges of the hole in the baffle board. Note: an accessory predrilled mounting ring is available. Order E-V Model No. P708.

**SYSTEM LAYOUT**

Accurate system layout with the PRO-12 may be made by referring to the axial frequency response of Figure 2 as well as the octave band random noise polar response of Figure 3. From these figures, the sound pressure level available at a distance of 4 feet with full power in may be determined for any octave band at any angle.

**Level Variations with Distance: Non-Reverberant Environments:** In a non-reverberant environment (such as out-of-doors), sound pressure level will drop 6 dB every time the distance from the speaker is doubled (inverse square law). The nomograph of Figure 5 shows the dB losses to be expected as distance from the PRO-12 is changed.

**Level Variations with Distance: Reverberant Environments Indoors:** Where sound is reflected from walls and

ENGINEERING DATA MODEL PRO-12 TWO-WAY SPEAKER

other surfaces and the environment is reverberant, there is a point (the "critical distance") beyond which the "reverberant field" dominates and sound pressure is nearly constant. This distance is typically ten to twenty-five feet from the speaker and is shortest for the most reverberant rooms. Because of the reverberant field, the sound pressure level obtainable in a room is much higher and more constant than that predicted by the inverse square law alone. However, the information in Figures 2 and 3 is still necessary in order to obtain satisfactory distribution of the sound direct from the loudspeaker ("direct field"), which still follows the inverse square law.

In installations where applicable, it is good practice to make sure that the direct field is no more than 12 dB below the reverberant field if satisfactory intelligibility is to be obtained. This condition is fulfilled if the listener is no more than four times critical distance from the loudspeaker.

**Level Variation with Power:** Each time the power delivered to the speaker is halved, a drop of 3 dB occurs, in any type of environment. The nomograph of Figure 5 shows this effect.

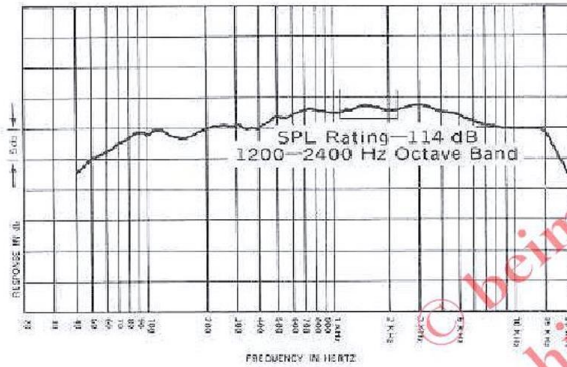


FIGURE 2 - Axial Frequency Response

Shaded Area =  
Octave Bands from  
300-2400 Hz

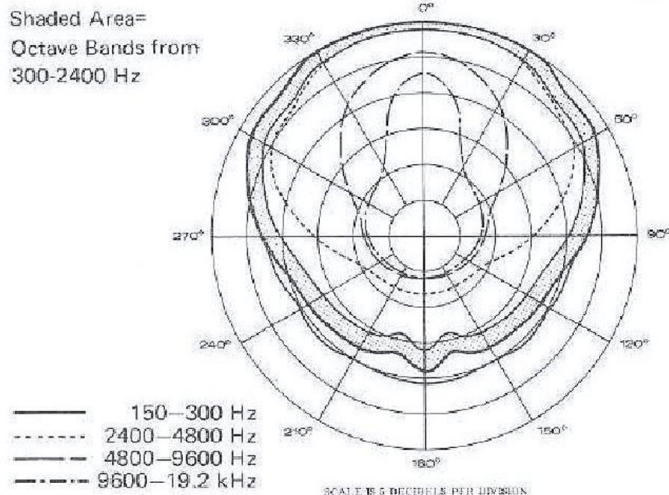


FIGURE 3 - Octave Band Polar Chart (levels not normalized)

**Level Variations due to Multiple Speakers:** The chart above indicates the total sound pressure level resulting from two loudspeakers aimed at the same point. This chart greatly facilitates layout of systems employing multiple speakers.

WHEN TWO SIGNALS  
DIFFER BY:

- 0 dB
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

ADD TO THE  
LARGER READING

- 3.00 dB
- 2.50
- 2.10
- 1.70
- 1.40
- 1.10
- .97
- .79
- .63
- .51
- .43
- .35
- .26

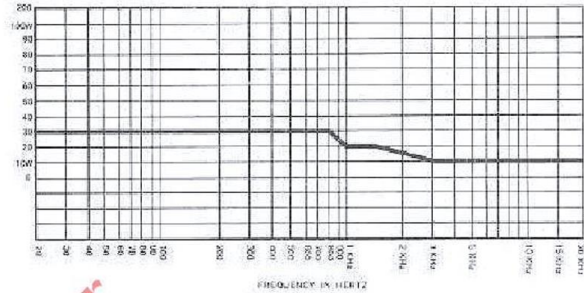


FIGURE 4 - Average Sine Wave Power Handling with Relation to Frequency (One Hour)

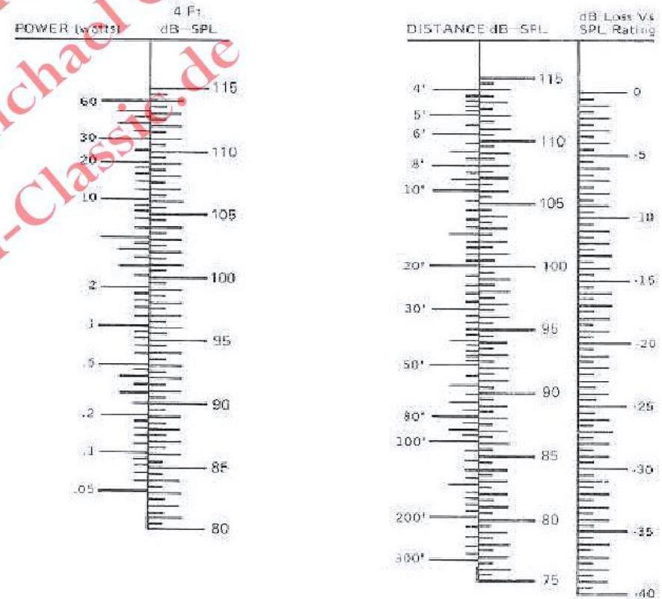


FIGURE 5 - Nomographs

**WARRANTY**

The Electro-Voice PRO-12 is guaranteed for two years against malfunction due to defects in workmanship and materials. If malfunction from this cause occurs, the unit will be repaired or replaced (at our option) without charge for materials or labor, if delivered to Electro-Voice or its service agency. It will be returned prepaid. Warranty does not cover finishes or failures 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.

