SPECIFICATIONS

Frequency Response:
700-10,500 Hz ±5 dB
(see Figure 3)

Power Handling,
8 Hours, 6-dB Crest Factor:
12 watts (500-5,000 Hz pink noise)

Impedance,
Nominal:
8 ohms

Sound Pressure Level at 1 Meter,
1 Watt Input Averaged, Pink Noise
Band-Limited from 1,000 to 5,000 Hz:
103 dB

Horizontal Beamwidth:
125° @ 2 kHz (see Figure 2)

Vertical Beamwidth:
125° @ 2 kHz (see Figure 2)

Directivity Factor R_θ (Q):
8.5 @ 2 kHz

Usable Low-Frequency Limit:
500 Hz

Construction:
Diecast zinc outer housing in mesa tan
finish and high-impact ABS inner horn
components

Voice-Coil Diameter:
2.54 cm (1.0 in.)

Magnet Weight:
0.2 kg (0.4 lb)

Magnet Material:
Strontium ferrite

Flux Density:
1.0 Tesla

Dimensions,
Diameter:
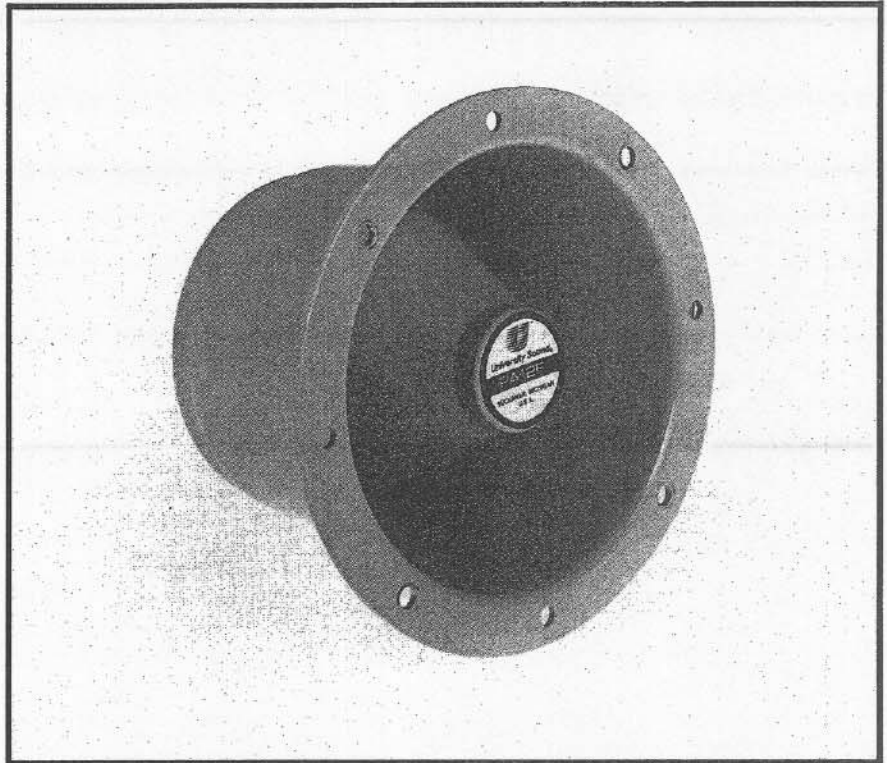15.2 cm (6.0 in.)
Depth:
9.2 cm (3.6 in.)

Net Weight:
1.4 kg (3.0 lb)

Shipping Weight:
1.5 kg (3.3 lb)

PA12F   Reentrant Paging Projector

DESCRIPTION

The University Sound PA12F is a conservatively rated 12-watt reentrant paging projector
designed for flush-mounting.

The driver uses a rugged phenolic diaphragm, a 1.0-inch voice coil and component parts
proven reliable under stressful conditions.

A 15-inch SJTO-18-2 connecting cable, phased and color coded, is provided.

A dispersion angle of 125° ±25° is maintained over the frequency range of 600 Hz to 3,000 Hz.
Excellent loading is maintained to a low-frequency cutoff of 500 Hz.

The PA12F is of diecast zinc and ABS molded inner horn components and are virtually
impervious to bad-weather conditions.

Designed for low-impedance systems, this compact horn has outstanding speech intelligibility
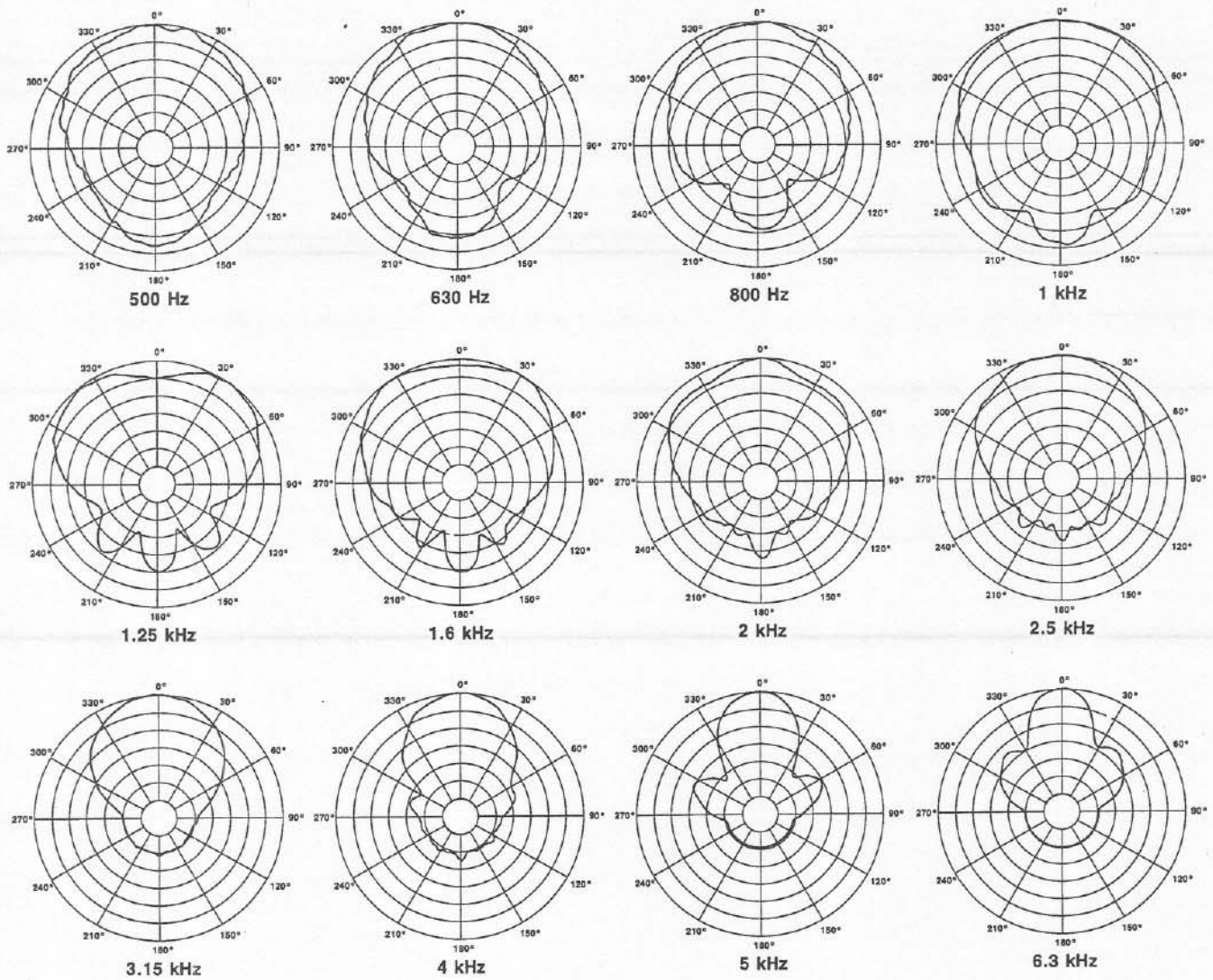and high efficiency.

500 Hz   630 Hz   800 Hz   1 kHz

1.25 kHz   1.6 kHz   2 kHz   2.5 kHz

3.15 kHz   4 kHz   5 kHz   6.3 kHz

FIGURE 1
PA12F Polar Response

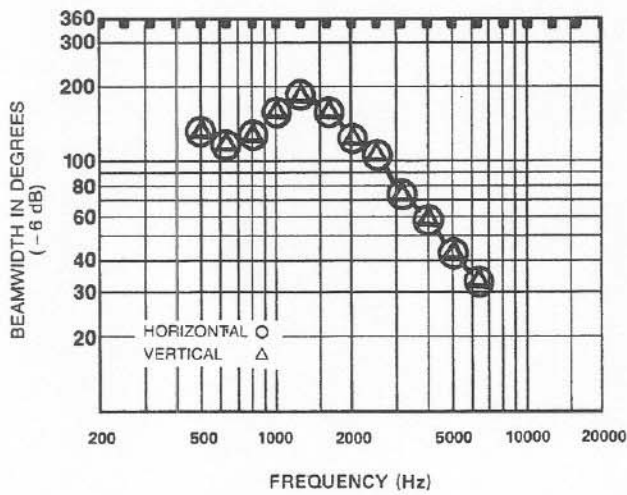HORIZONTAL ———
VERTICAL – – – –

FIGURE 2
PA12F Beamwidth vs. Frequency
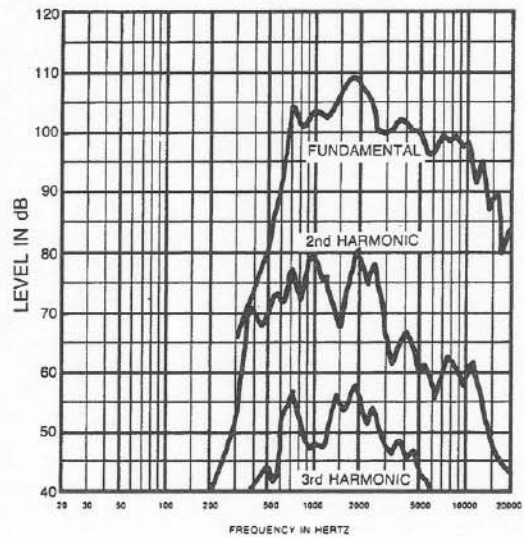

FIGURE 3
PA12F Frequency Response
(1 watt at 1 meter)

POLAR RESPONSE

The directional characteristics of the PA12F were measured by running a set of horizontal/vertical polar responses, in University's large anechoic chamber, at each one-third-octave center frequency. The test signal was one-third-octave pseudo-random pink noise centered at the indicated frequencies. The measurement microphone was placed 6.1 m (20 ft.) from the horn mouth, while rotation was about the waveguide geometric apexes. These axes of rotation are quite close to the apparent (acoustic) apexes across the frequency range of measurement. Errors attributable to the slight differences between the geometric and acoustic apexes are reduced to an inconsequential level by the relatively long, 20-foot measuring distance. The horn was suspended freely with no baffle. The polar plots shown in Figure 1 display the results of these tests. The center frequency is noted on each plot. The wider plot on each chart is the horizontal polar (–) and the narrower plot is the vertical polar (– – –).

BEAMWIDTH

A plot of the PA12F's 6-dB-down total included beamwidth angle is shown in Figure 2 for each one-third-octave center frequency.

FREQUENCY RESPONSE

Figure 3 shows the axial frequency response of the PA12F. It was measured at a distance of 1 meter, using a swept sine wave.

INSTALLATION

The PA12F can be mounted behind a 12.4 cm (4.87 in.) diameter hole or through a hole 12.7 cm (5.0 in.) in diameter.

When mounting from behind, allow a sufficient depth of 9.21 cm (3.62 in.) to accommodate the horn. When mounting through the hole, allow only for the depth behind the flange: 8.89 cm (3.50 in.)

For either installation, the gasket must be attached between the horn's flange and the mounting surface for a weathertight seal.

ARCHITECTS' AND ENGINEERS' SPECIFICATIONS

The loudspeaker shall be an integral driver and reentrant horn having a rugged phenolic diaphragm and a high-temperature-rated 1.0-inch voice coil.

The axial frequency response will extend from 700 to 10,500 Hz and the horn shall exhibit a low-frequency cutoff of 500 Hz. Sound pressure level will be 103 dB (1 W/1 M) with a 1,000-to-5,000 Hz pink noise signal applied, and the horn will produce a dispersion angle of 125° at 2 kHz.

The loudspeaker shall be capable of handling a 12-watt, 1,000-to-5,000-Hz pink noise signal with a 6-dB crest factor for a period of eight hours.

The horn shall be diecast zinc with inner horn components of high-impact ABS, fungus-proof, moisture-proof, and capable of satisfactory mechanical performance in bad-weather extremes.

Finish is mesa tan baked enamel. The University Sound Model PA12F is specified.

Service and repair information for this product: University Sound, Inc., Phone 818/362-9516, FAX 818/367-5292.

Applications and technical information for University Sound products: University Sound, Inc., Technical Coordinator, Phone 818/362-9516, FAX 818/367-5292.

Specifications subject to change without notice.

BASIC GUIDELINES FOR THE USE OF HORNS AND DRIVERS WITHIN A SOUND SYSTEM.

DESIGNING FOR INTELLIGIBILITY AND ADEQUATE SPL

The Basic Idea

Many sound systems would have better performance if the following basic principles are kept in mind. Speakers with the appropriate coverage patterns should be chosen, aimed and powered to achieve a uniform direct field in the highly absorbtive audience, with no sound aimed at the reflective wall and ceiling surfaces. Where multiple speakers are required in order to achieve a uniform direct field, their coverage patterns should be only slightly overlapped, so that each section of the audience is covered by a single speaker. To the extent this ideal is achieved, reverberation is minimized and intelligibility is maximized.

The following material explains these concepts in more detail and illustrates two design approaches.

What is Reverberation?

Reverberation is the persistence of sound within an enclosure, such as a room, after the original sound has ceased. Reverberation may also be considered as a series of multiple echoes so closely spaced in time that they merge into a single continuous sound. These echoes decrease in level with successive reflections, and eventually are completely absorbed by the room.

Non-Reverberant Environments

An open, outdoor space is considered to be a non-reverberant environment, as virtually all sound escapes the area without reflection.

Variations in Level Due to Distance for Non-Reverberant Environments

In non-reverberant environments, such as outdoors, sound pressure level will be reduced by half (6 dB) every time the distance form the speaker is doubled (this is called the inverse-square law). Figure A shows the dB losses to be expected as distance from the speaker is increased from the one-meter (3.28-foot) measuring distance typically used in SPL specifications.

Reverberant Environments

Where sound is reflected from walls and other surfaces, there is a point beyond which the "reverberant field" dominates and the sound pressure level is higher and more constant than predicted by using the inverse-square law alone.

### Variations in Level Due to Distance for Reverberant Environments

The reverberant field will begin to dominate typically at distances of 10 to 30 feet. This distance is greatest for the least reverberant rooms and speakers with narrow beamwidth angles. The frequency and beamwidth specifications provided by the data sheet are still required to obtain satisfactory distribution of the direct sound (or direct field) from the loudspeaker(s), which still follows the inverse-square law. It is the direct signal that contributes to speech intelligibility. This is why the sound system designer should seek a uniform direct field, with as little reverberant field as possible. For example, consider a single speaker with a wide beamwidth angle used to cover a long, narrow, reverberant room. The direct field will be so far below the reverberant field at the back of the room that speech will probably be unintelligible.

Calculating Variations in Level Due to Changes in Electrical Power

Each time the power delivered to the speaker is reduced by one-half, a level drop of 3 dB occurs. The nomograph of Figure B shows the the change in dB to be expected as the power varies from the one-watt input typically used in SPL specifications.

Power Handling

The power rating of a speaker must be known to determine whether a design is capable of meeting the sound pressure level requirements of the system. The power rating combined with the sensitivity will enable a system designer to calculate the maximum sound pressure level attainable at a given distance.

FIGURE A
Level Variation
With Distance

FIGURE B
Level Variation
With Power
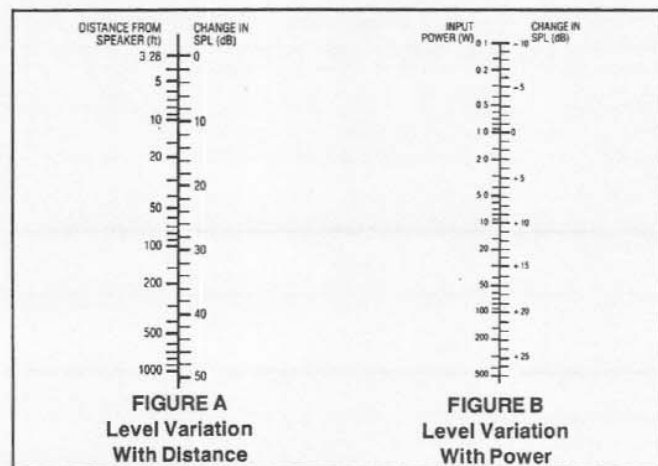
Powering to Achieve Both Average and Peak SPL

The average power that must be delivered to the speaker(s) to achieve the desired average SPL can be determined from the previously presented material on speaker sensitivity, level variation with distance and level variation with power. Enough additional power must be available to reproduce without distortion the short-term peaks that exist in voice and music program. This difference between the peak and average capability of a sound system, when expressed in dB, is often called "peak-to-average ratio," "crest factor" or "headroom." The peaks can be large, as noted earlier: at least 10 times the average (10 dB).

The better sound systems are designed for peaks that are 10 dB above the average, although 6 dB of headroom is sufficient for most general-purpose voice paging systems. The 10-dB peaks require amplifier power ten times that required for the average sound levels. The 6-dB peaks require four times the power.

Utilizing Speaker Beamwidth Information for Maximum Intelligibility

Knowing the beamwidth angle of a loudspeaker can aid in providing a uniform direct field in the listening area. After selecting a desired speaker location, the beamwidth angle needed to adequately cover the listeners without spilling over to the walls or ceilings must be determined. Once these angles are known, the correct speaker can be found by using catalog specifications.

Using Easy-VAMP™ and Floor-Plan Isobars

In some circumstances, it is desirable to use an approach that is more detailed than using the basic horizontal and vertical beamwidth angles. Environments which have excessive reverberation or high ambient noise levels make it especially difficult to achieve the desired SPL and intelligibility.

In recent years, a number of computer-based techniques have been developed to help sound system designers. Some of the more complex systems use personal computers, with relatively sophisticated graphics. Simpler systems, such as Electro-Voice's VAMP™ (Very Accurate Mapping Program), utilize clear overlays and require programmable scientific calculators. However, the hardware/software and training investment required to utilize even the simpler systems are not attractive to some sound systems designers. Because of this, University Sound has developed a special adaptation of VAMP, called Easy-VAMP™, which provides a similar design aid without the complexity and cost of the VAMP programs.

More information on both the Easy-VAMP™ and floor-plan isobars can be found in the University Sound Guide.