™ University Sound®

a MARK IV company

## SPECIFICATIONS

Frequency Response:
800-5,000 Hz ±5 dB
(see Figure 3)

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

Impedance:
16 ohms

Sound Pressure Level at 1 Meter, 1 Watt Input Average, Pink Noise Band-Limited from 800-5,000 Hz:
104 dB

Horizontal Beamwidth:
82° @ 2 kHz (see Figure 2)

Vertical Beamwidth:
82° @ 2 kHz (see Figure 2)

Directivity Factor $R_\theta$ (Q):
10.25 @ 2 kHz

Usable Low-Frequency Limit:
600 Hz

Construction:
Rugged die-cast aluminum case and transformer housing. Diaphragm is phenolic impregnated linen-base. All metal speaker parts are of anodized aluminum with baked-on acrylic paint. A cable entrance is provided on the bottom side

Voice-Coil Diameter:
5.1 cm (2.0 in.)

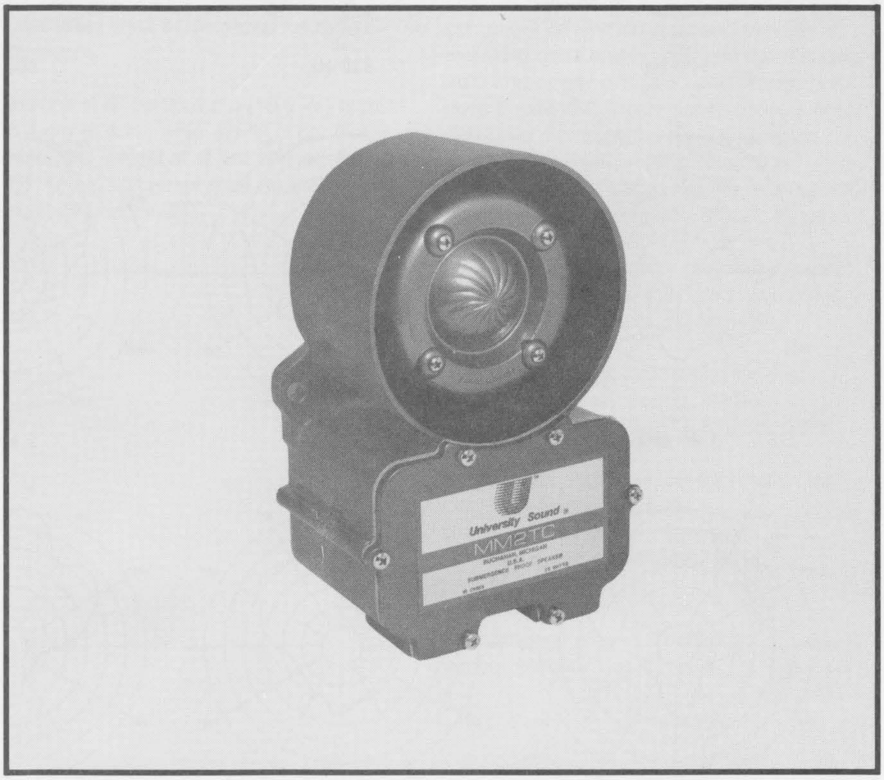
Magnet Weight:
0.93 kg (2.1 lb) with plates

Magnet Material:
Alnico V

Dimensions,
Height:
25.4 cm (10.0 in.)
Width:
16.4 cm (6.4 in.)
Depth:
11.3 cm (4.4 in.)

Net Weight:
4.0 kg (8.8 lb)

Shipping Weight:
4.5 kg (10.0 lb)




# MM2TC

## Bulkhead Mounting Submergence-Proof Speaker

## DESCRIPTION

The University Sound MM2TC is a conservatively rated 25-watt "submergence-proof" speaker designed for wall, ceiling, or bulkhead mounting.

The driver employs a diaphragm with a phenolic impregnated linen-base and 2.0-inch voice coil with "W" shaped Alnico V magnet structure.

Provisions are made in the housing for installation of a matching transformer such as the University Sound model 5030 (30 W).

The voice-coil/diaphragm assembly is protected by a special anit-fungicide treatment and is easily accessible for cleaning by removal of the die-cast reflector on the front of the speaker.

The MM2TC is self-draining and designed to withstand fungus, dust, salt spray, live steam, and gases. It is built to penetrate high noise levels in boiler rooms, mines, railroads, etc.

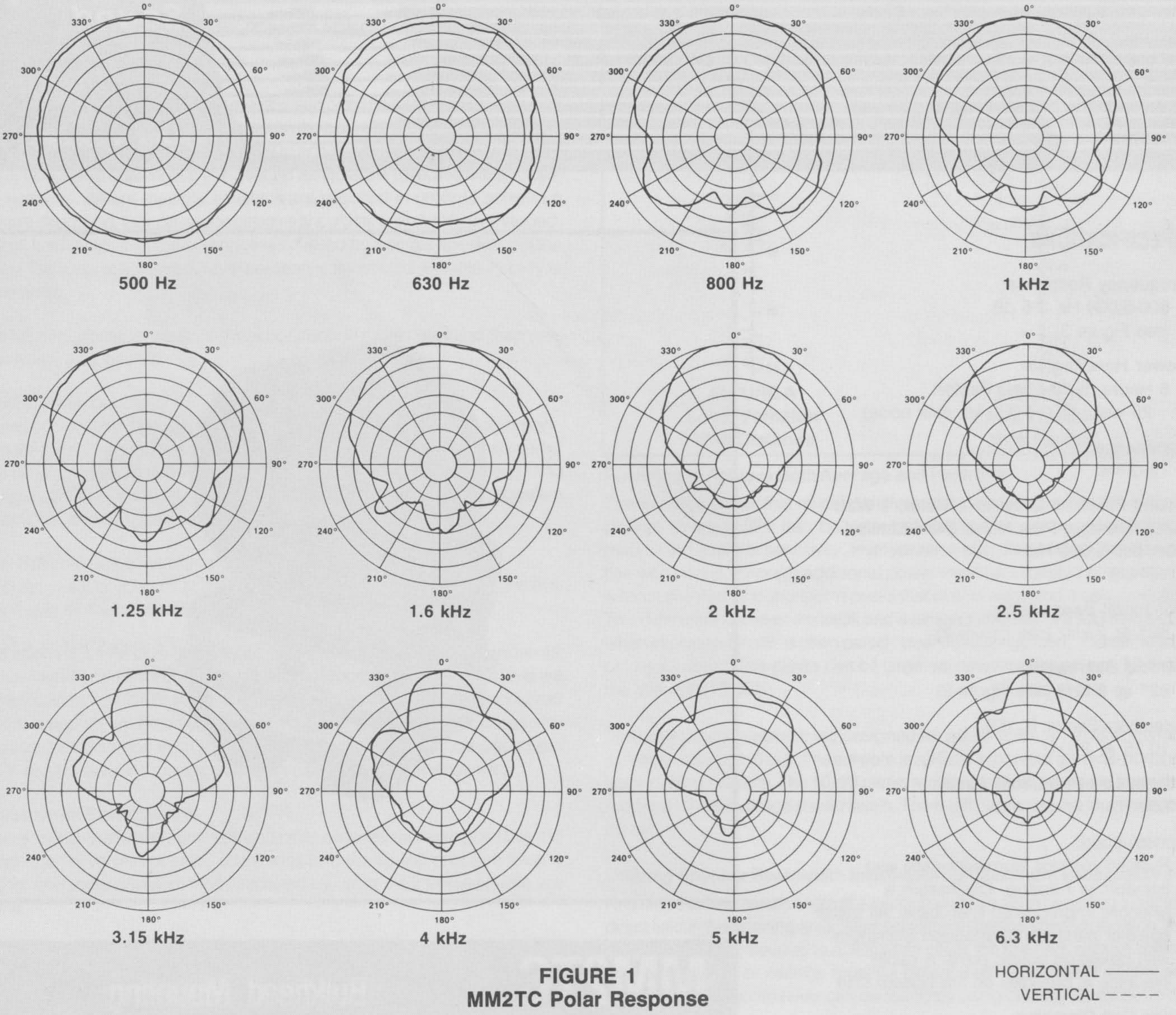



**FIGURE 1**
**MM2TC Polar Response**

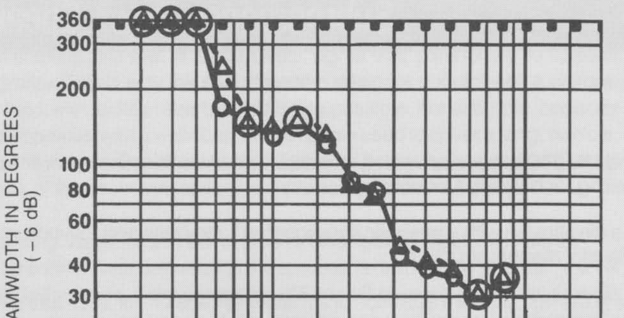



**FIGURE 2**
**MM2TC Beamwidth vs. Frequency**

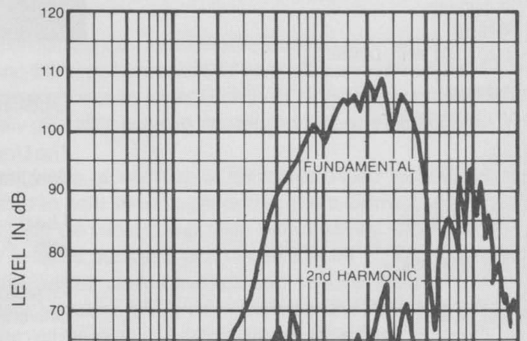



**FIGURE 3**
**MM2TC Frequency Response**
**(1 watt at 1 meter)**

## DIRECTIONAL PERFORMANCE

The directional characteristics of the MM2TC were measured by running a set of polar responses in University's large anechoic chamber. The test signal was ⅓-octave-band-limited pseudo-random pink noise centered at the ISO standard frequencies indicated in Figure 1.

Additional typical data is provided in Figure 2 which indicates 6-dB-down beamwidth versus frequency for an MM2TC.

## FREQUENCY RESPONSE

Figure 3 shows the axial frequency response of the MM2TC. It was measured at a distance of 1 meter, using a swept sine wave.

## INSTALLATION

Mounting of the MM2TC is by way of two 13⁄32″ holes spaced 5.688″ on centers.

A cable entrance threaded for ½″-14 I.P.S. pipe or rigid conduit is provided in the bottom side of its cork-neoprene gasketed transformer housing.

## LOW-FREQUENCY DRIVER PROTECTION

When frequencies below the low-frequency cutoff for the horn assembly are fed to the driver, excessive current may be drawn the by driver. For protection of driver, amplifier, and transformer (if driver with built-in transformer is used), capacitor(s) in series with driver, or transformer primary are recommended.

For drivers without transformers:
16-ohm driver, 25 V - 50 mf

150 V dc or 150 V non-polarized electrolytic, or two 150 V dc electrolytics of two times required value in series, back to back, for 70-volt lines.

## ARCHITECTS' AND ENGINEERS' SPECIFICATIONS

The loudspeaker shall be integral driver and submergence-proof speaker with a phenolic impregnated linen-base diaphragm and rugged two-inch voice coil.

The axial frequency response will extend from 800 to 5,000 Hz and the horn shall exhibit a low-frequency cutoff of 600 Hz. Sound pressure level will be 104 dB (1 W/1 M) with an 800 to 5,000 Hz pink noise signal applied. Dispersion shall be 82° at 2 kHz.

The bell, reflector, and weatherproof transformer housing shall be die-cast aluminum and designed so that reflector can be removed for easy accessibility and cleaning of diaphragm. Voice-coil/diaphragm assembly shall be protected by special anti-fungicide treatment.

Transformer housing shall be provided for installation of line-matching transformer not to exceed 5.8 cm (2.25 in.), by 5.8 cm (2.25 in.), by 7.0 cm (2.75 in.). Two 13⁄32-inch diameter holes shall be provided for mounting purposes.

Dimensions shall be 25.4 cm (10.0 in.) high, by 16.4 cm (6.4 in.) wide, by 11.3 cm (4.4 in.) deep. Net weight shall not exceed 4.0 kg (8.8 lb). The loudspeaker shall be the University Sound MM2TC.

**WARRANTY (Limited)** — University Sound Speakers and Speaker Systems (excluding active electronics) 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 University Sound. Unit will be returned prepaid. Warranty does not extend to finish, appearance items, burned coils, or malfunction due to abuse or operation under other than specified conditions, including cone and/or coil damage resulting from improperly designed enclosures, nor does it extend to incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you. Repair by other than University Sound will void this guarantee. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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.

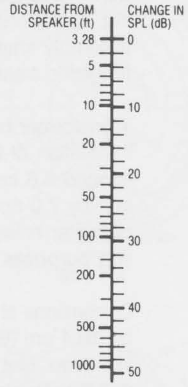



**FIGURE A**
**Level Variation With Distance**


**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.

Part Number 531291—923
US 42-02-026117
Litho in U.S.A.

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