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# **MA12EX**

modular line array loudspeaker

Design Guide  
English

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## Introduction

The MA12EX modular line array loudspeaker is ideal for a variety of indoor and outdoor applications where voice and full-range music performance without bass augmentation are the main requirements. The MA12EX is well suited for indoor and outdoors spaces like houses of worship, recreation areas, multipurpose venues, retail spaces, restaurants, hospitality establishments, auditoriums, atriums, malls, and gymnasiums.

This guide describes recommended design practices for MA12EX installations by exploring these concepts:

- the recommended loudspeaker array **height**
- the best **location** for loudspeaker arrays
- the **total number** of loudspeaker modules required
- the calculation of loudspeaker array **pitch**, if needed

To illustrate these concepts and practices, this guide uses the example of a performing arts venue with rows of seats split by a center aisle.

## Get Started

When designing MA12EX loudspeaker systems, consider the following guidelines:

A **cluster** is an assembly of one or more MA12EX loudspeaker modules at 1 location.

The **height** of a cluster should be measured from the base of the lowest module in the cluster to 20 centimeters (8 inches) below the ear height of the lowest listener.

The **spacing** between adjacent clusters in a space should be at least 10 meters (30 feet).

The usable **throw distance** of a cluster varies with the number of MA12EX modules in the cluster:

Number of MA12EX modules in cluster:	1	2	3
Usable throw distance:	10 m (30 ft)	23 m (75 ft)	35 m (120 ft)

## System Performance (single module)

For more complete information, see the MA12EX technical data sheet at [BoseProfessional.com](https://www.bose.com/ma12ex).

Frequency Response ( $\pm 3$ dB) <sup>1</sup>	75 Hz – 13 kHz
Frequency Range ( $-10$ dB) <sup>1</sup>	58 Hz – 16 kHz
Nominal Dispersion ( $-6$ dB) <sup>2</sup>	160° horizontal × 20° vertical
Long-term Power Handling <sup>3,4</sup>	150 W, continuous / 600 W, peak
Sensitivity (SPL / 1 W @ 1 m) <sup>5</sup>	87 dB SPL
Maximum SPL @ 1 m <sup>5</sup>	112 dB SPL continuous / 118 dB SPL peak
Nominal Impedance	8 $\Omega$ (transformer bypassed)
Dimensions	986 mm × 104 mm × 140 mm (38.8 in × 4.1 in × 5.5 in)
Net Weight	9.4 kg (20.7 lb)

- Frequency response and range measured on-axis with recommended active EQ in an anechoic environment.
- Vertical coverage varies with number of modules in array and distance from line-source boundary. Use Modeler software for the best prediction.
- Power handling tested using pink noise filtered to meet IEC 268-5, 6 dB crest factor, 100 hours, with recommended EQ.
- Power handling: 150 W for full-range music and speech applications. 300 W / 1200 W (continuous) for speech-only applications (155 Hz to 12 kHz).
- Sensitivity measured in free field (no boundary-loading gain) with recommended active EQ, referenced to 1 W/1 m.
- Maximum SPL calculated from sensitivity and power handling specifications exclusive of power compression.

## Design Checklist

A typical MA12EX loudspeaker design uses a decentralized cluster approach where left and right main clusters are installed near the front of a stage in a venue. The following sections illustrate the steps required to design for this type of venue.

### 1. Determine the Throw Distance

First, determine the estimated throw distance (**D**) — the distance between the location of the loudspeaker and to the farthest listener.

Throw distance (**D**): \_\_\_\_\_

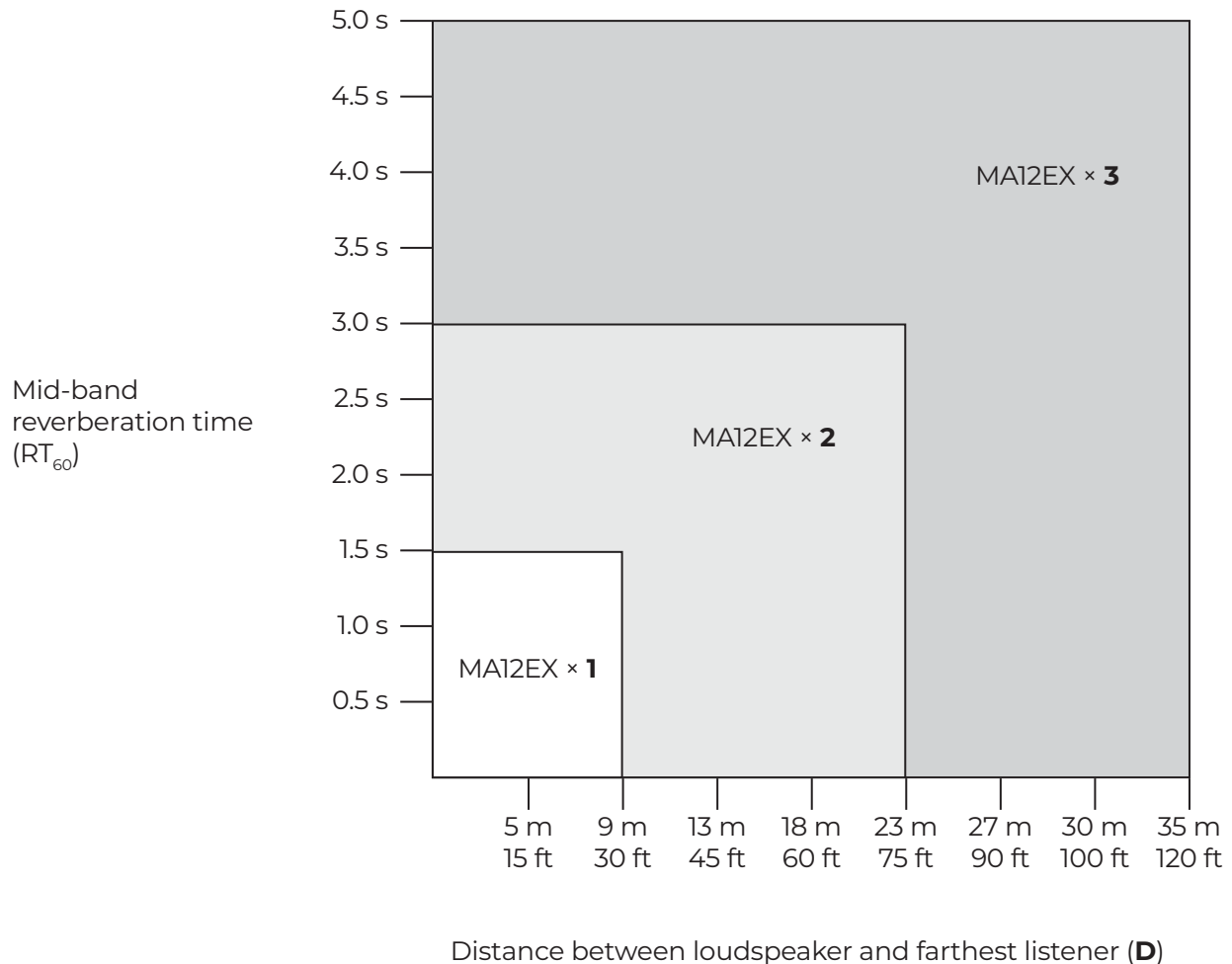
### 2. Determine the Number of Loudspeakers per Cluster

Next, determine how many loudspeaker modules will be required for each cluster.

#### Flat Floor

For **flat-floor** seating areas, use the chart below. Draw a vertical line corresponding to the throw distance (**D**) recorded in Step 1. Next, draw a horizontal line corresponding to the estimated mid-band reverberation time of the room ( $RT_{60}$ ) in seconds. Note the shaded area of the chart where the 2 lines intersect; this shaded area indicates how many MA12EX modules will be required in a cluster.

Number of MA12EX modules per cluster: \_\_\_\_\_

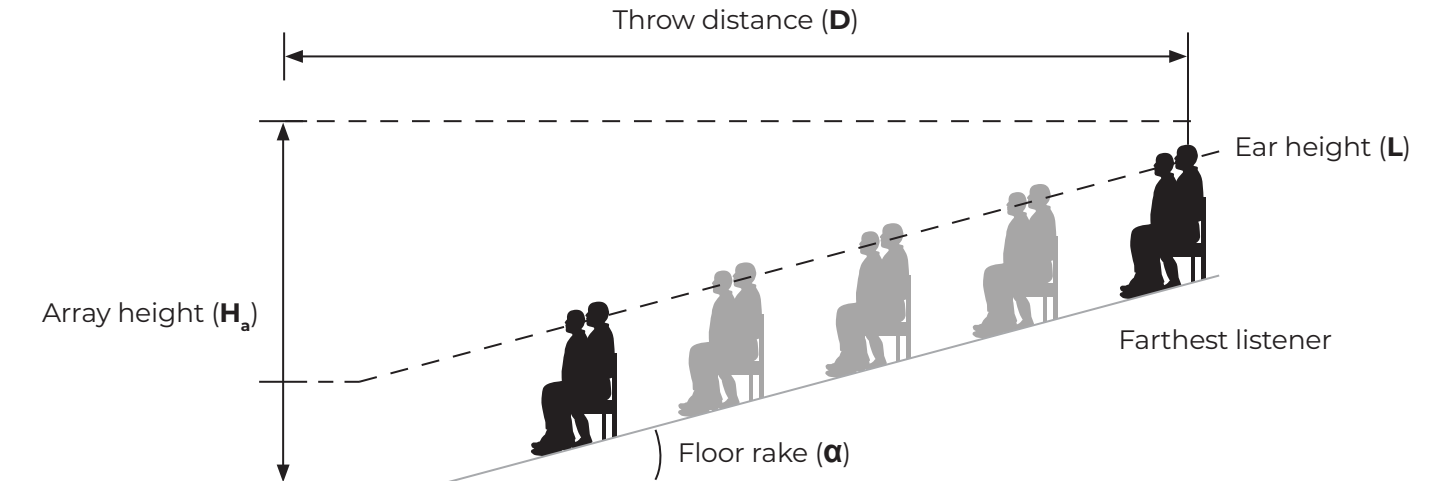


### Raked Floor

For **raked-floor** seating areas (seats mounted on a sloped floor), refer to the illustration and equation below. This will determine the number of modules required to provide appropriate vertical coverage to the listeners. Remember the earlier guideline that the base of the lowest module in the cluster should be 20 centimeters (8 inches) below the ear height of the lowest listener.

$$H_a = (D \times \sin \alpha) + (L + (20 \text{ cm or } 8 \text{ in}))$$

Number of MA12EX modules per cluster: \_\_\_\_\_



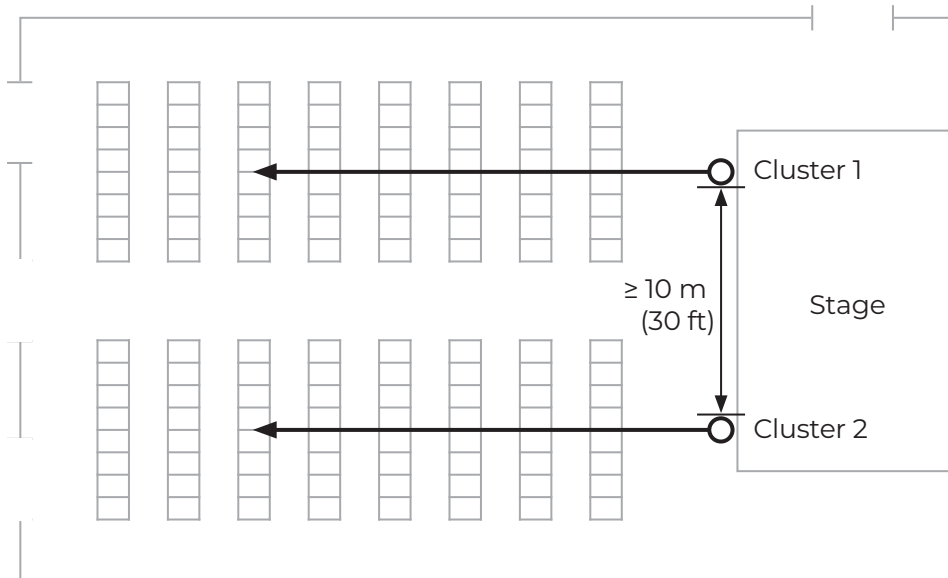
### 3. Determine the Total Number of Loudspeakers

Next, determine how many loudspeaker modules are required for the entire project:

$$\text{Number of modules per cluster (Step 2)} \times \text{Number of clusters in project} = \text{Total number of modules}$$

Total number of MA12EX modules: \_\_\_\_\_

In this design example, we are using two cluster locations — remember the earlier guideline that adjacent clusters should be spaced at least 10 meters (30 feet) apart. The arrows in the illustration below indicate the aiming direction of each cluster.



## 4. Adjust the Pitch

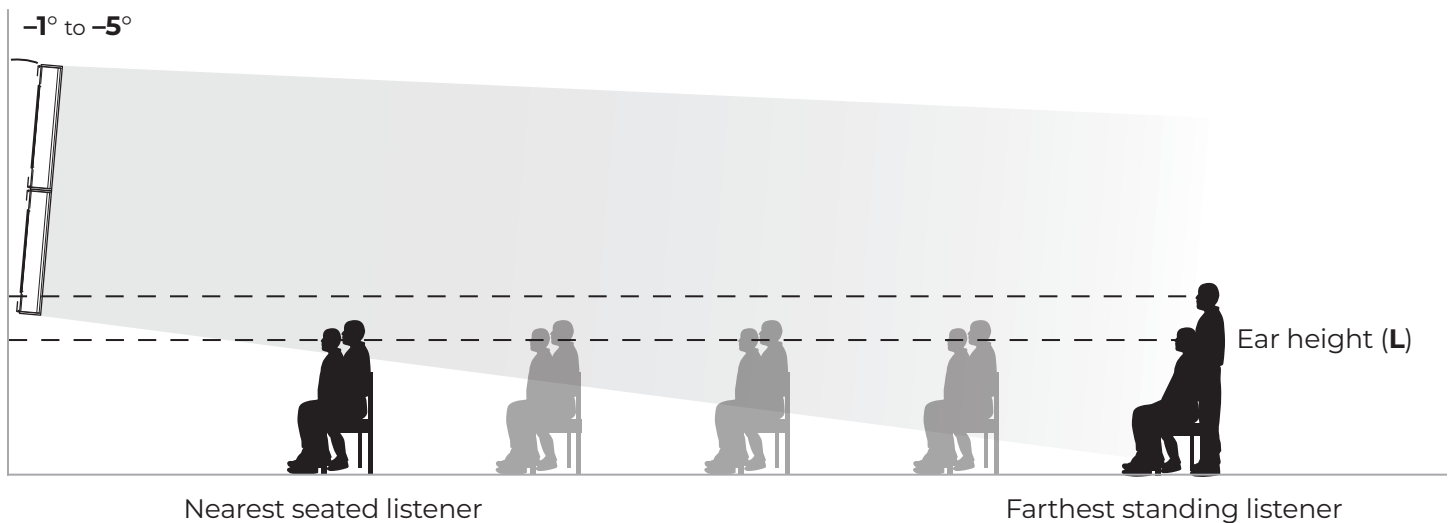
Finally, determine if any pitch adjustment is required for each cluster. This is usually unnecessary, but you may need to adjust the pitch for either or both of these reasons:

- to prevent a **late-arriving reflection** at the front of the seating area off of a reflective rear wall

- to ensure **unobstructed line-of-sight coverage** to all listeners

If you need to adjust the pitch, ensure the ears of the nearest seated listener and the ears of the farthest standing listener are within the vertical coverage pattern of the array. The pitch adjustment needed to compensate for the effects mentioned above is typically 1–5 degrees downward ( $-1^{\circ}$  to  $-5^{\circ}$ ).

After adjusting the pitch of a cluster, verify the coverage at the rear of the seating area with a listening test.



## 5. Determine the Rigging

An MA12EX loudspeaker module can be mounted on its own, or you can attach multiple MA12EX modules together to achieve greater throw distance and vertical coverage.

To install an array of **one, two, or three** MA12EX modules, use Bose Professional brackets compatible with the MA12EX (see the MA12EX product page at [BoseProfessional.com](https://www.bose.com)).

To install an array of **four or more** MA12EX modules, obtain a mounting system from a reputable manufacturer. Ensure the mounting system works for the intended use of the loudspeaker array. Always ensure a licensed professional engineer reviews the design and fabrication of the mounting system for structural integrity and safety in the intended application.

