MICROPHONE AND SPEAKER BAR

PLACEMENT GUIDE

Nureva® HDL410 system

CONTENTS

Introduction

The Nureva® HDL410 system is in the HDL pro series, which provides exceptional audio conferencing without a complex setup.

The HDL410 system features two integrated microphone and speaker bars and is designed for extra-large spaces up to 35' x 55' (10.7 x 16.8 m).

While the system's Microphone Mist™ technology provides built-in flexibility for placement of the microphone and speaker bars, following these guidelines will help ensure an optimal audio experience.

How Microphone Mist™ technology works

When installing an HDL410 system, the approach required for targeting the microphone coverage is different than with traditional pro AV setups. There is no need to aim and fine-tune the coverage for specific locations (where people are speaking), as Microphone Mist technology applies an audio data processing model across the entire space, picking up sounds from all locations and directions. These signals are then processed to focus on the most meaningful sounds — human speech and conversations.

This approach means:

- The microphone coverage is applied throughout the room without dead spots.
- There's no need to aim and fine-tune the microphone coverage for specific locations.
- The system adapts automatically whenever the room is rearranged.

While flexibility is offered with the positioning of the HDL410 microphone and speaker bars, their placement will determine how effectively the Microphone Mist technology data model works in different spaces. For rooms with good acoustics and that fall within the HDL410's size limits, following the HDL410 Quick Start Guide for bar placement and mounting will ensure satisfying performance. However, challenging environments and special circumstances may require more careful consideration of bar placement and mounting options.

General guidelines for bar placement

Understanding proper microphone and speaker bar placement helps achieve optimal HDL410 system performance. The basic principles are described below, followed by specific installation guidelines that are easy to follow and apply.
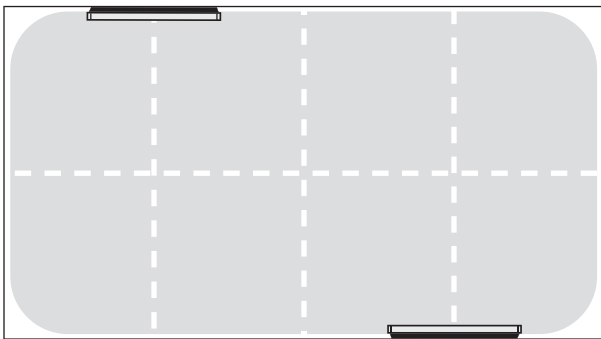
Basic configurations

When an HDL410 system calibrates, it determines the location and orientation of each microphone and speaker bar in a room. A unified coverage map, which represents a uniform distribution of virtual microphone positions, is generated for the area between the two bars and across the entire space. The coverage map is rectilinear in geometry, meaning that it functions in or consists of straight lines.

Guideline 1: Choose from four bar placement configurations

The HDL410 system works in four types of configurations with the assumption that the microphone and speaker bars are mounted on the walls of a rectangular room:

- On opposite walls, staggered
- On opposite walls, facing each other
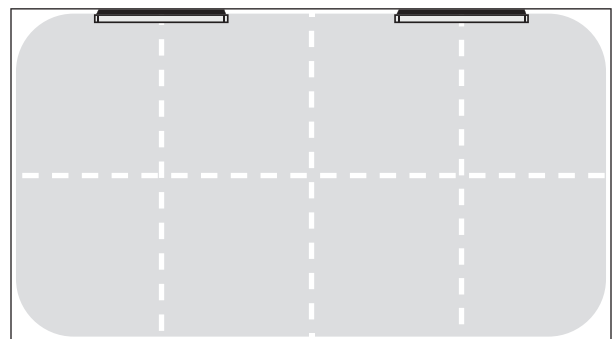- On perpendicular walls
- On the same wall

Mounted on opposite walls, staggered.
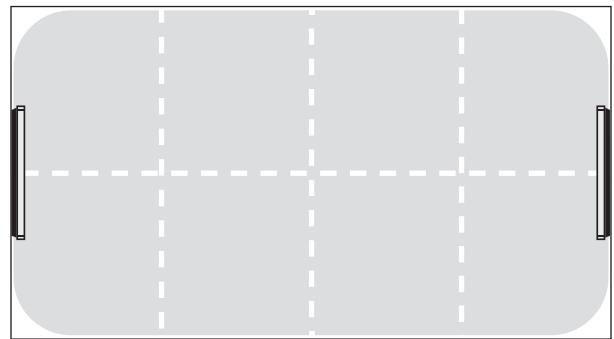
Mounted on opposite walls, facing each other.
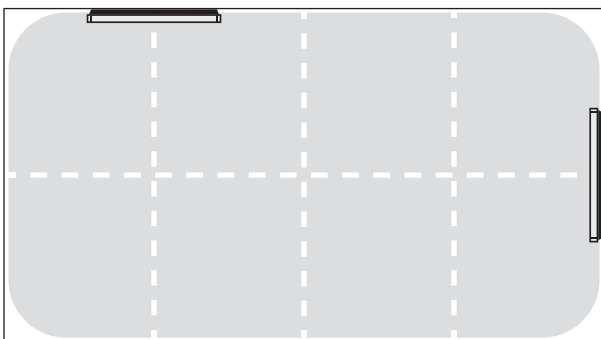
Mounted on perpendicular walls.

Mounted on the same wall.

Selecting one of these configurations will ensure the coverage map is created properly. It's important these same principles are applied in non-rectangular rooms and when mounting bars on tripods or carts.

Guideline 2: Consider proximity to activity areas

When deciding on where to place the HDL410 microphone and speaker bars, it's important to have at least one bar placed close to the areas where people will most often be speaking. Examples are meeting tables, presentation podiums, teaching areas and collaboration spots.

Like with any type of microphone, the sound quality improves with closer proximity to the source. Although Microphone Mist technology will capture audio throughout an extra-large space, the best raw audio signal and performance will be achieved when the speaker is closer to the microphone and speaker bar and facing toward it.
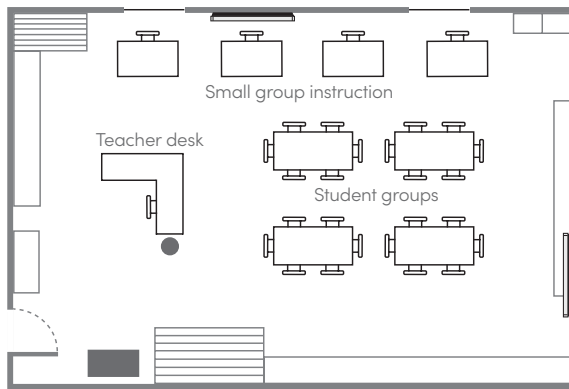
Good placement with at least one bar close to activities.
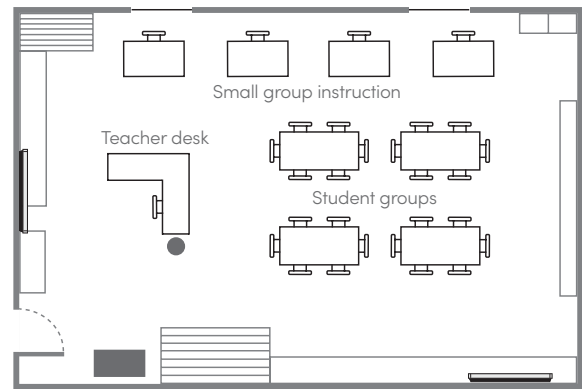
Poor placement with both bars far from activities.

Physical restrictions

While these next guidelines might seem obvious to some installers, they are often overlooked and this can significantly impact system performance.

Guideline 3: Maintain a clear sound path and avoid reflections

Due to their unique design, the HDL410 microphone and speaker bars need to be mounted on a reflective surface so the sound hits the surface directly behind them and enters the physical microphone arrays. However, placing the bars near obstacles causes them to receive unwanted reflected sound that negatively impacts audio quality and system performance. Direct sound paths between the microphones and the people talking will provide the best results.

Avoid placing bars:

- Behind posts
- In recessed areas
- Behind covers
- Within 3' (0.9 m) of room corners or side walls

Guideline 4: Avoid sources of background noise

Keep the microphone and speaker bars away from:

- HVAC vents
- Equipment with fans
- Other persistent noise sources

Even though the HDL410 system and audio conferencing applications have sophisticated processing built in to reduce echoing and background noise, placing the bars close to constant noise sources creates fundamental challenges. Echo cancellation, double talk detection and speech intelligibility are affected when the bars are placed too close to background noise sources.

Coverage map considerations

When an HDL410 system calibrates, it determines the location and orientation of each microphone and speaker bar in the room. A coverage map is then generated that represents the area between the two bars.

Within a given bar placement configuration (*Guideline 1: Choose from four bar placement configurations*), there is considerable flexibility for positioning the bars to improve overall audio quality without significantly impeding formation of the coverage map. For example, this might involve moving a bar closer to an area with activity (*Guideline 2: Consider proximity to activity areas*) or away from a post (*Guideline 3: Maintain a clear sound path and avoid reflections*) or a vent (*Guideline 4: Avoid sources of background noise*).

The following guidelines explain the more subtle details of bar placement configurations. They show how purposefully choosing a particular configuration to adjust the coverage map will help address special challenges in a space.

## Guideline 5: Position bars on the same wall for forward coverage

The option of placing the two microphone and speaker bars on the same wall is particularly suitable for long rooms. The coverage map will center between the bars, extending forward into the room. If the bars are placed further apart, the coverage map will form a landscape orientation, maximizing the coverage area.

When choosing a same-wall configuration, remember to:

- Mount both bars at the same height.
- Separate the bars at least 30' (9.1 m) apart for a landscape coverage.
- Keep the bars away from persistent noise sources.
- Mount the bars on a longer wall, if possible.
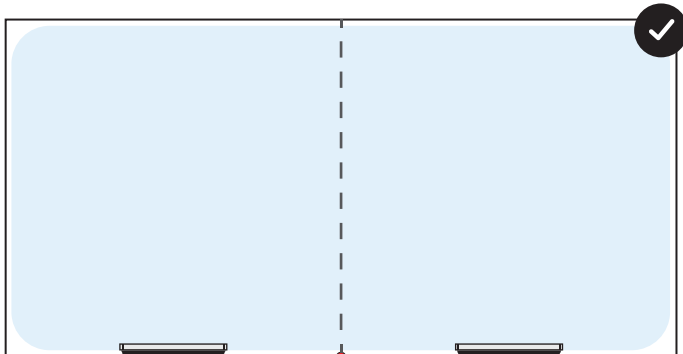
Bars are placed 30' (9.1 m) apart.
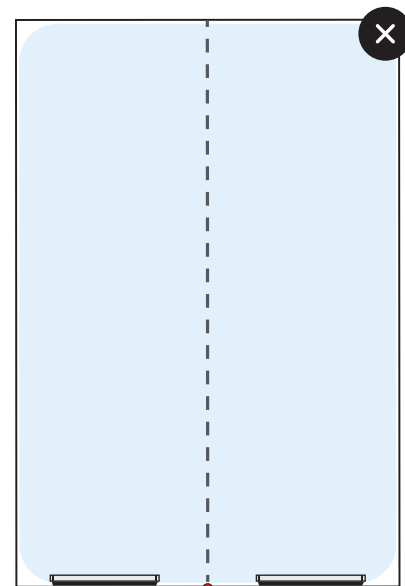


Bars are placed too close together.

If the two microphone and speaker bars are placed too close together, the coverage map will change to a portrait orientation. While mounting the bars on a shorter wall may still provide full-room coverage, the distance from the opposite side of the room to the physical microphones may be too long for good performance (see *Guideline 2: Consider proximity to activity areas*).

Guideline 6: Locate bars on opposite walls for contained coverage

When choosing an opposite-walls configuration in which the microphone and speaker bars are staggered, be mindful that the x-axis (horizontal) distance between the two bars can affect the quality of the microphone coverage.
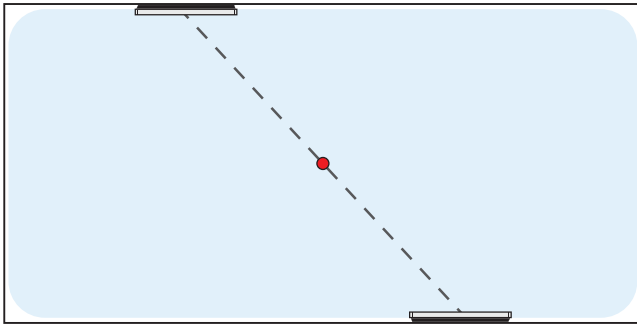
Horizontal distance is greater than the distance between the walls.
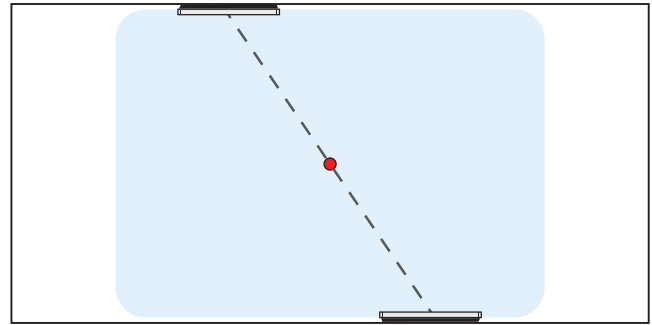
Horizontal distance is shorter than the distance between the walls.

Unlike with the three other configurations, the coverage map is naturally limited to the perpendicular distance between the two bars. When the x-axis (horizontal) distance between the bars is greater than the distance between the opposite walls, the width of the coverage map will increase to 55' (16.8 m). Otherwise, the width will be about 30' (9.1 m).

## Guideline 7: Place bars on perpendicular walls for optimal sound location data

When choosing a perpendicular configuration, be mindful that the distances from the two microphone and speaker bars to their intersection point will determine how the coverage map forms.
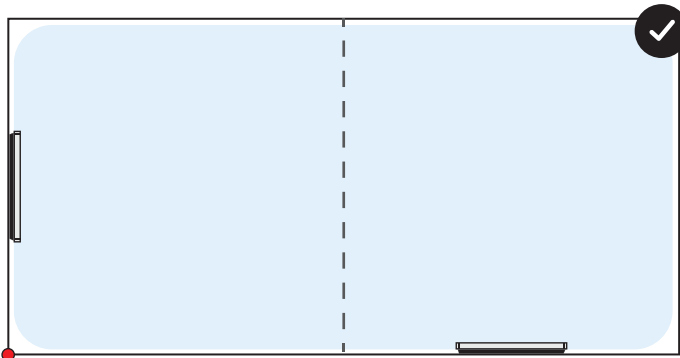
Red dot showing the intersection of the two walls.

The coverage map will start at the intersection of the two walls and extend diagonally into the room. The bar with the longer distance to the intersection will expand the coverage map in its direction.

A natural benefit of this configuration is sound location accuracy, making it ideal for applications like camera tracking.
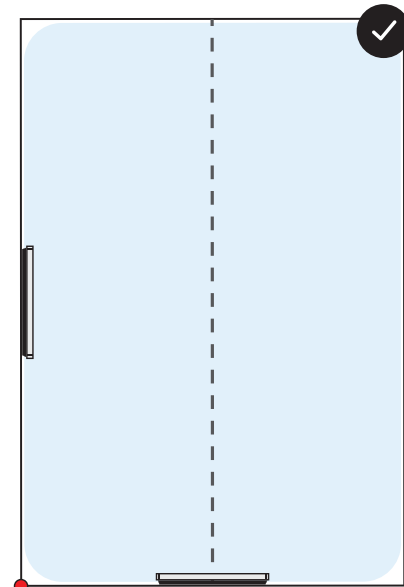
Red dot showing the intersection of the two walls.

Guideline 8: Consider bar mounting height relative to the coverage map

In a level room, each of the microphone and speaker bars should be mounted horizontally at a height between 7' (2.2 m) and 10' (3.0 m) to ensure adequate coverage of the individuals speaking, whether they are seated or standing. Installing below this range is not prohibitive, but it will result in more floor and table reflections, especially in rooms with hard surfaces. This will influence the sound quality. Always keep in mind that the two bars need to be at the same height to keep the coverage map horizontal.


Horizontal coverage map

Sloped coverage map
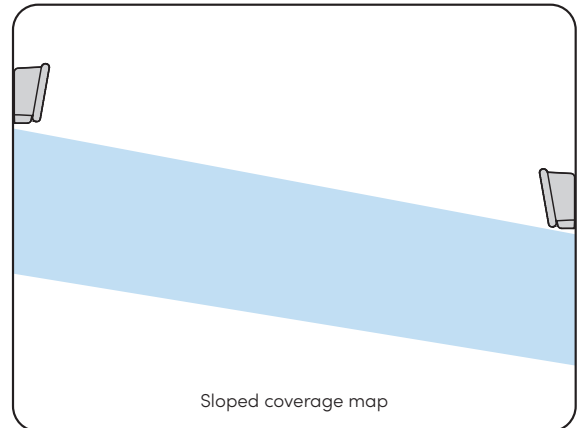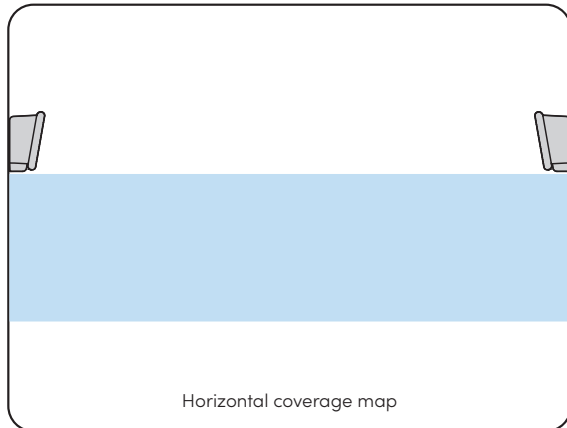
In a tiered room, to have proper microphone coverage you will need to deliberately mount the bars to tilt the coverage map so it remains in line with the room's slope.

Bar installation

To ensure optimal audio performance and coverage, it's important to follow the guidelines below, which explain how to mount the HDL410 microphone and speaker bars.

## Guideline 9: Maintain sufficient clearance below the bars

At the bottom of each microphone and speaker bar is a microphone array. It's important there's enough space below each bar and adequate sound reflection from the surfaces they're mounted on to ensure these microphone arrays work well.
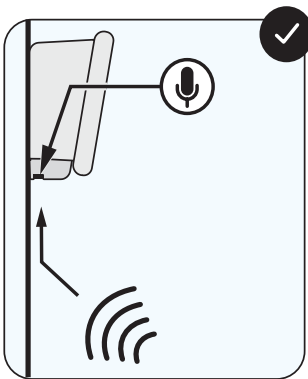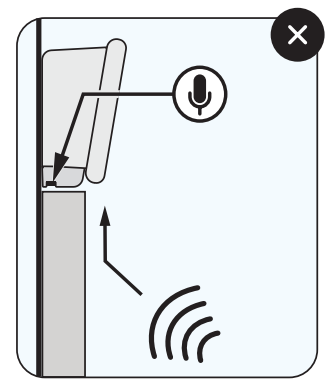

Side view of the bar mounted flat against the wall allowing sound to reflect to the microphone array.
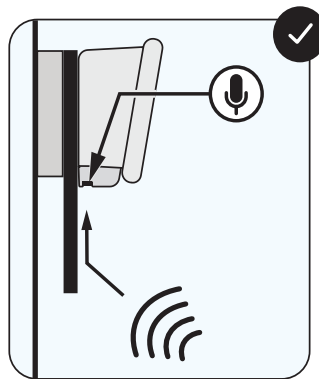
Side view of the bar mounted with a backboard allowing sound to reflect to the microphone array.
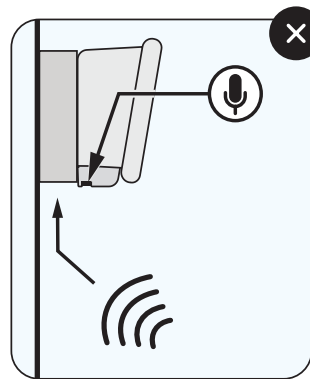
Side view of the bar mounted on a raised surface. Mounting this way reflects minimal sound to the microphone array.


Side view of the bar mounted too close to an object below it, preventing sound reflection to the microphone array.

Calculating the clearance requirements

The minimum clearance between a microphone and speaker bar and an object below it is calculated as a 3:2 ratio.

The object's depth (the **X** value) is multiplied by 1.5 to determine how much space is needed between the bar and the object below it (the **Y** value).
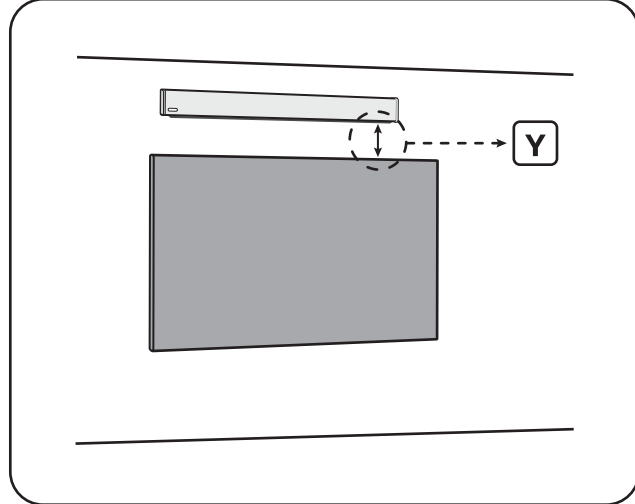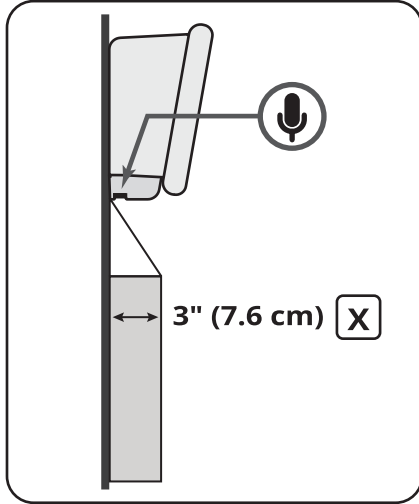
Example: A wall-mounted display sits below the microphone and speaker bar.

Depth (**X**) = 3" (7.6 cm)

3 x 1.5 = 4.5

The required minimum microphone clearance (**Y**) is 4.5" (11.4 cm).

Guideline 10: Optimize sound reflection from the mounting surface

A sound-reflective backboard must be used if a microphone and speaker bar is mounted on a:

- Wall that has been treated and is sound-absorbent
- Display stand, moving cart or tripod
- Fixture such as an Axeos ceiling mount
- Rough surface, such as brick with large grout lines or a wood slat wall

A sound-reflective backboard behind a microphone and speaker bar.
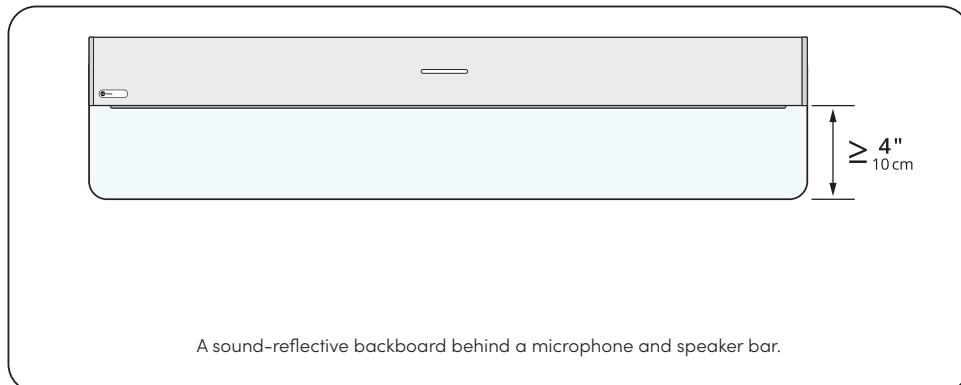
This guideline may sound contradictory, as rooms with high levels of reverberance are often treated with sound-absorbent material. But the HDL410 microphone and speaker bars require sound to be reflected from the surfaces they're mounted on as they enter the microphone array.

Good sound-reflective materials have low porosity, a smooth surface and a rigid structure. Cost-effective and easy-to-cut options include acrylic plastic (plexiglass), plywood and MDF (medium-density fiberboard).

Acrylic plastic or plexiglass of at least 1/8" thickness is recommended for wall mounting, since it's transparent and has minimal effect on wall paints and texture and therefore maintains the room's aesthetics.

To avoid speaker vibrations, the backboard needs to be entirely behind the bar and fastened tightly to the wall, bracket or post it's mounted on.

Cardboard doesn't reflect sound well and must not be used as the backboard material.

Learn more about mounting a microphone and speaker bar with a backboard.

Bar placement in particular scenarios

The general rules above for microphone and speaker bar placement provide many options for a given space. However, specific room characteristics and setups will often guide which options work best — and sometimes trade-offs have to be made.

Camera tracking and switching

The HDL410 system provides X and Y sound location coordinates for camera tracking and switching solutions. For example, the Nureva camera zones feature, which uses these coordinates, can be set up by pairing an HDL410 with an INOGENI® CAM230 multi-camera selector. The Nureva Developer Toolkit offers the sound location device API.

Generally, when the microphone pickup performs well throughout the room, the camera tracking and switching feature will perform well too. However, perpendicular wall mounting of the microphone and speaker bars provides the best overall sound location accuracy (*Guideline 7: Place bars on perpendicular walls for optimal sound location data*) and should be the first choice.

Specific coverage areas

Sometimes, a room will require a specific coverage area, such as for a boardroom table in the center of a large meeting room. In a case like this, *Guideline 2: Consider proximity to activity areas* applies. Start by placing one microphone and speaker bar close to this area. Then, for the other bar, select a position that will extend the coverage across the entire room.

For classrooms, consider the ways in which people will be talking in the room. For example, placing a bar above the writing board might seem logical, but teachers typically face students when presenting. Mounting the bar at the side of the room will allow for better pickup of the teacher's voice because there will be a clearer path to the microphone and speaker bar.
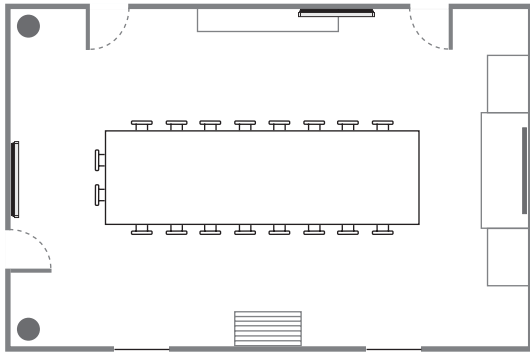
Meeting room with the bars mounted for optimal coverage.
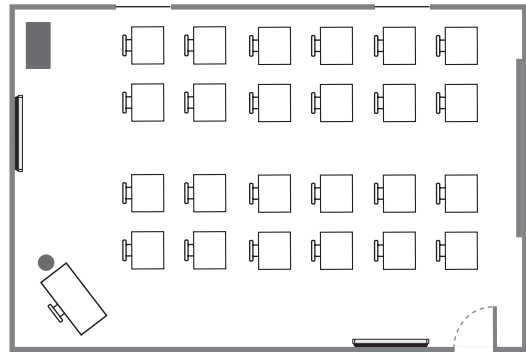
Classroom with the bars mounted for optimal coverage.

Tiered rooms

When installing microphone and speaker bars in a tiered room, like a lecture hall, it's important to consider the coverage map (see *Guideline 8: Consider bar mounting height relative to the coverage map*). The mounting height and the mounting angle for each bar will need to be adjusted to align the coverage map with the room's slope.

In the lecture hall example, the presentation area is at the front, with the seats rising gradually toward the back of the space.
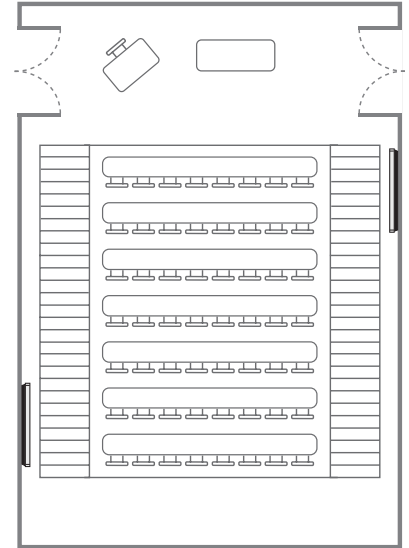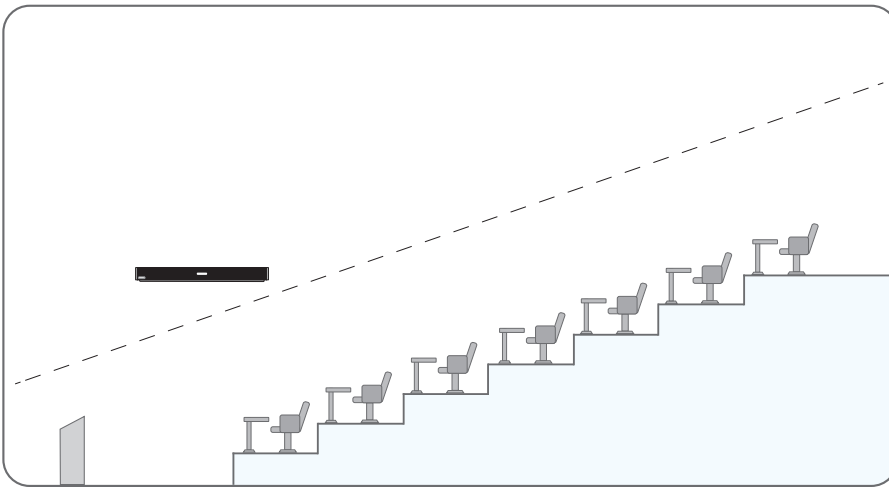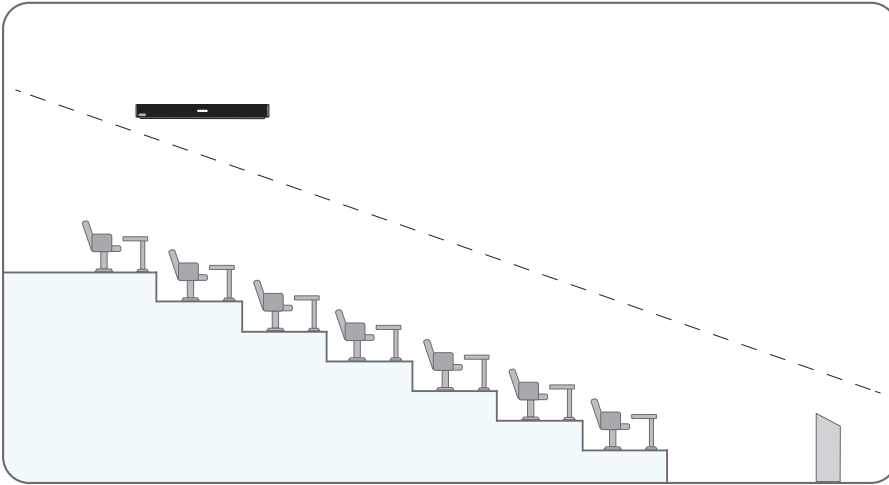
Configuration 1: Front and back walls

- Mount each bar horizontally on the front and back walls.
- Bear in mind the height difference will determine the coverage map angle.
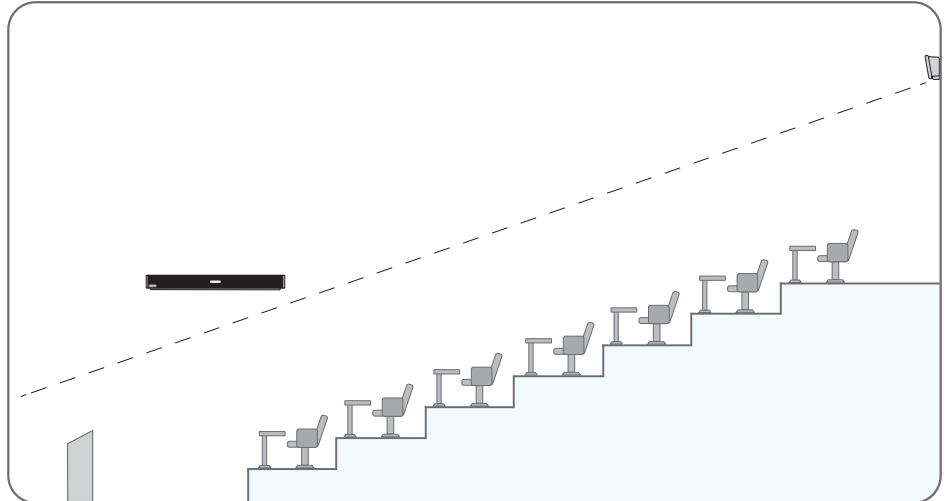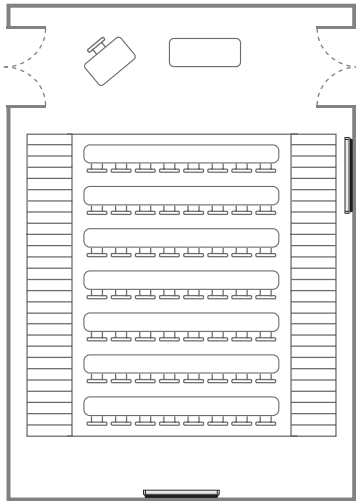- Position the bars so the coverage map angle matches the room's slope.
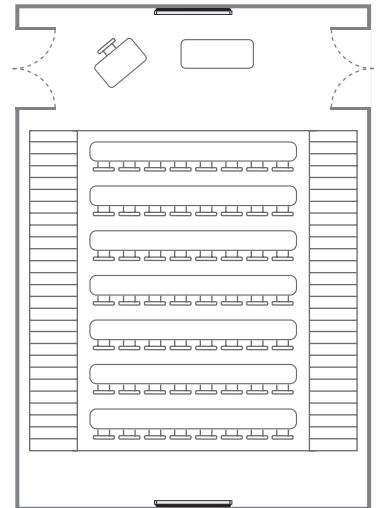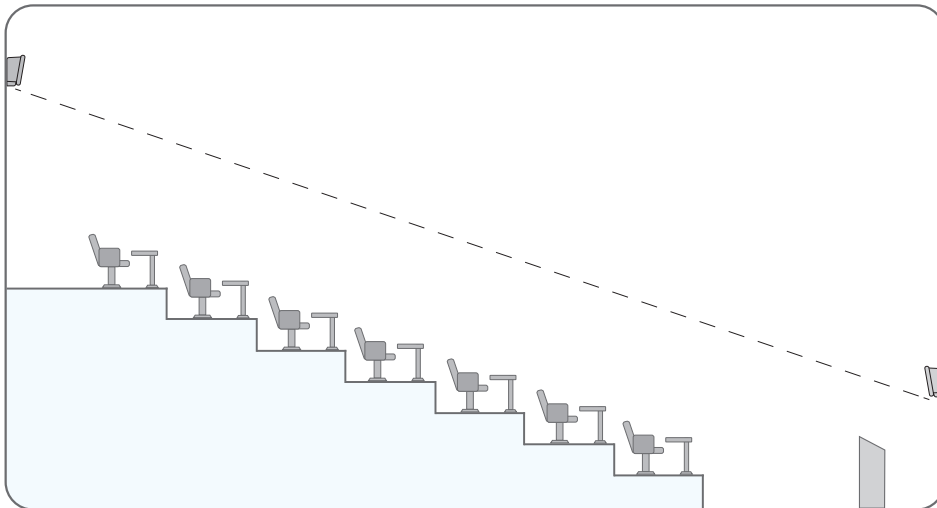
Configuration 2: Opposite side walls

- Mount both bars to match the slope of the room.
- Stagger the bars from each other on opposite side walls.
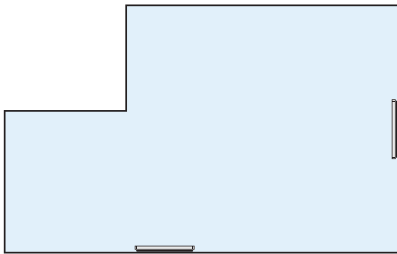
Configuration 3: Perpendicular walls

- Mount one bar horizontally on the back wall.
- Mount the second bar on a side wall, closer to the front of the room.

Irregularly shaped rooms

Remember that the coverage map retains the same shape (rectilinear) regardless of room geometry. Therefore, when installing the microphone and speaker bars in irregularly shaped rooms:

- Decide on one of the four configuration options (*Guideline 1: Choose from four bar placement configurations*).
- Position the bars to ensure a clear sound path to primary speaking areas and avoid mounting in recesses or behind posts (*Guideline 3: Maintain a clear sound path and avoid reflections*).
- Mount the bars with a reflective backboard behind them when installing on a display stand, tripod or ceiling mount (*Guideline 10: Optimize sound reflection from the mounting surface*).
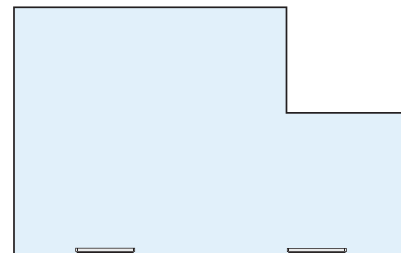

Mount on perpendicular walls for optimal coverage.

Mount staggered on opposite short walls.
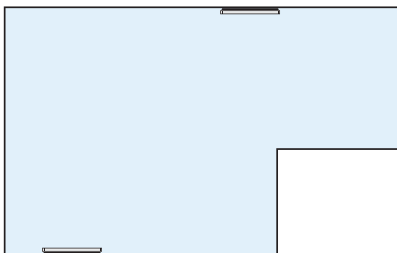
Mount staggered on opposite long walls.

Mount to the same wall with proper spacing.

Rooms with high reverberation levels

When installing the microphone and speaker bars, begin by analyzing the room's reflective surfaces. Common ways to reduce reverberation include adding soft furnishings, area rugs and acoustic panels. When dealing with highly reflective surfaces like glass walls or windows:

- Avoid mounting a bar directly facing a reflective surface, if possible.
- Position the two bars closer to areas where people typically speak (*Guideline 2: Consider proximity to activity areas*) to improve direct sound pickup.

Using the acoustic check tool

The Nureva acoustic check tool uses an iPhone® or iPad® device to capture both the background noise level and the reverberation time. The acoustic check tool combines the background noise and reverberation measurements, providing an overall acoustic score that predicts audio performance in a given location. This is how the accoustic check tool works:

- It allows users to take background noise and reverberation measurements using the iOS device microphone.
- If at least one background noise and one reverberation measurement are taken, an overall acoustic score is calculated.
- The acoustic score (and individual measurements) can help when choosing the optimal position for HDL pro series microphone and speaker bars.

Learn more about using the acoustic check tool.

Open spaces

When dealing with spaces much larger than the specified 35' x 55' (10.7 x 16.8 m), microphone pickup performance becomes less predictable due to limited sound reflections, acoustic energy dissipation, variable ambient noise and complex room layouts. Extensive testing will be required before finalizing the setup as well as system recalibration before each use.

Adaptive Voice Amplification

In large spaces, use of the Adaptive Voice Amplification feature is recommended to ensure the presenter is clearly heard in the room and by remote participants. With Adaptive Voice Amplification enabled, the HDL410 system's microphones work together with the presenter's wireless headset microphone. Plus:

- The HDL410 provides wider coverage of the in-room audience for remote participants.
- The wireless microphone captures the presenter's voice for both in-room and remote participants.

Dynamic boost

Dynamic boost enhances HDL410 speaker output and improves speech intelligibility in large or challenging rooms. Using this feature helps to ensure clear audio distribution when remote participants speak and when in-room presenters use wireless headset microphones.

Resources	
Adaptive Voice Amplification	*Adaptive Voice Amplification — HDL410 system*
Dynamic boost	*An introduction to dynamic boost*

We are Nureva

We believe that amazing things happen when people come together. They imagine greater possibilities, create better solutions and find greater joy in how they work and learn. It's why we create and support truly original solutions that make it astonishingly easy for our customers to connect and collaborate no matter where they are.

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