TeamConnect Ceiling 2

System design guide for Microsoft Teams certified bundle of Sennheiser TeamConnect Ceiling 2 and biamp TesiraFORTÉ® AVB VT4

Certified for

Microsoft Teams

SENNHEISER

System design guide for meeting rooms

This application note shows how TeamConnect Ceiling 2, Biamp Tesira hardware and Microsoft Teams can be integrated to support a Large Meeting Room Space. In this document a large meeting room is defined as a meeting space about 4.5 m x 8.5 m (15' x 28').

Equipment list

Below is the list of equipment used in this system configuration:

1	TeamConnect Ceiling 2	Ceiling microphone array
1	Microsoft Certified Teams Room System	
1	TesiraFORTÉ AVB VT4	Audio DSP
1	Tesira EX-UBT	USB connection to Microsoft Teams Room System
1	TesiraCONNECT TC-5	5 port AVB expansion box
1	Dante AVIO Analog Input 1ch (ADP-DAI-AU-1X0)	
1	Dante AVIO Analog Output 1ch (ADP-DAO-AU-0X1)	
1	Network switch for Tesira Control and Dante communications	
1	Computer running Control Cockpit, Tesira Software and Dante Controller *	

*This document assumes familiarity with these software platforms. It is recommended that a Tesira Certified Programmer is engaged for system configuration and commissioning.

Optional accessories:

1	Tesira AMP-450BP	4 channel PoE + amplifier
4	desono C-IC6	6.5" ceiling mounted loudspeaker

These accessories are recommendations. You may also use amplifiers and loudspeakers of your choice.

Equipment installation

The diagram below provides an example of typical installation locations for the required hardware and may vary based on room layout. The desono Speaker Calculator has been created to assist with determing the speaker quantities and locations for a given space.
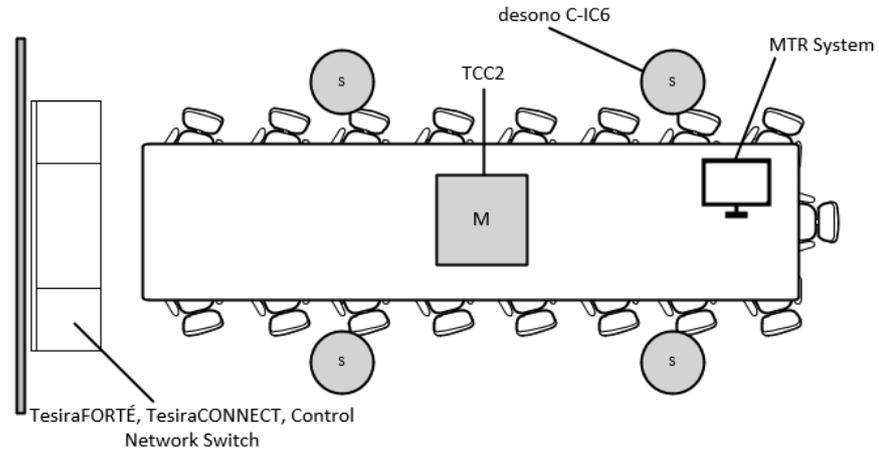
It is recommended that a qualified AV integrator be utilized for installation and configuration of all hardware. For assistance locating an integrator, please contact the Sennheiser Customer Service.

▷ Connect the hardware components as outlined in the diagram below.
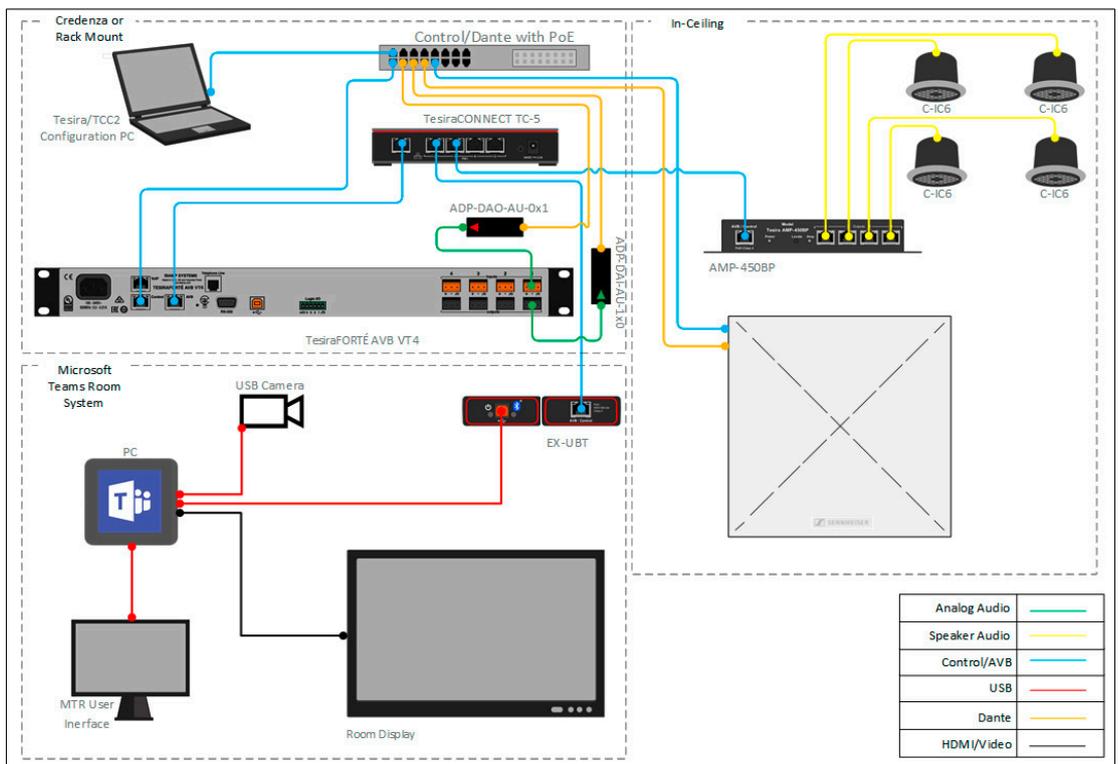
Tesira Device Configuration

The provided configuration file for this system is set up with all the audio I/O, processing, and routing already in place to support the room design requirements.

The file's Equipment Table is populated with the proper hardware to match the layout, but will need to have serial numbers and proxy host assignments added before loading the file to system.


In the file, the matrix routing is already in place to support the room design requirements. A single AEC input channel on the TesiraFORTÉ AVB VT4 will support the connection to the TeamConnect Ceiling 2 via the Dante to analog convertor. A single analog output channel will be used to route a reference signal back to the TeamConnect Ceiling 2 via the analog to Dante converter.
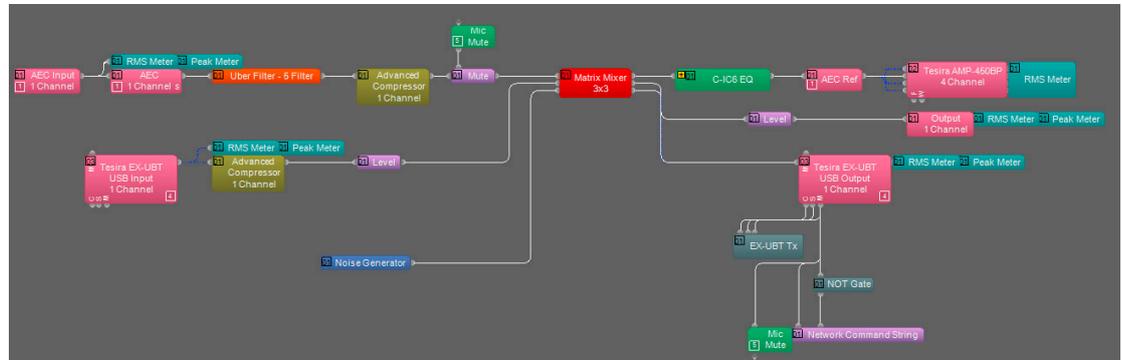
The EX-UBT is configured for Speakerphone: Disables Computer AEC. In this mode Teams will offload its AEC processing and allow Tesira to handle this exclusively.

The EX-UBT Input block receives far end audio from the Teams Room System to route to the amplifier outputs and AEC references. The EX-UBT Output block sends the microphone audio to the Microsoft Teams Room System for transmission to the far end.
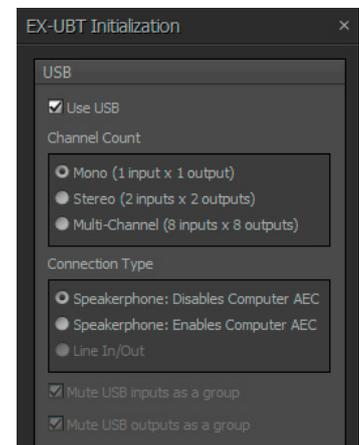
Each C-IC6 loudspeaker will be connected direc-
tly to the AMP-450BP using standard CAT cable.
A custom block with the recommended C-IC6
EQ curve has been added before the output.

Each AMP-450BP channel will support up to two
C-IC6 loudspeakers. The current configuration
assumes four speakers will be in use. If additio-
nal speakers are needed, this can be configured
from the AMP-450BP control dialog by changing
the Speaker Count parameter for the appropriate
channel.
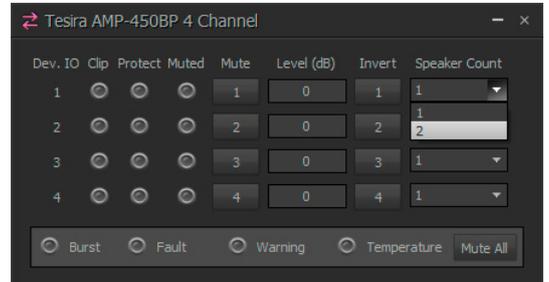
Setting the audio device from the Teams Room System

Setup and deployment of specific Microsoft Teams Rooms hardware may vary, please see manufacturer documentation for proper operation. The Biamp Tesira system enumerates as a USB audio peripheral device when connected to any Microsoft Teams Room System.

1. Navigate to the Settings menu on the Teams Room user interface
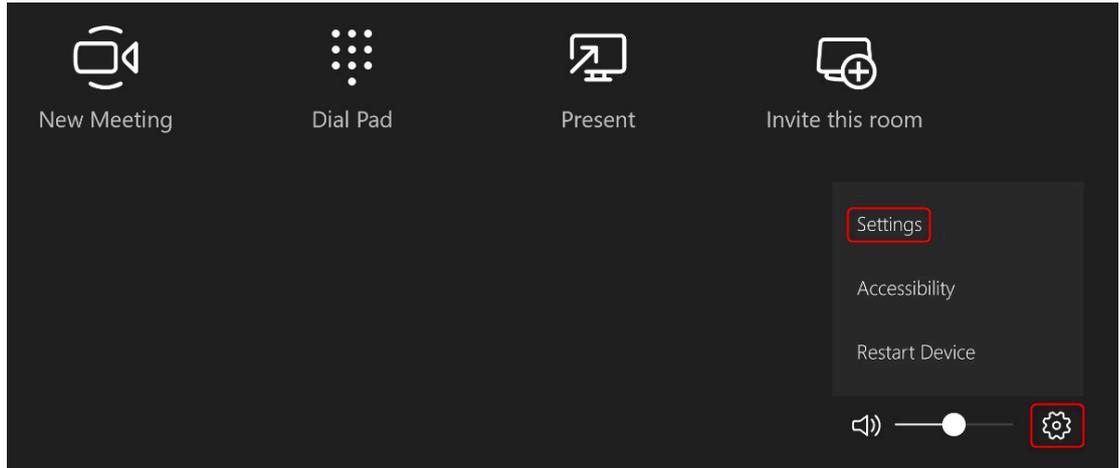
2. From the Features menu, use the dropdowns to select the EX-UBT.
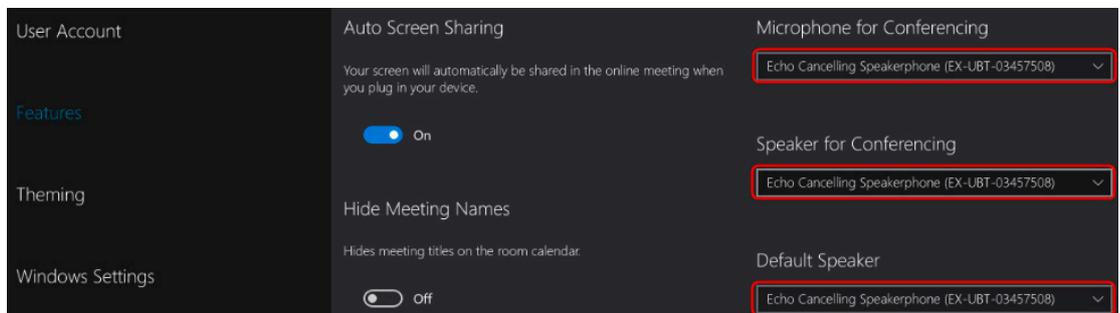
HID Communication Logic

The EX-UBT synchronizes privacy mute state and volume control when connected to the Microsoft Teams Room System. This is achieved through Human Interface Device (HID) communication. Within the running Tesira configuration, room level control from the Teams Room System user interface will sync with the level control in the EX-UBT USB Input block, while privacy mute from the Teams Room System user interface will sync with the mute control in the EX-UBT USB Output block.
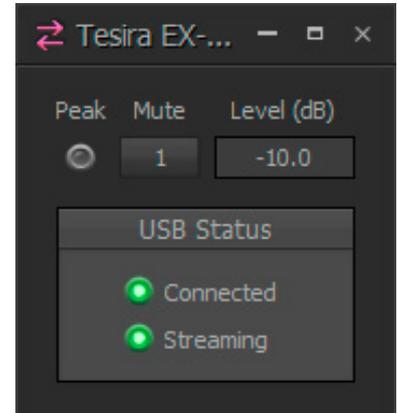
By default, the Microsoft Teams Room System volume control will set to 50 when a meeting is started. This level will be reflected in the EX-UBT USB Input block as shown on the image to the right.


The TeamConnect Ceiling 2 can be controlled by a 3rd party device over UDP port 45. This is accomplished in Tesira by using a Network Command String block and requires that the Tesira control port be connected to the same network as the TCC2 PoE/Ctrl port. The IP address assigned to the TCC2 PoE/Ctrl port is entered in the Server Address field.
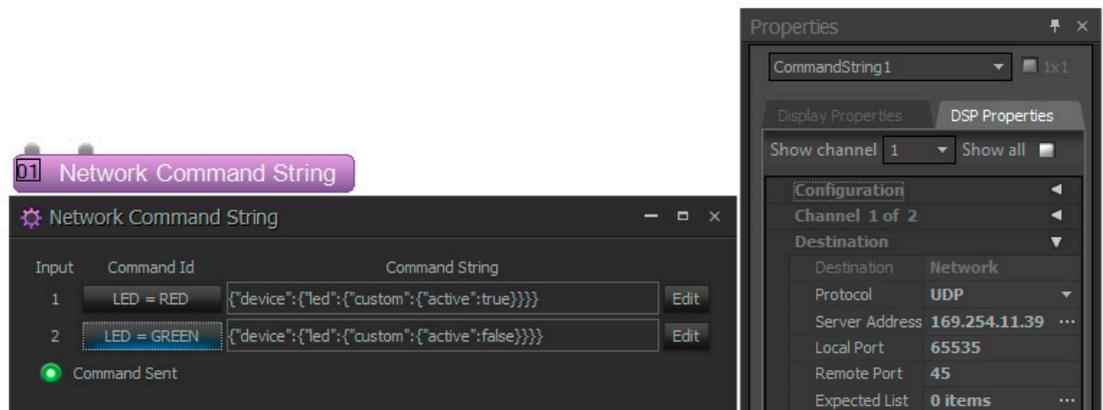
HID mute sync feedback from the Teams Room System is used to set the LED color on the TCC2, Red for privacy "mute on" and Green for privacy "mute off". This also triggers a Mute block to mute and unmute the audio being sent to the far end participants.

When configuring the TCC2 from Control Cockpit, be sure to set the Custom Color to Red and leave the mic unmuted. Privacy mute will be handled in Tesira, post AEC processing.
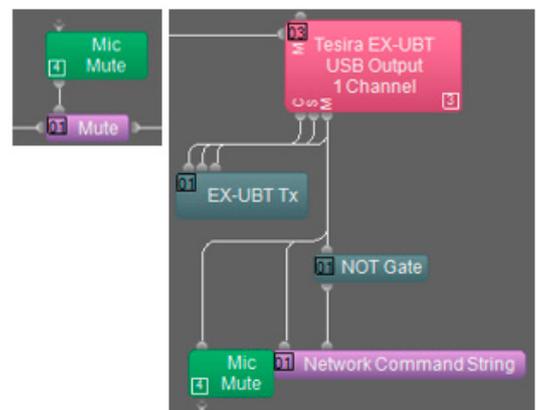
TeamConnect Ceiling 2 Setup and Configuration

The TeamConnect Ceiling 2 is a ceiling mounted dynamic beamforming microphone. It supports both Dante (input/output) and auxiliary balanced analog (output) connections for audio transport. A PoE/Control connection and the Sennheiser Control Cockpit software is required to begin setup.

With the network cable attached to the TeamConnect Ceiling 2 ("Ethernet PoE/Ctrl"-Socket) the browser-based Control Cockpit Interface should detect and identify the TeamConnect Ceiling 2 unit as shown below (using MDNS).
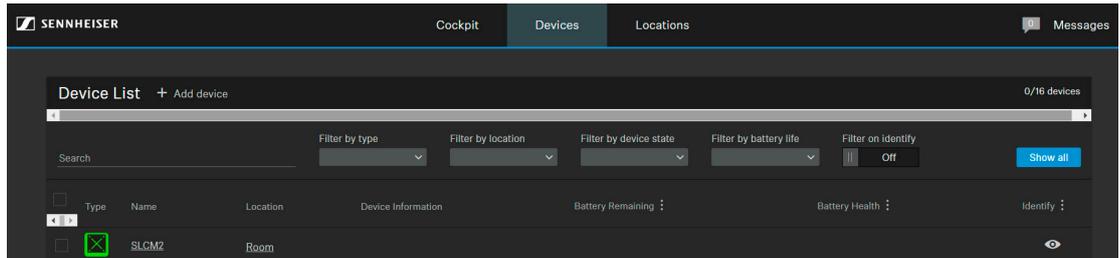

Clicking on the unit to be configured from the device list opens the settings view where system and audio parameters can be examined and edited.

In the leftmost section of the "Audio" pane the current focus of the automatic beam-steering can be tracked in real-time. Via the "Edit" button the user can manually declare vertical and horizontal exclusion zones (marked grey) which will prevent the source detection from being deterred by noise sources at known locations (e.g. ceiling mounted AC-vents, projector fans).

More information can be found in the online help of the Control Cockpit.
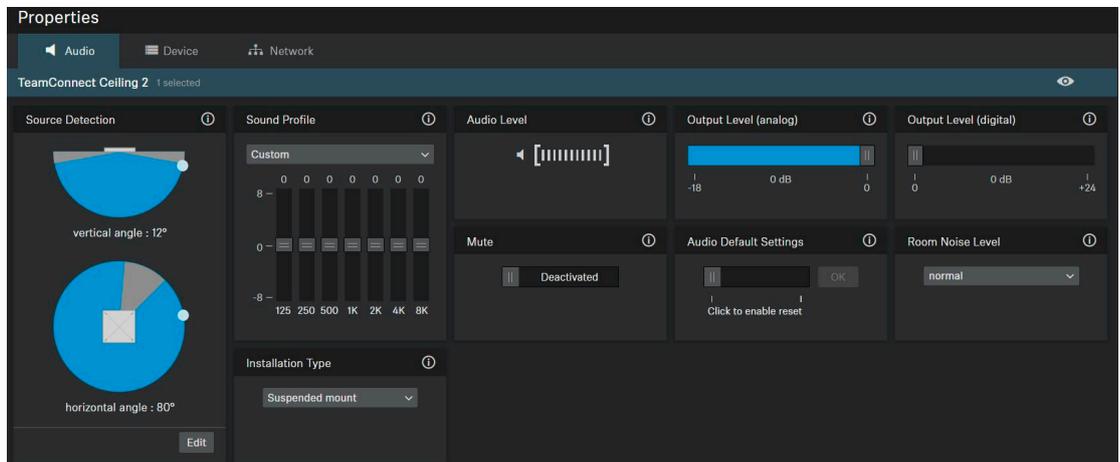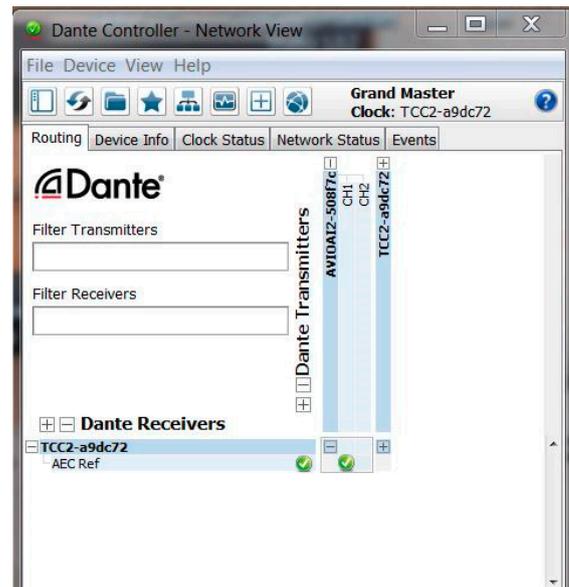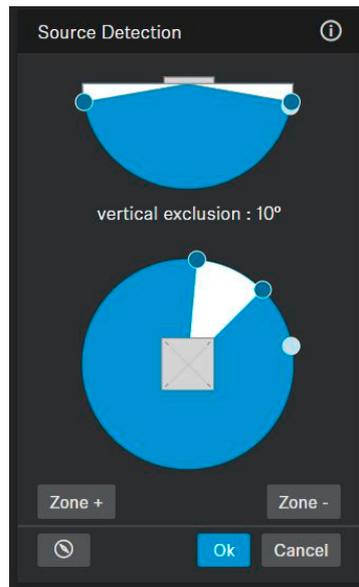
In order to improve the AEC-performance of the overall conference setup it is advisable to provide the AEC-reference signal (i.e. as being played back by the loudspeakers) to the TeamConnect Ceiling 2's reference-input-channel (1st Dante input-channel), so the beam-steering can be stabilized during far end speech.

Use the Dante-Controller-Software on a computer attached to the Dante network to establish the routing between the respective Dante-endpoints.

Leveling of the AEC-reference:

The far-end signal (receive signal from the far end talker) needs to be routed from the DSP to the TeamConnect Ceiling 2 AEC Ref input via Dante. This AEC reference signal is used inside the TeamConnect Ceiling 2 to steer the beam into a static status (at 315° horizontally and 90° vertically) at any time when the far-end talker is active. The static status is enabled when the level of the AEC reference signal exceeds a certain threshold. In order to ensure appropriate functionality of this feature, it is crucial to adjust the level of the AEC reference signal. Optimally, the level of the AEC reference signal should be adjusted in such a way that the static status is not active when the far end talker is not active.

Proposed procedure to find the right level for the AEC ref signal:

Setup a test-call where the far-end talker is unmuted but remains quiet. Set the output level for the AEC ref-signal inside the control software for the AEC to minimum. In this way the position of the near-end talker should be tracked properly, never reaching the static status. The static status is indicated in Sennheiser Control Cockpit by a direction of 315° horizontally and 90° vertically. When the output level of the AEC reference signal is increased steadily, at a certain point the static status becomes active and the displayed position in Sennheiser Control Cockpit is stuck to 315° horizontally and 90° vertically. Find the level where the static status is starting to be active with a quiet far-end. When this threshold is found, reduce the output level of the AEC reference signal by 15-20 dB.

Networking Details

This system deployment makes use of PoE+ powered endpoints. The TesiraCONNECT provides all necessary resources to support these communications.

Setup Requirements:

- The TesiraCONNECT TC-5 requires no configuration to support Tesira device communications and will provide all necessary power to PoE powered devices.
- The TesiraFORTE AVB VT4 should be configured for Separated AVB and Control Networks as outlined in this article.
- Control/Dante network switch
  - Optional: PoE capable switch to provide power for the TeamConnect Ceiling 2
  - Alternate: 802.3af (Class 3) PoE injector for powering the TeamConnect Ceiling 2 (if Control switch does not provide PoE power).
  - Tesira Control Port and the TeamConnect Ceiling 2 PoE/Ctrl port will need to be configured with addresses in the same subnet for LED mute sync control to function.
- Note that the EX-UBT, and the AMP-450BP use Layer 2 AVB for audio and control data, IP address setup is not required.

Microphone and speaker placement

Microphone placement

The laws of physics can't be ignored when deciding on the right placement of a microphone. A good signal-to-noise ratio is key in every part of the audio signal chain and for a typical microphone pickup scenario, this translates to avoiding large distances between the mic and the talker.

▷ Keep the distance to the talker as short as possible.

▷ Keep the distance to the ceiling speakers as high as possible.

▷ Stay away from noise sources like projector fans and air vents.

Speaker placement

Placing speakers in a room can be as equally critical as finding the right spot for a microphone. An ideal positioning of multiple ceiling speakers will achieve an even SPL coverage and a good speech intelligibility across the entire room.

desono Speaker Calculator

The desono Speaker Calculator can aid in determining the correct number and proper location in which the ceiling speakers should be located.
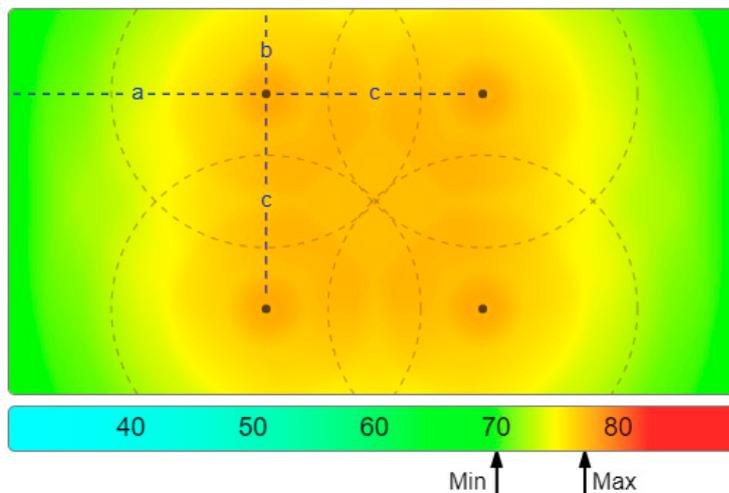
Minimum level in room: 70.2 dBSPL
Maximum level in room: 77.4 dBSPL