



Version 5.0.0

Illusonic GmbH, registered offices:
Bahnstrasse 23, 8610 Uster, Switzerland

www.illusonic.com

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IAP features and specs may change without notice

Safety Notice

Make sure to respect the following rules:

- Install the IAP on a stable base.
- Do not install the IAP near water.
- Do not expose the IAP to any kind of liquid.
- Do not install the IAP near any heat source or in direct sun light.
- Do not install the IAP in a confined space and make sure sufficient air can flow around it.
- Do not operate the IAP under high (>35° C) or low (<5° C) ambient temperature. See operating conditions in Chapter 7.
- Do not operate the IAP under extremely high humidity. See operating conditions in Chapter 7.
- Do not open the IAP nor try to service it by yourself. Always refer to a qualified technician for service and maintenance. Failure to do so will void the warranty.
- Make sure to use 3 terminals (phase, neutral, and earth) power cables with ground conductor. Make sure your local AC voltage matches the voltage printed next to the IAP's AC power connector.

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FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Adjust or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into a mains outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Disposal – Environmental Care

Directive 2002/96/EG of the European Parliament requires consumer electro-technical appliances to be disposed separately and have to be indicated with the symbol on the left. Should you dispose this component, please do so in conformity with local and global legal and environmental regulations and according to best practices. We strongly encourage you to recycle any batteries used with this component.



1 Introduction

1.1 Foreword

Conventionally in high end audio, people “mix and match” devices. They may use a DAC, an analog pre-amplifier, a phono stage, an equalizer, and a processor.

Illusonic Audio Processors integrate these functionalities - because they belong together from a quality, technical, and usage perspective. The number of signal transmissions and conversions (AD, DA, digital clock sync) are minimized.

Use IAP 2 as a preamplifier and DAC to refine the sound of a conventional stereo system. IAP 4, IAP 8, and IAP 16 feature four to sixteen channels and allow optimization of systems with more than two channels. The channels can be used flexibly for surround, center loudspeaker, active crossovers, subwoofers, and height loudspeakers. World-class signal processing is built into IAPs to make the most out of almost any configuration.

The following pages give an overview of IAP's features.

I hope you'll enjoy countless hours of quality listening and entertainment!

Yours truly,

A handwritten signature in black ink, appearing to read 'Christof Faller', with a horizontal line underneath and a small flourish at the end.

Christof Faller
Founder and Owner of Illusonic

1.2 How To Use This Manual

- The manual is structured to be read through from beginning to end.
- In case you read the manual only punctually, there are many pointers within the text, referring to related information and chapters. Detailed contents in the beginning and an index in the end help you find desired information quickly.
- You will find text and figures with additional information and insights placed in the info margin.¹

¹ This text is in the info margin.



This symbol indicates important information.

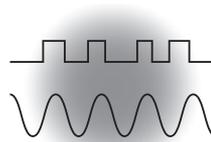


General knowledge and tutorial information is indicated with this symbol.

1.3 IAP Overview

Inputs

IAP can connect to a variety of sources. There is usually no need for a device between the source and IAP. In addition to conventional analog and digital inputs, IAP features a phono stage, USB audio, network media rendering, and four HDMI inputs with multi-channel LPCM support (up to 192 kHz, 24 bit, 8 channels).



Analog, Digital



Hi Res
HDMI, USB, Network



Phono Stage

Outputs

IAP 2 and IAP 4 feature each of its channels as symmetric XLR and corresponding RCA line outputs. IAP 8 and IAP 16 feature symmetric XLR outputs only. These can be converted to unbalanced RCA by means of an adapter cable.¹



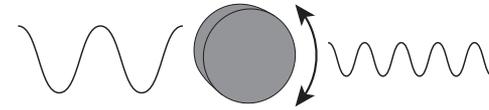
¹ Make sure the adapter connects XLR pin 1 to RCA shield, XLR pin 2 to RCA signal, and keeps XLR pin 3 unconnected. Connecting XLR pins 1 and 3 short-circuits IAPs line-out amplifiers and can cause damage.



IAP's HDMI output connects to a TV or projector, if needed.

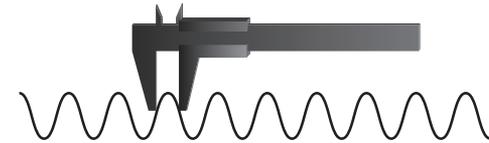
Volume Control

In order to be able to connect directly to power amplifiers or active loudspeakers, IAP features volume control, implemented digitally. Volume control, using 32-bit floating point arithmetic and dithering, is applied just before the DACs.



Calibration

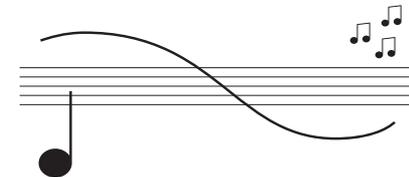
IAP Calibration software and IAP are a system for acoustic measurement, analysis, and optimization. Each IAP channel features gain, delay, polarity, and fully parametric equalizers, which can be used for linearization, time-alignment, room EQ, and crossovers.



Tone Control

While room equalization has the goal to mitigate dominant characteristics of the room, Tone Control is used to subjectively adjust the level of low and high frequencies.

Not only bass and treble gain can be adjusted, but also their frequencies. With this flexibility, Tone Control can also be used to optimize sound for a zone far off sweet spot (e.g. dinner table, other room, etc.). IAP Calibration software includes means of optimizing Tone Control.

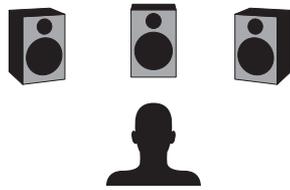


Clarity

A good musician can adapt, the way how he plays, to the room. For example, in a room with bass resonances, a bass player can play “shorter” to reduce resonances. This also works at higher frequencies, a violin can adapt its playing to reduce negative effects of a bad room.

Similarly, Clarity adapts the music, such that it excites a room’s resonances less, making the sound more transparent and bass more dry.





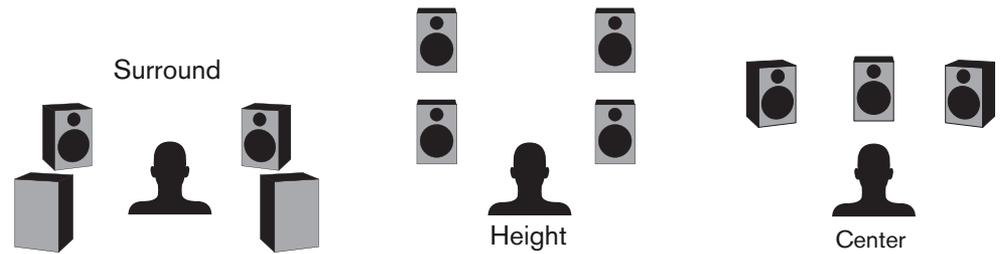
Center Loudspeaker

IAP 4/8/16 support a center loudspeaker. For stereo audio, IAP can reproduce phantom center over the center loudspeaker, for precise and interferenceless audio reproduction. The Sound stage is stable beyond the sweet spot. When IAP receives a center channel via HDMI, it will reproduce it over the center loudspeaker.



Depth/Immersion

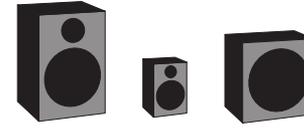
The specific room, loudspeakers, and loudspeaker positions determine how a room reacts to the sound. Depth/Immersion adds freedom to modify the perceived spaciousness beyond the traditional physical parameters.



Depth/Immersion works great for stereo systems. Additional surround, height, or center loudspeakers can make Depth/Immersion more natural and spectacular. Depth/Immersion also makes movies greatly immersive.

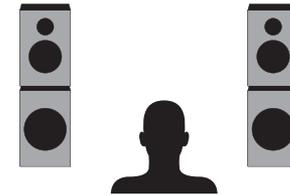
Bass Management

IAP 4/8/16's versatile bass management enables optimal use of different loudspeaker sizes and/or subwoofers. If a loudspeaker is smaller than others, or for room acoustic reasons, the bass can be removed from it and be reproduced over other loudspeakers and/or subwoofers.



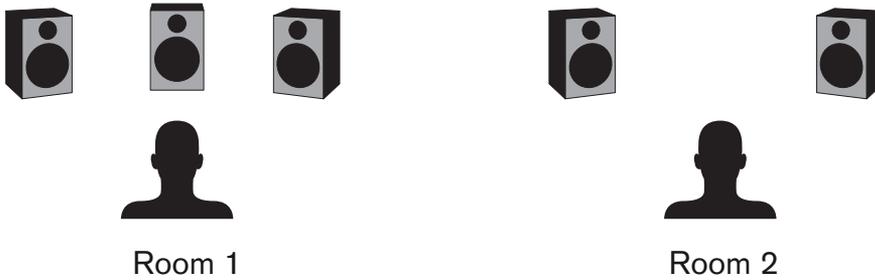
Crossovers

IAP 4/8/16 support implementation of active crossovers with as many channels as are available in the IAP model.



Multiroom

IAP 4/8/16 can use their channels to reproduce sound in different rooms. Each room can be calibrated individually.



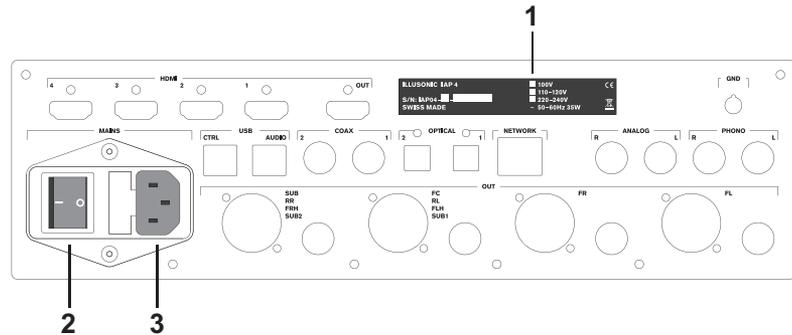
2 Getting Started

Step 1: Unpacking

Unpack IAP. Store the packaging for future transportation. The package contains:

- IAP unit
- AC power cable
- Remote control
- This user manual

Step 2: Installing the AC Power Cable



1. Make sure that the indicated voltage matches your local AC voltage.
2. Make sure that the main power switch on the back is set to off (0).
3. Install the AC power cable.¹

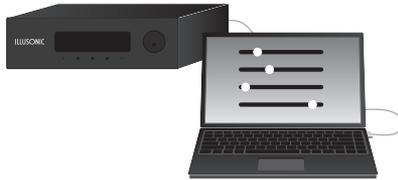


¹ Make sure to use 3 terminals (phase, neutral, and earth) power cables with ground conductor.

Step 3: Configuring IAP

Get your IAP up to date and configure it:

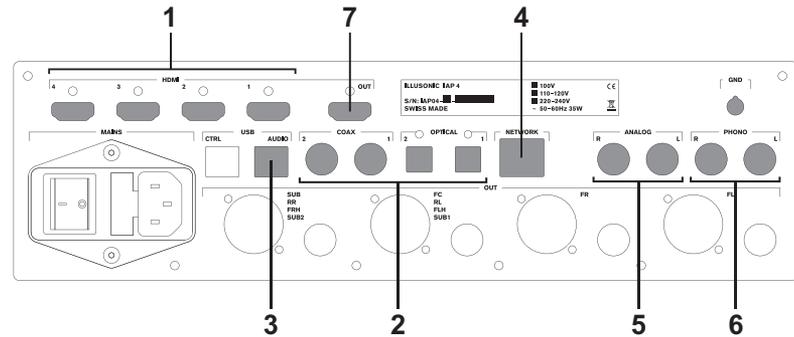
- Connect your Mac/PC via USB to IAP's USB Ctrl input.
- Download the latest IAP firmware update from Illusonic's web-site. IAP firmware can be downloaded under *Audio Processors* in the *Support/Downloads* section.
- Run firmware update.¹
- Install IAP Configuration and IAP Calibration software.
- Use IAP Configuration to configure IAP (Chapter 4).
- Use IAP Calibration to measure and calibrate your system (Chapter 5).²



¹ Only one software can access IAP via USB at a time. Before running firmware update quit IAP Configuration and IAP Calibration software in case they are open.

² You can do this step also later.

Step 4: Connecting Audio/Video Devices



Connect audio and video devices to any of the above shown connectors:

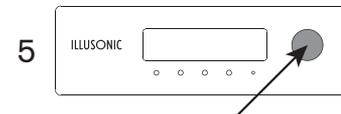
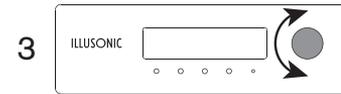
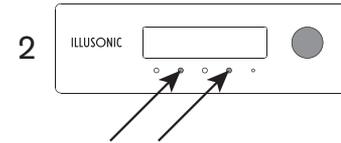
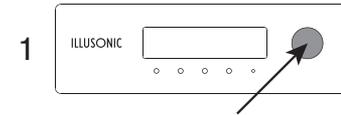
1. HDMI sources, such as Blu-ray players, game consoles, and set top boxes.
2. Digital audio sources, such as CD players.
3. A PC or audio server over USB.
4. A network, PC, or audio server via Ethernet.
5. An analog audio source.
6. A turntable.
7. If you want to watch video, connect a TV or projector.¹

¹ If you use IAP only for enjoying audio, then there is no need to connect a TV or projector. All necessary information is shown on the built-in display.

Step 5: Using IAP

1. Push the rotary to switch IAP on.
2. Select an input source, using the < > buttons below the display.
3. Adjust the volume by turning the rotary control on the right.
4. Play sound with the selected input source.
5. Once you are done, push the rotary control for two seconds to put IAP to standby.¹

To get more familiar with usage of IAP, continue with Chapter 3.

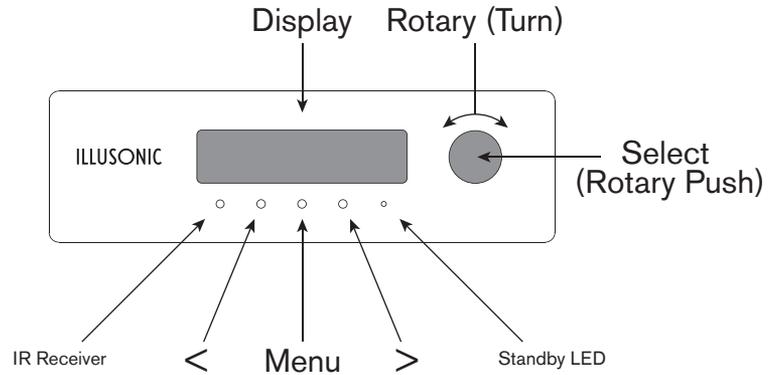
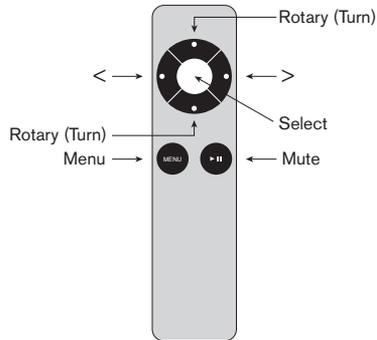


¹ When you set the main power switch to off or disconnect the main AC power, without going to standby first, IAP does not save its current settings.

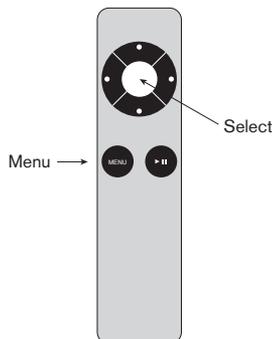
3 Usage

3.1 Front Panel and Remote Control

¹ The same controls, and a *Mute* button, are available on the remote control:



² To pair the remote control with IAP, go to IAP menu *System: Remote Pairing* and press on the remote control simultaneously *Select* and *Menu* for a few seconds.



IAP's front panel has a display, showing the current state of the device, and a number controls:¹

- **Select** (Rotary Push): Select/Enter, IAP On/Standby (long push).
- **Menu**: Enter Ad Hoc Settings, exit menus, directly go to main screen (long push).
- **< >**: Changes value shown in the **middle of display**, e.g. Input or Menu.
- **Rotary**: Changes value shown on the **bottom of display**, e.g. Volume or Sub-Menu.

If you use an Apple IR remote control for another device, such as an Apple TV, you can pair the remote control with IAP, such that IAP reacts only to one specific remote control. To pair IAP with its remote control, go to Configuration Menu (Chapter 3.5) *System: Remote Pairing* and press on the remote control *Menu* and *Select* buttons simultaneously for a few seconds.²

3.2 Common Usage

In normal operation mode, the display shows the currently active input source, Sound Settings Preset, and volume level, as illustrated in the figure on the right. The normal operation mode states are changed as follows:

Volume is changed by using *Rotary*.

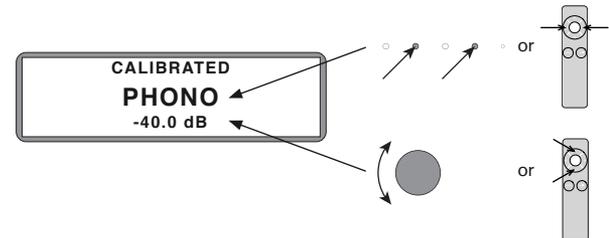
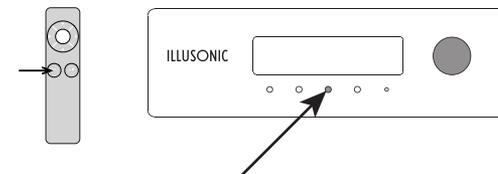
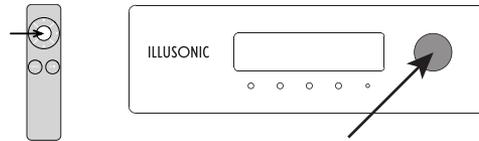
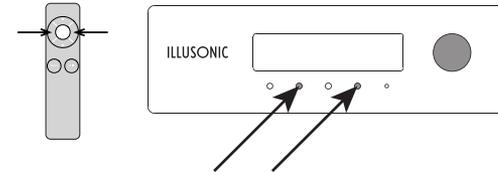
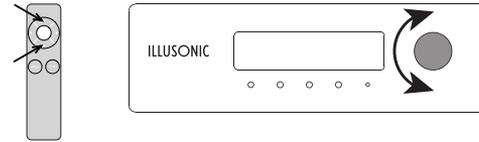
The **Input Source** is changed by using $< >$.

Push *Select* to change the active **Sound Settings** preset with $< >$. Push *Select* again to enter the Sound Settings menu (Section 3.3).

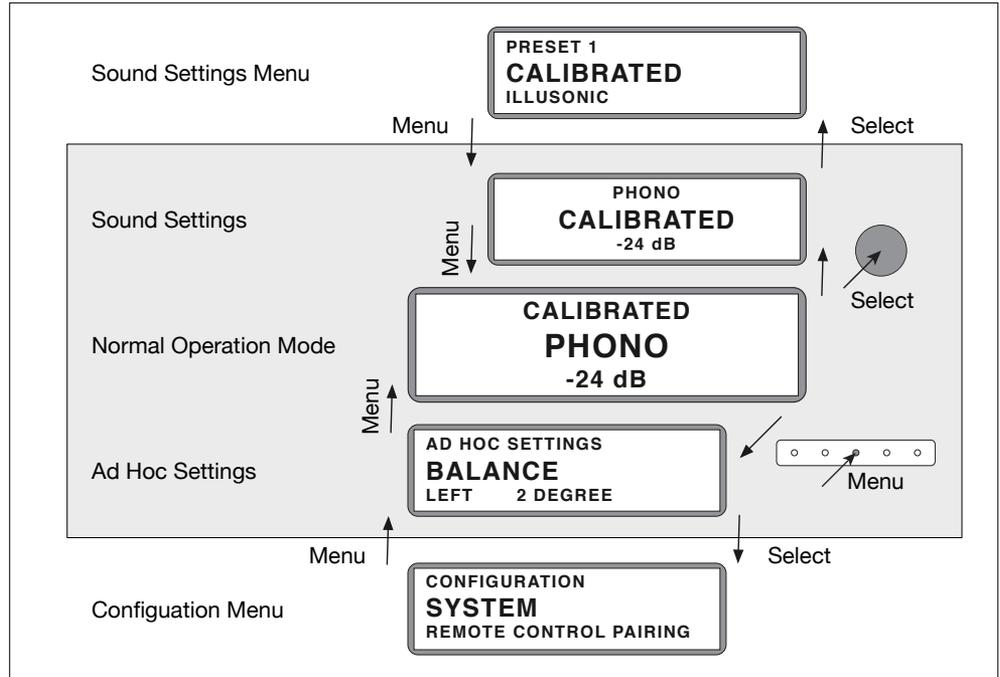
Push *Menu* to change **Ad Hoc Settings** (Section 3.4), such as balance. *Menu* also exits menus. Push *Menu* for two seconds to return directly to normal operation mode from any other state.

Remember this simple rule:

$< >$ *always* modifies the menu or value in the middle of the display and *Rotary* modifies the menu or value on the bottom.



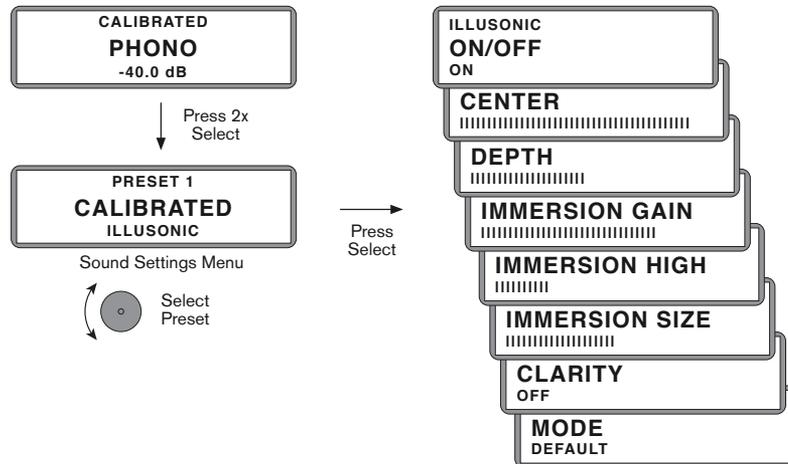
The figure below illustrates navigation between the different modes. *Normal Operation Mode* allows to directly change input and volume. By means of pressing *Select* or *Menu*, one can change *Sound Settings* preset or modify *Ad Hoc Settings*, respectively.



Sound Settings parameters and IAP configuration can be modified in the *Sound Settings Menu* and *Configuration Menu*, respectively. These are accessed, as indicated in the figure, by *Select – Select* and *Menu – Select*, respectively. When Menu Lock is enabled, then these menus are not available.

3.3 Sound Settings Menu

Press twice *Select* to enter the Sound Settings Menu. There you can change the preset to edit (< >) and sub-menu (*Rotary*). *Select* will enter the sub-menu. In the following, the parameters of each sub-menu are described.¹



Illusonic

Choose Illusonic On to apply Illusonic signal processing. Note that parameters which do not apply will not show (e.g. if there is no center loudspeaker, Center will not be shown, etc.).

Center

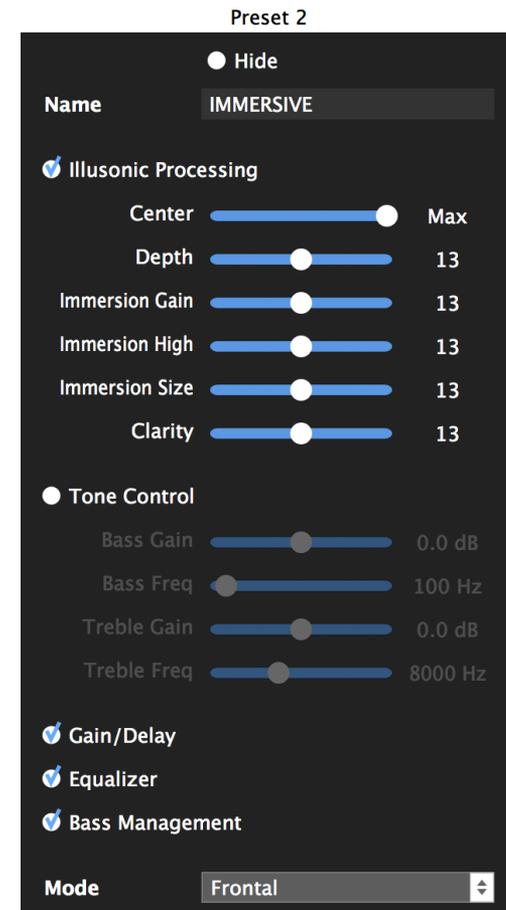
Center determines to which degree a phantom center is converted to a real center (played back with the front center FC loudspeaker). Center increases the sweet spot area: dialogue and soloists are localized in the center, from everywhere in the room, as intended by the mix.

Depth

Depth determines how much volume and depth is added. The otherwise flat sound stage becomes three-dimensional. Psychoacoustically, Depth relates to "auditory source width" and physically it relates to early reflected sound.



¹ IAP Configuration software (Chapter 4) presents all Sound Settings parameters clearly, as shown below. Nevertheless, IAP Sound Settings Menu is quickly accessible to modify parameters during listening without a need for a PC.



Immersion Gain

Immersion determines how much listeners are immersed into sound (in psychoacoustic terminology “enveloped”). Physically, this setting relates to how strong diffuse sound is reproduced.

Immersion High

Immersion High is a sub-feature of Immersion and determines how “brilliant” immersion sounds.

Immersion Size

Immersion Size is a sub-feature of Immersion and determines the reverb time RT60 of the immersion signals.

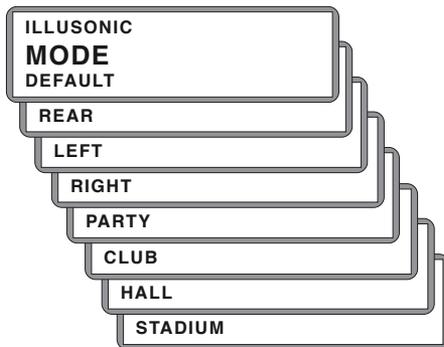
Clarity

Clarity in a way is the opposite of Depth/Immersion, it makes the reproduced sound more dry, reducing your room’s reverberance. Also, when Clarity is used, Depth/Immersion tend to sound cleaner.

Mode

This feature is only available with surround loudspeakers and stereo sources. It allows you to move the sound stage from front to a side or rear. The idea is, that you can have the sound stage at a different direction, depending on your listening situation.

Additionally, there are a few fun modes, such as Party, Club, Hall, and Stadium. You can control the room effect of Club, Hall, and Stadium with the above described Depth parameter. Depth beyond 50% amplifies the rear channels.



Tone Control

Use Tone Control to modify bass and treble. With Bass and Treble Gain you can adjust the level of low and high frequencies. Bass and Treble Frequency allow to adjust the corresponding frequencies.

Tone Control can also be used to optimize sound for a zone far off sweet spot (e.g. dinner table, other room, etc.). IAP Calibration software (Chapter 5) includes means of optimization of Tone Control.

Other Settings

A number of other settings are available for each preset.

Name

You can customize each preset's name. *Rotary (Push)* toggles between the letters and *Rotary (Turn)* selects a specific letter or blank.

Gain/Delay Trim, Equalizer, Bass Management

For each preset, you can switch each of these functions On or Off. Note that Low and High Pass Filters stay active even when Equalizer is Off, i.e. crossover filters stay always active (except during measurement with IAP Calibration).

Show/Hide

You can change the show/hide status for each preset and so change the number of available presets. Select one of the presets with *Rotary* and toggles between show and hide with *Select*.



3.4

Ad Hoc Settings

Press *Menu* to enter Ad Hoc Settings. These settings are temporary, i.e. changes will be reset when restarting IAP.

DSP Info

This menu shows DSP related information, such as sampling rate, input format (HDMI), and DSP load/peak-load.

Balance

Left-right balance can be modified by shifting stereo input phantom center to left or right.

Subsonic Filter

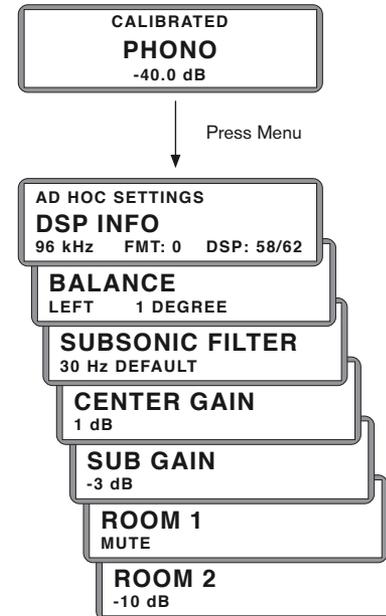
A subsonic filter is globally defined in IAP's outputs configuration. Here the subsonic filter can be changed or switched On/Off temporarily.

Gains

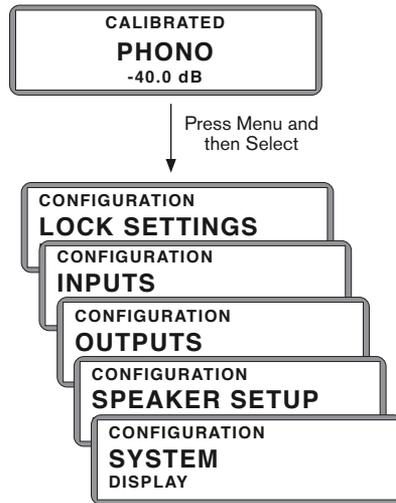
When using center or subwoofers, their gains can be modified.

Room Mute and Volume

When IAP is used with several rooms, each room can be set to mute and its relative volume can be changed.



3.5 Configuration Menu



IAP can be conveniently configured with IAP Configuration software (Chapter 4). Many of its settings are also available in the Configuration Menu. Enter Configuration Menu by pressing *Menu* and then *Select*. The figure on the left illustrates the available menus:

Lock Settings

In this menu you can lock settings of your IAP to prevent that things are changed accidentally. When lock settings is enabled, only Input, Volume, Sound Settings Preset, and Ad Hoc Settings can be changed.

Inputs

This menu contains settings related to IAP's inputs. Inputs can be renamed, delays and gains can be applied to each input, and the HDMI inputs can be configured for different audio formats. USB, network, and phono settings can also be changed in this menu.

Outputs

This menu contains settings related to IAP's outputs, such as line level, phono settings, channel gain/delay/polarity, and pink noise test.

Speaker Setup

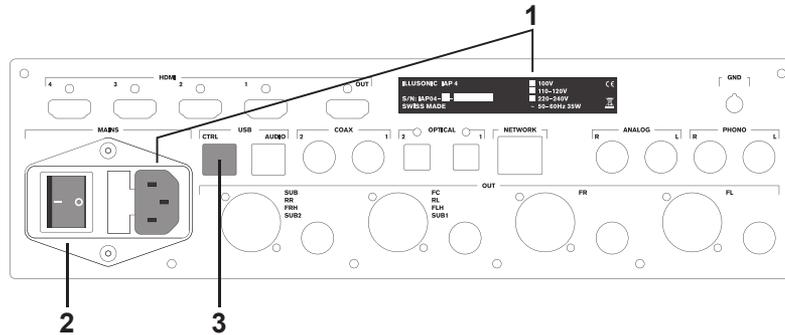
In this menu you can change IAP 4/8/16's loudspeaker setup.

System

This menu contains system-related settings and information, such as display brightness/sleep, network info, firmware version, remote control pairing, and IAP factory default reset.

3.6 Back Panel

Power and Control Connectors



1. AC Power

Before connecting a power cable here, make sure that the indicated voltage corresponds to your AC power voltage.¹

2. Power On/Off

If you do not use IAP for a longer period of time, it is recommended that you turn off the main power switch.²

3. External Control (USB)

A personal computer can connect to IAP to control it, read and write parameters, and update its firmware.

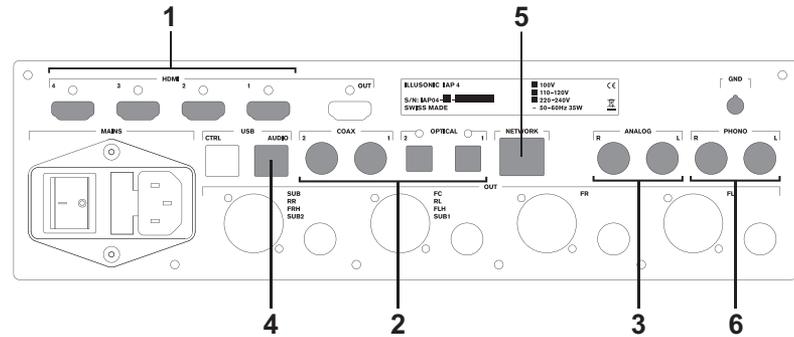


¹ Make sure to use 3 terminals (phase, neutral, and earth) power cables with ground conductor.



² When you set the main power switch to off or disconnect the main AC power, without going to standby first, IAP does not save its current settings.

Input Connectors



¹ Many Blu-ray players decode Dolby Digital, Dolby True HD, DTS, and DTS HD and deliver the decoded multi-channel signal to IAP.

² Note that Dolby Digital (AC-3) and DTS over S/PDIF are not decoded by IAP.

³ The RCA connectors are buffered and acquired differentially.

1. HDMI 1-4

These are four HDMI connectors for audio/video sources, such as Blu-ray players, game consoles, and set top boxes. Up to 8-channel/192 kHz/24 bit audio over HDMI is supported.¹

2. Digital (Coax 1-2, Optical 1-2)

These are two coax and two optical S/PDIF connectors for digital audio sources. Up to 192 kHz and 96 kHz (24 bit) audio is supported by Coax and Optical, respectively.²

3. USB Audio

IAP's USB audio input can be configured as USB Class 1 or Class 2 compliant. Up to 192 kHz/24 bit audio over USB is supported.

4. Network

IAP's network input complies to the UPnP / DLNA protocol as a Digital Media Renderer. Up to 192 kHz/24 bit audio over the network is supported.

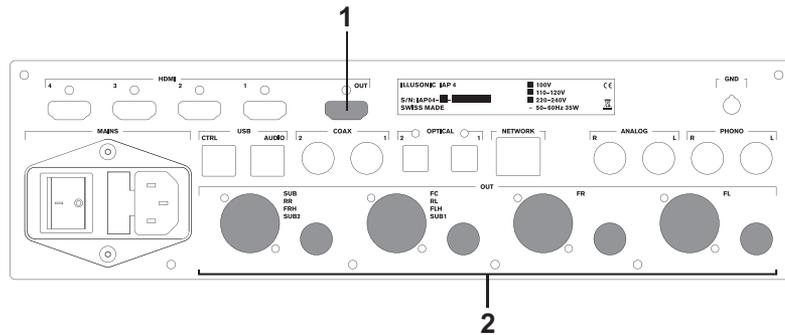
5. Analog

Analog sources can be connected to this stereo RCA unbalanced/balanced input.³

6. Phono

A turntable with moving coil (MC) or moving magnet (MM) cartridge can be directly connected to this RCA input with additional ground connector (GND).

Output Connectors



1. HDMI Out

Typically, a TV or projector is connected to the HDMI output. The video signal is passed through from the selected HDMI input, while the audio is removed.

2. Analog Out

Each of IAP's output channels is available on balanced XLR and unbalanced RCA connectors (IAP 2 and IAP 4).¹

3.7 Cleaning, Maintenance, and Service

Use a dry towel of cloth for cleaning. Never use any solvent or liquids, as they may damage the surface treatment or may penetrate into IAP.

IAP contains no user serviceable parts. Do not try to open, repair, or modify IAP by yourself. This will void any warranty. IAP must be checked by a qualified technician in any of the following cases: IAP is not functioning properly, the mains cable or the power cord receptacle is damaged, IAP has been dropped or shows external damage, or IAP has been exposed to liquids (such as rain or other substances).



¹ Use adapters when connecting IAP 8 and IAP 16 XLR outputs to RCA inputs. Make sure the adapter connects XLR pin 1 to RCA shield, XLR pin 2 to RCA signal, and keeps XLR pin 3 unconnected. Connecting XLR pins 1 and 3 short-circuits IAPs line-out amplifiers and can cause damage.

4 IAP Configuration Software

With IAP Configuration you can conveniently configure IAP, including its pre-sets, inputs settings, outputs settings, bass management, and equalizers. IAP Configuration works in real-time, all changes you make are instantly transmitted to IAP.



¹ Only one software can access IAP via USB at a time. Before starting IAP Configuration make sure IAP Calibration software is not open.

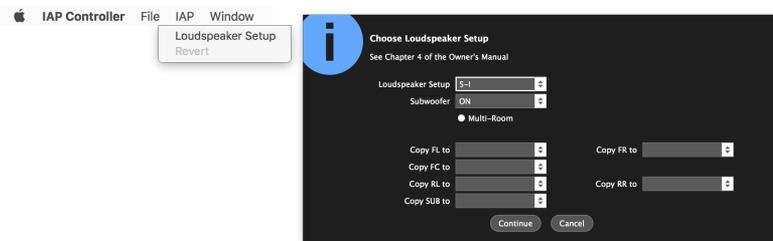
IAP Configuration transmits data between your Mac/PC and IAP via USB. Connect IAP (USB Ctrl) to the Mac/PC with a USB cable, make sure both are switched on, and start IAP Configuration.¹ IAP Configuration will instantly read all settings from IAP and show them.



The following sections outline how to configure IAP.

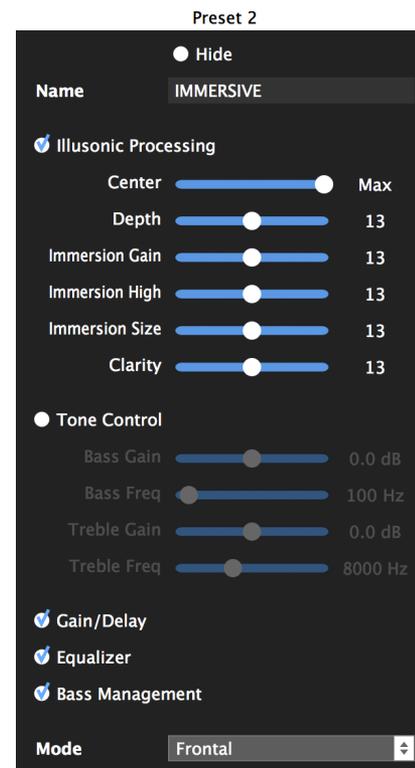
4.1 Loudspeaker Setup

While IAP in its default configuration works right away for stereo, you have to configure IAP if you use a different loudspeaker setup. Follow Chapter 6 to configure the loudspeaker setup.



4.2 Sound Settings

Sound Settings presets can be defined and be assigned to each input. Sound Settings can also conveniently be switched and modified in IAP's Sound Settings Menu. Sound Settings Menu and all parameters are described in Chapter 3.3.



4.3 Inputs

IAP has a large choice of inputs. Usually not all inputs are used. You can hide any unused input. Inputs can also be renamed. For every input you can also define a gain and delay. You can map several inputs to the same physical input. For example, you can define “CD JAZZ” and “CD CLASSICAL” inputs, both mapping to digital-in, but using different Sound Settings.

Hide	Name	Input	HDMI Output	Preset	Delay	Gain
<input type="checkbox"/>	TUBE PREAMP	ANALOG	OFF	CALIBRATED	0 ms	8.0 dB
<input type="checkbox"/>	THORENS	PHONO	OFF	CALIBRATED	0 ms	6.0 dB
<input type="checkbox"/>	OPPO MUSIC	HDMI 1 - 2 Channel (Stereo)	HDMI 1	IMMERSIVE	0 ms	0.0 dB
<input type="checkbox"/>	OPPO MOVIES	HDMI 1 - 8 Channel (Auto)	HDMI 1	CALIBRATED	56 ms	0.0 dB
<input type="checkbox"/>	UPNP SERVER	NETWORK	OFF	CALIBRATED	0 ms	0.0 dB
<input type="checkbox"/>	COAX 2	COAX 2	OFF	CALIBRATED	0 ms	0.0 dB
<input type="checkbox"/>	USB	USB	OFF	CALIBRATED	0 ms	0.0 dB
<input type="checkbox"/>	NETWORK	NETWORK	OFF	CALIBRATED	0 ms	0.0 dB

4.4 Outputs

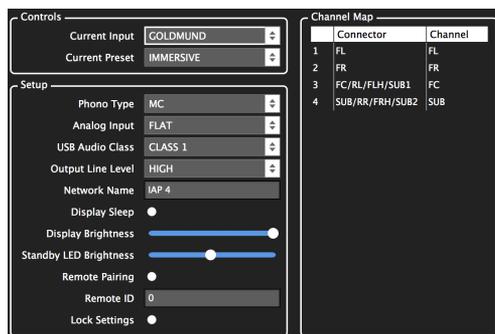
IAP’s output settings are very comprehensive, they include channel gain, channel delay, channel polarity, equalizers, bass management, etc. You can manually set everything here, IAP will react in real time.

The screenshot displays a comprehensive set of audio output settings. On the left, there are global settings including a limiter (set to ALL), EQ gain (1.0 dB), a subsonic filter (25 Hz), LFE gain (0.0 dB), sub overhead (0.0 dB), and bass management (Crossover 1 for Small 1, Crossover 2 for Small 2, and Bass Gain 0.0 dB). The main area is divided into four columns for channels: FL (Front Left), FR (Front Right), FC (Front Center), and SUB (Subwoofer). Each channel has its own Gain/Delay settings, a Bell filter with frequency (f), gain (g), and quality (q) sliders, and a Crossover filter with frequency (f), gain (g), and quality (q) sliders. The SUB channel also includes an invert option.

Usually IAP’s output settings are determined using IAP Calibration software (Chapter 5).

4.5 General

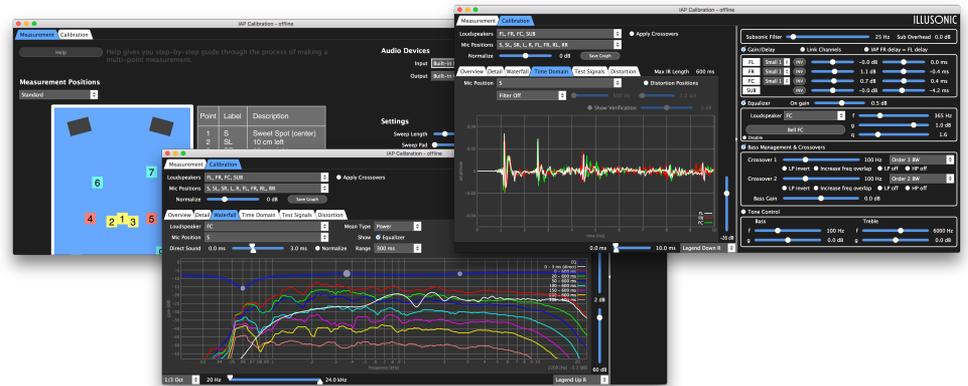
Here global IAP settings can be changed, such as display settings, phono settings, and DAC output level.



On the right side, IAPs output channel map is shown. For each output connector, the corresponding signal's abbreviation is shown. This is particularly useful for complex setups, such as multiroom or crossovers.

5 IAP Calibration Software

With IAP Calibration you can measure and calibrate your system. Visualizations of your room’s responses for each loudspeaker help greatly to set IAP’s equalizers to mitigate issues of your room and setup. As you set parameters (equalizers, etc.), you see in real-time how the frequency and time responses of your room change, without a need to measure again. With IAP Calibration’s signal generators you can additionally optimize the sound by listening.



¹ Only one software can access IAP via USB at a time. Before starting IAP Calibration make sure IAP Configuration software is not open.

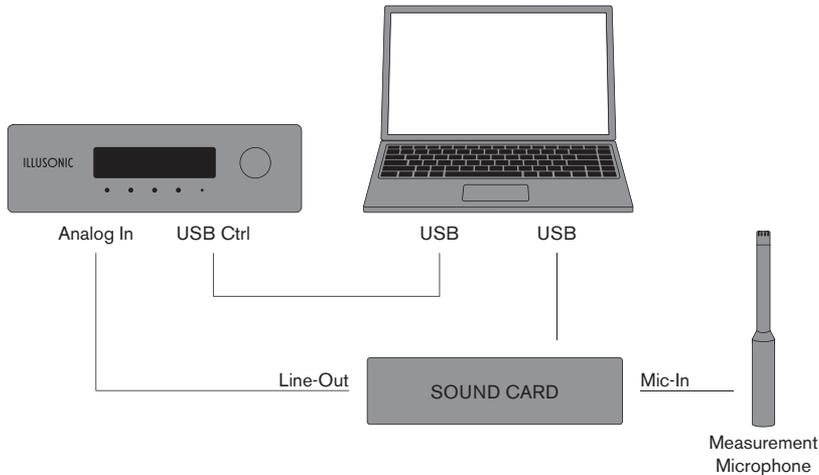
IAP Calibration transmits data between your Mac/PC and IAP via USB. Connect IAP (USB Ctrl) to the Mac/PC with a USB cable, make sure both are switched on, when you start IAP Calibration.¹ IAP Calibration will instantly read all parameters from IAP and its GUI shows IAP’s current calibration-related settings.



5.1 Setup

To measure your IAP and sound system you need the following equipment:

- Soundcard with microphone input and line output.
- Measurement microphone and microphone cable long enough to measure throughout your room.



Connect the soundcard to Mac/PC and IAP as shown in the figure above. Connect the microphone to the soundcard. Most microphones will require that you enable phantom power on the soundcard's microphone input.

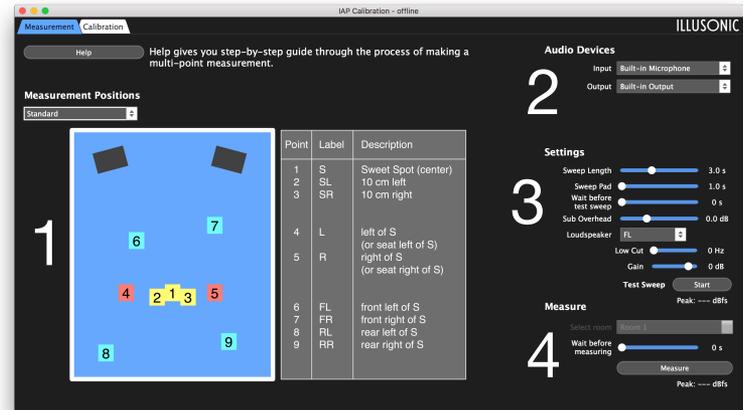
Set the sampling rates of soundcard input and output to 48 kHz (Mac: Audio MIDI Setup, Windows: Sound Control Panel). You should not use different soundcards for input and output. E.g. do not use a USB microphone. If different soundcards are used for input and output, due to clock drift between them, time/delays will not be correctly measured.



5.2 Measuring



IAP will automatically disable all signal processing during measurement. There is no need to “reset” equalizers, etc.



The figure above shows IAP Calibration's Measurement panel:

1. Determine the microphone measurement positions. Either choose one of the microphone positions templates or determine your own measurement positions (choose Custom with up to 64 microphone positions).
2. Select the soundcard connected to IAP and microphone as IAP Calibration input and output. Select IAP input to Analog, to receive the measurement signals from the soundcard.
3. Set the microphone to sweet spot position and do a test sweep on each loudspeaker to check the system. Modify soundcard output level and IAP volume until the sweep is loud, but does not hurt your ears. Now modify soundcard microphone input gain until the peak level, shown after each test sweep, is in the range of -18 and -10 dB for each loudspeaker.¹
4. Start measurement and move the microphones to the different positions as instructed by the software. Once you are done, save the measurement. A measurement is saved as three files (.iapc, .wav sweep, .wav measurement).



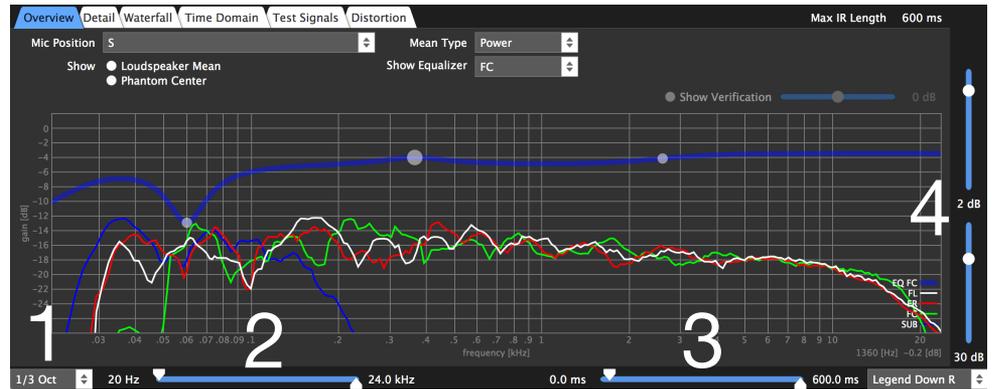
¹ If gains between loudspeakers deviate significantly, modify their amplifiers' such that microphone peak level for all loudspeakers is within the recommended range. If not possible, modify loudspeaker gains in IAP Calibration (gain slider above Test Sweep Start button).

5.3 Calibrating



The figure above shows IAP Calibration's Calibration panel:

1. Here you can include/exclude any of the loudspeakers and microphone positions. You can define groups of loudspeakers and microphones. Average frequency responses are always computed as average of the currently included loudspeakers/microphones.
2. These controls are used to show and set all signal processing related parameters. With the Gain/Delay, Equalizer, Bass Management/Crossovers, Tone Control On/Off buttons, you can enable/disable IAP Calibration's simulations of these. IAP will also, in real-time, enable/disable these as you enable/disable them here (great for AB comparisons).
3. In this area the measurement data and simulations are visualized. Equalizers can not only be added and edited in 2, but also conveniently here, using the mouse directly in the graphs.



The frequency and time plots provide great control over how data is visualized:

1. The frequency resolution can be chosen from very high resolution to full-octave smoothing.
2. The frequency range of the plot can be determined.
3. The impulse-response-time-window is set here.
4. The dB range and maximum are chosen here.

In the following, the different calibration panels (Overview, Detail, Waterfall, Time Domain, Test Signals, Distortion) are briefly explained.

Overview

The Overview panel shows all included loudspeaker frequency responses for one microphone, or average over all included microphones. When Bass Management/Crossovers are enabled, the channels are integrated accordingly (for example, subwoofers and other channels are combined). Also, the frequency response of phantom center can be simulated.

Detail

The idea of the Detail panel is to do detail analysis on one loudspeaker. For the selected loudspeaker, simultaneously the frequency responses of microphone positions and microphones-average can be shown. This helps to make trade-off decisions between sweet-spot, listening positions, and room averages.

Waterfall

The Waterfall panel shows how frequency responses decay in time. Data is shown for one loudspeaker and microphone position, or microphone average. Long-sustaining resonances can easily be detected in these plots.

Time Domain

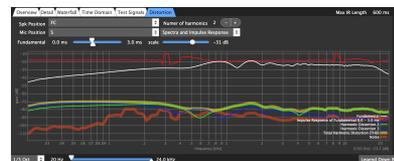
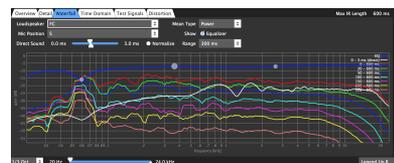
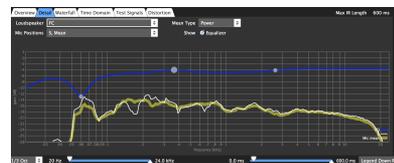
The Time Domain panel shows the measured and modified impulse responses. Use this panel to time align loudspeakers, delays between channels are precisely measured by IAP Calibration and visualized here.

Test Signals

A wide variety of test signals are available, including different noises, pulses, and tones. Additionally, the Test Signals pane allows you to auralize (listen with headphones) the measured room at any microphone position. Auralization also simulates the complete calibration, including gain/delay/polarity, equalizers, crossovers, and bass management.

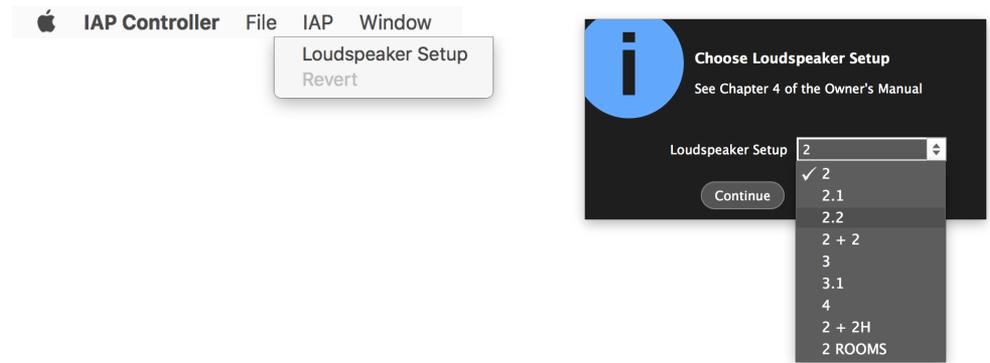
Distortion

IAP Calibration measures with swept sines, increasing frequency logarithmically. This way of measurement also allows to do a detailed harmonic distortion analysis. The direct sound, relative to which distortion analysis shall be carried out, can be isolated. Harmonic distortion, as a function of frequency, can be visualized in different ways.

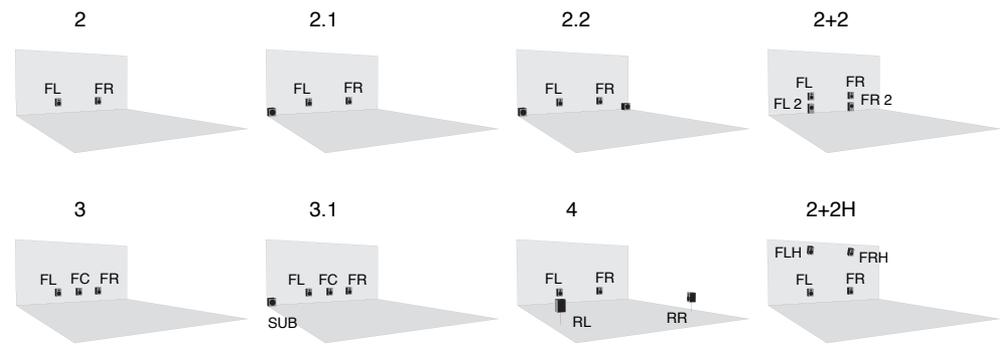


6 Loudspeaker Setups

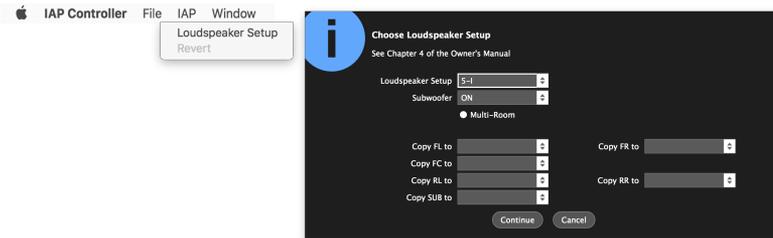
6.1 Configuring IAP 4



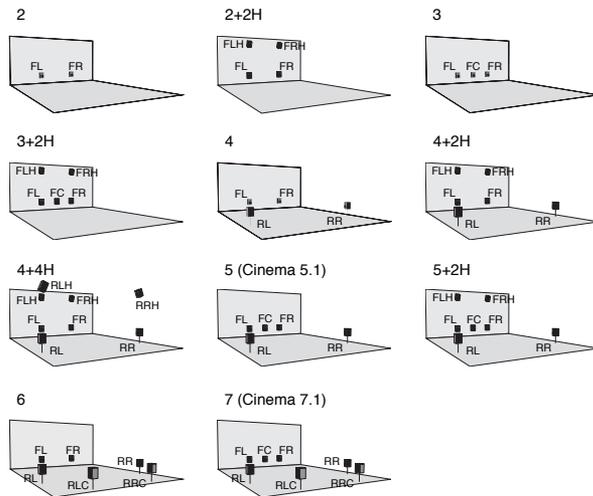
Open Loudspeaker Setup in IAP Configuration as shown above. The figure below illustrates the available loudspeaker setups and IAP 4 signal output connector labels. More details on these loudspeaker setups are given in Section 6.3.



6.2 Configuring IAP 8 and 16



Open Loudspeaker Setup in IAP Configuration as shown above. The figure below illustrates the available IAP 8 main loudspeaker setups and signal output connector labels. More details on loudspeaker setups is given in the following Section, including also all setups supported by IAP 16.



Each main loudspeaker setup has a subwoofer option and the option to copy channels to unused channels. Channel copy is used when using more than one subwoofer or when using active crossovers. The number of channel copies determines the number of subwoofers beyond one and the number of crossover channels.



Multiroom configuration example: choose loudspeaker setup, Multi-Room on, and copy channels for the additional rooms.

Sound Settings | Inputs | Outputs | **General**

Channel Map		
	Connector	Channel
1	FL	FL 1
2	FR	FR 1
3	FC/RLH	FC 1
4	RL	SUB 1
5	RR	FL 2
6	RLC/FLH	FR 2
7	RRC/FRH	FL+FR 3
8	SUB/RRH	SUB 1

Room 1: 3.2
FL 1, FR 1, FC 1
SUB 1, SUB 1

Room 2: stereo
FL 2, FR 2

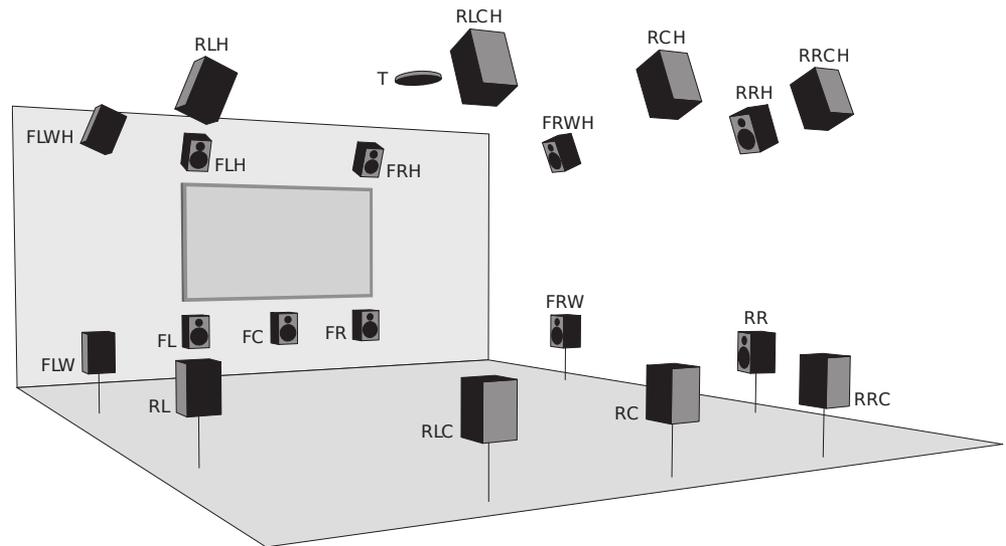
Room 3: mono
FL+FR 3

IAP Configuration's General Panel shows IAP's output channel map.

Multiroom is configured as follows. Select your main loudspeaker setup (Room 1) without channel copies (only Sub copies are allowed, copy Sub to left-most free IAP outputs). Now copy the channels for Room 2, starting with FL. If you have FC and Sub in Room 1 but not Room 2, you need to copy these to each channel of Room 2 (such that IAP downmixes the signals, -3dB downmix gain is automatically applied). On the left, a complex example with 3 rooms is given (Room 1: 3.2, Room 2: stereo, Room 3: mono).

6.3 Loudspeaker Setups Details

The figure below illustrates 10 horizontal, 9 height, and top (T)loudspeaker positions. The supported loudspeaker setups use loudspeakers at a subset of these positions.

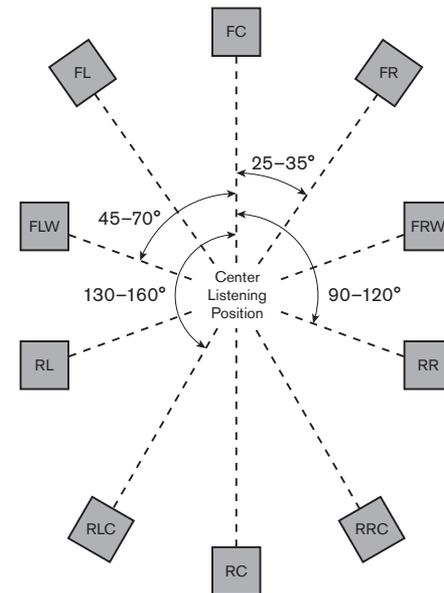


The table below specifies loudspeaker names and abbreviations.¹

Channel Name	Abbreviation
Front Left	FL
Front Right	FR
Front Center	FC
Rear Left	RL
Rear Right	RR
Rear Left Center	RLC
Rear Right Center	RRC
Front Left Wide	FLW
Front Right Wide	FRW
Rear Center	RC
Front Left Height	FLH
Front Right Height	FRH
Rear Left Height	RLH
Rear Right Height	RRH
Rear Left Center Height	RLCH
Rear Right Center Height	RRCH
Front Left Wide Height	FLWH
Front Right Wide Height	FRWH
Rear Center Height	RCH
Subwoofer	SUB
Top	T

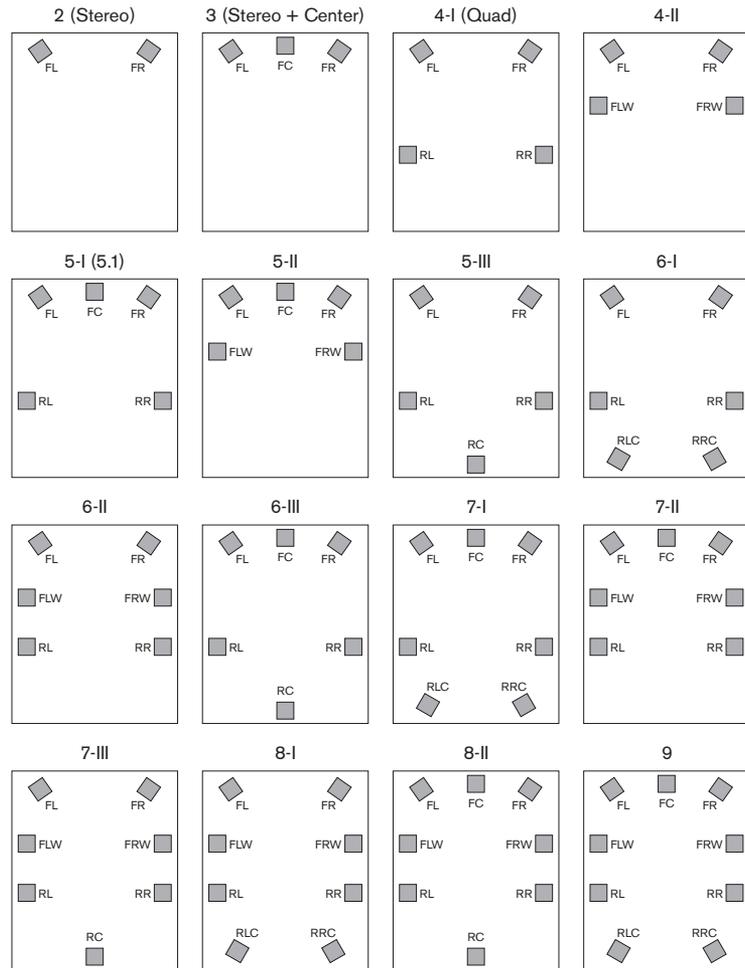


¹ IAP output connectors' labels indicate loudspeaker abbreviations. IAP Configuration software's *General* pane (Section 4.5) shows for each connector its output signal, according to its configuration.



The degree ranges indicate a recommendation at which angles the loudspeakers should be relative to a central listening position. It is recommended that the elevation of the height loudspeakers be in the range 20° to 70°.

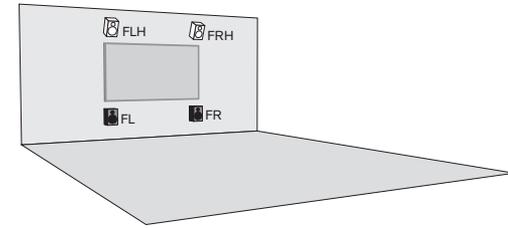
The available horizontal loudspeaker setups and corresponding names are shown in the figure above. On the following pages, each of these setups is discussed, including the options for height loudspeakers.



2 (Stereo)

This is a conventional two-channel stereo setup, with front left (FL) and front right (FR) loudspeakers with a height loudspeaker option:

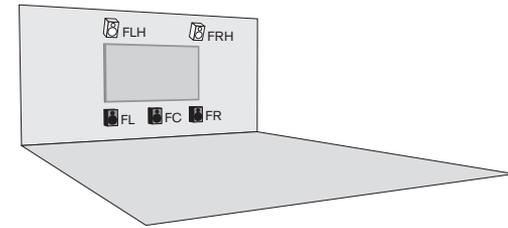
Loudspeaker Setup	Used Loudspeakers
2	FL, FR
2 + 2H	FL, FR, FLH, FRH



3 (Stereo + Center)

This is a conventional stereo setup (FL and FR), extended with a center loudspeaker (FC). The center loudspeaker improves the perceived sound stage. The various options are:

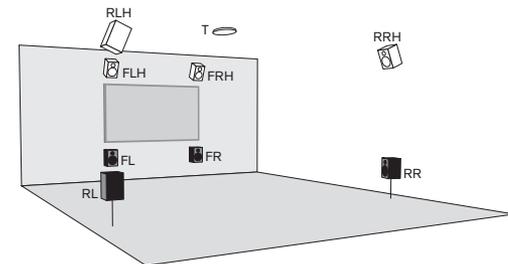
Loudspeaker Setup	Used Loudspeakers
3	FL, FR, FC
3 + 2H	FL, FR, FC, FLH, FRH



4-I (Quad)

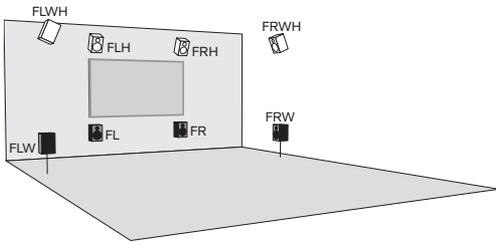
This is a conventional 5.1 surround setup, but without a front center loudspeaker. The various options are:

Loudspeaker Setup	Used Loudspeakers
4-I	FL, FR, RL, RR
4-I + 2H	FL, FR, RL, RR, FLH, FRH
4-I + 4H	FL, FR, RL, RR, FLH, FRH, RLH, RRH
4-I + 4H + T	same as 4-I + 4H with T assigned to RRC



4-II

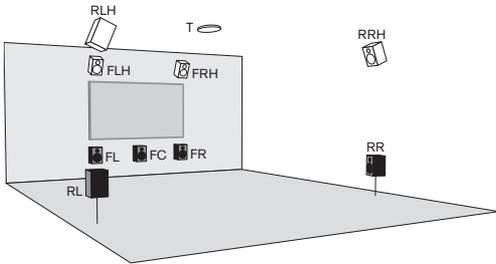
If you do not want to have center and rear loudspeakers, this setup enables an enhanced sound experience with only front loudspeakers (FL, FR, FLW, FRW). The various options are:



Loudspeaker Setup	Used Loudspeakers
4-II	FL, FR, FLW, FRW
4-II + 2H	FL, FR, FLW, FRW, FLH, FRH
4-II + 4H	FL, FR, FLW, FRW, FLH, FRH, FLWH, FRWH

5-I (Cinema, DVD, and Blu-ray 5.1)

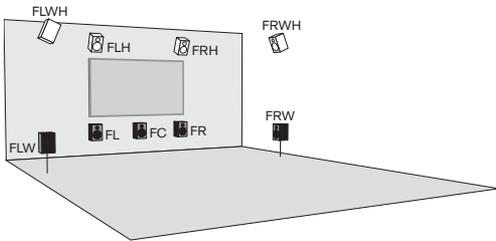
This is a conventional 5.1 surround setup. The various options are:



Loudspeaker Setup	Used Loudspeakers
5-I	FL, FR, FC, RL, RR
5-I + 2H	FL, FR, FC, RL, RR, FLH, FRH
5-I + 4H	FL, FR, FC, RL, RR, FLH, FRH, RLH, RRH
5-I + 4H + T	same as 5-I + 4H with T assigned to RRC

5-II

If you would like to have as advanced as possible multi-channel sound, but without rear channels, this setup is a good choice. The various options are:

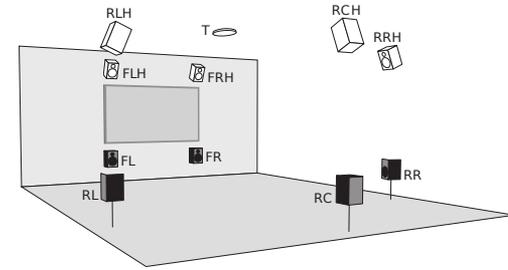


Loudspeaker Setup	Used Loudspeakers
5-II	FL, FR, FC, FLW, FRW
5-II + 2H	FL, FR, FC, FLW, FRW, FLH, FRH
5-II + 4H	FL, FR, FC, FLW, FRW, FLH, FRH, FLWH, FRWH

5-III

This is a 4-I (Quad) surround setup with an additional rear center (RC) loudspeaker for improved immersion and a larger optimal listening area. The various options are:

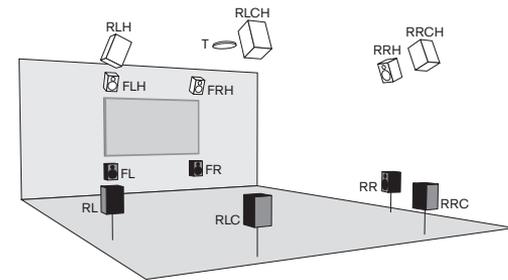
Loudspeaker Setup	Used Loudspeakers
5-III	FL, FR, RL, RR, RC
5-III + 2H	FL, FR, RL, RR, RC, FLH, FRH
5-III + 4H	FL, FR, RL, RR, RC, FLH, FRH, RLH, RRH
5-III + 4H + T	same as 5-III + 4H with T assigned to RLCH
5-III + 5H	FL, FR, RL, RR, RC, FLH, FRH, RLH, RRH, RCH
5-III + 5H + T	same as 5-III + 5H with T assigned to RLCH

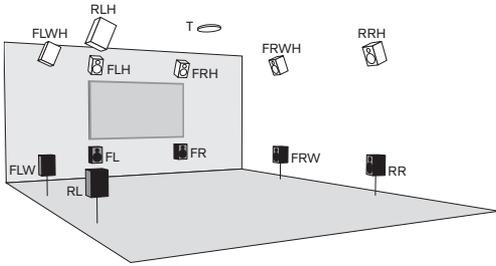


6-I

This is a 7.1 surround setup, but without a front center (FC) loudspeaker. Compared to Setup 4-I, this setup has two more surround loudspeakers, beneficial for improved immersion and a larger optimal listening area. Depending on your room and requirements, you may also want to consider Setup 6-II (described next). The various options are:

Loudspeaker Setup	Used Loudspeakers
6-I	FL, FR, RL, RR, RLC, RRC
6-I + 2H	FL, FR, RL, RR, RLC, RRC, FLH, FRH
6-I + 4H	FL, FR, RL, RR, RLC, RRC, FLH, FRH, RLH, RRH
6-I + 4H + T	same as 6-I + 4H with T assigned to FC
6-I + 6H	FL, FR, RL, RR, RLC, RRC, FLH, FRH, RLH, RRH, RLCH, RRCH
6-I + 6H + T	same as 6-I + 6H with T assigned to FC

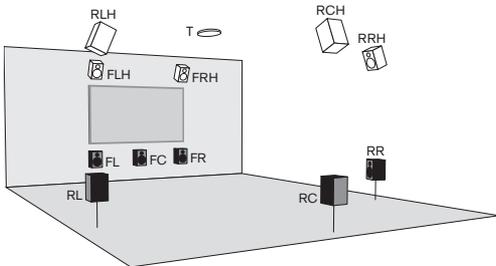




6-II

This is a 7.1 surround setup, but without a front center (FC) loudspeaker. Compared to Setup 4-I, this setup has two more loudspeakers between front and rear, beneficial for improved immersion and a larger optimal listening area. Depending on your room and requirements, you may also want to consider Setup 6-I (described previously). The various options are:

Loudspeaker Setup	Used Loudspeakers
6-II	FL, FR, RL, RR, FLW, FRW
6-II + 2H	FL, FR, RL, RR, FLW, FRW, FLH, FRH
6-II + 4H	FL, FR, RL, RR, FLW, FRW, FLH, FRH, RLH, RRH
6-II + 4H + T	same as 6-II + 4H with T assigned to RRC
6-II + 6H	FL, FR, RL, RR, FLW, FRW, FLH, FRH, RLH, RRH, FLWH, FRWH
6-II + 6H + T	same as 6-II + 6H with T assigned to RRC



6-III

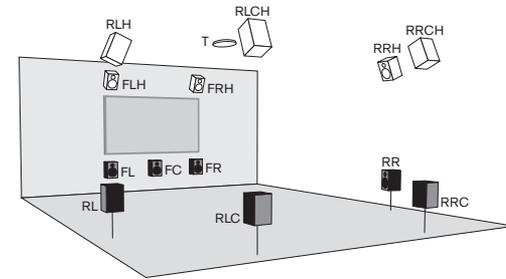
This is a conventional 5.1 surround setup with an additional rear center (RC) loudspeaker for improved immersion and a larger optimal listening area. The various options are:

Loudspeaker Setup	Used Loudspeakers
6-III	FL, FR, FC, RL, RR, RC
6-III + 2H	FL, FR, FC, RL, RR, RC, FLH, FRH
6-III + 4H	FL, FR, FC, RL, RR, RC, FLH, FRH, RLH, RRH
6-III + 4H + T	same as 6-III + 4H with T assigned to RLCH
6-III + 5H	FL, FR, FC, RL, RR, RC, FLH, FRH, RLH, RRH, RCH
6-III + 5H + T	same as 6-III + 5H with T assigned to RLCH

7-I (Cinema and Blu-ray 7.1)

This is a 7.1 surround setup. Compared to a 5.1 setup (5-I), this setup has two more surround loudspeakers, beneficial for improved immersion and a larger optimal listening area. Depending on your room and requirements, you may also want to consider Setup 7-II (described next). The various options are:

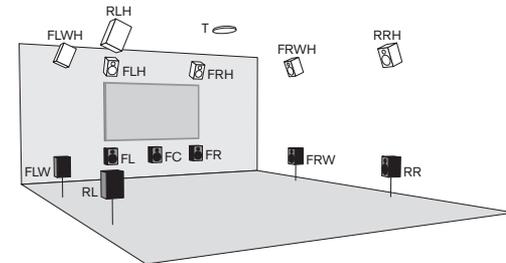
Loudspeaker Setup	Used Loudspeakers
7-I	FL, FR, FC, RL, RR, RLC, RRC
7-I + 2H	FL, FR, FC, RL, RR, RLC, RRC, FLH, FRH
7-I + 4H	FL, FR, FC, RL, RR, RLC, RRC, FLH, FRH, RLH, RRH
7-I + 4H + T	same as 7-I + 4H with T assigned to FLW
7-I + 6H	FL, FR, FC, RL, RR, RLC, RRC, FLH, FRH, RLH, RRH, RLCH, RRCH
7-I + 6H + T	same as 7-I + 6H with T assigned to FLW

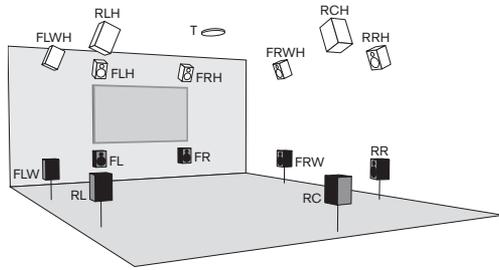


7-II

This is a 7.1 surround setup. Compared to a 5.1 setup (5-I), this setup has two more loudspeakers between the front and rear loudspeakers, beneficial for improved immersion and a larger optimal listening area. Depending on your room and requirements, you may also want to consider Setup 7-I (described previously). The various options are:

Loudspeaker Setup	Used Loudspeakers
7-II	FL, FR, FC, RL, RR, FLW, FRW
7-II + 2H	FL, FR, FC, RL, RR, FLW, FRW, FLH, FRH
7-II + 4H	FL, FR, FC, RL, RR, FLW, FRW, FLH, FRH, RLH, RRH
7-II + 4H + T	same as 7-II + 4H with T assigned to RRC
7-II + 6H	FL, FR, FC, RL, RR, FLW, FRW, FLH, FRH, RLH, RRH, FLWH, FRWH
7-II + 6H + T	same as 7-II + 6H with T assigned to RRC

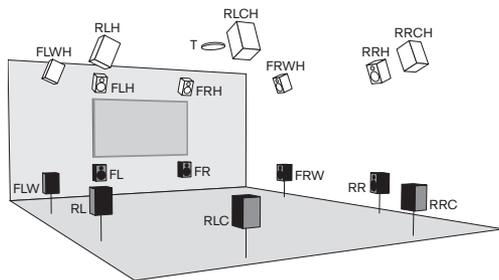




7-III

This is a 6-II setup with an additional rear center (RC) loudspeaker for improved immersion and a larger optimal listening area. The various options are:

Loudspeaker Setup	Used Loudspeakers
7-III	FL, FR, RL, RR, FLW, FRW, RC
7-III + 2H	FL, FR, RL, RR, FLW, FRW, RC, FLH, FRH
7-III + 4H	FL, FR, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH
7-III + 4H + T	same as 7-III + 4H with T assigned to FC
7-III + 5H	FL, FR, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, RCH
7-III + 5H + T	same as 7-III + 5H with T assigned to FC
7-III + 6H	FL, FR, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, FLWH, FRWH
7-III + 6H + T	same as 7-III + 6H with T assigned to FC
7-III + 7H	FL, FR, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, FLWH, FRWH, RCH
7-III + 7H + T	same as 7-III + 7H with T assigned to FC



8-I

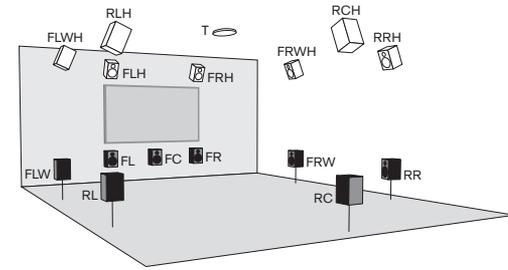
This is a 9.1 surround setup, but without a front center (FC) channel. The four more side/surround loudspeakers, compared to 5.1, are beneficial for improved immersion and a larger optimal listening area. The various options are:

Loudspeaker Setup	Used Loudspeakers
8-I	FL, FR, RL, RR, RLC, RRC, FLW, FRW
8-I + 2H	FL, FR, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH
8-I + 4H	FL, FR, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH, RLH, RRH
8-I + 4H + T	same as 8-I + 4H with T assigned to FC
8-I + 6H	FL, FR, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH, RLH, RRH, RLCH or FLWH, RRCH or FRWH
8-I + 6H + T	same as 8-I + 6H with T assigned to FC

8-II

This is a 7.1 surround setup (7-I) with an additional rear center (RC) loudspeaker for improved immersion and a larger optimal listening area. The various options are:

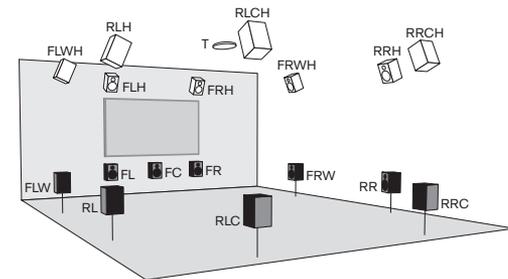
Loudspeaker Setup	Used Loudspeakers
8-II	FL, FR, FC, RL, RR, FLW, FRW, RC
8-II + 2H	FL, FR, FC, RL, RR, FLW, FRW, RC, FLH, FRH
8-II + 4H	FL, FR, FC, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH
8-II + 4H + T	same as 8-II + 4H with T assigned to RRC
8-II + 5H	FL, FR, FC, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, RCH
8-II + 5H + T	same as 8-II + 5H with T assigned to RLCH
8-II + 6H	FL, FR, FC, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, FLWH, FRWH
8-II + 6H + T	same as 8-II + 6H with T assigned to RRC
8-II + 7H	FL, FR, FC, RL, RR, FLW, FRW, RC, FLH, FRH, RLH, RRH, FLWH, FRWH, RCH



9

This is a 9.1 surround setup. The four more side/surround loudspeakers, compared to 5.1, are beneficial for improved immersion and a larger optimal listening area. The various options are:

Loudspeaker Setup	Used Loudspeakers
9	FL, FR, FC, RL, RR, RLC, RRC, FLW, FRW
9 + 2H	FL, FR, FC, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH
9 + 4H	FL, FR, FC, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH, RLH, RRH
9 + 4H + T	same as 9 + 4H with T assigned to RLCH
9 + 6H	FL, FR, FC, RL, RR, RLC, RRC, FLW, FRW, FLH, FRH, RLH, RRH, RLCH or FLWH, RRCH or FRWH



7

Hardware Specifications

General

User control	rotary control with push function, three buttons
Remote control	compatible with "Apple Remote" infrared remote control, support for pairing, codes for automation systems
Display	graphical VFD display with 160×32 resolution
Power supply	non-switched, toroidal transformer, internally selectable 100 V, 115 V, or 230 V AC, 47 Hz to 63 Hz
Power consumption	max: 35 Watt, standby: 1 Watt
Operating conditions	temperature: +5° C to +35° C, humidity: 5 % to 85 % (no condensation)
Dimensions	314 mm×314 mm×97 mm (main body)
Weight	5.9 kg

Inputs

4 HDMI	HDMI with HDCP (various versions), up to 8-channel/24 bit/192 kHz
2 Coax (S/PDIF)	RCA connector, 0.5 V _{pp} diff., 75 Ω, 16/24 bit, 32/44.1/48/88.2/96/176.4/192 kHz
2 Optical (S/PDIF)	TOSLINK optical connector, 16/24 bit, 32/44.1/48/88.2/96 kHz
1 USB Audio	Audio Class 1 and 2, up to 192 kHz/24-bit
1 Ethernet	UPnP™ AV 2.0 / DLNA, Digital Media Renderer, up to 192 kHz/24-bit
1 Stereo Analog RCA	unbalanced/balanced, max. 4.6 V _{rms} , buffered and acquired differentially
1 Stereo Phono RCA + GND	moving coil (1 kΩ, 1 nF, 60 dB) or moving magnet (47 kΩ, 22 pF, 40 dB), digital minimum phase RIAA filter
1 USB Ctrl	USB connector for firmware updates (microcontroller, DSP, HDMI, Ethernet) and external control

Outputs

1 HDMI	HDMI with HDCP (various versions), HDMI input audio removed
Analog XLR	balanced 2/4 and 8 V _{rms}
Analog RCA	unbalanced 2 and 4 V _{rms} (only IAP 2 and IAP 4)

Analog Audio Performance (IAP 2, IAP 4)

Input SNR	unweighted: 110 dB, A-weighted: 112 dB (22 Hz – 22 kHz)
Input Distortion	-101 dB THD+N (XLR, 1 kHz, 4 Vrms, 22 Hz – 22 kHz)
Output SNR	unweighted: 117 dB, A-weighted: 121 dB (22 Hz – 22 kHz)
Output Distortion	-104 dB THD+N (1 kHz, 8 Vrms, 22 Hz – 22 kHz)

Analog Audio Performance (IAP 8, IAP 16)

Input SNR	unweighted: 110 dB, A-weighted: 112 dB (22 Hz – 22 kHz)
Input Distortion	-101 dB THD+N (XLR, 1 kHz, 4 Vrms, 22 Hz – 22 kHz)
Output SNR	unweighted: 117 dB, A-weighted: 121 dB (22 Hz – 22 kHz)
Output Distortion	-104 dB THD+N (1 kHz, 8 Vrms, 22 Hz – 22 kHz)

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