

IOSONO CORE



User Manual

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1 INTRODUCTION

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All rights created by patent grant or registration of a utility model or design patent are reserved. The manufacturer reserves the right to amend this manual at any time and without notice as result of technical progress.

This manual is applicable to the IOSONO CORE and the software components Easy Control and Control Unit.

Read through this manual thoroughly before using the IOSONO CORE in order to avoid mistakes and dangers, and to inform yourself about how to use the system safely.

2 SAFETY

About this chapter

Read this chapter thoroughly before attempting to install or operate the IOSONO CORE.

To prevent personal injury to users or physical damage to the IOSONO CORE while installing and using your IOSONO CORE, ensure that you understand and follow all safety guidelines, instructions and warnings included in this chapter and this manual.

Overview

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2.1 General Considerations

The IOSONO CORE is designed for installation in control cabinets. The IOSONO CORE is a high-performance audio processor used to drive and configure a BARCO IOSONO sound system.

The IOSONO CORE and all associated components may only be used if they are in perfect, technical working order, and for their intended purpose, with safety in mind and an awareness of the dangers, and as stated in this manual.

The IOSONO CORE is operated via a graphic user interface. Reference is made to the currently valid guidelines for working with a visual display unit.

There are additional documents for other components of the sound system containing warning, safety and working instructions. These instructions must be observed independently to this manual.

2.2 Important safety instructions

The IOSONO CORE offers an extremely high level of safety if used properly and in compliance with the instructions contained in this manual. Read and comply with the following safety instructions before operating the device. Retain safety and operating instructions for future reference. Adhere to all warnings on the device and in the operating instructions manual. Follow all instructions for operation and use.

Installation

The device may only be installed and operated by authorized, suitably qualified personal. More advanced configurations of the apparatus may only be made by skilled personnel with knowledge of sound technology.

Place the device on a flat, solid and stable surface or fix the device to an appropriate rack mounting system that can support the total weight of the device. If you use an unstable cart or stand, the device may fall, causing serious injury to a child or adult and serious damage to the device.

Modifications to the unit

Do not modify this equipment without authorization of the manufacturer. No serviceable parts inside.

Electric shock or fire hazard

To prevent electric shock or fire hazard, do not remove cover. Do not insert any objects through aperture in the casing.

Power connection and transient over voltage

- To avoid the risk of electric shock, this equipment must only be connected to supply mains with protective earth.
- The equipment should be installed near an easily accessible outlet.
- The equipment is intended for continuous operation.
- If the device is not used for long time, disconnect it from the AC inlet to avoid damage by transient over-voltage.
- To fully disengage the power to the device, please disconnect all power cords from the AC inlets.

Power cords

Please always use the power cords provided with the product. Furthermore, make sure that the used power cord always corresponds to the voltage of the power socket, is permitted to be used at your location and complies with the safety standards of your country. Do not overload wall outlets and extension cords as this may result in fire or electric shock.

Mains lead protection (U.S.: Power cord): Power cords should be routed so that they are not likely to be walked upon or pinched by items placed upon or against them, paying particular attention to cords at plugs and receptacles. The power supply cords should be replaced by the designated operator only at all times.

Water and moisture

Never expose the device to rain or moisture. Never use the device near water – e.g. near a swimming pool.

Ventilation

Inadequate heat dissipation can lead to hardware faults and loss of data. Do not cover or block any ventilation openings in the side and back of the set. When installing the device in a cupboard or another closed location, heed the necessary space between the set and the sides of the cupboard. If necessary, consider additional external cooling, to ensure proper heat dissipation.

Material damage caused by electromagnetic fields

The apparatus contains parts sensitive to electromagnetic fields, like hard disc drives. Strong magnetic fields may lead to loss of data or harm the system functionality partly or persistently. Do not place the apparatus within the range of strong magnetic fields.

2.3 Warranty

The manual and the hardware and software components described have been produced according to the currently applicable state of the art. Nevertheless, the products described are continually being further developed so that we have to reserve the right to make changes to the form, equipment and technology of the scope of supply and the software components included.

Barco N.V. shall not be liable for any damage arising from the use of the documentation or the hardware and software components. No claims for changes to products already supplied can be asserted on the basis of the statements, illustrations and descriptions in this documentation.

Barco N.V. shall not accept any liability for consequences or damages arising from improper use of the device. Unauthorized modifications to the hardware or software configuration shall exclude liability for damage resulting therefrom.

3 HARDWARE

Overview

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3.1 Front panel

The front panel contains the following elements:

1. Power button
2. Volume control
3. Touch screen



Image 3.1 IOSONO CORE front panel

3.2 Rear panel

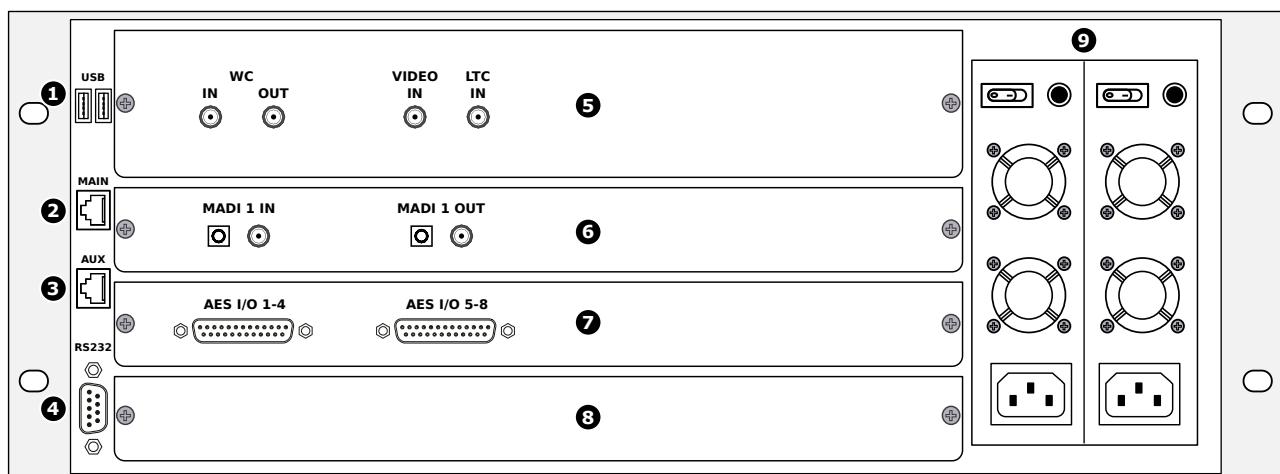


Image 3.2 IOSONO CORE rear view

Number and kind of audio drawers depends on IOSONO CORE configuration. For detailed information about connections and available hardware options see chapter [10](#).

Item No.	Element	Function
1	USB connections	Connection of USB storage devices for system backup and restore. Firmware update.
2	MAIN ethernet port	Network connection to remote computer to control and setup the IOSONO CORE with the Control Unit software.
3	AUX ethernet port	Not Used
4	COM port	Media control
5	Sync drawer	Input and output of different sync signals.
6	MADI drawer	Electrical and optical MADI input and output connections.
7	AES drawer	Electrical AES inputs and output connections.
8	Blind drawer	
9	Power Supply	Power supply of the IOSONO CORE.

4 SYSTEM STARTUP

Overview

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4.1 Initial Operation

4.1.1 Installation

Your IOSONO CORE consists of electronic parts that may be sensitive to variations in temperature and humidity. Such variations could appear with changing the place of installation or by leaving the device unused for a longer period of time.

To avoid harm to the device, always leave your device unpowered for a while. This should climatize the IOSONO CORE and its hardware components to a normal working condition.

4.1.2 Initial connection

Depending to your device hardware configuration, IOSONO CORE consists of single or redundant power supply component. Before powering your device ensure each main inlet has been connected to your local power circuit orderly and in consideration of local law and technical policies.

Please note: In case of local power circuit failure, redundant power supply will only get effective when inlet of redundant power supply is orderly connected to a redundant local power circuit.

Based on your application connect all needed audio and data connections to the system now. A description of the device connectors could be found at Figure 3.2. For proper operation always ensure sufficient connections. Always use cables and connectors that matches your applications need with respect to type, dimension and quality.

4.1.3 Power on

To power on system, please activate main power switch, located at the backside of your IOSONO CORE. For systems featuring redundant power supply, please activate each of both power switches available.

Deactivate each main power switch if system is unused for longer period of time. Always deactivate each main power switch before disconnecting the system from local power circuit.

Your IOSONO CORE is now ready to be started. In order to power on IOSONO CORE, please push the power button like shown at Figure 3.1. The power button is now illuminated, indicating device is powered and running.

4.2 Basic System Control

Your IOSONO CORE is controlled via control software named "Control Client". The Control Client connects a MS Windows computer remotely to the IOSONO CORE processor. For installation details, please refer to the Quick Start Guide that has been delivered with your product.

Connect to IOSONO CORE Control Unit or to Easy Control by pushing the button respectively. The Control Unit gives you an extended access to available configurations of the IOSONO CORE. The Easy Control gives you access to the most important configurations and preset controls. All settings of Easy Control are accessible using IOSONO CORE touch interface (Figure 3.1).

4.2.1 Get system control

- 1 Set up a network connection between the remote computer and the IOSONO CORE (Main Port). Configure the remote computer's network interface IP address to the same network as the IOSONO CORE. By factory default, device network is set to be IP 192.168.1.1, Network mask: 255.255.255.0. For example: Static IP of remote computer is 192.168.1.2.
- 2 Start the Control Client at your remote computer. Connect to the target device using the corresponding target IP address.

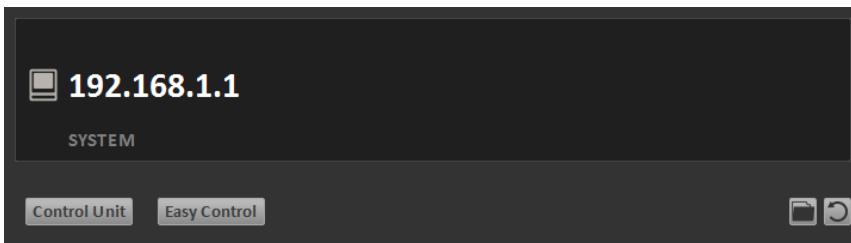


Image 4.1 Control Client

4.2.2 File transfer

Files can be transmitted via the Control Client using the folder button in the lower right corner. The button opens a file browser. In the file browser, the left half shows the file structure of remote computer while the right half shows the accessible IOSONO CORE file structure.

Upload and download files and folders from the remote computer to the IOSONO CORE and vice versa using the appropriate commands of the context menu. Create your own folders and directories at the IOSONO CORE file system. This will easier your workflow at minimum in case of file management for

- content distribution and import
- system backup and restore
- configuration of your show and venue
- system update management

4.2.3 Factory reset

Clear user data and/or restore factory configuration using the arrow button in the lower right corner of the Control Client window. Use the check boxes to select the reset options - you have to complete by entering the randomly generated character string.

It is recommended to restoring factory settings of your device whenever the IOSONO CORE is not working properly. In such case of faulty settings, any reset will reload the factory settings or restore a previously created backup.

4.2.4 Touchscreen Interface & Easy Control

Your IOSONO CORE includes an integrated 7" pressure sensitive touch screen interface (Figure 3.1). By pushing the focused area on the screen, you can directly access the control elements of "Easy Control". Easy Control is a graphic interface to easily access all basic settings of your device and your show. The easy control interface is even more accessibly remotely using the IOSONO CORE Control Client (Please refer to Section 4.2.2).

An overview of Easy Control and its control elements is outlined following.

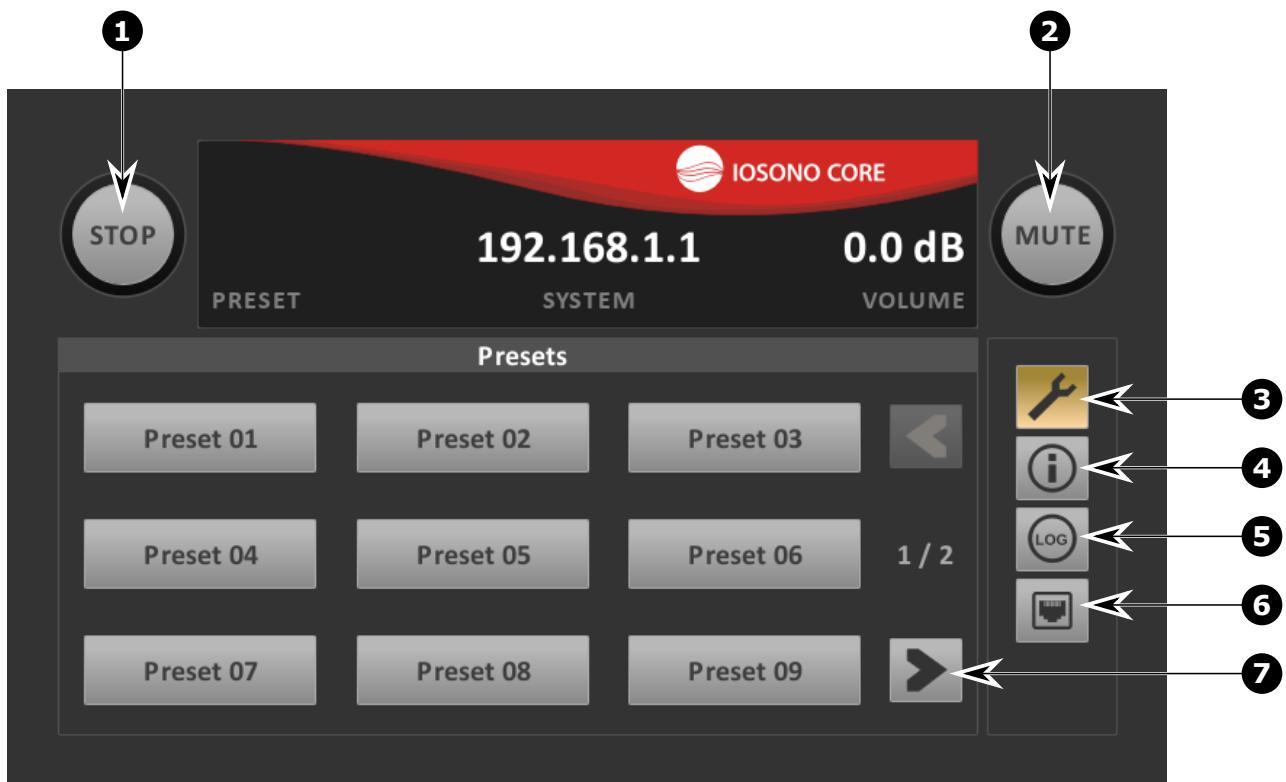


Image 4.2 Easy Control user interface

Item No.	Function	Result
1	STOP button	The active preset is stopped.
2	MUTE button	The active preset is muted.
3	Configuration button	The configuration display is activated.
4	Information button	Call detailed information about the software version.
5	LOG button	The log files of the IOSONO CORE can be stored on a USB storage device connected to one of the IOSONO CORE USB ports.
6	Network button	Enter the network configuration of the Main Ethernet Port: <ul style="list-style-type: none"> • Activate DHCP by pressing "DHCP ON". • Set a fixed IP address and network mask when DHCP is off. • Reboot the IOSONO CORE to apply changes or press "Cancel" to restore the previous configuration.
7	Preset selection list	Preset buttons are labeled with the name of the related preset. When pressed, that preset will be started. Press the left/right arrows to go to previous /next page of the selection list.

5 INITIAL SYSTEM CONFIGURATION

Overview

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5.1 Hardware connections

To enter the Control Unit and make configurations, a remote computer (PC with Windows, laptop, ...) with Control Client installed and Ethernet connection between remote computer and IOSONO CORE is needed. Please refer to Section 4 for further details.

A standard system setup should be similar to the wiring scheme as shown in Figure 5.1.

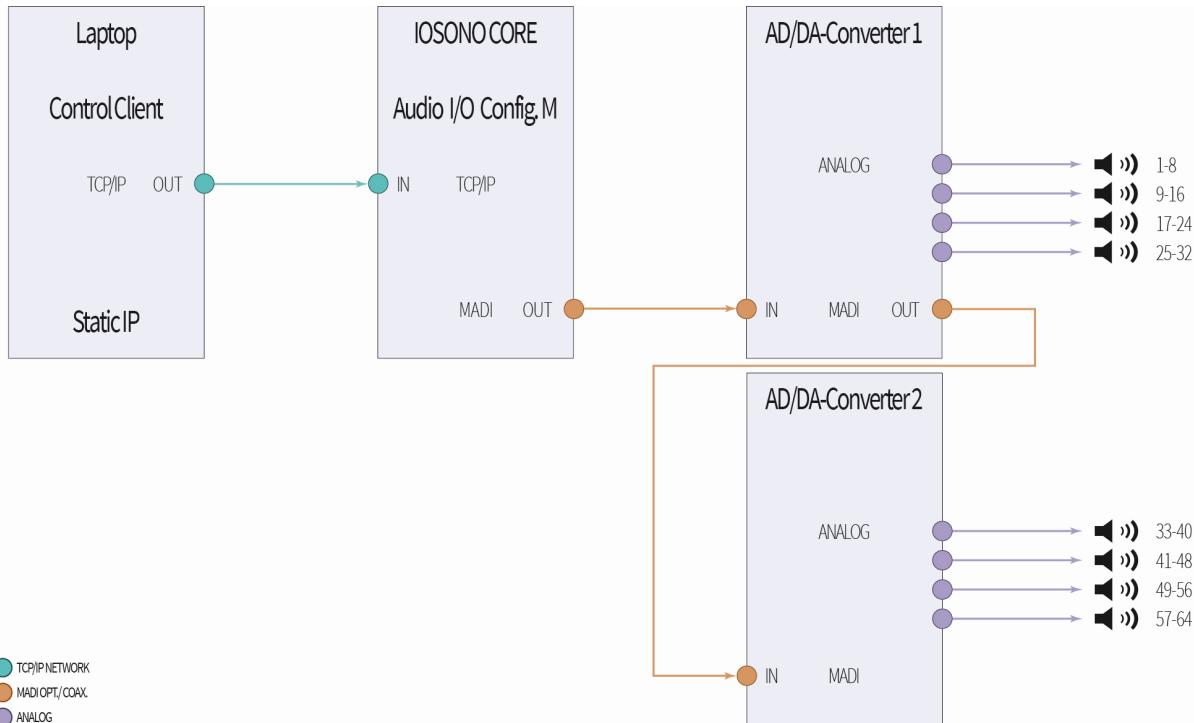


Image 5.1 Standard wiring with 64 output channels via MADI

- 1 Start the Control Client, type in the target IP address of the IOSONO CORE and push "Connect". Enter the Control Unit software, type in the password and press "OK" to confirm. The default password is "))))"

5.2 Create a loudspeaker file

A loudspeaker file is always needed to setup presets or to execute the rendering process. It has to reflect the real loudspeaker setup as closely as possible. Any deviation between the actual physical setup and the file will impair the rendering precision and the overall sound quality.

In this section we will describe how to create a loudspeaker file with example values.

To create a loudspeaker file for your actual setup you need to use real data.

- 1 Go to menu System - Options – Loudspeaker Setups – Create. A window is shown like in Figure 5.2.

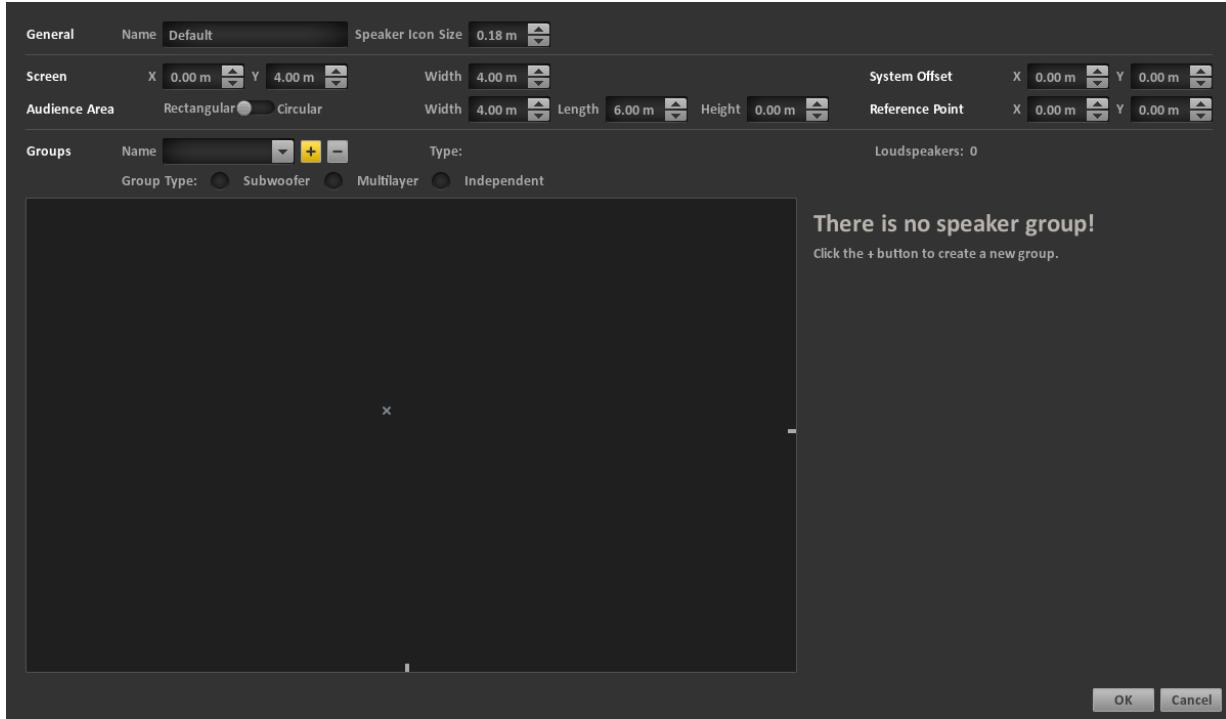


Image 5.2 Create Loudspeaker Setup view

- 2 Name your loudspeaker setup, for example “3D ls file”
 - change Audience Area Height to “1.20m”
 - keep all other default settings in the second line (Screen, System Offset and Reference Point)



Note: The audience area defines the area where the audience will be located. The height of the audience area refers to the average ear level of the audience, which is usually 1.20m when seated and 1.70m when standing.

- 3 Create a speaker group with “+” in Groups
 - keep Type “Rectangle”
 - Name your group, for example “Ring”
 - press “OK” to confirm ...

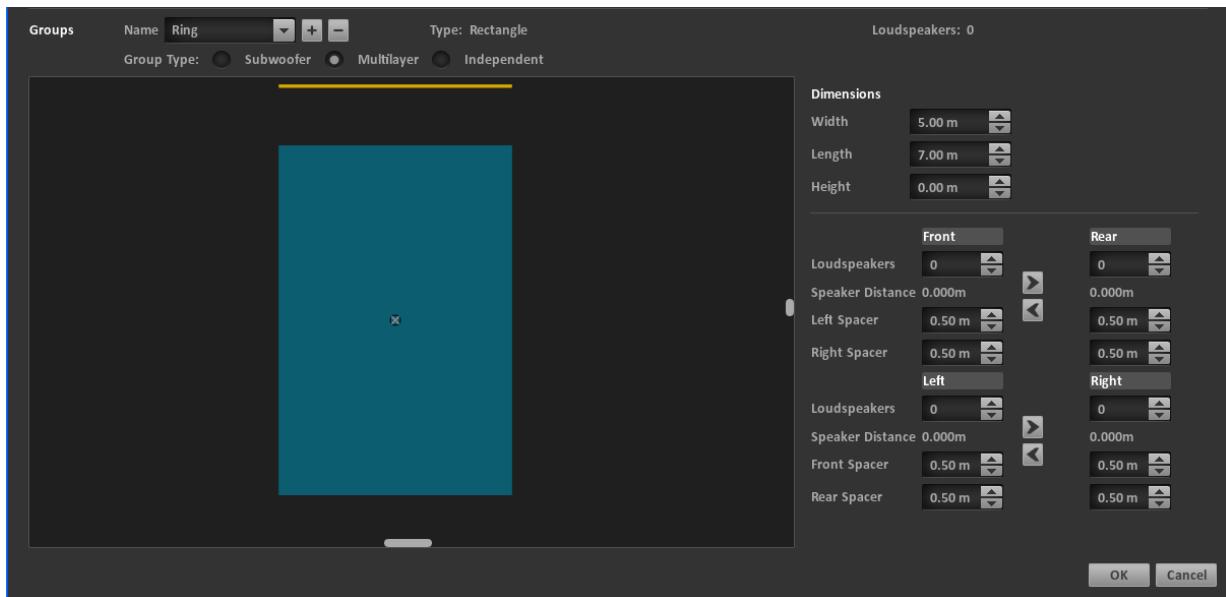


Image 5.3 Create a rectangular group

- ④ Back in main window. In Group Type keep Multilayer "check", keep default Width and Length in Dimensions and type "1.5m" in Height (value describes the absolute installation height of the speakers' acoustical center above ground).
- ⑤ Loudspeakers
 - Front "7",
 - Rear "5",
 - Left "7",
 - press ">" between Left and Right to copy the entered data from Left
- ⑥ Create a new group with "+" in Groups.
 - choose Type "Surface" from drop-down menu
 - name your group, for example "Ceiling"
 - press "OK" to confirm

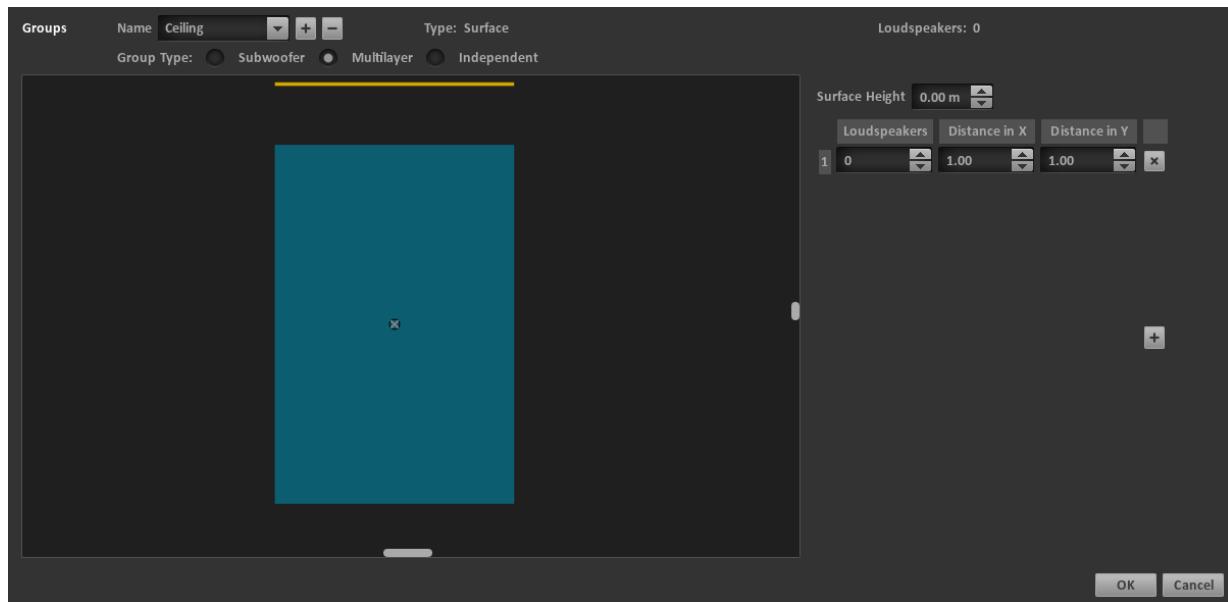


Image 5.4 Create a surface group

- 7 Keep Multilayer “check” and type in Surface Height “3m” (value is the absolute height of this group above ground). Add 4 more lines by processing “+” 4 times
 - type in line 1: Loudspeakers “4”,
 - line 2: Loudspeakers “3”,
 - line 3: Loudspeakers “4”,
 - line 4: Loudspeakers “3”,
 - line 5: Loudspeakers “4”,
 - Distance X keep default value (“1m”) for line 1-5,
 - Distance Y type “1.5” for line 1-5
- 8 Create a new group with “+” in Groups
 - keep Type “Rectangle”
 - name your group, for example “Subwoofer”
 - press “OK” to confirm
- 9 “Check” Subwoofer in Group Type
 - Dimensions: Height “0.5m” (value describes the absolute installation height of the speakers’ acoustical center above ground)
 - Loudspeakers - Front “2”, Left/Right Spacer “1.5m”
 - Rear “1”, Right Spacer “2.5m” (with a dimensions width of 5m the rear subwoofer will be half-way of the width in the rear center)
- 10 Press “OK” to create the loudspeaker file



Note: Using this tool you can create many different loudspeaker files, including standard setup types such as 2.0, 5.0, 7.0 as well as multilayer setups, simply by adding more groups with different height values. The layers will be automatically organized in ascending order based on their average height information.

- 11 The “3D ls file” is displayed in layers at Options menu (left: top view, right: file name). Choose the layer to be displayed using the drop-down menu Loudspeaker Group. Figure 5.5 visualizes the loudspeaker setup previously created with the Setup Designer.

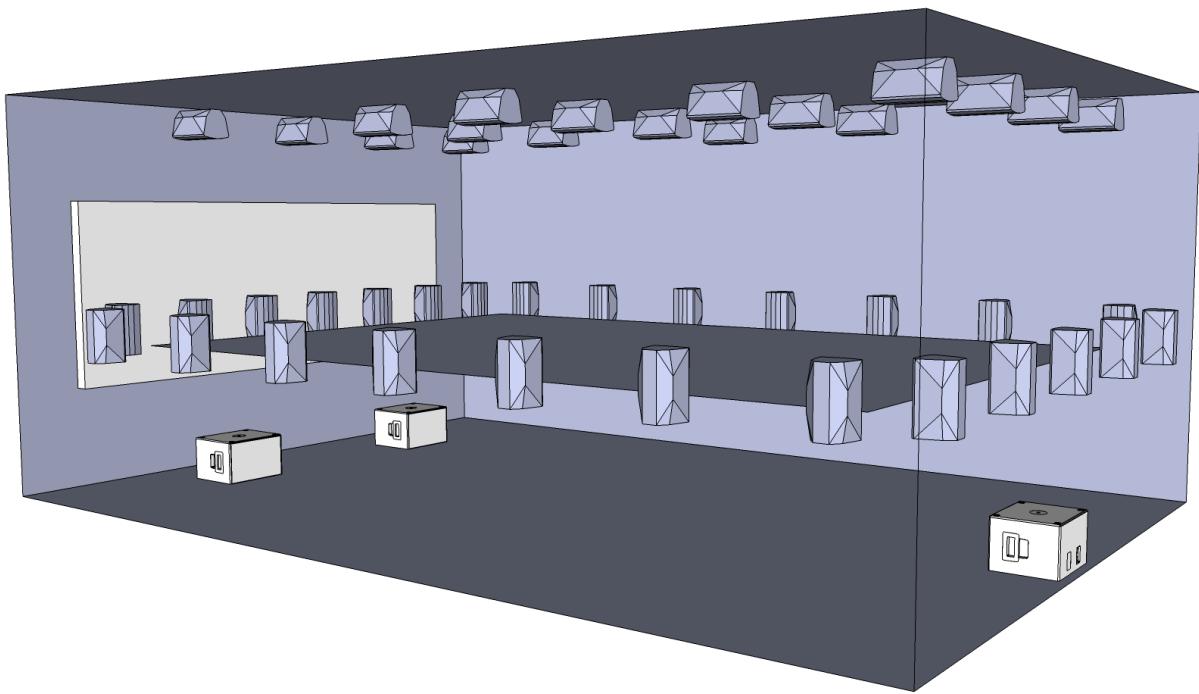


Image 5.5 Simple 3D model of the created loudspeaker setup

- 12** Define Zones to ensure correct reproduction of Zone Objects, the corresponding Zones need to be defined in the loudspeaker setup. Zones can be defined individually for each loudspeaker setup as a property of the specific setup.

Make sure you are at menu System - Options – Loudspeaker Setups

- Select the loudspeaker setup in which you want to define Zones
- Click on "Edit"
- Click on the "Zone mode" Icon in the lower left corner
- Click on "Zone Assignment"
- Select the loudspeaker(s) for the first assignment



Note: Multiple loudspeakers can be selected by holding "shift"+click or "cmd"+click

- From the right list, select the Zone ID you want the selected loudspeakers to be assigned to
- Repeat until at least one loudspeaker is assigned to each of the desired Zones



Note: Loudspeakers can be assigned to Multiple Zones in case several Zone Objects should be reproduced by the same loudspeaker. For example the Zones "left surround" and "left back surround" need to be reproduced using a single loudspeaker present left to venue.

- When you have finished with Zones definition, exit the edit mode by clicking "Edit" again.

- 13** Press "Export" to save your loudspeaker setup file for backup reasons

- Create a new directory in the Export dialog using the icon "Folder". As an example name it to "Ls Files" and save your loudspeaker file to the directed folder as filype type "*.ls4"



Note: Save your file as file type “*.ls3” for being compatible with previous system generations such as the IPC100. Some features exclusive to the IOSONO CORE will not be contained to “*.ls3”

- 14 Press “OK” to leave the Options menu

5.3 Create a test preset

5.3.1 Noise

In this chapter a new preset will be created as preparation for running a line check to all connected signal components.

- ① Press "New" and assign a Preset Name for example "Noise"
 - press "OK" to confirm
- ② The view switches to the Preset Details tab with a tree structure on the left. Keep default values in General, make sure that in Loudspeaker Setup the previously created loudspeaker setup file "3D ls file" is selected from the dropdown menu and Visibility has a "check".
Ignore Filtering for the time being. An advanced explanation is given within Section [6.2.2.2](#). Ensure the IOSONO CORE is the used device right having a look to Devices and Services.
- ③ In IOSONO CORE select Processing and I/O Control from Available Services and assign to Used Services with "<"
- ④ Go to I/O Control - Configuration in the tree structure and press "Autodetect". The displayed Configuration should match your purchased hardware configuration with the IOSONO CORE (regarding I/O Config M, 1x MADI should be selected)
 - in Synchronization, press "Internal".
- ⑤ Go to Processing in the tree structure
 - Select the following in the General tab for Renderer
 - "Active"
 - "Auto Configuration"
 - Push "OK" to confirm the warning dialog

Note: The software creates three render slots automatically. This is due to each loudspeaker file consists of 3 loudspeaker groups ("Ring", "Ceiling", "Subwoofer"). Within our example we want to use the automatically configured settings for these render slots. The loudspeaker group



- "Ring" uses "IOSONO" in algorithm selection
- "Ceiling" uses "Panning" in algorithm selection & "3D / Ceiling" in geometry mode
- "Subwoofer" uses "Panning" in algorithm selection & "2D / Surface" in geometry mode.

To allow bass management - check Loudspeaker Extension in Ring at Slot Settings
– Subwoofer.

- ⑥ In the General tab, press "Active" in Noise and "check" Autostart. A new tab Noise appears above.

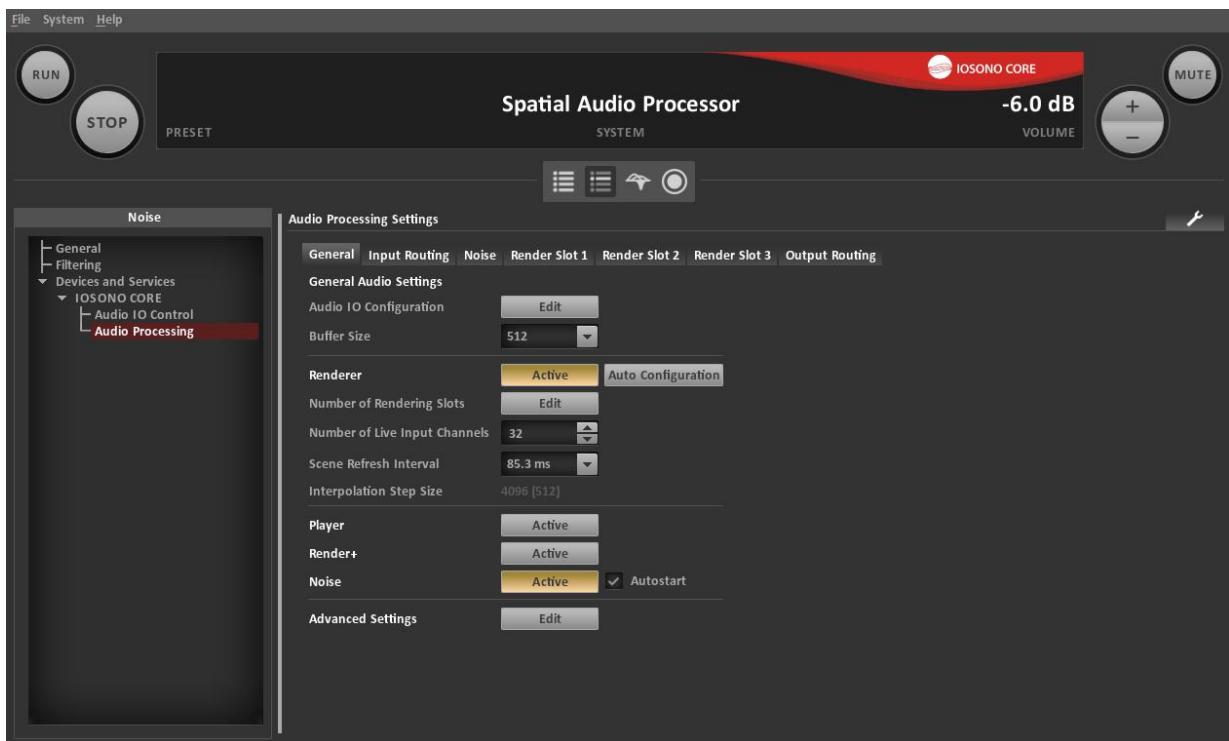


Image 5.6 Processing settings (Noise)

7 Go to Output Routing tab



Note: In the matrix, the rows represent the loudspeakers of your loudspeaker setup that are assigned to render slots, each with an individual color. The columns represent physical audio outputs of the processor, which can be accessed at the rear of your IOSONO CORE hardware. You may configure your individual output routing here. In our example, speakers 1-15 in render slot 1 are connected to outputs 1-15 (dummy speakers 16 and 17 require no connection to physical audio outputs), speakers 1-4 in render slot 2 are connected to outputs 18-21, speakers 1-2 in render slot 3 are connected to outputs 22-23 and speakers 1-5 in render slot 4 are connected to outputs 24-28. Therefore we want to use the automatically configured diagonal 1-to-1 routing.

8 Turn down the Main Volume to "-inf dB" by holding "-" in the upper right corner.

- To start the preset press "Run" in the upper left corner



Note: The button as well as the status lights of Audio I/O Control and Processing should get a green halo.

9 Go to the Noise tab

- set the maximum volume of the noise sequence with the "Volume" Fader
- press Play with the "Loop" icon
- to step through all speakers of each loudspeaker group sequentially select All Groups in Sequence
- to step through all speakers of a single loudspeaker group only select Single Group in Sequence with group name
- to step through loudspeakers manually press "forward/backward" Play button



Note: In the display you can see that the noise sequence steps through the selected speakers according to the noise signal sequence.

10 Go to Audio I/O Control in the tree structure and press "Status" icon

- at main window, turn up the Main Volume with "+" in the upper right corner
- the amplitude of level meters in Processing and Output will rise with increasing volume and a full range pink noise becomes audible to the respective speaker



Image 5.7 Processing settings (Noise)



Note: It is advisable to carefully check each output channel for sending a signal to the expected speaker. If the step sequence is too fast or you want to listen to single groups more closely, you can change playback settings in Preset Details – Processing – Noise – "Tool" icon. Continue when you're done with signal check for all speakers.

11 Go to Preset list by clicking the "List" icon, select the "Noise" preset and save it

- press "Stop" in upper left corner of main window

5.3.2 WAV playback

This chapter uses the system setup as described in Chapter 5.1, the loudspeaker file from Chapter 5.2 and the noise preset from Section 5.3.1.

It is advised to create a preset for dedicated purpose by copying and amending an already functional preset. This preset needs to contain a loudspeaker file as well as all general settings like described in previous chapters.

1 Go to Preset tab "Preset"-Icon

- select "Noise" in Presets
- Copy the preset using the "Copy" button
- type in a name for the new preset, for example "Wav playback"
- press "OK" to confirm

- ② Select "Wav playback" in Presets list
 - go to tab "Preset Details" icon
- ③ Go to IOSONO CORE in the tree structure on the left
 - Add a source with the Add button on the lower right corner of the scene display.
- ④ In the main window turn down the Volume to "-inf dB" with "--" in the upper right corner
 - Add a source with the Add button on the lower right corner of the scene display.



Note: The Run button as well as green status lights of Audio I/O Control and Processing should get a green halo when playback is running properly.

- ⑤ Go to Processing in the tree structure on the left
 - select the Player tab
 - press Status "i"-Icon
 - press "+" in the lower left corner
 - select "/testfiles/Full Bandwidth PinkNoise -20dB"
 - press Add



Note: You may add any WAV file available on the IOSONO CORE hard disk. It is recommended to add other music (*.wav) files that are familiar to you, in order to use it for verification. This may support improving the automatically configured render settings.

- ⑥ Press "Loop Play" icon
 - press "Play" icon

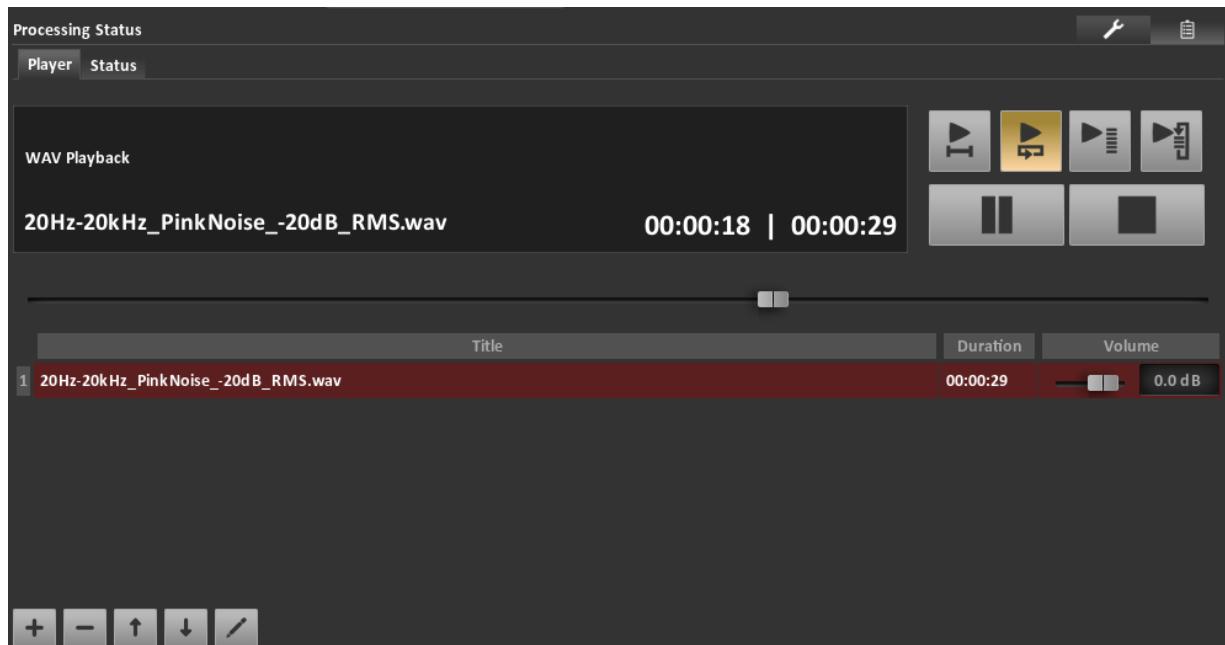


Image 5.8 Player status view



Note: The run time and total time of the selected WAV file is displayed as well as a cursor moving along a timeline.

7 Go to Scene Designer in the tree structure on the left

- turn up the Volume by holding “+” in the main windows top right corner
- a full range pink noise becomes audible



Note: The level meters in I/O Control, status “i”, Processing and Output show amplitudes. You should use this status frequently to check which and how many outputs are active and sending signals.

8 Grab the “Unnamed Source” with your mouse and move the source around in the system view

- you will hear the noise move according to the position and movement of the source icon
- in Traits check “Ceiling”
 - you will hear the pink noise from the ceiling speaker group
- uncheck “Ceiling”
 - the sound will be coming from the ring speaker group

9 Position the source directly onto one speaker in a Loudspeaker Group (Choose the ring loudspeaker group to display by using the drop down menu if necessary; use the zoom function with the mouse scroll wheel)

- change Type from “Point” to “Plane”
 - you will hear the noise from only one speaker with Type: Point and from more speakers with Type: Plane

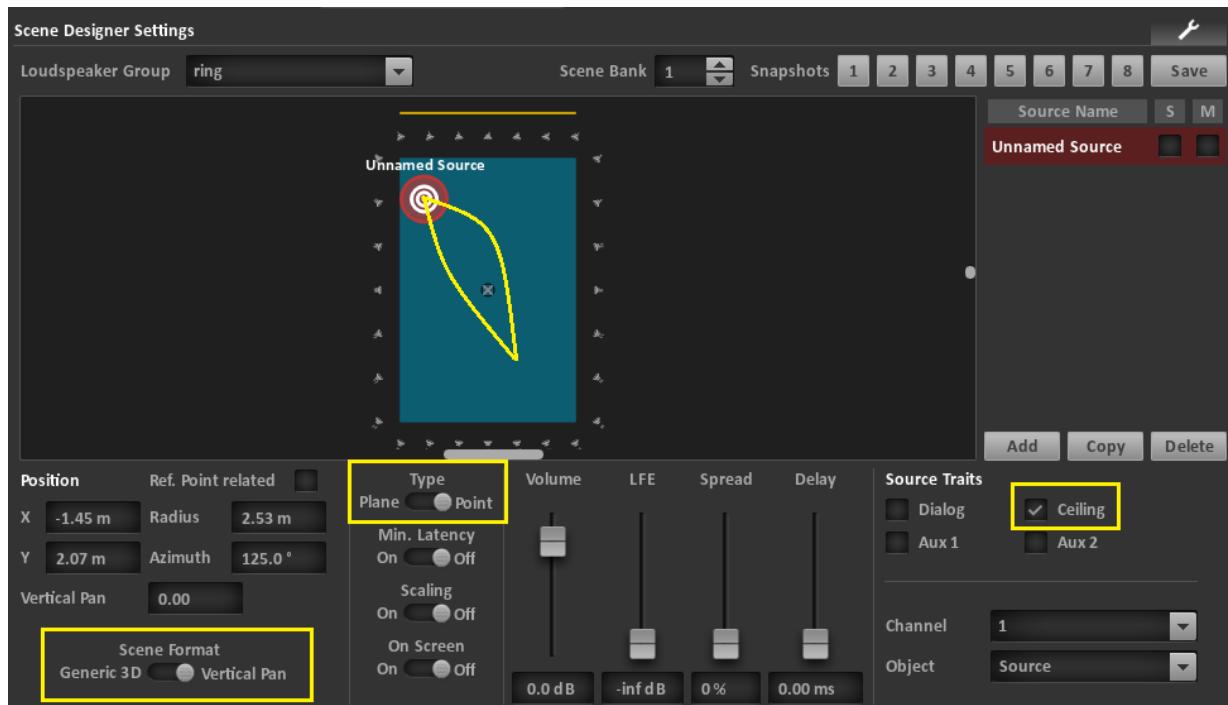


Image 5.9 Scene Designer view



Note: If you are experiencing a considerable volume difference at low frequencies (below 1 kHz) when comparing both source types, please follow step 13-14.

10 Keep the preset running

- go to Processing in the tree structure on the left
- change view to Edit mode using the “Tool” button in the upper right corner
- go to tab Render Slot 1 – Settings, Prefilter
- turn Prefilter “ON” if switched off and increase the Upper Frequency in Prefilter by approx. 10% (i.e. “190 Hz” for this example), hit Enter key on Keyboard
- The preset will restart and the WAV file playback starts from the beginning

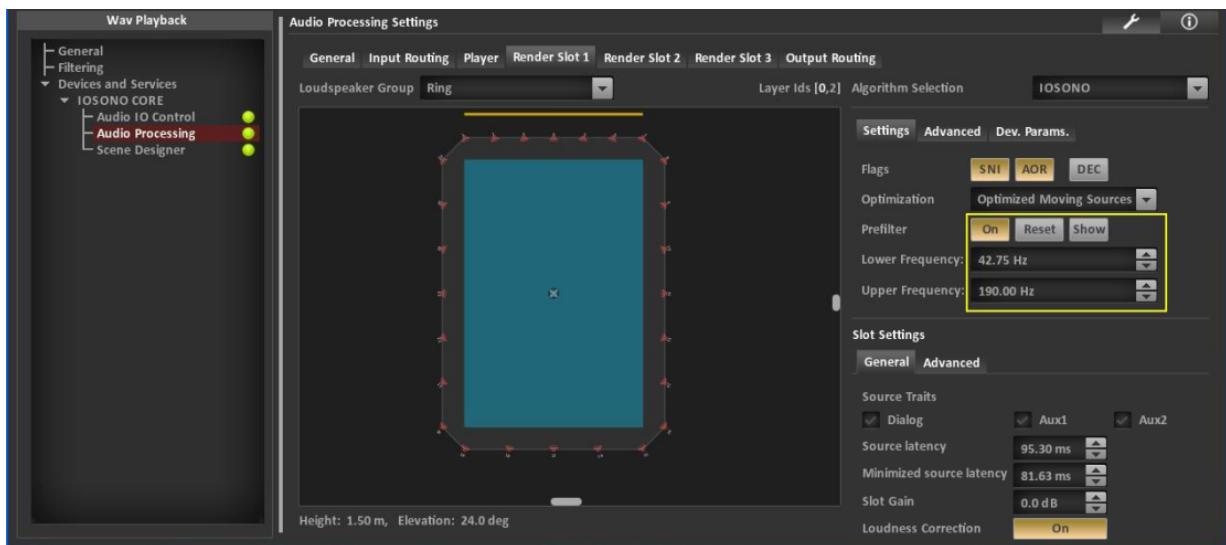


Image 5.10 Processing settings (Render Slot 1)

11 Go back to Scene Designer

- toggle source Type from “Plane” to “Point”
- listen to the results



Note: Repeat procedure until you’re not experiencing a considerable volume difference at low frequencies (below 1 kHz). Therefore both source types need to be compared. The actual prefilter’s upper frequency value will most likely differ if you are using your own setup. If the bass build up is audible a 10% increase of the upper frequency value is a good starting point for this procedure.

12 Press “Stop” in top left corner of the main window

- go to Preset tab - “Preset” icon
- select the “Wav playback” preset and Save it

6 CONTROL UNIT 3

Overview

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6.1 Introduction

6.1.1 Graphic User Interface overview

The graphic user interface of the Control Unit 3 is divided into two areas. The upper area is always visible and holds general system controls for starting and stopping a preset, as well as information about the currently selected preset, system name and volume. By default, the lower area shows the Home tab, which displays a list of all presets and their associated services. The tab bar offers quick navigation to the Preset Details, Filter Library, and additional plug-ins, depending on your system configuration.

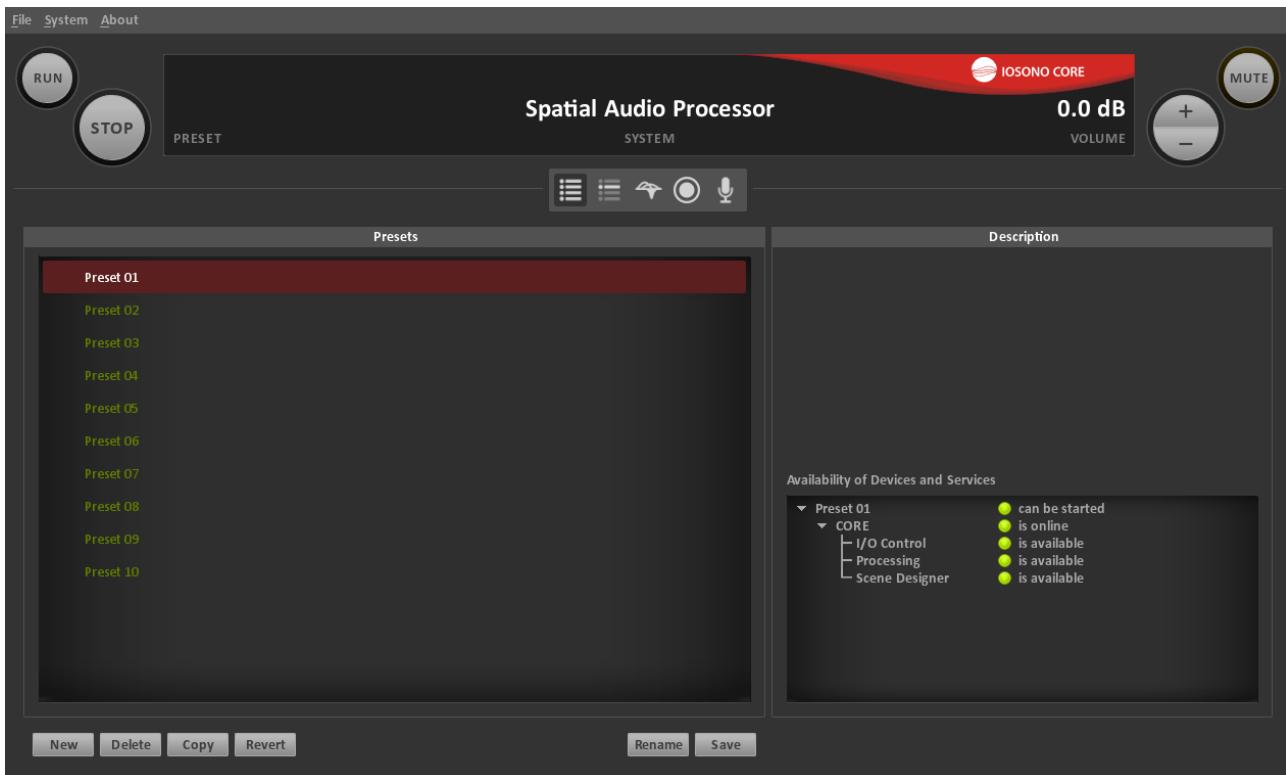


Image 6.1 Control Unit (Home tab)

6.1.2 Preset structure

To achieve maximum performance without sacrificing flexibility, the IOSONO CORE is able to load only the software modules that are necessary for a specific application. The set of configuration instructions of the different modules are stored as presets. For correct operability the preset configuration must at least contain the following data and software modules:

- Loudspeaker File: defines the arrangement of the connected loudspeakers
- I/O Control service: defines the flow of audio signals to and from the IOSONO CORE
- Processing service: defines the way the audio is processed by the IOSONO CORE



Note: Although essential for optimized reproduction, filters do not have to be configured for a preset to properly operate.

6.2 Preset details

6.2.1 General preset settings

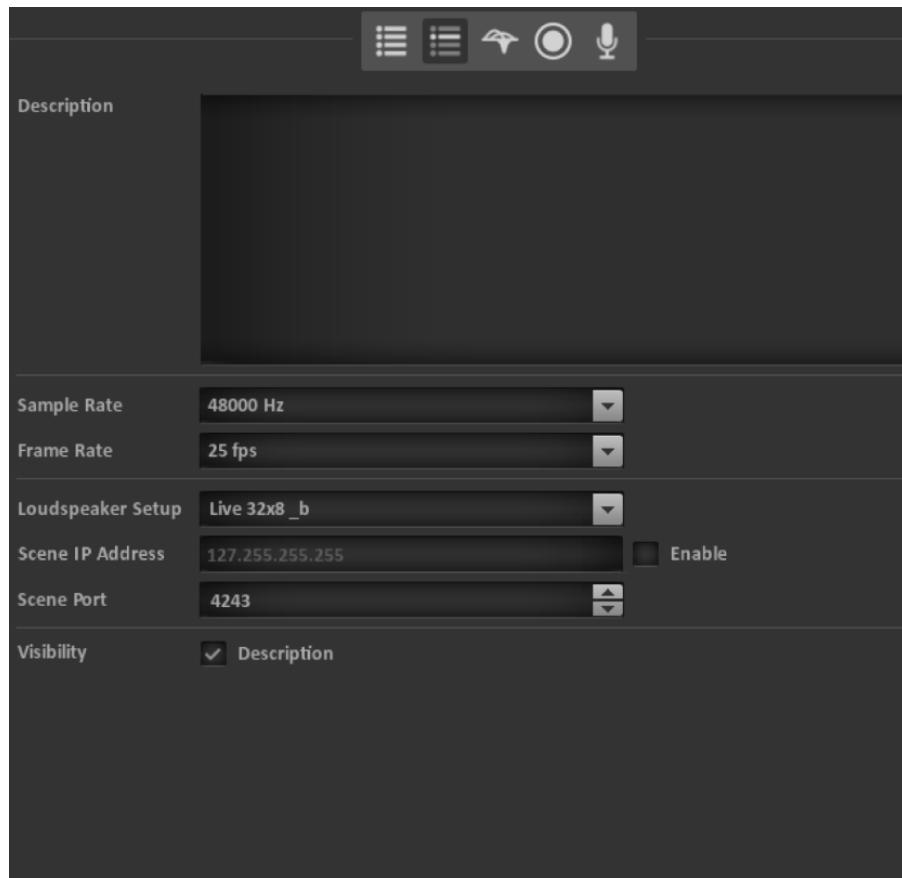


Image 6.2 General Preset settings

- **Description:**
Text area to store and display notes regarding the current preset.
- **Sample Rate:**
Defines the sample rate, at which the IOSONO CORE is processing audio. Supported sample rates are 44.1 kHz, 48kHz and 96kHz (optional).
- **Frame Rate:**
Defines the frame rate, at which Linear Timecode signals are decoded. To sync the IOSONO CORE to incoming LTC signal, make sure that the corresponding LTC source is connected to the LTC port of the IOSONO CORE's rear panel.
- **Loudspeaker Setup:**
Defines the arrangement of a loudspeaker system and works as basis for configuration of any preset. For detailed information on how to create a loudspeaker setup, please refer to Chapter 3.2.
- **Scene Port:**
Defines the IP port number, on which the IOSONO CORE sends and receives scene data.



Note: If you have multiple devices in your network that sends scene data (for example a CORE and a SAW production PC), make sure to separate the data streams by configuring presets with scene ports according to the particular application and scene data sender.

- Visibility:

Controls whether the preset is visible as a buttons in the Easy Control on the touch display of the IOSONO CORE.

6.2.2 Filtering

To ensure an optimized and homogenous audio reproduction throughout the listening area and to match different speaker models, a various number of filters can be applied to the speakers to shape their frequency response as desired. In addition you can create frequency-separating filters to feed every speaker only with the frequency range that it is capable of reproducing.

Filters can either be created and managed as a part of a preset in the filtering section of the preset details tab, or as global filter configurations in the filter library, which is accessed from the tab bar.

6.2.2.1 Filter library

The filter library provides access to global filter configurations that are always linked to a particular loudspeaker file and that can be referenced by any preset with the same loudspeaker setup. The filters contained by filter configurations can either be designed with the System Tuning Extension or be created manually.

To create a new filter configuration:

- ① Click on "Filter Library" in the tab bar
- ② Click on "New" and enter a name for the new filter configuration
- ③ Select the Loudspeaker Setup that you want to link with the filter configuration from the dropdown menu below the tab bar.



Note: You can change the association of the filter configuration by selecting a different loudspeaker setup. This will however delete the assignments of filter to the speakers

6.2.2.2 Filter creation

Filters can either be created from a finite impulse response (like the ones designed by the System Tuning Extension) or be designed as infinite impulse response filter with a full-parametric EQ with up to ten individual filter bands.

Create a new FIR filter:

Inside a preset:

- ① Click on Preset Details in the tab bar and go to the Filtering tab or inside a filter configuration:
- ② Go to Filter Library tab and select the desired filter configuration
- ③ In the FIR section click on "New"
- ④ Enter a name for the new filter and load the impulse response file from the IOSONO CORE 's hard drive.



Note: Please refer to Section 4.2.2 on how to upload files onto the IOSONO CORE.

-
- ④ Click on "New" and the new filter will be created from the impulse response.

Create a new IIR filter:

Inside a preset:

- ① Click on "Preset Details" in the tab bar and go to "Filtering"

or inside a filter configuration:

- ① Go to Filter Library tab and select the desired filter configuration

- ② In the IIR section click on "New"

- ③ In the creation dialog, enter a name for the new filter and click "OK"

- ④ Adjust the number of filter stages you want to use in the filter with "+" and "-"

- ⑤ Design each filter stage with the following parameters:

- type:

defines the basic type of each filter stage. Available types are low pass, high pass, low shelf, high shelf, peak EQ and band pass

- frequency:

defines the cut-off frequency of shelving and high pass / low pass stages, defines the center frequency of peak EQ and band pass stages

- Q-factor:

defines the slope for shelving stages defines the quality for peak EQ and band pass stages

- stage gain:

defines the gain of the filter stage depending on the stage type

filter	gain
low pass, high pass	n.a.
low shelf, high shelf	gain of stop/pass band
peak EQ, band pass	gain at center frequency

The overall gain of the resulting filter can be adjusted with the "Gain"-field below the frequency plot.



Note: IIR filters can be created and adjusted in real time, even while a preset is running, so you can listen to the resulting filters while you design them. The icon of each filter stage can be moved in the frequency response view to edit the filter stage.



Image 6.3 IIR filter stage

6.2.2.3 Filter assignment

To assign any filter to a speaker or group of speakers, activate the filter assignment mode by clicking the Filter Assignment button.

To assign a filter to a speaker:

Inside a preset:

- ① Click on "Preset Details" in the tab bar and go to "Filtering"

or inside a filter configuration:

- ② Go to Filter Library tab and select the desired filter configuration
- ③ Click on "Filter Assignment"
- ④ Select the speaker(s) to be assigned
- ⑤ Select the filter(s) you want to assign
- ⑥ Click on "Filter Assignment" again to exit filter assignment



Note: You can assign a single filter to more than one speaker and more than one filter to a single speaker. Keep in mind that the total amount of IIR filter stages assigned to a single speaker cannot exceed 30 and the total amount of FIR filters should not exceed 10.

6.2.2.4 Filter management

While filters in a filter configuration can be copied and deleted in the filter library, those filters that were created inside a preset can also be copied to other presets using the same loudspeaker setup.

To copy all filters from one preset to another:

- ① In the Home tab right click on the preset with the filters you want to copy and select "Copy filter settings" in the context menu

-
- 2 In the pop up window select the preset you want the filters to be copied to
 - 3 Click "OK"
-



Note: This will have no effect on the reference to a global filter configuration in a preset but only on filters that are configured inside the preset.

6.2.3 Devices and services

In this section of the preset, you can configure which devices and services have to be contained by the preset in order for it to fulfill the intended task. Start by selecting the number of devices you want to use. In most cases this is the IOSONO CORE only, additional devices like processing extensions can be purchased from Barco.

- 1 Go to the Devices and Services in the tree structure on the left in the Preset details tab
- 2 Select the Device you want to use from the list on the right
- 3 Click on the "left arrow" button to add the device to the preset

Continue by selecting the services for each device. These generally include an I/O Control to configure the soundcard(s), and a Processing service to configure the audio processing of each device.

Other services may be available depending on your application and software license.

To add a service to the list of used services:

- 1 Go to the "Devices and Services" section in the tree structure on the left of the Preset details tab
- 2 Select the device you want to add services to
- 3 Select the service you want to add
- 4 Click on the "left arrow" button

6.2.4 Services

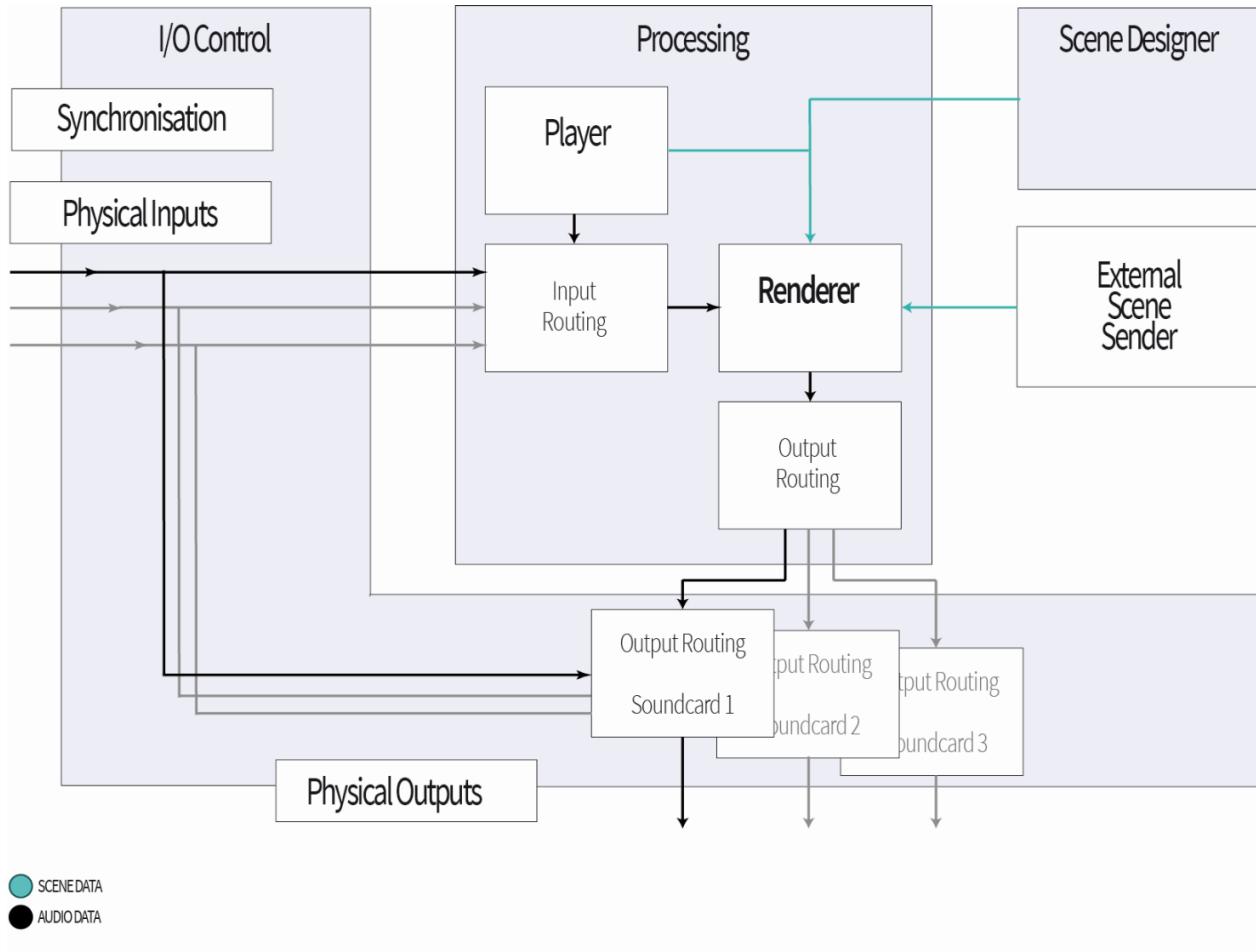


Image 6.4 General signal and scene data flow between services

6.2.5 Service settings and service status

Due to the modularity of the Control Unit each service has not only its own configuration page, but also displays information about its status in the currently running preset in a separate view. When no preset is running, only the settings tab is displayed. When a preset is running, the preset details can be toggled between settings tab and status tab on each service page.



Image 6.5 Settings and status tab buttons

6.2.6 I/O Control

The I/O Control service handles the physical routing and synchronization options of the IOSONO CORE. Typically, the configuration of this service is started by automatically selecting the number and type of installed soundcards of the IOSONO CORE by clicking the "Autodetect" button. Further the synchronization source can be selected.



Note: If "Signal" is selected as the synchronization source, the incoming signal at the primary soundcard will be the determined synchronization source. The primary sound card is AES 1 in AES and AES/MADI systems and MADI 1 in MADI only systems.

The physical inputs and outputs of the soundcard(s) are connected to the processing service as shown in figure 19 in Chapter 4.2.4. In addition to the standard outputs, parallel "direct-out" paths can be created in the "Advanced" menu in the I/O Control settings tab, which can be used to route incoming audio signals directly to the physical outputs of the soundcard(s).

6.2.7 Processing

The Processing service is the heart of the IOSONO CORE, where audio signals will be rendered to the loudspeaker setup utilized in the preset according to the descriptive scene data. The source of audio signals (e.g. live-feed to the soundcard(s) input or playback of an .icf file) is configured using the corresponding settings in the "General" tab of the processing service.



Note: While simultaneous rendering of audio from different devices is possible, there can only be one scene sender active at a time for each object. Multiple scene data sources cannot control the same object.

For a detailed description of the rendering options please refer to the "Step by Step Configuration" chapter in Chapter 5 that best resembles your type of application.

6.2.7.1 SamplePlayer Module

The SamplePlayer module is optional. If installed, it allows to play back up to 16 *.imf files in parallel using up to 16 sample-slots simultaneously.

Playback can be controlled independently and simultaneously for all sample-slots.

The SamplePlayer is a module of the Processing service and can be activated and configured from within the Processing Settings page at General tab (see Image 6.6).

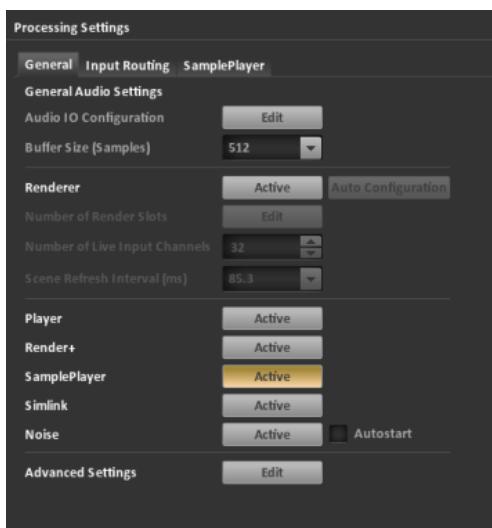


Image 6.6 Overview Sampleplayer settings

The SamplePlayer functionality (loading, playback, stop, loop) can be controlled via the remote control protocol exclusively, but not in the Control Unit (see section 6.3.2.1 for available remote commands). The audio and scene data output of the SamplePlayer is directly fed into the Renderer if available and does not appear at the input routing. Image 6.7 shows extended settings page for the SamplePlayer module.

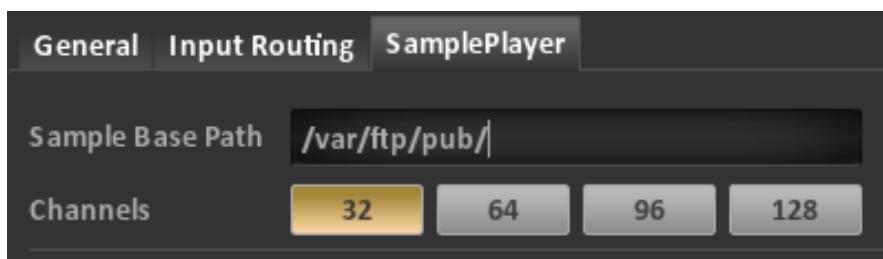


Image 6.7 SamplePlayer configuration page

Sample Base Path

The path containing *.imf sourced file location.

The preconfigured path (/var/ftp/pub/) corresponds to the root path of the remote-accessible FTP.



Note: The SamplePlayer can only play *.imf files but no *.icf files

Channels

The channel setting limits the number of objects that can be played in parallel. This number is the sum of all samples (*.imf files) played simultaneously at any point in time. Objects exceeding the Channel settings will be muted automatically.



Note: Two files containing 32 objects each, will require a Channel setting of 64 to be played back in parallel or overlapping. When set to 32 channels, only the file started first will be audible. Higher numbers of Channels will increase the processing load of the system

6.2.8 Scene designer

The object based audio description concept requires an audio object to consist of audio data and scene data. The scene data is created in the Scene Designer, such as position, source type and others. With the Scene Designer you can create acoustic scenes by arranging multiple audio objects in your setup. According to the input routing the audio data will be assigned to each source.

For applications that do not include an external scene sender like the Spatial Audio Workstation or any other kind of OSC device, scene data can be generated with the Scene Designer service. Each source you create provides the scene data for its corresponding live input channel.



Note: If you use the Scene Designer, make sure to create sources for all your input channels. Inputs without corresponding scene data will be automatically muted.

6.3 Extensions

Extensions are software add-ons that come either free with every IOSONO CORE system or can be purchased from Barco individually. These add-ons can be activated from the System - Options menu and provide additional features that are not tied to a specific preset. Once activated, each extension will add an additional icon to the tab bar, providing direct access to all its features.

6.3.1 Scene display extension

The Scene Display extension displays the scene data as sources describing the auditory scene that is currently processed by the IOSONO CORE. A fold-out table on the right of the display gives detailed information about each source and its rendering parameters.



Note: The Scene Display only shows a scene when a preset is running and the Processing service is provided with valid scene data.

6.3.2 Remote control extension

The Remote Control extension provides a network command line interface to the IOSONO CORE that enables third party programmable, external media controllers to remote control the IOSONO CORE. The extension supports TCP and UDP connections via Ethernet and RS232 connections with an ASCII based message protocol.

This section gives you a complete overview of remote control commands and system status messages to fully integrate the IOSONO CORE into your remote control environment.

Several commands can be parameterized and have specialized return values to adapt the IOSONO CORE behaviour to your setup needs. Please refer to the sub-sections below to get detailed information on this.

6.3.2.1 Commands

Command	Parameters	Return value	Description
ping			Connection test
controlunit/set_preset	<string>		Start preset <name>
controlunit/set_preset_nr	<integer>		Start preset <number>
controlunit/get_current_preset		<string> (line is empty if no preset is active)	Queries preset name
controlunit/get_all_presets		<string-list>	Queries all available presets
controlunit/get_nr_of_presets		<integer>	Queries preset number
controlunit/get_state		<state>	Queries current Control Unit status
controlunit/set_volume	<float>-60...0 dB		Defines global volume (dB)
controlunit/get_volume		<float>-60...0 dB	Queries global volume (dB)

controlunit/stop_current_preset			Stop actively running preset
controlunit/get_filter_configs	<string> preset name	<string> list	Queries all available filter configurations for the given preset.
controlunit/set_filter_configs	<string> filter config name or "None"	<string> list	Sets defined filter config for the active preset. Nothing is done with no preset is active.
system/shutdown			System shutdown
player/play			Start playback
player/stop			Stop playback
player/pause			Pause playback
player/get_tracklist		<string-list>	Queries track list
player/get_nr_of_tracks		<integer>	Queries number of tracks in the track list
player/set_track	<integer>		Selects track by number
player/set_loopmode	<loopmode>		Defines playback mode
player/get_loopmode		<loopmode>	Queries playback mode
player/get_tracklength		<integer>	Queries length of current track - If the player is inactive, the length of the last track played is returned
player/get_playbackstate		<playbackstate>	Queries playback status
player/set_position	<float>0...100		Defines track position in %
player/get_position		<float> 0...100	Queries track position in %
sampleplayer/get_num_slots		<integer>	Returns number of available sample slots
sampleplayer/get_max_num_channels		<integer>	Returns maximum allowed number of simultaneous playing channels
sampleplayer/load_sample	<integer> slot id 0.. , <string> path to sample file		Loads a sample from a file into the given slot. The path is relative to the base path configured in the sampleplayer plugin. An existing sample in the slot will be removed.
sampleplayer/play_slot	<integer> slot id 0..		Starts playing back a given slot.

sampleplayer/stop_slot	<integer> slot id 0..		Stops playing back a given slot.
sampleplayer/set_loop	<integer> slot id 0..		Sets the loop state for a given slot. 0 means off, any other value means on.
sampleplayer/get_slot_states		<string> list, comma seperated	Returns list of numbers, representing current slot state. 0-stopped, 1-playing.
sampleplayer/get_num_channels	<integer> slot id 0..	<integer>	Returns list of numbers, representing current slot state. 0-stopped, 1-playing.

6.3.2.2 Command parameter

All available command parameter are described below. Please replace the command parameter wildcards by values described.

<parameter>	Description
<string>	ASCII code that is a name
<string-list>	List of names, each name on a separate line
<integer>	ASCII code that is an integer
<float>	ASCII code that is a floating-point number

6.3.2.3 Command execution status return

All remote control commands lead to an acknowledge status message, indicating the acceptance of the remote control command. Refer to below description.

Execution status	Description
:OK:	Command executed successfully
:EXECUTION_ERROR:	Error during execution of command
:MALFORMED_COMMAND:	Invalid command
:MALFORMED_PARAMETER:	Invalid parameter

6.3.2.4 System status messages

The following messages are returned after sending remote command "controlunit/get_state".

Status	Description
:STATE_ERROR:	System error
:STATE_WARNING:	Warning
:STATE_OK:	Status OK

6.3.2.5 Playback status messages

The following messages will be returned after sending remote command "player/get_playbackstate".

Playback status	Description
:PLAYING:	Playback running
:PAUSED:	Playback paused
:STOPPED:	Playback stopped

6.3.2.6 Playback mode: commands and status return messages

The following command parameter are available for sending remote command "player/set_loopsmode". The following status messages will be returned after sending the command "player/get_loopsmode".

Playback mode	Description
:PLAY_ONE:	Play selected track once
:PLAY_ALL:	Play complete track list once, start with selected track
:REPEAT_ONE:	Play selected track in endless loop
:REPEAT_ALL:	Play complete track list in endless loop, start with selected track

6.4 Preset management

Since presets are an immanent part of the IOSONO CORE system, presets can be exported to the internal memory of the IOSONO CORE, and then downloaded to the remote PC via the file transfer dialog. Uploading and importing presets works in the same fashion.



Note: When a preset is exported as .icp file, the complete preset configuration including the loudspeaker file is exported. Therefore when you import a preset into a CORE, the loudspeaker file that comes with the preset is automatically added to the list of loudspeaker setups.

6.4.1 Import / export preset

To export a preset to the CORE hard drive:

- ① In the Home tab, select the preset you want to export
- ② Open the "File" menu and select "Export Preset"
- ③ In the file save dialog, select the folder where you want to store the preset and click on "Save"

To export multiple presets to the CORE hard drive:

- ① In the Home tab, select the preset you want to export
- ② Open the "File" menu and select "Export Multiple Presets"
- ③ In the next dialog, choose the presets you want to export, select the folder where you want to store the presets and click on "Save"

To import a preset from the CORE hard drive:

- ① In the Home tab, open the "File" menu and select "Import Preset"
- ② In the file dialog, navigate to the preset you want to import and click on "Select"

6.4.2 Revert a preset

Changes to the configuration of a preset can be undone by using the revert function. A preset can be reverted to the state when it was last saved at any time using the "Revert" button in the Home tab.

6.5 System management

6.5.1 Create and restore backups

It is advised to create system backups on a regular basis, which contain the general configuration, loudspeaker files and presets. To save a complete system backup:

- ① Go to menu System - Backup and choose "Backup"
- ② In the file dialog, navigate to the folder where you want the backup to be saved, create a new folder with a meaningful name (today's date) and click on "Save"

To restore a backup:

- ① Go to menu System - Backup and choose "Restore Backup"
- ② In the file dialog, navigate to the folder where your backup is located and click on "Select"

6.5.2 Update the Control Unit

An update of the Control Unit can either be done from an USB stick, or by transferring the update files to the user directory of the IOSONO CORE via the file transfer dialog. To update the Control Unit from an USB Stick:

- ① Copy the respective files to an USB stick and plug it into one of the USB ports of the CORE
- ② In the Easy Control, press the "Update" button, select the update file and press "Update". The update will then be executed and the CORE will reboot

To update the Control Unit from the hard drive

- ① Copy the binaries to the user directory with the file transfer dialog
- ② Go to menu System - Update, open the "File" menu and select "Update"
- ③ Navigate to the folder where the update files are located and click on "Select"
- ④ Choose the update you want to install and click on "Execute"

7 STEP BY STEP CONFIGURATION

Overview

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7.1 Live application

7.1.1 Hardware connections

In this chapter we describe a scenario with a number of live input audio signals are fed in to the IOSONO CORE. Usually these signals are fed from a mixing console in a live event context. The mixing console may have MADI outputs connected to the IOSONO CORE or different output formats connected to a suitable signal converter which then is connected to the IOSONO CORE.

A typical wiring scheme for a live application with analog outputs is shown in figure 7.1.

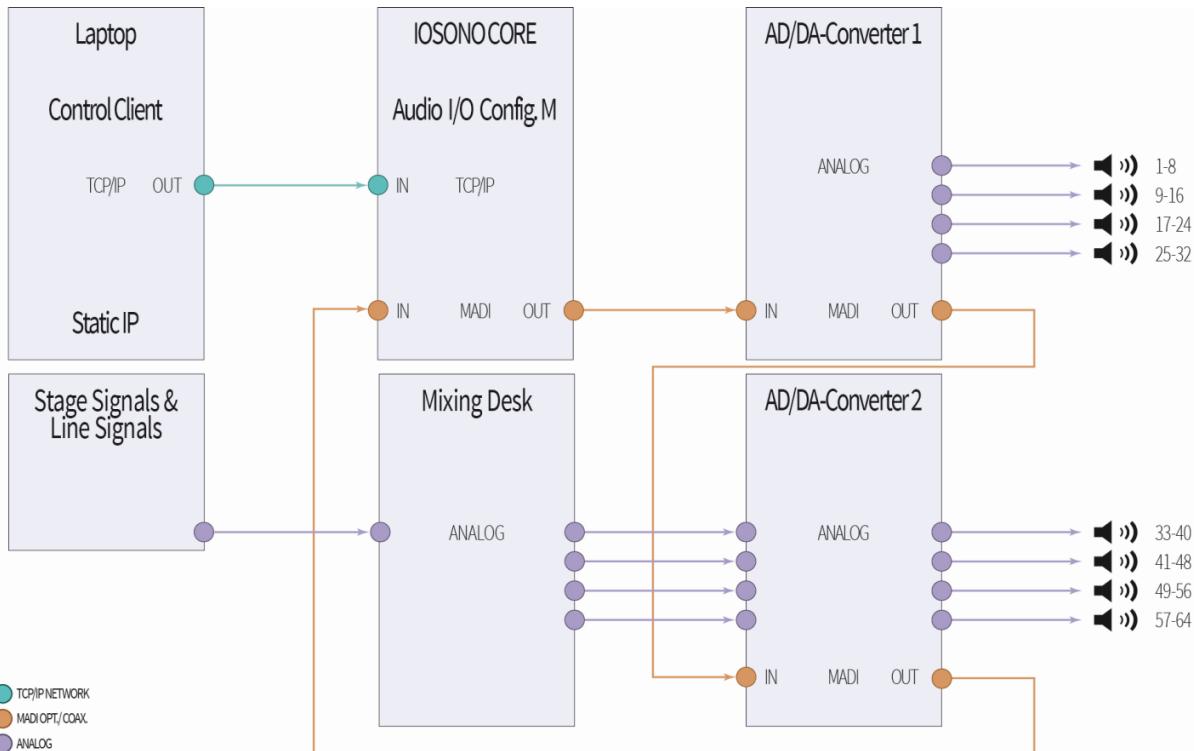


Image 7.1 Typical wiring for a live application

7.1.2 Create loudspeaker file

A loudspeaker file is the basis for any preset and the rendering process. It has to reflect the real loudspeaker setup as closely as possible. Any deviation between the actual setup and the file will impair the render precision and the overall sound quality. In this section we will create a setup consisting of a stereo main PA system, a line of nearfill speakers, a subwoofer array and multiples single surround speakers. To create a loudspeaker file for your actual setup you have to use in real data. For further explanations, see Chapter 5.2.



Note: Nearfill loudspeakers are positioned as a horizontal array along the apron of the stage. They are used to provide correct spatial imaging for the audience close to the stage. Depending on the type of loudspeaker and the venue's geometry, this is true for the first 5-15 rows of the audience.

- 1 Go to menu System - Options - Loudspeaker Setups - Create
- 2 Name your loudspeaker setup, for example "Live"
 - under General, change Speaker Icon Size to "0.8m" to improve visibility of these icons in large setups

- change the values in Audience Area, Width to "25m", Length to "40m" and Height to "1.20m" or according to your actual setup



Note: The audience area defines the area where the audience will be located. The height of the audience area refers to the average ear level of the audience, which is usually 1.20m when seated and 1.70m when standing.

Create a group with "+" in Groups

- select Type "Standard Setups"
- Name your group, for example "Stereo PA"
- press "OK" to confirm
- in Group Type "check" Independent



Note: See how the audience area is created in the scene display as a blue rectangle with red two speaker icons as well as a yellow screen line is inside it. With actual positions entered, the audience area should not comprise the screen and the speakers

- ③ In Screen change the Y value to "30m", see how it moves 10m behind the front edge of the audience area.



Note: The screen has to be in the front direction of the system and outside of the audience area.

- ④ Keep Setup Type "2.0" - choose Height "8m" (value describes the absolute installation height of the speakers' acoustical center above ground) and Radius "30m" (value is the radius from the point of origin with a standard stereo opening angle for the front speakers of +/-30°)
- ⑤ Create a new group with "+" in Groups - select Type "Rectangle" from drop-down menu - Name your group, for example "Nearfills" - press "OK" to confirm - "check" Group Type Independent - in Dimensions, enter the values of this loudspeaker group, for example Width "32m", Length "50m", Height "1.5m" (value describes the absolute installation height of the speakers' acoustical center above ground) - type in the following values: Front Loudspeakers "15", Left/Right Spacer "3.50m", Rear Loudspeaker "2", Left/Right Spacer "0"



Note: The two rear loudspeakers are not representing physical present speakers, but are considered as "dummy" loudspeakers to allow for IOSONO processing including Wave Field synthesis, used for correct localization of sound sources. Please make sure that their positions together with the front fill span a shape, that completely includes the audience area.

- ⑥ Create a new group with "+" in Groups
 - keep Type "Rectangle"
 - Name your group, for example "Surrounds"
 - press "OK" to confirm
 - in Group Type "check" Independent
 - Dimensions: Width "32m", Length "50m", Height "5m" (value describes the absolute installation height of the speakers' acoustical center above ground)
 - type in Rear Loudspeaker "2", Left/Right Spacer "8.50m",

- Left Loudspeakers "3", Left/Rear Spacer "10"
- press ">", the right speakers will have the same values automatically



Note: With these loudspeaker numbers and spacers, all surround speaker positions will have the distance of 15m to each other within the given dimensions.

7 Create a new group with "+" in Groups

- keep Type "Rectangle"
- Name your group, for example "Subwoofer"
- press "OK" to confirm
- Subwoofer "check"
- Dimensions: Width "32m", Length "50m", Height "0.5m" (value describes the absolute installation height of the speakers' acoustical center above ground)
- type in Front Loudspeakers "3", Left/Right Spacer "6m"

8 Press "OK" to create the loudspeaker file

9 The "Live" loudspeaker file is displayed in layers in the Options menu (left: topview, right: file name). Choose which layer to be displayed using the drop-down menu Loudspeaker Group. In case you realize there was a mistake while creating the loudspeaker setup it is possible to go to Edit mode and change data entries.



Note: The grey color of the shape connecting the speakers indicates a valid loudspeaker setup for IOSONO rendering.

10 Choose Loudspeaker Group "Stereo PA"

- press "Edit"
- select the left speaker icon in the topview
- change Position x "-12m" and y "25m"
- press the "+" icon in Direction to align the speaker towards the center
- do the same with the right speaker icon with x "12m" and y "25m"
- press "Edit"

Figure 7.2 below visualizes the loudspeaker setup previously built with the setup designer:

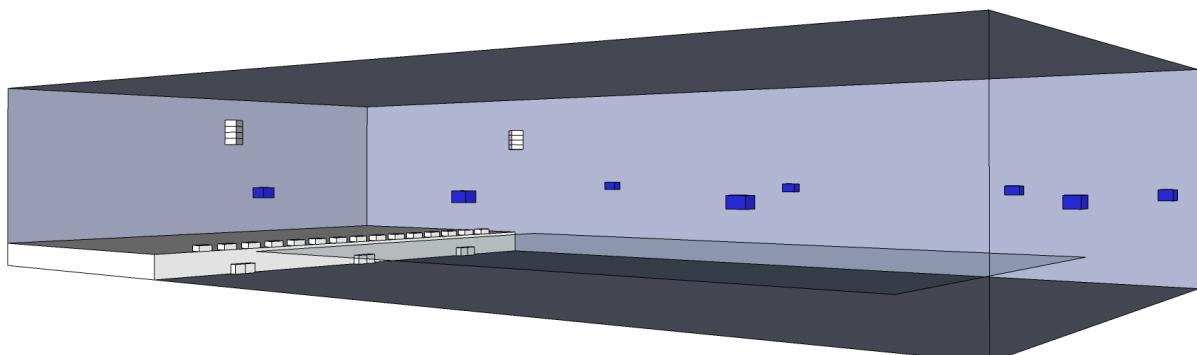


Image 7.2 Simple 3D model of the created loudspeaker setup

- 11 Press "Export" to save your loudspeaker setup file for backup reasons
 - Create a new directory in the Export dialog using the "Folder" Icon
 - Name it for example "Is files" and save your loudspeaker file in this folder as File Type "*.ls4"
- 12 Press "OK" to leave the Options menu

7.1.3 Preset configuration

- 1 In the Presets menu, press "New" and assign a Preset Name, e.g. "Live"
 - press "OK" to confirm
- 2 The view switches to the Preset details tab with a tree structure on the left. In General – Loudspeaker Setup select the file created before "Live" and keep Visibility checked.



Note: Ignore the Filtering tab for the time being. This feature is explained in detail in Chapter [6.2.2.2](#). In Devices and Services the IOSONO CORE should be the used device.

- 3 In IOSONO CORE move Processing, I/O Control and Scene Designer from Available Services to Used services with "<"
- 4 In the tree structure, go to I/O Control – Configuration, press "Autodetect". The displayed configuration should match your purchased hardware configuration with the IOSONO CORE. (In case of I/O Config M, 1x MADI should be selected) - in Synchronization choose a suitable setting according to your setup.
- 5 In the tree structure, go to Processing - General tab and choose in Buffer Size - "128" samples for low system latency



Note: See Chapter [7.1.3.3](#) for delay minimization techniques and related trade-offs, for further explanations, see Chapter [6.2.4](#)

- press "Active" in Renderer
- press "Auto Configuration"
- "OK" the warning dialog
- select a Number of Live Input Channels according to the number of real inputs from your mixing console for example "16"



Note: Because the loudspeaker file has 4 loudspeaker groups ("Stereo P.A.", "Nearfills", "Surrounds" and "Subwoofer") the software creates 4 render slots automatically.

- 6 Go to the Input Routing tab - make individual routing in the provided matrix if necessary or keep default diagonal line if your live inputs feed into the IOSONO CORE in a linear fashion.



Note: The rows represent your input signals from the external audio signal source at the physical audio inputs while the columns represent the virtual sources as renderer input channels.

7 Go to tab Render Slot 1

- select Loudspeaker Group "Nearfills"
- select "IOSONO" in Algorithm Selection
- in Settings keep default selection of flags
- select Static Scene Rendering
- turn Prefilter "ON" (Refer to Chapter 3.3.2 for further explanation of these values and delay minimization techniques and trade-offs.)
- in Slot Settings "uncheck" the Source Trait Dialog



Note: In Slot Settings you may adjust the source latency, minimized source latency and slot gain with regards to the other render slots. Have the same delay time in all render slots (as automatically set) for the sound to arrive at the same time at the center of the audience area from all loudspeaker groups. Adjust the delay time of the individual render slots to exploit the Haas effect in live sound reinforcement.

8 Go to tab Render Slot 2

- select Loudspeaker Group "Stereo P.A."
- select "Panning" in Algorithm Selection
- in Settings keep Level Correction on and Geometry Mode "2D (Ring)", Delay Correction Mode "Speaker Distance" selected
- in Slot Settings "uncheck" the Source Traits Dialog



Note: For geometry mode, select the option that comes close to your loudspeaker group. If you're not sure select "Auto 2D/3D". The delay correction mode has two options - "Speaker Distance" and "Source Distance":

- "Speaker Distance" is optimized for ring shaped speaker groups.
- "Source Distance" is optimized for planar shaped speaker groups.

9 Go to tab Render Slot 3

- select Loudspeaker Group "Surrounds"
- select "Panning" in Algorithm Selection
- in Settings keep Level Correction on and Geometry Mode "2D (Ring)", Delay Correction Mode "Speaker Distance" selected
- in Slot Settings "check" the Source Traits Dialog

10 Go to tab Render Slot 4

- select Loudspeaker Group "Subwoofer"
- select "Panning" in Algorithm Selection
- in Settings keep Level Correction on and Geometry Mode "2D (Ring)", Delay Correction Mode "Speaker Distance" selected
- in Slot Settings - LF Speaker Extension "ON" for all loudspeaker groups



Note: Selecting the LF speaker extension enables bass management in the system for the selected loudspeaker groups.

11 Go to tab Output Routing

Note: In the matrix, the rows represent the loudspeakers of your loudspeaker setup that are assigned to render slots, each with an individual color. The columns represent physical audio outputs of the processor, which can be accessed at the rear of your IOSONO CORE hardware. You may configure your individual output routing here. In our example,



- speakers 1-15 in render slot 1 are connected to outputs 1-15 (dummy speakers 16 and 17 require no connection to physical audio outputs),
- speakers 1-4 in render slot 2 are connected to outputs 18-21,
- speakers 1-2 in render slot 3 are connected to outputs 22-23 and speakers 1-5 in render slot 4 are connected to outputs 24-28.

Therefore we want to use the automatically configured diagonal 1-to-1 routing.

7.1.3.1 Scene Designer

1 In Preset Details go to Scene Designer in the tree structure on the left

- Create 16 sources by clicking the “Add” button (according to your inputs from the mixing console)
- name the sources by double clicking on each source’s name label in the source list and type in the name with respect to the input channels (e.g. follow a naming scheme from your mixing console, for example sub mixes of microphone groups)
- arrange the sources in a way that reflects the stage settings or other situations you wish to create (for more information about the Scene Designer, see Chapter 6.2.8)



Image 7.3



Note: The sources have been arranged to represent the spot microphone positions of individual instrument groups in a classical orchestra body along with two sources representing reverb generator returns placed around the audience for creating artificial reverb sounds.

2 For Channel 15 and 16 “check” Dialog in Source Traits

- increase Spread to about “30%” for both sources

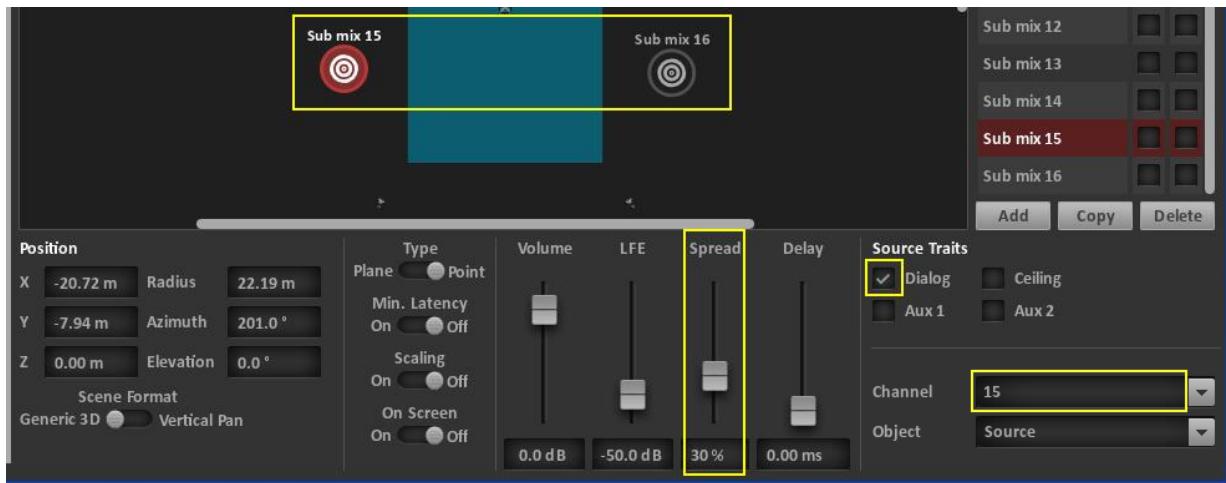


Image 7.4



Note: Selecting “Dialog” in “Source Traits” assigns these sources to render slot 3/surrounds and 4/subwoofer, because of the source trait setting made in render slot 3 and 4. Spread values higher than zero will increase the number of speakers involved to reproduce the source when using Panning algorithms.

- ③ To quickly access different source position arrangements for different static scenes do the following in Snapshots

- press Save - “1” for first arrangement, rearrange sources
- press Save - “2”
- switch between “1” and “2”

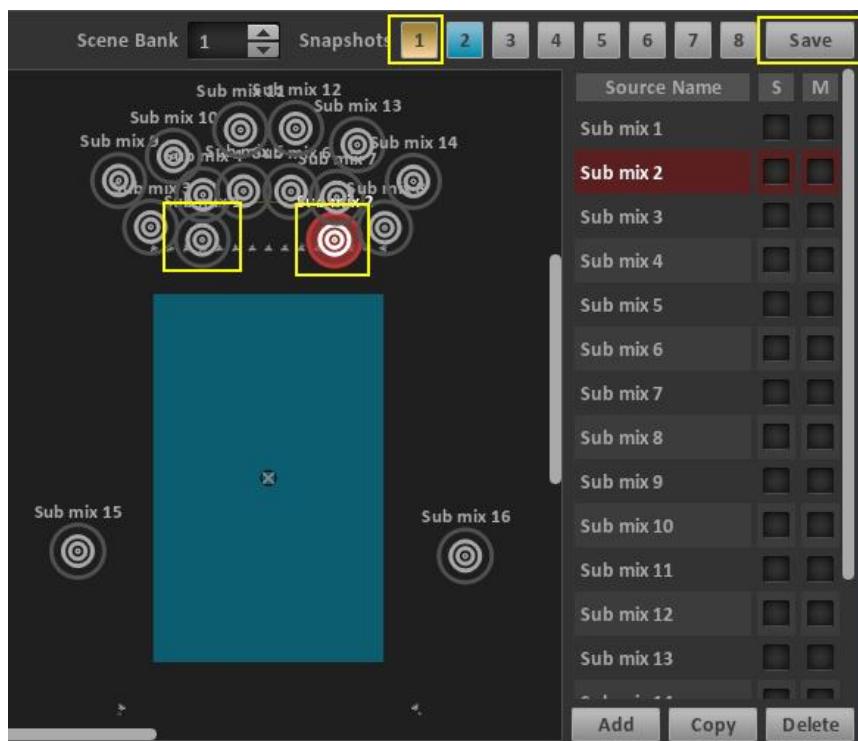


Image 7.5

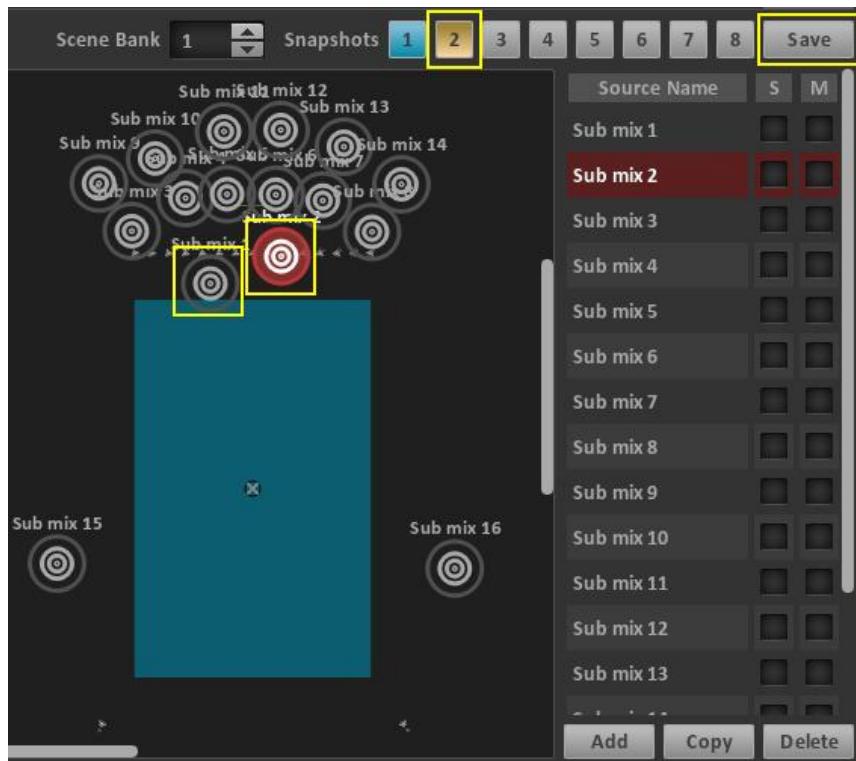


Image 7.6

- 4 In the main window, turn down the Volume to “-inf” with “-” in the top right corner
- press “Run” in the top left corner.



Note: The button as well as green status lights of audio I/O control and processing should get a green halo.

- 5 Go to Audio I/O Control and press the “Status”-Icon
- turn up the Volume with “+” in the top right corner of the main window
 - the amplitude of the level meters in Processing and Output will rise with increasing volume if the CORE processor is fed with input signal. These output signals will become audible

7.1.3.2 Level and EQ using IIR-filtering

The preset described in Chapter 5.1 uses a bass management configuration and several loudspeaker groups with differing acoustic properties. Therefore it is advisable to apply IIR-Filters to individual system components for leveling, separating low frequency and full-range components and equalization. (Find more information about IIR-filters in Chapter 6.2.2.2)

- 1 Go to Filter Library “Library”-Icon
 - press “New”
 - name the new Filter Configuration for example “LiveFilter”
- 2 In Loudspeaker Setup
 - select “Live” (or any other loudspeaker file which you wish to apply filters to)
 - understand and press “Yes” in the warning dialog
 - create a New Filter in the IIR Filter List
 - name the IIR Filter for example “HiPass”

- 3 A filter settings dialog appears on the lower right corner in the main window
- add another line in filter parameters with “+”
 - select High Pass from the drop down list in both lines
 - Change the frequency in both lines to for example “150 Hz”
 - Change the Q-factor in both lines to for example “0.7”

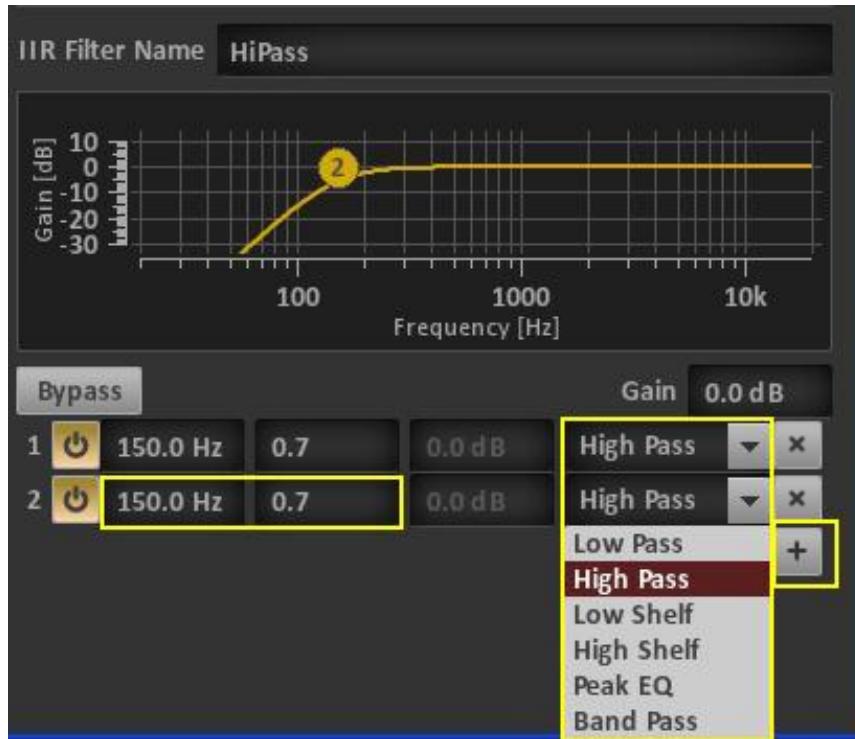


Image 7.7



Note: This filter will have a cut-off frequency (-6dB) at 150Hz with a slope of -24dB/Oct.

- 4 Press “Filter Assignment” to enable filter assignment mode
- select loudspeakers (for selection of multiple speakers use “shift+left click”) in the loudspeaker group you wish to assign the HiPass filter to, for example the line of 15 loudspeakers in the Nearfills group
 - press “HiPass” in IIR Filter List, the filters are now assigned to the selected speakers
 - press “Filter Assignment” again to disable the assignment mode



Image 7.8



Note: When loudspeakers have at least one filter assigned, their icons turn blue. Speaker icons turn yellow when the assigned filter is selected in the IIR Filter List.

5 Change the Loudspeaker Group in the drop-down list, for example to "Stereo P.A."

- press "Filter Assignment" to enable filter assignment mode
- select loudspeakers (for selection of multiple speakers use "shift+left mouse") in the loudspeaker group you wish to assign the HiPass filter to, for example the stereo pair loudspeakers in the Stereo P.A. group
- press "HiPass" in IIR Filter List, the filters are now assigned to the selected speakers
- press "Filter Assignment" again to turn it off
- assign the HiPass filter in Loudspeaker Group "Surrounds" in the same way as described for Nearfills and Stereo P.A.
- press "Filter Assignment" again to disable the assignment mode



Note: All full-range system components (Stereo P.A., Nearfills, Surrounds) now have a lower cut-off frequency at 150Hz to separate them from the subwoofers.

6 Make a New Filter in IIR Filter List

- name the IIR Filter for example "LoPass"
- add another line in filter parameters with "+"
- select "LoPass" from the drop down list in both lines
- change the frequency in both lines to for example "150 Hz"
- change the Q-factor in both lines to for example "0.7"



Note: This filter will have a cut-off frequency (-6dB) at 150Hz with a slope of -24dB/Oct.

7 Change the Loudspeaker Group in the drop-down list to "Subwoofers"

- press "Filter Assignment" to enable filter assignment mode
- select loudspeakers (for selection of multiple speakers use "shift+left mouse") in the loudspeaker group you wish to assign the LoPass filter to, for example the 3 subwoofer icons in the Subwoofers group
- press "LoPass" in IIR Filter List, the filters are now assigned to the selected speakers
- press "Filter Assignment" again to disable the assignment mode



Note: All subwoofers now have an upper cut-off frequency at 150Hz to separate them from the full-range system components.

8 Make a New Filter in IIR Filter List

- name the IIR Filter for example “-5dB”
- change the Gain to “-5dB” in the filter parameter dialog
- keep the default values in your first filter parameter list
- change the Loudspeaker Group in the drop-down list, for example to “Stereo P.A.”
- press “Filter Assignment” to enable filter assignment mode
- select loudspeakers (for selection of multiple speakers use “shift+left mouse”) in the Loudspeaker Group you wish to assign the filter to, for example the stereo pair loudspeakers in the Stereo P.A. group
- press “-5dB” in IIR Filter List in addition to “HiPass”, the filters are now assigned to the selected speakers
- press “Filter Assignment” again to disable the assignment mode



Note: The full-range system component “Stereo P.A.” now has two filters assigned. The first filter is a high pass filter with a cut-off frequency of 150Hz to separate it from the subwoofers. The second filter is spectrally flat with an overall gain of -5dB to lower the overall gain of this loudspeaker group. You may design many different filters for your specific purpose and assign it to any speaker in each loudspeaker group.

7.1.3.3 Latency minimization

In live applications the latency time of the reproduction system is always a critical issue. Below is a list that states sources of delay introduced by an IOSONO system, parameters that can be used to lower the system latency (latency minimization) and drawbacks that are introduced when setting parameters to allow for lowest system latency.

Sources of latency	Measures	Drawbacks
Setup design	Segmentation of loudspeaker files. It introduces loudspeaker groups with fewer speakers in groups where possible.	Use of IOSONO algorithm only possible in groups with sufficient number of loudspeakers.
	Keep reference point far away from loudspeaker groups.	Loudspeaker setups may not reflect the reality.
Buffer Size	Keep Buffer Size low (64/128 samples) to minimize processing delay. Reduce processing load to allow for small Buffer Size by:	Preset might not run properly, Underruns in complex setups
	Keeping the number of Live Inputs to required minimum.	Less live inputs possible.
	Use VBAP algorithm instead of IOSONO.	Correct localization only at reference point. Audio image limited to loudspeaker array.
	In render slots with IOSONO algorithm applied select "Static Scene Rendering" instead of "Optimized Moving Sources".	Audible artifacts when moving sources.
	Do not use FIR-Filters.	Less options of loudspeaker equalization.
Pre Delay	Turn on minimum latency as a source property in Scene Designer.	Sources within the perimeter of the system will not be focused but reproduced by the loudspeakers closest to the source position.

7.2 Playback

7.2.1 Hardware connections

In a playback scenario pre-produced material will be stored on the CORE's internal memory. The immersive audio content it is stored as an IOSONO content file (*.icf or *.imf) containing both audio and scene data in a common file. Standard multichannel wave files can be played back as well but will require additional scene data as created in the Scene Designer. External inputs may be fed via the audio inputs of the IOSONO CORE. The wiring scheme for this application often is similar to a standard IOSONO setup as described in Chapter 5.1 or in figure 7.9 below.

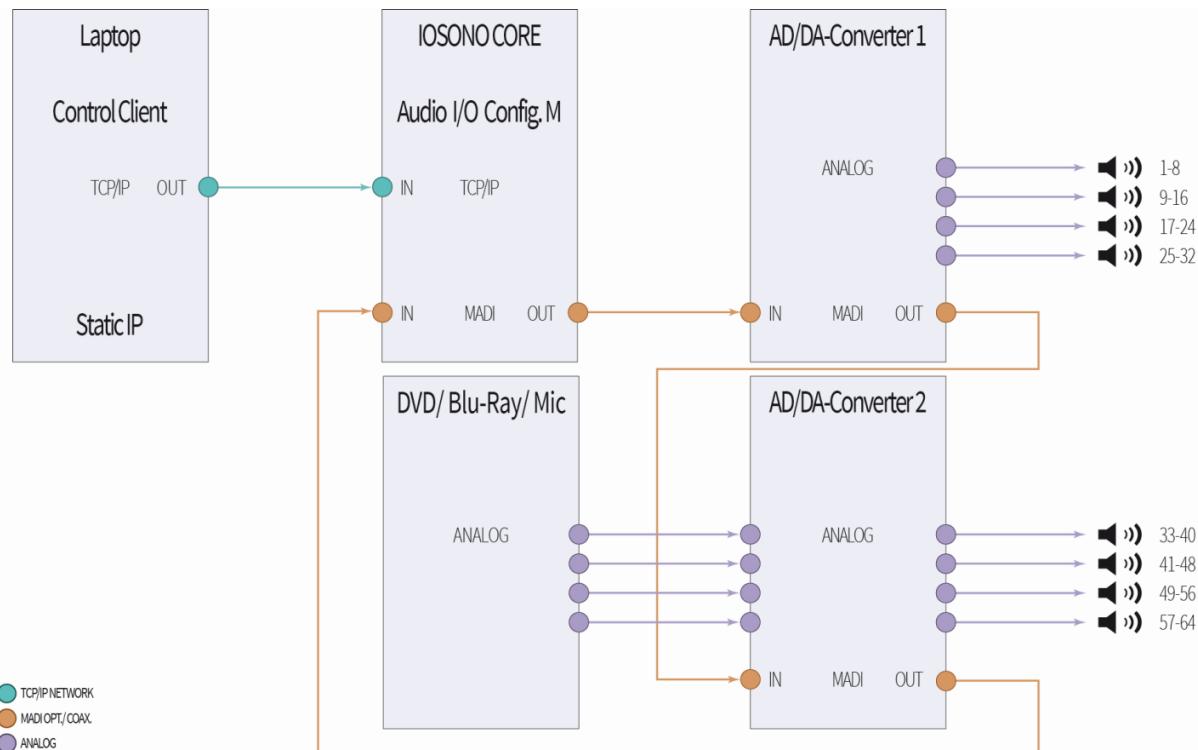


Image 7.9 Typical wiring scheme for playback

7.2.2 Create a loudspeaker file

A loudspeaker file is the basis for any preset and the rendering process. It has to reflect the real loudspeaker setup as closely as possible. Any deviation between the actual setup and the file will impair the render precision and the overall sound quality.

Please find several examples of how to build different loudspeaker files in the previous chapters 5.2, 7.1.2 and 7.2.2.

① Create a Loudspeaker Setup in System:

- Options – Loudspeaker Setups – Create
- type in Name, Screen size and position, Audience Area dimensions
- add Groups "+" (Type: Rectangle, Circle, Surface, Standard Setups)
- define system Dimensions
- define Loudspeaker numbers and positions

7.2.3 Preset configuration

It is advised, that a preset for a dedicated purpose is created by copying and amending a functional preset already existing which contains a loudspeaker file and general settings as described in previous chapters.

7.2.3.1 ICF/IMF playback

In this chapter the preset will be configured to play back IOSONO 3D audio content mixed and stored as IOSONO content file (*.icf and *.imf) with the CORE player based on the preset described in chapter [5.3.2](#).

- ① Go to Preset tab "Preset"-Icon
 - select "Wav Playback" in Presets
 - Copy
 - enter Preset Name, for example "Icf playback"
 - press "OK" to confirm
- ② Select "Icf Playback" in Presets list
 - go to tab "Preset Details"-Icon or double click the preset "Icf Playback"
- ③ Go to IOSONO CORE in the tree structure on the left
 - select Scene Designer from the column Used Services and reject by pressing the button ">" to Available Services
- ④ Go to Processing in the tree structure on the left
 - go to Player tab
 - select ICF Playback in Play Mode
 - "check" Autostart
 - select for example "64" in Channels
 - keep all other default settings



Note: The number of Channels refers to the maximum number of audio objects used in the original mix. If in doubt, select the maximum number of 128 channels. If the number of objects in a content file exceed the number of channels configured in the preset the exceeding sources will be muted during playback and a warning message will be displayed.

- ⑤ In the main window turn down the Volume to "-inf" with "-" in the top right corner
 - press "Run" in the top left corner



Note: The button should get a green halo as well as green status lights of I/O Control and Processing.

- ⑥ Go to Processing - Player tab
 - Status "i"-Icon
 - press "+" on the lower left corner
 - select the applicable content file
 - press Add - press "Play"-Icon
 - press the Play button
 - turn up the Volume with "+" in the top right corner
 - audio should become audible



Note: Only *.icf and *.imf files available on the internal memory of the CORE will be displayed in the content list. When the player is playing, the run- and total time of the selected file is displayed as well as a cursor moving along a timeline.

7.2.3.2 ICF (LTC-Slave)

In this chapter, the preset will be configured to playback IOSONO content in sync with an incoming LTC track. This scenario is often used for synchronizing media elements of a show such as video and audio or lighting and audio. Incoming LTC allow the simultaneous start of audio playback at the CORE and e.g. video (from external video source, media server/DVD/Blu-Ray player, ...). The timecode signal itself often is contained in the audio track of a video file and can be fed as an audio as shown in figure 25 or directly to the LTC Input at the corresponding hardware port at the rear panel of the CORE.

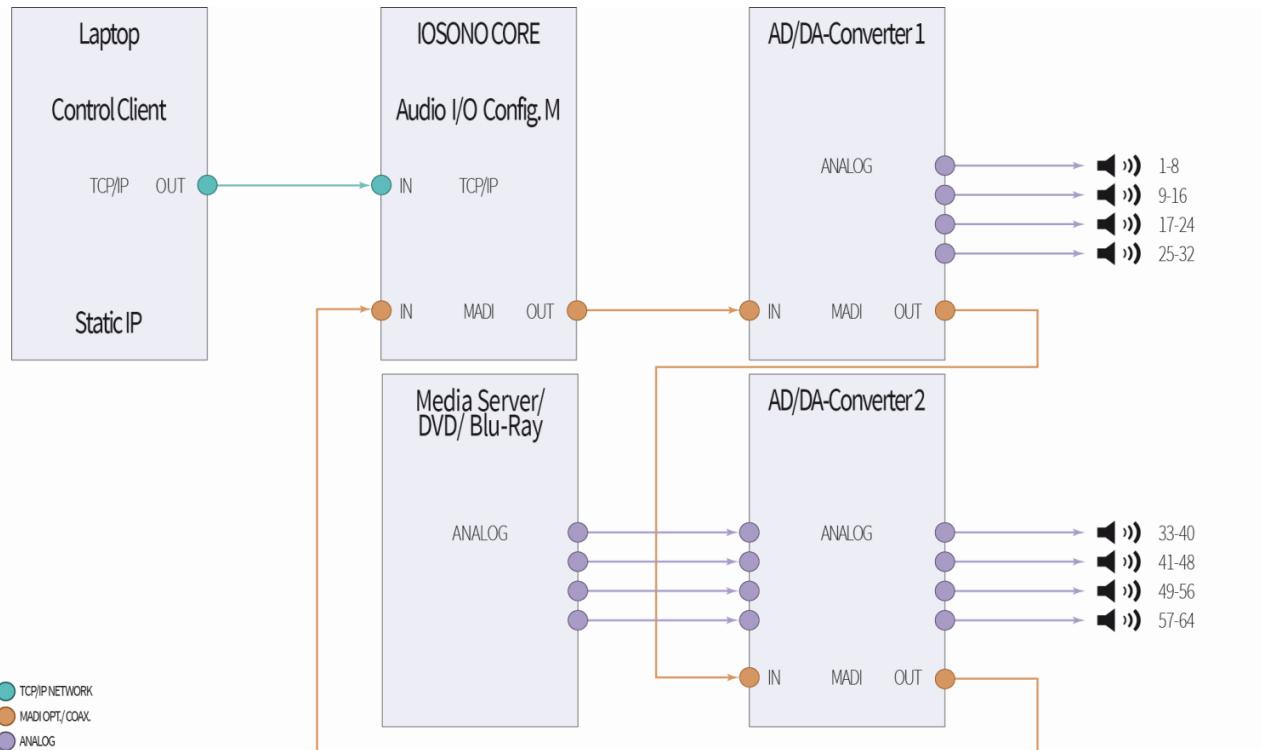


Image 7.10 Typical wiring for video/ICF/IMF playback

- ① Go to Preset tab "Preset"-Icon
 - select "Icf Playback" in Presets
 - Copy the preset by pressing the Copy button
 - type Preset Name, for example "Video playback"
 - press "OK" to confirm
- ② Select "Video Playback" in Presets list
 - go to tab "Preset Details"-Icon or double click "Video Playback"
- ③ Go to General in the tree structure on the left
 - make sure that the Frame Rate setting is the same as used for the incoming timecode
- ④ Go to Processing in the tree structure on the left
 - go to Player tab
 - select "ICF Playback (LTC-Slave)" in the dropdown menu from Play Mode
 - select "64" Channels
 - "check" Autostart
 - in LTC Input select Audio Input



Note: If the timecode on the video source is connected to an audio input select "Audio Input" or if connected directly to the CORE's LTC In select "LTC In". The number of Channels refers to the maximum number of audio objects used in the original mix. If in doubt, select the maximum number of 128 channels. If the number of objects in a content file exceed the number of channels configured in the preset the exceeding sources will be muted during playback and a warning message will be displayed.

In the main window turn down the Volume to "-inf" with "-" in the top right corner

- press "Run" in the top left corner



Note: The button should get a yellow halo as well as yellow status light in Processing and a green I/O Control status.

5 Go to Processing - Player tab

- press Status "i"-Icon
- press "+" in the lower left corner
- select the applicable content file
- press Add - press "Play"-Icon
- press the Play button
- turn up the Volume with "+" in the top right corner
- press the edit "Tool"-Icon in the lower part of the player window
- set the desired Start Timecode point
- press play at your external player with the video source
- the CORE player starts playback according to the incoming timecode
- the Processing status LEDs for "ICF Decoder" and "Timecode Decoder" turn from yellow to green

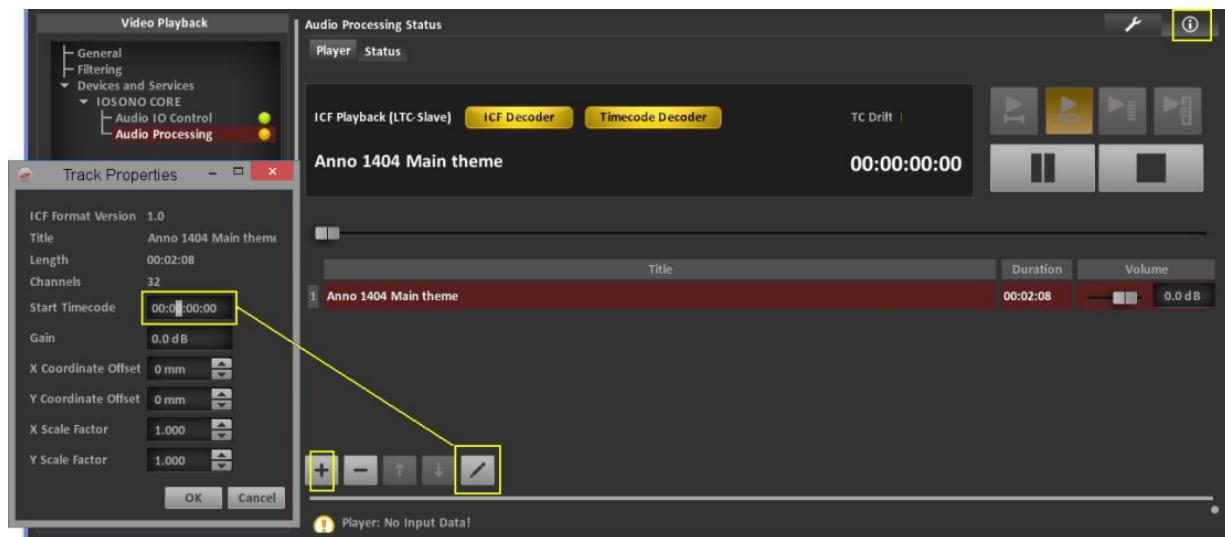


Image 7.11



Note: Only *.icf and *.imf files available on the internal memory of the CORE will be displayed in the content list. When the player is playing, the run- and total time of the selected file is displayed as well as a cursor moving along a timeline.

7.2.3.3 DVD/Blu-Ray Playback with Render+

In this chapter the preset will be configured to playback audio content fed from an external DVD/Blu-Ray Player with a soundtrack in standard 5.1 and being spatially enhanced by the Render+ algorithm.

- ① In the main window Copy the "Wav Playback" preset
 - rename the Preset name to "Render+" for example
 - press "OK" to confirm
- ② Go to the Preset Details of "Render+" preset
 - in the tree structure, go to Processing - General tab
 - deactivate Player with "Active"
 - activate Render+ with "Active"



Note: When activating the Render+ a new tab appears above.

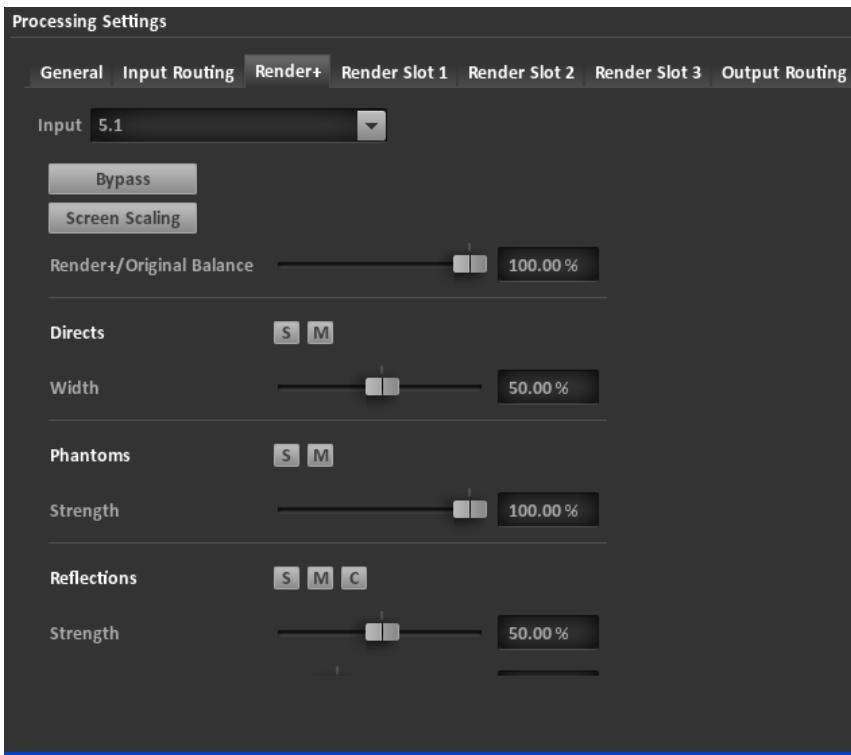


Image 7.12

- ③ Go to Render+ tab
 - select 5.1 from the Input dropdown menu
 - disable Bypass
 - move the fader to 50

4 Go to Input Routing tab

- in the matrix scroll to the right to see/change input routing
-

Note: Make individual routing in the provided matrix if necessary or keep default diagonal line if your 5.1 stream is connected starting at input channel 1. The rows represent your input signals from the DVD/Blu-Ray Player at the audio input of the CORE and the columns represent the input channels to Render+ in the following order:



- 1 Left
- 2 Right
- 3 Center
- 4 LFE
- 5 Left Surround
- 6 Right Surround

Keep the soundcard input routing to the renderer to be able to have other input sources in parallel to the 5.1 Render+, such as mic inputs for announcements or similar.

7.3 IOSONO content production

In an IOSONO content production setup, audio and scene data is delivered to the IOSONO CORE from an external computer running Nuendo and the "Spatial Audio Workstation 2 Upmix!" (SAW) plug-in. It is advised, that his computer has an audio connection to the CORE via MADI using appropriate soundcards. Refer to the SAW documentation for more information on how to setup a Nuendo/SAW session with correct I/O configuration.

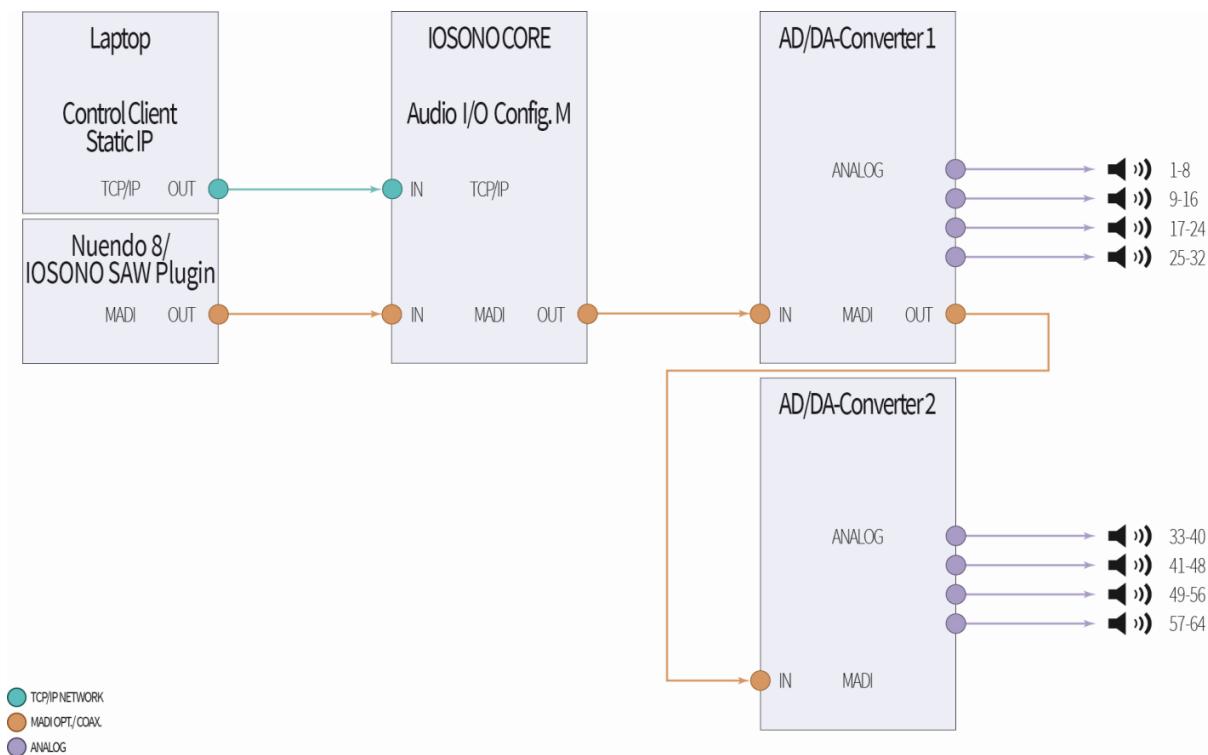


Image 7.13 Typical wiring for a production setup with SAW plug-in

7.3.1 Create a loudspeaker file

A loudspeaker file is the basis for any preset and the rendering process. It has to reflect the real loudspeaker setup as closely as possible. Any deviation between the actual setup and the file will impair the render precision and the overall sound quality. Please find several examples of how to build different loudspeaker files in the chapters [5.2](#), [7.1.2](#) and [7.2.2](#).

① Create a Loudspeaker Setup in System:

- Options – Loudspeaker Setups – Create
- type in Name, Screen size and position, Audience Area dimensions
- add Groups "+" (Type: Rectangle, Circle, Surface, Standard Setups)
- define system Dimensions
- define Loudspeaker numbers and positions

7.3.2 Preset configuration

It is advised, that a preset for a dedicated purpose is created by copying and amending a functional preset already existing which contains a loudspeaker file and general settings as described in previous chapters.

① Go to Preset tab "Preset"-Icon

- select "Wav Playback" in Presets
- Copy
- type Preset Name, for example "SAW"

- press "OK" to confirm

2 Select "SAW" in Presets list

- go to tab "Preset Details"-Icon or double click "SAW"

3 Go to General in the tree structure on the left – make sure that Scene IP Address and Scene Port is the same as in SAW settings.

4 Go to IOSONO CORE in the tree structure on the left

- select Scene Designer from the column Used Services and reject to Available Services by pressing the ">" button

5 Go to Processing in the tree structure on the left

- in the General tab deselect Player with "Active"
- in General, Renderer, Number of Live Input Channels type in the number of used audio objects in the Nuendo/SAW session



Note: The number of live input channels refers to the maximum number of audio objects used in the Nuendo/SAW session. If in doubt, select the maximum number of 128 channels. If the system performance becomes an issue try to limit the number of input channels to the number of audio objects used in the Nuendo/SAW session.

6 Step through the tabs in Processing and check Input routing, Render Slot settings and Output Routing.



Note: For more information how to select the correct settings for a specific setup go to chapter [5.3.1](#), [7.1.3](#) and [7.2.3](#).

7 In the main window turn down the Volume to "-inf" with "-" in the top right corner

- press "Run" in the top left corner
- turn up the Volume with "+" in the top right corner
- start playback in Nuendo and audio should become audible



Note: The button as well as the green status lights of I/O Control and Processing should get a green halo when running the preset.

8 ADVANCED SYSTEM TUNING WITH THE SYSTEM TUNING EXTENSION

Overview

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This chapter gives an overview about the process of acoustical tuning of an IOSONO system. The desired result of acoustical tuning is a system performing at its best with the given gear in the given space. The IOSONO system's overall frequency response and level shall follow the IOSONO recommendations which ensure comparable conditions across all IOSONO systems and transparency in content interchange.

While IIR filters and gains can be set and controlled in the Control Unit itself, the advanced tuning using automatically generated individual FIR filters based on acoustical measurements, is executed using the System Tuning Extension. The System Tuning Extension is an optional feature and is not part of the basic feature set.

8.1 Hardware connections

A wiring scheme of a system setup for acoustical measurements, based on the standard setup described in Chapter 7.2.1, is shown below in figure 8.1.

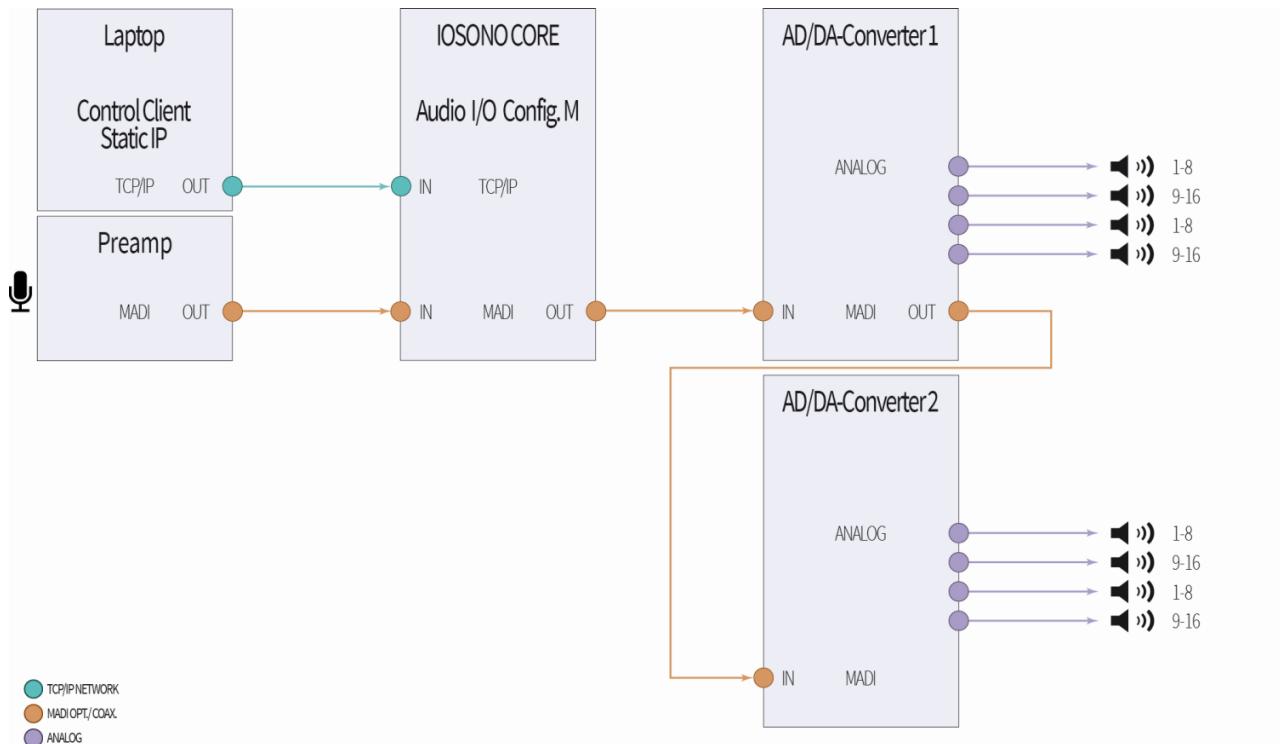


Image 8.1 Typical wiring of a tuning setup

8.2 Settings

- ① To enable the System Tuning extension, go to menu System - Options – Extensions
 - select System Tuning
 - press Enable
 - press “OK” to confirm

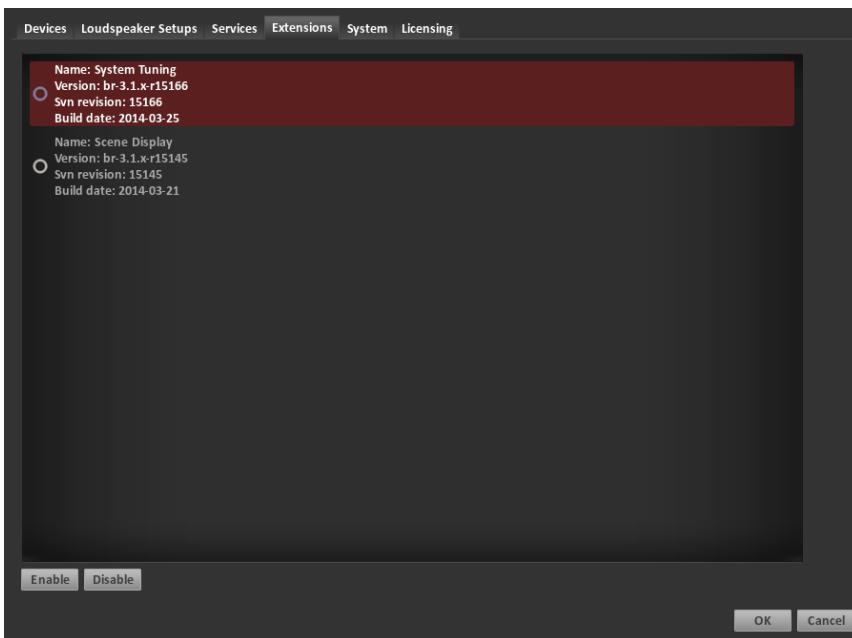


Image 8.2 Extensions overview



Note: A valid loudspeaker file must be present in the Control Unit before enabling the System Tuning extension. The symbol on the left of each available extension changes from a grey circle to a red dash when enabled.

- ② The tab bar will show an additional icon representing the System Tuning Extension. Navigate to the extension by clicking the “Mic”-Icon in the tab bar



Image 8.3

- ③ In the Measurement tab select the Loudspeaker Setup representing the speaker setup that is supposed to be tuned, for example “3D ls file”
 - Understand and press “Yes” in the warning dialog
 - in Group Name “check” all groups that should be measured and tuned, i.e. “check” Ring, Ceiling, Subwoofer
 - in Measure Microphone Position select the number of microphone positions that are going to be used in the measurement, i.e. “1 to 8”
 - set a Start Delay for example “20s”



Note: The number of Measure Microphone Positions may exceed the number of microphones actually being connected to the system. In that case, the set of position will be measured in multiple cycles. The "Start Delay" setting describes the amount of time that will pass between pressing the Start button to begin the measurement and the first playback of the measurement sweep. This is meant as a health safety feature by allowing the user to leave the room or place ear protectors before starting the measurement sweeps.

4 Go to Settings tab

- in Preferences tab set the Number of Simultaneous Microphone Inputs to the number of connected microphones to the system, i.e. "4"
- keep all other default values

5 Go to Input Routing

- make a routing for all available Microphones to the Soundcard Inputs

6 Go to Output Routing

- make a diagonal line from cell "1/1" in the first loudspeaker group Ring to cell "3/47" in the last loudspeaker group Subwoofer

Note: In the matrix, the rows represent the loudspeakers of your loudspeaker setup that are assigned to render slots, each with an individual color. The columns represent physical audio outputs of the processor, which can be accessed at the rear of your IOSONO CORE hardware. You may configure your individual output routing here. In our example,



- speakers 1-15 in render slot 1 are connected to outputs 1-15 (dummy speakers 16 and 17 require no connection to physical audio outputs)
- speakers 1-4 in render slot 2 are connected to outputs 18-21
- speakers 1-2 in render slot 3 are connected to outputs 22-23 and speakers 1-5 in render slot 4 are connected to outputs 24-28

Therefore we want to use the automatically configured diagonal 1-to-1 routing.

7 Go to the MADI 1 tab

- set Synchronization to Signal
- in Input Select select "Optical"



Note: Depending on the I/O configuration of the CORE processor there will be setting tabs for each soundcard displayed. In this example with CORE I/O Config M (1x MADI) only MADI 1 is displayed. In this example the microphone preamp is the sync source and the CORE is the sync slave connected via MADI optical. In case of correct settings the Status lights "SYNC 48kHz MADI" should all turn green.

8.3 Measurement

8.3.1 Preparations

Following preparations should be done before performing correct measurement calibration of the measurement microphones.

Adjust the microphone preamp gain of all channels individually, so that all microphones induce the same voltage when being exposed to the same SPL. Place all used microphones at close quarters on axis of a distant loudspeaker of the setup. Thus they are virtually at the same position as seen from the distant loudspeaker. Play back pink noise with the Control Unit's player or feed pink noise to the system's audio input and route the signal to that distant speaker using the Scene Designer. Adjust the preamp's gain of each microphone to equal amplitude using the level meters on the preamp or the level meters in the settings tab of the System Tuning extension.

Measurement Level The speakers nearest to the reference point should induce a SPL of around 80dBC at the reference point. This level is sufficient for good Signal to Noise Ratio (SNR) of the measurements under typical conditions. Try to achieve a SNR of at least 10dB. If the installed loudspeakers are not powerful enough to reach reasonable levels the venue's noise floor has to be reduced.

The microphone positions nearest to the loudspeakers should be checked against clipping with a test run of sweeps in the System Tuning extension. Proceed similar with the subwoofers because room mode distribution and pressure chamber effects often cause microphone clipping even at low playback volume. The gain of subwoofer can be reduced globally using the subwoofer attenuation option in the settings tab. An attenuation of -24dB is a good starting point for further adjustments. This attenuation setting applies to the measurement routine only.

Microphone Placement By measuring every speaker's transfer function at several positions different acoustic conditions of the room and speaker installation as well as the speaker's directivity are taken into account. Averaging all measurements of a certain loudspeaker avoids equalization of singular acoustical phenomena.

Therefore it is necessary to sample the whole desired audience area with microphone positions which have to be distributed evenly. The height of the microphone capsule should be at the desired ear height of the future listeners. For a seated auditorium a microphone height of 1.20m, for a standing auditorium 1.70m above floor level will work. If there are acoustically reflecting objects near the microphones like e.g. the backrest of an armchair in seated venues, the microphones' tips should be at least 0.30m above those barriers to prevent acoustical shadowing and minimize comb filter effects due to reflections.

The error thresholds for SNR and IRNR can be set by the user in the settings tab. The default values are 10dB for SNR and 45dB for INR. To improve those ratios, increase the playback level of the stimulus, still paying attention to clipping. If you have reached maximum output or input level, try to decrease ambient noise during measurement.

8.3.2 Running the Measurement

- 1 Press the "Start" button in the Measurement tab.



Note: The measurement signal is played back via the selected loudspeakers in chronological order in one loudspeaker group after the other. The remaining duration of the measurement will be displayed at the bottom of the window.

- 2 Once a measurement run is finished, the measurements are analyzed regarding Signal to Noise Ratio, IR Noise Ratio and Clipping of the measurement mic signal
 - mark lines with red cells
 - adjust input gain on your mic preamp or output gain on the CORE
 - repeat the measurement only for selected/red cells

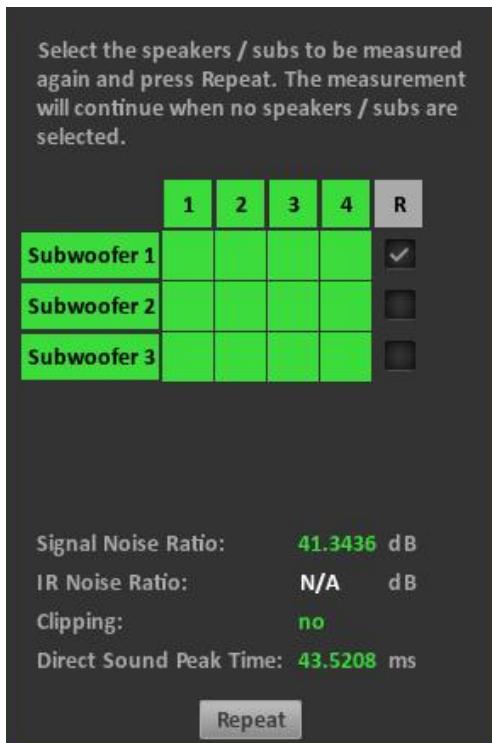


Image 8.4 Measurement Summary



Note: In the window "Measurement Summary" each measured speaker is represented as a rows and microphone inputs/measurement positions as columns. The color of the matrix' cells indicate, whether all checks have been passed. Green indicates a correct measurement while yellow and red indicates critical or failed checks. Furthermore there are checkboxes adjacent to every row for repeating the measurement of each particular speaker.

Right-click onto the matrix opens a context menu offers selecting or deselecting all speakers to be measured again. Place the cursor on one of the matrix cells to display the measurement check's results at the bottom of the window. Clicking the button at the bottom of the dialogue will start the repetition of the marked measurements or proceed with the process when no repetitions are set.

- ③ If none of the checkboxes is marked press "Proceed"
 - the software will ask the user to put the microphones to the next set of positions and go on with the measurement
 - click "OK"
- ④ Once the measurement is finished, you can access the impulse response for every loudspeaker measured at every microphone position
 - go to the loudspeaker setup display in the Measurement tab
 - mark the desired speaker by "left click"
 - hold the "Ctrl-key" and "left-click" onto the desired "Microphone"-Icon
 - "right-click" onto the desired "Loudspeaker"-Icon
 - select "Show Impulse Response"



Note: You can use this feature to check the measurements for general correctness and analyzing phase issues.

8.4 Filter creation

Tuning filters will be designed and applied in the second tab of the System Tuning extension, named "Filter Creation". Before you can start with the filter design the previously measured data has to be loaded correctly.

- 1 In the list right to the graph you can "de-/select" loudspeaker groups in column A (for Active). Only selected loudspeaker groups will be displayed in the graph on the left and incorporated in the filter processing and assignment. The filter of each speaker group will be processed to the Filter Kit assigned in the column next to the loudspeaker groups. Select a Filter Creation Kit, for example "Speaker Default".



Note: In "Filter Creation Kit" you can add a kit with "+" and given names. In "Kit Name" you can select added or default filter kits. A filter kit contains all settings and parameter used to process the filters.

- 2 Click on the "Whitelist" button on the right. This button will open a matrix called Measurement Whitelist containing all selected and measured speakers as rows and all measured microphone positions as columns. Select only "green speaker" cells - click "OK" to close the Whitelist dialogue.

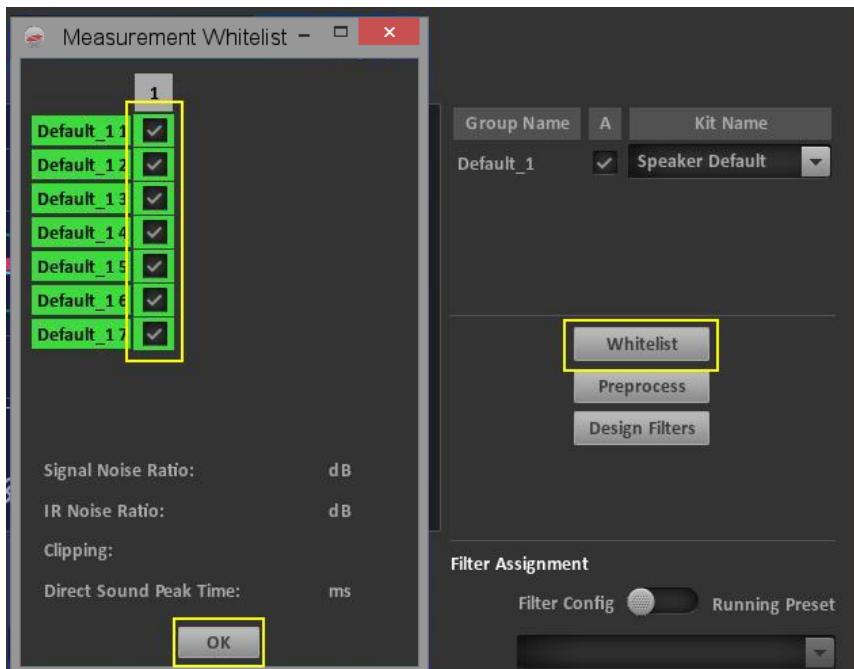


Image 8.5 Whitelist



Note: Red matrix cells indicate corrupt measurements. Place the cursor on one of the matrix cells to display the measurement check's results at the bottom of the window. Only checked measurements are taken into account for the creation of the filters. Therefore, all measurements colored green are checked as default. Deselect cells colored red to avoid use of corrupt measurements. Right click on the matrix to access global de-/select all commands.

You can also inspect the impulse responses in the whitelist window by right-clicking while the cursor is above a matrix cell. Select "Show impulse response" from the context menu.

- 3 Click the "Preprocess" button. This will automatically window, average and smooth the measurements according to the Kit Parameters Smoothing. You can find a description of smoothing parameters in this

section's step 7. A progress bar will indicate the progress of the preprocessing, stating the number of speaker and microphone positions that is being included.

- 4 All selected and measured speakers can be displayed as red frequency response curves in the upper main display. Use the Fullscreen-, Show none-, Show all- and Show single-Icons to display the frequency response in full screen, of all, none or single measured speakers as red curves. Choose a certain speaker and subwoofer to be displayed in Show single mode using the drop down list next to the buttons.

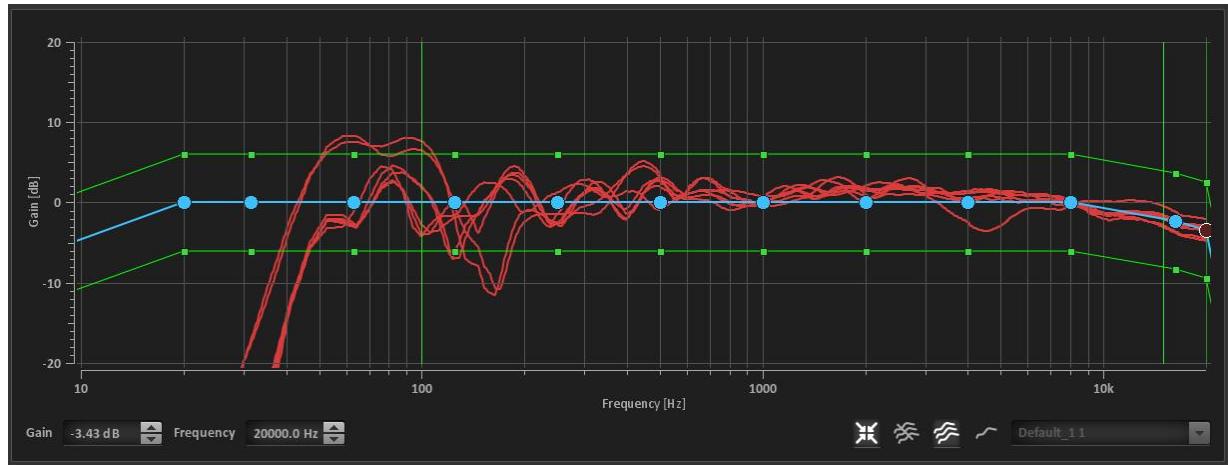


Image 8.6 Target curve view



Note: The only graph visible in all modes is the target curve (blue). This graph represents the desired, spatially averaged frequency response which is the tuning goal for all loudspeakers including subwoofers. The frequency response of each speaker always refers to the speaker's direct sound and is a result of the average of all measurement positions.

- 5 Define a target curve for the IOSONO system's overall frequency response based on the measurement results. The target curve can be edited by "drag and drop" of the blue dots. Furthermore you can select the grabbers by "left click" and edit Gain and Frequency in the edit fields below the diagram. Initially, set the target curve with a high frequency roll-off that matches the shallowest displayed response of the measured speakers. The System Tuning extension calculates filters for the system's subwoofers as well. They are designed toward the same target curve as the other loudspeakers.



Note: For tuning IOSONO systems toward the SMPTE X-Curve, its characteristics can be applied to the target curve. The standard X-Curve has a HF slope falling with -3dB/Oct beyond 2 kHz and -6dB/Oct beyond 8 kHz.

- 6 Adjust the two green lines (Relevance scope) in a way that the measured responses, red curves are fully included between the green lines above their cut-off frequencies. The shape of the Relevance scope can be edited by "drag and drop" of the green squares. Furthermore you can select the grabbers by "left click" and edit Gain and Frequency in the edit fields below the diagram.

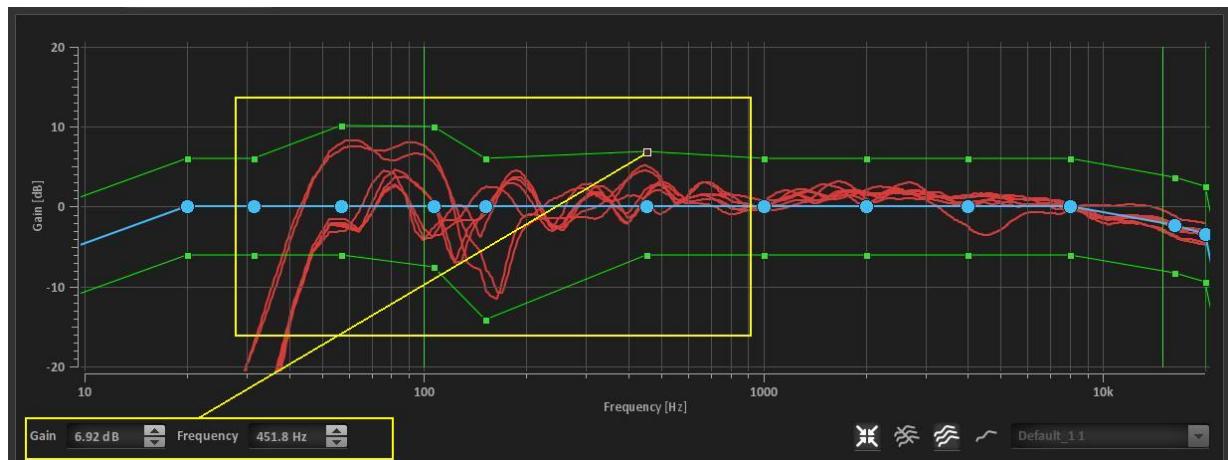


Image 8.7 Editing target curve and relevance scope



Note: By default, the Filter Creation Kit "Speaker default" shows two green horizontal lines that define the relevance scope of the filters. Phenomena of measured responses that overhang the relevance scope will not be corrected by the filters. The relevance scope follows changes of the target curve.

- 7 To add or remove additional filter creation kits press the "+" or "-" buttons. When adding a new kit the user may name the Filter Kit and choose to copy settings from other kits.

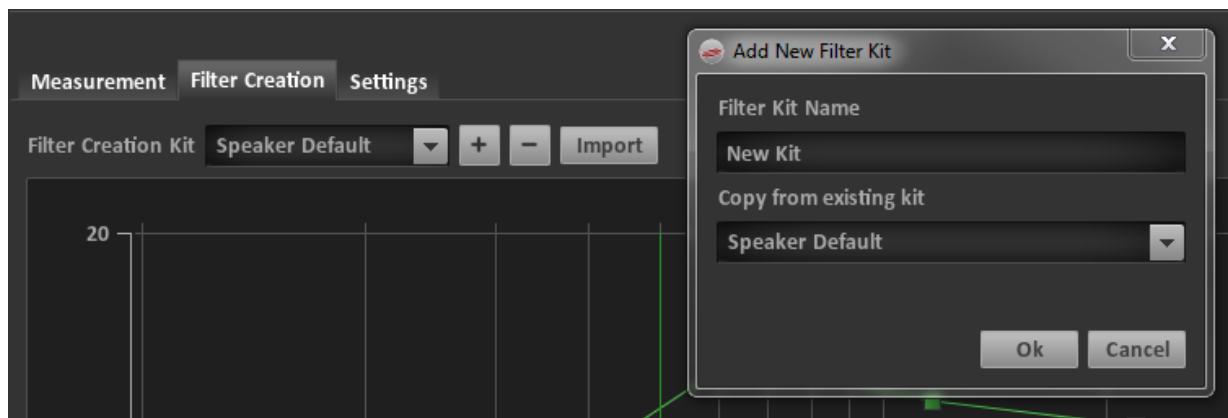


Image 8.8 Add/Remove/Copy Filter Kit curve settings



Note: For maintaining a common target curve but being able to manage differences in relevance scope and preprocessing settings for multiple speaker groups, copying Filter Kit setting is a useful feature.

- 8 Press Import to make previous curve settings available. Select a desired measurement session from the path it has been transferred to the CORE's internal memory.
- 9 In Kit Parameters, make specific filter settings for filter kits assigned to loudspeaker groups.

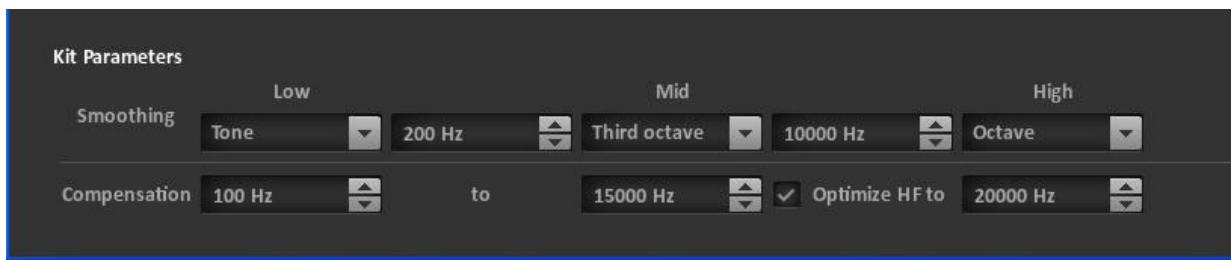


Image 8.9 Filter Kit Parameters

Note: In the kit parameters the filters' frequency range is divided into three smoothing sections. Thus, filters can be smoothed with frequency dependent resolution. The intervals range from 1Hz to the lower frequency (Low), from the lower to the higher frequency (Mid) and from the higher frequency to 24 kHz (High). The smoothing section's frequency borders and the smoothing resolution can be edited using the smoothing parameters. Select the two provided Filter Creation Kits "Speaker Default" and "Subwoofer Default" and see the changes applied to each kit.

In "Subwoofer Default" the setting will design filters with equalization between the frequency boundaries of 10 Hz to 100 Hz as compared to "Speaker Default" where setting will design filters from 100 Hz to 15 kHz with an optimization to 20 kHz. The active frequency range of the filters can be defined using the edit fields "Compensation from" and "to" in each group. The filters will affect the frequency response only between these two specified frequency boundaries. The according frequencies are represented in the diagram by vertical green lines. Below the lower frequency, the filter is set to unity.



Selecting "HF optimization to" activates equalization of the speakers' high frequency behavior beyond the upper boundary frequency. The HF optimization adapts the speaker's frequency response to the target curve without energy equalization of the full interval. The upper frequency boundary for the HF optimization can be defined, too. If you disable the HF optimization the filter is set to unity beyond the upper boundary frequency.

- 10 Press the Design Filters to start the actual calculation of the filters based on the given parameters.

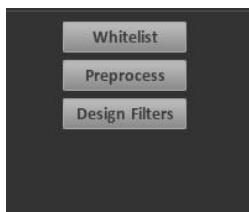


Image 8.10 Control buttons



Note: Changing the measurement choice, filter boundaries and other fundamental filter properties will require to redo the preprocessing. This condition is displayed by a highlighted "Preprocess" button. A new preprocessing run and changes of the filter characteristics itself, like target curve etc. requires to recalculate the filters in order to apply the new settings. This condition will be displayed by a highlighted "Design Filters" button.

- 11 Apply Filters to loudspeakers in a setup. Generally there are two ways to apply filters in Filter Assignment.
a) Selecting "Running Preset" in Filter Assignment will apply the filters to the preset running currently, which has to contain the loudspeaker setup that has been used in the measurement.. b) Selecting

"Filter Config" in Filter Assignment will apply the filters to a Filter Configuration that is available in the Filter Library. This configuration may be used with all presets using the same loudspeaker setup file. Press Apply Filters to map the calculated filters to the according loudspeakers in either state. The Bypass Filters sets spectrally flat filters in either state.

8.5 Filter evaluation

Filters can be evaluated in three different ways:

- 1 Listen to the system by alternating between applied and bypassed filters. To evaluate the filters subjectively, observe the whole frequency range by listening to a musical piece familiar to you. Check the sound at different positions throughout the room. Compare the subjective sound impression with applied and bypassed filters. Eliminate occurring tonal problems by readjusting the filter creation parameters and applying the new filters.
- 2 Check the filter's frequency response and the resulting frequency response of the speaker visually. To check, whether your settings lead to the filters you are trying to achieve select the speaker of interest in the "Measurement" tabs' loudspeaker setup display by left click. Right click on the marked speaker, select "Show filter" to open the "Filter comparison" dialog.

The upper plot shows the frequency response of the filter calculated for the selected speaker and additional speaker or subwoofer filters. The target curve can be displayed in both diagrams by checking the "Show target curve" checkboxes at the right.

The lower plot can display the measured frequency response of the selected speakers/ subwoofers as well as the combination of filter and measurement, which represents the spatially averaged frequency response after applying the filters. Check "Show sum spectrum" and "Show result" to show or hide the corresponding curves. Choose the additional speaker/subwoofer using the according drop down lists on the right.



Note: This dialog will only work when the preprocessing and filter creation has already been done at least once for all speakers and subwoofers in all groups.

There are two edit fields at the bottom of each diagram to define the Y-axis boundaries to change the scaling of the plots.

- 3 Measure the response of the filtered speaker.

In general, pay attention if the speakers' performance is improved by the filters. Often physical problems of the sound radiation cause phenomena that cannot be corrected by a filter e.g. by putting more energy onto problematic frequencies.

9 FILTER LIBRARY

Overview

9.1 FIR filter	84
9.2 IIR filter	85

In "Filter Library" you can create Filter Configurations containing FIR and IIR filters that are each based on a particular loudspeaker setup. Each Filter Configuration can be used by any preset that is based on the same loudspeaker file. You can create, assign and adjust new IIR filters similar to step 8 in Chapter [7.2.3.2](#).

9.1 FIR filter

- 1 Go to Speaker Library tab in the tab bar
 - create a Filter Configuration with "New" and name it "General" for example
 - select a Loudspeaker Setup i. e. the same as used in the last chapter

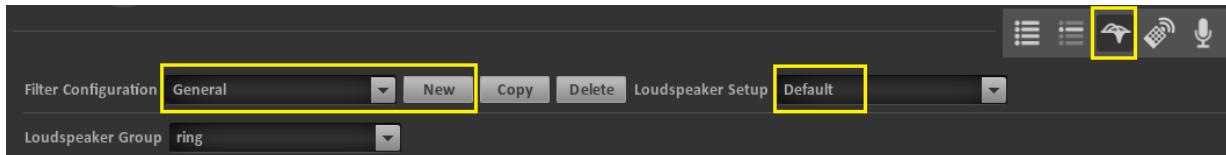


Image 9.1 Filter Library head

- 2 Copy a filter configuration using the "Copy" button.



Note: This is a useful feature for applying a set of existing FIR filters to a loudspeaker setup file that has not been used for creating the FIR filters. In this case, you may copy a Filter Configuration that contains the desired FIR filter set, change the Loudspeaker Setup and assign the filters to the speakers manually as described in the following steps.

- 3 Select your measured Loudspeaker Group
 - mark a speaker in the setup display
 - the corresponding filter in the FIR Filter List should be highlighted yellow

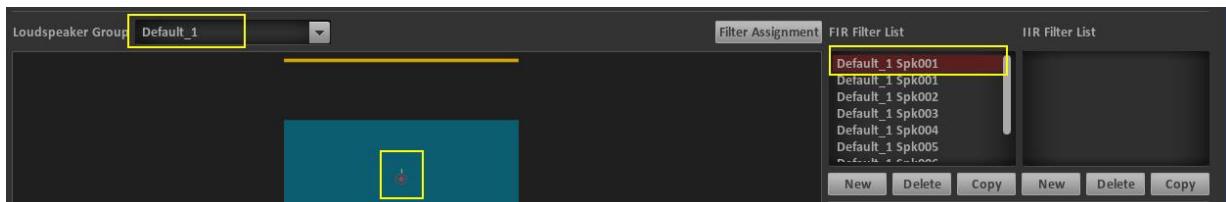


Image 9.2 Show assigned filters

- 4 Reassign filters
 - activate the filter assignment mode by clicking the Filter Assignment button
 - select a loudspeaker
 - select a Filter from FIR or IIR Filter list
 - deactivate the filter assignment mode by clicking the Filter Assignment button
 - select a loudspeaker to check if the reassignment was successful



Image 9.3 Change filter assignment



Note: When loudspeakers have at least one filter assigned, their icons turn blue. Speaker icons turn yellow when the assigned filter is selected in the IIR Filter List.

9.2 IIR filter

1 In Loudspeaker Setup

- select "Live" (or any other loudspeaker file which you wish to apply filters to)
- understand and press "Yes" in the warning dialog
- create a New Filter in the IIR Filter List
- name the IIR Filter for example "HiPass"

2 A filter settings dialog appears on the lower right corner in the main window

- add another line in filter parameters with "+"
- select High Pass from the drop down list in both lines
- Change the frequency in both lines to for example "150 Hz"
- Change the Q-factor in both lines to for example "0.7"

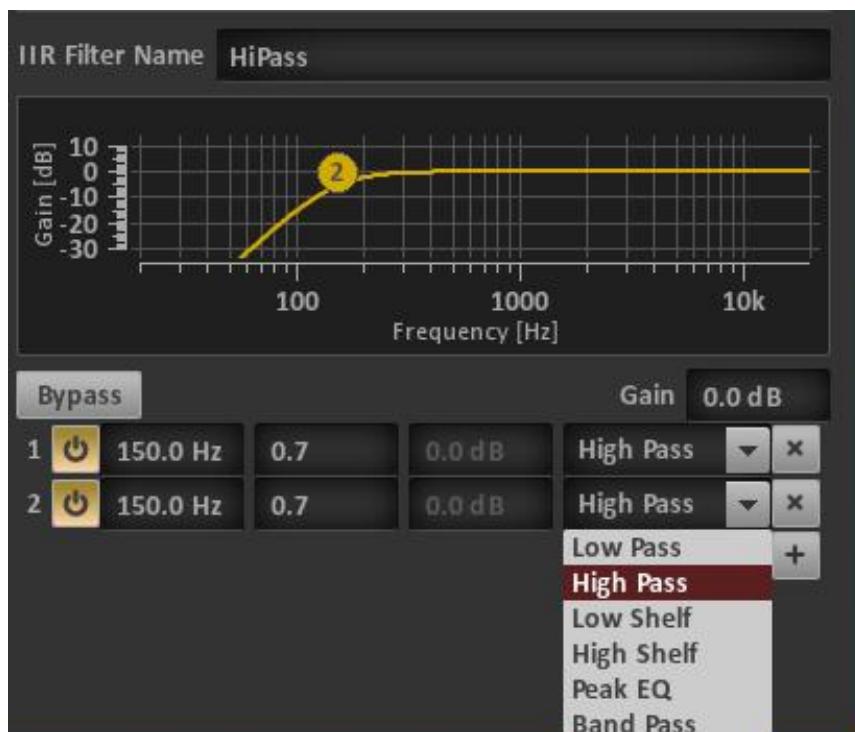


Image 9.4 IIR filter stage



Note: This filter will have a cut-off frequency (-6dB) at 150Hz with a slope of -24dB/Oct.

3 Assign Filters

- activate the filter assignment mode by clicking the Filter Assignment button
- select loudspeakers (for selection of multiple speakers use "shift+left click") in the loudspeaker group you wish to assign the HiPass filter to
- select HiPass in IIR Filter List, the filters are now assigned to the selected speakers
- deactivate the filter assignment mode by clicking the Filter Assignment button

10 TECHNICAL SPECIFICATIONS

The information in this section is subject to change without notice. For current technical information, visit the product website or contact your sales support representative.

Dimensions and weight

Housing	19 in. / 4 RU
Dimensions (without connectors)	485 mm (W) x 178 mm (H) x 615 mm (D) (19 in. (W) x 7 in. (H) x 24.2 in. (D))
Built in depth (without connectors)	555 mm (21.9 in.)
Weight	20 kg (44.1 lb)
Shipping dimensions	790 mm (L) x 605 mm (W) x 385 mm (H) (31.1 in. (L) x 23.8 in. (W) x 15.2 in. (H))
Shipping weight	25 kg (55.1 lb)

Environmental conditions

Operating temperature	0 °C to +40 °C (+32 °F to +104 °F)
Operating humidity	10 % to 80 % non condensing
Storage temperature	-10 °C to +60 °C (+14 °F to +140 °F)
Storage humidity	10 % to 80 % non condensing

Power supply

Voltage range	100 - 240 VAC
Frequency range	50 - 60 Hz
Current range single [redundant]	4 - 2 A [2 x 4 - 2 A]
Max. power consumption single [redundant]	500W [2 x 500W]
Connection single [redundant]	1 x IEC 60320-1 C14 [2 x IEC 60320-1 C14]

Controls

Display	7" color display with resistive touchscreen provides basic controls and preset selection
Volume control	Via hardware volume wheel and remote control software
Remote control	Remote control software for Microsoft Windows provides control of all functionalities over standard TCP/IP network connection.
	Static IP and DHCP possible. Media control commands can be received via network and RS232
Illuminated power button	Boots up / shuts down system and indicates machine state

Connectors shared by all product configurations

USB	2 x USB 2.0, Type A
MAIN ethernet port (Remote control)	1 x Gigabit ethernet, RJ45
AUX ethernet port (Extension/s)	1 x Gigabit ethernet, RJ45
RS232	1 x Sub-D (DE-9M with UNC 4-40)
Wordclock input	1 x BNC 75 Ω
Wordclock output	1 x BNC 75 Ω
Video sync input	1 x BNC 75 Ω
Linear timecode (LTC) input	1 x BNC 75 Ω

Available hardware configurations

Order number	MADI I/O mono ch.	AES I/O mono ch.	Power supply
R9801502	64		single
R9801502b	64		redundant
R9801500	128		single
R9801500b	128		redundant
R9801503		32	single
R9801503b		32	redundant
R9801504	64	16	single
R9801504b	64	16	redundant

Available hardware extension

IOSONO CORE Extension

Extends the number of output channels by steps of 128 per extension. Two or more units can be connected to a IOSONO CORE processor which works as the head unit.

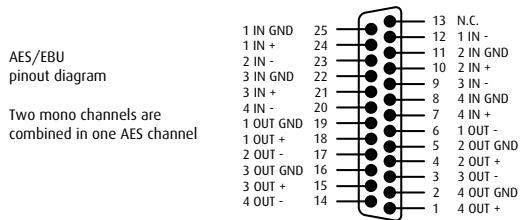
For more information see IOSONO CORE Extension datasheet

Image 10.1

Audio connectors

Number of connectors depends on hardware configuration

MADI input optical	1 x SC per 64 channels
MADI input electrical	1 x BNC 75 Ω per 64 channels
MADI output optical	1 x SC per 64 channels
MADI output electrical	1 x BNC 75 Ω per 64 channels
AES/EBU input/output	1 x Sub-D (DB-25F with UNC 4-40) per 8 mono input/output channels



Standard software functionality

Rendering	2D rendering for loudspeaker setups consisting of one single layer
Formats	Object based and discrete multi channel audio
Synchronisation	Synchronisation via audio input, wordclock input and video input
Audio performance	Rendering of 128 audio objects simultaneously to all available audio outputs with up to 24 bit / 48 kHz

Certificates

D, CE, KC, CCC, UL, RCM



Made in Germany

Software options

Player ...	Playback of object based IOSONO content from internal storage as well as streamed content from external devices. Playback of 48 kHz multichannel wave files from internal storage. Synchronisation possible over LTC timecode input
3D Renderer	Upgrade from 2D to 3D Rendering. Provides support for loudspeaker setups with multiple layers and dome shapes
Render+	Real-time processing of 5.1 and 7.1 audio inputs for enhanced spatial distribution of audio scenery
System tuning	Acoustical tuning and sound improvement of an IOSONO system based on multiple microphone measurements and individual FIR filters for every loudspeaker
Remote convolver	Realtime convolution of audio signals and FIR filters generated in MATLAB
96 kHz sample rate	Processing at 96 kHz sample rate

11 ENVIRONMENTAL INFORMATION

Overview

11.1 Disposal information	88
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11.1 Disposal information

Disposal Information



This symbol on the product indicates that, under the European Directive 2012/19/EU governing waste from electrical and electronic equipment, this product must not be disposed of with other municipal waste. Please dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

For more information about recycling of this product, please contact your local city office or your municipal waste disposal service.

For details, please visit the Barco website at: <http://www.barco.com/en/AboutBarco/weee>

Disposal of batteries in the product



This product contains batteries covered by the Directive 2006/66/EC which must be collected and disposed of separately from municipal waste.

If the battery contains more than the specified values of lead (Pb), mercury (Hg) or cadmium (Cd), these chemical symbols will appear below the crossed-out wheeled bin symbol.

By participating in separate collection of batteries, you will help to ensure proper disposal and to prevent potential negative effects on the environment and human health.