

CODA

C O D A A U D I O



Operation Manual
- LINUS Control v2.9.1 -





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1. General

The LINUS Control software provides a reliable and ruggedized application for the control and monitoring of the CODA LINUS amplification platform. It is optimised for both Mac OSX and Windows, for both tablet and native interfaces. Bundled in the application behind the scenes is the device Firmware, Loudspeaker Files, Control Logic and a 3rd Party UDP Control protocol that will allow for offline remote control of LINUS amplifiers from 3rd Party Devices, very useful in installation scenarios.

1.1. Network

LINUS Amplifiers communicate using TCP & UDP on an Ethernet Network. The devices can be controlled by a MacOS or MS Windows Personal Computer using the LINUS Control application. Control data, Firmware & Loudspeaker Files all travel on this Ethernet Network. It is currently possible to control up to 250 LINUS devices on one physical Network.

The amplifiers can exist on any subnet; however the last octet of the devices IP Address serves as an ID number for the amplifier in the application- thus each LINUS Device needs a unique last octet, which is shown as the ID number in top-right of its Front Panel LCD. With duplicate IP addresses on the Network, performance of the whole network will be hampered & correct operation cannot be guaranteed. If multiple duplicate IP's have recently existed on a network but have since been corrected, as with most IP based systems, it may in some circumstances prove necessary to reboot the network switching & routing hardware, or wait an undetermined time for the switching fabric to update its internal MAC Address -> IP Table.

Whilst the individual devices are fitted with 100Mb/s interfaces, larger networks will benefit greatly from Gigabit networking infrastructure, especially the interface of the LINUS Control computer. The network should be built with CAT5e U/FTP Cable with a maximum length of 100m. For lengths over 100m, Network Switches with Fibre links should be utilised.

Note: The length limit of 100m is normally only achievable with new, undamaged cable. The maximum achievable length of an Ethernet link may be significantly reduced below 100m if the cable is damaged / crushed / kinked / poor quality.

For optimum performance, ensure all LINUS ID's are unique on the network prior to connecting network infrastructure. A star network topology should be used where practical. It is however generally possible to link (daisy-chain) up to 6 devices on a node. Further daisy-chaining may be possible, but should be tested to ensure reliable communication for the specific deployment. The Dante ports on the LINUS14D should (in most cases) be connected to a 'distributed star' topology network. Careful attention should be paid to ensure the minimum number of 'switch



hops' between the transmitter & receivers, or the latency setting will need to be increased appropriately to guarantee network stability.

Network protocol

Protocol types: TCP, UDP

Ports: 3000, 3001, 3011, 800, 8001

Multicast address: Broadcast 255.255.255.255

QoS Requirement: No

Bandwidth: Ca 16kbyte per device

DANTE: Channel and sample rate depending, please refer to Audionate's specification

1.2. Amplifier ID Numbers & IP Schema

Amplifiers have an addressable ID number in the top-right of the Front Panel LCD Display.

This number can only be adjusted when LINUS Control is offline, or the amplifier is disconnected from the network. In the typical use case, the Amplifiers are confined to the 192.168.1.X/24 subnet, however it is now possible for the amplifiers to exist in any IP range & subnet.

There is a limitation of 250x amplifiers on a network, for them to be controlled with LINUS Control, and the amplifiers are individually identified within LINUS Control by the last octet of their IP. This means that it would be completely acceptable to have an IP / Subnet setting on the control computer of **192.168.10.250/16 (255.255.0.0)** with two amplifiers at **192.168.10.1** and **192.168.181.13**, but it would not be possible for there to be two amplifiers at **192.168.14.140** and **192.168.29.140**, as their last octets (*140*) clash.

The ID Number in the top right of the LCD on the front panel of the amplifier / controllers always repeats the last octet of the IP address.

Note: Changing the IP address from the front panel will always change the amplifier back to the default 192.168.1.X range, where X is the ID number chosen from the front panel. To retain the custom IP Range, you must change the IP address of the amplifier either through LINUS Control, or with the 3rd Party Control protocol.

For example, an amplifier with ID Number #42 would have IP Address 192.168.1.42.

Note: Purely as a suggestion, for operation in the standard subnet, we would recommend setting the LINUS Control computer to: 192.168.1.251/16 (255.255.0.0). IP address 192.168.10.10 is reserved for the Firmware update channel, please avoid this IP on control surface and LINUS units.



1.2.1. LINUS6.4 Network configuration

LINUS6.4 has a static IP address configured in each device which is delivered from factory
 The factory setting is: 192.168.1.11

The IP address can be modified in LINUS Control.
 Please refer to section 5.4 IP Address Range

If multiple devices are connected at once to LINUS Control, please check the IP address shown in device display:



All devices should have an individual IP address configured (within a given range).

Devices with the same IP Address will not be able to connect to LINUS Control and will be displayed with this message in the discovery manager:





1.3. Upgrading Firmware

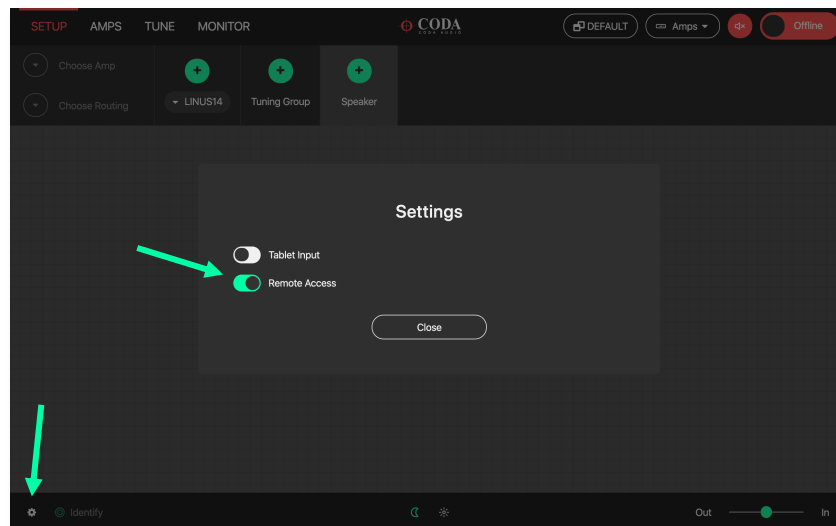
LINUS Control contains internal logic to update the amplifiers firmware and loudspeaker library safely to the correct firmware. Please see the accompanying document “LINUS Update Procedure” to find the correct procedure for upgrading and downgrading Firmware.

Note: Failure to upgrade the firmware as described within the accompanying document “LINUS Update Procedure” will result in amplifiers in an indeterminate state and will not be reachable by LINUS Control. In this case, they will need to be placed within Hardware Update mode, and the process restarted as prescribed in the document.

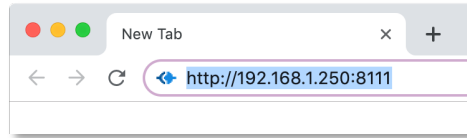
1.4. Multiple Clients

It is not possible to run multiple instances of LINUS Control on one host, or on the same control subnet. It is however possible to run an instance of Google’s Chrome Browser on another computer, tablet or iPad for instance, and allow it to control the LINUS Control backend server. In order to do this follow these steps:

- Enable “Remote Access” within the LINUS Control settings page:



- Install / Run Google Chrome on the secondary device.
- Navigate in the web browser to the IP address of the LINUS Control host machine, followed by a colon (:), then 8111 – (this is the control port).
- You will then be presented with a native LINUS Control interface.
- This will mitigate the need for use of things such as VNC clients.



- In this example, 192.168.1.250 would be the IP address of the host machine.

2. LINUS Control Application

The LINUS Control application is divided into three key areas; the top toolbar, the workspace and the bottom toolbar. The top toolbar and bottom toolbar persist through all the views, and the workspace changes depending on which mode LINUS Control operates.

2.1. Top Toolbar

The top toolbar contains the top-level operating modes of LINUS Control, a dropdown list for choosing the amplifier detail views, a master mute button, the Fallback Recovery button & the control for taking LINUS Control Online & Offline.



2.2. Top Toolbar Modes

The active mode is highlighted in RED. Keyboard shortcuts are mapped as below:

Modes	Keyboard Shortcut	
SETUP	S	Provides methods for configuring the system
AMPS	A	Amplifier status, plus control of snapshots on a global level
TUNE	T	Methods for controlling the system
MONITOR	M	Methods for monitoring the system

2.3. Top Toolbar Fallback Controls - Recover Digital

This button is visible if one or more amplifiers in the workspace is running on their backup signal. This would happen under one of two circumstances:



- Their digital signal has been lost
-or-
- The amplifiers were “forced” to fallback, either through front panel button presses, the 3rd Party Control protocol, or from the Q-SYS Plugin.

In either of these circumstances, the ‘Recover Digital’ button will be presented. Pressing the button will command all connected amplifiers in the workspace to return to their primary digital signal. If all amplifiers in the workspace successfully returned to their primary digital signal, this button will then be hidden.

2.4. Top Toolbar - Dropdown Detail View

This dropdown menu provides functionality for switching through the different view states of the Amplifier Icons. Its entities are mapped to keyboard shortcuts [‘1’ through ‘8’].



Dropdown Menu	Amplifier Icon	Keyboard Shortcut
Amps 1	01 LINUS14 ●	! 1 Amplifier type
ID / IP 2	01 192.168.1.01 ●	@ 2 IP Address
Name 3	01 Module #1 ●	# 3 Amplifier name
Speaker 4	01 ●	S 4 Out channel speaker assignments
Inputs 5	01 ●	% 5 Input routing
Mutes & Outputs 6	01 ●	^ 6 Out meter & mute button
Gain 7	01 0.0 0.0 0.0 0.0 ●	& 7 Out channel combined gain (dB)
Delay 8	01 0.0 0.0 0.0 0.0 ●	* 8 Output channel combined delay (ms)

2.4.1. Amplifier Type

The type of amplifier is displayed in the amplifier icons.

This has implications for the creation of the show file, key differences crucial for preset compatibility are detailed in the table below:



Amplifier Type	Sensor	Dante	LiNET Channels
LINUS6.4	NO	Optional	8
LINUS14	YES	Optional	8
LINUS10	YES	NO	8
LINUS10-C	NO	NO	4
LINUS12C	NO	Optional	8
LINUS5-C	NO	NO	4
LINUS CON	ALLOWED	NO	8

Please see the accompanying document “LINUS Control Loudspeaker File List” to determine loudspeaker compatibility.

2.4.2. ID / IP

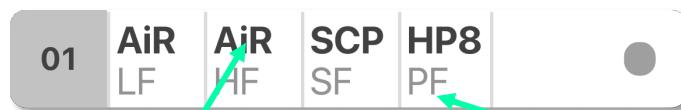
The ID number of the amplifier is displayed (as with all other detail views) in the left side of the icon. The IP Address for this amplifier is shown in the central area of the icon.

2.4.3. Amplifier Name

This is a ‘friendly name’ that can be given to each amplifier in the workspace. It is a standalone entry that does not refer to anything else. Click the name and enter text to edit the name.

2.4.4. Speaker

This view shows which loudspeakers are assigned to each channel. The top line displays a short name of the type of loudspeaker & the bottom line shows the type of the output channel.



Loudspeaker Type	Short Name
AiRAY	AiR
ViRAY	ViR
TiRAY	TiR
APS	APS
HOPS8	HP8
HOPS5	HP5

Output Channel	Suffix
Sub	SF
Low	LF
Mid	MF
High	HF
Passive	PF
Front Facing Cardioid	FF
Rear Facing Cardioid	RF



2.4.5. Inputs

The channel input sources are shown on a per-channel basis. The Input Level meters are drawn on a per channel basis.

Prefixes:

- A / B / C / D = Analog Inputs
- 1 / 2 / 3 / 4 .. 8 = LiNET Inputs
- D1 / D2 / D3 / D4 = Dante Inputs

Suffixes:

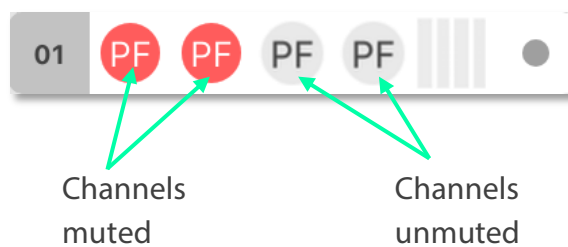
- - (negative sign) = Polarity Inverted
- ! (exclamation mark) = Mixture of Inputs, or no input

The meters show the input signal level on a per-channel basis for the input assigned to that channel.

- Input meters start at -60dBFS.
- When the peak level exceeds -10dBFS, the meter will turn yellow.
- When the peak level exceeds -3dBFS, the meter will turn red.

2.4.6. Mutes & Outputs

For each channel, there is a combined mute button & output level indicator. If the mute is active on the channel, the indicator turns solid red. If the mute is inactive, the background of the channel is light grey.



When the channel mutes are off, output meters are displayed in green behind the suffix.

The output meters are calibrated in dB relative to the loudspeaker's full RMS output potential on a per-channel basis.

- Output meters start at -45dB (rel)
- Output meters are full-scale at 0dB (rel)





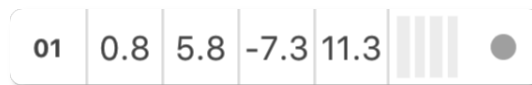
To the right of each amplifier icon, an orange gain reduction indication is drawn. This shows gain reduction on a per-channel basis.

- Gain Reduction meters are indicated when there is -3dB of Gain reduction (Peak or RMS)



2.4.7. Gain

For each channel, the combined sum of all the group gains is displayed.



2.4.8. Delay

For each channel, the combined sum of all the group delays is displayed.



2.5. Top Toolbar - Master Mute

This button toggles the mute state of all connected & online amplifiers on the network. Red is muted, white is unmuted.




2.6. Top Toolbar - Online / Offline

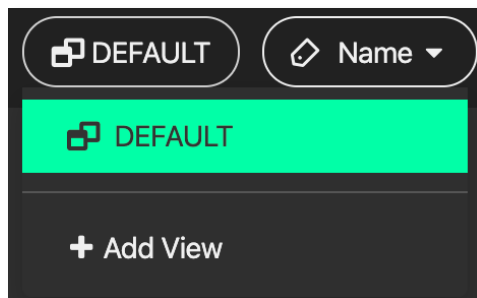
This button toggles the software Online & Offline.



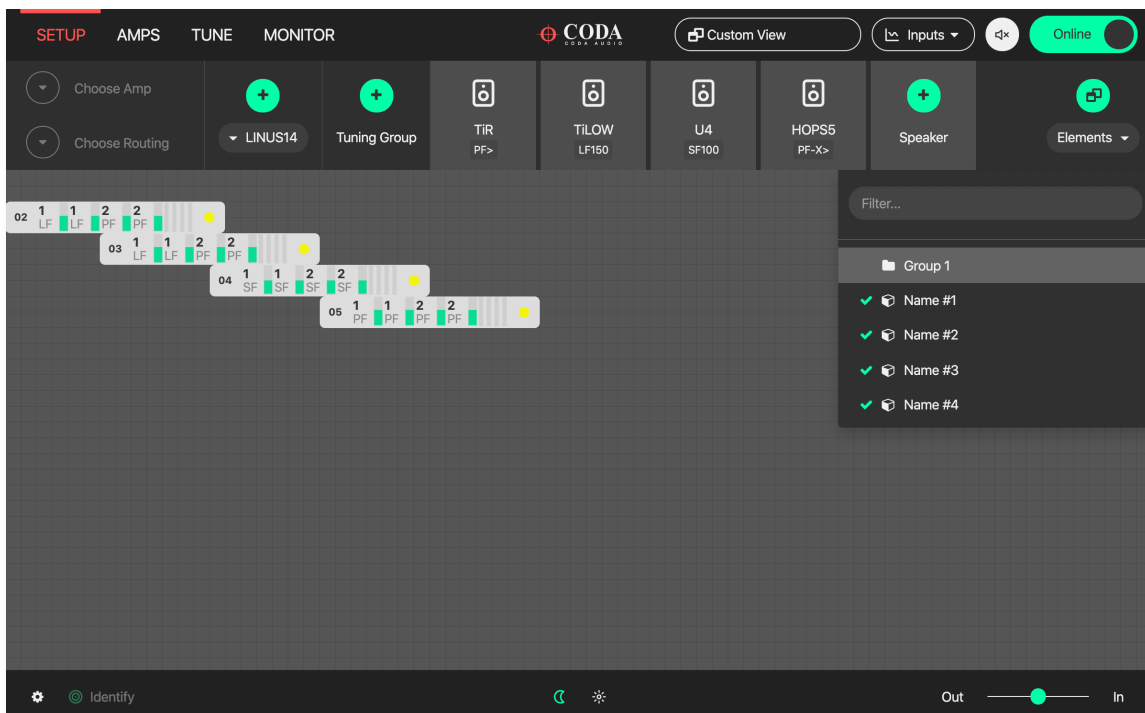
2.7. Top Toolbar – View



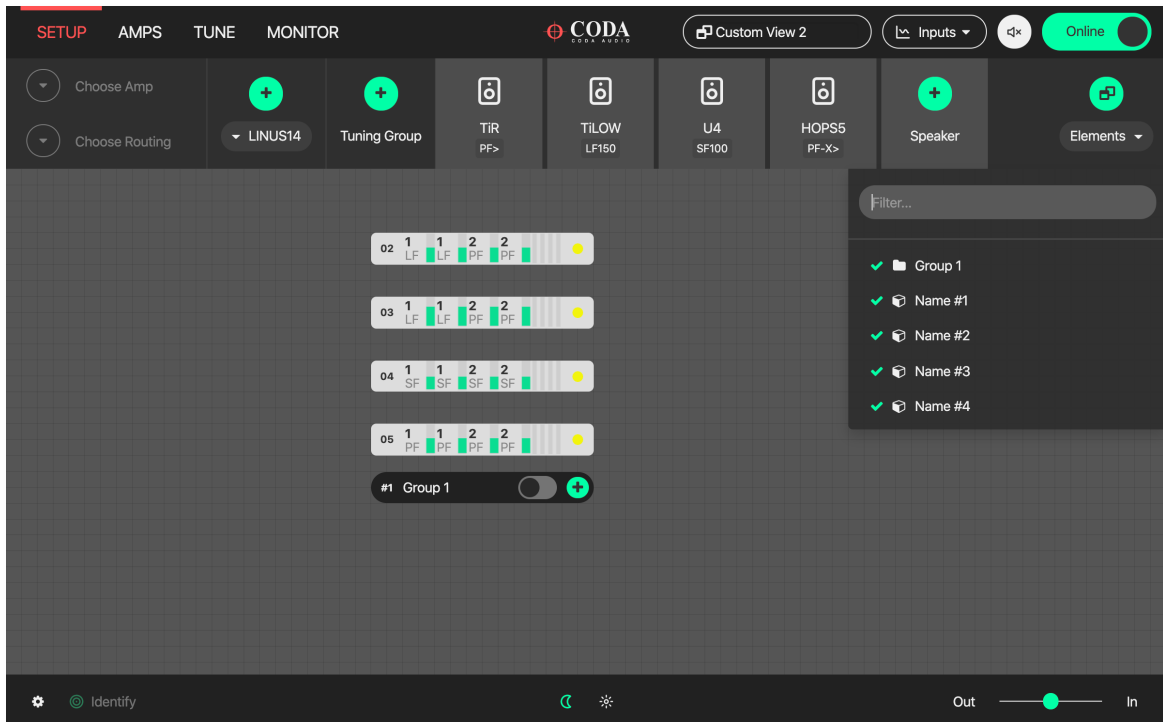
This button  toggles View presets. Custom View presets can be created, these store selected elements and their position in the space (Amplifiers and Groups).



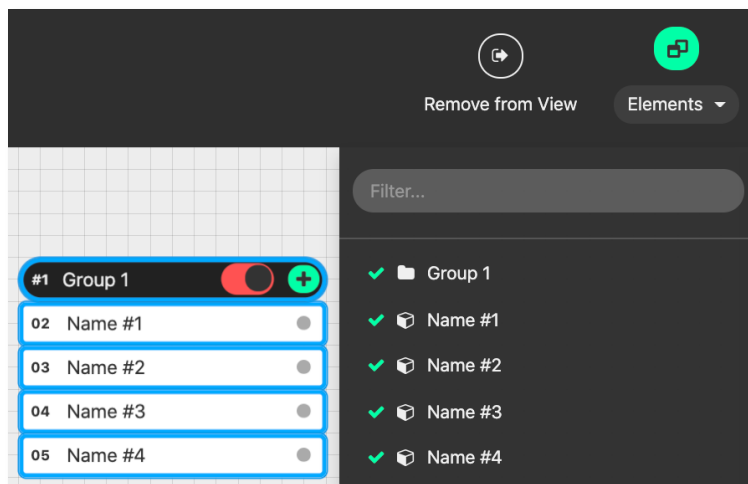
- Example 1:
Group is unselected and Amplifier icons are displaced:



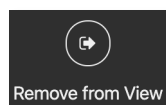
- Example 2:
All elements selected and shown in the space, Amplifier and Group icons displaced:



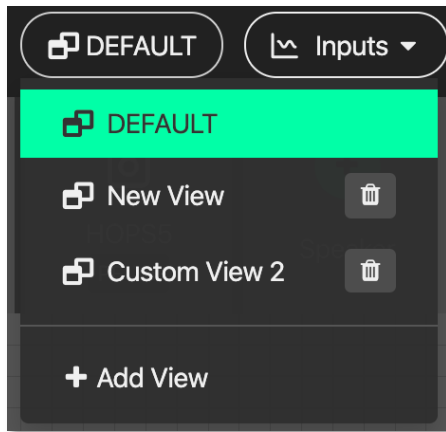
- Elements represent Names of Amplifiers and Groups



- Elements can always be removed from individually from the view. Just select the element in the setup space and press this button:



- Custom View can be reset by pressing Default (Views are stored in the Linus Control file)





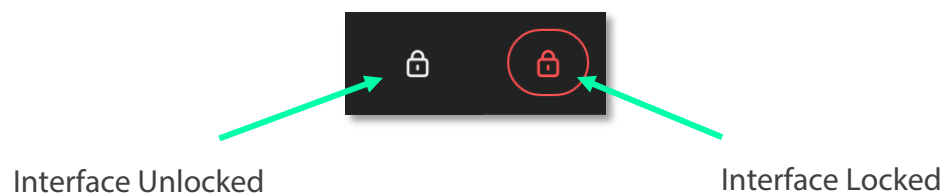
3. Bottom Toolbar

The Bottom Toolbar contains tools relevant to the LINUS Control window & the extra functionality of amplifier identification.



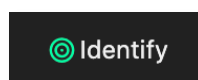
3.1. Bottom Toolbar – Lock

The Padlock icon in the Bottom Toolbar is displayed when the operation mode is changed to “MONITOR” in the Top Toolbar. When pressed, it will turn red/orange and all interface controls will be locked to prevent inadvertent keyboard or mouse inputs during the show.



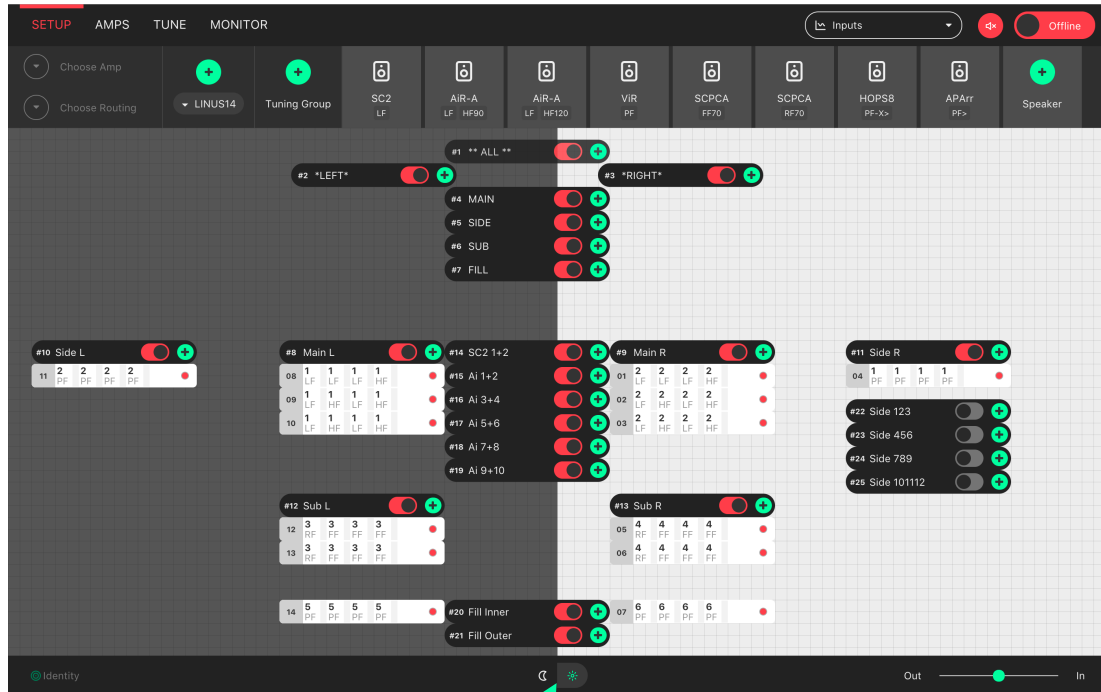
3.2. Bottom Toolbar – Identify

Click ‘Identify’ to flash the LED’s on the amplifiers that are selected on the workspace.



3.3. Bottom Toolbar - Night Mode / Day Mode

The button in the centre of the Bottom Toolbar toggles the interface between night & day mode.



Night Mode / Day Mode

3.4. Bottom Toolbar – Zoom

The slider in bottom right side of the Bottom Toolbar scales the workspace and its contents. This allows for the optimum display size on different resolution screens from small systems to large ones.

3.5. Bottom Toolbar – Settings

Pressing the settings ‘cog’ or ‘gear’ icon will present the application settings page.

3.6. Bottom Toolbar – ‘Attention Getter’

The background of the Bottom Toolbar is black by default. In the event of an error, it will change its background colour accordingly. This serves to quickly get the attention of the user in a subtle way. Clicking the background of the Bottom Toolbar will navigate to the AMPS view, where the error status of the amplifier(s) can be seen.

In the case of an Error, the Bottom Toolbar background will change to a Red colour.





4. Setup Mode

The setup page is the start point for the design of the workspace. Here it is possible to Add Amplifiers & Groups to the workspace, choose input routing, assign groups and arrange the system in a logical manner.

Key Concepts:

- Amplifiers are displayed with the following icon style:



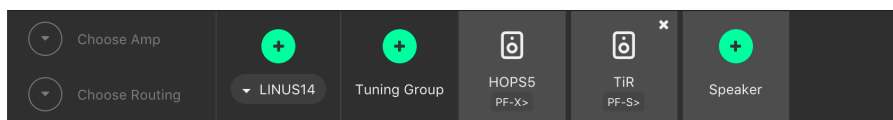
- Tuning Groups are displayed with the following icon style:



- Loudspeakers are assigned to Amplifier Channels.
- Amplifier Channels are assigned to Tuning Groups.
- Tuning Group parameters are adjusted on the TUNE page.

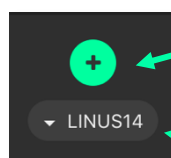
4.1. Setup Mode - Top Toolbar

In Setup mode, an extra toolbar is visible underneath the Top Toolbar. Extra setup-specific controls are displayed here, which are not necessary in the Tune or Monitor modes.



4.2. Setup Mode - Add Amplifier

Pressing the plus icon (or pressing Cmd + F) will add a new amplifier of the selected type into the workspace. It will be given the next logical ID (next free ID number, numerically ascending). The type of amplifier can be chosen by pressing the bottom half of the icon and choosing from the list.



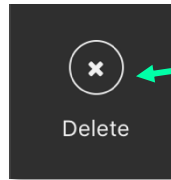
Press here to add the chosen amplifier to the workspace

Press here to choose a different type of amplifier



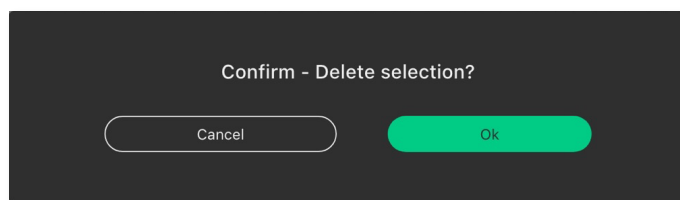
4.3. Setup Mode - Delete Amplifier / Group

Pressing the 'X' icon will remove all selected Amplifiers and Groups from the workspace.



Press here to delete any items that are selected on the workspace.

A confirmation dialog is presented to confirm this action:

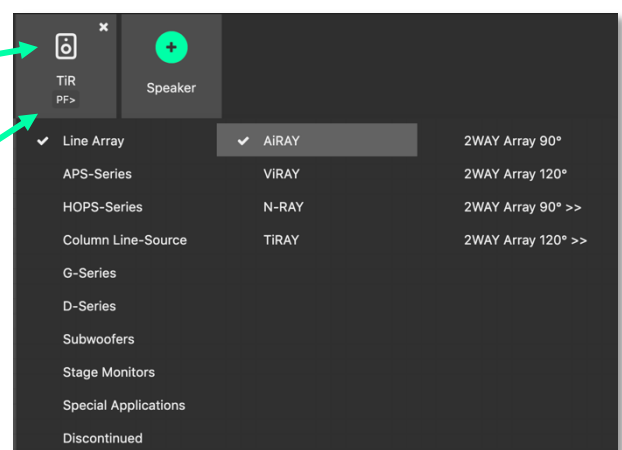


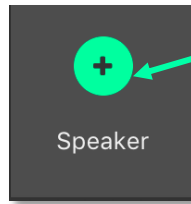
4.4. Setup Mode – Choose Loudspeakers

When a new file is created and an Amplifier is added to the workspace, a loudspeaker file is added to the loudspeaker banner. Additional loudspeakers can be added to the banner by pressing the "+" button. This loudspeaker file has two areas:

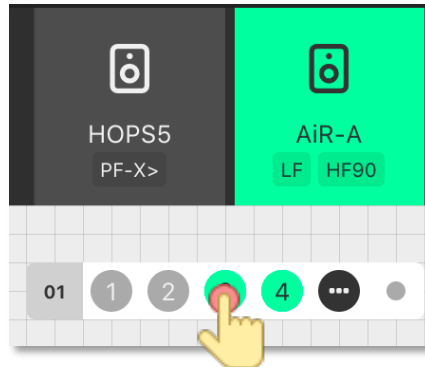
The top half of the icon is the 'ASSIGN' button.

The bottom half of the icon displays the dropdown list where the loudspeaker can be chosen.



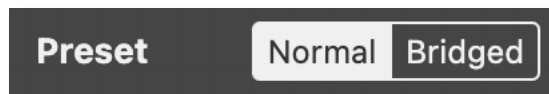


Pressing this button adds a new loudspeaker to the Loudspeakers Banner.



When the loudspeaker is in 'ASSIGN' mode, the channels can be selected that the loudspeaker should be assigned to.

LINUS6.4 offers the option to select "Normal" or "Bridged" speakers



Normal: Conventional single channel speaker assignment

Bridged: Dual channel speaker assignment. Channel 1+2 or 3+4 can be assigned

Bridged Speakers will be shown with this symbol in the Speaker Banner

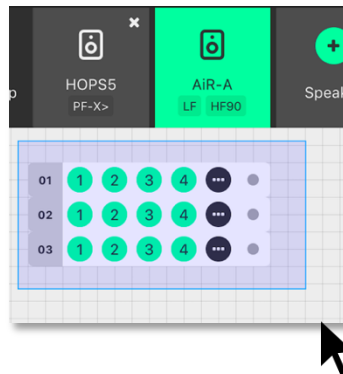


Attention: Please refer to LINUS6.4 manual for amplifier output wiring

4.5. Setup Mode – 'Lasso Assign' Loudspeakers to Channels

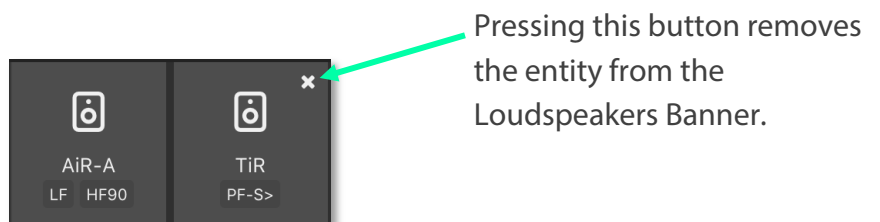


When the loudspeaker is in 'Assign' mode, it is possible to click and drag a bounding box to assign the channels quickly to multiple channels:



4.6. Setup Mode – Remove Loudspeakers from Loudspeakers Bar

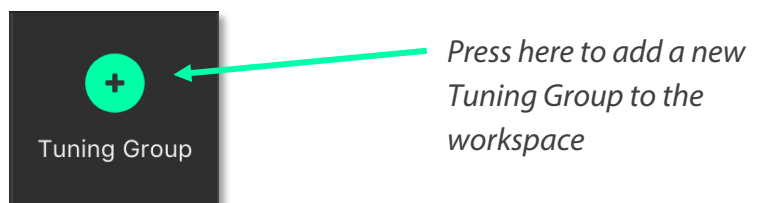
When a loudspeaker is not assigned to any amplifier in the workspace, a small cross is displayed in the upper right of the icon. Clicking this will remove it from the Loudspeakers bar:



4.7. Setup Mode – Add Tuning Group

Pressing this button (or pressing Cmd + G) will add a new Tuning Group to the workspace.

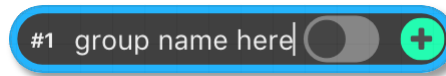
Note: If the user clicks the Add Tuning Group button, then immediately start typing the desired name of the group, before pressing 'Enter', the Tuning Group will accept this text as its name.



4.8. Setup Mode - Name Tuning Group



Single clicking the group selects it. Double clicking the group enables the name to be changed. Press enter on the keyboard to accept the name.



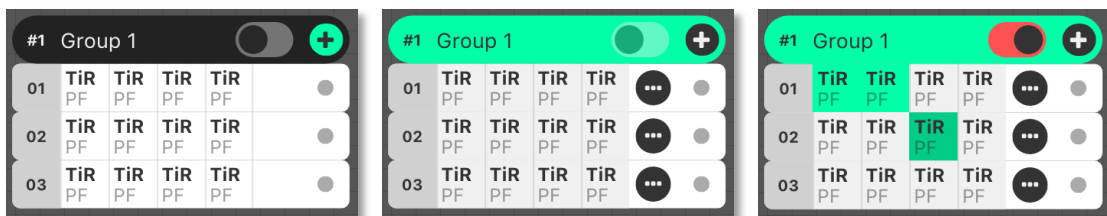
4.9. Setup Mode - Assign Loudspeakers to a Group

Clicking the green 'Plus' Arrow **+** on the group places it into 'Assign' mode.

The Group's background colour changes to green to indicate this.

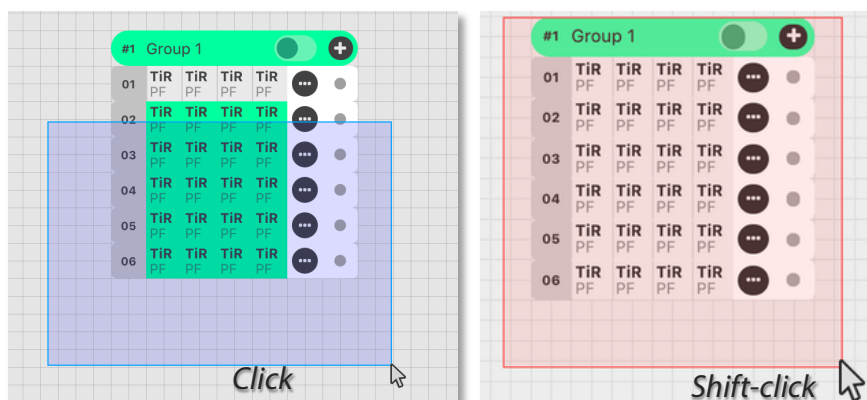
Click the Loudspeakers to assign them to the Group.

Click the **⋮** button to assign all the Loudspeakers / Amp Channels into the Group.



4.10. Setup Mode – Lasso Assign Loudspeakers to a Group

When the group is in 'Assign' mode, it is possible to click and drag a blue bounding box to add loudspeakers into that group. Pressing 'Shift' and clicking the bounding box will remove the chosen loudspeakers from that group (the bounding box will be red in this case):



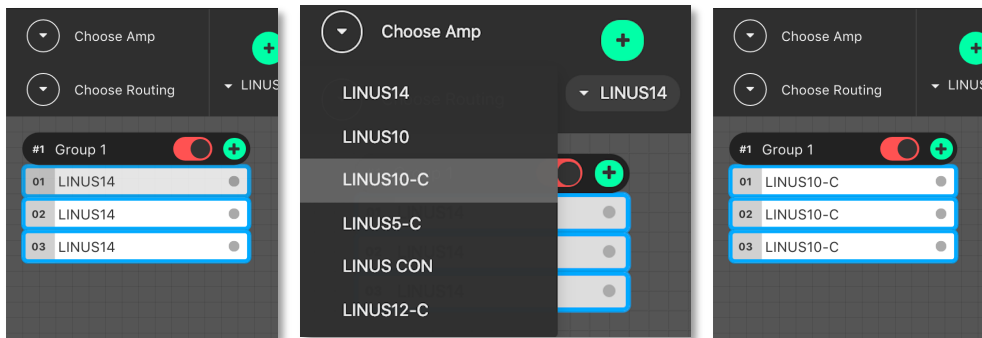
4.11. Setup Mode – Group Assign Alternate Method

If Amplifiers are selected when a new group is added to the workspace, they will be added to the group automatically.



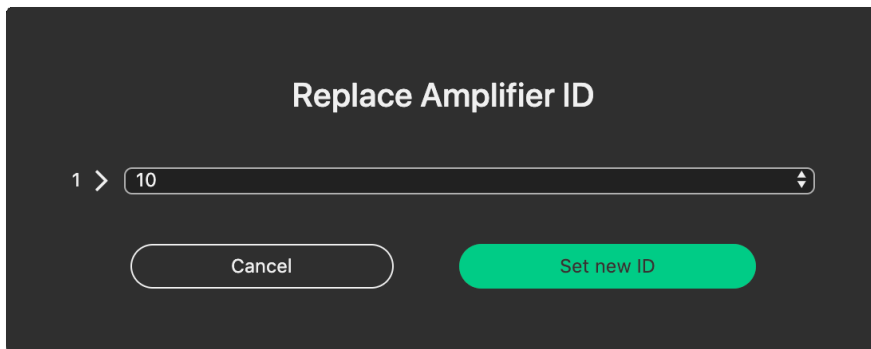
4.12. Setup Mode – Change Amplifier

It is possible to change the type of Amplifier in the offline workspace. Select the Amplifiers in the workspace, either with the multiselect lasso or by individually clicking, then click the “Choose Amp” dropdown in the toolbar.



4.13. Setup Mode – Replace Amplifier ID

It is possible to change the ID of an amplifier in the workspace when Offline. In Setup mode, double click the ID number of the amplifier in the workspace. The following dialog will be presented:



4.14. Setup Mode - Set Routing

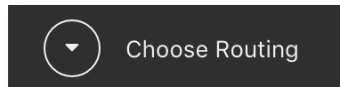
It is possible to adjust the input routing of one or more amplifiers at the same time.



Note: There are couple of variables that affect the routing possibilities, namely Amplifier Type and Loudspeaker Choice. If more than one Amplifier is selected & this selection comprises different Loudspeaker types and/or Amplifier types, the lowest common denominator of routing possibilities will be presented in the Routing Window. For instance, if two LINUS14's are selected, with AiRAY (a 2-WAY enclosure) selected on the first and SCP (a 1-WAY enclosure) on the second, the Routing Window would only allow for patching Channels 1+2 and Channels 3+4 as a 2-WAY pair, even for the Amplifier with the SCP assigned.

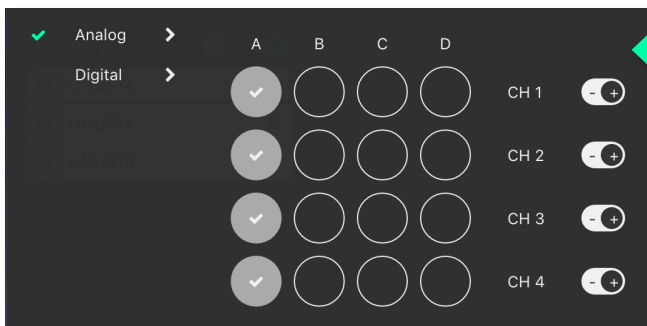
Select the Amplifier(s)

Click the "Choose Routing" button:

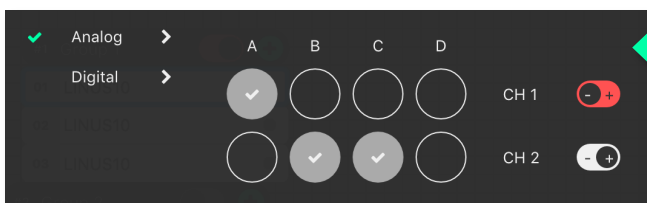


Choose "Analog" or "Digital":

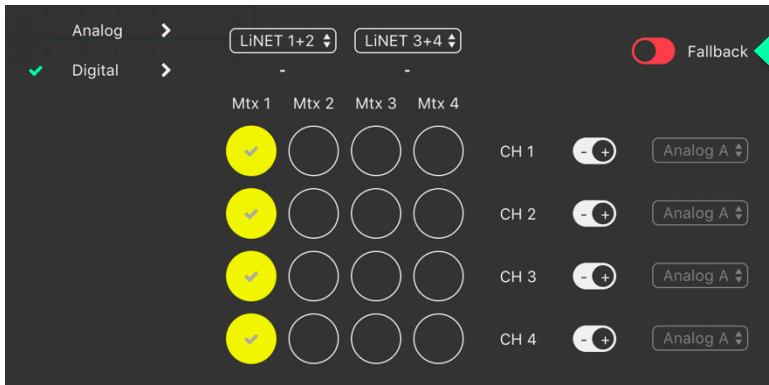
- Input signals are represented in the vertical columns
- Outputs are the horizontal rows
- Click the 'Ticks' to patch the Inputs to the Outputs
- The Output Polarity buttons are the toggle switches to the right of the Outputs



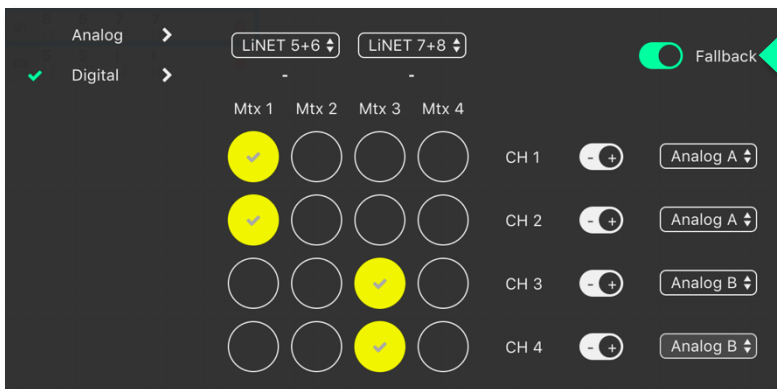
*Analog CH A is routed to all outputs.
All the outputs are in Polarity.*



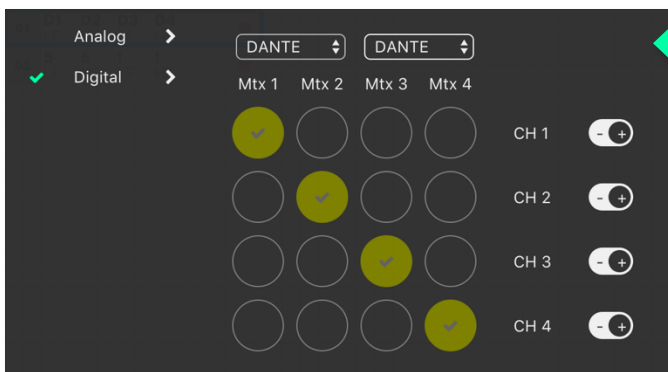
*Analog i/p A is routed to o/p CH 1.
Analog i/p B & C are routed to o/p CH 2.
Output CH 1 is out of Polarity.*



LiNET i/p 1 is routed to all o/p Chans.
Fallback is OFF
All o/p's are in Polarity



LiNET i/p 5 is routed to o/p CH 1 + 2
LiNET i/p 7 is routed to o/p CH 3 + 4
Fallback is ON.
Analog A is the Fallback source for CH 1+2
Analog B is the Fallback source for CH 3+4



Dante i/p 1 is routed to o/p CH 1
Dante i/p 2 is routed to o/p CH 2
Dante i/p 3 is routed to o/p CH 3
Dante i/p 4 is routed to o/p CH 4

To patch the entire row vertically, hold shift whilst clicking one of the patching cross-points.

Note: The Dante patch is fixed one to one in the firmware.

To adjust the routing of the Dante, please use Audinate's Dante Controller.

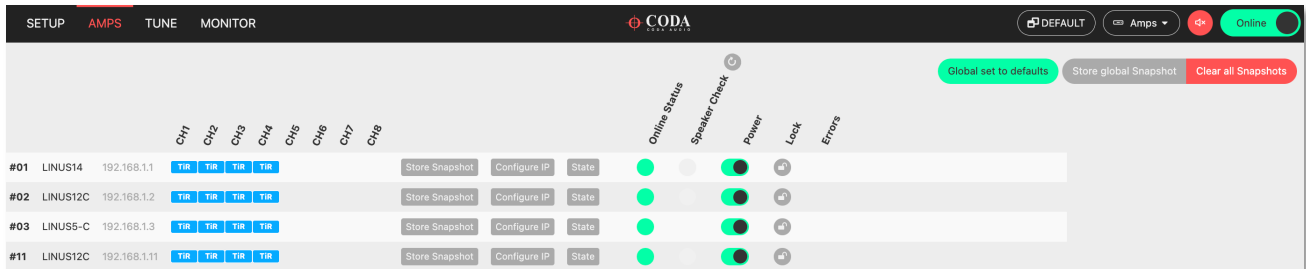
5. AMPS Page

The AMPS Page gives a fast overview of the status of all connected amplifiers in the system. It also provides the interface for the Snapshot, State & IP functionality which is discussed later.

5.1. AMPS Page - List of Amplifiers

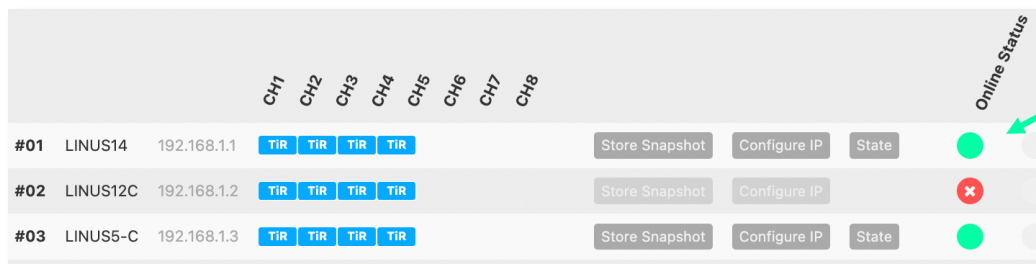


Arranged numerically by ID number, the Amplifier List is central to the AMPS Page. On the left, after the ID Number is the Amplifier Type. The Loudspeakers assigned to the channels are next represented by blue icons. There is an Amplifier specific 'Store Snapshot' button in each row.



5.2. AMPS Mode - Online Status

If the amplifier is online, a green indicator is present here.



5.3. Snapshots

Snapshots can be thought as a way of storing the absolute state of an amplifier at an exact point in time. Absolutely all parameters are stored, apart from the ID of the Amplifier & the contents of the other Snapshots. Snapshots can either be recalled from the Front Panel, or from the 3rd Party UDP Commands which are detailed in the accompanying document "LINUS Third Party Control".

Note: There is a fundamental difference in operation between the legacy application LINUS Live v1.X and LINUS Control v2.X in that there are no 'Presets' stored within the Amplifiers, only the 20x Snapshots & the 'Live State' of the Amplifier as commanded by LINUS Control.



Note: Snapshots cannot be stored or overwritten from the Front Panel on LINUS5-C and LINUS10-C Amplifiers. On LINUS14 / LINUS10, LINUS CON and LINUS12-C, Snapshot locations 1 through 10 inclusively have read-write access from the Front Panel. Snapshot locations 11 through 20 inclusively are read only from the Front Panel & can only be stored or overwritten from LINUS Control.

Example Usage

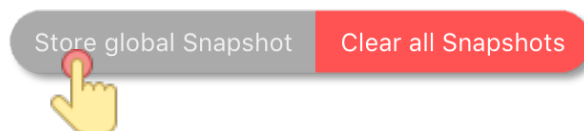
Scenario A). (Semi)-Permanent Installation

The Sound Designer commissions the system and saves a LINUS Control Show File. (S)he also creates a couple of other deployments of the same system, when the 'venue' is utilised for different roles, again, creating show files for these.

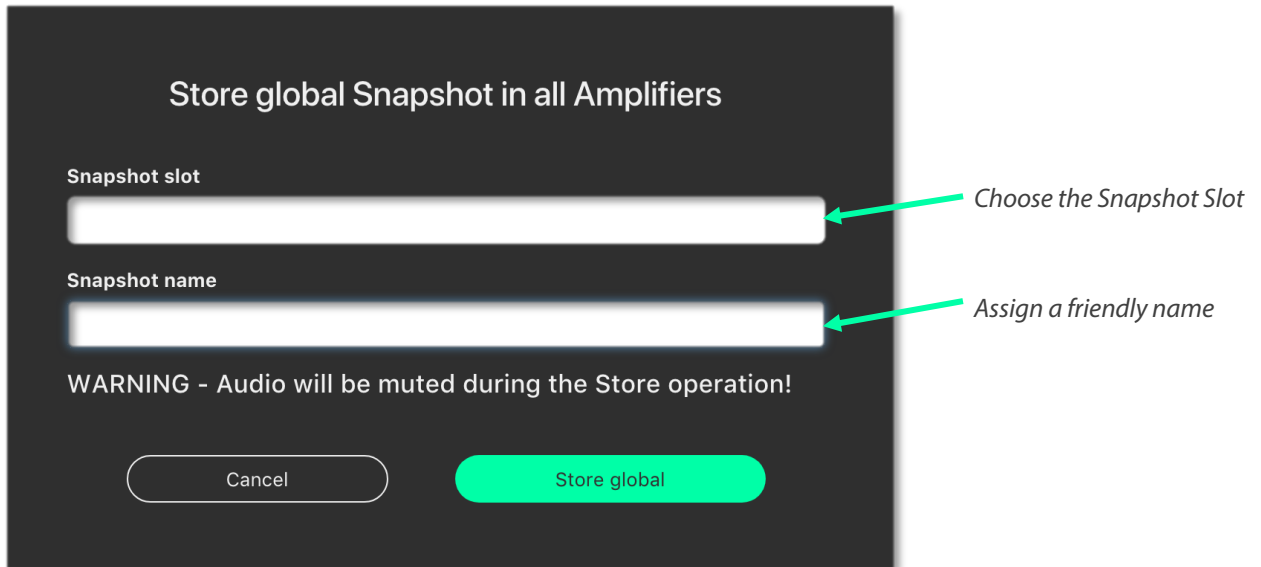
I.E:

- There is a main system with delays, all time aligned and tuned to cover one big room -and-
- It is also possible to compartmentalise the same large room into smaller rooms, whereby the delays are rotated around to act as the main system for the smaller 'satellite' rooms.

In this instance, when (s)he is happy with the tuning of the system for the larger room, (s)he will press the "Store Global Snapshot" button on the top right of the AMPS Page.



A window will then pop up, whereby the Snapshot Location will be chosen, together with a suitable name for the Snapshot. This Snapshot Location is used together with the Snapshot Name to identify it to the user on the Front Panel. It is also used as a reference for recall using the 3rd Party UDP Control Protocol, which can be commanded from most network devices that can transmit custom UDP Messages, for example Crestron™ Remotes.

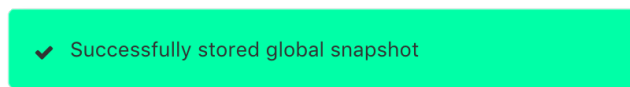


Note: The software will report [mixed snapshots] in the 'Snapshot slot' list if snapshots with different names are stored in the same slot in multiple amplifiers.



Note: As the popup states, when the Snapshots are Stored, Audio will be muted temporarily as the memory is accessed. It is important not to Store Snapshots during a show!

When the Store operation is complete the following message will be displayed in the lower right-hand side of the LINUS Control Workspace:



If the user then changes Tuning Parameters / Loudspeakers / Routing etc in the LINUS Control show file, they can then store a new snapshot in a new location. This will allow fast recall from the front panel of different offline 'States' of the LINUS Control show.

Scenario B). Rental Company

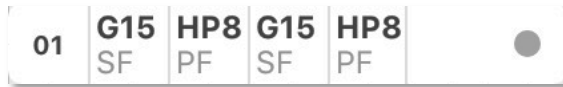
A hire company may wish to send out small systems with operators who do not wish to use the LINUS Control software & just want to recall the setup from the Front Panel.

Prior to dispatching the equipment, the hire company can configure the different smaller systems that are used and save these as Snapshots, so the end user only needs to choose a Snapshot and Recall it from the Front Panel.

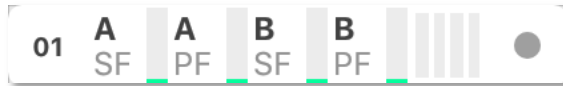


Example – 2x HOPS8 on 2x G15 Subs.

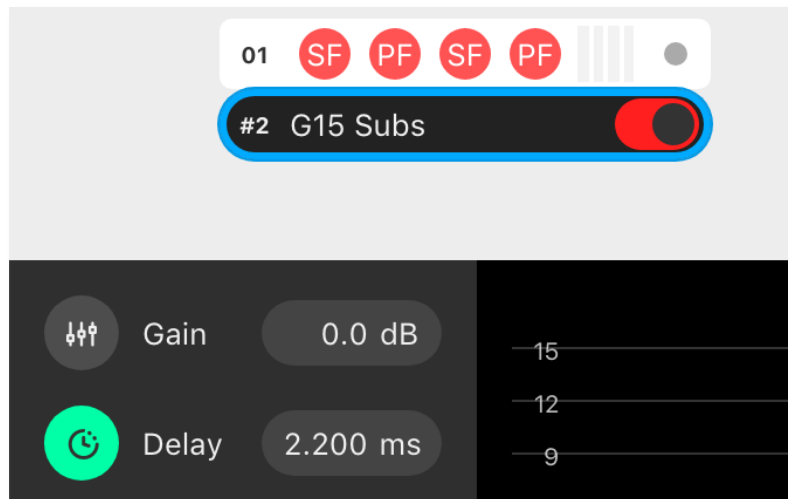
Firstly, the Loudspeakers are assigned to the Amplifier:



The input routing is then assigned:



A Tuning Group is then assigned to the G15 Subs, in order to add the 2.2ms co-planar delay (as determined from the time alignment spreadsheet guide).



The Snapshot should now be stored on this amplifier, to enable offline recall from the Front Panel on site. Group Parameters (Gain / Delay / EQ etc.. can be adjusted from the Front Panel without use of the computer).

5.4. IP Address Range

The LINUS Amplifiers & LINUS Control can exist in any IP Range & Subnet, they are not required to be in the 192.168.1.X range.

There is a limitation of 250x amplifiers on a network, for them to be controlled with LINUS Control, and the amplifiers are individually identified within LINUS Control by the last octet of their IP. This means that it would be completely acceptable to have an IP / Subnet setting on the control computer of 192.168.10.250 / 255.255.0.0 with two amplifiers at 192.168.10.1 and

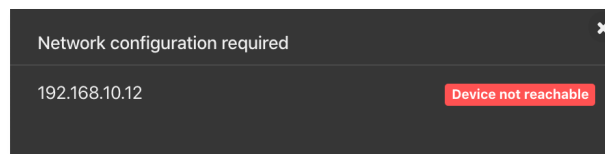


192.168.181.13, but it would not be possible for there to be two amplifiers at 192.168.14.140 and 192.168.29.140, as their last octets (140) clash.

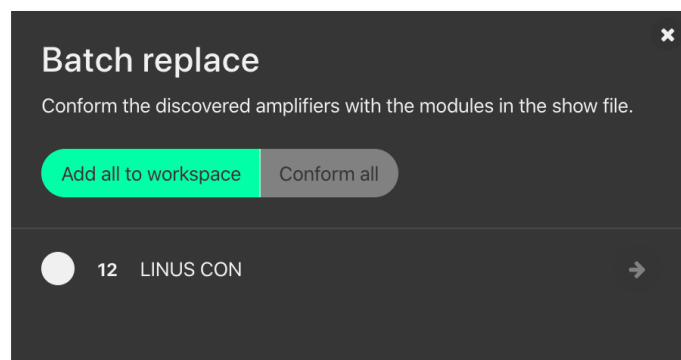
The ID number in the top right of the LCD on the front panel of the amplifier / controllers always repeats the last octet of the IP address.

Note: Changing the IP address from the front panel will always change the amplifier back to the default 192.168.1.X range, where X is the ID number chosen from the front panel. To retain the custom IP Range, you must change the IP Address of the amplifier either through LINUS Control, or with the 3rd Party Control protocol.

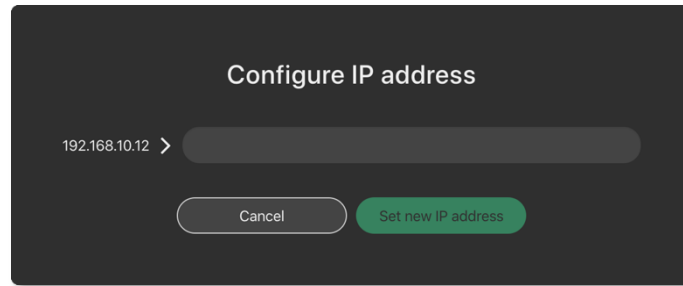
To change an amplifier to a custom range within LINUS Control, take a note of the current IP Address of the amplifier. Ensure that the subnet mask of the control computer will allow the LINUS Control application to talk to the amplifier; if this is set incorrectly, the amplifier may still be discovered by LINUS Control, however it will not be able to communicate. In this instance, it will be presented in the discovery list as “not reachable”:



With the IP & Subnet of the control computer set correctly, the device will be reachable and can be added to the workspace:



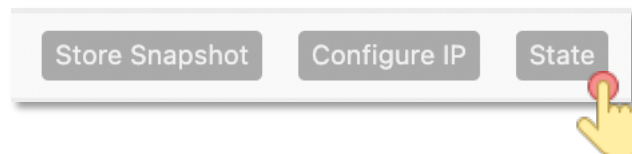
When the amplifier is added to the workspace, click the relevant **Configure IP** button, on the AMPS page. This will launch a dialog, where the IP Address of the amplifier can be adjusted.



If the last octet of the new IP address is unchanged, the amplifier will show up on the workspace with the new IP. If not, it will show as offline on the workspace, and will show up as a newly discovered amplifier within the discovery list – it can then be replaced with the amplifier in the workspace using the standard method.

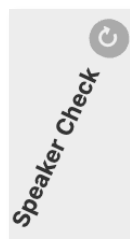
Note: IP address 192.168.10.10 is reserved for the Firmware update channel, please avoid this IP on control surface and LINUS units.

State Manager, please refer to section [8.5](#).



5.5. Speaker Check

Speaker Check is a tool for checking loudspeaker connection lines and loudspeaker impedance when connected to LINUS14 and LINUS12C.





5.5.1. Start Speaker Check application

Open the Speaker Check application



5.5.2. Speaker Check overview

Amplifier channel and its loaded speaker Speaker Check activation/deactivation for individual channels Selected amplifier Measured impedance value

Speaker Check #01 LINUS14

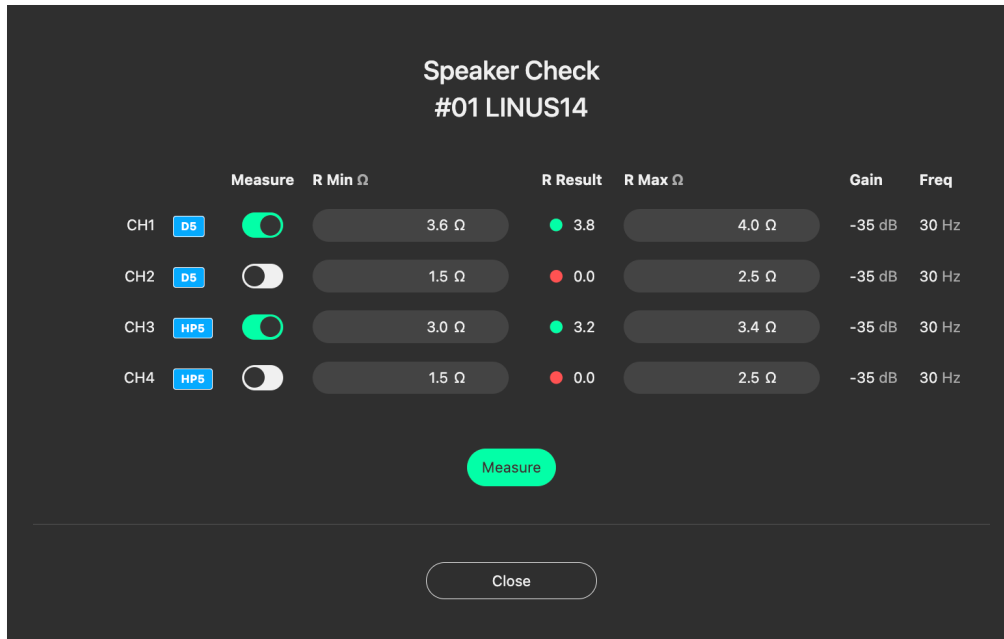
	Measure	R Min Ω	R Result	R Max Ω	Gain	Freq
CH1	<input checked="" type="checkbox"/>	1.5 Ω	0.0	2.5 Ω	-35 dB	30 Hz
CH2	<input type="checkbox"/>	1.5 Ω	0.0	2.5 Ω	-35 dB	30 Hz
CH3	<input checked="" type="checkbox"/>	1.5 Ω	0.0	2.5 Ω	-35 dB	30 Hz
CH4	<input type="checkbox"/>	1.5 Ω	0.0	2.5 Ω	-35 dB	30 Hz

Configurable impedance minimum and maximum values *Sinus signal generator value*

5.5.3. Speaker Check Setup

1. Define the speakers in the setup section first.
2. Select the amplifier which should run the Speaker Check application
3. Select amplifier channels which should run the Speaker Check

Example shows Speaker Check activated for CH1 (loaded speaker: D5) and CH3 (loaded speaker HOPS5)



- Connect amplifier channels with the loudspeaker and press "Measure".
You might hear the sine wave generator running (at -35dB / 30Hz) at low level.
The selected channels will be measured one by one, consecutively (measurement per channel takes ca. 3 seconds).

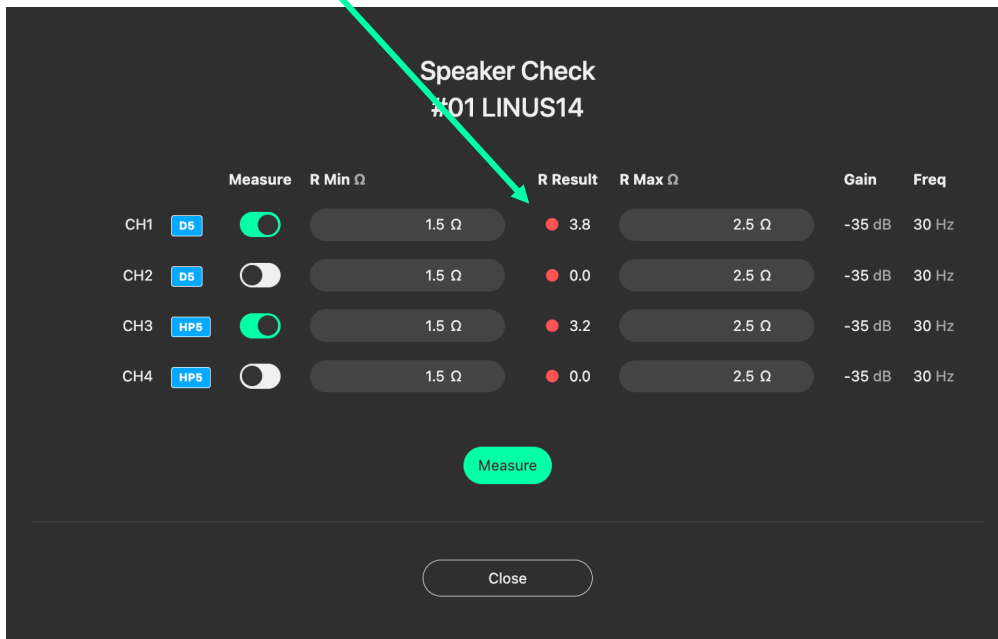
Example shows a performed measurement value for the selected channels in the column "R Result"

The R Result value represents the impedance (Ohms) of the speaker measured at 30Hz, combined with the impedance of the loudspeaker cable.

In this example:

Channel 1: D5 + 10m/ 2x4mm² loudspeaker cable = 3.8 Ohm

Channel 3: HOPS5 + 20m/ 2x4mm² loudspeaker cable = 3.2 Ohm



5.5.4. Speaker Check R Min and R Max

The R Min and R Max values can be defined after a performed Speaker Check measurement. These will give the threshold for further indicators.

It is recommended to run the Speaker Check measurement at least four times in a row and to monitor the R Result values in that time frame. (This simulates a real operation with a warmed up speaker voice coil).

A basic recommendation for the R Min and R Max values are:

R Min -0.2 Ohm from R Result value

R Max +0.2 Ohm added to R Result value

This example shows the defined R Min and R Max values:

Channel 1: D5 + 10m/ 2x4mm² loudspeaker cable = 3.8 Ohm

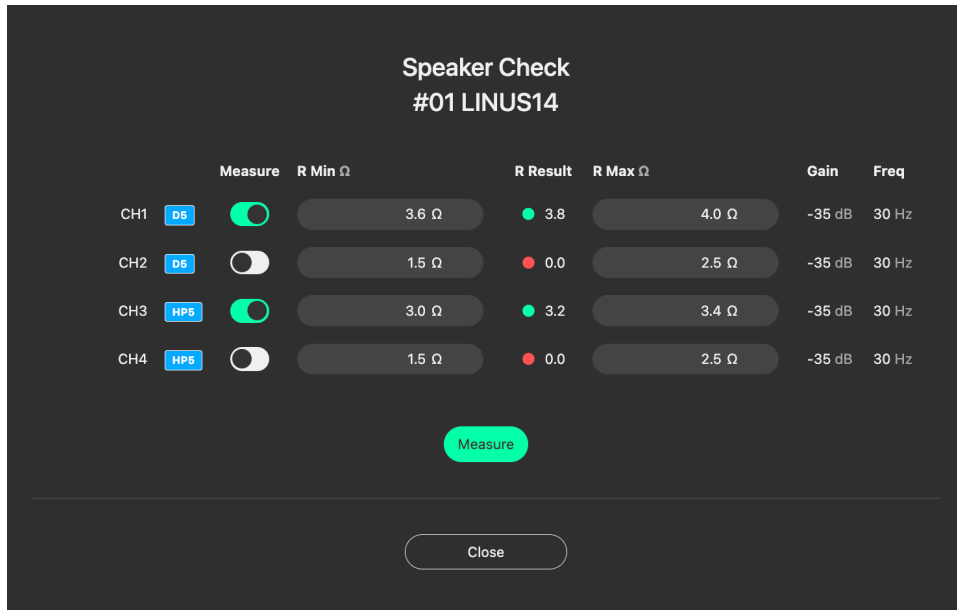
Recommended R Min Value = 3.6 Ohm

Recommended R Max Value = 4.0 Ohm

Channel 3: HOPS5 + 20m/ 2x4mm² loudspeaker cable = 3.2 Ohm

Recommended R Min Value = 3.0 Ohm

Recommended R Max Value = 3.4 Ohm



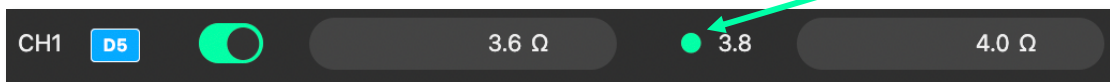
Note: The R Result values are dependent on many factors and may vary due to cable type and environmental conditions. Therefore, multiple measurements are recommended to the define proper R Min and R Max threshold values.

5.5.5. Speaker Check Indicator

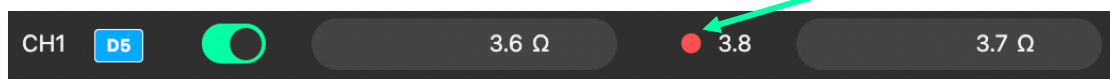
The Speaker Check application indicates whether the speaker is connected or not (component monitoring might be added in future)

Once the R Min and R Max values are defined, you will get the following information:

R Result represents a value which is within the defined R Min and R Max threshold. A green dot means loudspeaker is connected.

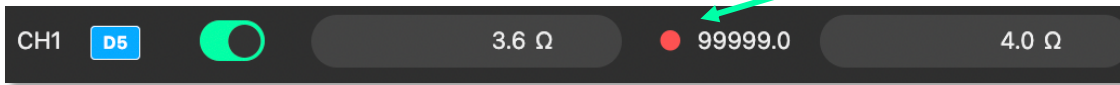


R Result represents a value which is slightly out of the defined R Min and R Max threshold (red dot). Repeat measurement (a minimum of four times) and readjust the R Min or R Max values.





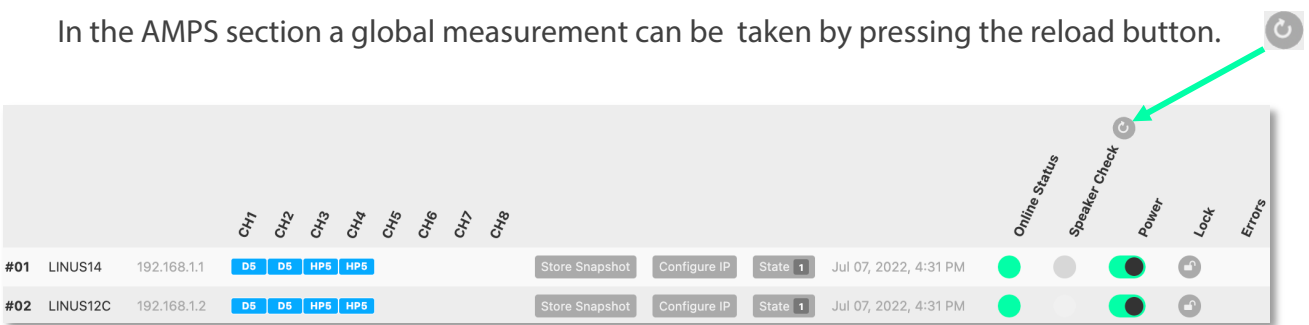
R Result represents a value which is far outside of the defined R Min and R Max threshold (red dot). This means the loudspeaker is not connected



5.5.6. Speaker Check Indicator AMPS Section

Speaker Check can be performed on all activated and defined LINUS14 and LINUS12C devices which are connected to the LINUS Control Network.

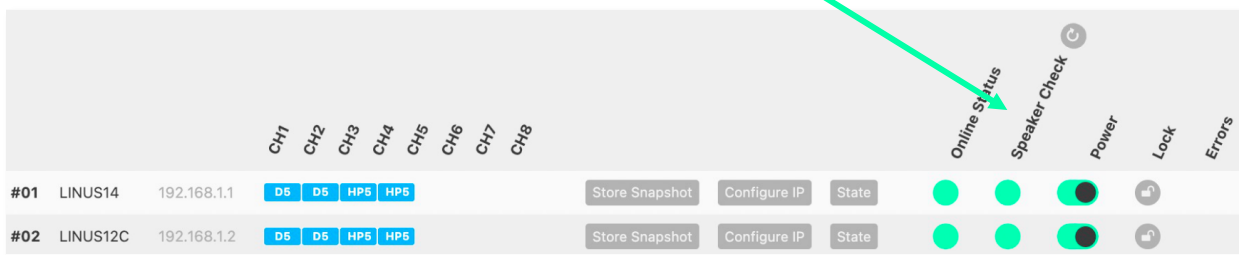
In the AMPS section a global measurement can be taken by pressing the reload button.



Note: Speaker Check performs a global measurement on all amplifiers at the same time (one by one activated channel = maximum four measurements, each channel taking around 3 seconds), independent of whether the channel mutes are activated or not. It is strongly recommended to perform this global measurement in a time frame where no audience is present and not during a show, as the sine wave signal will be audible on loudspeakers with low frequency output (for example, subs or full-range speakers).

Once the global Speaker Check has been performed, the following indications will be displayed:

Green = all Channels with activated Speaker Check are within the R Min and R Max threshold:

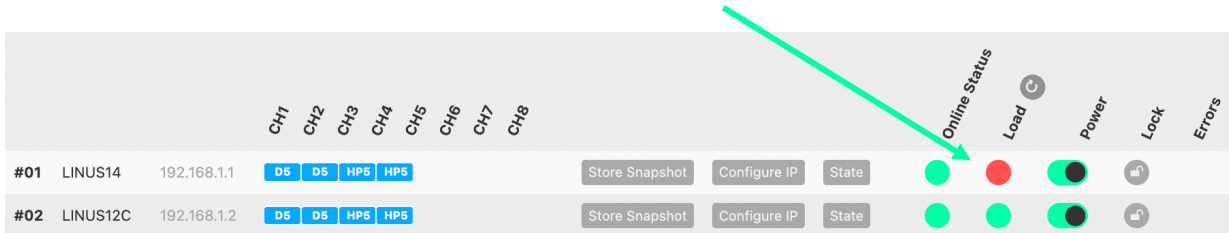




Red = One or more channels are out of the defined R Min and R Max threshold values.

This means two possible causes:

1. Loudspeaker is not connected. (Check loudspeaker and its connection to the amplifier channel.)
2. R Result measurement is slightly out of the defined R Min and R Max threshold value. (Redefine R Min and R Max threshold values.)

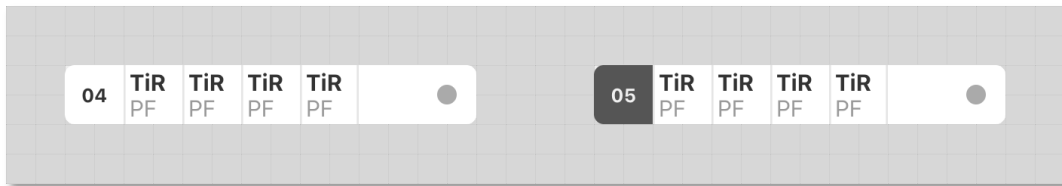


Note: Speaker Check setup is stored on each defined amplifier and not in the Show File.

5.6. Standby

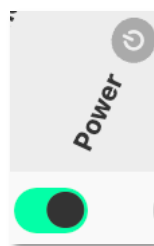
All amplifiers, with the exception of LINUS10 and LINUS CON, when online, can be switched in and out of 'standby' from the AMPS page within LINUS Control.

To recap, an amplifier is shown as **on** or **in standby** with a grey colour to the left of the icon in the SETUP page:



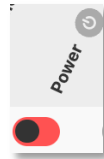
Amplifiers set in standby/ wake up in the AMPS Section

On

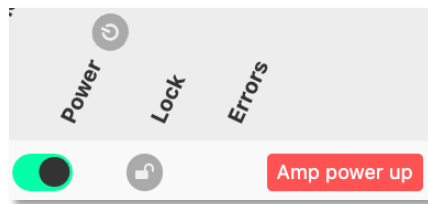




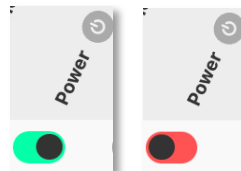
Standby



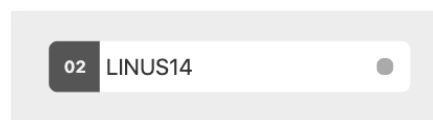
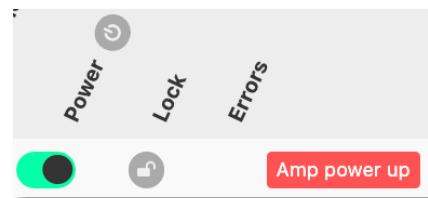
Wake Up



To place an amplifier in or out of standby, with LINUS Control online, click the "Power" button in the AMPS page. This will toggle the amp between on, or standby. The front panel switch works in combination with LINUS Control in a "Latest takes precedence" manner – I.E: LINUS Control can override a front panel switch and "wake up" an amplifier that's in standby with its front panel switch off.



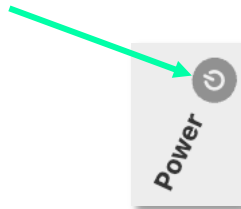
Waking up the amplifier can be done in the AMPS page or in the SETUP page, simply by clicking the grey square on the left.



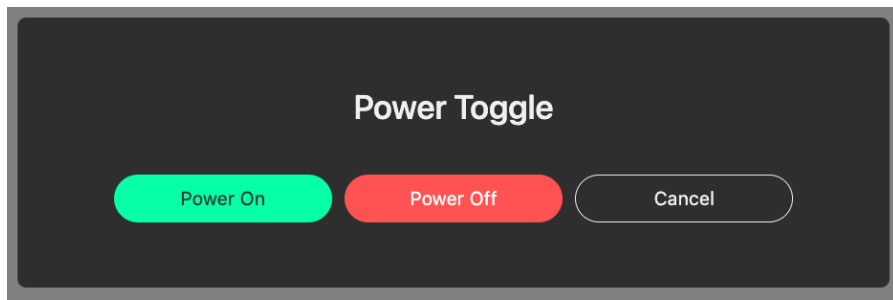


5.7. Global Standby

Amplifiers which are suited with the stand by feature can be switched globally into standby or woken up. Pressing the power symbol button will launch the Power Toggle selection.

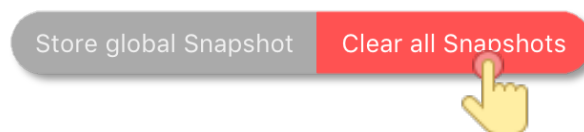


Power On = all modules will be woken up from standby
 Power Off = all modules will be switched to standby



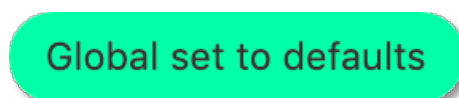
5.8. Clear Global

To clear ALL snapshots in ALL online amplifiers on the network, press the “Clear all Snapshots” button, then confirm this action with the confirmation dialog.



5.9. Global set to defaults

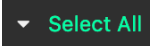
On the AMPS page, a button can be found to launch the “Global set to defaults” dialog:

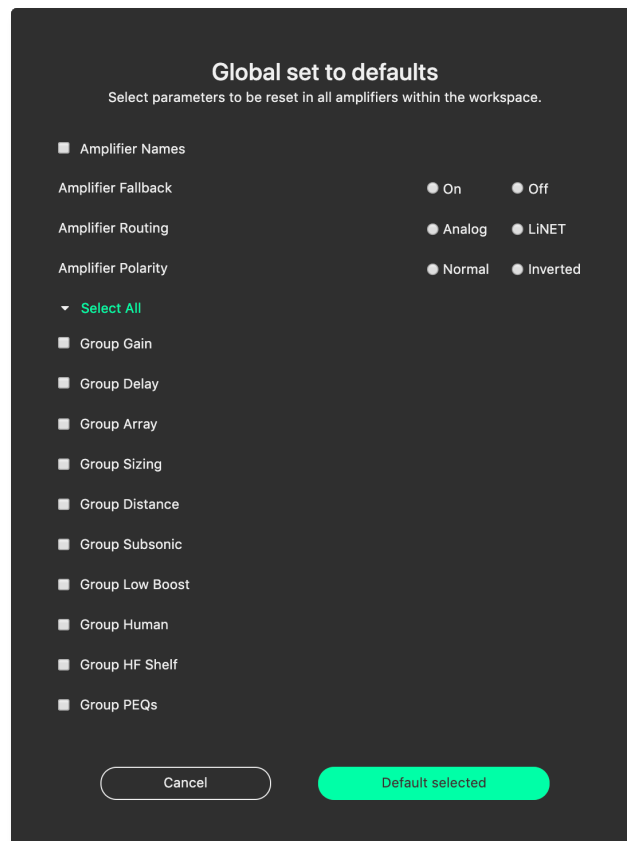


When pressed, the following dialog will be presented. This dialog allows the user to determine which (if any) parameters they would like reinstated to their default values. This is particularly



useful in touring scenarios, where it is desirable to use the same LINUS Control show file from the previous day, but the tuning data would like to be 'zero-ed'.

Pressing  will allow all parameters below this to be defaulted, whilst preserving the Amplifier names, fallback states, routing and polarity information.



5.10. Locking

It is possible to lock the Amplifiers from LINUS Control. There are two levels of locking;

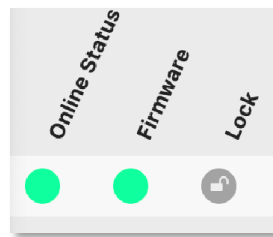
- Display Lock prevents casual changes being made to the amplifier's front panels. The Display Lock can be defeated by pressing both the CH1 select button and the STORE button simultaneously.
- Unit Lock allows mutes to be toggled on the front panel, but prevents parameters being changed from the Front Panel. A password (PIN Code) is needed to unlock the amplifier. The password can be any number, up to 5 digits long. The PIN can be entered from either the Front Panel, or from the LINUS Control software.



Note: On LINUS 14 / CON / 10/ 12C, the Display Lock can be defeated by pressing both the CH1 select button and the STORE button simultaneously

Note: In the event of the PIN code being lost, please contact techsupport@codaaudio.com detailing the scenario that has led to the loss of the PIN Code, together with information that substantiates your request for the PIN code to be reset, and instructions will be given. In the situation with an installed system, the local distributor / dealer & installation consultants / contractors will be contacted first to establish the authenticity of the PIN code reset.

To access the amplifier locking dialog, press the relevant padlock icon on the amplifier entry on the AMPS page:



The following dialog will be presented:



Pressing the (Lock) button to the right of the Display Lock text will toggle the display lock state of the relevant amplifier. An 'L' or 'Padlock' icon will be displayed on the amplifier LCD.

Pressing the (Lock) button to the right of the Unit Lock text will present the following dialog, where a password can be set. (This should be numeric, of any value from 0 to 99999 inclusively):



When the lock is set, the icon will change to (Unlock) shown below:



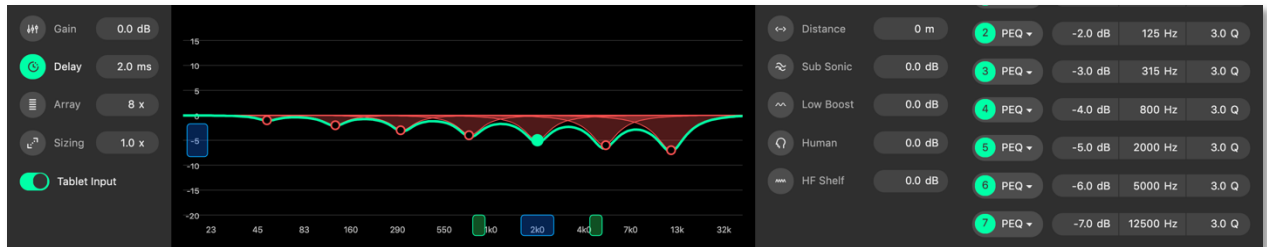
To unlock the amplifier, press this (Unlock) button, then enter the password into the dialog that is presented:





6. Tune Page

6.1. Adjusting Group Parameters



All group tuning parameters are enabled and disabled by clicking on the corresponding icon. A greyed-out icon means the parameter is disabled. A green icon means the parameter is enabled.

When the filter data is adjusted, the filter will be enabled automatically.



6.2. Absolute vs Relative Filters

When a Loudspeaker is assigned to more than one group, an absolute filter can only be active in one group. A relative filter can be active in all groups with the output being the sum of all assigned groups.

Absolute Filters	Relative Filters
Array	Gain
Sizing	Delay
Distance	Human
Subsonic	HF Shelf
Low Boost	
PEQ's	

6.2.1. Gain

The relative gain of the assigned loudspeakers can be adjusted from +12db to -99db.

6.2.2. Delay

The relative delay of the assigned loudspeakers can be adjusted from 0mS to 1000mS. (0 to 200mS in the case of LINUS5-C or LINUS10-C).



6.2.3. Array Filter

When Line Array loudspeakers are assigned to the group, the absolute Array value can be adjusted from 4x to 20x.

This can only be active within one group per loudspeaker.

6.2.4. Sizing Filter

The absolute sizing of the assigned loudspeaker can be adjusted from 0.5x to 2.0x.

This can only be active within one group per loudspeaker

6.2.5. Distance Filter

The absolute distance value for the assigned loudspeakers can be adjusted from 0m to 100m.

This can only be active within one group per loudspeaker

6.2.6. Sub Sonic Filter

The absolute level of the sub sonic filter which can be adjusted from +12db to -20db.

This can only be active within one group per loudspeaker

6.2.7. Low Boost Filter

The absolute level of the low boost filter which can be adjusted from +12db to -20db.

This can only be active within one group per loudspeaker

6.2.8. Human Filter

The relative level of the human filter which can be adjusted from +12db to -20db.

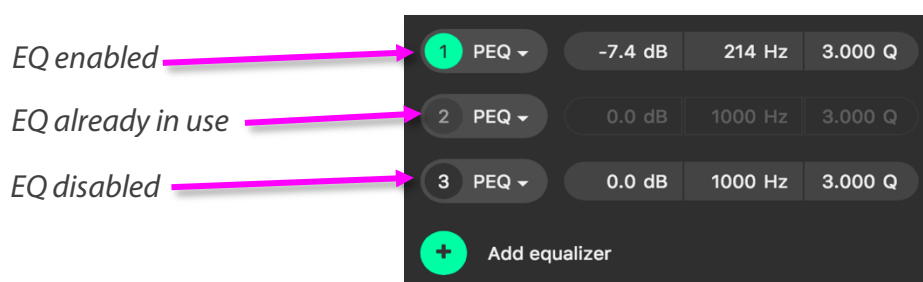
6.2.9. HF Shelf Filter

The relative level of the HF shelf filter which can be adjusted from +12db to -20db.

6.2.10. PEQs

There is a total of 7 equalisers per loudspeaker (4x if using a LINUS10-C or LINUS5-C Amplifier) that can be utilised throughout any of the assigned groups.

- Only EQ's that have not been enabled in another group can be used.
- An already enabled EQ in another group will be greyed out.
- Additional EQ's can be added by clicking the Add equaliser button.

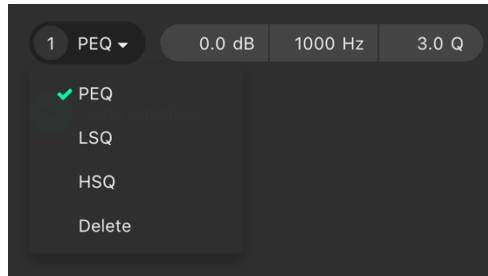




6.2.11. PEQ Modes

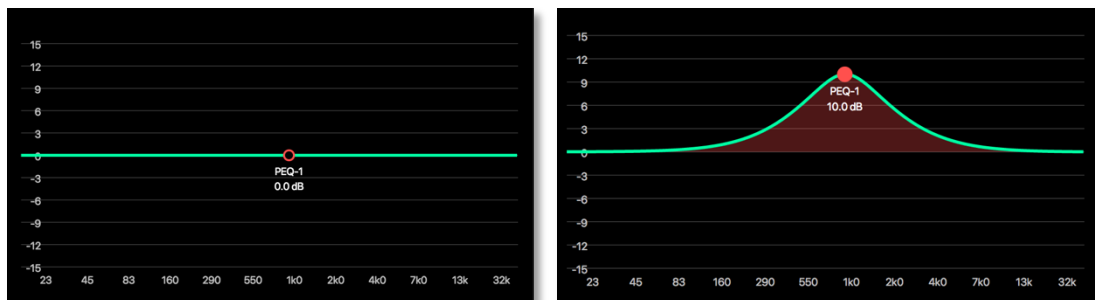
All 7 equalisers can be changed between parametric, high self and low shelf.

Clicking on the dropdown arrow displays the three options, plus the ability to delete the filter.



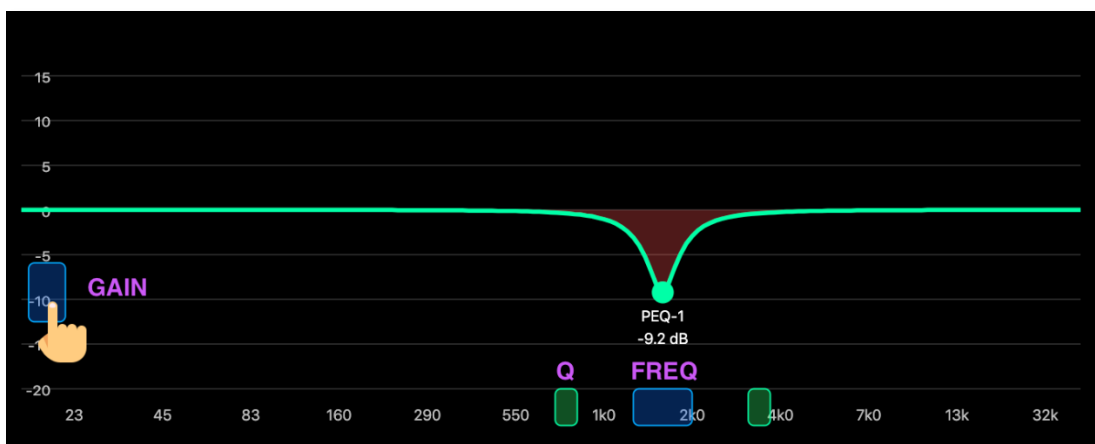
6.2.12. Click & Drag EQ Window

The gain and frequency of the equaliser can be manipulated by left clicking and dragging the corresponding handle. The PEQ number and gain value is displayed when the cursor moves over the handle.



6.2.13. PEQ Handles

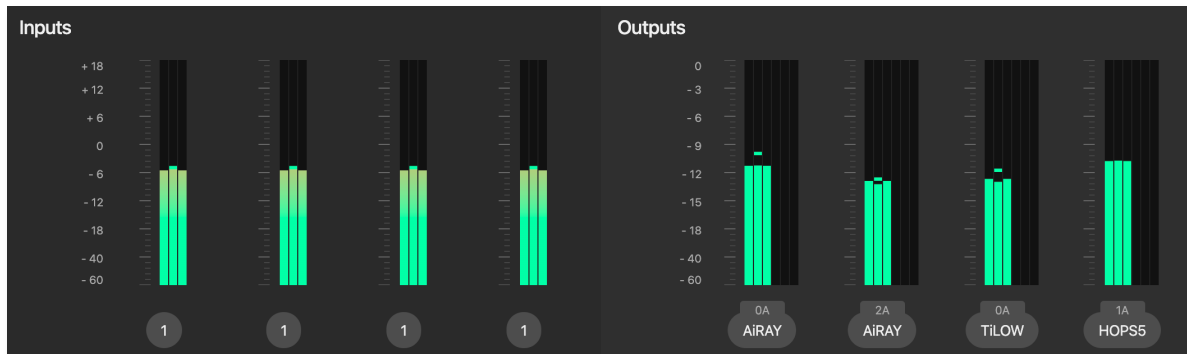
The filters can be manipulated within the PEQ graph by clicking on the filter point on the PEQ graph, then adjusting the handles that appear.





7. Monitor Page

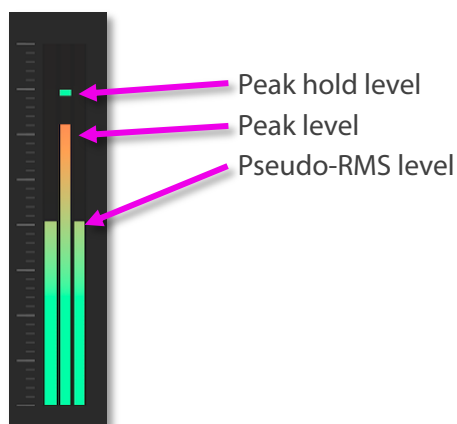
The monitor page provides a detailed view primarily of the metering data for a selected amplifier. By clicking on an amplifier in the workspace the window below will display following:



7.1. Input Meters

The leftmost 4x meters (2x if LINUS10) are the input meters.

The label underneath each input meter states which input is being monitored, and routed to the respective channel. Peak level is shown in the centre, with the calculated effective RMS power level shown either side:



If the input meters are hitting the top (turning orange or red), and the loudspeakers are not in gain reduction, it would be wise to assess the gain structure of the system to prevent overloading or overshooting the input stage. Attenuate the input signal and increase the system gain. Don't be a silly billy and clip the analogue inputs, it's not a sign of intellect!

Amplifier user manuals should be consulted for the latest information, however for reference, the maximum input levels are shown here:

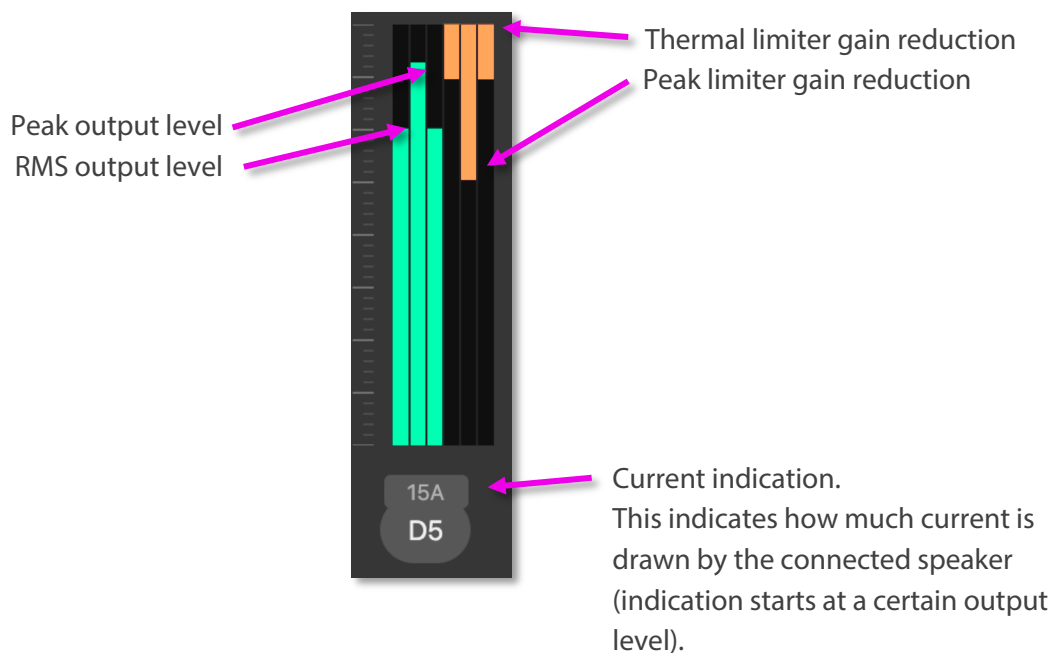


Model	Max input level (analogue differential)
LINUS6.4	+21 dBu / 8.69 Vrms / 24.6 Vp-p
LINUS14	+18 dBu / 6.15 Vrms / 17.4 Vp-p
LINUS CON	+18 dBu / 6.15 Vrms / 17.4 Vp-p
LINUS10	+21 dBu / 8.69 Vrms / 24.6 Vp-p
LINUS12-C	+18 dBu / 6.15 Vrms / 17.4 Vp-p
LINUS10-C	+15 dBu / 4.36 Vrms / 12.3 Vp-p
LINUS5-C	+15 dBu / 4.36 Vrms / 12.3 Vp-p

Note: The amplifiers operate internally at 32bit with double precision, which represents a massive internal dynamic range, so it is next to impossible to run out of headroom within the digital signal path inside the amplifier. It would therefore be very beneficial to pay close attention to the gain structure of the system to get the best results in a given deployment.

7.2. Output Meters

The output meters are drawn to the right of the monitor window. The output meter comprises three areas, the output level (peak & RMS), the limiter gain reduction activity (peak and thermal) and in the lower section the current indication





7.3. Group Meters

Global input and output meter indication of a group and its assigned channels



8. Amplifier Discovery

8.1. Network Scanning

When LINUS Control is taken Online, it will search for all amplifiers on the network. It will do one of two things with these amplifiers, either mark them as 'Online' in the workspace providing certain criteria are met, or place them in the discovery list.

Criteria for marking them as 'Online':

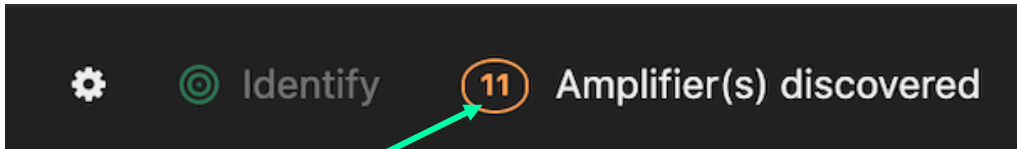
- The ID Matches
- The Loudspeaker Files match on all Channels
- The Amplifier has not had a snapshot recalled from the Front Panel.

If these tests are all true, it will be marked 'Online' and the tuning data present in the show file (Group Assignments / Gain / Delay / Filters / Routing etc) will be pushed to the Amplifier.

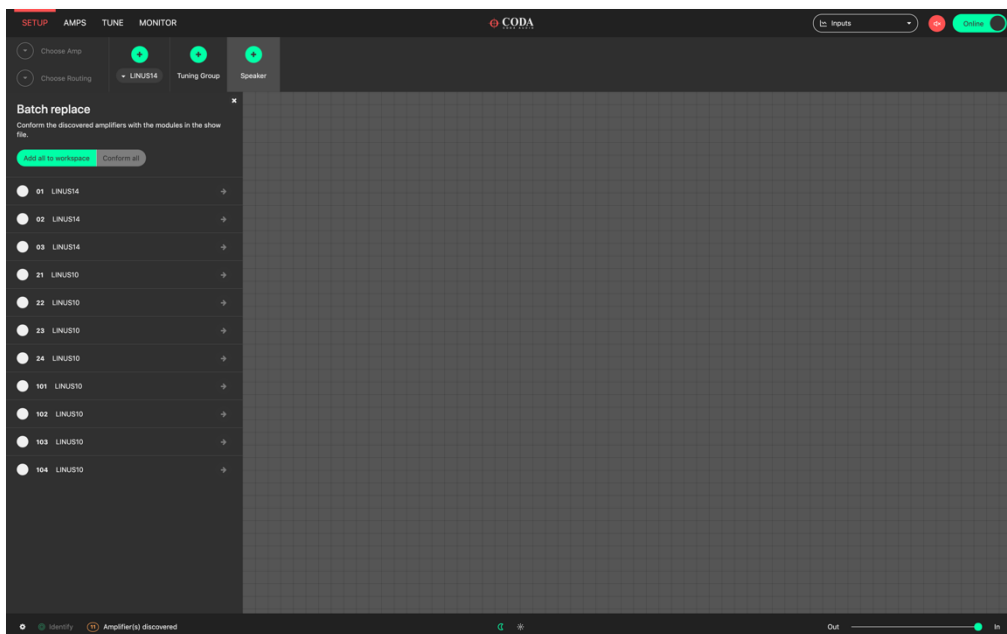
These tests increase resilience in mistakes arising in the operation of the software during a show, which would otherwise result in the changing or loss of audio.



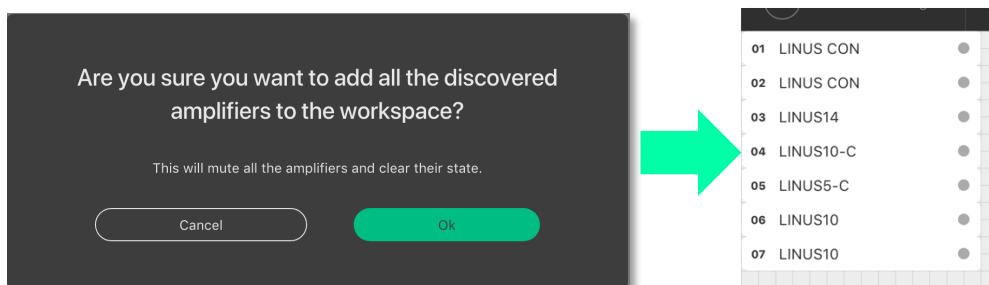
If any of these tests are not true, the Amplifier will be put in the 'discovery list'. The presence of amplifiers in the 'discovery list' is announced in the bottom taskbar. Clicking the announcement will result in the 'discovery list' being displayed.



Click the "Amplifiers Discovered" announcement to see the discovery list:



The "Add all to workspace" button will add the amplifiers that were discovered on the network to the workspace. As the confirmation popup dialog suggests, this will clear the amplifiers active state and mute the outputs.



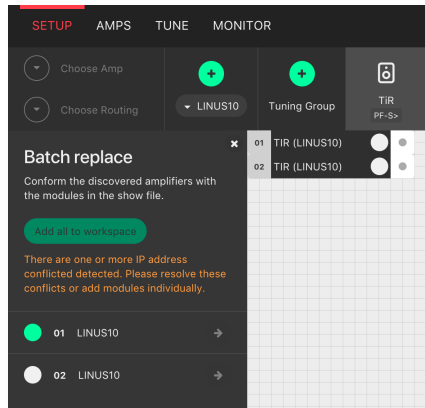
The "Conform All" button will replace all amplifiers of a given ID within the workspace with amplifiers in the discovery list with the same ID, if the amplifier in the workspace has loudspeakers assigned that are compatible with the amplifier in the discovery list.



8.2. ID Conflicts

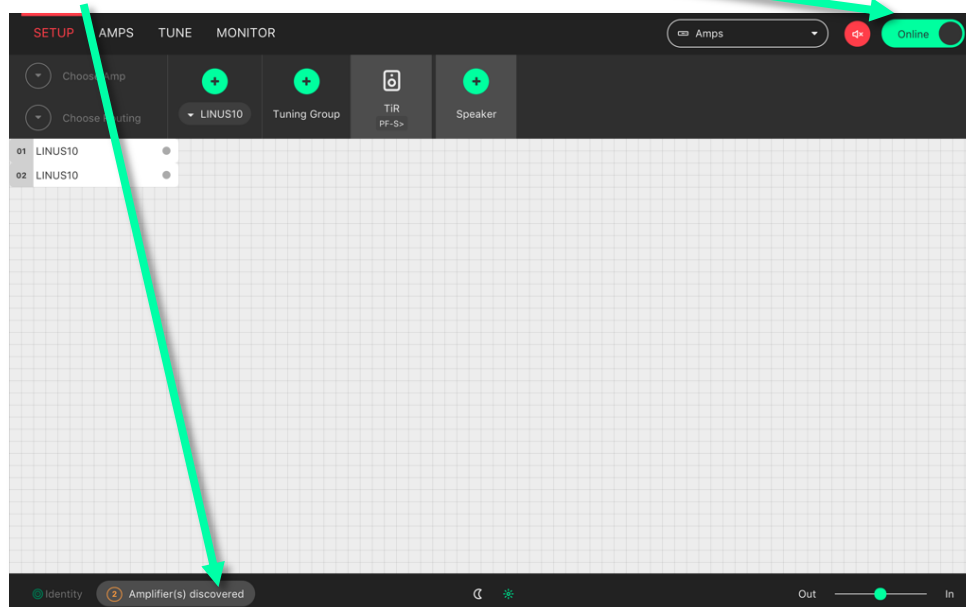
If there are one or more amplifiers in the discovery list that fail one or more of the tests described in section 8.1, however the ID is found in the workspace, an ID conflict is recognised. In this instance, it is not possible to 'Add all to workspace'. Instead you have two choices:

- Add more substitute 'virtual' amplifiers to the workspace, then replace the discovered ones to these, or:
- Replace one of the amplifiers discovered with one already in the workspace.



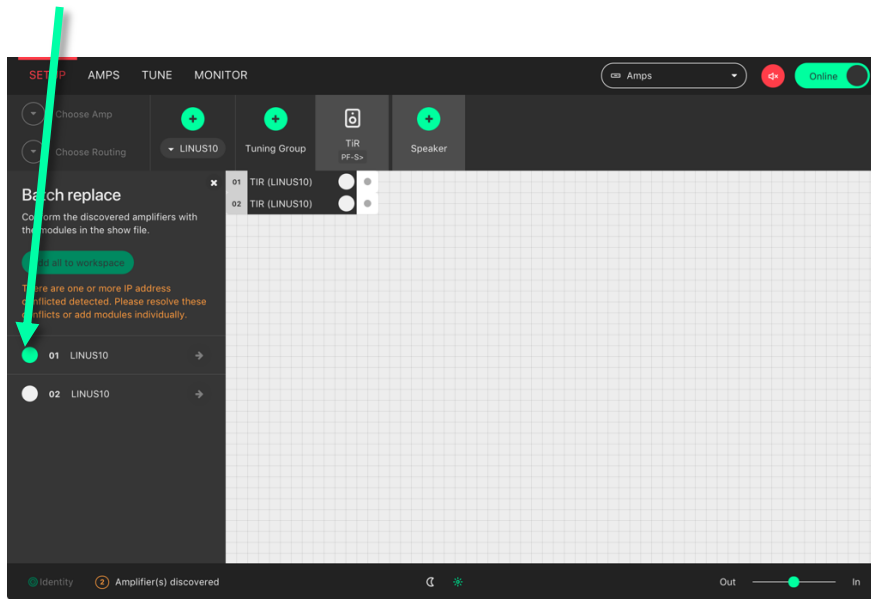
8.3. Matching the discovery list with the workspace

In this example, we have two virtual amplifiers in the workspace, which we want to replace with amplifiers found on the network. Go Online, then Click the discovery list button in the bottom taskbar:

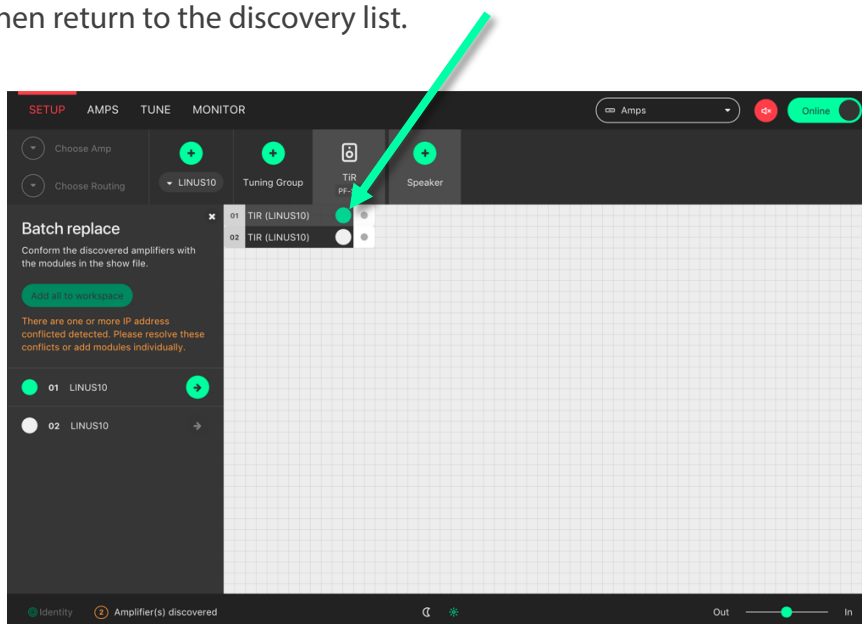




The discovery list is now open & we can see the two amplifiers that were found on the network. Press the circle on the left of the amplifier in the discovery list that you wish to use as the replacement.

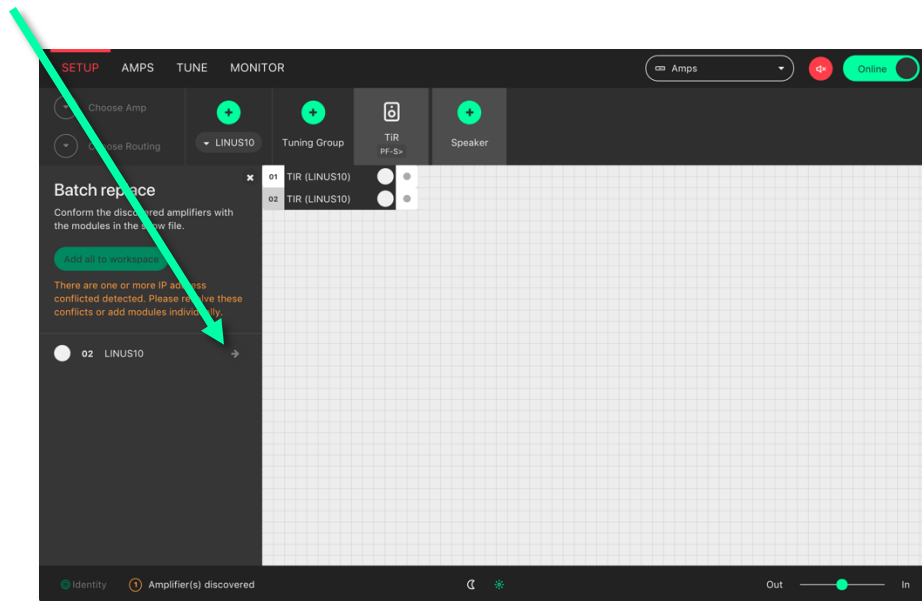


Select the destination amplifier in the workspace that you would like the replacement in the discovery list to take over from. This amplifier can either be Virtual, or Online. If it is an Online amplifier that is chosen as the destination, after the replacement is undertaken, this amplifier will itself then return to the discovery list.





Press the 'arrow' button to invoke the replacement



8.4. Autosave

Show files will also be autosaved to the Users home directory in a folder called \LINUS Control every 10 minutes. A new file be created every 10 minutes.

Do not solely rely on these autosaved files, take manual backups of the show file at key times during the working day, the same as would be done for mixing consoles or other equipment, to prevent & mitigate any possible downtime or other outages.

8.5. State Manager

The entire LINUS Control file can be stored within the amplifier(s) on the network themselves, then recalled at a later date. This enables the user to recall the state of the network to a completely new machine, without having access to a LINUS Control file. The entire state of the LINUS Control file is stored, not just the individual amplifier's parameters within this file, thus it is possible to recover the entire show file comprising all 250x amplifier's worth of data + tuning groups etc. from just one amplifier.

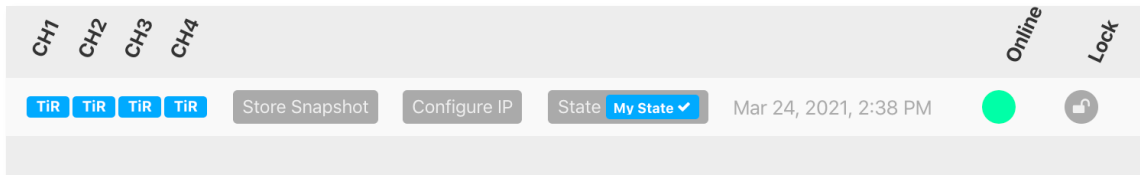
The state is stored to the online Amplifier(s) from the AMPS Page.

The state is recalled from an Amplifier, either from the discovery list, or from the AMPS Page.

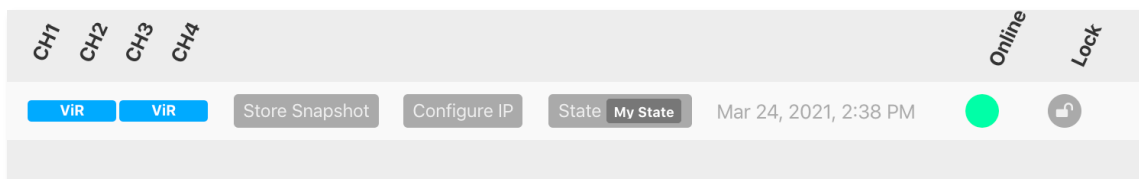
Note: The storing of the state is a manual operation that should be performed when the system engineer / commissioning individual is happy with the current state of the system. Storing the state interrupts audio briefly, so should not be performed during a show.



The current state stored within an online Amplifier is shown on the AMPS page. If the state that is stored within the Amplifier matches **exactly** that of the current state of LINUS Control, the state name is shown with a blue background, and with a 'tick' mark next to it:

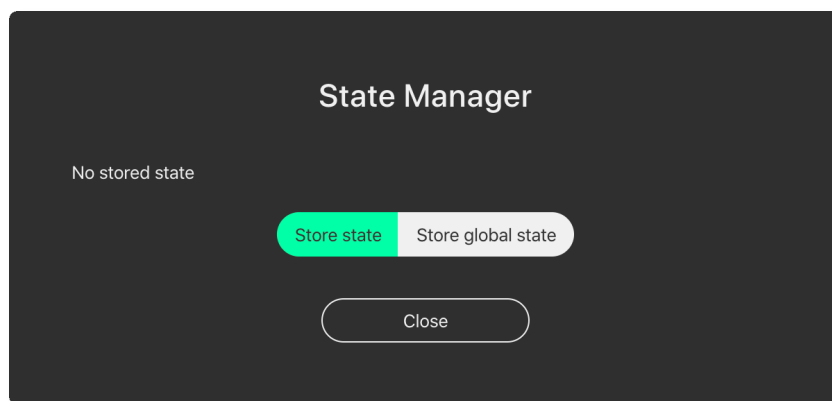


Otherwise, the state will be shown in grey, without the 'tick' mark:

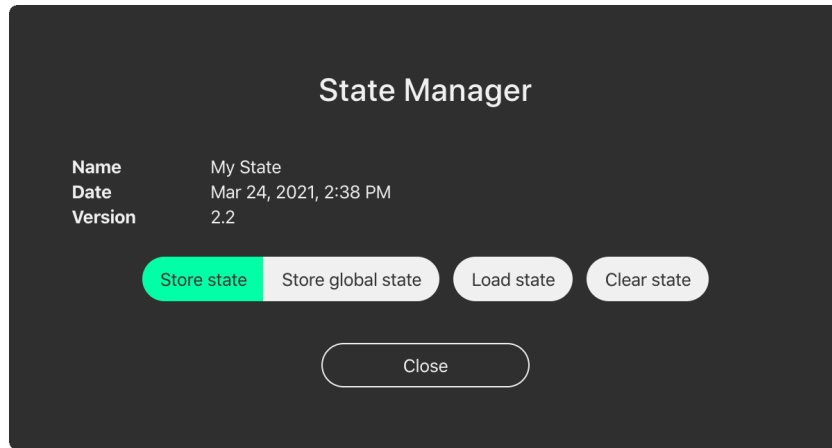


In all cases, whenever there is a state stored within the amplifier, the name of the state is stored within the 'State' button, and the date and time of the store is shown to the right of this.

To store the state of the LINUS Control file to an amplifier, click the State button on the AMPS page; this will present the "State Manager" dialog. You will either be able to store the state to just the one device, or to all devices globally. The picture below shows an amplifier that does not already contain a state:

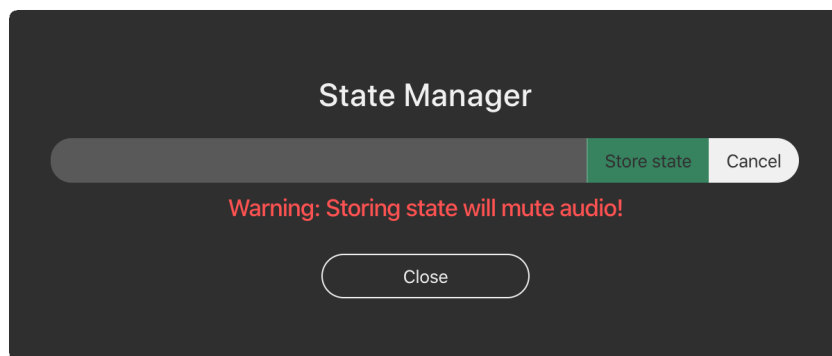


The picture below shows an amplifier that contains a state, entitled "My State", stored on March the 24th 2021 at 14:38; furthermore, this state was stored with LINUS Control v2.2:

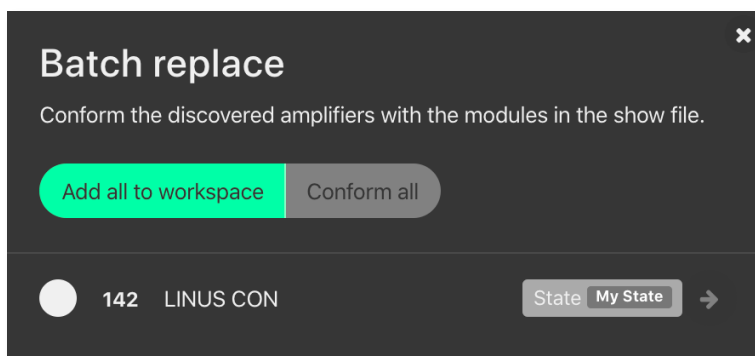


Clicking & confirming the 'Clear state' button, will clear the state from that individual amplifier.

Clicking the 'Store state' or 'Store global state' button will present the following dialog, where you can enter a name for the state store. There is a reminder here, that continuing by clicking 'Store state' will mute audio for a moment, whilst the operation is invoked.



As mentioned previously, the state can either be recalled from one of the amplifiers in the AMPS page, or from the discovery list - from an amplifier that is not yet in the workspace:

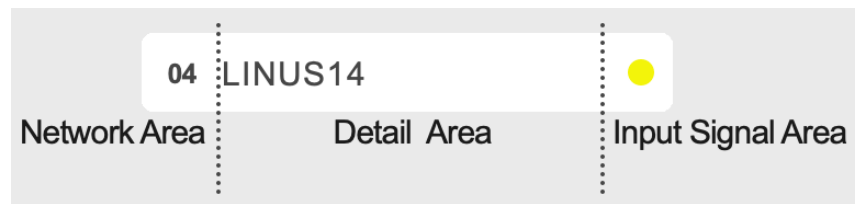


Clicking the state button next to the amplifier, will present the State Manager dialog, where you can inspect the parameters of the state, and choose whether to load it or not.



9. Reference - Amplifier Icons

- The Amplifier icon is 'divided' into three areas.
- These areas are 'independent' of each other.
- Network related indications are on the left - (Network Area).
- The amp ID number is always displayed here.
- Input signal format and signal related events are on the right - (Input Signal Area)
- The middle (Detail) area in the amplifier is where conditions are displayed, depending on the users choice from a dropdown menu in the host program.





	Virtual Amplifier	<i>Network Area = Grey</i>
	Online Amplifier	Network Area = White
	Digital Signal Selected (Fallback Disabled) Clock Present	<i>Input Signal Area = Yellow</i>
	Digital Signal Selected (Fallback Disabled) Clock Not Present	<i>Input Signal Area = Red</i>
	Digital Signal Selected (Fallback Enabled) Digital Clock Locked	<i>Input Signal Area = Yellow with Grey Border</i>
	Analog Signal Selected	<i>Input Signal Area = Grey</i>
	Amp Disconnected	<i>Network Area = Red</i>
	Amp in Standby	Network Area = Black
	Digital Signal Selected (Fallback Enabled) Digital Signal Lost Amp in Analog Fallback	<i>Input Signal Area = Grey. Orange Background.</i>
	Digital Signal Selected (Fallback Enabled) Digital Signal Recovered Amp in Analog Fallback	<i>Input Signal Area = Grey with Yellow Border.</i>
	Amplifier Error	<i>Detail Area = Red Background</i>



10. References – Keyboard Shortcuts

Keyboard shortcuts have been implemented to enable the user to reach the required screen as fast as possible. The shortcuts are disabled when typing values into either name fields or numerical fields.

Action	Shortcut
Amplifier detail view \ display amplifier type	1
Amplifier detail View \ display amplifier ID and IP address	2
Amplifier detail View \ display amplifier name	3
Amplifier detail View \ display output loudspeaker assignments	4
Amplifier detail View \ display amplifier input routing and levels	5
Amplifier detail View \ display mute buttons and output levels	6
Amplifier detail View \ display the output channel combined gain	7
Amplifier detail View \ display the output channel combined delay	8
Workspace view \ setup page	S
Workspace view \ amplifier page	A
Workspace view \ tuning page	T
Workspace view \ monitor page	M
Add Amplifier to workspace	Cmd + F
Add Group to workspace	Cmd + G
Select all items in workspace	Cmd + A
Delete selected item	Backspace / Del