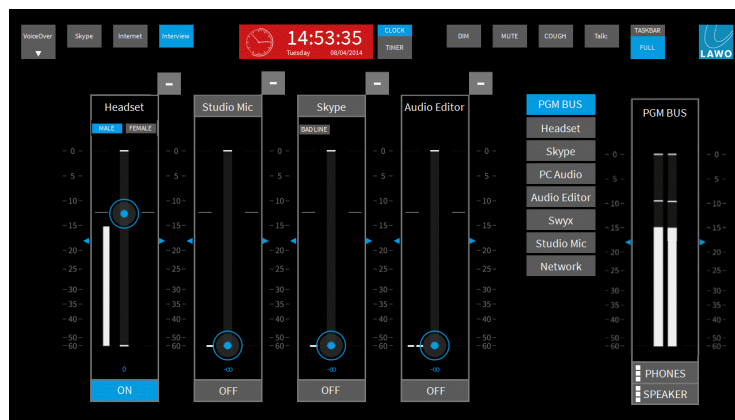


RELAY

VRX⁴ Virtual Radio Mixer

User Guide

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To obtain the latest documentation and software downloads, please visit:
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1. Introduction

Welcome to **RELAY VRX⁴**.

About this Manual

This document describes how to install, configure and operate the system.

Look out for the following which indicate:

Notes - points of clarification.

Tips - useful tips and short cuts.

Attention: Alert you when an action should *always* be observed.

Software Updates

The latest User Guides and software are available from the **Downloads** area at www.lawo.com (after **Login**).

Lawo User Registration

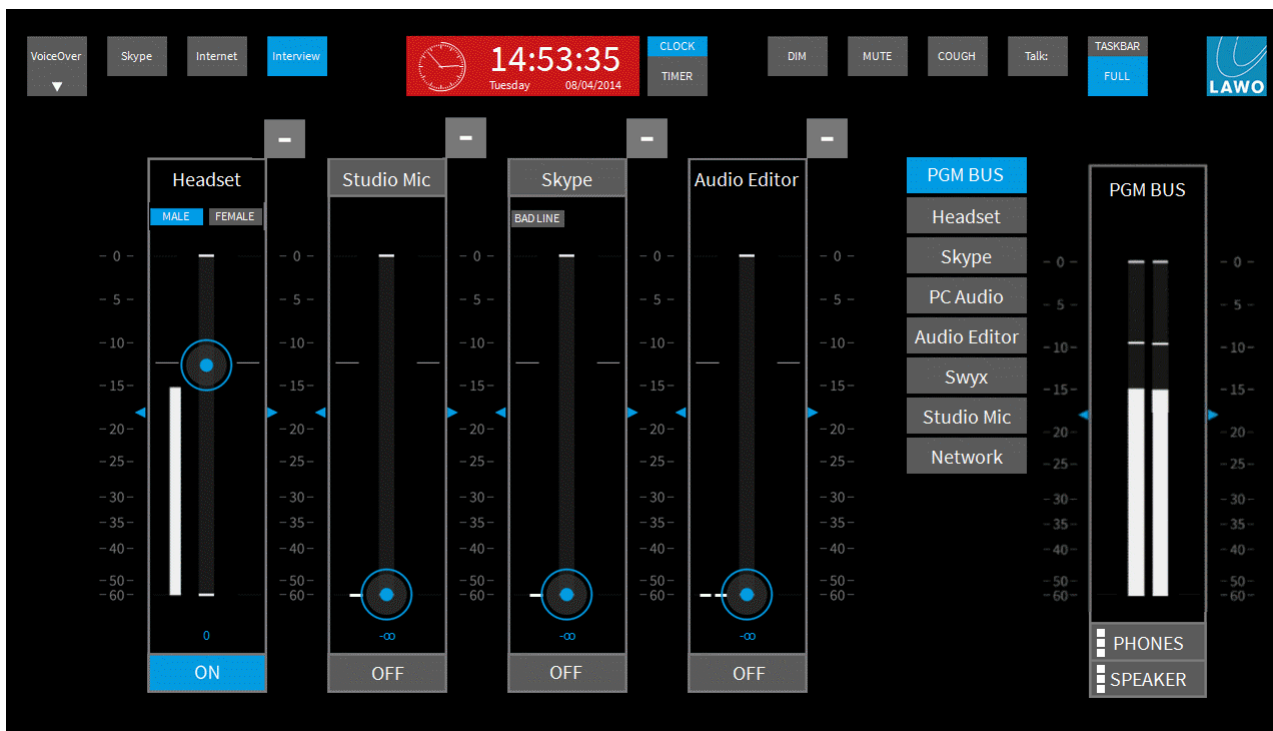
For access to the **Downloads** area and to receive regular product updates, please register at:

www.lawo.com/registration.

2. Product Overview

2.1 Introducing RELAY VRX

RELAY VRX⁴ is a software application which provides a 4-channel stereo audio mixer. It runs on a Windows PC, with all functions controlled via the Graphical User Interface (GUI):



Users can mix up to 4 channels, mono or stereo, selected from a pool of 12 sources (prepared in Admin mode). Each channel has a fader for level control, input metering, on/off button, talkback and "easy processing" buttons (prepared in Admin mode to apply signal processing such as EQ and Compression).

The 4 channels are mixed to the stereo programme bus, metered on the right of the GUI. A stereo monitor bus is output to both headphones (**PHONES**) and loudspeaker (**SPEAKER**), with individual level control. Users can listen to the programme bus, or any source from the source pool.

An N-1 output, also known as a clean feed or mix minus, can be created for up to 4 of the 12 audio sources. This enables a contributor to hear the programme mix minus themselves.

Up to 16 snapshots provide easy access to commonly used setups, and 16 user keys offer fast access to functions such as a **COUGH** switch, monitor **DIM**, **TALK** to an N-1, GPIO commands, etc. In each case, the main functions are always directly available with additional options stacked in drop-down menus (indicated by the down arrow).

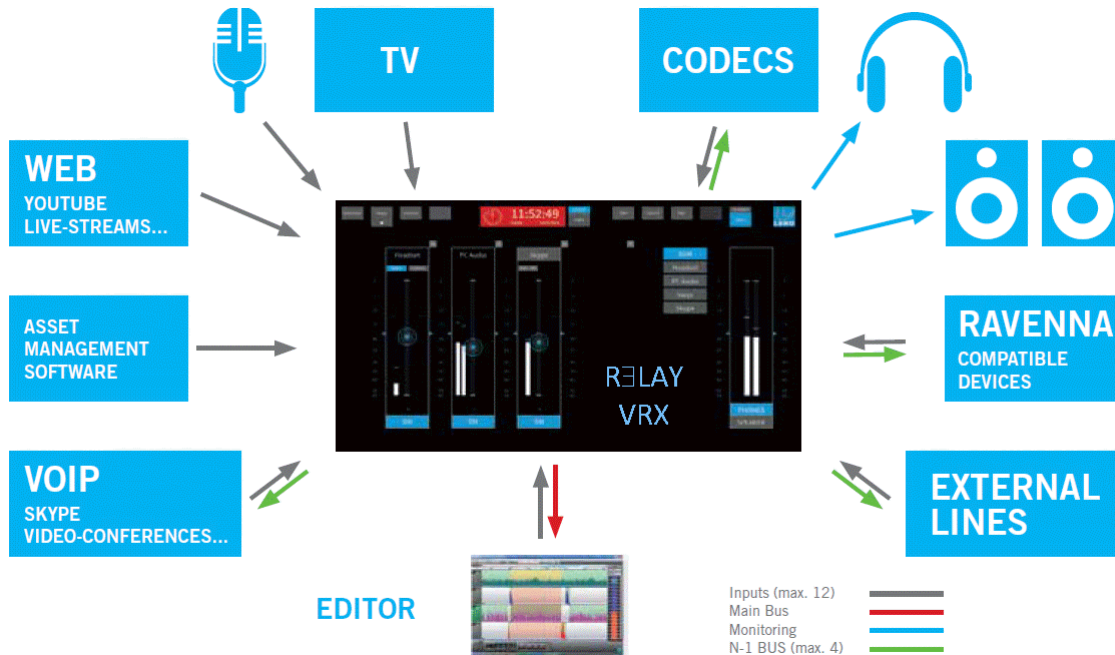
The real time clock indicates the on-air state (red = on-air, grey = off-air), and also offers a variety of **TIMER** functions to assist with programme timings.

The GUI can switch between two views: Fullscreen or Taskbar; the example above is Fullscreen. In Taskbar view, the main functions are condensed onto a single Taskbar which remains visible while accessing other applications.

The GUI also supports two modes: User or Admin; the example above shows User mode. Administrator mode is password-protected and is used to prepare audio sources and processing, the bus outputs, snapshots, user keys and all global settings.

2.2 Third-Party Integration

In the background, the software supports all non-proprietary audio interface drivers: ASIO, WDM, WASAPI and MME. This means that audio from all devices on a single computer can pass through **RELAY**:



One of the main benefits is that users can work with different interfaces simultaneously. For example, a journalist may record their own microphone and an interviewee, connected via their chat software, at the same time. Normally this isn't possible in Windows® applications, as only one audio i/o device may be specified at a time.

To integrate with the outside world, 8 GPIs and 8 GPOs may be assigned either to the five physical ports of an **OnAir4**, or to software clients via Ember+. This allows the GUI to control functions within an external device (such as trigger a fader start), or be remotely controlled (e.g. respond to talkback from an external comms system).

Once installed, **RELAY VRX⁴** can start either as an application (with full GUI control) or as a service (where prepared audio paths and RAVENNA streams run in the background). The latter is ideal for Playout Servers or remote-controlled **RELAY** devices where you wish to restrict the user access. The starting and stopping of different applications and services is managed by the **RELAY Service Manager**.

2.3 OnAir4

Optionally, the software can be purchased with its own dedicated audio interface, the **OnAir4**. This creates a complete stand-alone system, without the need for third-party hardware or drivers.

The **OnAir4** can be used with either **RELAY VRX⁴** or **RELAY VRX⁸**:



Each 1RU, 19-inch unit provides:

- 4 mono mic/line inputs (XLR+TRS combo connectors)
- 4 stereo headphone outputs (TRS)
- 4 mono line outputs (2xXLR, 2xTRS)
- 1 stereo S/PDIF digital input (RCA)
- 1 stereo S/PDIF digital output (RCA)
- 5 GPI inputs / 5 GPI outputs (DB-15)
- Lawo "plug-in" processing.

There is also an AES 67 / RAVENNA Gigabit Ethernet port for connection to the host computer (or IP network).

Note that the **OnAir4** can connect to your PC either directly, as shown above, or via a RAVENNA compatible network*.

*In a networked installation, all components (network switches, etc.) *MUST* meet the qualifying data network requirements.

3. Installation

This chapter describes how to install the software, set up the OnAir4 (optional), assign the virtual audio drivers and activate the license.

3.1 Preparation

R3LAY VRX⁴ is delivered as a software download only. You will need a customer login to download the installer, and a valid software license to activate the product.

To host the software, you will need a Windows PC which is not supplied.

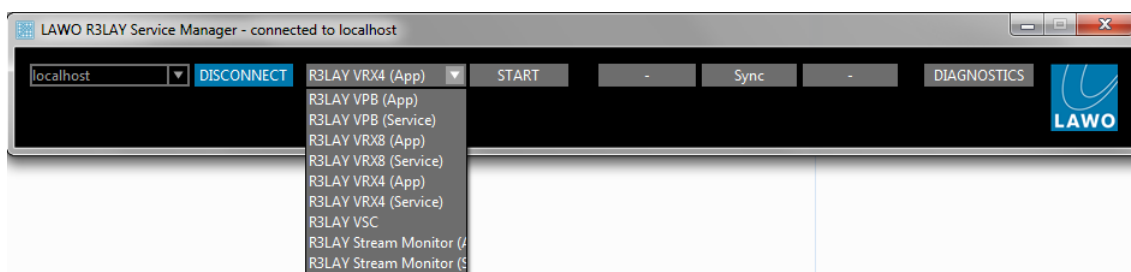
To get your system operational, please complete each of the following steps:

1. Check that your host PC meets the [system requirements](#).
2. Run the **R3LAY VRX⁴** [installer](#).
3. [Setup](#) the **OnAir4** (if applicable) and [update](#) its firmware.
4. Assign the [virtual audio drivers](#) for each software application you wish to connect.
5. [Activate](#) your software license.

3.1.1 Installing Multiple R3LAY Products on a Single PC

The **R3LAY** product family comprises several independent products: **VRX⁴** and **VRX⁸** (**Virtual Radio Mixers**), **VSC** (**Virtual Sound Card**) and **VPB** (**Virtual PatchBay**). In addition, the **AoIP Stream Monitor** provides a tool for monitoring RAVENNA streaming connections. **VRX**, **VPB** and **Stream Monitor** can run either as an application (with full GUI control) or as a service (in the background) whenever you start the PC.

You can install multiple products on the same PC, but they cannot run at the same time. If more than one flavour of **R3LAY** is installed, you can choose to stop and then start a different service or application from the **R3LAY Service Manager**:



3.1.2 Controlling R3LAY Services on a Remote PC

If multiple **R3LAY** PCs are connected to the network, then you can use the **R3LAY Service Manager** to connect to a remote PC, and then start or stop a **R3LAY** application or service running on the remote host. See [Connecting to a Local Host or Remote PC](#).

All settings are stored locally on the connected PC. If you wish to start **R3LAY VRX**, **VPB** or **Stream Monitor** as an application, then a user must be logged in on the remote PC (in order to open the application GUI).

3.2 System Requirements

RELAY Virtual Radio Mixer applications are processor-intensive, and can be very demanding on a computer's resources, especially the CPU.

While it is virtually impossible to keep track of the ever-changing list of CPUs available, we do have some guidelines that can assist you in making your selection. These have been selected to help ensure that your RELAY software operates properly using any combination of included features.

Look for CPUs and PCs with the following characteristics:

- A multicore processor specified for desktop or server applications.
- Processor should have a CPU benchmark score of 8,000 points, minimum.
- System must have 8GB minimum RAM.
- Operating system should be Windows 7, 8, 8.1,10 (32 and 64 Bit), Server2012 R2 or Server2016.
- Dedicated graphics card with a minimum benchmark of 2800.
- Gigabit Ethernet LAN connection. Better results are more likely to be achieved by using separate NICs for "normal" traffic and streaming.

To help you determine the best CPU for your RELAY system, we recommend PassMark's excellent website. You may be familiar with their benchmarking software; they also maintain a large list of CPUs with performance scores at https://www.cpubenchmark.net/cpu_list.php.

In general, you must select a CPU with 8,000 points or higher for optimal results. A score lower than 8,000 will likely result in performance problems. The more programs and tasks required to run while using RELAY, and the more streams the computer has to work with, the higher the CPU benchmark should be.

Warning Notices

Operating systems not listed above have not been thoroughly tested by Lawo. Although you may be able to run RELAY on these untested operating systems, we cannot support such installations; neither can we support RELAY on any computers using pre-release or beta OS versions.

Although RELAY may run on computers with CPUs which do not meet the benchmark requirements stated here, we cannot ensure that all software features will operate correctly unless that power requirement is met, and cannot support RELAY on any computers which do not meet the minimum hardware requirements.

Additional Notes

As some audio devices and network interface cards behave in a different and unpredictable manner after recovering from a power-saving sleep state, it is recommended NOT to allow your computer to enter a sleep state while using such devices with RELAY. You can configure your power plan in Windows®, by selecting the "Control Panel -> Power Options" - choose a plan which does not put the computer to sleep.

3.2.1 Running RELAY in a Virtual Machine

Lawo is a VMWare Partner, and so to run RELAY in a Virtual Machine we recommend VMWare Server 6.5 and VSphere.

To familiarize yourself with the VMWare environment, please read the following Technical White Papers (from VMWare):

- [Deploying Extremely Latency-Sensitive Applications in VMware vSphere 5.5](#)
- [Best Practices for Performance Tuning of Telco and NFV Workloads in VSphere](#)

When configuring VMWare for use with RELAY, it is essential to use the latency sensitivity settings (mentioned in the white papers), and to follow the “100% reservation rule” for CPU and memory.

In addition to VMWare’s recommendations, it is essential to configure a separate, standalone network for streaming, with additional NICs and an additional VSwitch.

3.3 Installing the Software

The latest **LawoR3LAYVRX4Setup** installer can be downloaded from www.r3lay.com/pages/manuals-downloads.

1. Copy the installer onto your computer and double-click on its icon to start the setup wizard.

If an earlier version of **R3LAY VRX4**, or another **R3LAY** flavour, is running on the computer, then it is best to [stop](#) and [disconnect](#) the current service, and then [close](#) the Service Manager GUI before continuing.

2. Select **Next** and follow the Wizard's instructions accepting the default options provided.

When the "Select Additional Tasks" screen appears, you may choose the following options. Note that the installer will detect which Virtual audio and RAVENNA Network drivers are currently installed; if there is a newer version, then the option is selected; if you already have the latest version, then the option is not ticked. If in doubt, leave the default options selected.

➤ Virtual audio drivers

These options determine which audio drivers will be installed:

- **ASIO** - installs a DLL which is loaded by devices using an ASIO driver. Most professional interfaces and applications use ASIO drivers (for lower latency).
- **WDM-Drivers** - installs 8 instances of the standard WDM driver. These are used by software applications such as chat software or media players.

➤ RAVENNA

- **Network Driver** - installs the RAVENNA network driver. The driver optimises network packet transmission for RAVENNA streaming.
- **Add firewall rules** - adds pre-determined firewall rules which may be required by the **Network Driver**.
- **Activate HPET (High Precision Event Timer)** - appears if you are running an OS prior to Windows 10. In this instance, HPET should be activated for proper RAVENNA timing.

Note that Windows 10 uses an improved internal clocking mechanism named "TSC_INVARIANT", which by default is active. Therefore, when running Windows 10, you will not see the **Activate HPET** option.

➤ **Licensing** - tick this option to install the **CodeMeter Runtime** software required for [licensing](#). If the software is already installed, then selecting this option will update the CodeMeter release and configure a new Cm container.

➤ **Additional icons** - tick this option to create a desktop icon for the application.

4. Select **Next** followed by **Install** to proceed with the installation.

If an existing **R3LAY** service is running, then the install may fail and an error dialog box will appear. Select the option to "automatically close the application(s)", **Abort** the install and then re-run the installer from step 1. Once the active **R3LAY** service or application has been closed, the installer should run successfully.

5. After the **R3LAY** installation, the **CodeMeter Runtime** Wizard appears (if **Licensing** has been selected during step 3). Select **Next** to install the licensing software. Or, **Cancel** to quit this part of the installation - for example, if the PC is already running the latest **CodeMeter Runtime** release.

6. After a successful install, a confirmation window appears - you will be prompted to restart the computer (if any of the "requires new start" options were selected during step 3). Select **Yes** (or **No**) and then click on **Finish**.

After the restart, you should see the **R3LAY Service Manager** icon in the taskbar:



If you have any problems with the software installation, please contact your local Lawo representative or email support@lawo.com.

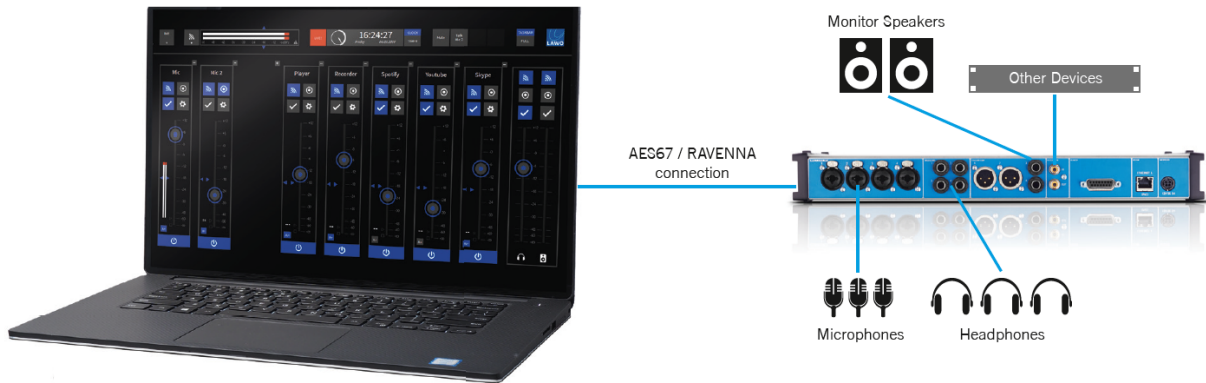
3.4 Uninstall & Updates

The software can be uninstalled in the usual Windows manner:

1. First, [stop](#) and [disconnect](#) the current application or service, and then [close](#) the Service Manager GUI.
2. Then open the "Uninstall or change a program" Control Panel, select the **RELAY VRX⁴** program and click **Uninstall**.

To update to a new version, follow the installation procedure described [earlier](#). There is no need to remove older versions of the application. The latest configuration is stored locally and is loaded automatically after the update, see [Saving the Configuration](#).

3.5 Setting up the OnAir4



If you have purchased an **OnAir4**, then please complete the following steps to set up the unit with your system. The frame installation and connections are covered later in the [OnAir4](#) chapter. Here we will describe how to setup the unit once the **RELAY** software has been installed.

For simplicity we will assume that you are making a direct network connection between the **OnAir4** and **RELAY VRX4** host PC as shown above. If connecting via an IP network, then all components (network switches, etc.) *MUST* meet the qualifying data network requirements. You can find more details on this topic in the separate "AV Networking Guide".

Note that it is important *NOT* to connect the **ETHERNET A** port of the **OnAir4** to your host PC until the correct network settings have been configured (see steps 2 and 3).

1. Apply power to the **OnAir4** by connecting the external 12V DC power supply.

Note that the **12V DC IN** port uses a locking 4-pin DIN connector. To fully insert or remove the connector, the collar on the power cable end must be pulled back, away from the connection:



The unit has no on/off switch and starts automatically as soon as power is applied - the **POWER** LED on the front panel illuminates. The front panel status display shows "**initializing...**" while the unit is booting. When the boot process is complete, you will see "**Device ID**":



2. Check the **Network Settings** of the **OnAir4** using its front panel [status display](#).

To do this, turn the rotary control until you see **Network Settings** in the display, and push down to enter the menu. Then turn again to scroll through the parameters:

- **Network Mode** - should be set to **Static**.
- **IP Address** - the default IP address = **192.168.110.251**.
- **Netmask** - the default netmask = **255.255.255.0**.
- **Gateway** - the default gateway = **0.0.0.0**.

If necessary the settings can be [edited](#) from the front panel.

Note that you can use a different static **IP Address** as long it is unique, and lies within the same range as that of the host PC.

Check the IP address of both the **OnAir4** and your host PC carefully. If there is an IP conflict, then the system will not operate correctly.

3. On the host PC (where **RELAY VRX⁴** is installed), configure the TCP/IP settings for the network interface which will connect to the **OnAir4**.

You can do this by opening the **Network Connections** in the Windows **Control Panel**, and double-clicking on the LAN port - make sure that you select the correct port if your PC supports more than one.

Select the **Internet Protocol Version 4 (IPv4)** entry in the list and click on the **Properties** button. Then edit the **IP address**, **Subnet mask** and **Default gateway** fields as follows:

- **IP Address** - this must be unique, and lie within the same range as that of the **OnAir4** - for our example: **192.168.110.nnn**
- **Subnet mask** - this must match that of the **OnAir4** - for our example: **255.255.255.0**
- **Default gateway** - in our example, this field can be left blank.

Click on **OK** to confirm the new settings.

4. If you have not already done so, [install](#) the **RELAY VRX⁴** software (but do not start the software until after the **OnAir4** is connected).

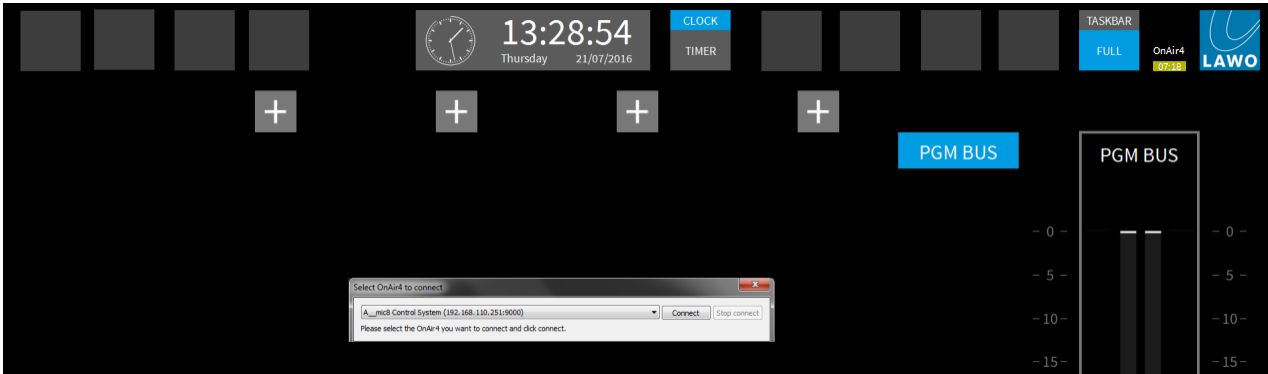
5. Using the network cable supplied, connect your PC's network interface to the **ETHERNET A** port on the rear of the **OnAir4**:



6. Start the **RELAY VRX⁴** software by selecting its application icon from the Windows **START** menu or desktop (if available).

3. Installation

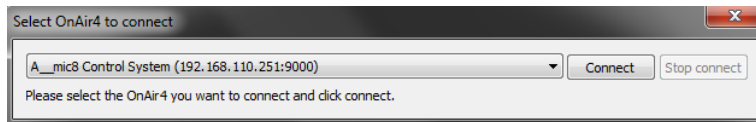
On startup, the software scans the network and, if a new **OnAir4** is detected, the following pop-up window appears. Note that the scan may take some time.



If, after a minute or so, the "Select OnAir4 to connect" window does not appear, then there are three possibilities:

- This is not the first time that the **OnAir4** has been connected - in which case, the software remembers the device and automatically reconnects on startup. You should see the **OnAir4** status flag (at the top right of the GUI) turn yellow and then blue, as described in step 8.
- The software is using the wrong network interface - this can occur if your PC supports more than one network port. In this instance, click on the **Lawo** logo to open the [Settings](#) menus, and select the [Global Settings -> RAVENNA](#) tab. Choose the correct network interface from the **NIC 1** drop-down menu, and save this interface by clicking on **FINISH**. Now [close](#) and [restart](#) the application, and use the [Global Settings -> OnAir4](#) tab to force a manual **Connect**.
- There is a problem with the network communication between your PC and **OnAir4** device. Check your physical connections. Then check both the **Network Settings** on the **OnAir4**, and TCP/IP settings of your PC's network interface card. Open the [RAVENNA Web UI](#) to test the communication. If can open the Home page, then the network communication is ok.

7. Choose the unit you wish to connect to, from the drop-down menu, and select **Connect**:

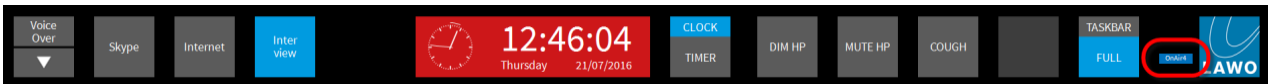


The front panel display on the **OnAir4** updates to show "**Press button to connect...**".

8. Press down on the rotary control to connect the unit.

The **OnAir4** status flag (at the top right of the GUI) updates as follows:

- **Grey** = unconnected.
- **Yellow** = device is connecting.
- **Blue** = device is connected and ready for operation:

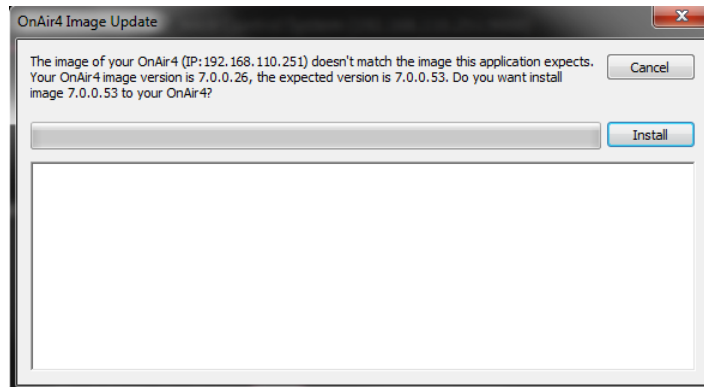


Note that the connection process may take a while, so please wait at least 30 seconds for the status flag to update. As part of the connection process, the software checks the firmware version on the **OnAir4** unit - if an update is required, then you will be prompted to perform the install.

From here on, the software remembers the **OnAir4**, and will automatically reconnect each time you power off and on the unit or restart the **RELAY** software. At any time you can force a manual connect (or disconnect), from the [Global Settings -> OnAir4](#) tab.

3.5.1 Updating the OnAir4 Firmware

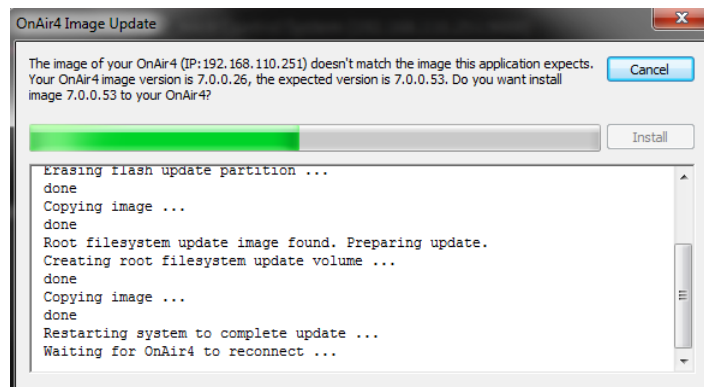
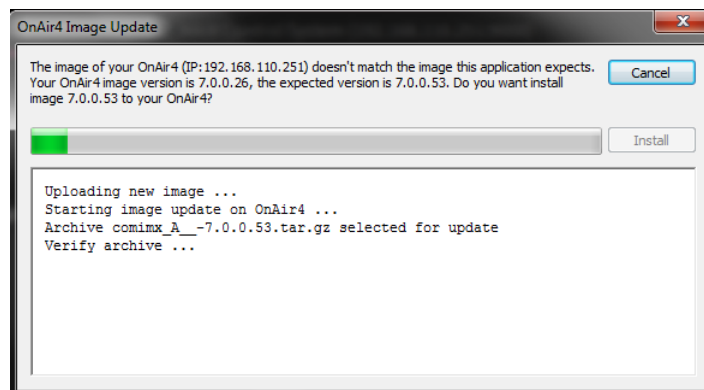
Whenever **RELAY VRX⁴** connects to an **OnAir4** (either at startup or by forcing a manual **Connect**), the software checks the firmware version on the unit - if an update is required, then the following pop-up window appears:



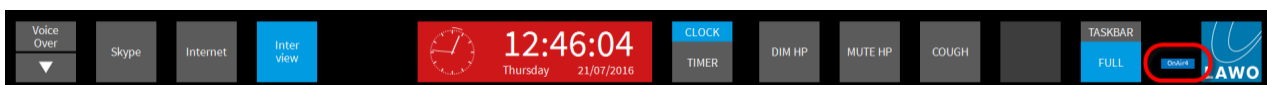
Click **Install** to start the update.

Note that you will need an internet connection from your host PC in order to download the image files. This can be achieved using a second wired LAN Network Interface or WiFi connection.

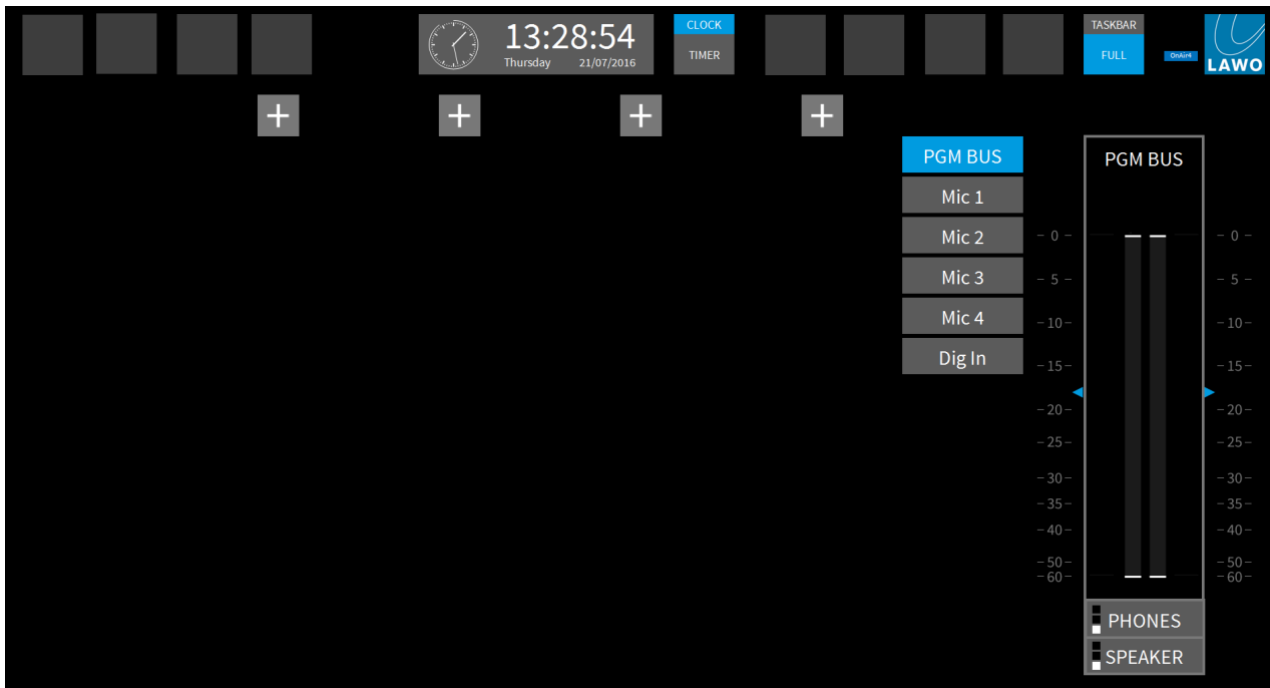
The green bar shows the progress of the download and update - this can take several minutes:



Once the update is complete, the **OnAir4** will reboot and then reconnect. The system is fully operational once the "Image Update" pop-up closes and the **OnAir** status flag turns blue:



3.5.2 OnAir4 Default Configuration



When **RELAY VRX⁴** is started for the first time with an **OnAir4** connected, a default configuration is loaded:

Sources

Five sources are created: **Mic 1**, **Mic 2**, **Mic 3**, **Mic 4** and **Dig In**.

The **Mic** sources are all mono, with inputs taken from the **MIC/LINE IN 1 to 4** XLR/TRS connectors; the input gain is set to +60dB and phantom power is turned off.

The **Dig In** source is stereo, with its input taken from the **DIGITAL IN S/PDIF** connector.

All five sources are assigned to the **PGM BUS**.

You can assign a source to a channel by clicking on the **+** buttons above each channel strip.

Monitoring

The stereo headphone output (**PHONES**) is routed to the **PHONES 1** TRS connector.

The stereo loudspeaker output (**SPEAKER**) is routed to the **LINE OUT 1 & LINE OUT 2** XLR connectors.

Both outputs are set to a level of -40dB.

Output Routing

The stereo **PGM Bus** is routed to the **LINE OUT 3 & LINE OUT 4** TRS connectors on the rear panel.

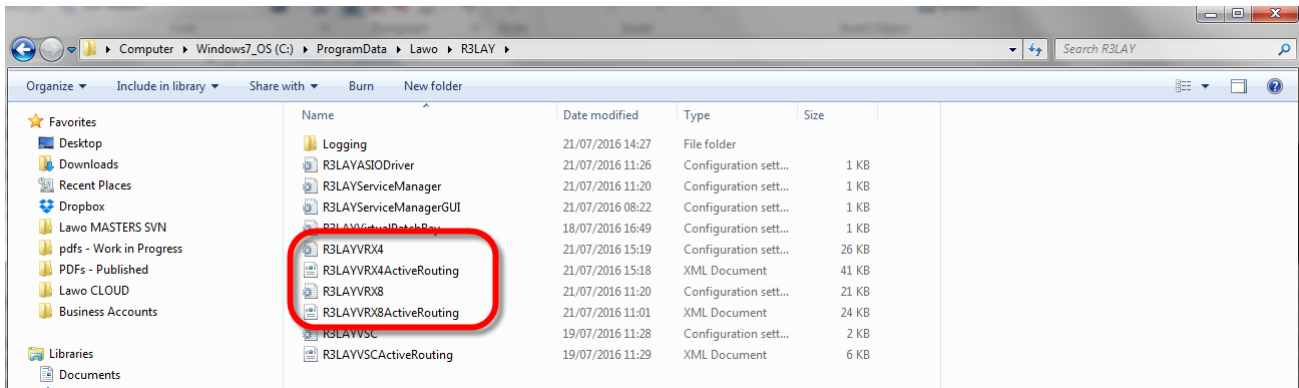
See [Source Configuration](#), [Bus Setup -> Monitoring](#) and [Bus Setup -> PGM Bus](#) for details on how to edit the configuration.

Resetting to the Default Configuration

If the software has already been started without an **OnAir4** connected, then it will load its existing configuration. In this instance, you can either configure the **OnAir4** sources and outputs manually, or use the following steps to reset the system to the default **OnAir4** configuration.

Note that these steps will delete the complete configuration including all existing sources, snapshots, user keys and global settings. Therefore, they should only be used if you wish to start from a completely "clean" system:

1. [Close](#) the application if it is open.
2. Using Windows Explorer, locate the following folder: C:/ProgramData/Lawo/R3LAY/



3. Delete both of the configuration files relating to your system, either **R3LAYVRX4** and **R3LAYVRX4ActiveRouting**, or **R3LAYVRX8** and **R3LAYVRX8ActiveRouting**.
4. Make sure your **OnAir4** is connected to the host PC as described [earlier](#), and then start the software - once an **OnAir4** is detected, the software loads the default configuration.

3.6 Assigning the Virtual Audio Drivers

R3LAY VRX⁴ supports 8 WDM drivers (stereo) plus an ASIO client (up to 256 channels). To use both driver types, they must have been selected during installation using the [Virtual Audio Driver](#) options.

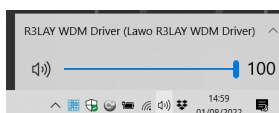
The driver you choose depends on the software client and whether you wish to make connections independently:

- For the lowest latency, best audio performance or multi-channel operation, use **ASIO** (if supported by your software client).
- If ASIO is not supported, or to connect to applications independently, assign a different **WDM Driver** instance to each software client.

Note that not all software clients support the option to assign an audio driver, and may use only the [Default Windows Sound Device](#).

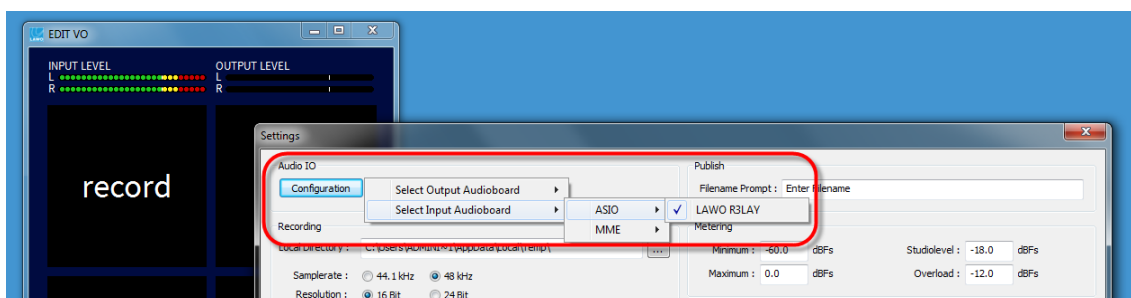
If a single driver is used more than once, then audio to and from these software clients is presented to **R3LAY** as a single audio stream.

Optionally, you can activate the Windows mixer volume for all **WDM driver** instances. This allows you to use the Windows volume control (shown below) to adjust the level to **R3LAY**. By default, this option is turned off. It can be enabled by editing the advanced options (described [later](#)).

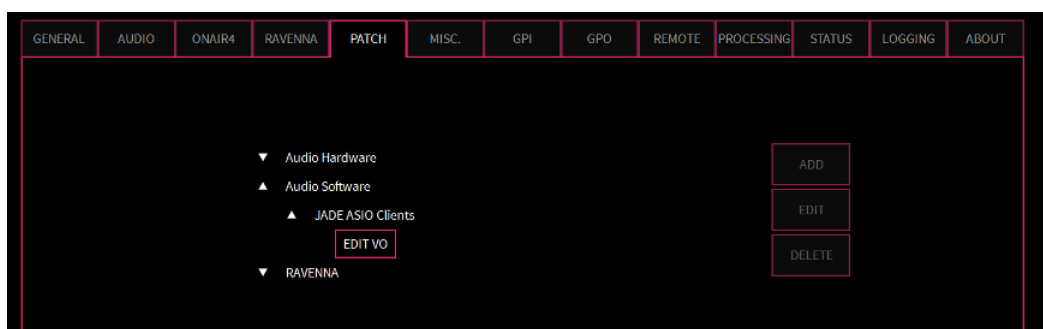


3.6.1 ASIO Software Clients

Most professional audio applications support ASIO. In order to connect audio to and from these clients using **R3LAY VRX⁴**, you will need to assign **R3LAY** as the audio input and/or output device within the software application. The exact procedure depends on the application; an example using Lawo's **Edit VO** is shown below:



If you now open the **R3LAY VRX⁴** GUI, the application appears as an ASIO Client in the [Global Settings -> Patch](#) list:



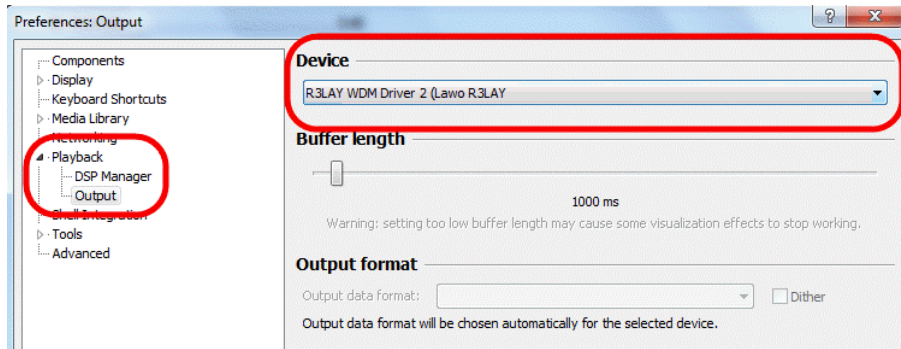
You may configure and run multiple ASIO applications simultaneously.

Sample rate conversion is automatically applied to audio to and from ASIO clients. For example, if a 48kHz audio hardware interface or RAVENNA stream is connected to a 44.1kHz ASIO software client, sample rate conversion will be applied.

3.6.2 WDM Software Clients

Applications such as chat software or media players do not usually support ASIO, and therefore you should assign one of the **R3LAY** WDM Driver instances. By assigning a different driver to each software client, you can connect RAVENNA streams to and from each program independently.

The exact procedure depends on the program. Below is an example of a common media player where the **Playback Output Device** has been assigned to the **R3LAY WDM Driver 2**:

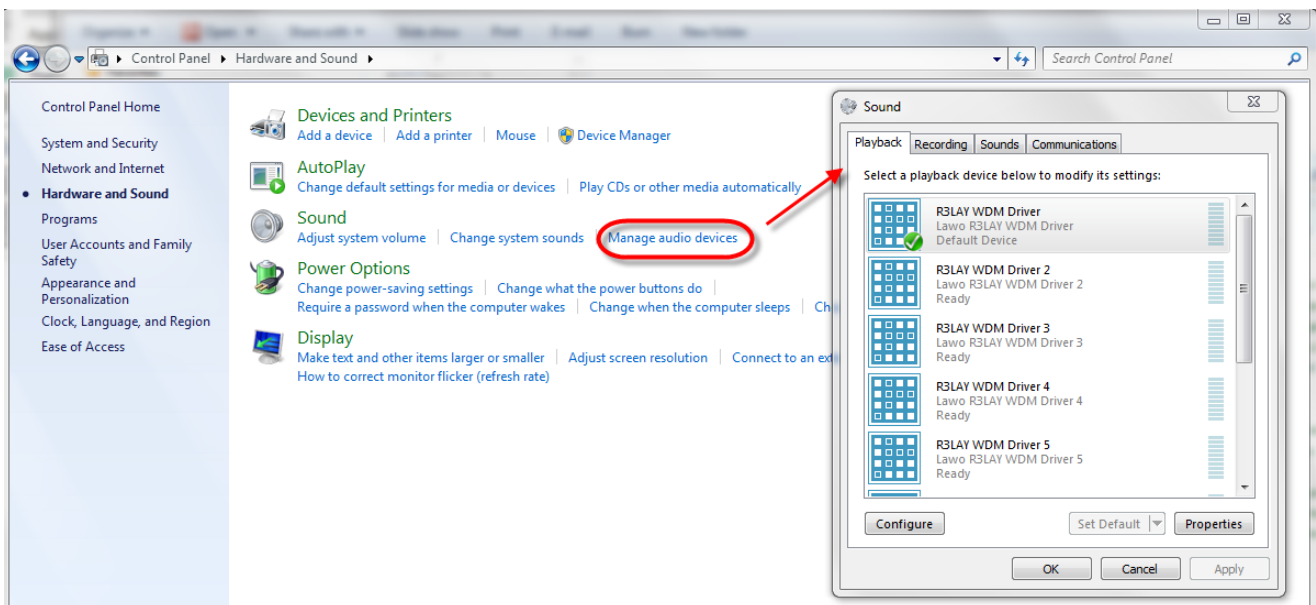


3.6.3 The Windows Default Sound Device

Some applications may not support the option to assign an audio driver and, instead, use only the default Windows Sound device. In order to connect audio to and from these clients using **R3LAY VRX⁴** you will need to assign one of the **R3LAY** WDM Driver instances as the default Windows Sound device:

1. In Windows®, select **Control Panel -> Hardware and Sound -> Manage audio devices**, and assign one of the **R3LAY WDM Driver** instances as the default **Recording** and **Playback** device:

Windows OS: Default Playback Device



If more than one software client uses the default Windows Sound device, then audio to and from these applications will be presented to **R3LAY** as a single audio stream.

3.7 Licensing

Once the software has been started, the system checks periodically for an active software license. This can be installed into a local container (on your PC), a remote container (on a networked server), or onto a USB dongle (for portability). If you wish to use a dongle, then this must be ordered separately.

The license is activated and managed by the CodeMeter Runtime licensing system from [WIBU systems](http://www.wibu-systems.com). The license code can be found on the delivery note supplied with the software.

3.7.1 Checking the License Status

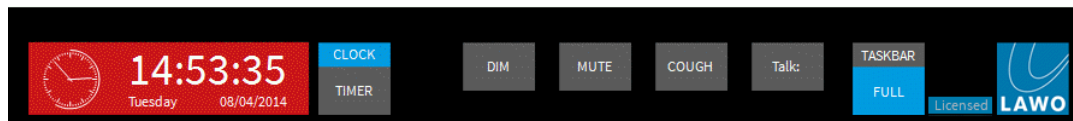
The current status of the license is indicated at the top of the GUI. If no license is found, then the software operates in demo mode, with all features enabled, for 15 minutes - during this time, the **Demo** field turns yellow and shows the 15 minute countdown:



After 15 minutes, a five second burst of white noise (at a level of -30dBFS) is inserted every minute. This is indicated by the red **Demo** field:



Once an active license is successfully located, the noise burst is removed and the field updates to **Licensed**:



If the license is later removed, after being found at startup, there is a 12 hour grace period before the noise burst resumes. This is indicated by a yellow **Demo** license field (with a 12-hour countdown). If the license is not reinstated at the end of the countdown, then the **Demo** field turns red to indicate that the noise burst is active.

3.7.2 Using a Dongle

All dongles are specially-configured USB memory sticks which can be purchased from either [Lawo](http://www.lawo.com) or [WIBU systems](http://www.wibu-systems.com). The dongles supplied for software and hardware products ship with different file systems, so please take care not to mix up the different types. If you have purchased a dongle for **RELAY VRX⁴**, then this will have a metal "LAWO logo" tag attached as shown below. Multiple **RELAY** products and other Lawo software can be licensed from a single dongle.

USB Dongle (for Lawo software)



3.7.3 Preparing for Activation

To activate a license, you will need:

- A PC with an internet connection (and USB port if using a dongle). If your PC does not have an internet connection, then the offline activation method can be used.
- The WIBU systems USB memory stick (if using a dongle).
- The license code. This can be found on the delivery note shipped with the system. It takes the form of a 25-digit ticket number such as the one shown below.

License Code Example

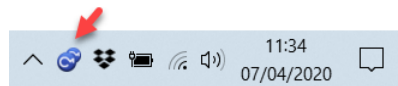
Ticket:
7MAMJ-8HZ95-N9VW5-3MKX6-LWUYM

Once activated, it is strongly recommended that you backup your licenses (using the **CodeMeter** [WebAdmin](#) portal). This will allow you to restore a license if the original is lost or damaged.

3.7.4 Installing CodeMeter Runtime

To activate a license, your PC must be installed with **CodeMeter Runtime** (from WIBU systems). The correct version is installed automatically with the setup software for your product.

You can check the installation by looking in the Windows taskbar where you should see the following icon.

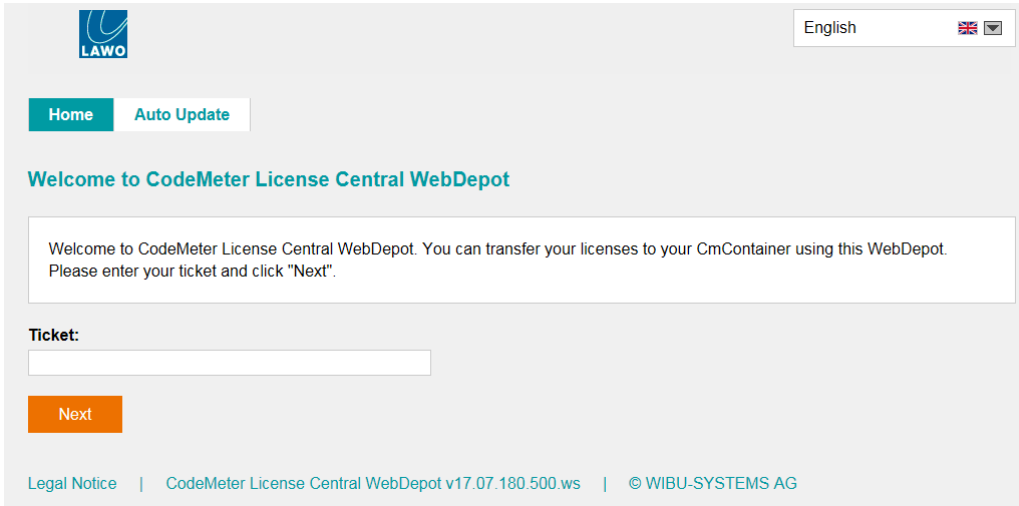


This shows that a Cm container (for local license storage) has been installed.

3.7.5 Activating a License Online

To use this method, your PC must have an internet connection. If installing onto a dongle, then this should be connected to the PC's USB port.

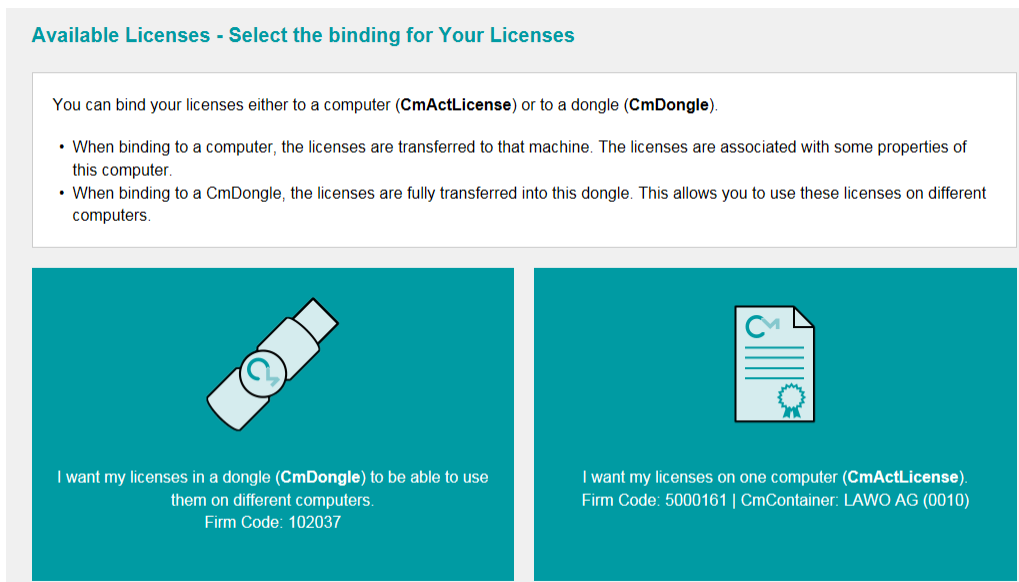
1. Open the Lawo licensing web page by copying the following URL into your web browser: <https://licenseportal.lawo.com>



If necessary you can choose a different language using the drop-down menu at the top right of the page.

2. Copy your license ticket number - this is the 25-digit number code - into the **Ticket** field and select **Next**.
3. The WebDepot searches for and displays your licenses - select **Activate Licenses** to continue.
4. At the next page, select the storage method for your license - note that this cannot be altered later.

Choose either **CmDongle** (to create a USB dongle) or **CmActLicense** (to bind the license to the local computer).



5. At the next page, select the licenses you wish to activate and the **CmContainer** to be used for the license storage.

Available Licenses

To activate your licenses:

1. Select the licenses you want to activate.
2. Select the locally connected CmContainer to which you want to transfer the licenses.
3. Click "Activate Selected Licenses Now".

<input checked="" type="checkbox"/>	Name	Activated On	CmContainer	Status
<input checked="" type="checkbox"/>	*Product Name* <small>(License Quantity: 1)</small>			Available

Select CmContainer

128-2311304 (LAWO AG) ↻

Activate Selected Licenses Now Offline license transfer

[◀ Select binding](#)
[◀ My Licenses](#)

You can store multiple licenses in the same container. If no Cm containers are available, then you will see an option to **"Get CmContainer automatically"**.

6. Click on **Activate Selected Licenses Now** and wait for a few seconds - a confirmation pop-up appears once the activation is successful:

Online License Transfer

! **Please wait!** The selected licenses are transferred. **This process may take several minutes to complete.** Please do not remove the CmContainer during this process and do not reload this page.

Starting license transfer.
Creating license request.

Online License Transfer

Starting license transfer.
Creating license request.
Downloading license update.
Importing license update to CmContainer.
Creating receipt.
Uploading receipt.

✓ License transfer completed successfully!

OK

7. After selecting **OK**, a summary appears:

Home
My Licenses
Auto Update

My Licenses

Name	Activated On	CmContainer	Status
Product Name <small>(License Quantity: 1)</small>	2018-07-05 18:33:51	128-2311304	Available: 0 (1)

Re-Host Licenses

8. You can now close the browser and return to your Lawo software application or install the USB dongle. For information on re-hosting a license, offline activation, backup/restore and using a license server, please see the [Advanced Licensing Features](#) appendix.

4. Operating Principles

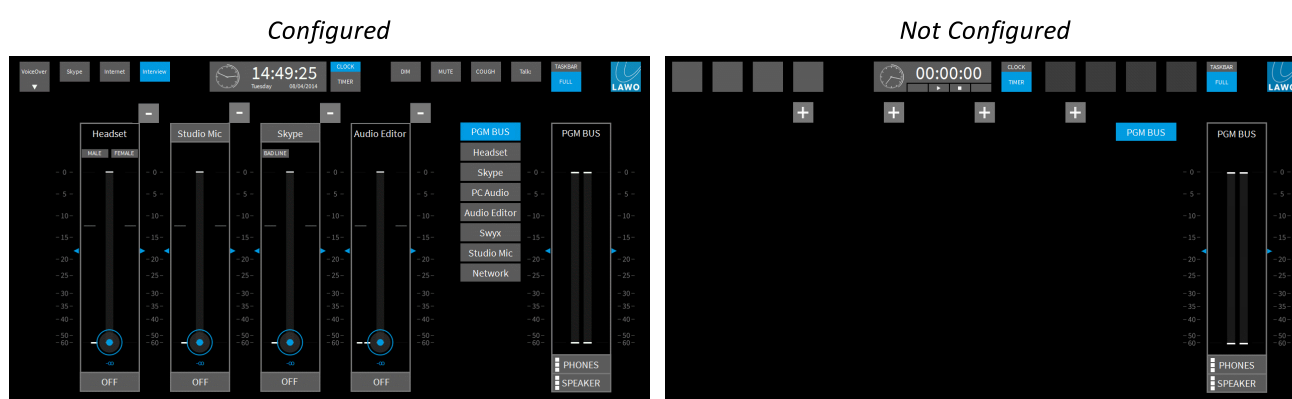
This chapter describes the operating principles of **RELAY VRX⁴**.

4.1 Starting the Application

The simplest way to start **RELAY VRX⁴** is by double-clicking on its desktop icon or selecting the program from the Windows START menu. **RELAY VRX⁴** can also be started from the [Service Manager GUI](#).

Only one instance of **RELAY** may be running at a time, and so if you see the message "This program is already started...", then check your taskbar icons and [close](#) the application, or use the **Service Manager** to [stop](#) the active service.

The application starts and you will see either an active configuration (if the software has been setup previously) or an empty operating window:



The software can start in either [Fullscreen](#) or [Taskbar](#) view, and a startup snapshot may be loaded. These options are defined in Admin mode, under [Global Settings -> General](#).

If the software is started with an **OnAir4** is connected, then the **OnAir4 default configuration** is loaded.

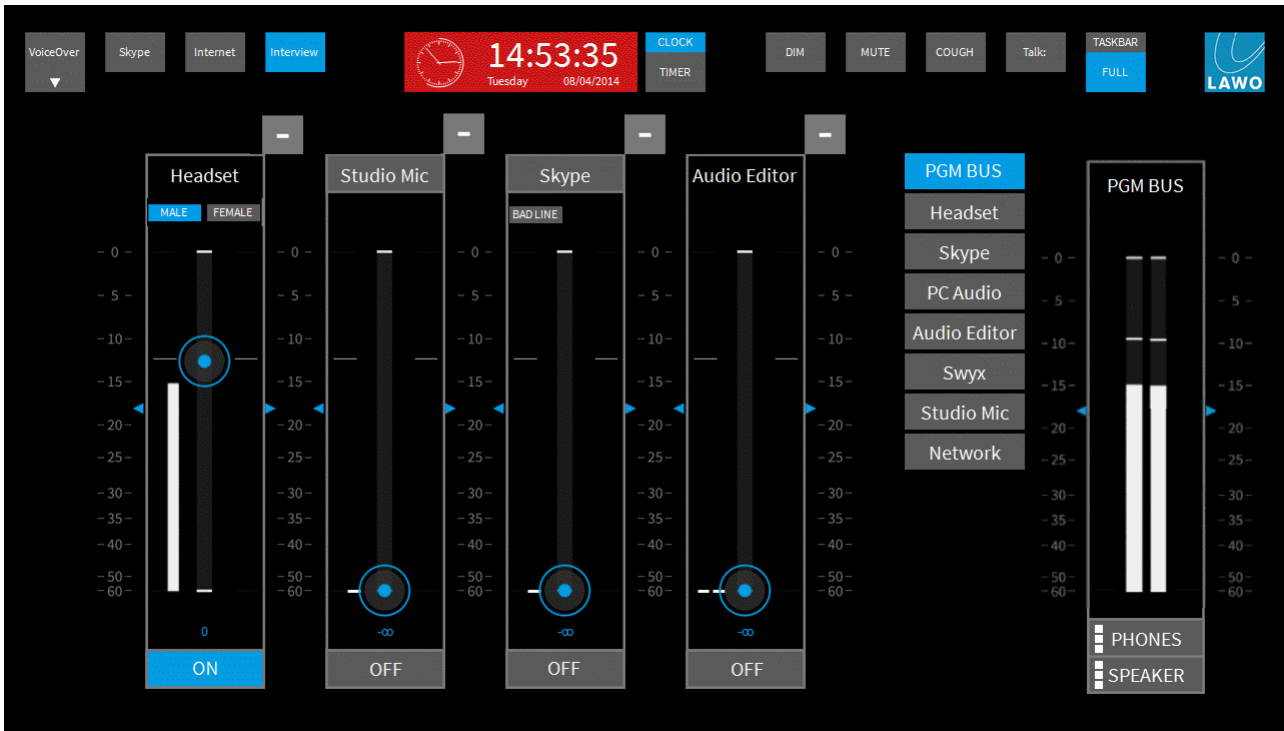
4.2 Changing the View: Fullscreen and Taskbar

The GUI can switch between two views: Fullscreen or Taskbar.


1. Select **TASKBAR** to switch to [Taskbar](#) view:

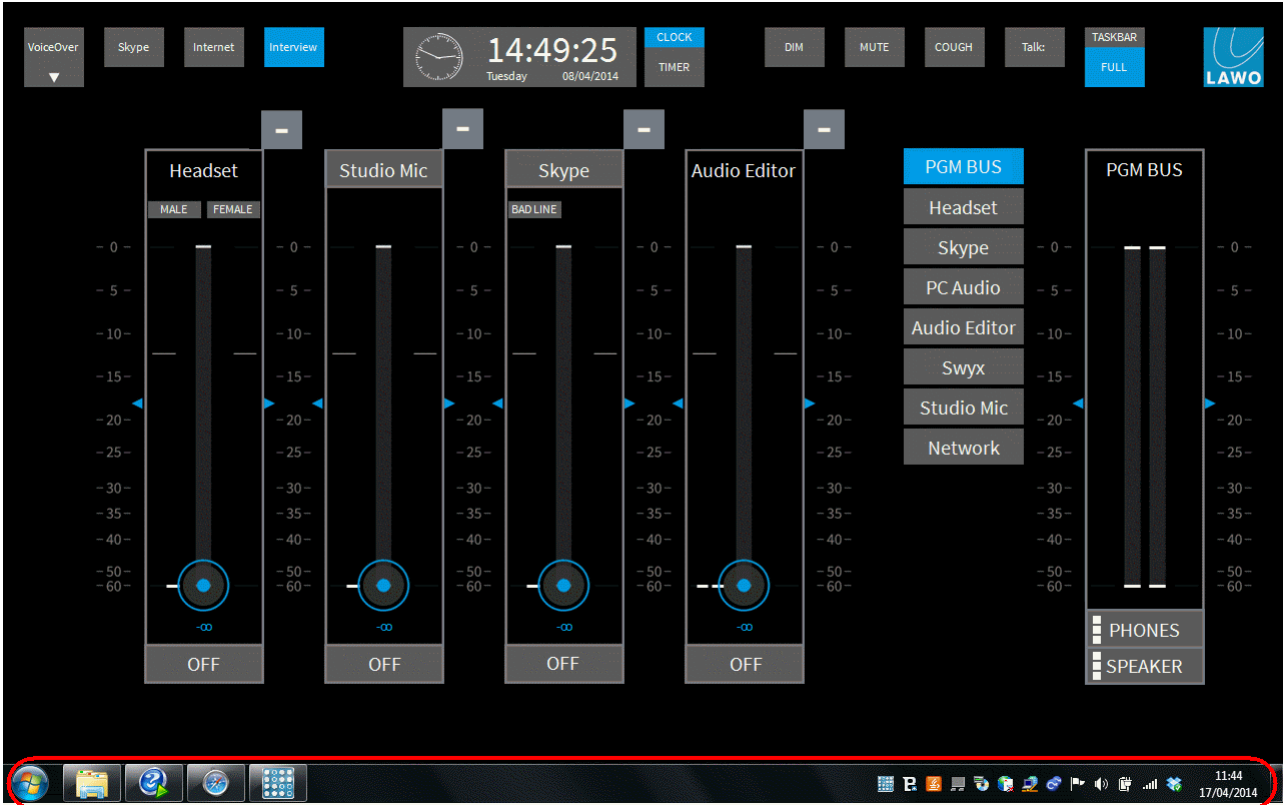


2. Select **FULL** to return to [Fullscreen](#):



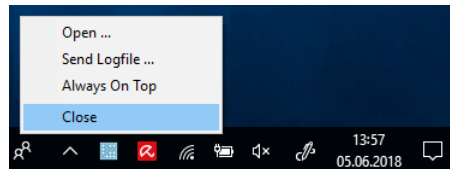
4.3 Switching Between Applications & Displays

1. To switch to a different application, press the Windows button  on your computer keyboard. This reveals the Start menu and taskbar. You can now select another open application from the Start menu options (bottom left):




Note that you cannot switch to a different application if the **Always on Top** option is ticked (see below).

2. Right-click on the **RELAY** taskbar icon (bottom right) to reveal the following options:



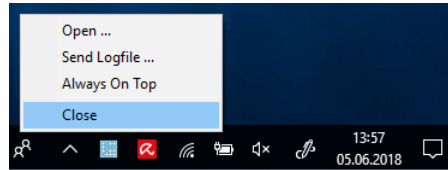
- **Open...** re-opens the **RELAY VRX⁴** operating window.
- **Send Logfile...** when [logging](#) is active, you can send a log file using this option.
- **Always on Top** - when ticked, the **RELAY VRX⁴** operating window will always appear on top of any other open application windows.
- **Close** - select this option to [close](#) **RELAY VRX⁴**. (Or, press **ALT + F4** on your computer keyboard.)

3. If there are multiple displays connected to your PC, then press the Windows button  + **SHIFT + Left/Right** arrows on your computer keyboard, to move the **RELAY VRX⁴** GUI between the different displays. If your PC has only one screen, then this command has no function.

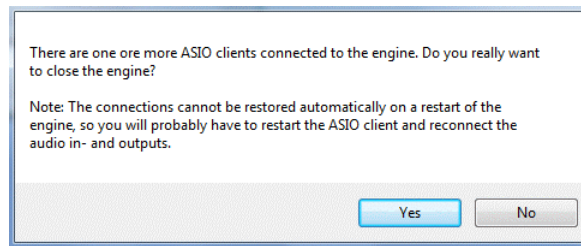
4.4 Closing the Application

To close **RĚLAY VRX⁴**:

1. Right-click on the notification icon in the taskbar and select **Close**:



If you attempt to close **RĚLAY VRX⁴** while one or more ASIO clients are running, then the following message appears:



If you select **Yes** and then restart **RĚLAY VRX⁴**, you may need to restart the ASIO software application, and reconnect its [audio input and output devices](#).

Closing **RĚLAY VRX⁴** stops all audio passing through the application. The right-click **Close** option is not available while [Admin mode](#) is open. Select **FINISH** to save the configuration - you can then close the application.

4.5 Starting RĚLAY VRX⁴ as a Service

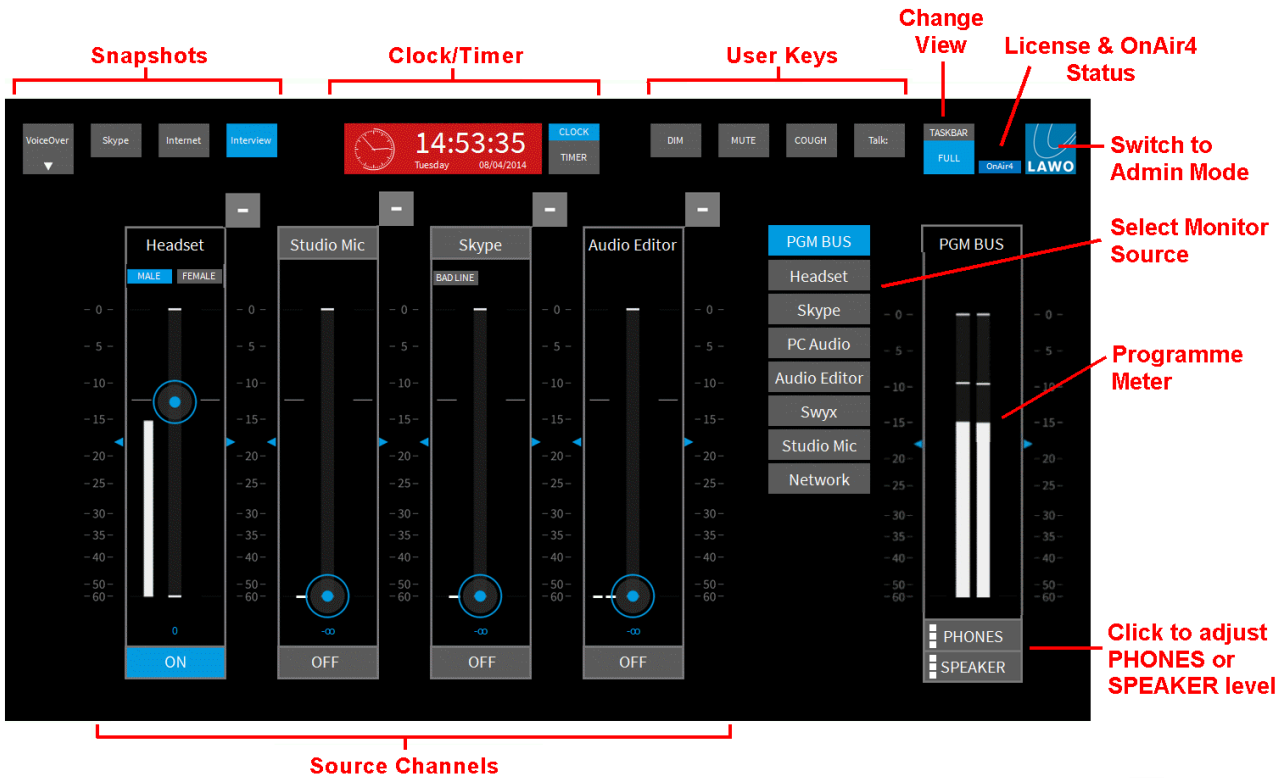
RĚLAY VRX⁴ can also be started as a service, so that all of the configured audio paths and RAVENNA streams can run in the background. See [The Service Manager](#) for more details.

5. User Mode

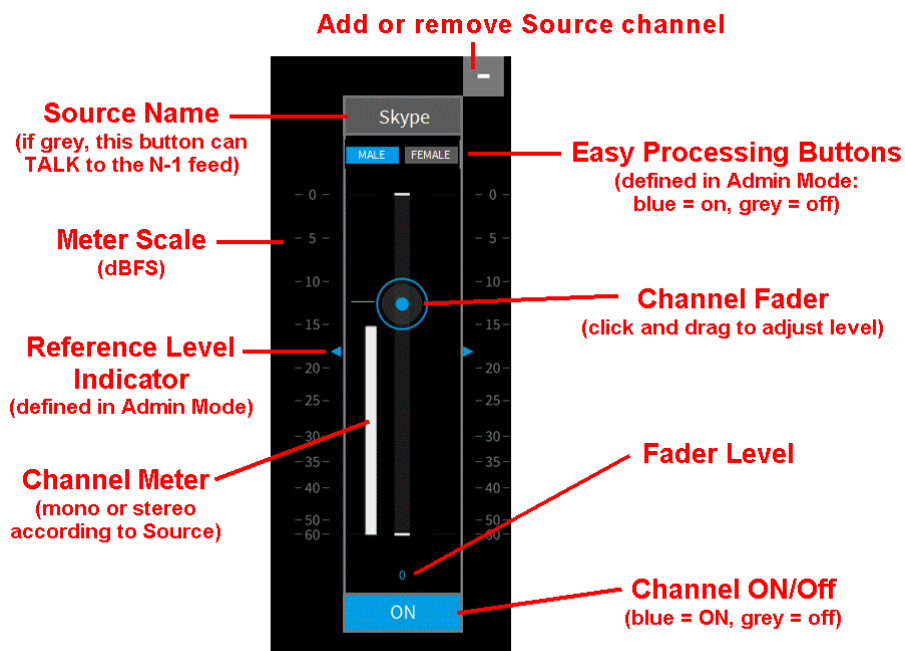
This chapter covers all the functions available in User mode.

5.1 Fullscreen View: Quickstart

In Fullscreen view, the GUI provides access to the following functions:



Up to 4 source channels can be active at any time. Note that sources which are not assigned to faders are not active in the mix. Each channel provides:



5.2 Assigning Sources to Channels

Users can mix up to 4 channels, mono or stereo, selected from a pool of 12 sources (which are prepared in Admin mode, see [Source Configuration](#)).

Sources which are NOT assigned to channels are not active in the mix.

A source can only be assigned to one channel at a time (duplicate assignments are not permitted).

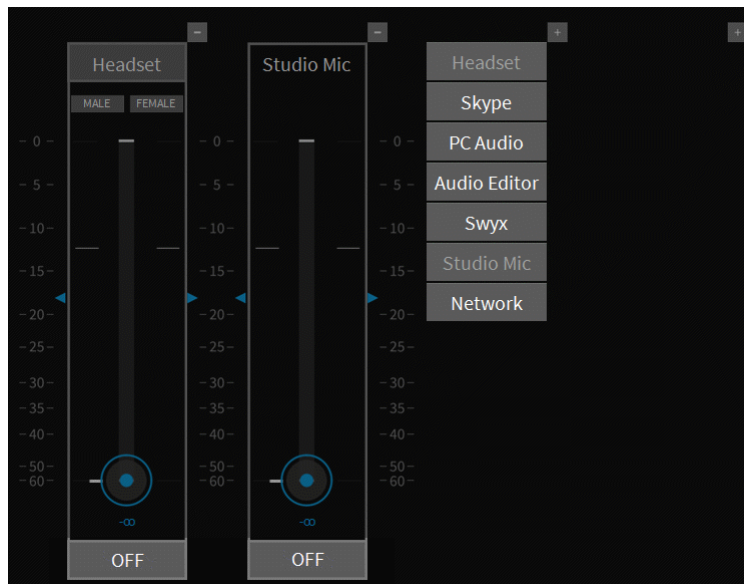
[Snapshots](#) reset all channel assignments.

The + (or -) buttons above each channel strip are used to add (or remove) a source:



➤ To add a source:

1. On an empty channel strip, select the + button - a drop-down menu appears listing up to 12 sources (defined in Admin mode, see [Source Configuration](#)). Note that the names coloured white can be selected; those coloured grey have already been assigned to another channel strip:



If you cannot see the source you require in the drop-down list, then check the [Bus Assignment: Main](#) option (defined in Admin Mode).

5. User Mode

2. Make a selection and the channel strip updates accordingly:



Depending on the source configuration, the channel may automatically open (either to 0dB or the last known value), include signal processing, have an N-1 return and trigger the red light status on opening. See [Channel Parameters](#) for more details.

➤ **To remove a source:**

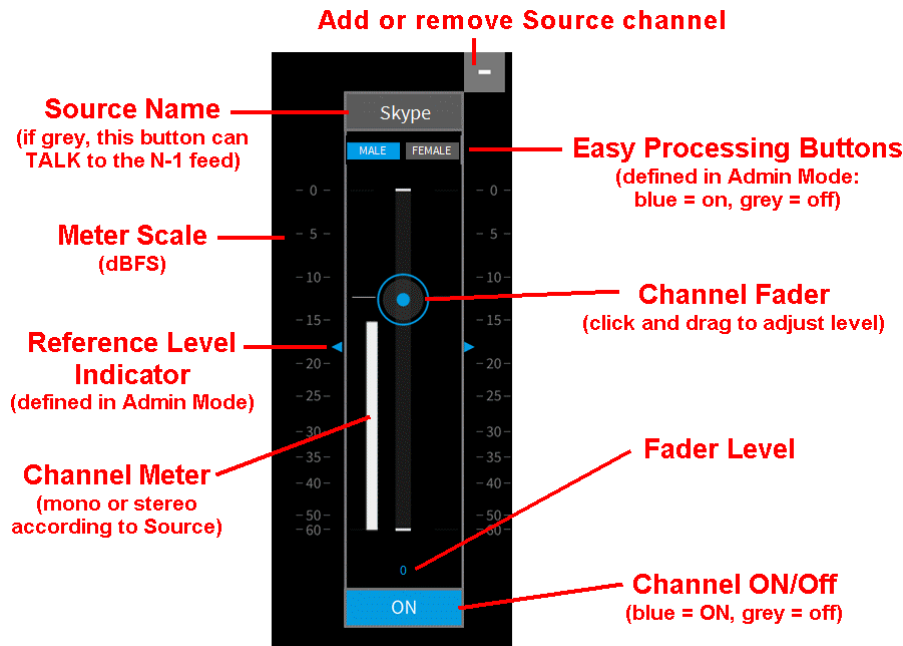
1. Select the - button above the channel strip - the source is instantly removed.



Note that if a channel fader is open, it cannot be removed.

5.3 Channel Parameters

Each channel strip provides the following information/controls:



Source Name / TALK to N-1

The source name is for information only, and is defined in Admin mode, see [Source Configuration: Name](#).

The background of the source name button is coloured either grey or black:

- **Grey** = the source has an N-1 return (defined in Admin mode, see [Source Configuration: Routing](#)). When this is the case, you can click on the source name to **TALK** to the N-1 feed - the button turns blue when talkback is active. See [N-1](#) for more details.
- **Black** = either there is no N-1 configured for the source, or the talkback source (defined in Admin mode, [Bus Setup](#)) is assigned to a channel and its fader is open. If this is the case, talkback is not permitted until the talkback source fader is closed.

You can only **TALK** while the source fader is closed; open source faders are deemed to be on-air and, therefore, talkback is not permitted.

Easy Processing Buttons

Up to two "easy processing" preset buttons may be defined for each source in Admin mode, see [Source Configuration: Processing](#).

If **User Mode Access** has been enabled for the source, then you can select a button (e.g. **MALE** or **FEMALE**) to enable the preset: blue = processing on (active); grey = processing off.

Note that if no presets have been configured for the source, or the **User Mode Access** option is off, then you will not see anything in this area.

The type of processing used for each preset, and its parameters, are defined in the [Global Settings -> Processing](#) menu.

Channel Fader and Level

Click and drag the blue circle to adjust the channel fader - the channel level (displayed in dB) updates accordingly.

You may adjust the level from +9dB (fully open) to - infinity (closed). Note that the horizontal white line indicates the unity gain point (0dB).

A channel is **ON** once the fader is open.

If the source is configured to trigger the red light status (see [Source Configuration: Routing](#)), then the on-air state is indicated by the red [Clock/Timer](#) background.

Channel ON/Off

Select this button to instantly open a fader - the fader opens to its last known value OR, if this is the first time you have adjusted a channel, the fader will open to unity gain (0dB).

The channel **ON** button turns blue when a fader is open.

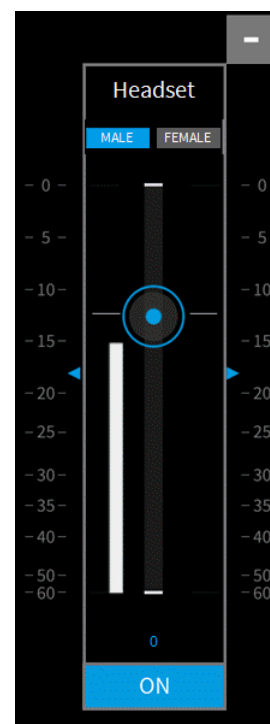
Channel Metering & Reference Level

To the left of each fader, you will see the channel meter (either mono or stereo depending on the [Source Configuration](#)).

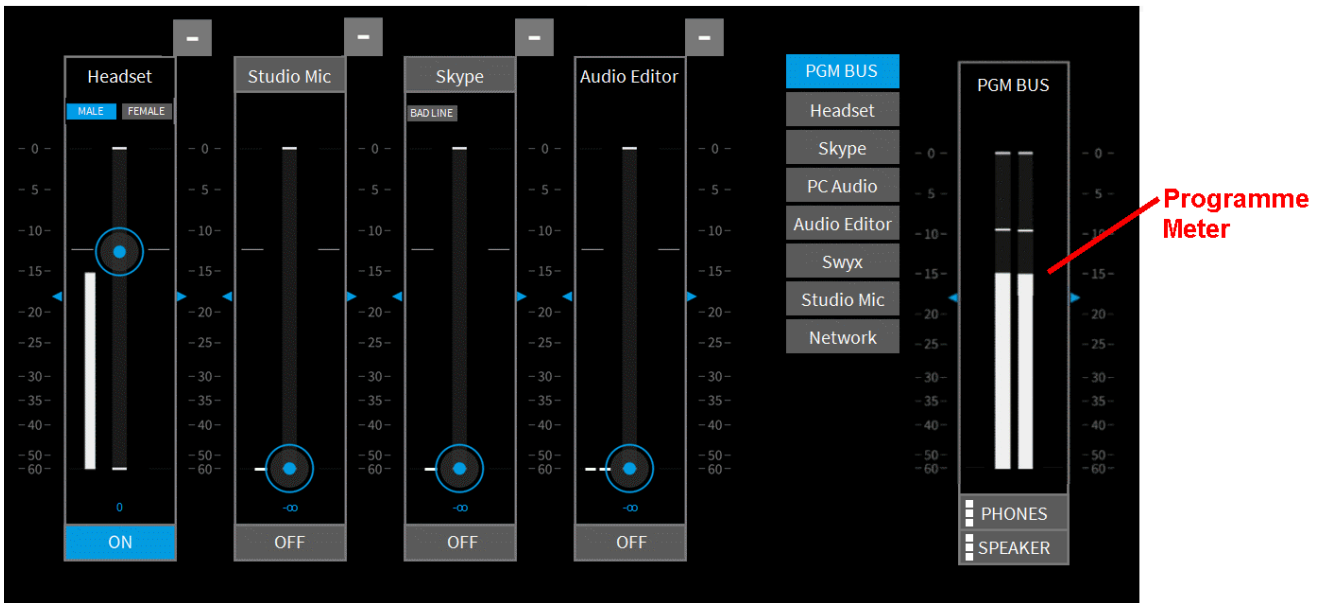
The meter pickup point can be either **Pre** (the input level direct from the source) or **Post** (the channel output level after the fader and processing). This option is defined Admin mode, see [Global Settings -> GUI](#).

The meter scale is always in dBFS (referenced to digital Full Scale).

The blue triangles on the meter scale indicate the studio's reference level, and can be adjusted in Admin mode, see [Global Settings -> GUI](#).



5.4 Bus Outputs & Metering



The active channels are mixed to a stereo programme bus, which is metered on the right of the GUI. There is no master level control or processing for the programme bus. The bus may be routed to two physical outputs; these are defined in Admin mode, see [Bus Setup](#).

N-1 Outputs

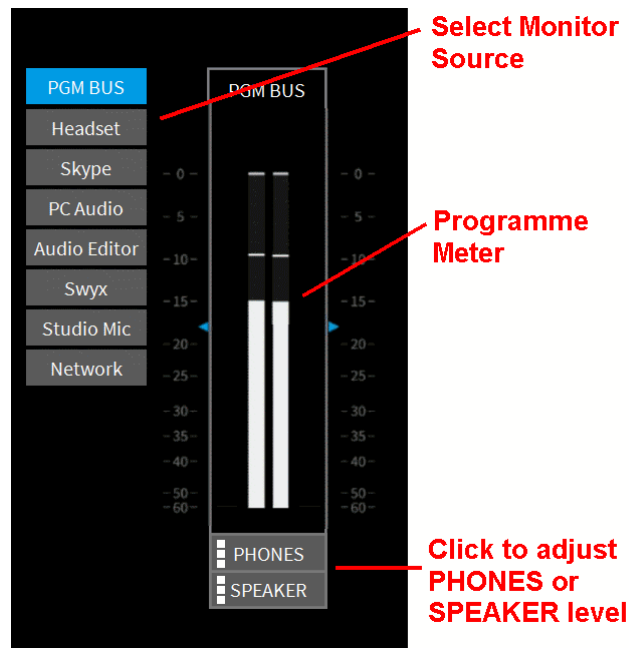
An N-1 output, also known as a clean feed or mix minus, can be configured for up to 4 of the 12 audio sources. The N-1 is a mix of the programme bus minus the source, enabling a contributor to hear the main mix minus themselves while on-air.

Start by defining the N-1 output for each source in Admin mode, see [Source Configuration: Routing](#). Up to four N-1 returns are permitted (mono or stereo).

Then assign the sources to some channels. The source name background changes to grey if an N-1 return has been configured - in our example, for the **Studio Mic** and **Skype** sources.

To talk to a source (via its N-1 return), click on the source name field - it turns blue while talkback is active. The N-1 signal can be dimmed or muted while talkback is active. The amount of attenuation and talkback input are defined in Admin mode, see [Bus Setup: Talkback](#).

5.5 Monitoring (PHONES & SPEAKER)



A stereo monitor bus can be output to both headphones (**PHONES**) and loudspeaker (**SPEAKER**). The physical outputs are defined in Admin mode, see [Bus Setup: Monitoring](#).

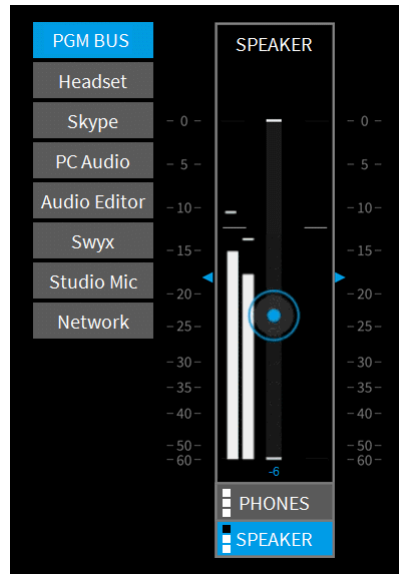
The **SPEAKER** output is automatically muted when the [on-air](#) state is active.

The **SPEAKER** output can be dimmed or muted when talkback is active. This option is defined in Admin mode, see [Bus Setup: Talkback](#).

Select a monitor source using the monitor selector buttons - the **PGM BUS** is always included; other monitor sources are configured in Admin mode, see [Source Configuration: Routing](#). A short press latches on the monitor selection; press and hold to listen momentarily to a source.

Note that the [Bus Assignment: Monitor](#) option (defined in Admin Mode) can be unchecked if you wish to remove a source from the monitoring (when listening to the programme bus). The actual programme output is not affected. You should use this option when working with say a USB headset microphone, where the latency of hearing the source in the monitor output would be distracting.

The **PHONES** and **SPEAKER** buttons provide access to the monitor output levels. Select a button (it turns blue) to reveal a blue circle beside the programme meter:

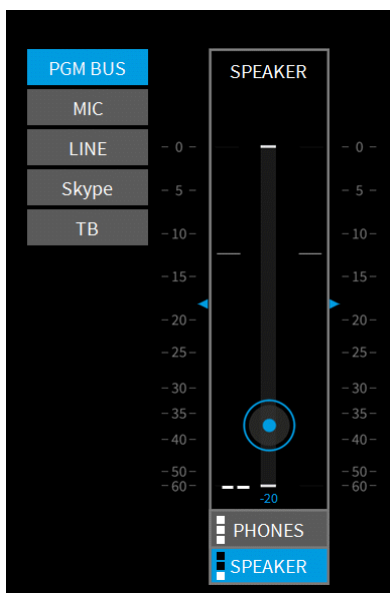


Click and drag the blue circle vertically to adjust the monitor level - in our example, for the **SPEAKER** output. The level (displayed in dB) updates accordingly. You may adjust the level from +9dB (fully open) to - infinity (closed). Note that the horizontal white line indicates the unity gain point (0dB).

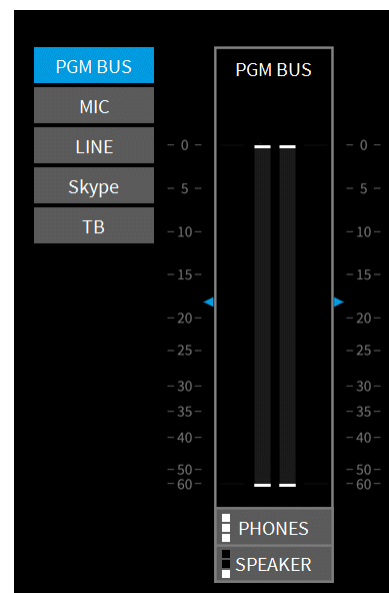
Deselect the **SPEAKER** (or **PHONES**) button to return to the normal mode of operation (programme bus metering).

Note that the three vertical boxes inside the **PHONES** and **SPEAKER** buttons provide a permanent indication of the monitor output levels. This allows you to quickly see if a monitor output is open or closed:

SPEAKER Level Adjust



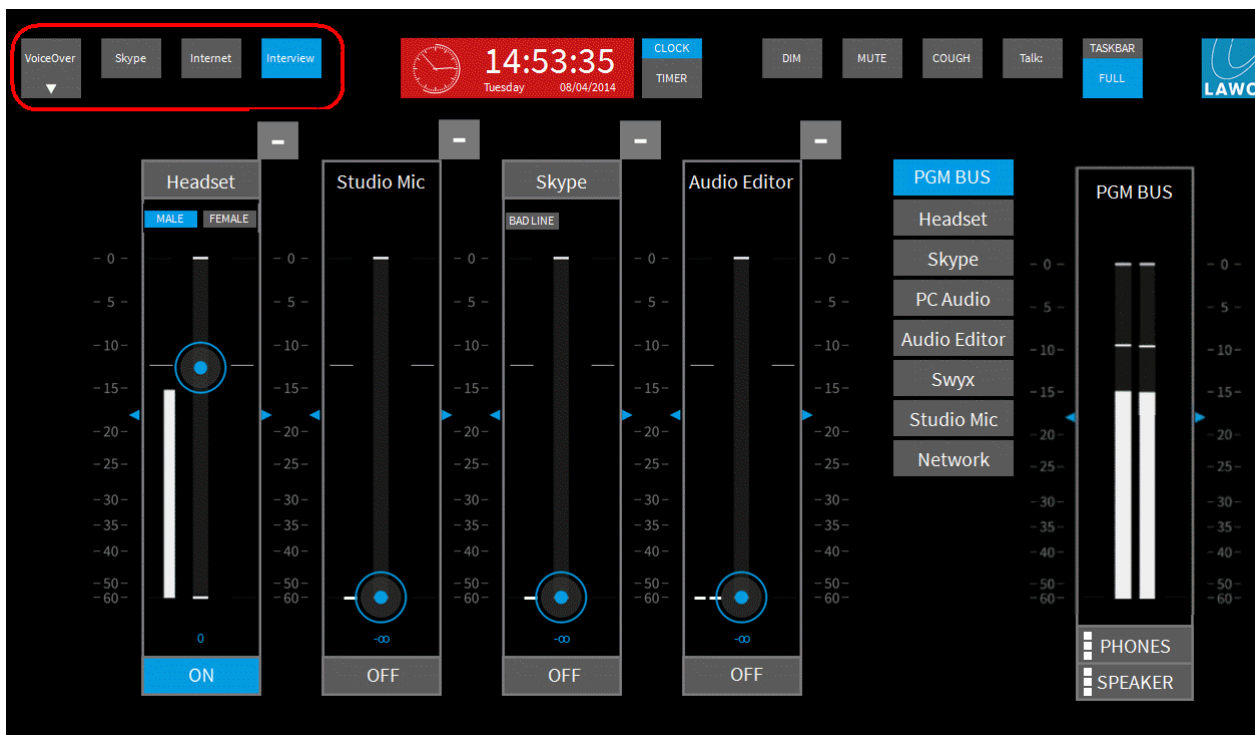
Normal Mode (PGM BUS metering)



5.6 Snapshot Recall

Up to 16 snapshots are defined in Admin mode, see [Snapshot Configuration](#). Each snapshot recalls the sources assigned to the channels strips and their fader levels, plus the choice of monitor source. In addition, a Windows batchfile can perform actions outside of **RELAY VRX⁴**. For example, to start your recording software and place it into record ready mode.

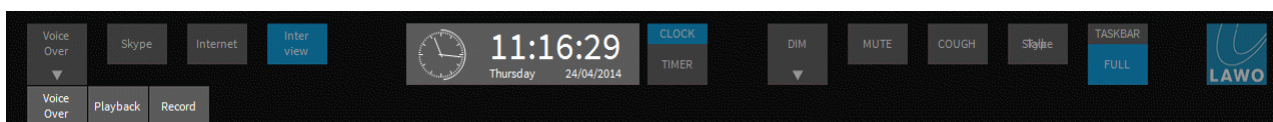
Four snapshots are always directly available with any additional snapshot memories stacked in the drop-down menus (indicated by the down arrow):



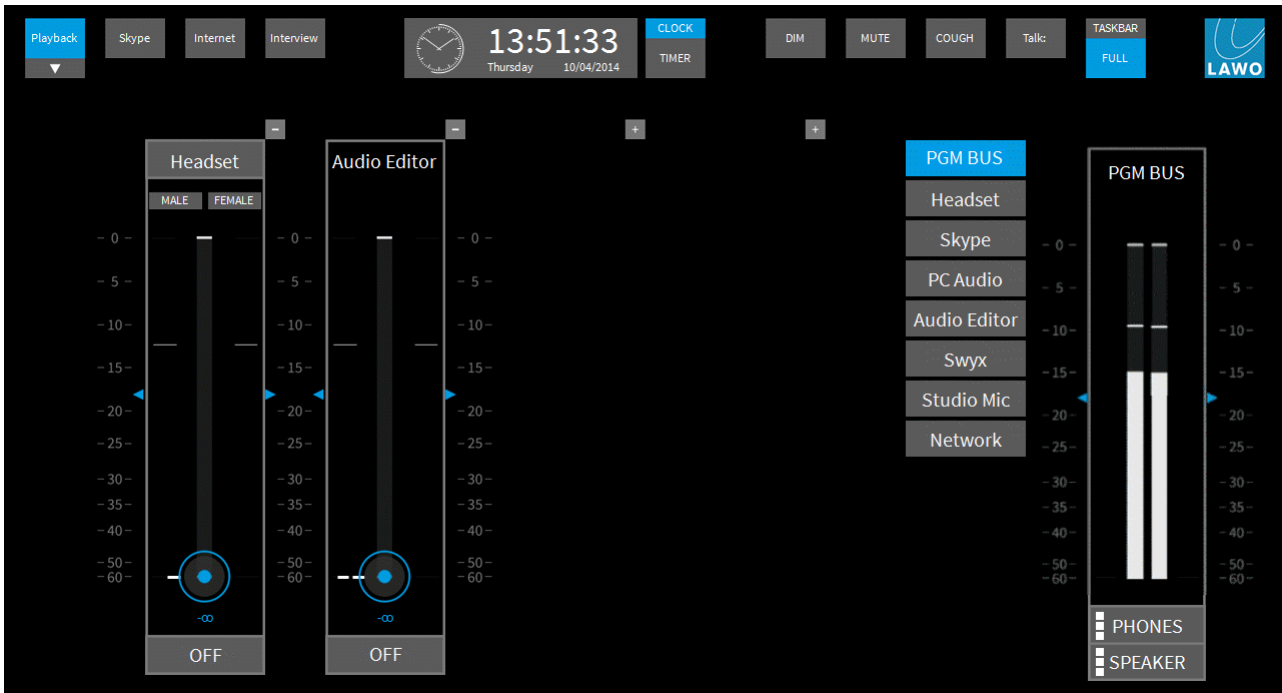
1. Select a top row button to load a snapshot - e.g. **Interview** - the button turns blue and the channel strips are reset.

If you cannot select a snapshot to load, check if the on-air (red-light) state is enabled - the **Prevent Snapshot Change on Red Light** option (defined under [Global Settings -> Misc](#) in Admin mode), can stop snapshots from being recalled once you are on-air.

2. If more snapshots are configured, then a down arrow appears below each button. Select the down arrow and choose a snapshot from the drop-down list (e.g. **Playback**):



The snapshot is recalled and moves up into the top row.



Note that you will only see a down arrow if additional snapshots have been configured. A maximum of 16 snapshots (4 x 4 rows) are permitted. See [Snapshot Configuration](#) for details.

5.7 Clock/Timer Functions & On-Air Status

The clock/timer operates in one of two modes - click on **CLOCK** or **TIMER** to choose the mode:

- The **CLOCK** displays the real time of your computer's network master both as a clock face (on the left) and digital display.
- In **TIMER** mode, the digital real-time clock is replaced by a timer to assist with programme timings (see below).

On-Air (Red-Light)

In both cases, the background colour indicates the on-air state (red = on-air, grey = off-air):



The on-air (red light) state can be triggered by individual sources, as defined in Admin Mode (see [Source Configuration: Routing](#)), or from a GPI input (see [Global Settings -> GPI](#)).

The [SPEAKER](#) output is automatically cut when the red light state is active.

The **Prevent Snapshot Change on Red Light** option (defined under [Global Settings -> Misc](#) in Admin mode), can stop snapshots from being recalled if the on-air state is enabled.

Timer Functions

The timer can be started manually or triggered from a specific source.

The latter option is defined in Admin Mode (under [Global Settings -> GUI](#)), and the timer starts when the selected source fader opens and stops when the fader is closed.

➤ To operate the timer manually:

1. Click on the Play icon to start, and the Stop icon to stop the timer:



2. When you next click on Play, the timer is reset.

➤ **To enable a count-down (or count-up) timer:**

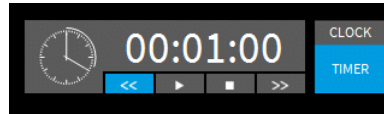
1. Click on the real-time clock face - three sets of up/down arrows appear:



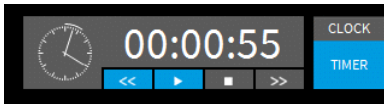
2. Use the arrows to enter the time you wish to count-down from (or count-up to) - for example, 1 minute:



3. Then click again on the real-time clock face - the count-down timer is prepared (as indicated by the << arrows):



4. Select the >> arrows to switch to count-up operation (or leave the timer in count-down mode as shown above).
5. Now start the timer, either manually or from the trigger channel, and the timer will count-down:

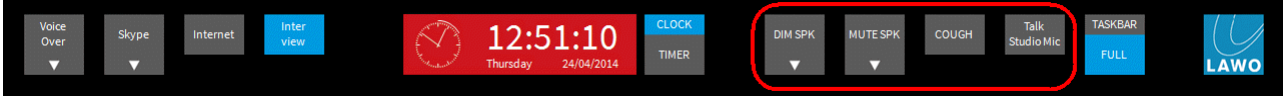


6. Stop the timer, either manually or by closing the trigger channel fader, and the count-down stops.
7. When you next start the timer, it resets to the time entered in step 2 - in our example, to 1 minute.

5.8 User Keys

Up to 16 user keys offer fast access to functions such as a **COUGH** switch, monitor **DIM**, **TALK** to an N-1, GPIO commands, etc. All functions are defined in Admin mode, see [User Key Configuration](#).

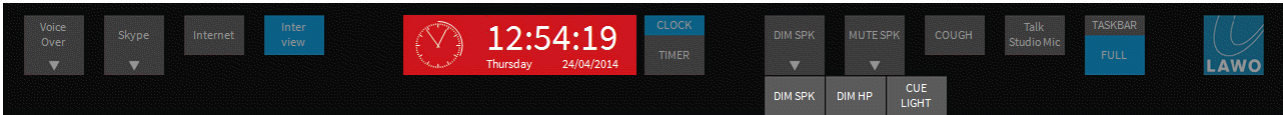
Four user key functions are always directly available (e.g. **DIM SPK**, **MUTE SPK**, **COUGH** and **Talk Studio Mic**) with any additional functions stacked in drop-down menus (indicated by the down arrows):



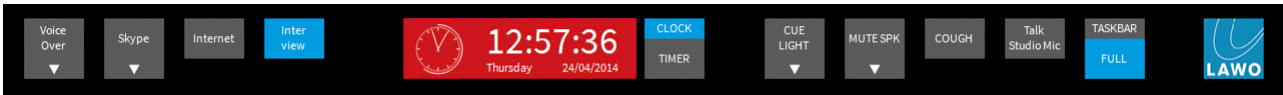
1. Select a top row button to action a function. Some functions (such as **COUGH** buttons) are always momentary. For other functions (such as monitor **DIM** and **Talkback**), use a short press to latch the button on; press and hold for momentary operation - the button turns blue when active.

If a key fails to light, then its function may not be correctly configured - for example, if no source has been assigned to a **COUGH** switch. See [User Key Configuration](#).

2. If more than four user keys are configured, then a down arrow appears below each button. Select the down arrow and choose a function from the drop-down list:



The function moves up into the top row:

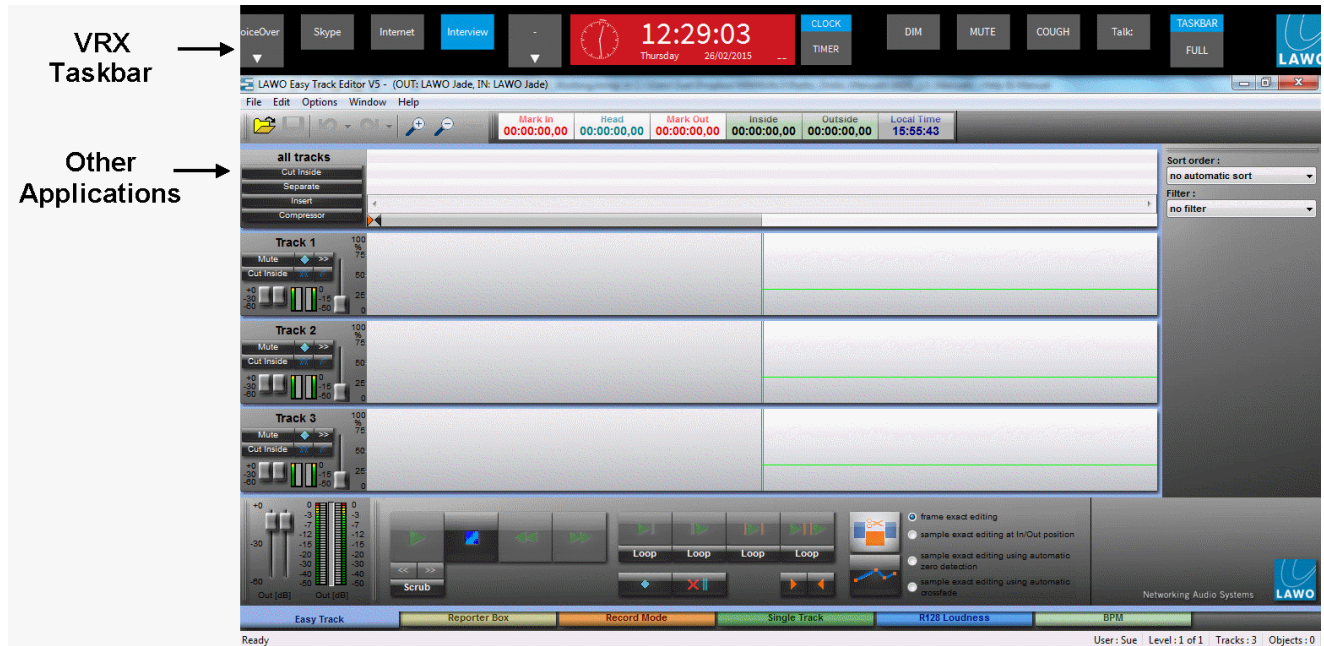


3. Click to action the function.

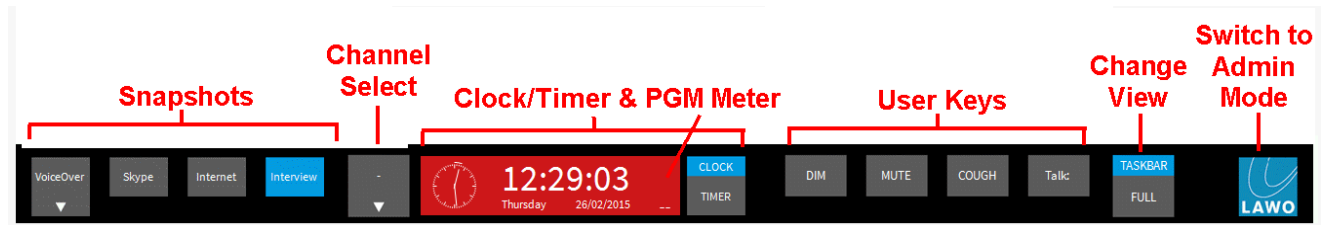
Note that you will only see down arrows if additional user keys have been configured. A maximum of 16 functions (4 x 4 rows) are permitted. See [User Key Configuration](#) for details.

5.9 Taskbar View

In Taskbar view, the main functions of **RELAY VRX⁴** are condensed onto a single Taskbar which sits above the main screen of your computer. This allows you to open other applications, such as your audio editing software, while retaining access to the **VRX⁴** mixer:



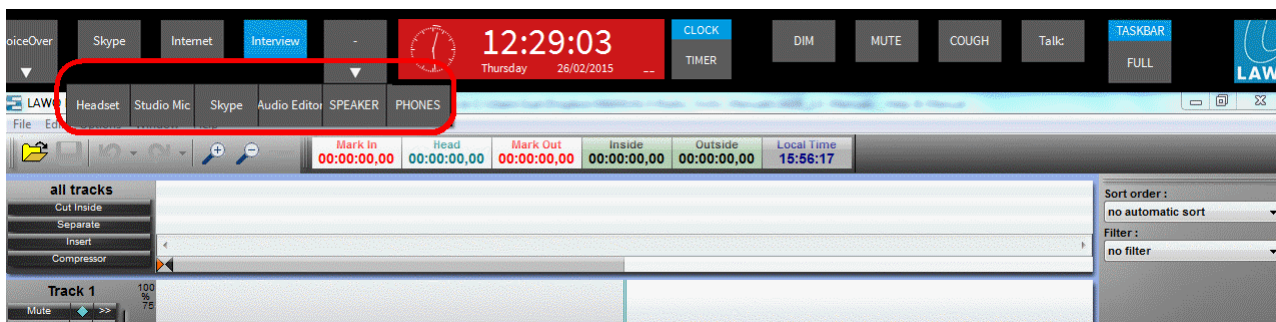
All [snapshot](#), [clock/timer](#) and [user key](#) functions operate in an identical manner to [Fullscreen](#) view. Note that there is a peak programme bus level indicator to the right of the clock/timer:



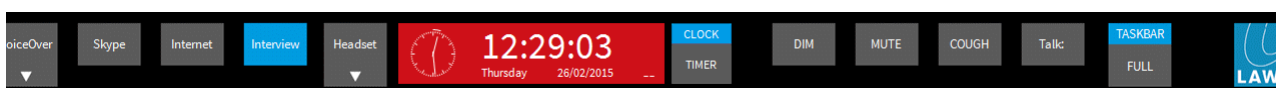
5. User Mode

To access source channels or monitor levels, an extra box (Channel Select) appears to the left of the clock/timer.

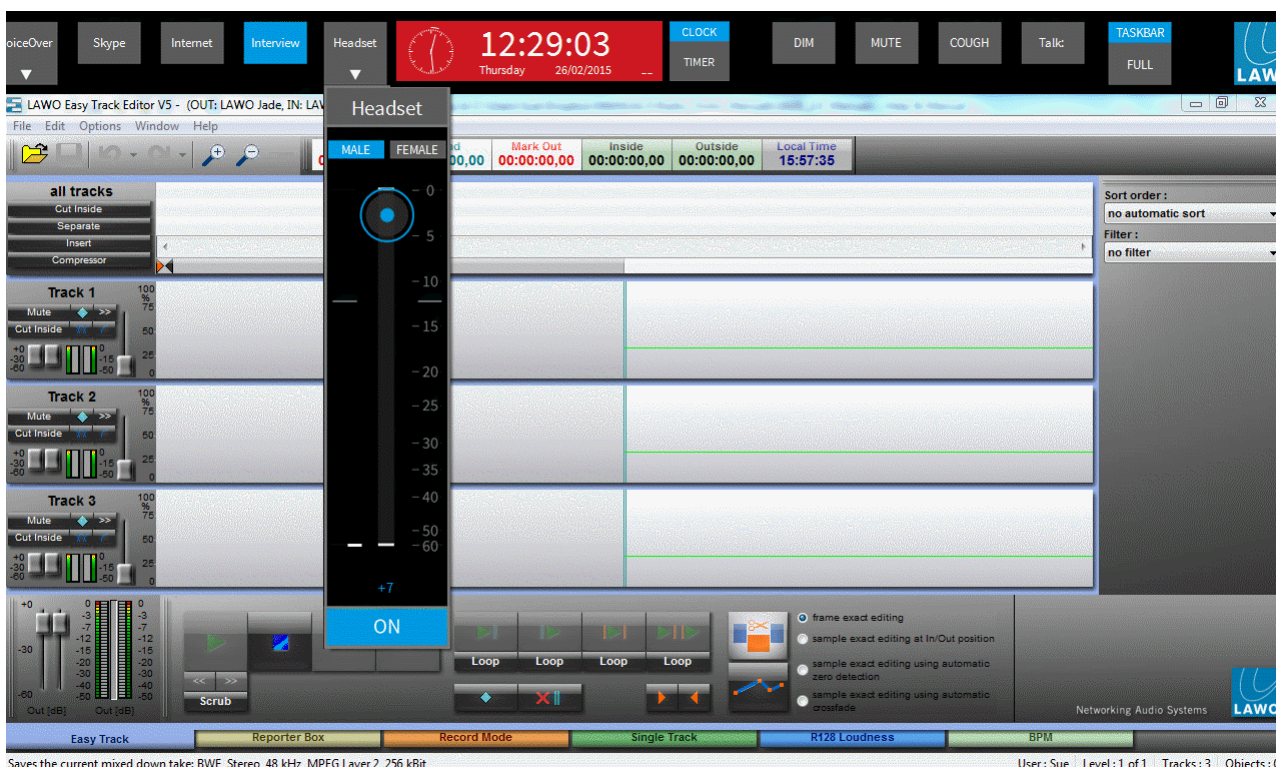
1. Click on the down arrow, and select a channel from the drop-down menu - you will see the names of all active source channels (up to 4) plus both monitor outputs (**SPEAKER** and **PHONES**):



Your selection appears in the Channel Select box (e.g. **Headset**):



2. Click on the name to open a drop-down fader - you can now adjust the [channel parameters](#) (or [monitor level](#)) in the usual manner:



3. Click again on the channel name to close the drop-down fader.

6. Admin Mode

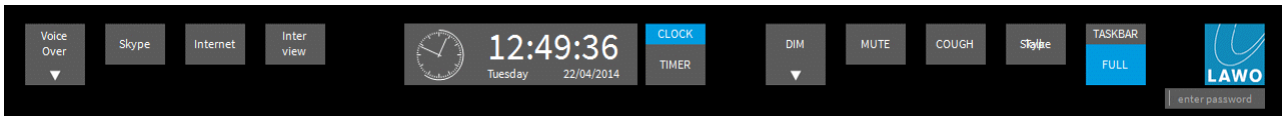
This chapter covers all the functions available in Administrator (Admin) mode. Note that the [Global Settings](#) are covered later in their own chapter.

6.1 Working in Admin Mode

The Admin mode is password-protected and is used to prepare audio sources, bus and monitoring options, snapshots, user key functions and all global settings.

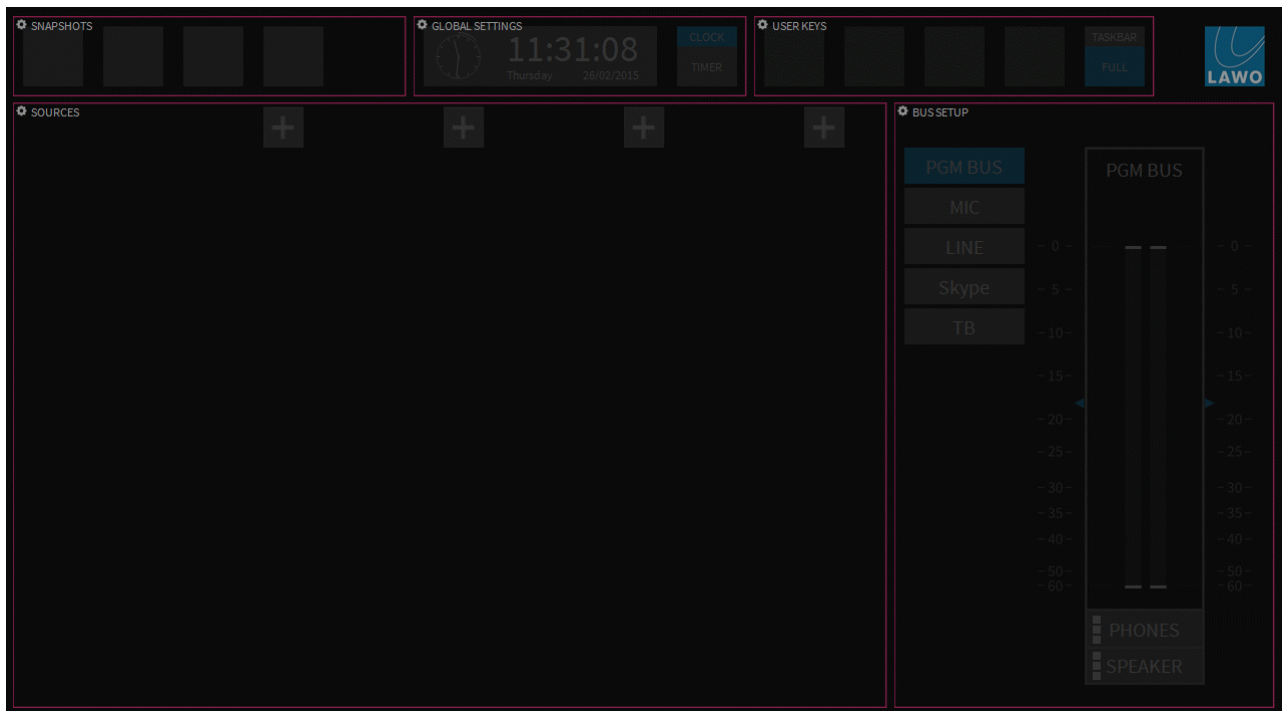
➤ **To switch to Admin Mode:**

1. Click on the Lawo logo (top right) to change from User to Admin mode, or vice versa - usually, the Administrator mode is password-protected, and so a login box appears below the logo:



Note that the password can be changed or removed from the [Global Settings -> Misc](#) menu.

2. Type in the Administrator password and press Enter to continue - if the password is correct, the Admin menu options appear:



➤ **To edit and save settings:**

1. Select a menu area (e.g. **SOURCES**) to open the configuration window:

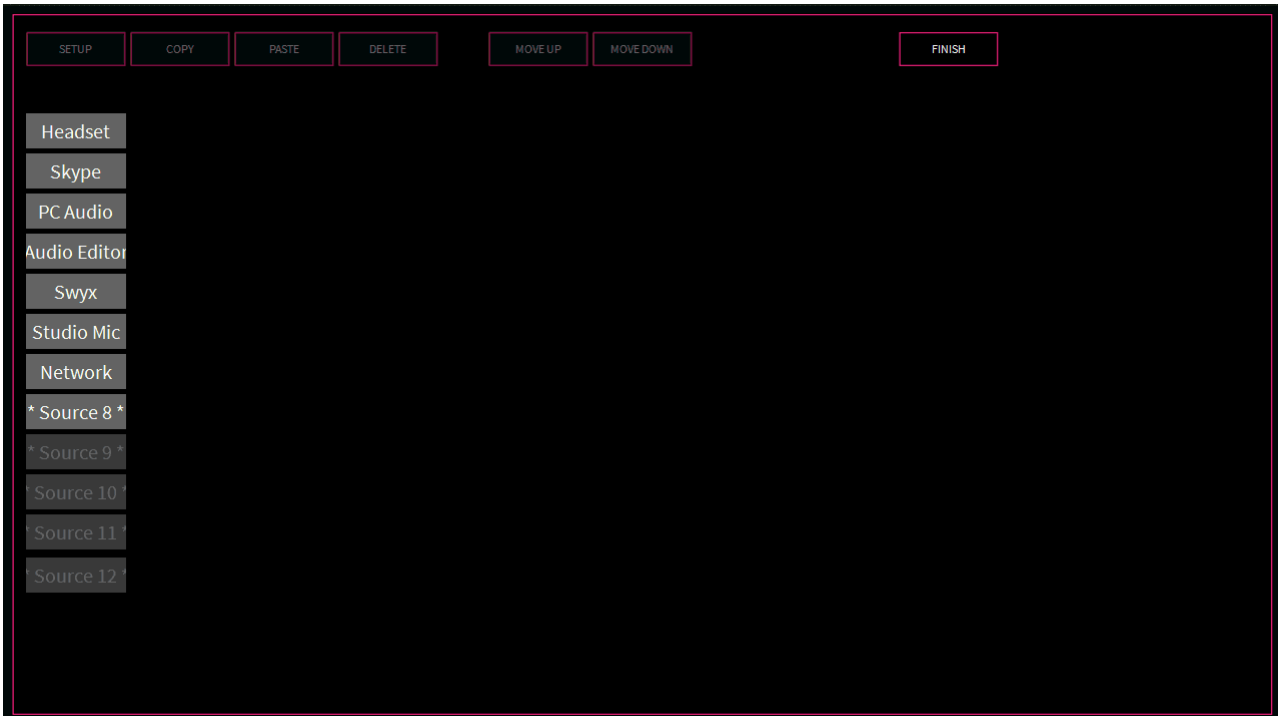


Each configuration window is covered in further detail on the next few pages.

2. Select **FINISH** to save any changes and return to the Admin menus.
- For more details on where the data is saved, see [Saving the Configuration](#).

6.2 Source Configuration

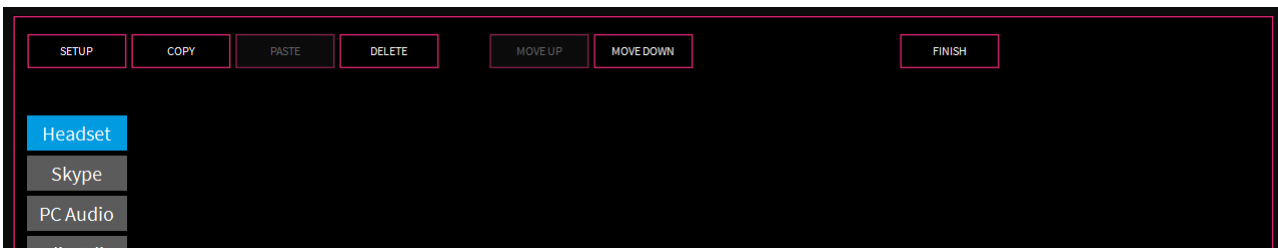
1. Switch to [Admin mode](#) and select **SOURCES** to open the 'Source Configuration' window:



This window prepares each of the 12 audio sources which can be assigned to a channel. The 12 available source positions are shown on the left. Note that the order of the list is how sources are presented to the end-user, see [Assigning Sources to Channels](#). The source parameters define the source name, audio input, signal processing, bus routing and surface assignment options, see [Channel Parameters](#).

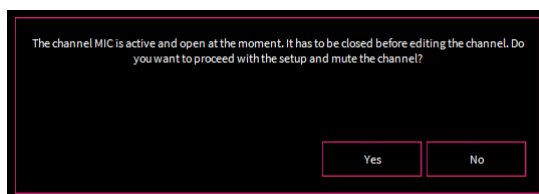
2. Select a source name (e.g. **Headset**), or to add a new source select the next available "free" slot - in our example, **Source 8**.

The selected source is highlighted in blue, and the editing options at the top of the window (**SETUP**, **COPY**, etc.) become active:



3. Select **SETUP** and choose a tab: [NAME](#), [INPUT](#), [PROCESSING](#), [ROUTING](#), [SURFACE](#) or [EMBER+](#) - each tab is covered in more detail over the next few pages.

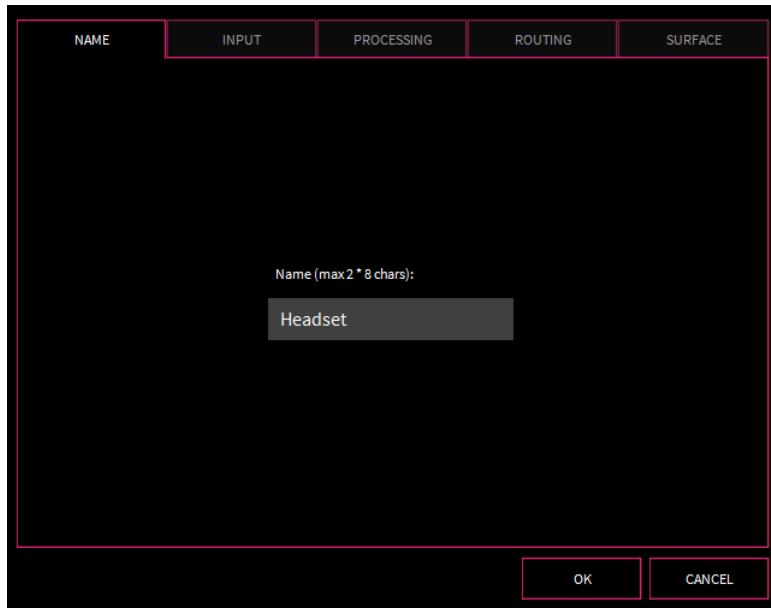
Note that you cannot edit an active source. Therefore, if the selected source is assigned to a channel and its fader is open, a pop-up appears asking if you wish to mute the channel - select **Yes** to continue:



4. Having made your changes, select either **OK** or **CANCEL** to return to the main 'Source Configuration' window.

6.2.1 Name

The **NAME** tab renames a source - enter a new name (up to 16 characters) and select **OK** to confirm:

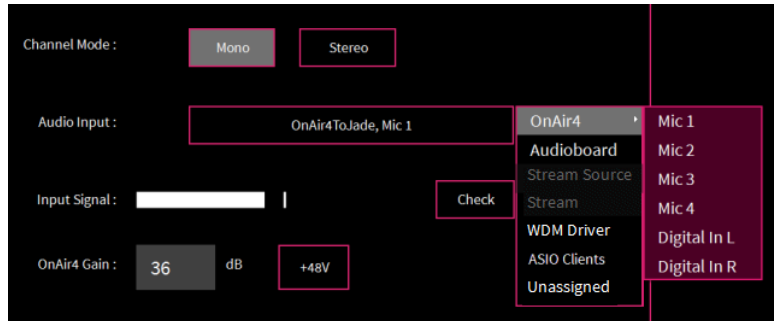


The screenshot shows a software interface with a dark background. At the top, there are five tabs: NAME, INPUT, PROCESSING, ROUTING, and SURFACE. The NAME tab is currently selected. Below the tabs, the text "Name (max 2 * 8 chars):" is displayed. Underneath this text is a text input field containing the word "Headset". At the bottom right of the interface, there are two buttons: "OK" and "CANCEL".

6.2.2 Input

The **INPUT** tab configures the audio input for the selected source:

1. Set the **Channel Mode** to be either **Mono** or **Stereo**.
2. Click in the **Audio Input** field to choose an input from the drop-down list:



The input options are divided into the following categories:

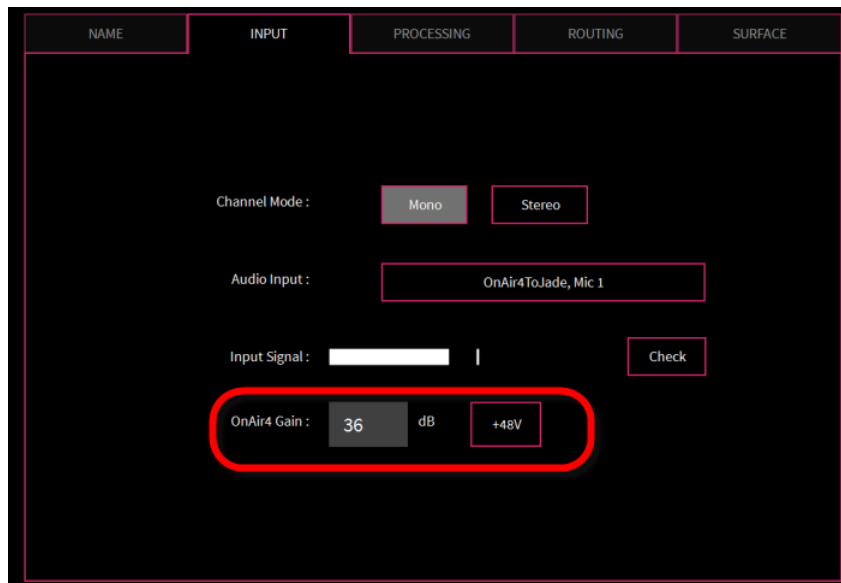
- **OnAir4** - inputs from an **OnAir4** (if configured under [Global Settings -> OnAir4](#)).
- **Audioboard** - hardware audio interfaces connected to your computer. The options available are defined in the "Audio Hardware" category of the [Global Settings -> Patch](#).
- **Stream Source** - RAVENNA streams sending from **RELAY** to the RAVENNA network. Note that this option is greyed out as it is not applicable when selecting an audio input.
- **Stream** - incoming RAVENNA streams received from the network. The available streams are defined in the "RAVENNA" category of the Global Settings -> Patch. See [Available Streams](#).
- **WDM Driver** - normally used to route audio streams from software applications such as chat software or media players. See [WDM Software Clients](#) and the [Windows Default Sound Device](#).
- **ASIO Clients** - third-party software applications using the **RELAY ASIO** driver. The options available are defined in the "Audio Software" category of the [Global Settings -> Patch](#).
- **Unassigned** - removes an existing assignment.

If a category is "greyed out", then either it is not applicable or no inputs of that type have been added to the [Global Settings -> Patch](#).

If a certain channel is already used, then it is highlighted. If you select a used channel, then a pop-up appears asking if you wish to remove the existing assignment.

It is not recommended that you create sources from the same device using different driver types. If you do, then audio may be received at slightly different times causing phasing problems if you attempt to listen to the streams simultaneously. See [Choosing the Best Driver](#).

If you choose an **OnAir4** MIC/LINE input, then you can adjust the microphone **Gain** and **48V** (phantom power):



3. Having made an assignment, the **Input Signal** field meters the level - you will see a solid white meter bar if signal is present.
4. By pressing **Check**, a 1kHz test tone is routed to the [headphone](#) output for as long as the **Check** button is pressed. The signal level is dependent on the headphone master, so please check that the PHONES level is not muted, otherwise you will not hear the test signal.

Always decrease the headphone volume before engaging the test tone. Prolonged exposure to loud frequencies may result in temporary or permanent hearing loss.

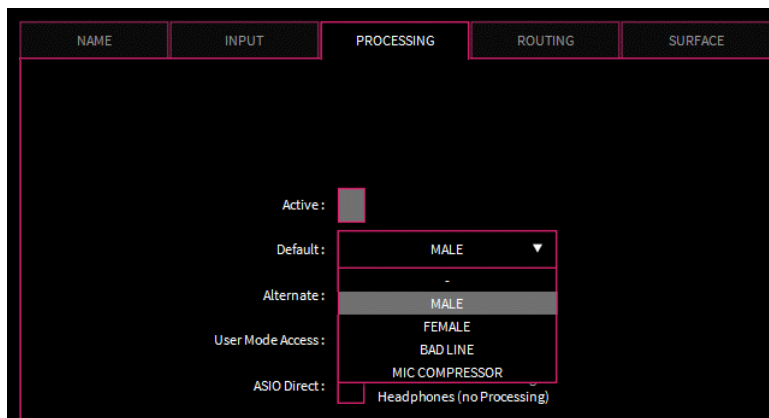
6.2.3 Processing

The **PROCESSING** tab configures the signal processing for the selected source:



You can configure permanent signal processing (not visible to the end user), or provide a choice of processing presets (**Default** and **Alternate**) which can be enabled or disabled by the user, see [Channel Parameters](#).

1. Enable the **Active** box to make the **Default** signal processing active by default.
2. Click in the **Default** (and **Alternate**) fields to select a signal processing preset:




The options available in the drop-down list are configured in [Global Settings -> Processing](#).

3. Enable the **User Mode Access** box to configure buttons, to switch the presets, in user mode.
4. Enable the **ASIO Direct** box to activate [ASIO Direct Monitoring](#) for monitoring purposes. If checked, and ASIO Direct Monitoring is supported, the input signal is routed directly to the headphone output without processing. This is ideal for artist monitoring applications where software-based latency is unacceptable. The option has no effect on other signal paths, and so any active processing is applied as normal to the programme output.

➤ Example Configurations

In our first example, we have assigned a **Default** processing preset (**MALE**) and an **Alternate** processing preset (**FEMALE**). The **User Mode Access** option is on, and therefore the two processing options appear as **MALE** and **FEMALE** buttons in user mode when the source is assigned to a channel strip:

Source Configuration

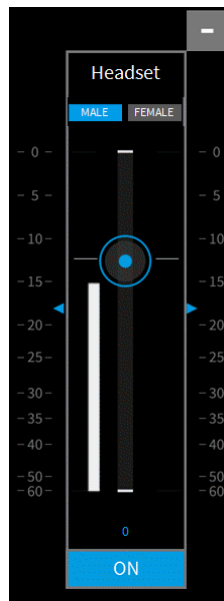


The screenshot shows the 'Source Configuration' dialog box with the 'PROCESSING' tab selected. The dialog has five tabs: NAME, INPUT, PROCESSING, ROUTING, and SURFACE. The 'PROCESSING' tab contains the following settings:

- Active:
- Default: MALE (dropdown menu)
- Alternate: FEMALE (dropdown menu)
- User Mode Access:
- ASIO Direct: Use ASIO Direct Monitoring on Headphones (no Processing)

At the bottom right, there are 'OK' and 'CANCEL' buttons.

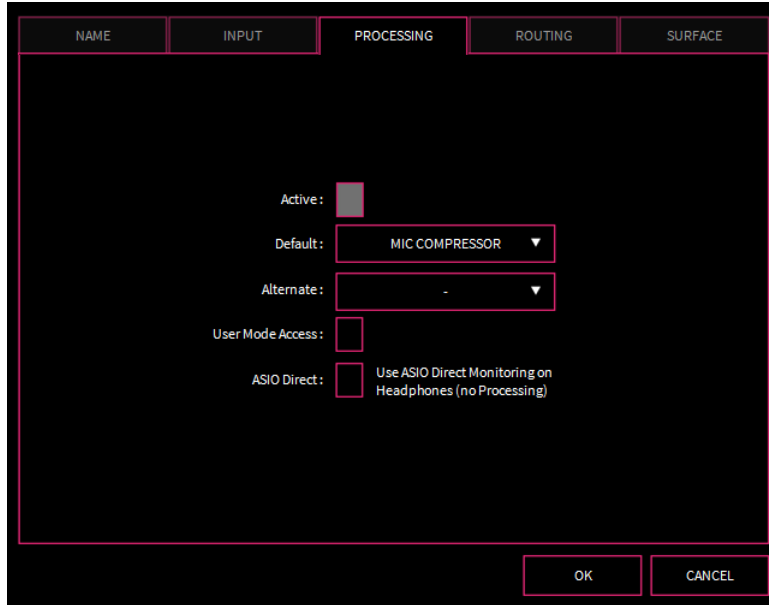
Channel Strip



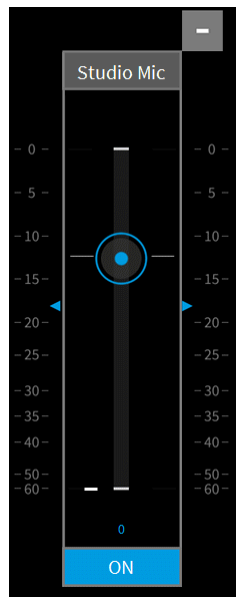
To achieve inaudible switching, it is essential that the **Default** and **Alternate** presets use identical Slot assignments. See [Global Settings -> Processing](#) for details.

In our second example, the **User Mode Access** option is disabled, and the **Active** box is enabled. This means that the **Default** processing preset (**MIC COMPRESSOR**) is always in circuit and is not visible to the end user:

Source Configuration

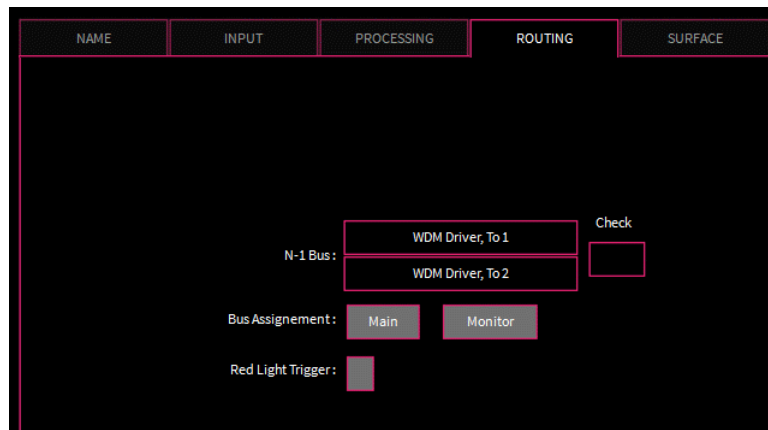


Channel Strip



6.2.4 Routing

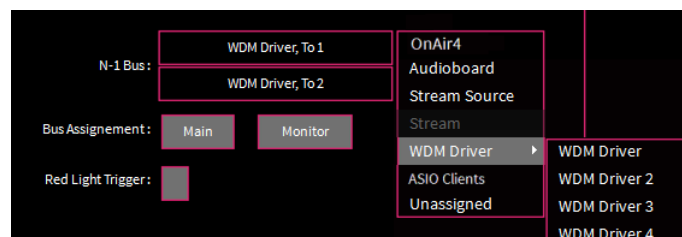
The **ROUTING** tab configures the bus and red light trigger options:



1. Click in the **N-1 Bus** field to choose an audio output for the source's [N-1 feed](#).

You may configure an N-1 for up to 4 audio sources. If all 4 assignments are already used, then the **N-1 Bus** field is greyed out, and you will need to unassign the **N-1 Bus** output from one of those sources before you can continue.

Note that the feed can be either mono (assign the upper field only) or stereo (assign both fields):



The output options are divided into the following categories:

- **OnAir4** - outputs of an **OnAir4** (if configured under [Global Settings -> OnAir4](#)).
- **Audiobards** - hardware audio interfaces connected to your computer. The options available are defined in the "Audio Hardware" category of the [Global Settings -> Patch](#).
- **Stream Source** - RAVENNA streams sending from **RELAY** to the RAVENNA network. The available streams are defined in the "RAVENNA" category of the Global Settings -> Patch. See [Add Stream](#).
- **Stream** - incoming RAVENNA streams received from the network. Note that this option is greyed out as it is not applicable when selecting an audio output.
- **WDM Driver** - normally used to route audio streams to software applications such as chat software or media players. See [WDM Software Clients](#) and the [Windows Default Sound Device](#).
- **ASIO Clients** - third-party software applications using the **RELAY ASIO** driver. The options available are defined in the "Audio Software" category of the [Global Settings -> Patch](#).
- **Unassigned** - removes an existing assignment.

If a category is "greyed out", then either it is not applicable or no outputs of that type have been added to the [Global Settings -> Patch](#).

If a certain channel is already used, then it is highlighted. If you select a used channel, then a pop-up appears asking if you wish to remove the existing assignment.

2. Use the **Check** button to send a 1kHz sinewave test tone to the selected output; the test signal is active for as long as the button is pressed.

3. The **Bus Assignment** fields determine whether the source can be assigned to a fader and/or the monitoring.

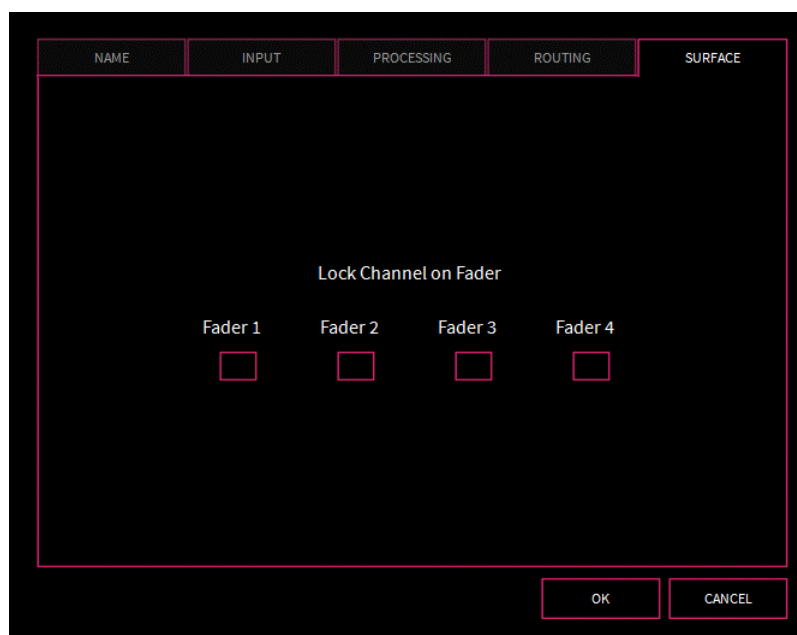
If **Main** is not selected, then the source cannot be assigned to a channel strip and, therefore, cannot be assigned to a bus (programme).

If **Monitor** is not selected, then the source is not available as a button on the [monitor source selector](#), and is also removed from the monitoring (when listening to the programme bus). The actual programme output is not affected. You should use this option when working with say a USB headset microphone, where the latency of hearing the source in the monitor output would be distracting.

4. Enable the **Red Light Trigger** if you wish the source to activate the [red light](#) status when the channel is open.

6.2.5 Surface

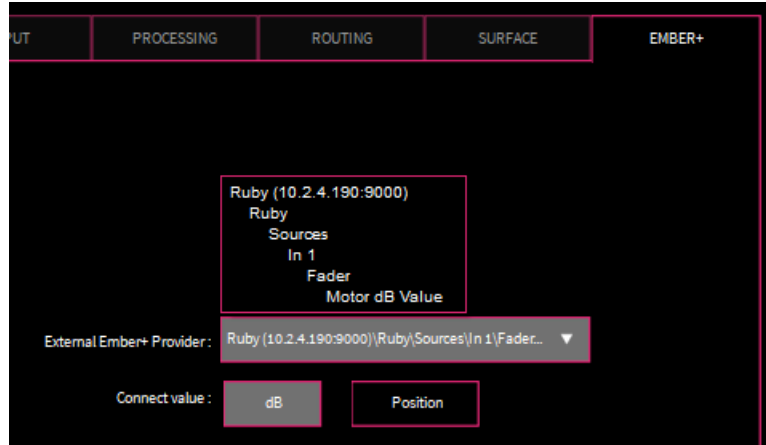
The **SURFACE** tab can be used to lock the selected source channel to a fader. Select the fader using the **Fader n** check boxes:



6.2.6 EMBER+

The **EMBER+** tab can be used to control the level of the source from an external Ember+ provider.

The provider must first be defined in the **GLOBAL SETTINGS** -> [EMBER+](#) tab. Then use the drop-down menu to search through the provider's Ember+ Tree and assign a Real value - for example, the **Fader Motor dB Value** from **Source 1** on our external **Ruby** surface:



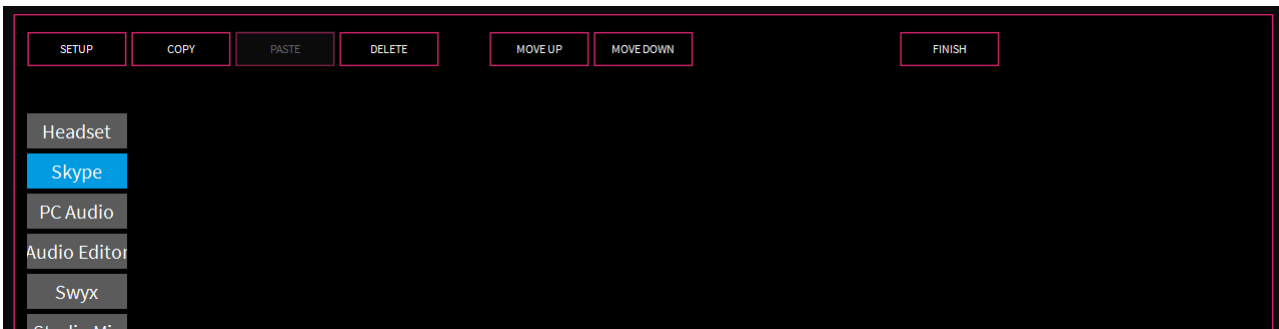
Then select which parameter within **RELAY VRX⁴** you wish to control - you can choose either the actual **dB** value or the relative **Position** of the fader.

For more details, see [Ember+](#).

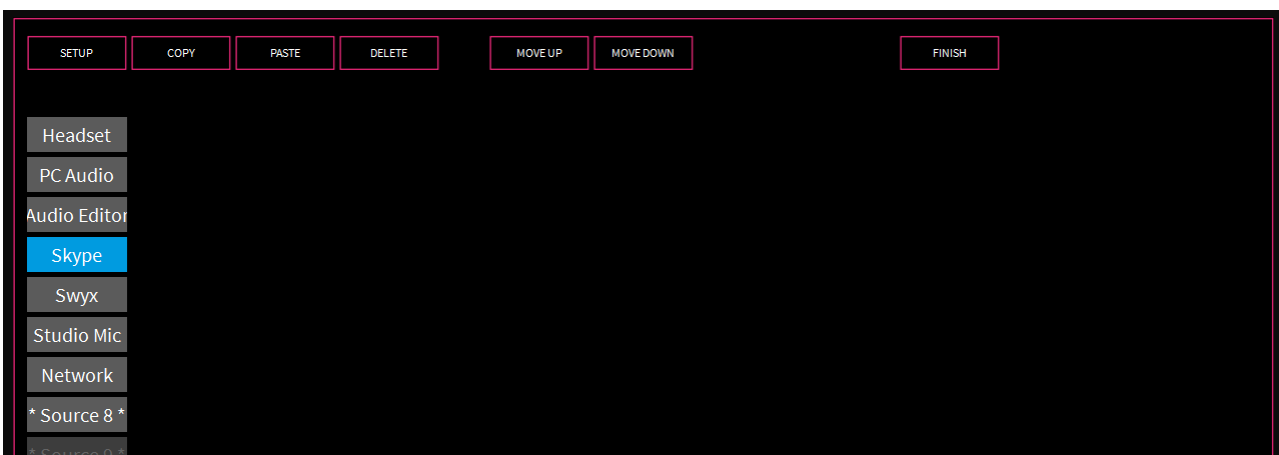
6.2.7 Other Source Configuration Tasks

➤ To change the position of a source in the list:

1. Select the source and choose either **MOVE UP** or **MOVE DOWN**:



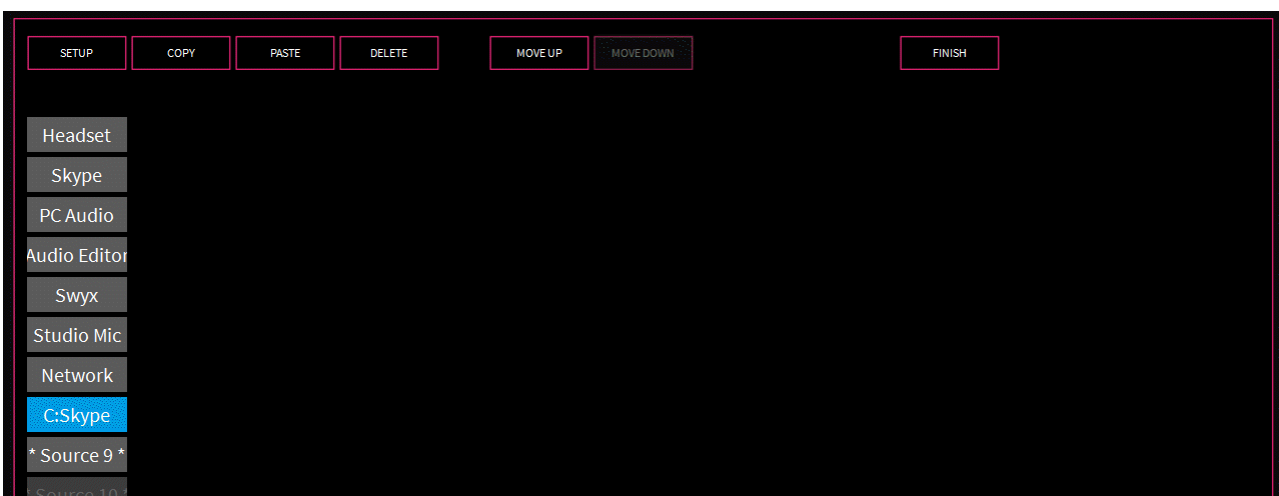
The selected source moves up or down the list:



➤ To copy and paste a source:

1. Select the source (e.g. **SKYPE**), and choose **COPY**.
2. Then select the destination position (e.g. **SOURCE 8**) and choose **PASTE**.

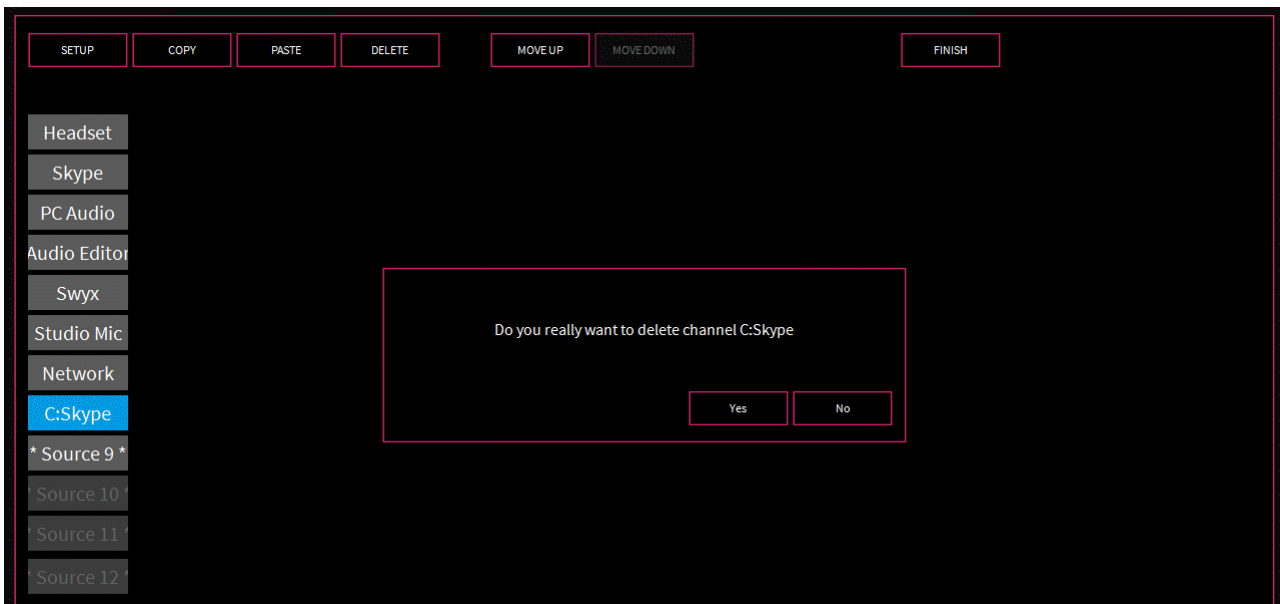
All parameters of the copied source are pasted to the selected position.



3. You can now edit the source parameters as you wish.

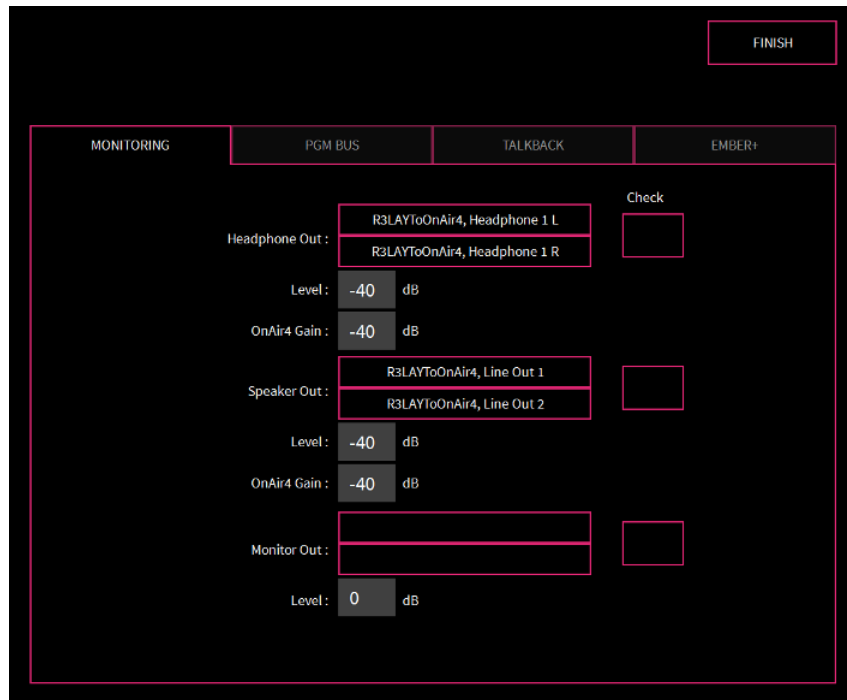
➤ **To delete a source:**

1. Select the source (e.g. **C:SKYPE**), and choose **DELETE**.
2. Select **Yes** to confirm the delete:



6.3 Bus Setup

1. Switch to [Admin mode](#) and select **BUS SETUP** to open the 'Bus Setup' window:



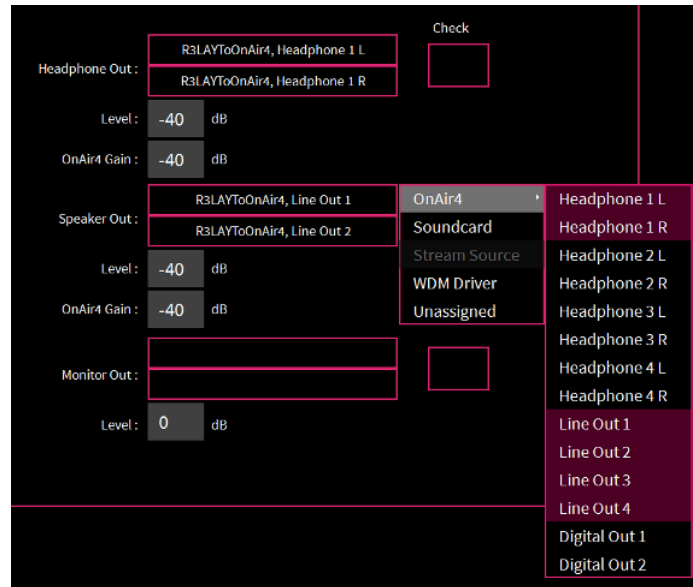
This window configures the monitor outputs, programme bus outputs and talkback options.

6.3.1 Monitoring

1. Select **MONITORING** to assign the **Headphone**, **Speaker** and **Monitor Outs** to their output destinations.

Note that the **Monitor Out** provides an output from the monitor source selector, but without level control. Typically, it can be used to feed an external "Follow Monitor" meter.

2. Click in each field to assign an output from the drop-down list - note that all outputs are stereo (so assign both fields: upper = Left, lower = Right):



The output options are divided into the following categories:

- **OnAir4** - outputs of an **OnAir4** (if configured under [Global Settings -> OnAir4](#)).
- **Audiobboards** - hardware audio interfaces connected to your computer. The options available are defined in the "Audio Hardware" category of the [Global Settings -> Patch](#).
- **Stream Source** - RAVENNA streams sending from **RELAY** to the RAVENNA network. The available streams are defined in the "RAVENNA" category of the Global Settings -> Patch. See [Add Stream](#).
- **Stream** - incoming RAVENNA streams received from the network. Note that this option is greyed out as it is not applicable when selecting an audio output.
- **WDM Driver** - normally used to route audio streams to software applications such as chat software or media players. See [WDM Software Clients](#) and the [Windows Default Sound Device](#).
- **ASIO Clients** - third-party software applications using the **RELAY ASIO** driver. The options available are defined in the "Audio Software" category of the [Global Settings -> Patch](#).
- **Unassigned** - removes an existing assignment.

If a category is "greyed out", then either it is not applicable or no outputs of that type have been added to the [Global Settings -> Patch](#).

If a certain channel is already used, then it is highlighted. If you select a used channel, then a pop-up appears asking if you wish to remove the existing assignment.

For [ASIO Direct Monitoring](#), the outputs assigned as headphone outputs must be set as a stereo pair in the ASIO device configuration software. Note that this is a requirement of the ASIO driver specification, and not **RELAY VRX⁴**.

3. Use the **Level** field to set the initial level (applied after a restart of the application). Use the **OnAir Gain** field to set the output gain within the **OnAir4**.
4. Use the **Check** button to send a 1kHz test tone to the selected output; the test signal is active for as long as the button is depressed.

Note: the test tone can be sent to physical outputs only, such as those found on the Lawo OnAir 4, or to RAVENNA streams. The tone cannot be sent to virtual outputs via Windows drivers.

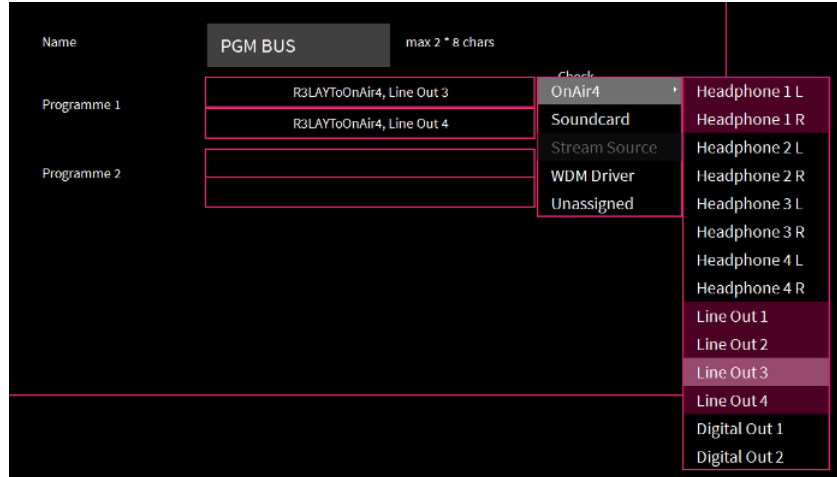
Always decrease monitor / headphone volumes before engaging the test tone. Prolonged exposure to loud frequencies may result in temporary or permanent hearing loss.

6.3.2 PGM Bus

1. Select **PGM BUS** to assign the stereo [programme](#) bus to its output destinations.

Note that the same bus can be assigned to two outputs: **Programme 1** and **Programme 2**.

2. Click in each field to assign an output from the drop-down list - each assignment can be mono (assign the upper field only) or stereo (assign both fields):



The output options are divided into the following categories:

- **OnAir4** - outputs of an **OnAir4** (if configured under [Global Settings -> OnAir4](#)).
- **Audiobords** - hardware audio interfaces connected to your computer. The options available are defined in the "Audio Hardware" category of the [Global Settings -> Patch](#).
- **Stream Source** - RAVENNA streams sending from **R3LAY** to the RAVENNA network. The available streams are defined in the "RAVENNA" category of the Global Settings -> Patch. See [Add Stream](#).
- **Stream** - incoming RAVENNA streams received from the network. Note that this option is greyed out as it is not applicable when selecting an audio output.
- **WDM Driver** - normally used to route audio streams to software applications such as chat software or media players. See [WDM Software Clients](#) and the [Windows Default Sound Device](#).
- **ASIO Clients** - third-party software applications using the **R3LAY ASIO** driver. The options available are defined in the "Audio Software" category of the [Global Settings -> Patch](#).
- **Unassigned** - removes an existing assignment.

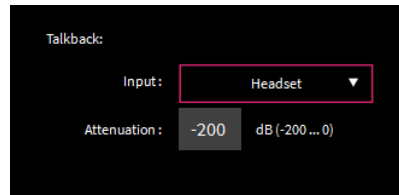
If a category is "greyed out", then either it is not applicable or no outputs of that type have been added to the [Global Settings -> Patch](#).

If a certain channel is already used, then it is highlighted. If you select a used channel, then a pop-up appears asking if you wish to remove the existing assignment.

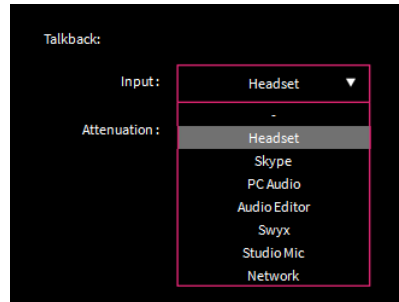
3. Use the **Check** button to send a 1kHz sinewave test tone to the selected output; the test signal is active for as long as the button is pressed.

6.3.3 Talkback

1. Select **TALKBACK** to configure the talkback options:



2. Click in the **Input** field to assign a talkback source (used when you talk to an [N-1](#) feed). You can choose any configured source, see [Source Configuration](#):

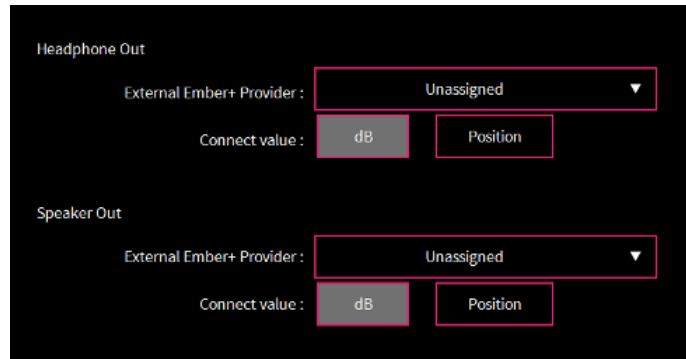


3. Use the **Attenuation** field to enter the amount (in dB) by which the [N-1](#) feed will be dimmed when talkback is active. The value can be adjusted from -200dB (mute) to 0dB (no attenuation).

6.3.4 Ember+

The **EMBER+** tab can be used to assign control of the Headphone or Speaker outputs to an external Ember+ provider.

Note that the provider must first be defined in the **GLOBAL SETTINGS** -> [EMBER+](#) tab. Then use the drop-down menu to search through the provider's Ember+ Tree and assign a Real value.



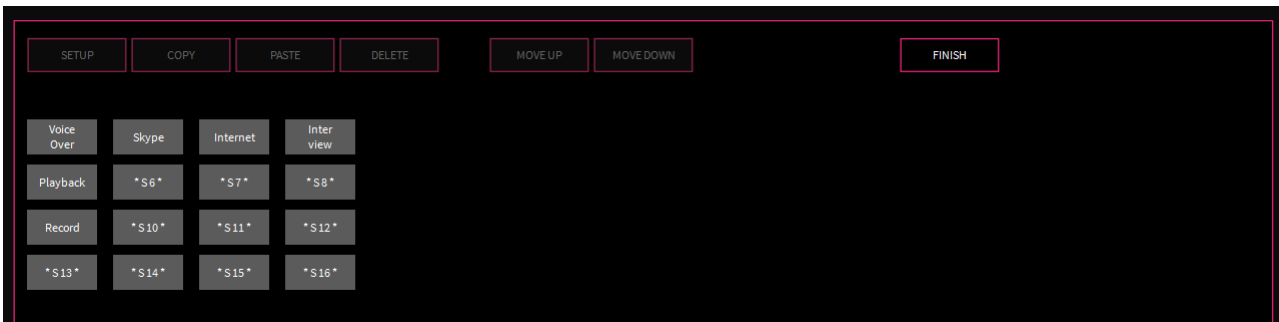
The screenshot shows a configuration interface with a black background and white text. It is divided into two sections: 'Headphone Out' and 'Speaker Out'. Each section has an 'External Ember+ Provider' dropdown menu currently set to 'Unassigned'. Below each dropdown is a 'Connect value' section with two buttons: 'dB' and 'Position'. The 'dB' button is highlighted with a red border in the original image.

Then select which parameter within **RELAY VRX⁴** you wish to control - you can choose either the actual **dB** value or the relative **Position** of the Volume controller.

For more details, see [Ember+](#).

6.4 Snapshot Configuration

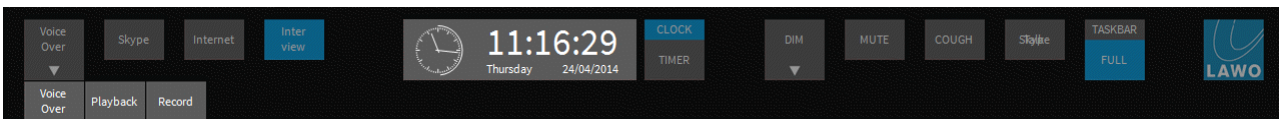
1. Switch to [Admin mode](#) and select **SNAPSHOTS** to open the 'Snapshot Configuration' window:



This window prepares the 16 snapshots available in user mode, see [Snapshot Recall](#).

Each snapshot recalls the sources assigned to the 4 channels strips and their fader levels, plus the choice of monitor source. In addition, a Windows batchfile can perform actions outside of **RELAY**. For example, to start your recording software and place it into record ready mode.

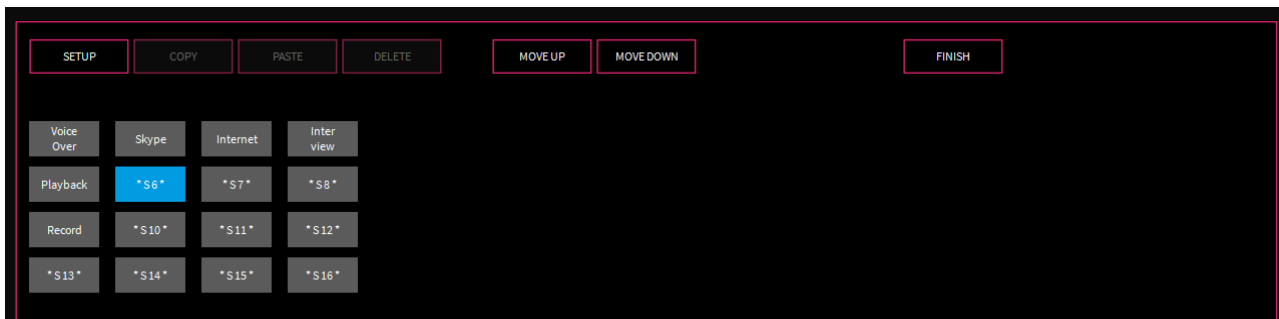
The top row of snapshots are presented directly to the user, while any additional snapshots, configured in the lower rows, are stacked in drop-down menus:



Any "free" positions are indicated by * (e.g. ***S6***).

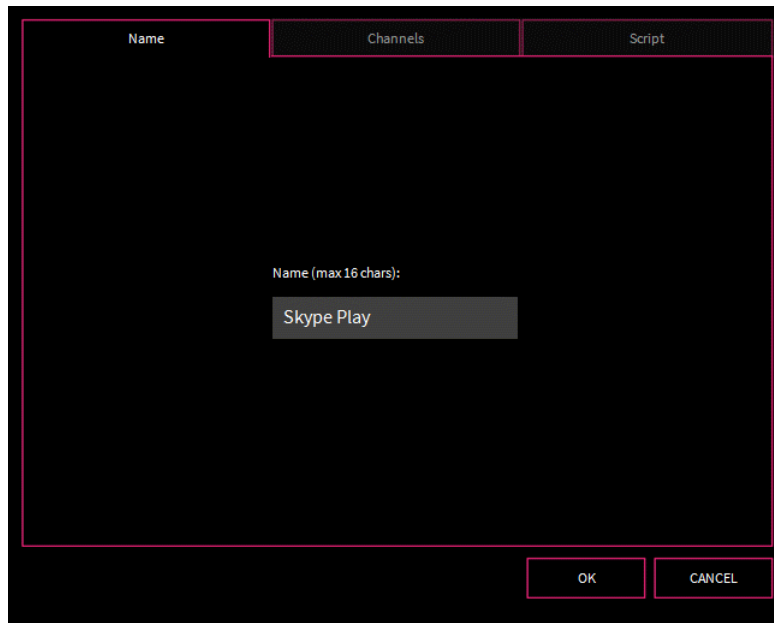
2. Select an existing snapshot (e.g. **Voiceover**) or a free position (e.g. ***S6***).

The selected snapshot is highlighted in blue, and the editing options at the top of the window (**SETUP**, **MOVE UP**, **MOVE DOWN**, etc.) become active:



3. Select **SETUP** and choose a tab: [NAME](#), [CHANNELS](#) or [SCRIPT](#) - each of the tabs is covered in further detail on the next few pages.
4. Having made your changes, select either **OK** or **CANCEL** to return to the main 'Snapshot Configuration' window.

6.4.1 Name



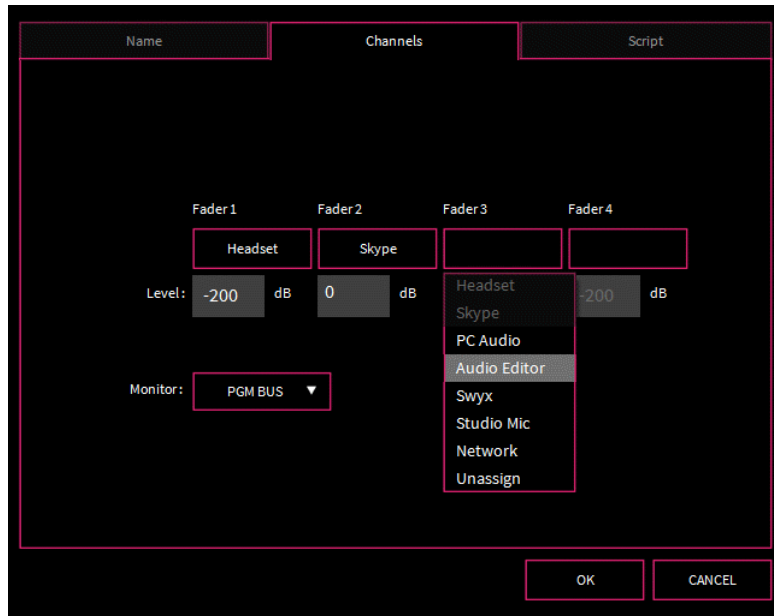
The screenshot shows a dialog box with a dark background and a light border. At the top, there are three tabs: 'Name', 'Channels', and 'Script'. The 'Name' tab is selected. In the center, there is a text input field containing the text 'Skype Play'. Above the input field, the text 'Name (max 16 chars):' is displayed. At the bottom right of the dialog, there are two buttons: 'OK' and 'CANCEL'.

The **NAME** field names the snapshot - enter a new name (up to 16 characters) and select **OK** to confirm. The new name is reflected in the snapshot grid (on the left).

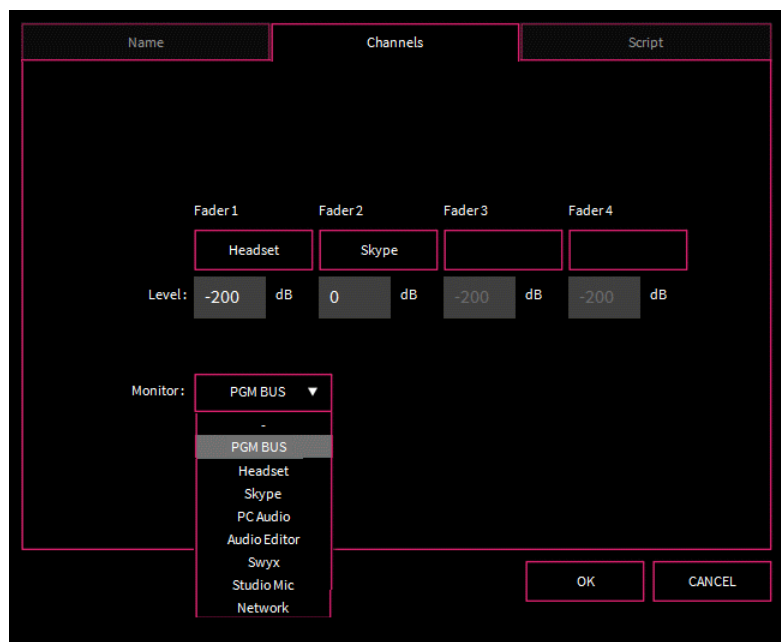
6.4.2 Channels

The **CHANNELS** tab defines the fader assignments, levels and monitor source to be recalled by the selected snapshot.

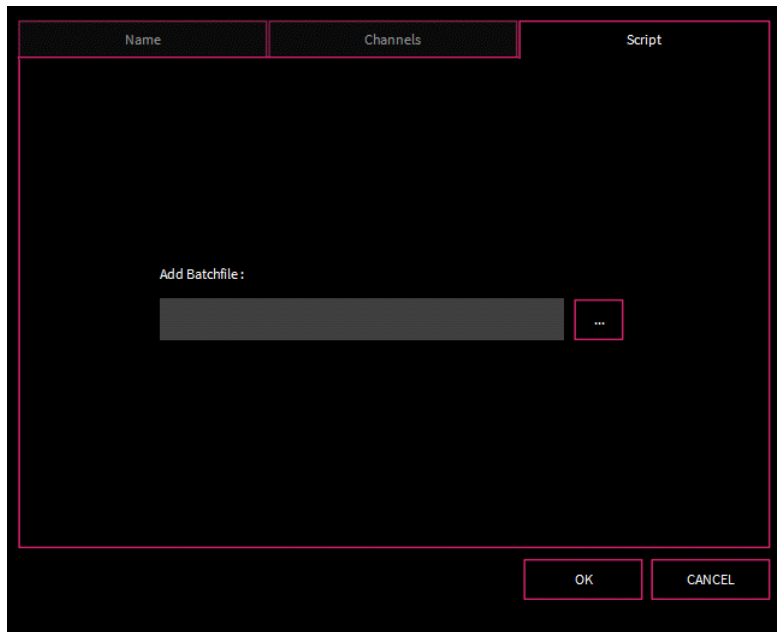
1. Click in the **Fader n** fields to choose a source from the drop-down list - you can choose any configured source, see [Source Configuration](#), or select **Unassign** to remove a fader assignment:



2. Enter the desired channel level in the **Level** field. The value can be adjusted from -200dB (off) to 0dB.
3. Click in the **Monitor** field to choose a monitor source from the drop-down list. This is the monitor source which will be selected when the snapshot loads - you can select the programme bus (**SUM**), or any configured source. Leave the field empty (-), and the monitor source remains unchanged when the snapshot loads.



6.4.3 Script



The **SCRIPT** tab enters the file path for a Windows batchfile; when the selected snapshot loads, the batchfile will run.

This can be used to perform actions outside of **RELAY VRX⁴**, such as starting and configuring your recording or chat software.

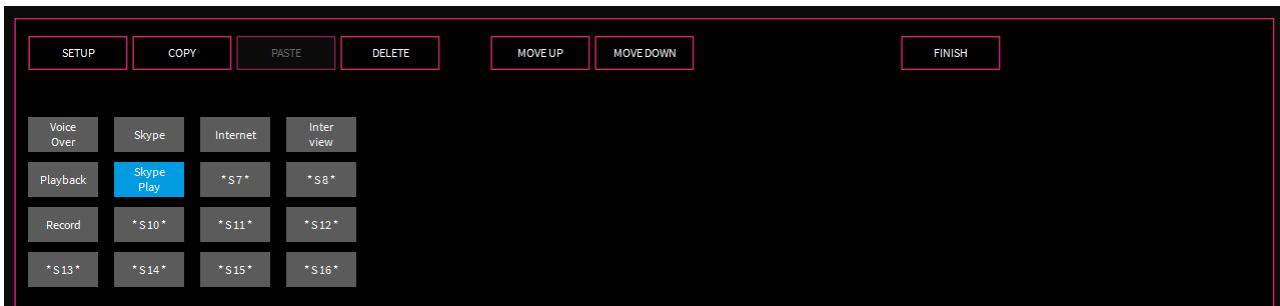
Click on the ... button to select the file path for the batchfile.

For best performance, batchfiles should be stored on a local drive.

6.4.4 Other Snapshot Configuration Tasks

➤ To change the position of a snapshot:

1. Select the snapshot and choose either **MOVE UP** or **MOVE DOWN**:



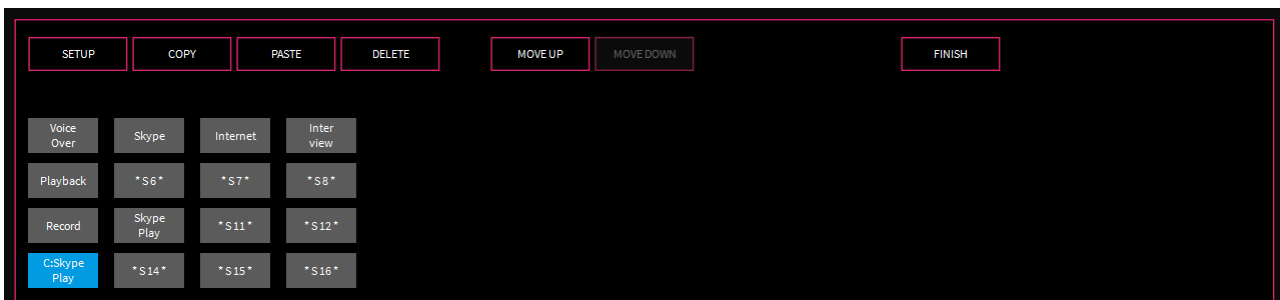
The selected snapshot moves up or down in the grid.

Note that you cannot move a snapshot left or right. However, you can copy and paste a snapshot to achieve the same result.

➤ To copy and paste a snapshot:

1. Select the snapshot (e.g. **SKYPE PLAY**), and choose **COPY**.
2. Then select the destination position and choose **PASTE**.

The copied snapshot is pasted to the selected position.



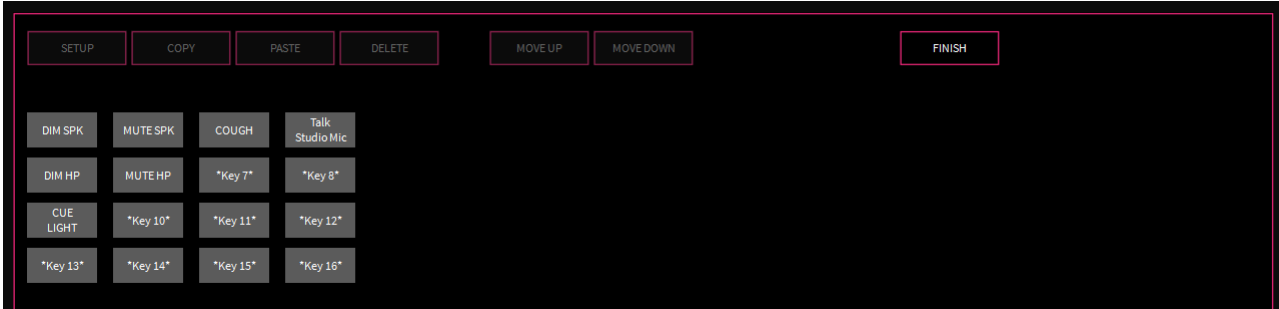
3. You can now edit the snapshot as you wish.

➤ To delete a snapshot:

1. Select the snapshot (e.g. **C:SKYPE PLAY**), and choose **DELETE**.
2. Select **Yes** to confirm the delete.

6.5 User Key Configuration

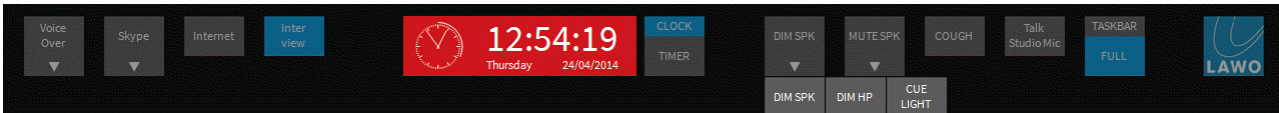
1. Switch to [Admin mode](#) and select **USER KEYS** to open the 'User Key Configuration' window:



This window prepares the 16 user keys available in user mode, see [User Keys](#).

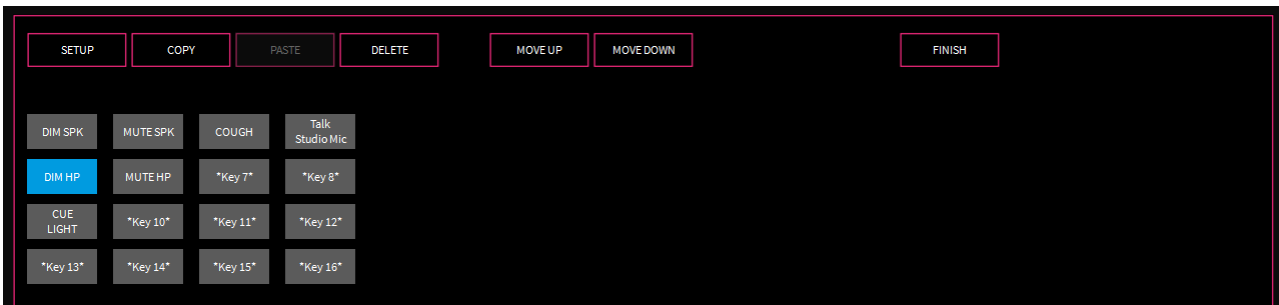
User keys offer fast access to functions such as a **COUGH** switch, monitor **DIM**, **TALK** to an N-1, GPIO commands, etc.

The top row of user keys are presented directly to the user, while any additional functions, configured in the lower rows, are stacked in drop-down menus:

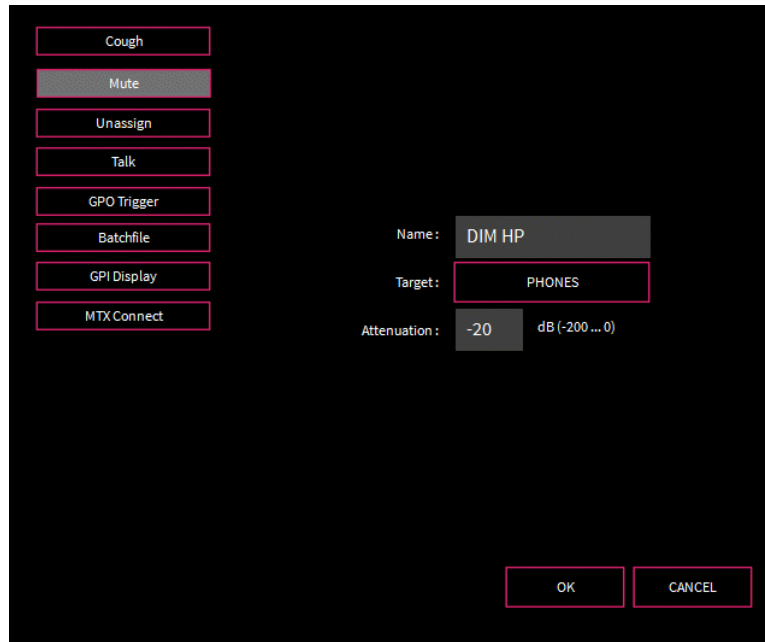


2. Select an existing user key (e.g. **DIM HP**) or a free position (e.g. ***Key 7***).

The selected user key is highlighted in blue, and the editing options at the top of the window (**SETUP**, **MOVE UP**, **MOVE DOWN**, etc.) become active:

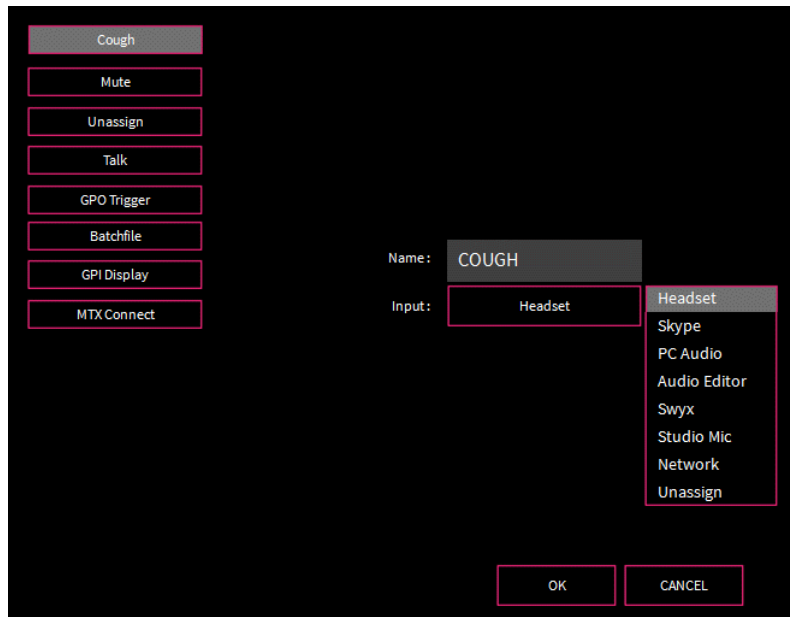


3. Select **SETUP** and choose a function from the function list: **Cough**, **Mute**, **Unassign**, etc.



4. Having made your changes, select either **OK** or **CANCEL** to return to the main 'User Key Configuration' window.

6.5.1 Cough Switch

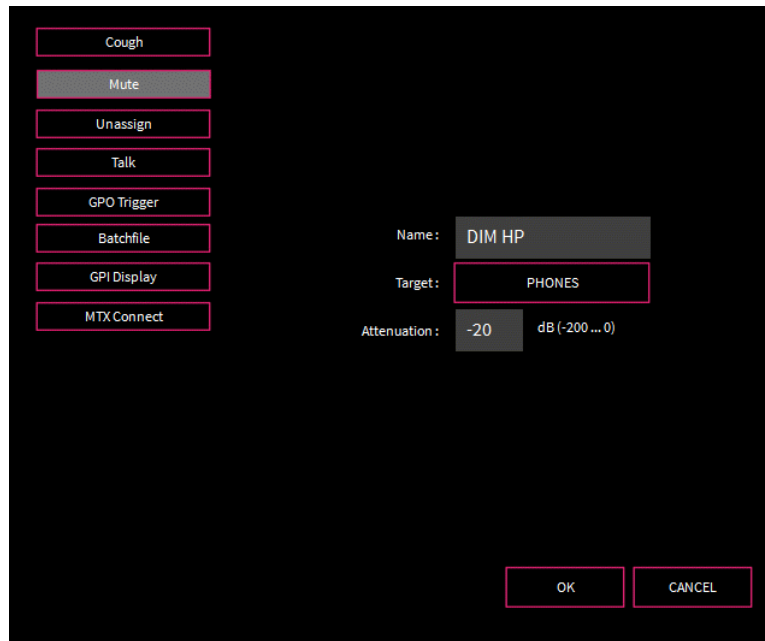


The **Cough** function creates a "cough" user key which temporarily mutes a source channel (while the presenter coughs):

- **Name** - this field renames the user key.
- **Input** - click in this field to select the source you wish to mute. You can select any configured source, see [Source Configuration](#).

Cough user keys are always momentary.

6.5.2 Monitor Mute (or Dim)



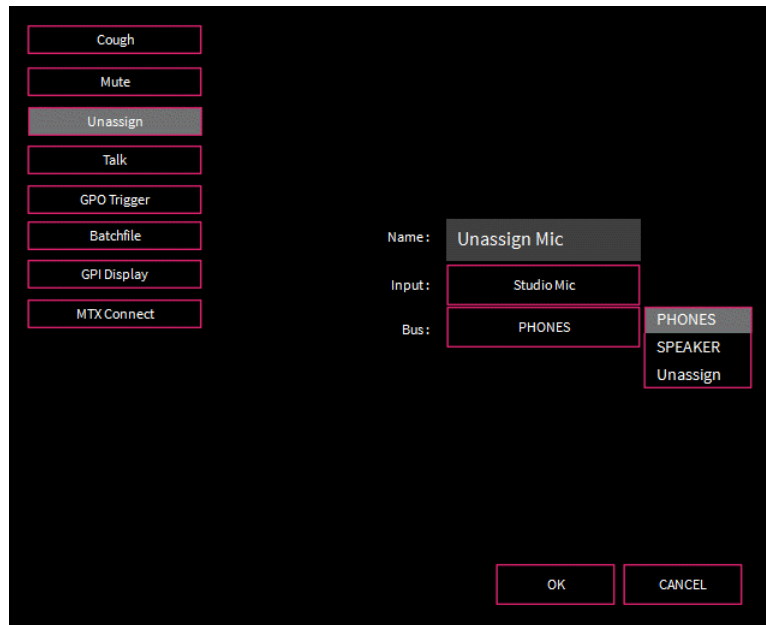
The **Mute** function creates a monitor mute or dim user key for either the speaker or headphone outputs:

- **Name** - this field renames the user key.
- **Target** - click in this field to select the monitor output you wish to attenuate. You can select either **PHONES** or **SPEAKER**.
- **Attenuation** - enter the amount (in dB) by which the target output will be dimmed. The value can be adjusted from -200dB (MUTE) to 0dB (no attenuation).

Our example shows a user key which will dim the headphone output by 20dB.

To operate **Mute** user keys, use a short press to latch the button on; press and hold for momentary operation.

6.5.3 Monitor Unassign



The **Unassign** function creates a monitor mute user key for a specific source. The source can be cut from either the speaker or headphone outputs:

- **Name** - this field renames the user key.
- **Input** - click in this field to select the source you wish to mute. You can select any configured source, see [Source Configuration](#).
- **Bus** - click in this field to select the monitor output. You can select either **PHONES** or **SPEAKER**.

Our example shows a user key which will unassign the Studio Mic from the headphone output.

To operate **Unassign** user keys, use a short press to latch the button on; press and hold for momentary operation.

6.5.4 Talk (to N-1)



The **Talk** function creates a talkback user key which talks to the N-1 output of a source. Note that the same function can be actioned from the channel strip, see [Talk to N-1](#).

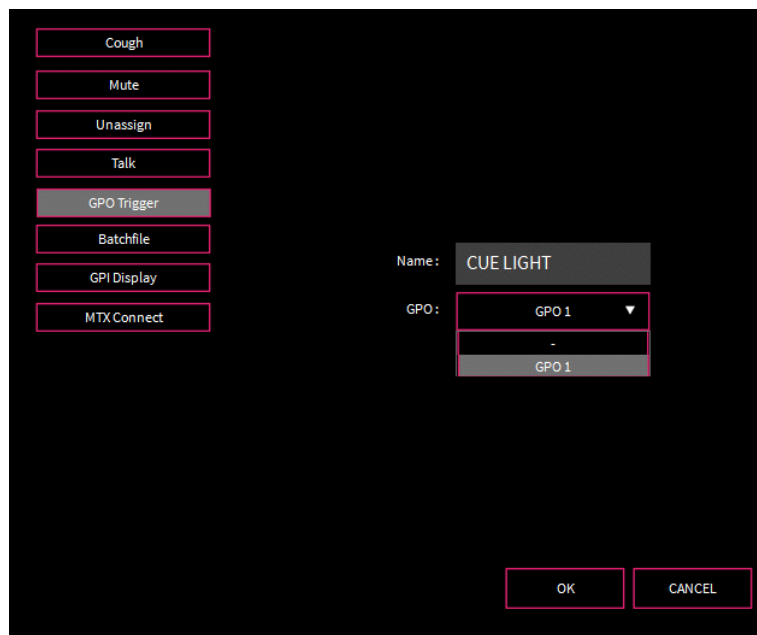
- **Input** - click in this field to select the source you wish to talk to. You can select any source with an N-1 output (configured in [Source Configuration: Routing](#)). If no sources appear in the drop-down list, then no N-1 outputs have been configured.

Our example shows a user key which will talk to the Studio Mic's N-1.

Note that these keys are automatically named as **Talk - "Source Name"**.

To operate **Talk** user keys, use a short press to latch the button on; press and hold for momentary operation.

6.5.5 GPO Trigger



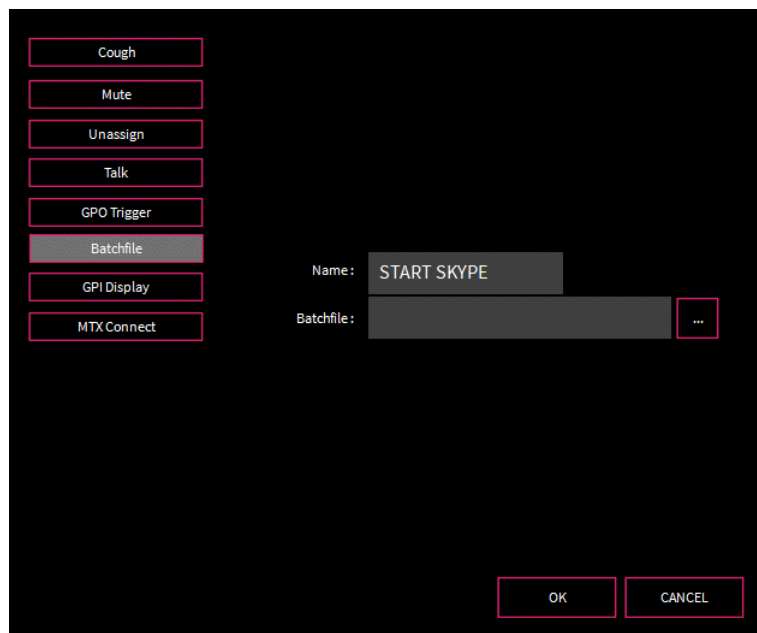
The **GPO Trigger** creates a user key which activates a GPO. For example, to light an external cue light. Note that the GPO functions and behaviour are defined in the [Global Settings -> GPO](#) menu.

- **Name** - this field renames the user key.
- **GPO** - click in this field to select the GPO you wish to trigger. You can select any GPO assigned to the [User Key Active](#) function in the "Global Settings -> GPO" menu.

Our example shows a user key which will light the studio's Cue Light (via GPO 1).

GPO Trigger user keys may be latching or momentary depending on the behaviour of the GPO.

6.5.6 Batchfile

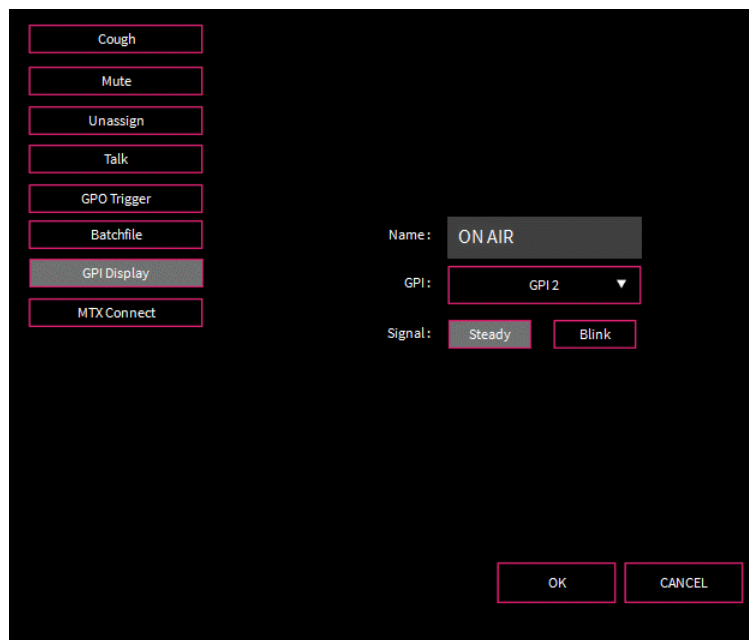


The **Batchfile** function creates a user key to perform actions outside of **RELAY VRX⁴**. For example, to start and configure your recording or chat software.

- **Name** - this field renames the user key.
- **Batchfile** - click on the ... button to select the file path for the batchfile. See [Snapshot: Script](#) for more details about editing scripts.

Batchfile user keys are always momentary.

6.5.7 GPI Display



The **GPI Display** function creates a user key which lights in response to a GPI. For example, to indicate an external state.

Note that the GPI functions and behaviour are defined in the [Global Settings -> GPI](#) menu.

- **Name** - this field renames the user key.
- **GPI** - click in this field to select a GPI. You can select any GPI assigned to the [Assign User Key](#) function in the "Global Settings -> GPI" menu. When the GPI is active, the user key will light.
- **Signal** - when the selected GPI is active, the user key can light in a **Steady** state, or **Blink**.

Our example shows a user key which will light when the studio is On Air (GPI 2 is active).

GPI Display user keys have no action; they light to indicate an external state.

6.5.8 MTX Connect



The **MTX Connect** function creates a user key which will action up to two external matrix connections via remote MNOPL. Typically, it is used to reset connections within a Lawo routing system, such as the Nova73.

Remote MNOPL must be enabled, in [Global Settings -> Remote](#), before the connections can be loaded. The **MNOPL** box in [Global Settings -> Status](#) indicates whether you have a valid connection.

- **Name** - this field renames the user key.
- **MNOPL** - use these fields to enter the **Source** and **Destination HLSD** for each connection you want to set.

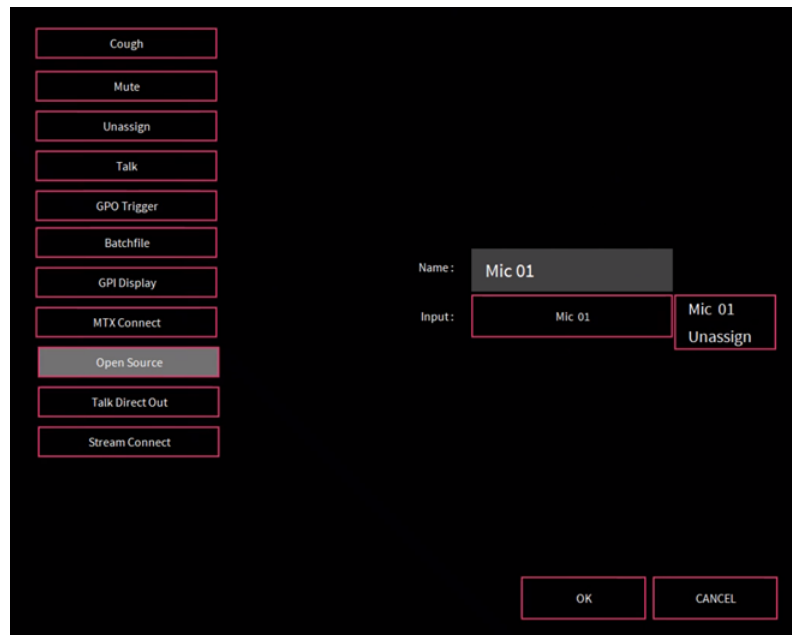
The High Level Signal Definition (HLSD) is a unique system address for the signal. The address syntax can be found by opening the **AdminHD configuration** for the Nova73 system - please refer to the "Nova73 Technical Manual".

When the user key is active, **Source 1** connects to **Target 1**, and **Source 2** connects to **Target 2**. This allows you to configure a mono or stereo connection.

Note that once the connections are set, they remain active. Therefore, you will need to create a second user key (e.g. **CLEAR**) to mute the Targets or return to another connection state.

6.5.9 Open Source

This function appears if "Open Source" is enabled via the [Advanced Options](#).

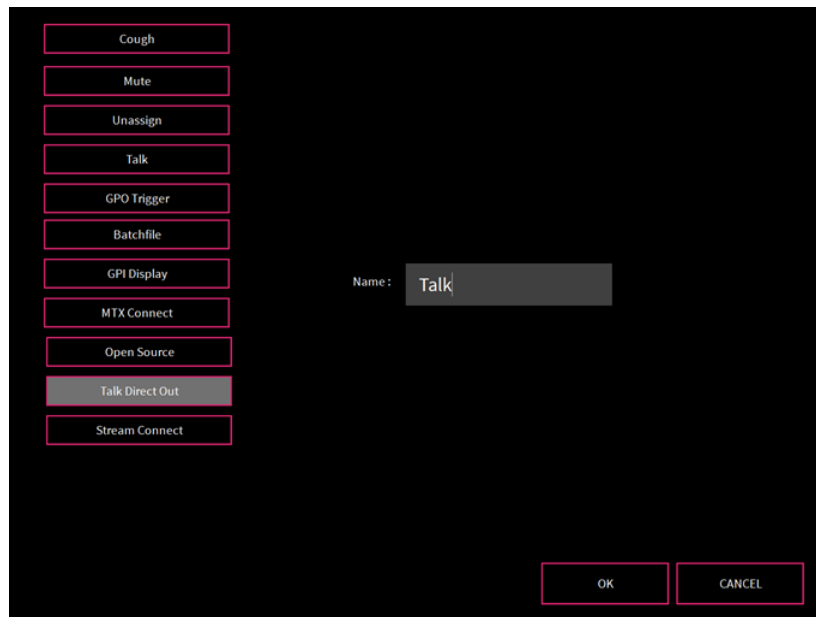


The **Open Source** function creates a user key which will open (and close) a source channel. On opening, the fader will return to its last known position.

- **Name** - this field names the user key.
- **Input** - click in this field to select the source you wish to control. You can select any configured source, see [Source Configuration](#).

6.5.10 Talk Direct Out

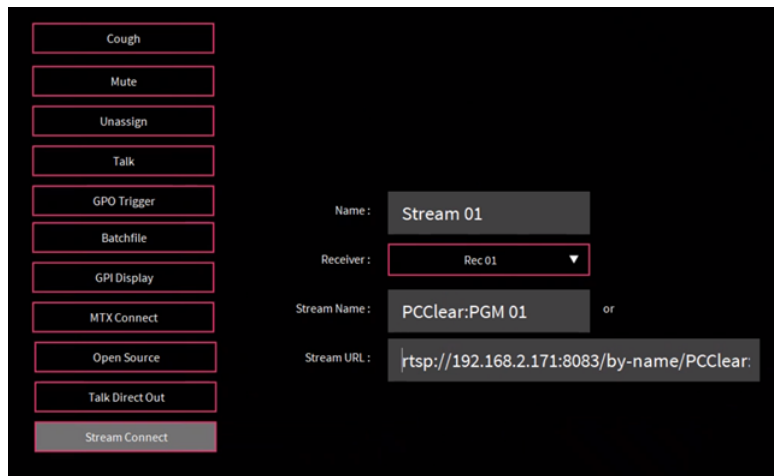
This function appears if "Talk Direct" is enabled via the [Advanced Options](#).



The **Talk Direct Out** function creates a user key which will talk to the direct out. Use the **Name** field to name the user key.

6.5.11 Stream Connect

This function appears if "Stream Receive Connect" is enabled via the [Advanced Options](#).



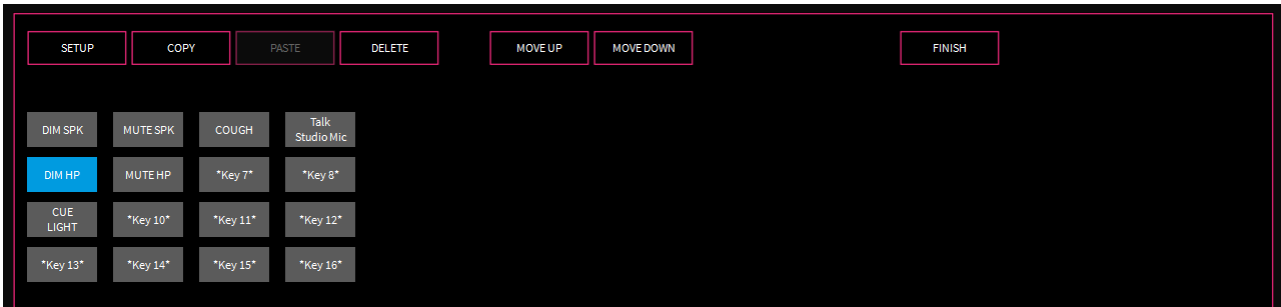
The **Stream Connect** function creates a user key which will connect (or disconnect) an incoming stream to a stream receiver. A prerequisite is that the "[Use Ember](#)" and "[Matrix Server](#)" options are enabled in order to prepare the stream receiver.

- **Name** - this field names the user key.
- **Receiver** - click in this field to select the stream receiver (as defined in the [Global Settings -> Patch -> RAVENNA](#) menu).
- **Stream Name** or **Stream URL** - to define the incoming stream, you can specify either the stream name or copy and paste the stream URL.

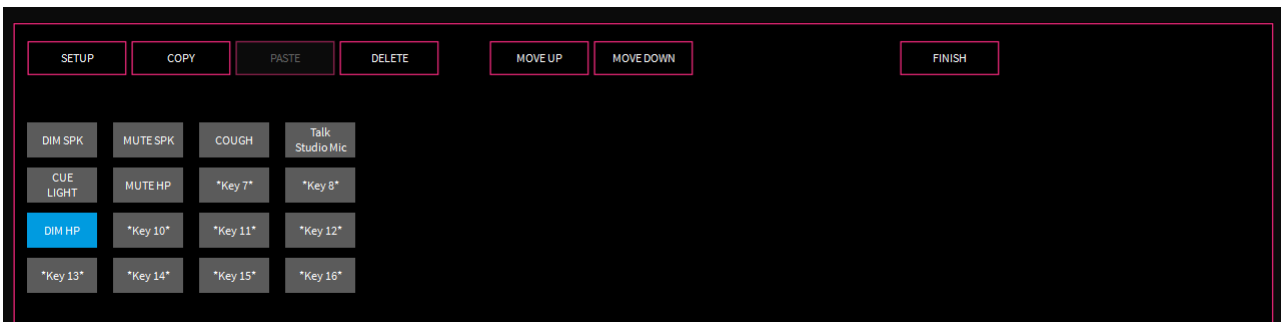
6.5.12 Other User Key Configuration Tasks

➤ To change the position of a user key:

1. Select the key and choose either **MOVE UP** or **MOVE DOWN**:



The selected user key moves up or down in the grid:



Note that you cannot move a user key left or right. However, you can copy and paste a user key to achieve the same result.

➤ To copy and paste a user key:

1. Select the key (e.g. **COUGH**), and choose **COPY**.
2. Then select the destination position (e.g. **S7**) and choose **PASTE**.

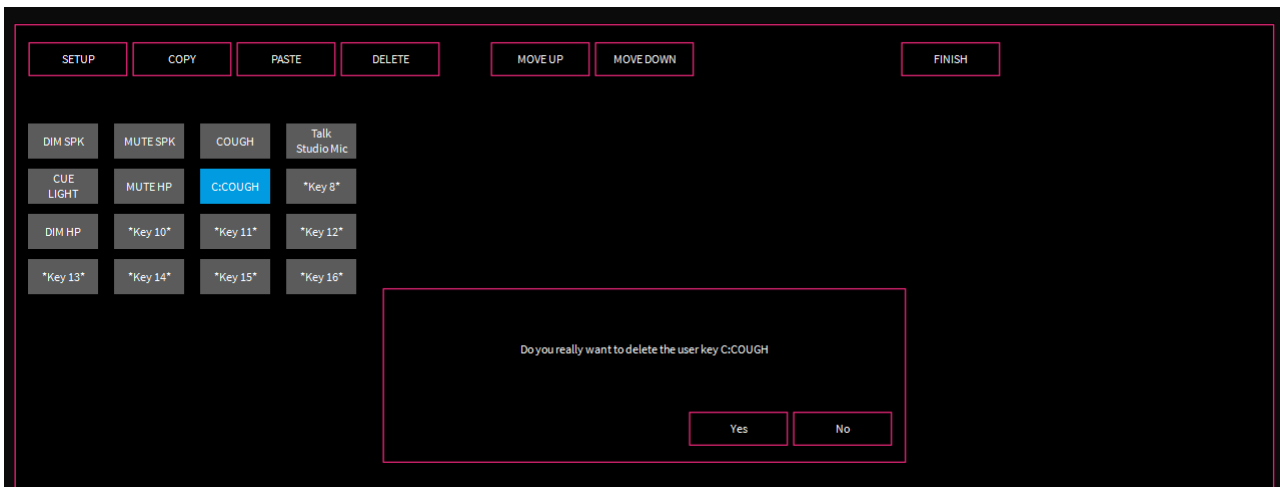
The copied user key is pasted to the selected position.



3. You can now edit the user key functionality as you wish.

➤ **To delete a user key:**

1. Select the key (e.g. **C:COUGH**), and choose **DELETE**.
2. Select **Yes** to confirm the delete:

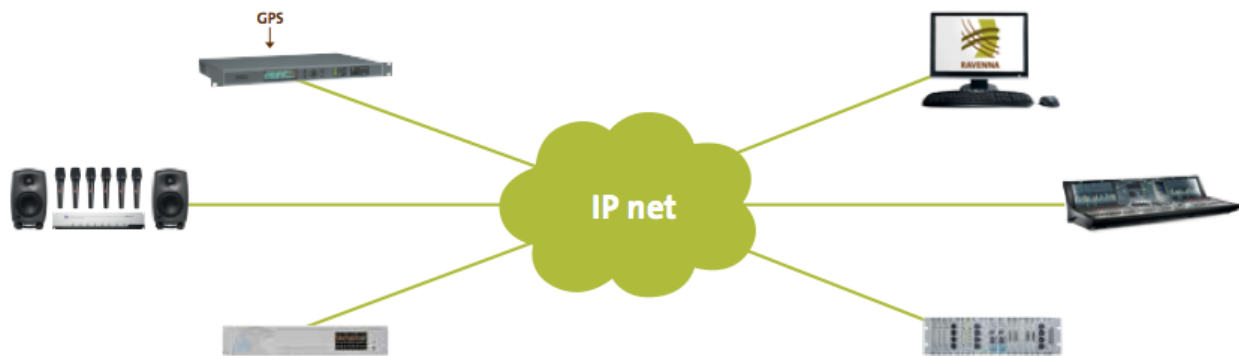


7. RAVENNA

This chapter describes the setup of RAVENNA streams for transferring audio-over-IP.

7.1 About RAVENNA

RAVENNA is an open technology which uses standardized networking protocols to stream audio, and other media content, across an IP network:



Each "node" on the network can be any RAVENNA compatible device (Lawo or third-party). RAVENNA nodes *MUST* be connected via a qualifying IP network - i.e. one that meets certain data network requirements. Audio streams can be published from each node to the network - for example, from a **RELAY PC**. Other nodes may then choose to start receiving the stream - for example, to play out the audio through one of the mixing consoles. Multiple streams can be published from a single node. In a multicast network, a published stream can be used by multiple receivers simultaneously. A major advantage of RAVENNA is that the network infrastructure can grow to meet the installation's requirements.

You can find more details about the data network requirements in the [Lawo IP Networking Guide](#).

7.1.1 RAVENNA & RELAY VRX4

RELAY VRX4 supports a native implementation of RAVENNA.

RAVENNA streams are treated as audio inputs and outputs just like any other device. Each stream can be either stereo or 8-channel.

Typical applications include receiving audio streams from a network playout server or other **RELAY** users, and publishing final mixes from your **RELAY VRX4** computer onto the network.

The maximum number of RAVENNA channels, used by any combination of streams, is 16 channels (receiving) + 12 channels (sending).

7.1.2 AoIP Stream Monitor

AoIP Stream Monitor can be used to check the status of RAVENNA streams on the network. It provides a useful diagnostics tool for master control and service technicians. It is available as a separate application (or service) and is described in the separate "AoIP Stream Monitor User Guide".

7.2 Configuring the Network Interface Card (TCP/IP Settings)

RELAY VRX⁴ connects to the RAVENNA network via the host PC's Network Interface Card (NIC). If the PC supports more than one NIC, then you can choose which interface will be used from the "Global Settings -> [RAVENNA](#)" menu.

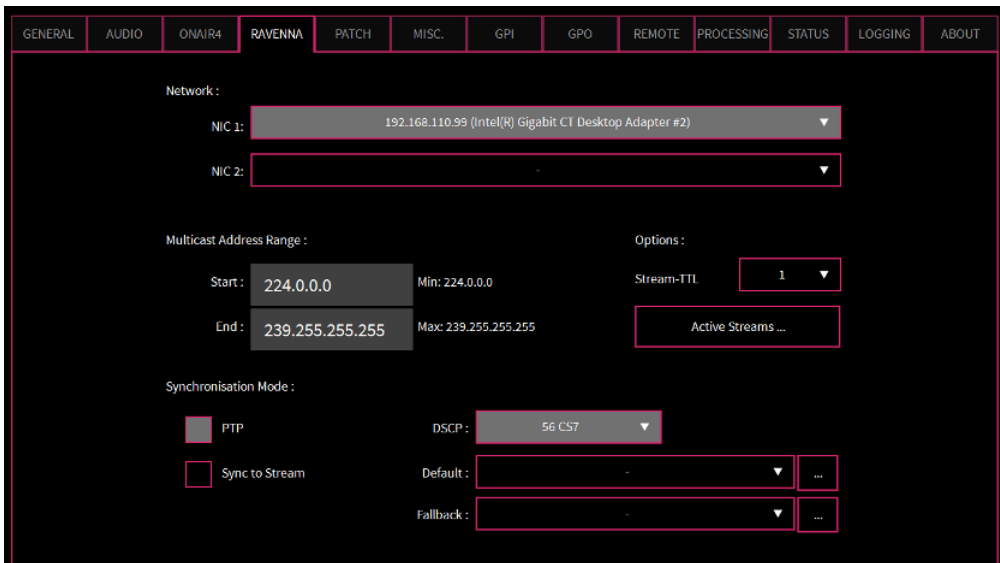
To establish communication, you must first configure the TCP/IP settings of the NIC as follows. The exact steps vary depending on your OS version.

- **IP Address** - this must be unique and lie within the same IP address range as the other streaming nodes connected to the network.
- **Netmask** - this must match the subnet mask of the other streaming nodes.
- **Gateway** - this setting is required if data packets are to be redirected. For example, if the streaming nodes are connected via a network switch with Layer 3 routing capability. Please contact your network administrator if this is the case.

RELAY VRX⁴ supports both DHCP and static IP addresses. If you are using **RELAY VRX⁴** with other Lawo RAVENNA hardware devices, then static IPs are recommended.

7.3 Defining the RAVENNA Settings

1. Open the [Global Settings](#) by switching to [Admin mode](#) and clicking on **GLOBAL SETTINGS**.
2. Select the **Ravenna** tab:



The RAVENNA settings configure the global streaming options used by **RELAY VRX⁴**:

- **Network** - selects the two Network Interface Cards (**NICs**) to be used for RAVENNA streaming. The drop-down menus list all available network interface cards fitted to your computer; up to two NICs can be assigned. Either NIC can be assigned to an outgoing RAVENNA stream. Or, if SMPTE 2022-7 compatible streaming is enabled via the [advanced options](#), it will be possible to transmit and receive streams to/from both NICs. The output stream assignments are made from the Global Settings -> Patch -> [Add Stream](#) dialog box. In addition, either NIC can be assigned for the connection to an **OnAir4** from the [Global Settings](#) -> [OnAir4](#) tab.
- **Multicast Address Range** - these values define the multicast address range used for outgoing RAVENNA streams. Enter a valid IP address into the **Start** and **End** fields if you wish to edit the range.
- **Options: Stream-TTL** - defines the Time To Live for outgoing RAVENNA streams. TTL is used within computer networks to limit the lifespan of data packets so that they do not circulate indefinitely. For RAVENNA streaming, you may need to increase the TTL value if you wish to cross several subnets within your network - click in the **Stream-TTL** field and increase the value to something like **4**.
- **Options: Active Streams** - click on this button to open a further dialog box. Here you will see information about all the streams which **RELAY VRX⁴** is sending and receiving:



Stream Name	NIC	Dir...	Status	RTSP
Source 2 (on crystal_95...	10.2.4...	In	Active	rtsp://10.2.4.194:8081/by-name/Source 2 (on cry...

You can copy and paste the details relating to any active stream - select a stream (or streams) from the list and press **CTRL + C** to copy the data to the clipboard. Then open a text editor and press **CTRL + V** to paste - the data appears in a .csv (comma separated values) format.

- **Synchronisation Mode:** see [Synchronisation](#).

7.4 Synchronisation

RAVENNA streaming relies on accurate timing information and a valid sync source must be specified. This can be either PTP (Precision Time Protocol) from the network or an incoming RAVENNA stream.

7.4.1 Defining the Sync Mode

1. Open the [Global Settings](#) by switching to [Admin mode](#) and clicking on **GLOBAL SETTINGS**.
2. Select the **Ravenna** tab, and under 'Synchronisation Mode' select either **PTP** (Precision Time Protocol) or **Sync to Stream**:

➤ PTP

The default mode is PTP (recommended for larger networks/multiple device streaming).

Note that **RELAY VRX⁴** acts only as a PTP slave and, therefore, a master PTP clock generator must be installed somewhere within the network. The PTP clock source should arrive via the Network Interface Card (specified in either the **NIC 1** or **NIC 2** field); the **Sync** status [field](#) flashes while synchronising, and lights once a valid PTP source is detected; this can take a few seconds.

The **DSCP** field can be used to assign a differentiated services code point, or quality class, to PTP sync requests. This can improve the timing of the system. DSCP values are used within computer networks to classify and manage different types of network traffic. For example, to provide low-latency for critical network traffic such as media streaming, while providing best-effort services to non-critical services such as web traffic or file transfers. If in doubt, please check the DSCP implementation with your network administrator.

➤ Sync to Stream

If your network has no PTP master, then **RELAY VRX⁴** can sync to an incoming RAVENNA stream. This can be useful in a small network with say a single sending device. **RELAY VRX⁴** will generate RAVENNA compatible streams locked to the incoming stream, allowing any outgoing streams to be received (by the sending device) without clock drift.

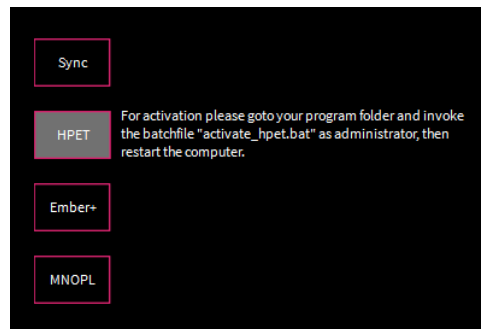
Select the **Sync to Stream** box, and then assign a **Default** (and **Fallback**) stream from the drop-down menus; the **Sync** status [field](#) flashes while synchronising, and lights once a valid PTP source is detected; this can take a few seconds. If the **Default** stream disappears, then the **Fallback** stream is used.

Note that the drop-down menus list all RAVENNA streams announced to the network. Alternatively, you can select a stream which has *not* been announced by clicking on the ... buttons - this opens a further dialog box where you can enter the URL of the stream manually.

3. Following a change, you will need to [restart](#) the **RELAY VRX⁴** service before the changes take affect.

7.4.2 Checking the Sync Status

The sync status is indicated in the [Global Settings -> Status](#) dialog box:



The **Sync** field has a black background if there is no valid sync signal detected.

The field will flash if the clock is synchronising - for example, after the **RELAY VRX⁴** service is [started](#). It is normal for the synchronisation process to take a few seconds.

The field has a grey background if **RELAY VRX⁴** is receiving a valid sync source.

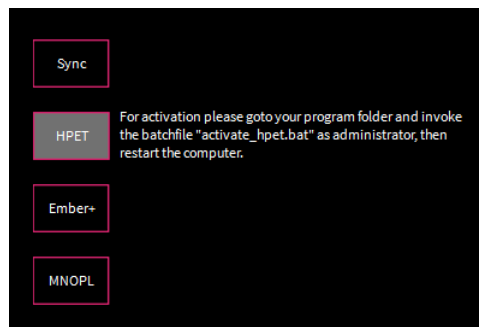
The **Sync** status can also be assigned to a GPO, see [Global Settings -> GPO](#).

7.5 Checking the Internal Clock (TSC or HPET)

For RAVENNA compatible operation, your PC must also have an active internal clocking mechanism. Depending on your Windows Operating System, there are two possibilities: **TSC** (for Windows 10) or **HPET** (for OS prior to Windows 10).

In both cases, the status is shown in the [Global Settings -> Status](#) menu; lit = the TSC (or HPET) is active.

HPET active (for OS prior to Windows 10)



HPET (High Precision Event Timer)

HPET is a high precision clock provided by your PC when running an OS prior to Windows 10.

By default, **HPET** should be activated during the software installation. If not, then re-run the [installer](#) and select the **Activate HPET** check box from the 'Additional Tasks' dialog box.

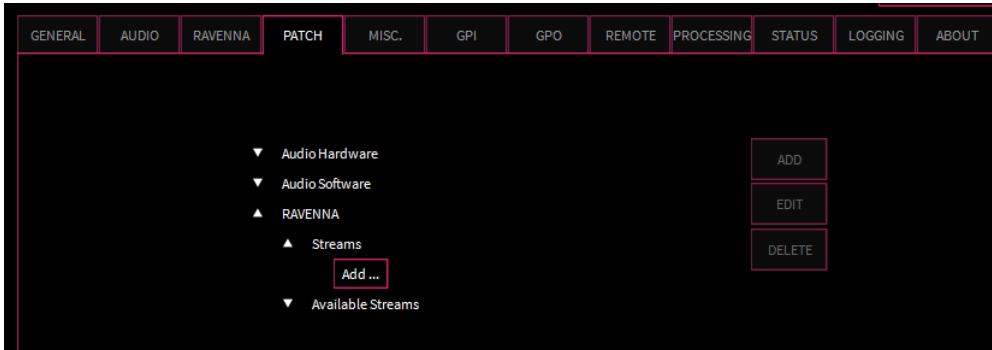
TSC

Windows 10 uses an improved internal clocking mechanism known as "TSC_INVARIANT". By default, TSC will be active.

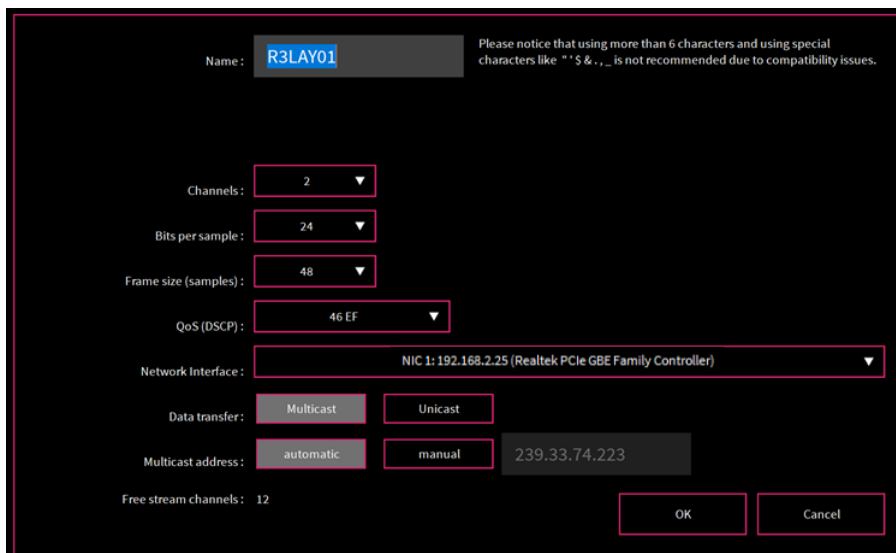
7.6 Publishing Audio to the Network (Add Stream)

To publish audio from your computer to the network, you must add a **Stream** device:

1. In Admin Mode, select the [Global Settings -> Patch](#) tab.
2. Open the **RAVENNA** category, and select **Streams Add ...**:



A dialog box appears with settings to configure the stream:

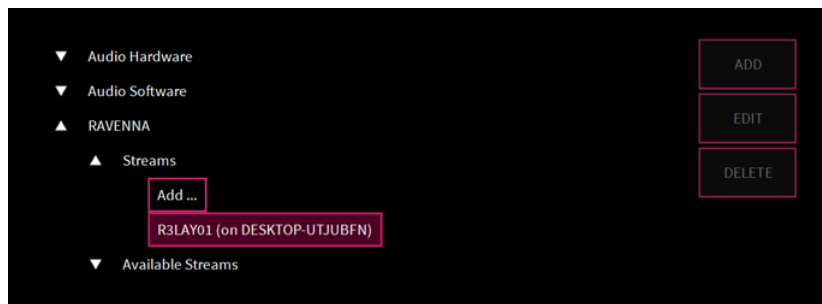


- **Name** - names the stream. This name appears within **RELAY VRX⁴**, and also identifies the stream to other network users. Therefore, the name cannot be edited later. Please follow the on-screen guidance relating to the length and use of characters in the name.
- **Channels** - enter the number of channels for the audio stream (2 or 8)*. The channel count forms part of the stream, and therefore cannot be edited later. The number of available channels is indicated by the **Free stream channels** counter - the total number of RAVENNA channels (used by sending + receiving streams) cannot exceed the [maximum](#) permitted by your license.
- **Bits per sample** - enter the bit depth (16 or 24-bit).
- **Frame size (samples)** - enter the frame size (32, 48, 64 or 128)*. The default setting is 48; the smaller the frame size, the lower the latency but, depending on system performance, the more susceptible to drop-outs.

*The values that appear in the **Channels** and **Frame size** drop-down menus can be expanded by editing the [advanced options](#).

RELAY VRX⁴ will automatically adjust the frame size so that data always remains within the maximum packet size for a RAVENNA audio stream. For example, if you enter 2 channels, at 24-bit with a frame size of 128, then the audio buffer size can be 128. However, if you enter 8 channels, at 24-bit, then **RELAY VRX⁴** automatically adjusts the buffer size accordingly.

- **QoS (DSCP)** - assigns a DSCP (differentiated services code point) or quality class to the audio stream. DSCP values are used within computer networks to classify and manage different types of network traffic. For example, to provide low-latency for critical network traffic such as media streaming, while providing best-effort services to non-critical services such as web traffic or file transfers. The default DSCP values for streams is 46 (=EF); and for PTP is 56 (=CS7). You can find more details on QoS in the separate "AV Networking Guide".
 - **Network Interface** - use the drop-down menu to assign a network interface to the audio stream. You can choose either of the two NICs defined in the [Global Settings -> RAVENNA](#) tab. If you are working within a PTP network, then the correct network interface (containing the PTP clock information) is automatically selected. If SPS is enabled via the [advanced options](#), then it is possible to choose both NICs.
 - **Data Transfer** - sets the transfer mode to either **Multicast** or **Unicast**.
 - **Multicast address** - if **Multicast** is selected, then this field sets the multicast address to either **automatic** or **manual**. Choose **manual** and enter the IP address if your network supports a limited IP range. The multicast address range is defined in the [Global Settings -> RAVENNA](#) tab. If SPS is enabled via the [advanced options](#), then it is possible to set a **second multicast address**.
3. Once you have made your selections, click on **OK** - the stream is added as an output device (indicated by the magenta highlight):



It is now available for assignment as an audio output (for example, in [Bus Setup](#)).

4. You can use the **EDIT** button to re-open the **Stream** parameter box (to edit the stream parameters). Note that cannot edit the **Name** or the number of **Channels**.
5. Two additional buttons can be revealed by editing the [advanced options](#) file: **Copy RTSP Link** and **Copy SDP**.

These buttons copy the stream's RTSP Link or SDP information to the clipboard, so that it can be used to set up a new stream. For example, via the [Add Stream URL](#) or [Add Stream SDP](#) window.

7.6.1 AES-67 Compliance

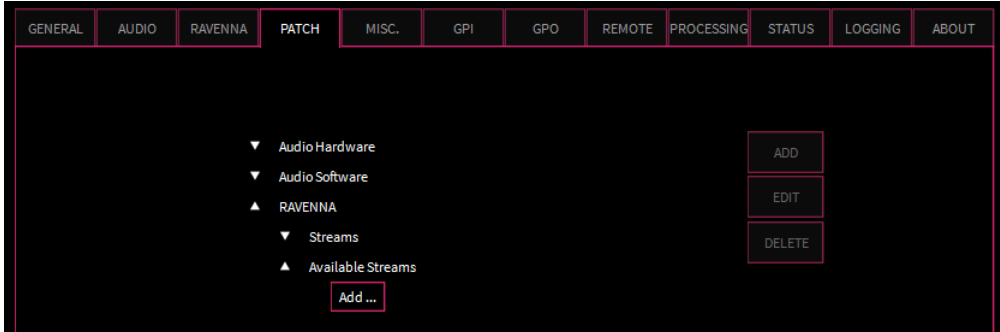
When a RAVENNA stream is published from **R3LAY VRX⁴**, the user can specify the stream name and number of channels. To ensure that all streams are AES-67 compliant, the remaining payload parameters should be defined as follows:

- **Bits per sample** = 24
- **Frame size** = 48 (for 2-channel and 8-channel streams).
- **Frame size** = 6 (for 64-channel streams).
- **QoS (DSCP)** = 46 (EF).

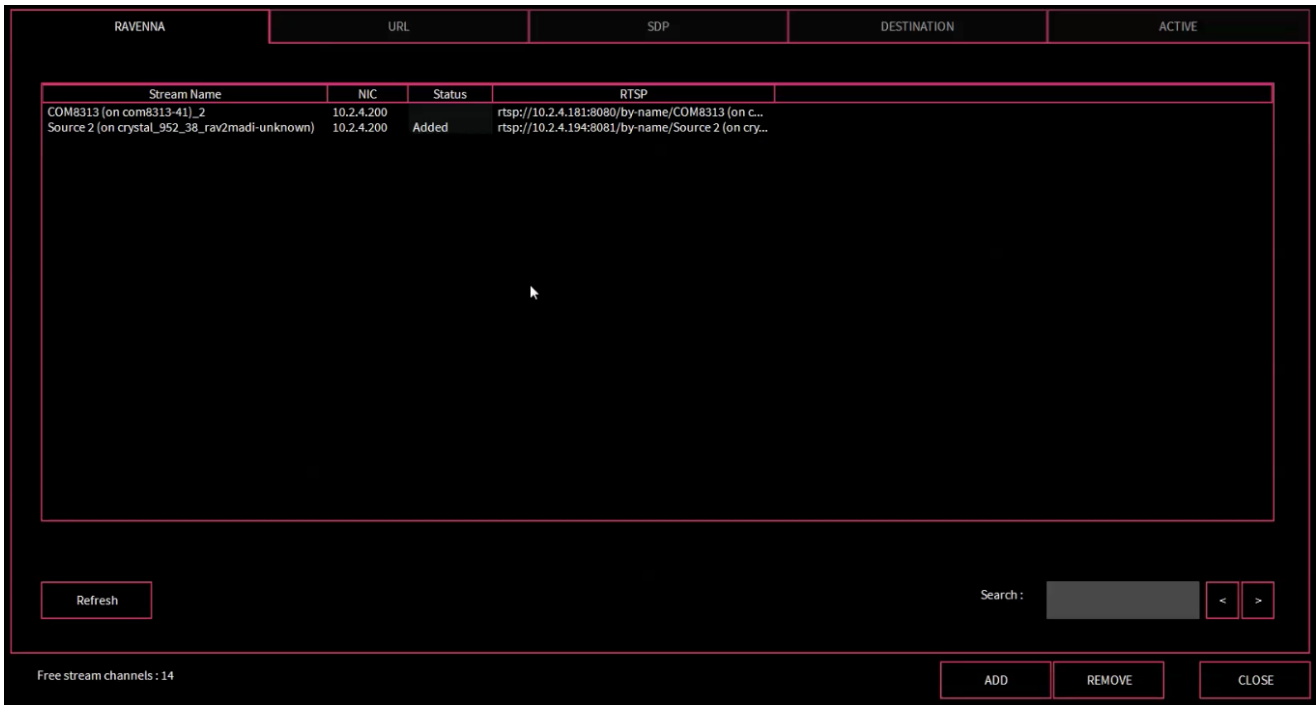
7.7 Using Audio from the Network (Available Streams)

To use audio from a stream on the network, you must add an **Available Streams** device:

1. In Admin Mode, select the [Global Settings -> Patch](#) tab.
2. Open the **RAVENNA** category, and select **Available Streams Add ...**



A dialog box appears. From here you can add a stream by name, URL or SDP, and also view all active streams:



7.7.1 RAVENNA Streams

1. Select the **RAVENNA Streams** tab to see all of the streams announced by Bonjour to the network.

The list will include incoming streams from other devices plus local streams published from this device.

2. Select a stream and then click on **ADD** - the stream is added as an input device, and its Status updates to **Added**.

Repeat to add more streams as you wish.

Click on **Refresh** to update the list.

You can search the Stream Names by entering a text string into the **Search** field and clicking on **Refresh**. Use the arrow keys to select the next or previous occurrence.

The number of available channels is indicated by the **Free stream channels** counter - the total number of RAVENNA channels (used by sending + receiving streams) cannot exceed the [maximum](#) permitted by your license.

3. To remove a stream, select an **Added** stream from the list followed by **REMOVE**.
4. To close the dialog box, click on **CLOSE**.

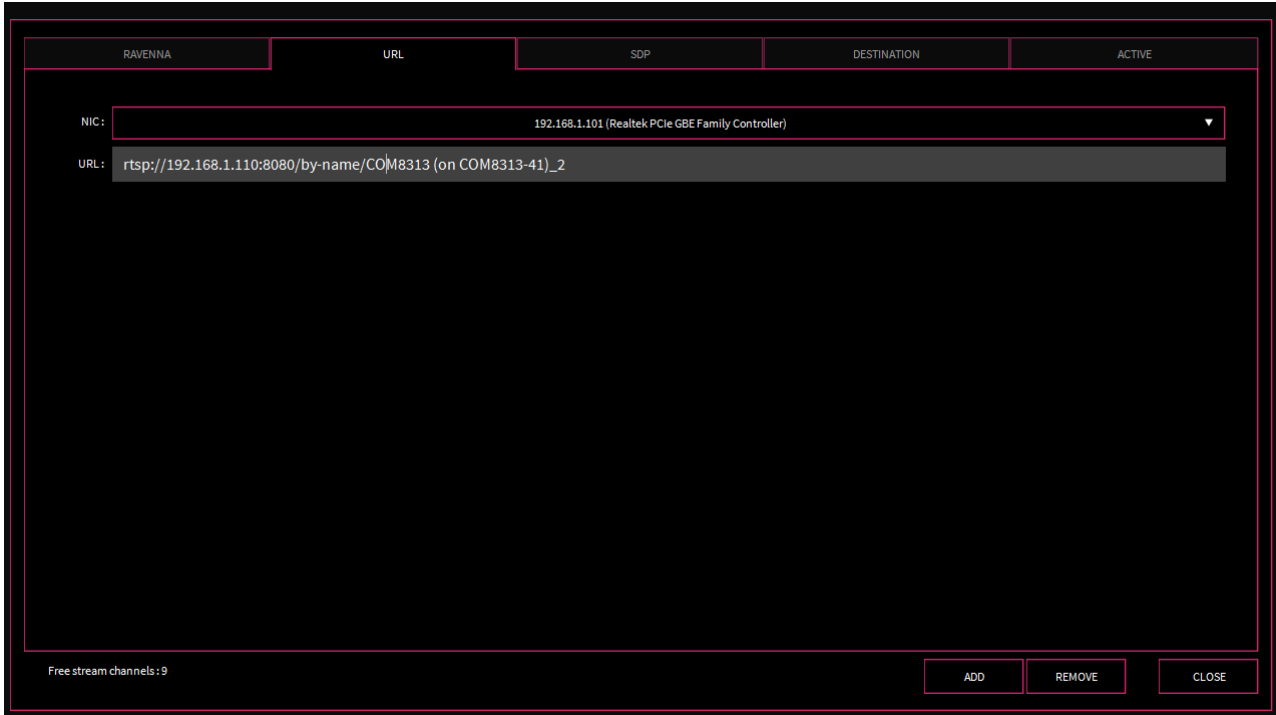
Any added streams, highlighted in magenta, are now available for assignment as an audio input (for example, in [Source Configuration: Input](#)).

The remaining tabs in the "Available Streams" dialog box work in a similar manner and are described over the next few pages.

7.7.2 Add Stream URL

Select this tab to add a RAVENNA stream with a specific URL - for example, if your network uses rtsp addresses.

1. Select the Network Interface Card (NIC) which is receiving the stream from the drop-down menu.
2. Enter the URL - the maximum length of an accepted URL is 200 characters.



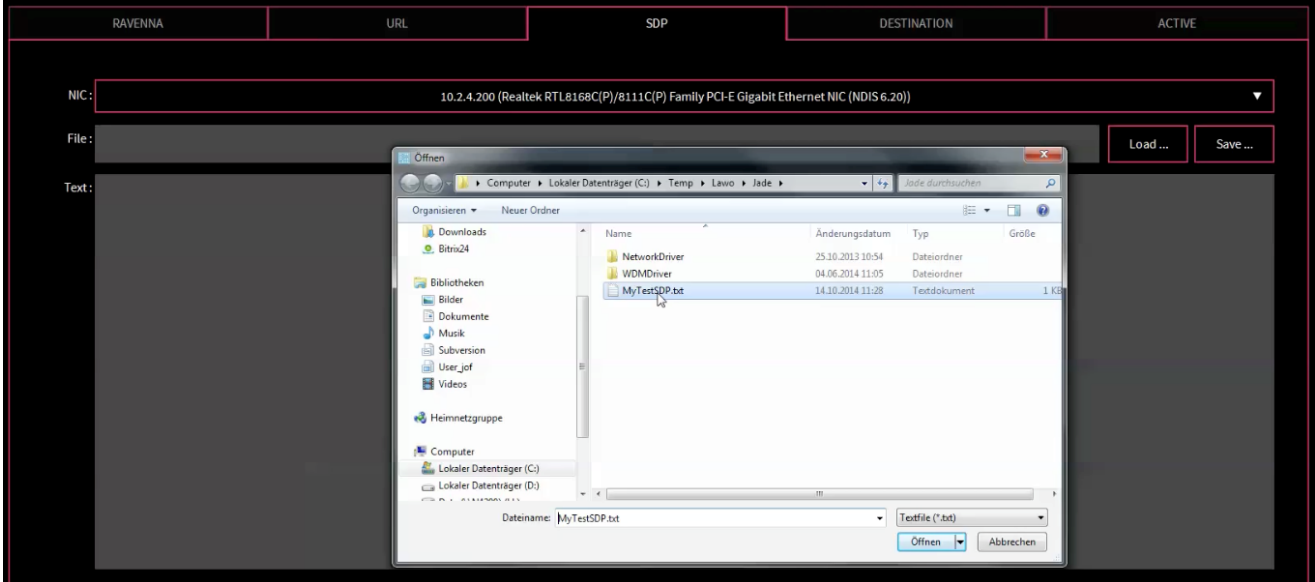
3. Click on **ADD** to add the stream as an input device.

7. RAVENNA

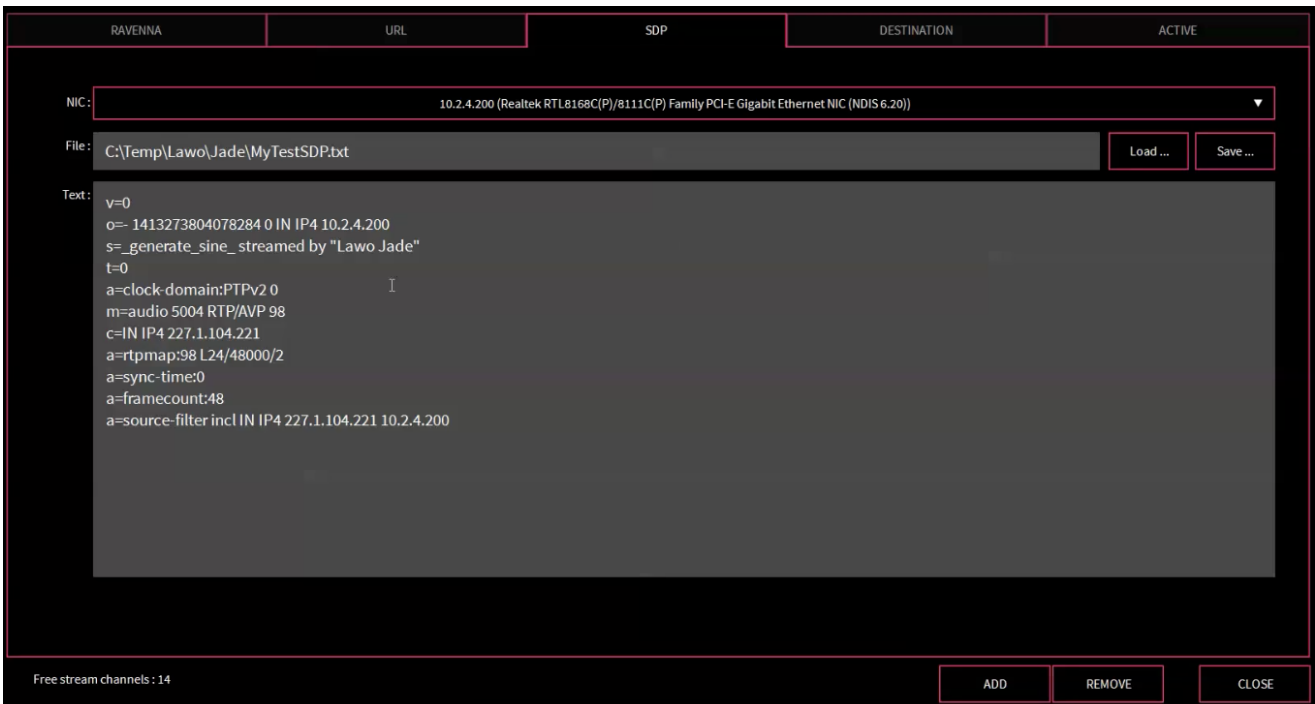
7.7.3 Add Stream SDP

Select this tab to add a RAVENNA stream identified by a stream description (SDP). The SDP can either be loaded (from a file) or entered manually (by typing in the text, or using copy/paste to paste the information from another location).

1. Select the Network Interface Card (NIC) which is receiving the stream from the drop-down menu.
2. To load an SDP, click on File **Load..** to select the file location:



Then select **Open** - the file contents are displayed in the Text area:



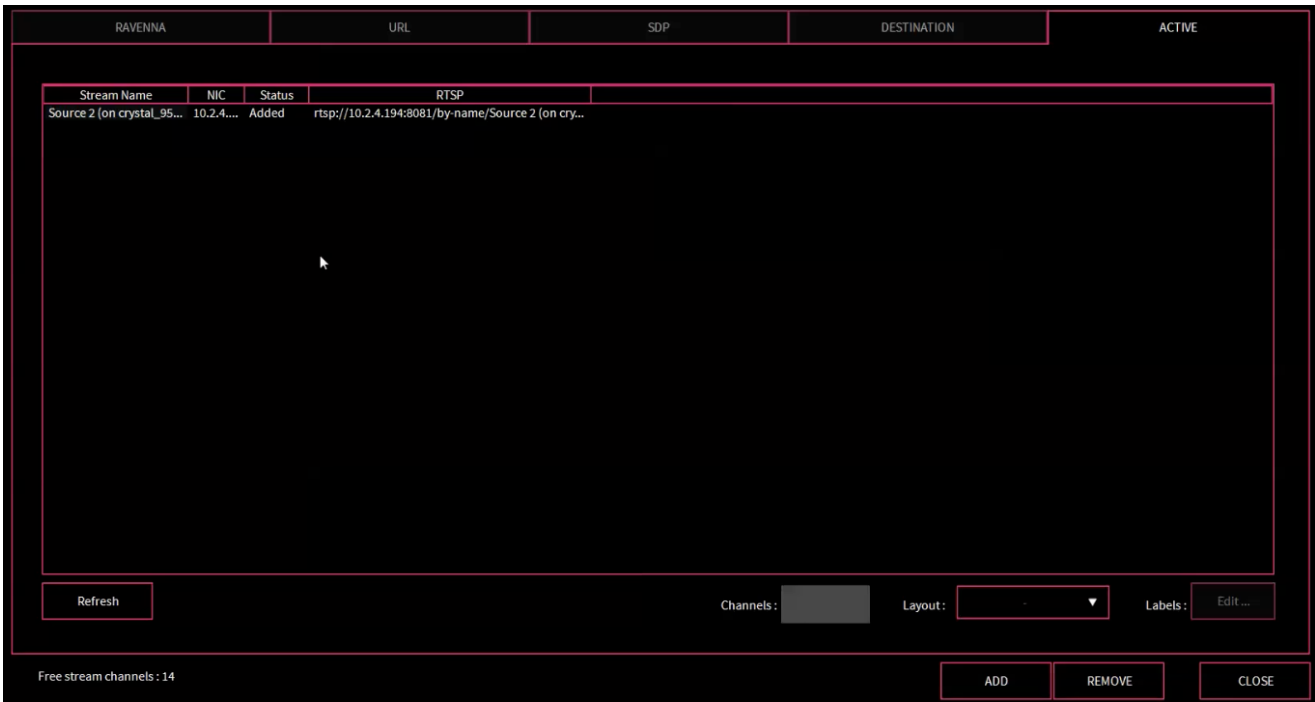
3. Alternatively, type in the SDP information into the Text area (or use copy/paste to paste text from another location).

The **Save..** button can be used to save the SDP Text content (under a new filename).

4. Click on **ADD** to add the stream as an input device.

7.7.4 Active Streams

Select this tab to display all active streams (those already added to **RELAY VRX⁴**):



Click **Refresh** to update the list.

Note that the **Channels**, **Layout** and **Labels** fields are reserved for future implementation.

8. Ember+

This chapter describes the Ember+ implementation.

8.1 About Ember+

Ember+ is a non-proprietary TCP/IP control protocol which allows devices to remotely control parameters within **R3LAY**, or **R3LAY** to control parameters within an external device. It is supported by a wide range of products and manufacturers. More details about the Ember+ protocol can be found at <https://github.com/Lawo/ember-plus/wiki>.

An Ember+ provider "publishes" parameters so that they may be controlled, or responded to, by an external consuming device. Parameters can include global functions such as GPIOs, or channel parameters such as fader and DSP functionality. An Ember+ consumer can then control, or respond to, parameters published by an Ember+ providing device. For example, to activate a red light on another console and illuminate its status.

All devices should be connected to the Lawo control network in the usual manner. You will need to know the hostname or TCP/IP Address and Port Number of each Ember+ device on the network.

An Ember+ Tree Viewer can be used to check the status of Ember+ parameters and/or switch a parameter manually. This can be useful when configuring and testing an Ember+ controlled device.

8.1.1 Ember+ & R3LAY VRX4

R3LAY VRX4 can operate as an Ember+ provider and Ember+ consumer.

When acting as a provider, it supplies elements to other Ember+ consumers on the network. Note that this does not govern the direction of the control, as parameters defined for ReadWrite operation can be adjusted from both sides. The amount of integration depends on the level of Ember+ support in the consumer. To configure the control, the Ember+ interface must be [enabled](#). All [User Mode](#) parameters will then be made available. This includes:

- Source Selection
- Channel Parameters (fader level, channel on/off, processing on/off and metering)
- PGM Bus metering
- Monitor source selection, level and metering for the both SPEAKER and PHONES
- Snapshot recall (for snapshots 1 to 16)
- Clock, Red Light and Timer functions
- User Key recall (for user keys 1 to 16)
- GPIs 1 to 8
- GPOs 1 to 8

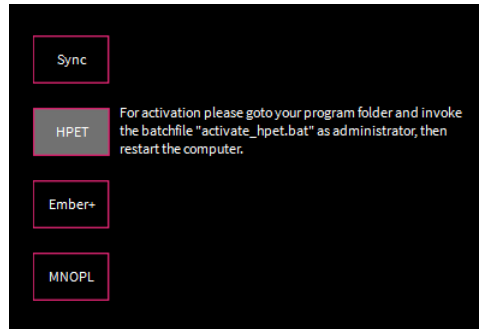
From Version 4.0.0, **R3LAY VRX4** can also operate as an Ember+ consumer. In this mode up to four Ember+ providers can be configured. Values from an active provider can then be used to trigger a GPI or GPO, or control the level of a source or bus. The amount of integration depends on the level of Ember+ support in the providing device.

8.2 Enabling the Ember+ Interface

Ember+ is enabled, or disabled, from the **GLOBAL SETTINGS** -> **Remote** dialog box:

1. Switch to [Admin mode](#) and click on **GLOBAL SETTINGS** to open the '[Global Settings](#)' window.
2. Select the [Remote](#) tab and under **Ember** tick the **Active** checkbox and define the **Listen Port**.
3. Select **FINISH** to save any changes.

The **Ember+** field in the [Global Settings -> Status](#) menu indicates the status of the connection:



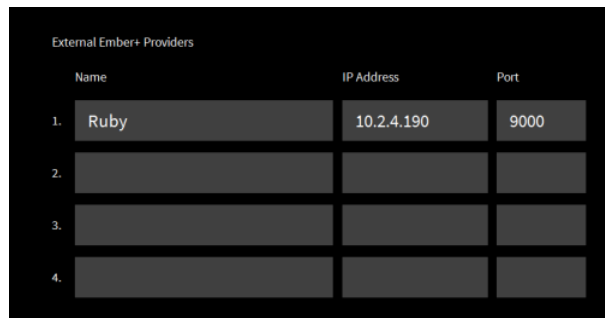
- **Black** background = Ember+ disabled.
- **Grey** background = a valid Ember+ connection.

Once the Ember+ interface is enabled, all published parameters are made available to the network (for use by a consuming device). In addition, **RELAY VRX⁴** can access the Ember+ Tree of any configured providers (described [next](#)).

8.3 Configuring Ember+ Providers

To operate as an Ember+ consumer, **RELAY VRX⁴** must know about each providing device. Up to four Ember+ providers can be configured. This is handled from the **GLOBAL SETTINGS** -> **EMBER+** dialog box:

1. Switch to [Admin mode](#) and click on **GLOBAL SETTINGS** to open the ['Global Settings'](#) window.
2. Select the **EMBER+** tab and enter the **Name**, **IP Address** and **Port** number used by each providing device:



	Name	IP Address	Port
1.	Ruby	10.2.4.190	9000
2.			
3.			
4.			

3. Select **FINISH** to save any changes.

Once you have an active provider, Ember+ values from the provider can be used to trigger a GPI or GPO, or control the level of a source or bus (described [next](#)).

8.4 Defining the Functionality

RELAY as an Ember+ Provider

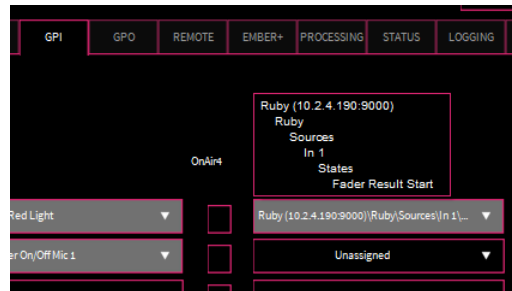
In this mode, all User Mode parameters are automatically published to the network once the Ember+ interface is [enabled](#). Therefore, the rest of the functionality should be configured within the consuming device.

RELAY as an Ember+ Consumer

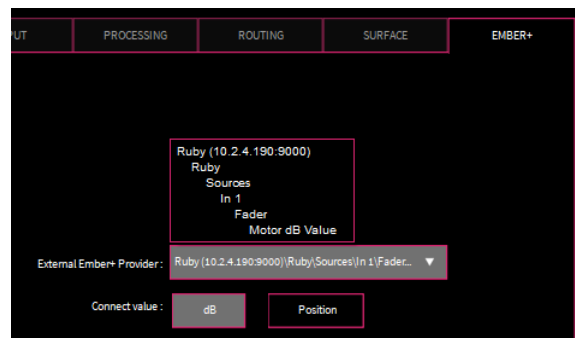
In this mode, once the Ember+ interface is [enabled](#) and you have [configured](#) a provider, its Ember+ Tree can be accessed by **RELAY VRX⁴**.

Ember+ values read from the external device can be used to trigger a GPI or GPO, or control the level of a source or bus. The amount of integration depends on the level of Ember+ support in the providing device.

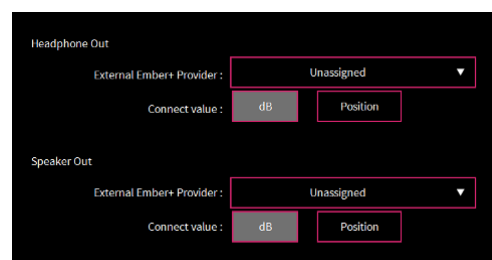
To control a GPI or GPO, open the "[GLOBAL SETTINGS](#)" and select either the [GPI](#) or [GPO](#) tab. Use the drop-down menus to search through the provider's Ember+ Tree and assign a Boolean value to the GPI (or GPO). In our example, GPI 1 will become active whenever the Source 1 fader is open on our external Ruby surface:



To control the level of a source, open the '[Source Configuration](#)' window and select the **EMBER+** tab. Use the drop-down menu to search through the provider's Ember+ Tree and assign a Real value to the source level. In our example, it will be adjusted from the **Source 1 Fader Motor dB Value** on our external **Ruby** surface. Note that for each source you can choose which parameter within **RELAY VRX⁴** you wish to control - either the actual **dB** value or the relative **Position** of the fader:



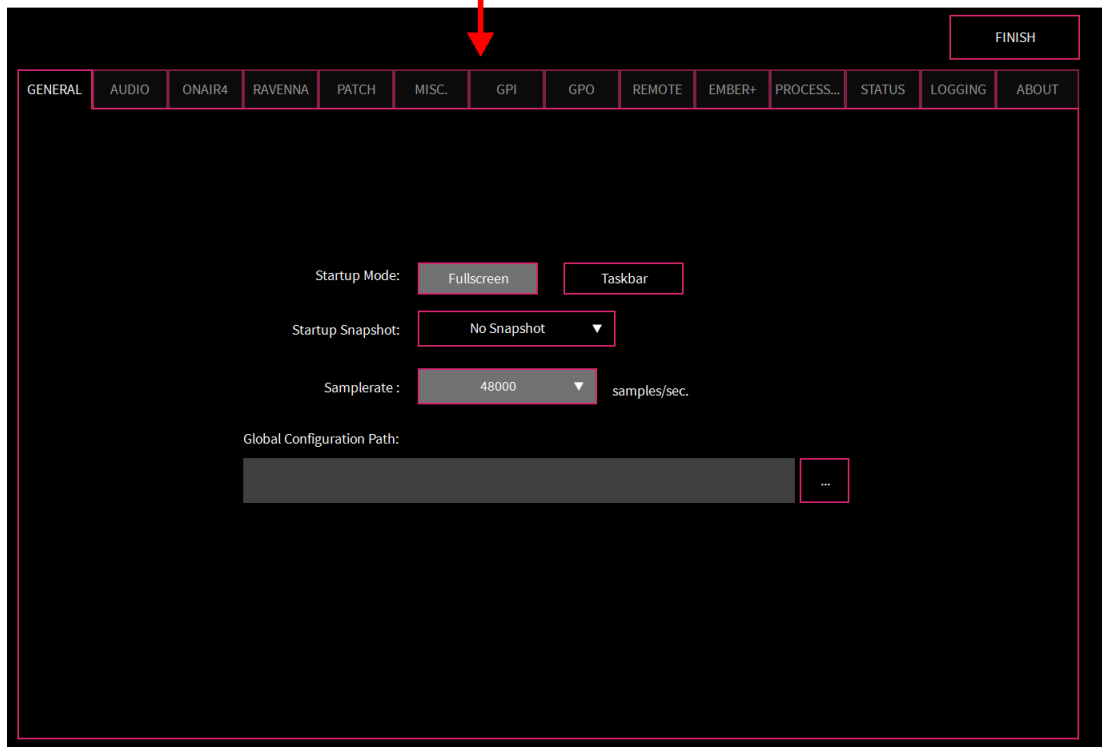
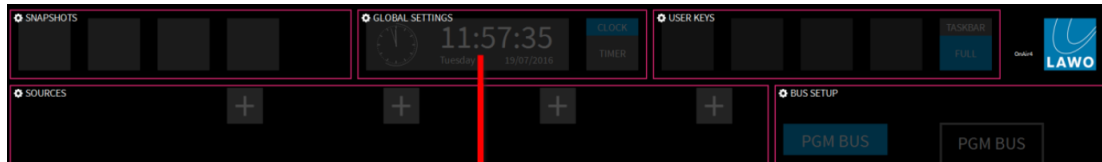
You can control the level of the Headphone or Speaker outputs in a similar manner via the '[Bus Setup](#)' window and **EMBER+** tab:



9. Global Settings

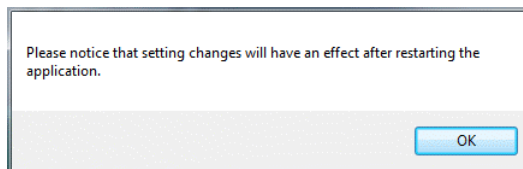
This chapter describes the program's global settings.

1. Switch to [Admin mode](#) and click on **GLOBAL SETTINGS**:



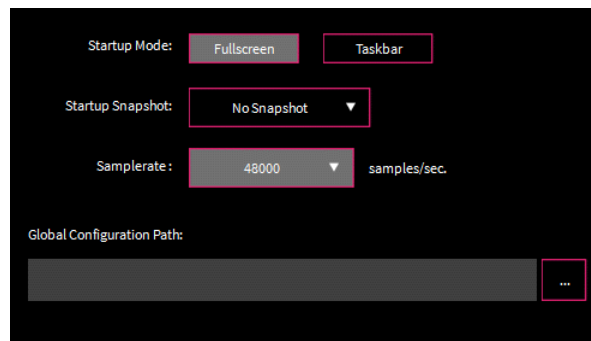
2. Select a tab and edit the settings. For check boxes, a grey background = option enabled; a black background = option disabled.
3. Select **FINISH** to save any changes and return to the Admin mode menus.

If the following message appears, you will need to close and restart the application (as described [earlier](#)).



All Global Settings are stored with the rest of the configuration, see [Saving the Configuration](#).
Global Settings are NOT stored in Snapshots.

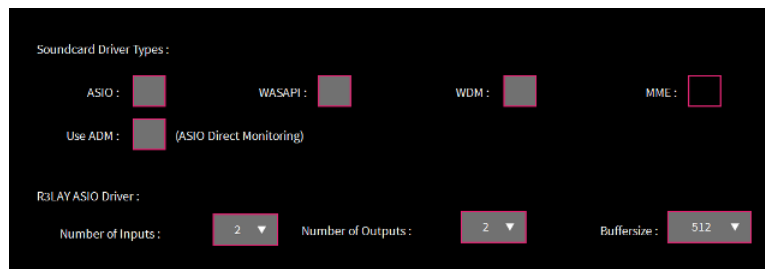
9.1 General



This tab defines what happens when the **RELAY VRX⁴** PC starts up:

- **Startup Mode** - opens the application in either [Fullscreen](#) or [Taskbar](#) view.
- **Startup Snapshot** - loads a snapshot to reset the application for a particular work flow. Use the drop-down menu to choose a snapshot (from those defined in the [Snapshot Configuration](#)). If you select **No Snapshot**, then **RELAY VRX⁴** opens with no sources assigned to faders unless you have [locked](#) the surface.
- **Sample rate** - sets the default sample rate which will be used when creating RAVENNA streams.
- **Global Configuration Path** - defines the file path for a global ".ini" file, see [Saving the Configuration](#). Click to enter the appropriate file path, or leave the field empty to store all settings locally on the **RELAY VRX⁴** computer.

9.2 Audio



➤ Soundcard Driver Types

- Use the **ASIO**, **WASAPI**, **WDM** and **MME** check boxes to define which driver types appear under the [Audio Hardware](#) category when configuring the audio patch ([Global Settings -> Patch](#)). This allows you to restrict **RELAY VRX⁴** to certain driver types.
- Check the **Use ADM** option if you wish enable ASIO Direct Monitoring on supporting ASIO hardware interfaces. These are usually interfaces which include a hardware audio mixer or DSP engine.

Once enabled, you can use the **ASIO Direct Monitoring** option (in [Source Configuration: Processing](#)) to route an ASIO input directly to an ASIO headphone output for monitoring purposes, thus bypassing the **RELAY** computer and reducing the latency of the audio path. This feature is ideal for artist monitoring applications where software-based latency is unacceptable.

ASIO Direct Monitoring is a feature of the ASIO driver and, therefore, is *only* supported by certain hardware interfaces. Please consult your third-party documentation for details.

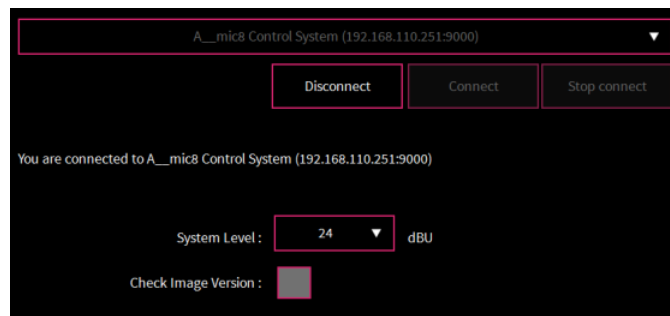
As the ASIO driver specification uses different volume adjustments for mono and stereo channels, and **RELAY VRX⁴** assumes all channels to use the stereo adjustment, please go to the ASIO device settings of your ASIO hardware and switch all output channels to stereo.

➤ RELAY ASIO Driver

These options define settings which relate to **RELAY VRX⁴** clients (software applications using **RELAY**):

- Use the **Number of Inputs** and **Number of Outputs** fields to set the number of channels to and from an ASIO client. By default, you can choose either 2 or 8, but the possible options can be expanded by editing the advanced options (described [later](#)).
- **Buffersize** - use this field to adjust the preferred audio buffer size for ASIO clients. The buffer size will affect latency and drop-out performance, see [Choosing the Best Driver](#).

9.3 OnAir4



➤ Connect / Disconnect

These options can be used to connect (or disconnect) any **OnAir4** which has been detected on the network. In the example above, select **Disconnect** to disconnect the current device. Then make a selection from the drop-down menu, and click on **Connect** to establish a new connection.

Once configured, the software remembers the **OnAir4**, and will automatically reconnect each time you power off and on the unit or restart the **R3LAY** software.

For more details on setting up the device, see [Setting up the OnAir4](#).

➤ System Level

Use this option to set the system level for the device - in the example above, +24dBu = 0dBFS.

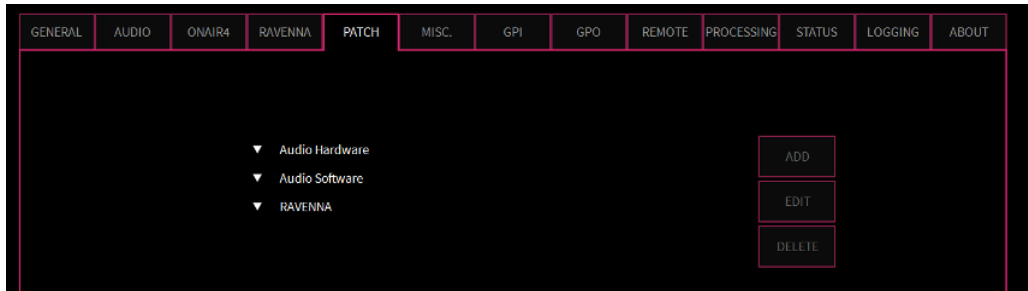
➤ Check Image Version

When this option is selected (grey), then the software will automatically check the firmware version running on the **OnAir4** when it connects. If an update is required, then you will be prompted to action the update, see [Updating the OnAir4 Firmware](#).

9.4 RAVENNA

These settings configure the global streaming options described [earlier](#) in the RAVENNA chapter.

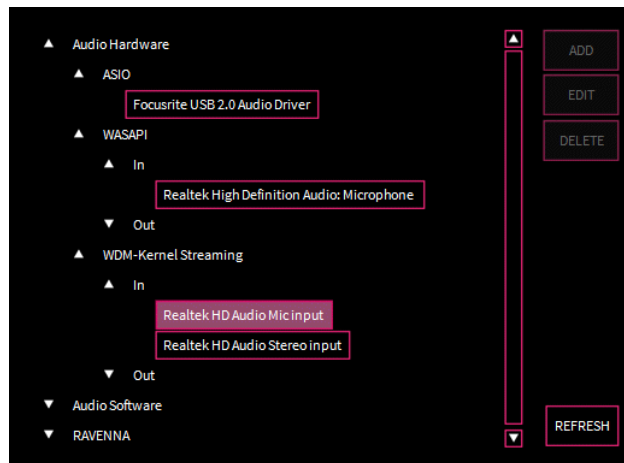
9.5 Patch



Use these options to filter which hardware interfaces, software applications and RAVENNA streams are available as audio inputs and outputs in **RELAY VRX⁴**. If a device has not been "added" here, then it will NOT appear as an audio input or output option elsewhere.

1. Click on the down arrows to interrogate each category.

Devices highlighted in magenta have been "added" - in our example, the **Realtek HD Audio Mic Input** has been added as an **Input** device:



- **Audio Hardware** devices are divided into four driver categories (**ASIO**, **WASAPI**, **WDM-Kernel Streaming** and/or **MME**). These are pre-determined by the **Soundcard Driver Types** options in [Global Settings -> Audio](#). Within each category, the available options depend on what interfaces are installed and connected to your computer, and what version of Windows® you are running.

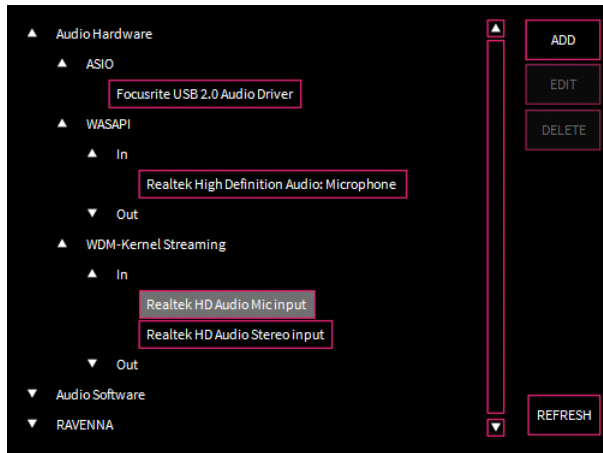
If an interface appears more than once, then it supports more than one driver type. Choose the highest available option, so look under **ASIO** first, then **WASAPI**, then **WDM-Kernel Streaming** and finally **MME**. This ensures the best performance for the device. See [Choosing the Best Driver](#).

- **Audio Software** devices list all **ASIO** software application(s) which have **RELAY** assigned as the audio i/o device. See [ASIO Software Clients](#). Note that the external software application must be running (with **RELAY VRX⁴** as the audio i/o device) at least once before the device is recognised in this list. Afterwards, the connections are remembered, even if the third-party software is not running.
- **RAVENNA** devices list all RAVENNA streams to or from the IP network, see [RAVENNA](#).

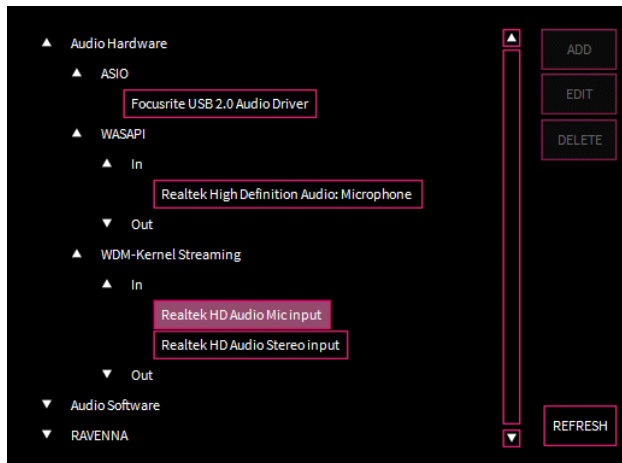
Some devices act both as inputs and outputs (e.g. editing software or internal plug-ins). While others may be input-only or output-only (e.g. microphones and speakers). A single device may support multiple channels; the number of channels is determined by the device driver. Or, for **ASIO** applications, you can set the maximum number of channels using the **Number of Inputs** and **Number of Outputs** dialog box ([Global Settings -> Audio](#)).

9. Global Settings

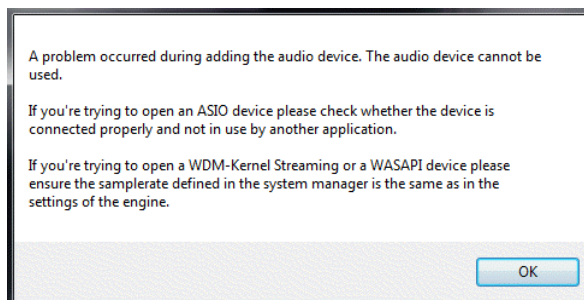
- To add a device, open the relevant category and select an entry - e.g. **Realtek HD Audio Mic Input**:



- Then select **ADD** - the device is added as an audio input (as indicated by the magenta highlight):



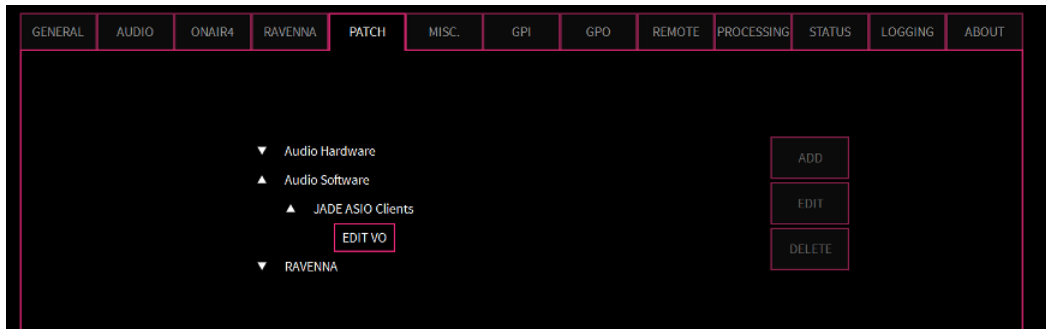
If the following dialog box appears, then the device cannot be added:



- For **ASIO** devices - check the connections and close any applications which may be using the device (or change the [audio input and output device](#) in the application).
 - For **WDM** or **WASAPI** devices, check that the sample rate of the device matches that of **RELAY VRX⁴** (48kHz).
- To remove a device, select an entry followed by **REMOVE** - the magenta highlight is removed.
 - The **EDIT** button is used to edit RAVENNA stream parameters, see [RAVENNA](#).
 - Click **REFRESH** to refresh the device list - for example, if you have connected a new hardware interface.

9.5.1 ASIO Client Connections

Once **RELAY** is [assigned](#) as the audio i/o device in your external software, its audio channels appear in the [Global Settings -> Patch](#) list under **Audio Software**:



You must have started the external software application (with **RELAY VRX4** as the audio i/o device) at least once before the device is recognised. Afterwards, the connections are remembered, even if the third-party software is not running.

You may configure and run multiple ASIO applications simultaneously.

Sample rate conversion is automatically applied to audio to and from ASIO clients. For example, if a 48kHz audio hardware interface or RAVENNA stream is connected to a 44.1kHz ASIO software client, sample rate conversion will be applied.

9.5.2 Choosing the Best Driver

Some audio interfaces support multiple drivers, and may appear more than once in the [Audio Hardware](#) category when configuring the audio patch ([Global Settings -> Patch](#)). There are two factors to consider when deciding which driver to choose: latency and independence. Both are determined by the driver and Windows®, and are beyond the control of **RELAY VRX4**:

➤ Latency

The driver type affects the audio buffer size and, therefore, the latency of the audio. The smaller the audio buffer size, the lower the latency but, depending on system performance, the more susceptible to drop-outs.

As an example, a value of 256 S/B at an input means that **RELAY VRX4** receives an audio data packet every 256 samples - this equates to every 5.3ms at a sample rate of 48kHz.

For ASIO clients, you can adjust the preferred audio buffer sizes, see [Global Settings -> Audio](#). Use a third-party software application, such as the Latency Monitor from www.resplendence.com, to analyse the performance of your system, and thereby optimise the audio buffer size parameters.

➤ Independence

Clients, which use the **RELAY** ASIO driver, are presented to **RELAY VRX4** independently as separate devices. The audio stream will be directly transferred from the client to **RELAY**, and vice versa, and will be bit-transparent.

However, clients which use the same **RELAY** WDM Driver are presented to **RELAY VRX4** as a single mixed audio stream and pass through the Windows® audio mixer. This mixer can apply sample rate conversion or bit depth changes, and so these audio streams will not be bit-transparent.

You should bear this in mind when [assigning](#) the **RELAY VRX4** WDM Drivers to your third-party software.

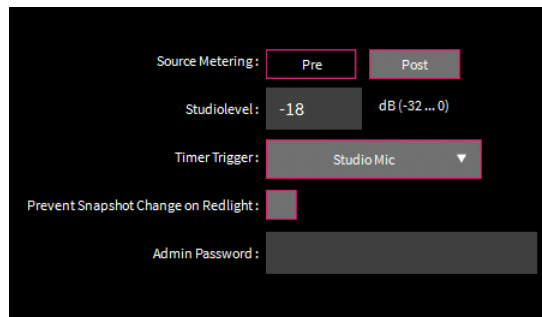
➤ Choosing a Driver

The driver you choose depends on what is supported by each interface, the intended application and your computer's specification. As a guide:

- For the lowest latency, best audio performance and independence, use **ASIO**.

- If **ASIO** is not available, choose one of the other drivers (recommended in the order below). Note that the choice of drivers, and whether single or multiple instances are supported, varies depending on the interface manufacturer:
 - **WDM-Kernel Streaming** - the audio streams are sent directly to/from the hardware at a low latency. The Windows® audio mixer is bypassed.
 - **WASAPI** - also uses smaller audio buffer sizes, resulting in lower latency, but is only supported from Windows® Vista onwards.
 - **MME** - uses larger audio buffer sizes (longer latency but less susceptible to drop-outs in an underpowered system). The Windows® audio mixer accesses the audio stream and will apply sample rate conversion, bit depth changes or channel conversions.

9.6 Misc.



Use these options to define:

- **Source Metering** - the four [channel meters](#) can be set to meter:
 - **Pre** - the input level direct from the source.
 - **Post** - the channel output level after the fader (and processing).
- **Studiolevel** - this option sets the 0dBFS reference level, indicated on the channel and programme [metering](#).
- **Timer Trigger** - this option selects a source to [start](#) the timer when a fader opens. In our example, the timer will start from the **Studio Mic** fader.
- **Prevent Snapshot Change on Redlight** - enable this option to prevent snapshot recall when the red light is enabled. This can be used to protect channel assignments when **RELAY VRX⁴** is on-air.
- **Admin Password** - use this field to set the password which must be entered to access Administrator mode, see [Switching to Admin Mode](#). If the field is left empty, then no password is required.

9.7 GPI

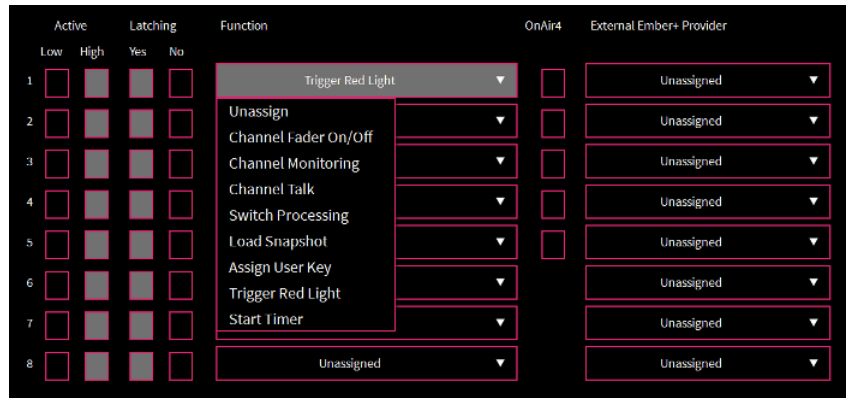
These options define the 8 GPIs (General Purpose Inputs) supported via the [Ember+](#) control protocol. They allow **R3LAY VRX4** to be remotely controlled from an external device. For example, to respond to talkback from an external communications system.

The Ember+ interface must be enabled, in [Global Settings -> Remote](#), for the GPIOs to be published.

Each input can be **Active** when **Low** or **High**, and be set to **Latching = Yes** or **Latching = No**.

➤ Defining the Functionality

Choose the function to be triggered by each input from the drop-down menu:



- **Unassign** - removes the GPI assignment.
- **Channel fader On/Off** - opens the selected channel fader, see [Channel Parameters: On/Off](#).
- **Channel Monitoring** - switches the selected channel to the monitor output, see [Monitoring](#).
- **Channel Talk** - talks to the selected channel's N-1, see [Bus Outputs: N-1](#).
- **Switch Processing** - switches the selected channel's processing to Alternate, see [Channel Parameters: Processing](#).
- **Load Snapshot** - loads the selected snapshot, see [Snapshot Recall](#).
- **Assign User Key** - allows the GPI to be assigned as a [GPI Display](#) user key (from the User Key Configuration menu).
- **Trigger Red Light** - enables the red light, see [Clock/Timer Functions](#).
- **Start Timer** - starts the timer, see [Clock/Timer Functions](#).

Note that you will only see the channel related functions if a source is assigned to a channel strip.

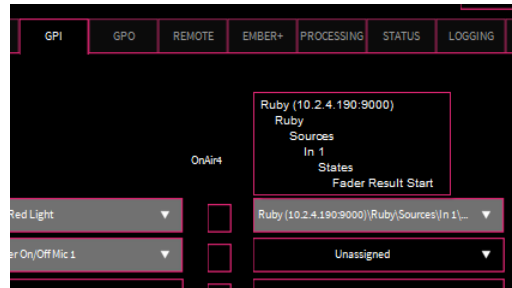
➤ OnAir4 Integration

The **OnAir4** check box activates the corresponding GPI (from 1 to 5) in the [OnAir4](#) if a unit is configured.

➤ Remote Control from an Ember+ Provider

This option allows the GPI to be remotely controlled from an external Ember+ provider.

Note that the provider must first be defined in the **GLOBAL SETTINGS** -> **EMBER+** tab. Then use the drop-down menu to search through the provider's Ember+ Tree and assign a Boolean value - for example **Fader Result Start**. In our example, GPI 1 will become active whenever the Source 1 fader is open on our external Ruby surface:



The values available depend on the level of Ember+ support in the providing device.

9.8 GPO

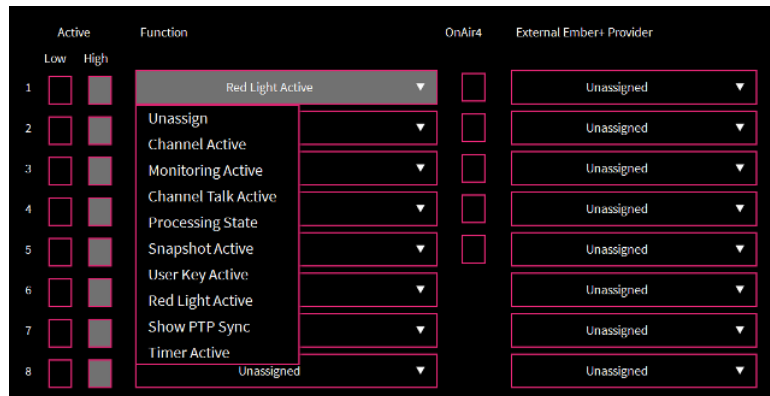
These options define the 8 GPOs (General Purpose Outputs) supported via the [Ember+](#) control protocol. They allow **RELAY VRX⁴** to control functions within an external device. For example, to trigger a fader start.

The Ember+ interface must be enabled, in [Global Settings -> Remote](#), for the GPIOs to be published.

Each output can be **Active** when **Low** or **High**.

➤ Defining the Functionality

Choose the function which will trigger each output from the drop-down menu:



- **Unassign** - removes the GPO assignment.
- **Channel Active** - the GPO is triggered by opening the selected channel fader, see [Channel Parameters: On/Off](#). Use this option to configure a fader start.
- **Monitoring Active** - the GPO is triggered by selecting a particular monitor source, see [Monitoring](#).
- **Channel Talk Active** - the GPO is triggered when talkback to the selected channel's N-1 is active, see [Bus Outputs: N-1](#).
- **Processing State** - the GPO is triggered when the selected channel's Alternate processing is active, see [Channel Parameters: Processing](#).
- **Snapshot Active** - the GPO is triggered when the selected snapshot is loaded, see [Snapshot Recall](#).
- **User Key Active** - the GPO can be triggered by a user key assigned to the [GPO Trigger](#) function (from the User Key Configuration menu).
- **Red Light Active** - the GPO is triggered when the red light is active, see [Clock/Timer Functions](#).
- **Show PTP Sync** - the GPO is triggered when PTP Sync is active, see [RAVENNA: Preparation](#).
- **Timer Active** - the GPO is triggered when the timer is active, see [Clock/Timer Functions](#).

Note that you will only see the channel related functions if a source is assigned to a channel strip.

➤ OnAir4 Integration

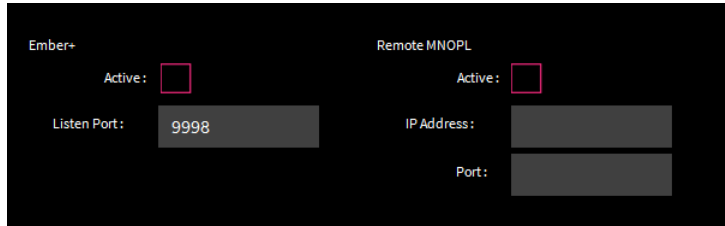
The **OnAir4** check box activates the corresponding GPO (from 1 to 5) in the [OnAir4](#) if a unit is configured.

➤ Remote Control from an Ember+ Provider

This option allows the GPO to be remotely controlled from an external Ember+ provider.

Note that the provider must first be defined in the **GLOBAL SETTINGS** -> [EMBER+](#) tab. Then use the drop-down menu to search through the provider's Ember+ Tree and assign a Boolean value. The values available depend on the level of Ember+ support in the providing device.

9.9 Remote



The screenshot shows two configuration sections on a dark background. The 'Ember+' section has an 'Active' checkbox (unchecked) and a 'Listen Port' field containing '9998'. The 'Remote MNOPL' section has an 'Active' checkbox (unchecked), an 'IP Address' field, and a 'Port' field.

These options configure and activate each of **RELAY VRX4**'s external interfaces. In each case, the **Ember+** and **MNOPL** flags in the [Status](#) tab indicate whether you have a valid connection.

➤ Ember+

- **Active** - select this box to enable the [Ember+](#) interface.
- **Listen Port** - defines the Listen Port which will be used to send out the Ember+ parameters; the default port (**9998**) is automatically entered. If this port is used by another application on your computer, then use the next available port with a high number (e.g. **9999**).

➤ Remote MNOPL

- **Active** - select this box to enable the Remote MNOPL interface. This can be used to reset matrix connections within an external Lawo routing system such as the Nova73 via a user key.
- **IP Address & Port** - enter the TCP/IP settings for the remote device.

9.10 EMBER+

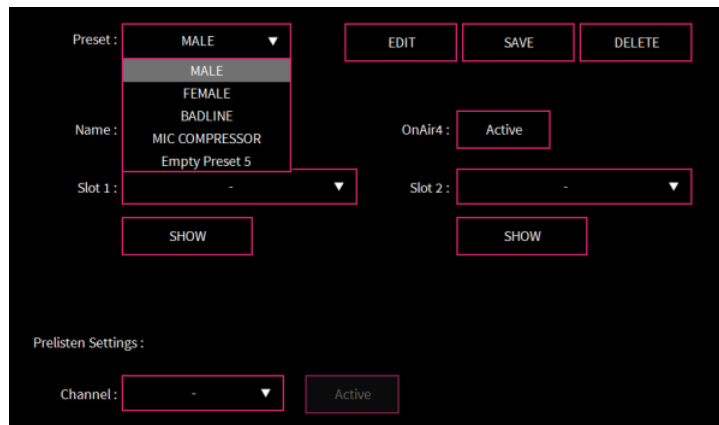
These settings configure the Ember+ providers as described [earlier](#) in the Ember+ chapter.

9.11 Processing

These options define the signal processing presets which are available in other **R3LAY VRX4** menus, (e.g. [Source Configuration: Processing](#)). Up to 10 presets may be defined, each using up to two processing slots in series.

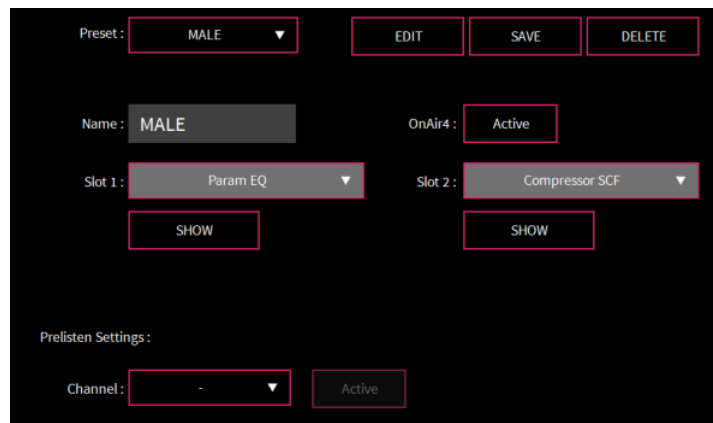
Note that if you have an **OnAir4** connected, then this includes some dedicated DSP resource. This provides the option to use either the hardware DSP (within the **OnAir4**) or software-based DSP for each preset.

1. Click on the **Preset** field and choose a name (e.g. **MALE**, **FEMALE**, etc.) - the editing options (**EDIT**, **SAVE** and **DELETE**) become active:



Note that if you wish to create a new preset, you should choose the next available empty preset name - e.g. **Empty Preset 5**.

2. Select **EDIT** to edit the preset's parameters:



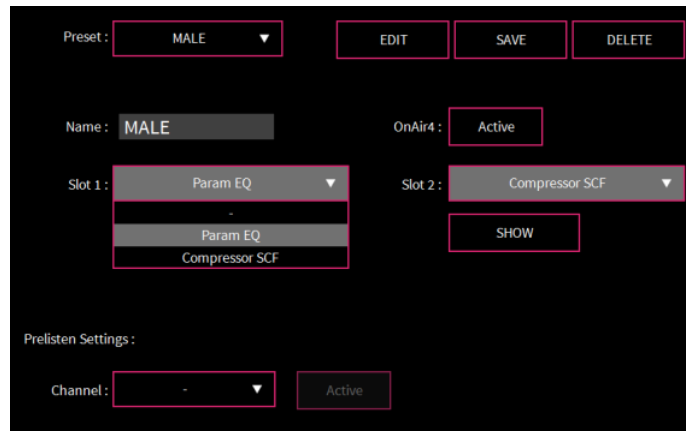
➤ Name

Enter a name (up to 12 characters). The name will appear in the "Easy Processing" buttons on the channel strip, if the preset is assigned to a source with user mode access, see [Source Configuration: Processing](#).

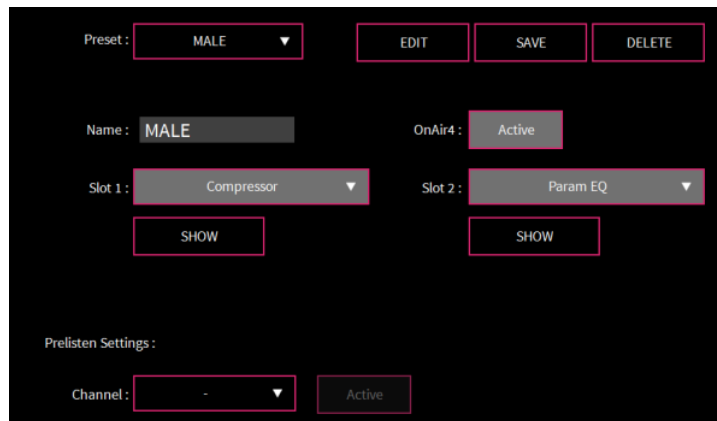
9. Global Settings

➤ Slot 1 and Slot 2

Either, assign a software-based processor from the drop-down menu - in **RELAY VRX⁴**, the options include two Lawo native plug-ins, from the mc² console series: a Compressor with Sidechain Filters (**Compressor SCF**) and 4-band Parametric EQ (**Param EQ**):



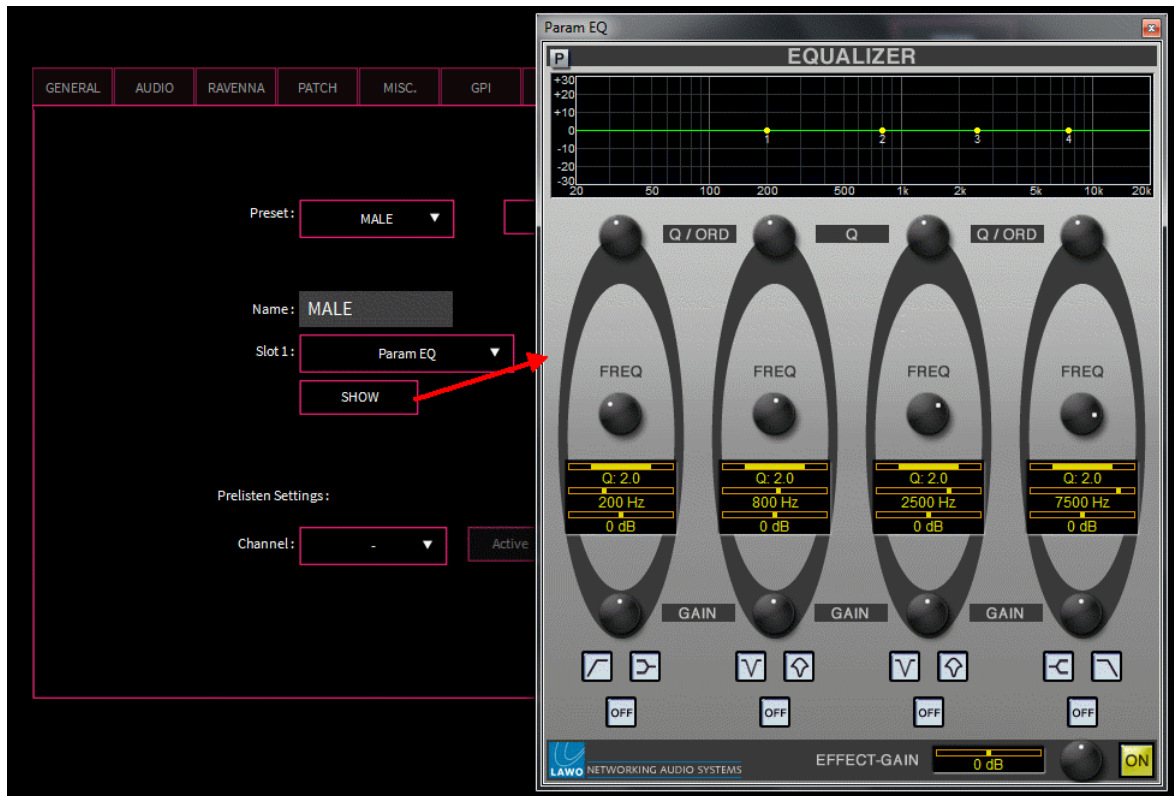
Or, to use the dedicated DSP resource within the **OnAir4**, select the **OnAir4** checkbox - in this instance, Slots 1 and 2 are automatically configured as Slot 1 = Compressor; Slot 2 = Param EQ:



If the presets are to be switched by the end-user (e.g on the channel strip), then it is essential they use identical Slot assignments - i.e. the processors assigned to **Slot 1** and **Slot 2** must match. If not, the user will hear a brief interruption in audio. Therefore, to achieve inaudible switching between **MALE** and **FEMALE** presets, assign the same processors to **Slot 1 (Param EQ)** and **Slot 2 (Compressor SCF)**. Then adjust the processor's parameters accordingly - for example, set the **FEMALE** Compressor (in **Slot 2**) to bypass mode.

➤ **SHOW**

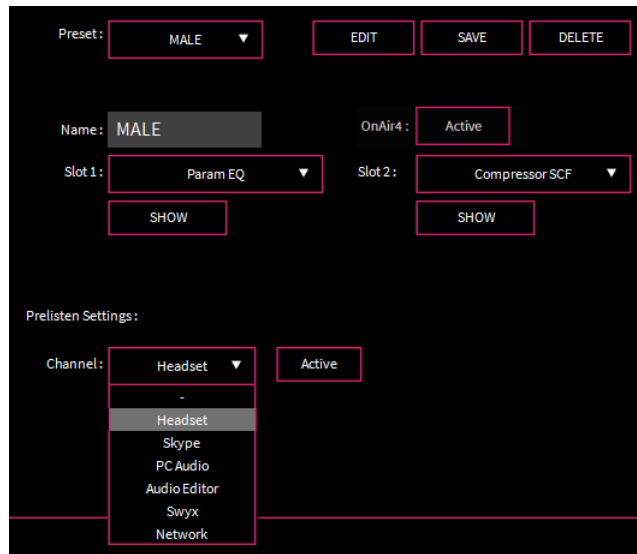
Select this button to view and adjust the processor's parameters:



See [The Lawo Processing Collection](#) for more details.

➤ PreListen Settings

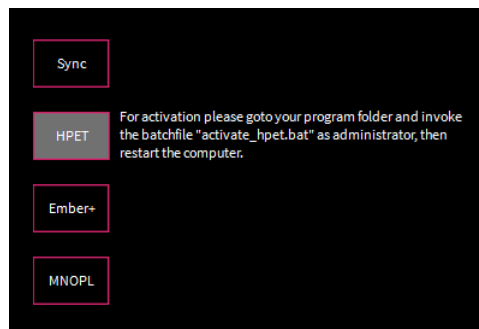
Choose a **Channel** from the drop-down menu (e.g. **Headset**) and select **Active** to route the channel (with the processing preset active) to the headphone output (**PHONES**):



3. When you are happy with the settings, select **SAVE** to save the preset - if you are editing an existing preset, then you will be asked to confirm the save.
4. To delete an existing preset, choose a name from **Preset** field and select **DELETE** - you will be asked to confirm the deletion.

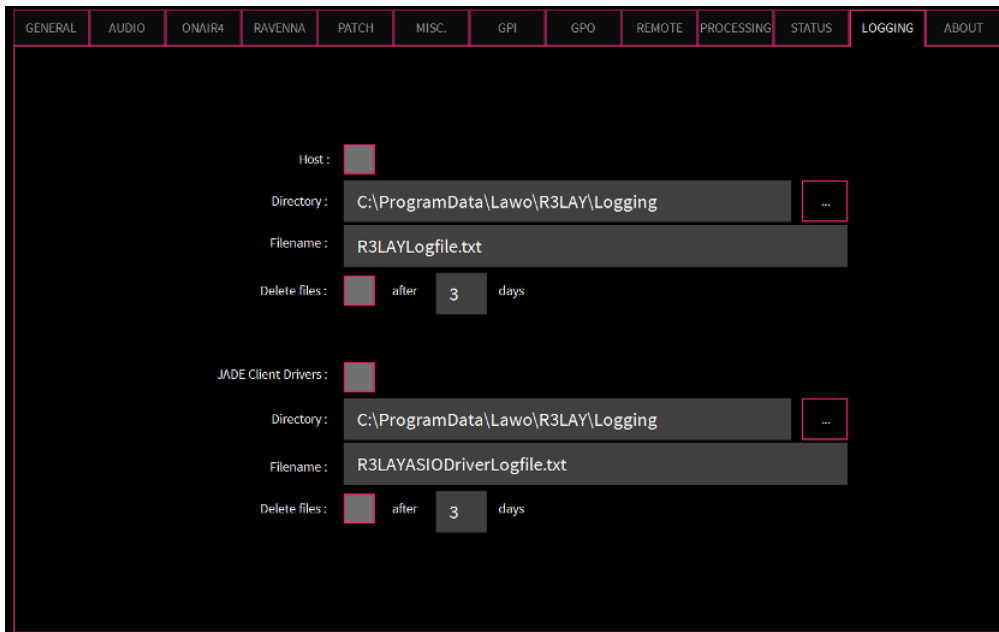
9.12 Status

These options indicate the status of:



- **Sync** = the RAVENNA sync source. This can be either PTP (Precision Time Protocol) or an incoming RAVENNA stream. The box is grey if **RELAY VRX⁴** is receiving a valid sync source. The box will flash on startup, while the clock is synchronising; this can take a few seconds. See [Global Settings -> RAVENNA](#).
- **HPET** = High Precision Event Timer. This is a high precision clock, provided by your PC, required for proper RAVENNA timing. The box should be grey if you wish to generate RAVENNA audio streams. See [RAVENNA: Preparation](#).
- **Ember+** - this open control protocol supports 8 GPIOs to and from **RELAY VRX⁴**. The box is grey if Ember+ is active and there is a valid connection, see [Global Settings -> Remote](#).
- **MNOPL** - this Lawo protocol is used to reset connections within an external matrix from a **RELAY VRX⁴** user key. The box is grey if Remote MNOPL is active and there is a valid connection, see [Global Settings -> Remote](#).

9.13 Logging

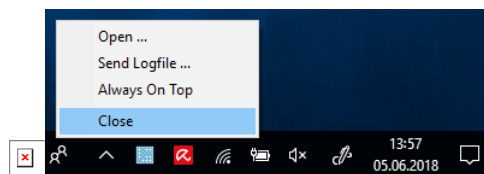


RELAY VRX⁴ produces a very detailed log of many events and statistics. These options define:

- **Logging active** - saves a log file whenever there is a problem with the software.
- **Directory** and **Filename** - sets the filename and location for the log file(s) - each file is automatically suffixed with a different number to make it unique.
- **Delete Files** - select this option to delete the log files after **x** days.

Note that the same settings can be defined for the main RELAY VRX⁴ application and its ASIO Driver.

Once logging is active, you can send a log file by right-clicking on the RELAY VRX⁴ icon in the task bar, and selecting **Send Logfile**:



RELAY VRX⁴ will then pack all the logfiles created today into a single zip-file, open your standard email client and attach the file to a new message. Please add a description of what was happening when the problem occurred, and email the message to support@lawo.com.

9.14 About

This page provides information about the RELAY VRX⁴ release and its drivers.

You can also display information about the third-party modules and/or Open Source libraries by selecting **Show Modules and Libs...**

The **Activate License** button opens the 'Lawo License' web browser page. If the button is greyed out, then a full license is already active.

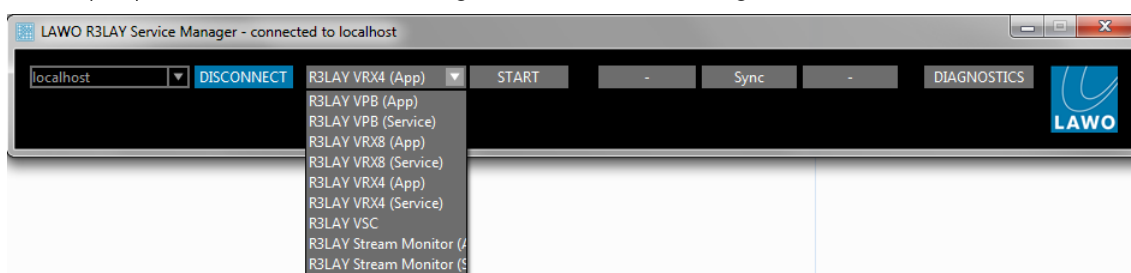
10. The Service Manager

This chapter describes the **R3LAY Service Manager** which is included with **R3LAY VRX⁴**. It can be used to start and stop a **R3LAY** service or application (running on either the local or remote host).

10.1 Architecture

Once **R3LAY VRX⁴** is installed, the user sees only the GUI. However, there are three executables:

- **R3LAY VRX⁴** - this is the program which deals with all audio handling and RAVENNA streaming configuration. It can run either as an application (with full GUI control) or as a service (in the background) whenever you start the PC. The default file path is: "C:\Program Files (x86)\LAWO\R3LAYVRX4\R3LAYVRX4.exe".
- **R3LAY Service Manager** - this service is required to start and stop the application or service (described above). It runs automatically in the background whenever you start the PC. The default file path is: "C:\Program Files (x86)\LAWO\R3LAYServiceManager\R3LAYServiceManager.exe".
- **R3LAY Service Manager GUI** - this is the GUI application which controls the Service Manager, which in turn starts and stops the **R3LAY** application or service. The GUI can connect to either the local host or a remote PC, and can start and stop any flavour of **R3LAY**. The default file path is: "C:\Program Files (x86)\LAWO\R3LAYServiceManager\R3LAYServiceManagerGUI.exe".



10.2 Opening the Service Manager GUI

1. To open the **R3LAY Service Manager GUI**, either click on the taskbar icon or select the application from the Windows START menu.

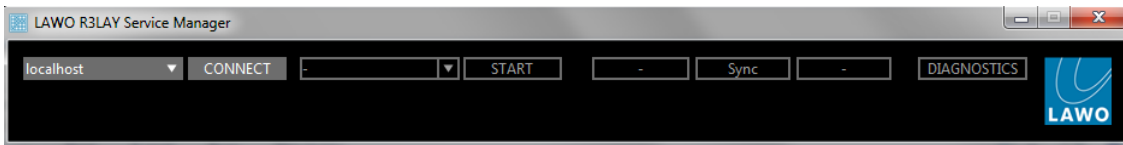
The GUI opens with an automatic connection to the local host's active **R3LAY** service - in our example, **R3LAY VSC**. This is indicated by the '**LAWO R3LAY VSC - connected to localhost**' text in the title bar, and the **localhost** and **R3LAY VSC** fields at the top of the GUI:



Only one **R3LAY** application or service may be running at a time. To switch to another application or service, you will need to stop the current service and [start](#) a new one.

10.3 Connecting to a Local or Remote Host

If you see the following window, then the host has been disconnected:



The connection status is also indicated by the taskbar icon - a green dot appears when the service is connected:



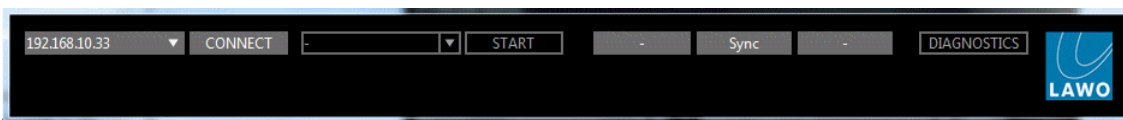
➤ To connect to a Local Host:

1. Select **localhost** from the drop-down menu (top left).
2. Click **CONNECT** - the GUI connects to the active **R3LAY** service running locally on this computer, in our example to **R3LAY VSC**:



➤ To connect to a Remote Host:

1. Select **DISCONNECT** - to disconnect the local host.
2. Type either the IP address or network name of the remote PC's Network Interface Card into the 'connected host' field - for example:



3. Click **CONNECT** - the GUI connects to the active **R3LAY** service running on the remote PC.

The Standard Port Number

The standard port used for a **R3LAY** connection = 9997. If you are not using the standard port, then you will need to add this number (after a colon) to the IP address or network name - for example, type "localhost:9997", "192.163.10.33:9997" or "MyPCName:9997" and then select **CONNECT**.

If you wish to use a different port number (other than 9997), then edit the number in the "C:\ProgramData\Lawo\R3LAY\R3LAYServiceManager.ini" file on the PC running the **R3LAY** service. The line to edit is "EmberPort=9997".

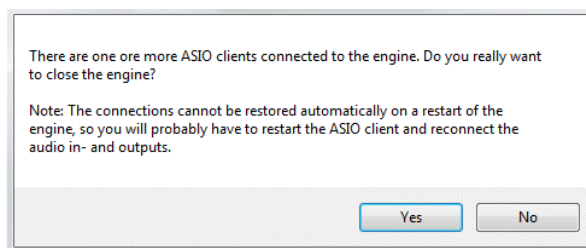
10.4 Starting and Stopping the Service

Only one **R3LAY** application or service may be running at a time. Therefore, if you have installed **R3LAY VRX**, **VPB** or **Stream Monitor** (which can run as either an application or service), or have multiple flavours of **R3LAY** installed on the same PC, you will need to stop the current service before starting a new one:

1. Select **STOP** to stop the active service:



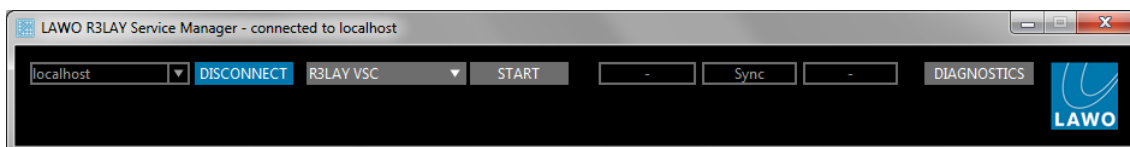
If an ASIO client is running, then you will be asked for confirmation:



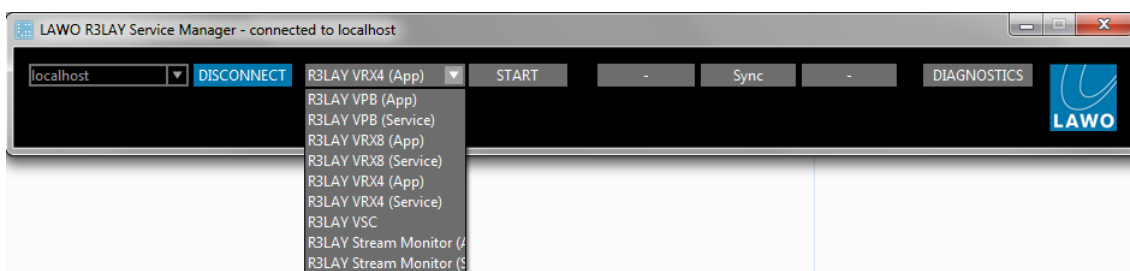
Select **Yes** to continue - the software [saves](#) the current configuration and stops the service. This may take a few seconds:



When the shutdown is complete, you will see a reduced GUI:



2. Select the new application or service from the drop-down service field - note that you will only see the options installed on the connected host:



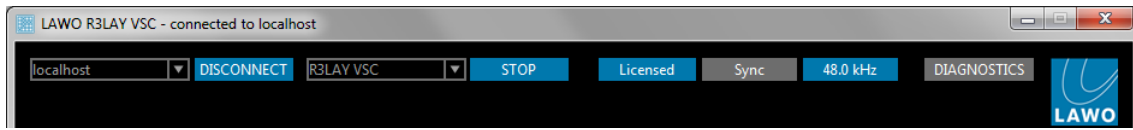
3. Select **START** - a pop-up appears showing the progress; it may take a few seconds to start a new service. At the end of the start-up, the software loads the latest configuration file:
 - For **R3LAY VRX**, **VPB** or **Stream Monitor** applications, the application GUI opens in a separate window.
 - For **R3LAY VRX**, **VPB** or **Stream Monitor** services, you will see a reduced Service Manager GUI (as shown above) - the service is now running in the background.
 - For **R3LAY VSC**, the Service Manager expands to reveal the full VSC GUI.

You need to restart your ASIO clients and [reconnect](#) their audio input/output devices following a service restart.

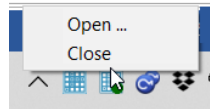
If the connection is to a remote PC, and you start a **R3LAY VRX**, **VPB** or **Stream Monitor** application, then a user must be logged in on the remote PC (in order to open the application GUI). To start **R3LAY** services on a remote PC, no user login is required.

10.5 Closing the GUI

The **RELAY Service Manager** GUI can be minimised or closed in the usual windows manner (from the top right of the window):



Alternatively, right-click on the taskbar icon and select **Close**:



Note that closing the GUI only closes the Service Manager GUI - all **RELAY** services continue to run in the background, meaning that any audio connections and RAVENNA streams remain active. If you wish to stop the active service, then use the **STOP** button. See [Starting and Stopping the Service](#).

To reopen the GUI, click on the taskbar icon.

11. Saving the Configuration

The **R3LAY VRX⁴** configuration is stored locally on the connected host, each time you click **FINISH** to exit the [Admin mode](#) configuration windows.

What is Saved?

All the settings defined in the [Admin mode](#) configuration windows are saved. This includes your choice of audio interfaces, RAVENNA streams, source configurations, bus and monitoring options, snapshots, user keys and global settings. The data is stored in the "R3LAYVRX4.ini" file in the "c:\ProgramData\Lawo\R3LAY" folder for all users. It is important that Windows Administrator rights grant full access to the ".ini" file for every user.

If you wish to protect settings, then use the [Admin Password](#) provided within **R3LAY VRX⁴**.

If a **Global Configuration Path** is entered (under [Global Settings -> General](#)), then settings are split between two file locations: local and global. Enter the path and restart **R3LAY VRX⁴**. From now on, **R3LAY VRX⁴** reads machine-specific settings from the local ".ini" file and all other settings from the global ".ini" file. If the global configuration path exists on a centralised network server, this makes it easy to add say a new user key to multiple **R3LAY VRX⁴** installations.

Restarting

R3LAY VRX⁴ may be started either as an application (with full GUI control) or as a service (where a prepared configuration runs in the background). The latter is ideal for Playout Servers or remote-controlled **R3LAYS**, where you wish to restrict the user access.

To start **R3LAY VRX⁴** as an application, either click directly on its [icon](#) (from the desktop or Windows START menu), or start the application from the [Service Manager](#) by selecting the **R3LAY VRX⁴ (App)** option. The operating window appears.

To start **R3LAY VRX⁴** as a service, [close](#) the application (if open), and then start the service from the [Service Manager](#) by selecting the **R3LAY VRX⁴ (Service)** option. In this mode, the operating window is not visible and the service runs automatically in the background.

In both instances, the software loads the latest active configuration at startup. This means that any audio paths and RAVENNA streams stored in the configuration will be reinstated after a restart. Note that connections can only be re-instated if the same hardware interfaces, client drivers and RAVENNA streams are available. For RAVENNA streams, you must also have a valid sync signal.

When the PC next restarts, the operating mode (application or service) is reinstated. This allows you to start **R3LAY VRX⁴** as an application to edit the configuration. Then, stop and restart **R3LAY VRX⁴** as a service. From then on, PC will start up with **R3LAY VRX⁴** running as a service (i.e. with the active configuration running in the background).

12. OnAir4

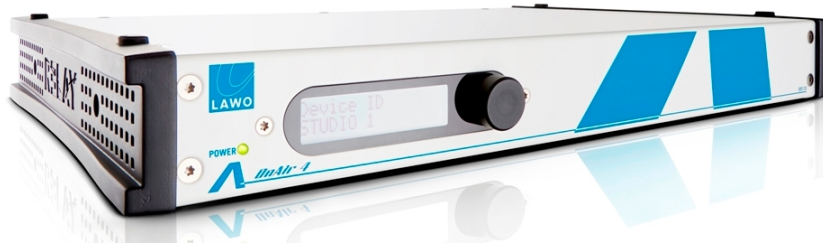
This chapter describes the optional **OnAir4** audio interface.

12.1 Important Safety Instructions

Please observe all of the instructions provided in the "General Safety Information for Lawo Equipment" booklet delivered with your devices. Double-click [here](#) to open the same information (as a pdf).

Please also observe the "Safety Information" included in the product data sheets. These are available from the **Downloads** area at www.lawo.com (after **Login**).

12.2 Key Features



The **OnAir4** is a member of Lawo's **A_line** series of Audio-to-IP interfaces. It can be used either as a stand-alone hardware interface or with the **R3LAY VRX** software to create a small portable mixing desk.

Each 1RU 19-inch unit provides a range of local inputs and outputs, plus one **AES67/RAVENNA** Gigabit Ethernet port for streaming signals to and from the IP network. Signals can be easily distributed between different device locations by networking multiple interfaces.

I/O Summary

Each device supports the following local I/O modules:

I/O	Connector Type
4 mono mic/line inputs	XLR+TRS combo connectors
4 stereo headphone outputs	TRS
4 mono line outputs	2 x XLR, 2 x TRS
1 stereo S/PDIF digital input	RCA
1 stereo S/PDIF digital output	RCA
5 GPI inputs / 5 GPI outputs	DB-15

Network

The rear panel provides a single female RJ45, Gigabit Ethernet connector: **ETHERNET A**. This can be used to stream signals to and from an AES67/RAVENNA compatible network. The connection carries Power over Ethernet (PoE), audio and control. Using a standard CAT5 cable, the device can be located up to 80m from the powering switch. If an optional Coax converter is fitted, then the cable length can be extended.

Power

The device is fanless with no internal power supply. It can be powered using either the external 12V DC power supply (included), or Power over Ethernet (**PoE**). Power redundancy is achieved by connecting both the external 12V supply and PoE; in this instance, PoE takes priority.

To use Power over Ethernet, a suitable powering device should be connected to the **ETHERNET A** port (e.g. a powering switch or **V_line** device).

Control

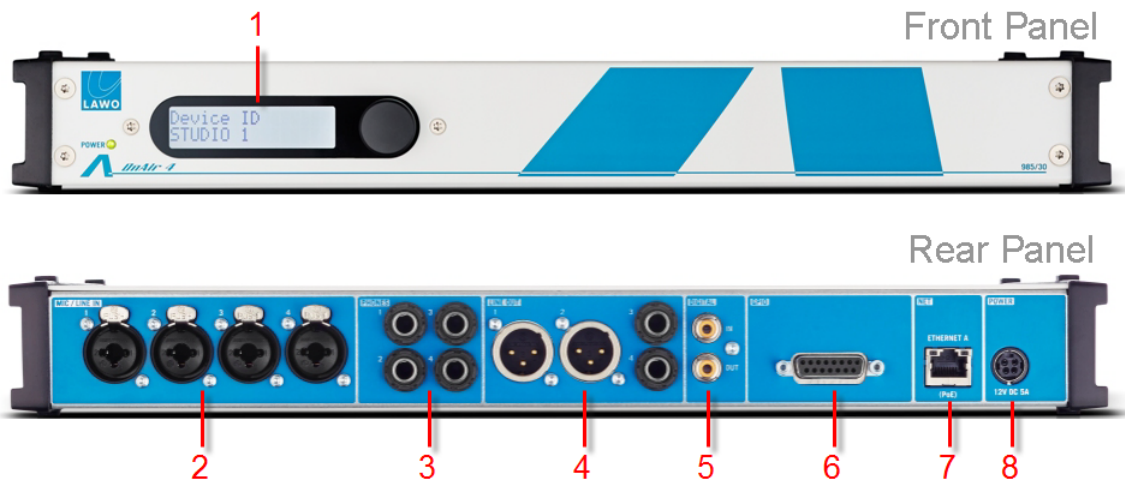
The front panel display provides access to basic parameters such as the IP address and network ID of the streaming port.

All other parameters including the streaming connections are handled by the **R3LAY VRX** software. Note that the RAVENNA Web UI can be used, if necessary, to fault-find the system. In addition, all parameters are accessible via Ember+, allowing them be remotely controlled from another networked Ember+ device.

Dimensions

- Height: 1 RU (1.75" / 46.6mm.)
- Width, with rack-mount kit: 19" / 482.6mm.
- Depth: 9.85" / 250.2mm.

12.3 Controls, Connectors & Indicators



1 Status Display & Menu Control - access to functions such as labeling the device and setting the IP address. The **POWER** LED illuminates as soon as power is applied.

2 4 x MIC/LINE IN - four mono mic/line inputs (XLR+TRS) for connecting microphones and local analogue devices (balanced; galvanic separated; suitable for unbalanced use; click-free gain adjustment; gain range 118dB_A; +48V phantom power; -20dB PAD; maximum input level +24dB_u).

3 4 x PHONES - four stereo headphone outputs (TRS) for connection to local headphone or monitor outputs (unbalanced).

4 4 x LINE OUT - four mono line outputs (2xXLR, 2xTRS) for connection to local analog devices (balanced; floating; suitable for unbalanced use; maximum output level +24dB_u).

5 1 x DIGITAL IN, 1 x DIGITAL OUT - one stereo S/PDIF input and output (RCAs) for connection to a local digital device.

6 5 x GPI IN / 5 x GPI OUT - five General Purpose Inputs and five General Purpose Outputs (SUB-D15) for local signaling and switched functions:

- GPI: 5 x optocouplers (3-36 VDC / 8mA @ 36V).
- GPO: 5 x silent CMOS relays (50V AD/DC / 0.5A AC; 1.0A DC).

7 ETHERNET A - connection to the **R3LAY** host PC or IP network (RJ45, Gigabit Ethernet: 100/1000 Base-T). This is the AES67/RAVENNA streaming port which carries both audio and control. The port also supports Power over Ethernet (PoE), enabling the unit to be powered via the network connection. The port can also be used to open the Web UI (for setup and control), or to access Ember+ parameters.

8 12V DC Input - connection to the external 12V DC power supply. The **CASE** grounding screw should be used to ground the frame.

The RAVENNA sub system is based on the COMi.MX board (used in other RAVENNA devices).

A_OnAir4 is a fanless unit and relies on convection cooling. Please do NOT obstruct the ventilation holes when connecting your cabling.

12.4 Installing the Unit

To install the **OnAir4**, please complete each of the following steps:

1. Unpack and check the contents of the shipping box. You should find:
 - 1 x **OnAir4** unit
 - 1 x External 12V DC Power Supply
 - 1 x Backpack
 - 2 x Rack-mounting ears
 - 1 x Ethernet cable

Please check the contents, and in the event of any transport damage, please contact your local Lawo representative or email support@lawo.com.

2. Install the frame.

The unit is delivered with rubber carry bumpers fitted to the sides of the frame as shown below - this is ideal for portable use or desktop mounting:

Front View



Rear View



Alternatively, to rack-mount the unit in a 19" housing, remove the rubber bumpers and attach the rack-mounting ears included in the shipping box.

Note that the ears may be rotated by 90 degrees, to allow mounting under a counter top, if desired.

3. Connect your local audio and GPIO devices. See [Controls, Connectors & Indicators](#).

At this stage, do NOT connect the **ETHERNET A** port to the network, as first you must configure its IP settings.

OnAir4 is a fan-less unit which relies on convection cooling. Please do NOT obstruct the ventilation holes when connecting your cabling.

4. Apply power, either by using Power over Ethernet or the external 12V DC power supply.

To use Power over Ethernet, a suitable powering device should be connected to the **ETHERNET A** port - for example, a powering network switch or **V__line** device.

To use the external power supply, connect its power cable to the **12V DC IN** port. The port uses a locking 4-pin DIN connector. So, to fully insert or remove the power cable, you must pull back its collar away from the socket.

If both PoE and the external supply are connected, then the unit benefits from power redundancy. In this instance, PoE takes priority.

The unit has no on/off switch and starts automatically as soon as power is applied - the **POWER** LED on the front panel illuminates. The front panel display shows "**initializing...**" while the unit is booting. When the boot process is complete, you will see "**Device ID**" - the unit is now ready for configuration.

12.5 Getting Operational

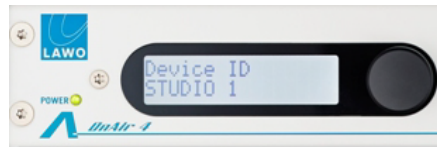
Once the unit has booted, follow the steps described in the [Installation](#) chapter to setup the OnAir4 with the **R3LAY VRX** software.

Note that it is important *NOT* to connect the **ETHERNET A** port of the **OnAir4** to your host PC until the correct network settings have been configured.

If you need to check or edit the TCP/IP settings of the OnAir4, then this can be handled from the front panel (described [below](#)).

12.6 Front Panel Parameters

The front panel display and rotary control provide access to local device parameters:



Turn the control to scroll through the available menus. Then push down to access the next level or edit the value. In each case, you can confirm all changes by pressing down on the **o** (ok) symbol. Alternatively, to exit without accepting the changes, press down on the **x** (exit). A step-by-step example is described below.

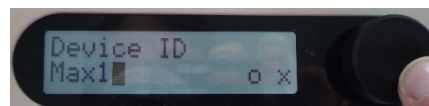
12.6.1 Editing Parameters from the Front Panel

The steps below show how to edit the **Device ID**. All other parameters can be edited in a similar manner.

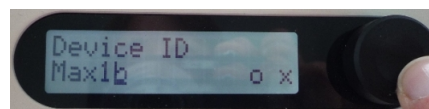
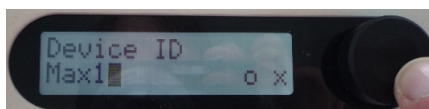
1. Turn the rotary control until you see the parameter you wish to edit - the current value is displayed. Then push down on the control to edit the ID - a cursor appears below the first field:



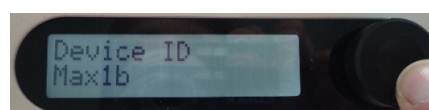
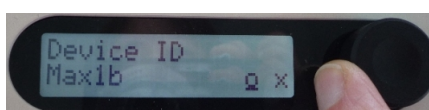
2. Turn the rotary control again to select a character, and press down to edit the selected field - the field flashes with a "filled" background:



3. Turn to select a new value, and press down to confirm the change.

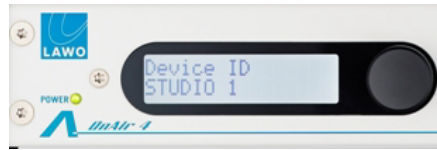


4. Repeat steps 2 and 3 to edit the other character fields as required.
5. Finally, turn the control to select the **o** (ok) symbol, and press down to confirm the **Device ID** change - the changes are accepted:



Alternatively, to exit without accepting any of the character field changes, press down on the **x** (exit) symbol.

12.6.2 Network Settings



Device ID

The Device ID must be a unique ID which identifies the unit within the IP network. Short, descriptive names are recommended. Use only normal characters, numbers and "_" or "-" without spaces. Up to 31 characters are permitted. The default ID is blank.

Device Label

The Label is optional, but can be useful in a networked installation with multiple devices. The default Label is blank.

Network Settings

The Network Settings menu defines four parameters (**Network Mode**, **IP Address**, **Netmask** and **Gateway**) for the streaming port (**ra0**). The port labeling corresponds to the rear connectors as follows:

- ra0 = ETHERNET A

Note that you edit several parameters in one visit and then select **Apply changes** to confirm.

Network Mode

The **Network Mode** can be set to one of the following options:

- **Static** - select this mode to enter the IP Address, Netmask and Gateway manually, as described below.
- **DHCP** - select this mode to receive an IP Address automatically from the network's DHCP server.
- **Auto** - in this mode, the unit will automatically assign its own IP address.

In the current RAVENNA release, the Configuration *must* be set to **Static** (so that a static IP address can be allocated to each streaming port). The **DHCP** and **Auto** modes are not supported.

IP Address, Netmask and Gateway

The **IP address** *must* be unique, and lie within the same IP address range as all other RAVENNA streaming nodes (i.e. the first three fields must match). The default IP address is:

- ra0 (ETHERNET A) = **192.168.101.250**

The **Netmask** *must* match the Subnet Mask of all other RAVENNA streaming nodes. The default Netmask = **255.255.255.0**

A **Gateway** is required if data packets are to be redirected. For example, if the streaming port is connected via a network switch with Layer 3 routing capability. If redirection is not required, then the Gateway can be left at its default = **0.0.0.0**

Check the IP settings of all streaming ports carefully. If there is an IP conflict, then the network will not operate correctly.

12.6.3 System Menu

The **System** menu provides access to the following options:

Reboot

Press down and then confirm to reboot the device. Once the reboot is complete, the latest settings will be restored.

Factory Defaults

Press down and then confirm to reset the device to the factory default settings.

This operation will overwrite all existing settings and, therefore, should be used with caution!

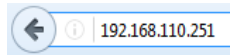
12.7 The RAVENNA Web UI

The RAVENNA Web UI can be used to check the network communication to the **OnAir4**, and edit settings such as the unit's network settings and sync source.

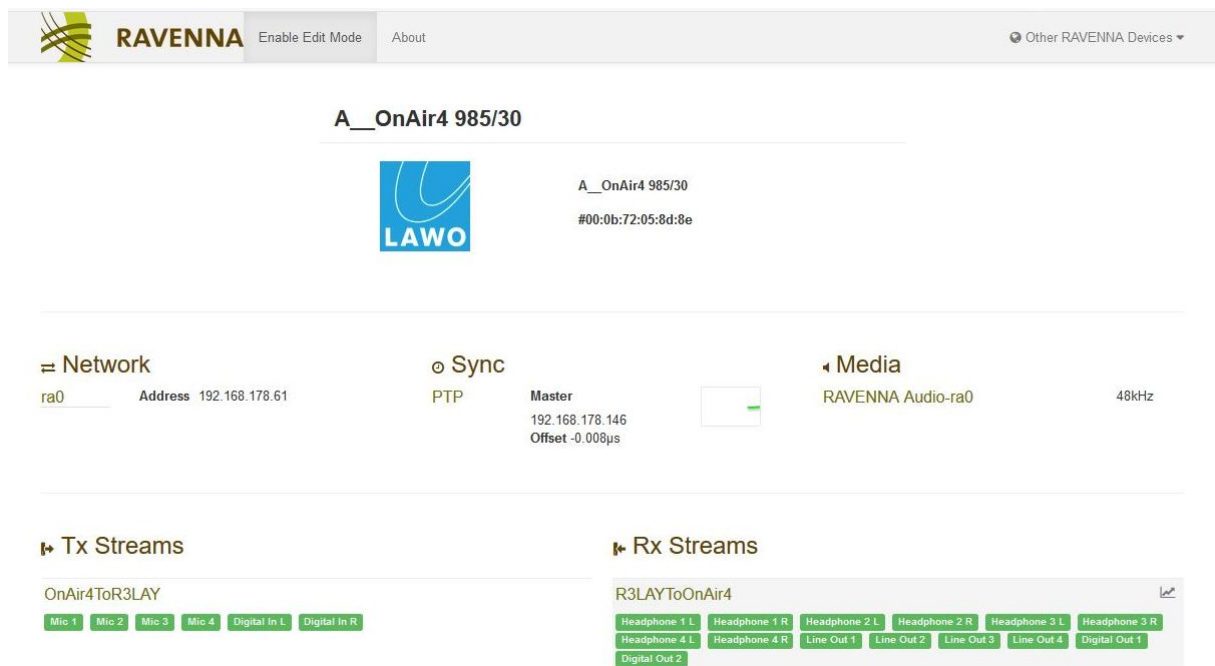
12.7.1 Opening the Home Page

1. Connect your computer to the unit's **ETHERNET A** port and configure the required TCP/IP settings.
2. Open your browser software, and enter the IP address of the streaming port into the URL field.

For example, to connect to a unit using the default IP Address, you would type "**192.168.110.251**" and press Enter:



The browser connects and the Home page appears:



The screenshot shows the RAVENNA Web UI interface. At the top, there is a navigation bar with the RAVENNA logo, "Enable Edit Mode", "About", and "Other RAVENNA Devices". The main content area displays the device name "A__OnAir4 985/30" and the LAWO logo. Below this, there are three main sections: "Network", "Sync", and "Media".

- Network:** Shows the interface "ra0" with the address "192.168.178.61".
- Sync:** Shows "PTP" as the sync source, with "Master" at "192.168.178.146" and an "Offset" of "-0.008µs".
- Media:** Shows "RAVENNA Audio-ra0" with a sample rate of "48kHz".

At the bottom, there are two sections for streams:

- Tx Streams:** Shows "OnAir4ToR3LAY" with inputs for "Mic 1", "Mic 2", "Mic 3", "Mic 4", "Digital In L", and "Digital In R".
- Rx Streams:** Shows "R3LAYToOnAir4" with outputs for "Headphone 1 L", "Headphone 1 R", "Headphone 2 L", "Headphone 2 R", "Headphone 3 L", "Headphone 3 R", "Headphone 4 L", "Headphone 4 R", "Line Out 1", "Line Out 2", "Line Out 3", "Line Out 4", "Digital Out 1", and "Digital Out 2".

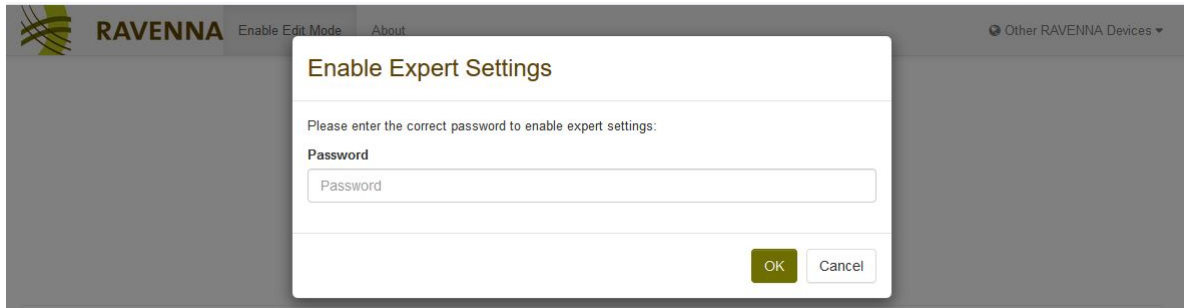
If the Home page does not appear, then there is a problem with the network communication between your computer and **OnAir4** device. Check your physical connections. Then check both the **Network Settings** on the **OnAir4** and TCP/IP settings of your computer's network interface card. You could also try running a Windows PING test and/or disabling your computer's firewall (if active).

12.7.2 Expert Mode

Many operations cannot be actioned unless you are running in expert mode. In addition, enabling expert mode will reveal some hidden menus and options.

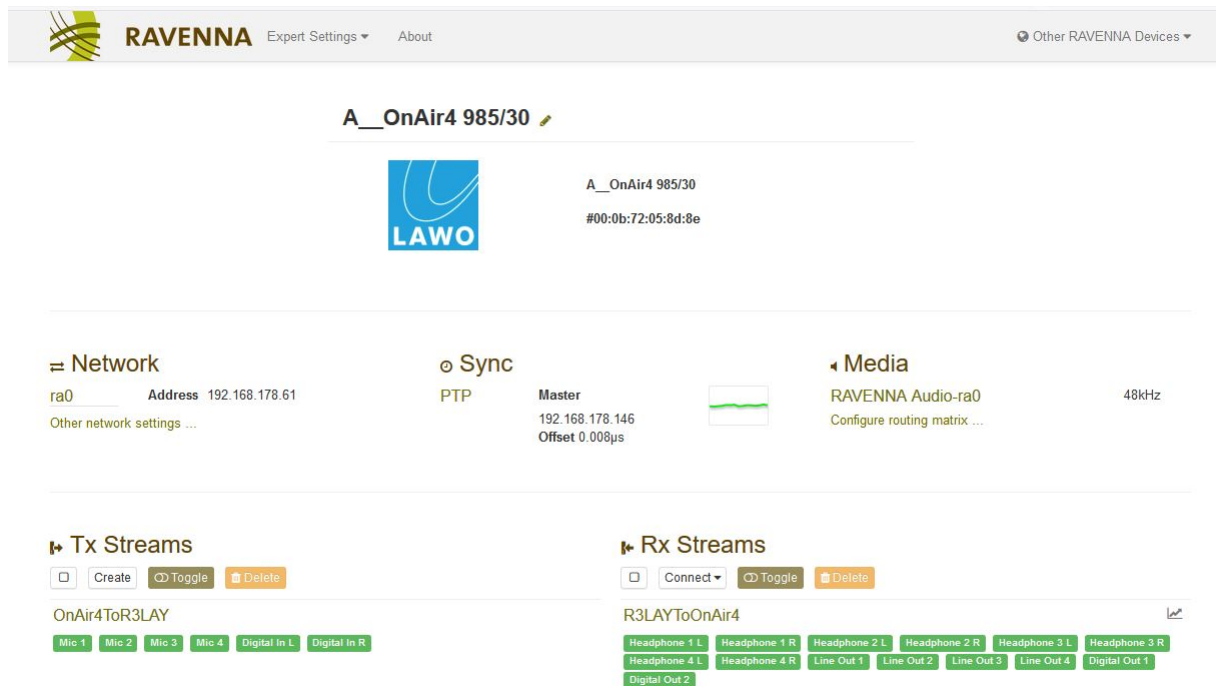
To enable expert mode:

1. Select **Enable Edit Mode** from the title bar at the top of the Home page - a pop-up window appears:



2. Type in the Password - **ravenna** - and click **OK**. The Home page updates to reveal the extra options.

12.7.3 The Home Page



The Home page is divided into the following areas:

Title Bar

- **Expert Settings (or Enable Edit Mode)** - click to [enable](#) expert mode or access the expert menus.
- **About** - click for more information about the RAVENNA IO Card firmware release.
- **Other RAVENNA Devices** - click to open a drop-down list of all other devices discovered by the network.

Device Name (and other details)

Below the title bar you will see the device name and the MAC address of the **ra0** interface.

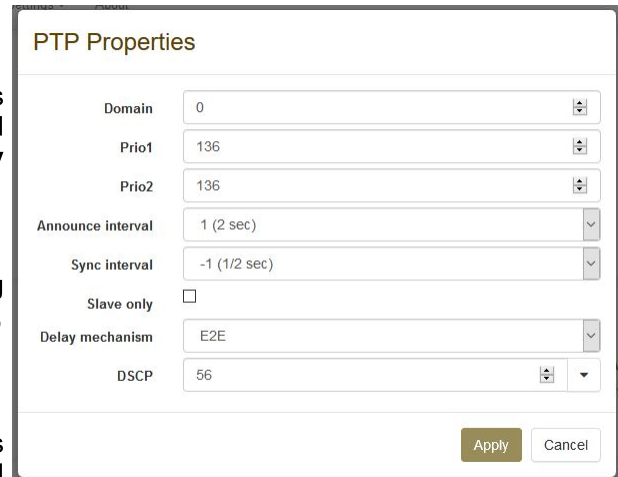
Network

In this area you will see the **ra0** network interfaces supported by the **OnAir4**. This corresponds to the **ETHERNET A** port on the rear panel of the unit.

Click to view the IP Address and other network settings. If you wish, you can edit the settings (as long as [expert mode](#) is enabled). The options are identical to those available from the front panel, described [earlier](#).

Sync

Here you will see the PTP sync mode for the device. This should be set to **Master**. If not, [enable](#) expert mode and then click on **PTP** to edit the sync settings - the **Slave only** checkbox should be disabled:



PTP Properties	
Domain	0
Prio1	136
Prio2	136
Announce interval	1 (2 sec)
Sync interval	-1 (1/2 sec)
Slave only	<input type="checkbox"/>
Delay mechanism	E2E
DSCP	56

Media

The list of **Media** shows all the RAVENNA streaming interfaces configured on the IO device - for the **OnAir4**, there is only one streaming port (**ra0**).

TX Streams

In this area you will see the names of any TX streams which have been created, and the RAVENNA interface and sending channels in use. TX streams are used to publish audio from this device to the network.

RX Streams

In this area you will see the names of any RX streams which you are using on this device, and the RAVENNA interface and playback channels in use. RX streams are used to receive audio from the network.

When using the **OnAir4** with **RELAY VRX4**, all media, source and destination streams are automatically configured by the **RELAY** software. Therefore, please do not edit the Media, TX Stream or RX Stream parameters.

The **TX Stream** and **RX Stream** areas should list any streams which have been configured - in our example, the default connections to and from an **OnAir4** device. This can be useful when fault-finding the system.

Click on the graphical icon to the right of a RX Stream to view its statistics:

RAVENNA Expert Settings About Other RAVENNA Devices

Destination Statistics

Source: R3LAYToOnAir4

RTCP

Current Status

Interarrival Jitter	10
Fractional Lost Packets	0
Cumulative Lost Packets	0

Interarrival Jitter/Lost Graph

Receive Buffer

Current Status

Min Offset	944	935
Max Offset	1030	1034
Too Late/Too Early (cum.)	0	0
Configured Delay	896	

Buffer Graph

Reset Close

Audio outputs: Headphone 1 L, Headphone 1 R, Headphone 2 L, Headphone 2 R, Headphone 3 L, Headphone 3 R, Headphone 4 L, Headphone 4 R, Line Out 1, Line Out 2, Line Out 3, Line Out 4, Digital Out 1, Digital Out 2

13. Appendices

This chapter includes further information which you may find useful.

13.1 Third-Party Modules & Open-Source Libraries

RELAY VRX⁴ uses the following third-party modules and/or Open Source libraries. Please click on the links below for more information about the code and license.

Live555

<http://www.live555.com/liveMedia>

<http://www.live555.com/liveMedia/#license>

Portaudio V19

<http://www.portaudio.com/>

<http://www.portaudio.com/license.html>

Rapidxml

<http://rapidxml.sourceforge.net/>

<http://rapidxml.sourceforge.net/license.txt>

reSIProcate

<https://www.resiprocate.org/>

<https://www.resiprocate.org/License>

Steinberg ASIO & VST

<https://www.steinberg.net/de/company/developer.html>

This program uses ASIO Technology by Steinberg Media Technologies GmbH. VST is a trademark of Steinberg Media Technologies GmbH.

Info-Zip

<ftp://ftp.info-zip.org/pub/infozip/license.html>

13.2 Advanced Options

RELAY supports a number of options which can be enabled (or disabled) by editing the "RELAYxxx.ini" file, where xxx is the application name: VSC, VRX4, VRX8, VirtualPatchBay or StreamMonitor.

The file can be found in the "C:\ProgramData\Lawo\R3LAY\" folder on the PC running the **RELAY** service. If more than one **RELAY** product is installed, then you will see a separate ".ini" file for each application.

In each case, use the following steps to update the file:

1. Using a plain text editor, add the correct syntax to the ".ini" file.
2. Save the file, taking care to retain the same file name and folder location.
3. [Stop](#) and then [restart](#) the **RELAY** application - the software will read the ".ini" file contents and update its feature set accordingly.

An ".ini" file [template](#) can be used to distribute parameters across several workstations or **RELAY** applications.

The next few topics describe the most common options. A list of all possible options is included [later](#).

13.2.1 Define Additional User Key Functions

These options allow you to program user keys for the following functions: [Open Source](#), [Talk Direct Out](#) and [Stream Connect](#).

Syntax

In each case, add the following syntax to the "R3LAYVRX4.ini" file:

```
[Debug]
```

```
UseJadeStudioOpenSource=1
```

```
UseJadeStudioTalkDirect=1
```

```
UseJadeStudioStreamReceiveConnect=1
```

The value can be set to either 0 (disabled) or 1 (enabled).

Functionality

Once enabled, you will see the function in the [User Key Configuration](#) menu. If disabled, the function is hidden.

13.2.2 Setup SPS Connections

This option supports SMPTE ST2022-7 compatible streaming, otherwise known as Seamless Protection Switching (SPS) or Hitless Merge. Once enabled, you will be able to transmit and receive streams using both of your computer's NICs. Thus, supporting the two separate network paths required for SPS.

To achieve real redundancy, it is recommended to use different subnets or even a different network infrastructure (switches, etc.) to achieve the two separate paths. This will ensure that twice the load is not placed on the same network.

Using different subnets is also better for stream detection via mDNS.

Syntax

To enable SPS, add the following syntax to the "R3LAYVRX4.ini" file:

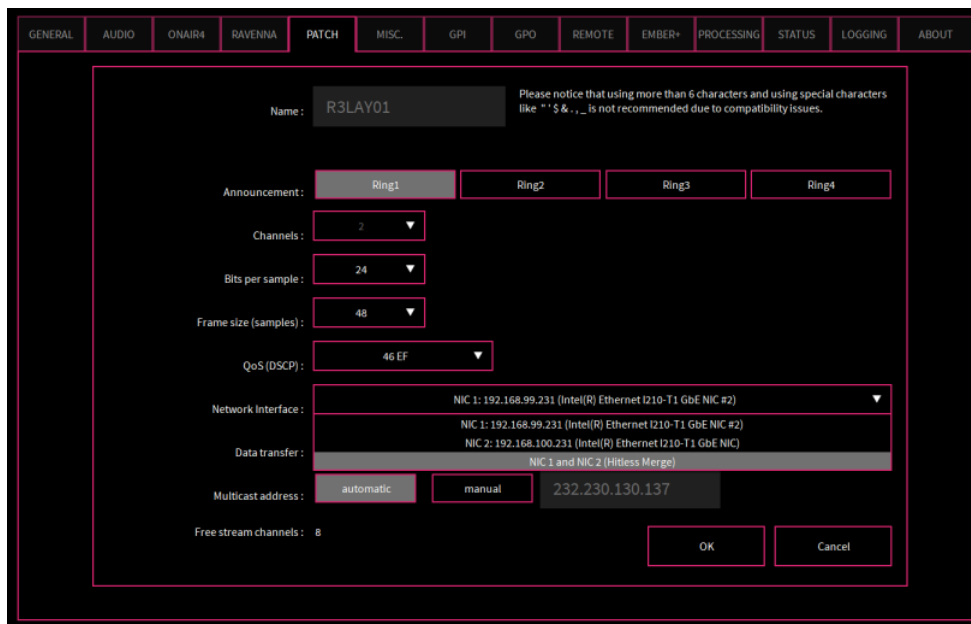
```
[Debug]
```

```
StreamingUseHitlessMerge=1
```

The value can be set to either 0 (disabled) or 1 (enabled).

Functionality for TX Streams

The output stream assignments are made from the "Global Settings -> Patch -> [Add Stream](#)" dialog box. Once the "Hitless Merge" option is enabled, you will be able to select both NICs in the **Network Interface** field.



Thus, the stream will be transmitted to the network via both NIC 1 and NIC 2.

Note that NIC 1 and NIC 2 must be defined in the Global Settings -> [RAVENNA](#) tab. If a second NIC is not defined, then you will not see the options shown above.

13.2.3 Setup mDNS Announcement Rings

This option allows you to define up to four separate mDNS announcement rings. The system will then listen on all of the defined rings for stream announcements, and allow you to select an individual ring or rings whenever you [add](#) a stream.

Syntax

To enable the announcement rings, add the following syntax to the "R3LAYVRX4.ini" file:

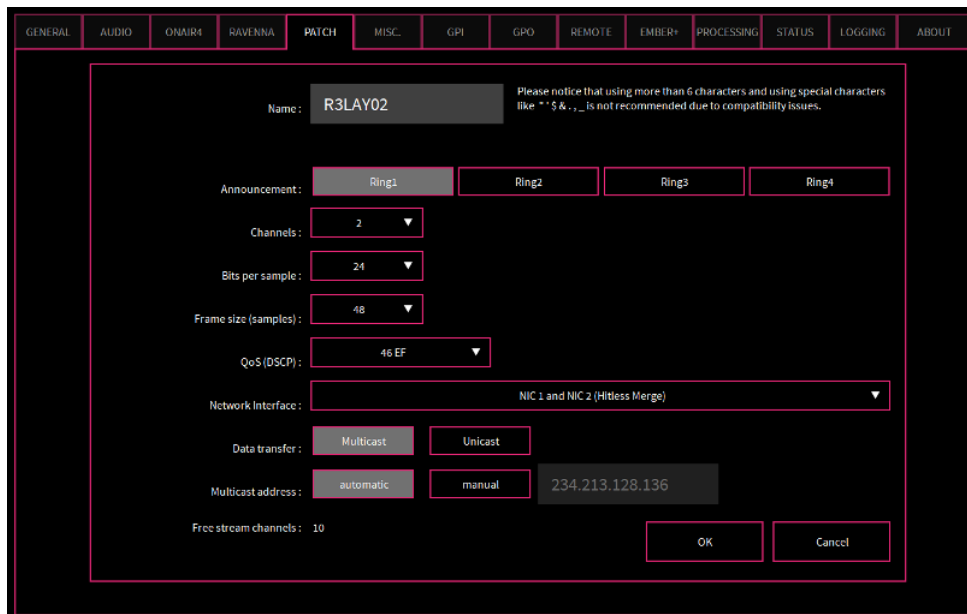
```
[Debug]
UseBonjour=INT
UseBonjourAddress1=224.0.0.251
UseBonjourPort1=5353
UseBonjourAddressName1=Ring 1
UseBonjourAddress2=224.0.0.252
UseBonjourPort2=5353
UseBonjourAddressName2=Ring 2
UseBonjourAddress3=224.0.0.253
UseBonjourPort3=5353
UseBonjourAddressName3=Ring 3
UseBonjourAddress4=224.0.0.254
UseBonjourPort4=5353
UseBonjourAddressName4=Ring 4
```

You can define any number of rings up to the maximum of 4.

The "UseBonjourAddressName" syntax appears in the stream source setup (shown below). So, in our example, the rings appear as "Ring 1", "Ring 2", "Ring 3" and "Ring 4".

Functionality for TX Streams

Once defined, you will be able to select an individual ring or rings whenever you [add](#) a stream source.



GENERAL AUDIO ONAIR4 RAVENNA PATCH MISC GPI GPO REMOTE EMBER+ PROCESSING STATUS LOGGING ABOUT

Name: R3LAY02 Please notice that using more than 6 characters and using special characters like * : \$ & . _ is not recommended due to compatibility issues.

Announcement: Ring1 Ring2 Ring3 Ring4

Channels: 2

Bits per sample: 24

Frame size (samples): 48

QoS (DSCP): 48 EF

Network Interface: NIC 1 and NIC 2 (Hitless Merge)

Data transfer: Multicast Unicast

Multicast address: automatic manual 234.213.128.136

Free stream channels: 10

OK Cancel

Functionality for RX Streams

When receiving streams, the system listens on all of the defined rings in the "R3LAYVRX4.ini" file.

13.2.4 Setup SAP Support

If this option is enabled, then the software will listen for SAP announcements, and announce streams to the network via SAP. This provides an alternative method of stream detection to the usual mDNS/Bonjour. Up to four SAP announcement rings can be specified.

Syntax

To enable SAP announcements and configure the rings, add the following syntax to the "R3LAYVRX4.ini" file:

```
[Debug]
UseSAP=1
UseSAPDoSDPSort=1
UseSAPAddress1=239.255.255.255
UseSAPPort1=9875
UseSAPAddress2=
UseSAPPort2=9875
UseSAPAddress3=
UseSAPPort3=9875
UseSAPAddress4=
UseSAPPort4=9875
```

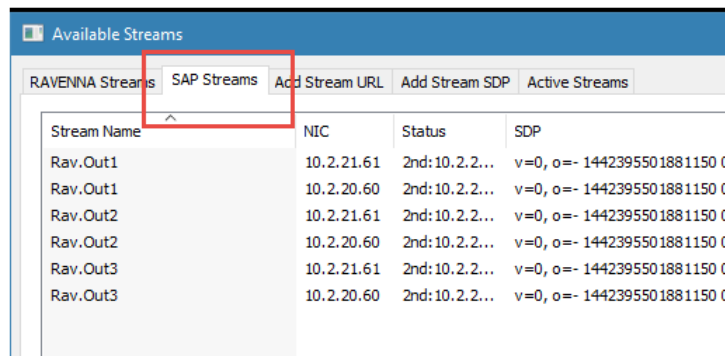
The "UseSAP" value acts as the "on/off" switch for SAP and can be set to either 0 or 1. It must be set to 1 before you can do anything further with SAP.

Functionality for TX Streams

Once enabled, all streams will be announced to the network via SAP.

Functionality for RX Streams

Once enabled, an additional tab appears in the "Available Streams" dialog box - select **SAP Streams** to view all of the streams announced by the SAP rings:



Then click on **ADD** to add a stream as an input device in the usual manner.

13.2.5 Define Stream Name

If this option is enabled, then the computer name is added to all stream names, resulting in names like "stream01 (on xxx)". This makes it easy to identify streams on the network.

Syntax

To enable the computer name suffix, add the following syntax to the "R3LAYVRX4.ini" file:

```
[Debug]
StreamNameAddComputerName=1
```

The value can be set to either 0 (disabled) or 1 (enabled).

13.2.6 Setup Automatic Multicast Address Generator

This option allows you to set your own default pattern for the multicast address generator.

Syntax

Add the following syntax to the "R3LAYVRX4.ini" file:

```
[Streaming]
MulticastIPv4Pattern=239.NIC3.NIC4.n
```

The value is an IPv4 pattern, where:

- the number is a fixed value in the range 0 to 255.
- **NIC3 / NIC 4** is the corresponding number of the NIC sending the stream (NIC1 to NIC4 are permitted).
- **n** is an increasing number in the range 0 to 255.
- **x** is a random number in the range 0 to 255.

13.2.7 Define Offset for Second Multicast Address

When sending Hitless Merge streams, you can add an offset to the mulitcast address for the second stream.

Syntax

Add the following syntax to the "R3LAYVRX4.ini" file:

```
[Streaming]
SecondMulticastIPv4Offset=0.0.0.1
```

where the "IPv4Offset" value defines the offset for each digit of the address.

13.2.8 Setup AlarmLog and Matrix Server Connections

This option supports connections to a DSA Alarmlog PC and/or Matrix Server.

Syntax

To enable a connection, add the following syntax to the "R3LAYVRX4.ini" file:

```
[Interfaces]
AlarmLogActive=1
AlarmLogNIC1=
AlarmLogIPAddress1=alarmlog.stream
AlarmLogPort1=18200
AlarmLogNIC2=
AlarmLogIPAddress2=alarmlog2.stream
AlarmLogPort2=18200
AlarmLogMatrixServerActive=1
AlarmLogMatrixServerIDOffset=0
```

The "AlarmLogActive" and "AlarmLogMatrixServerActive" values can be set to either 0 or 1. The "AlarmLogMatrixServerIDOffset" sets a general offset for all IDs from 0 to 65535.

13.2.9 Setup Stream Switching via Ember+

This option allows stream parameters to be read and controlled via [Ember+](#). For example, to switch streams to and from R3LAY. To switch streams into R3LAY, a prerequisite is that the "[Matrix Server](#)" connection must be enabled.

Syntax

To enable the Ember+ access, add the following syntax to the "R3LAYVRX4.ini" file:

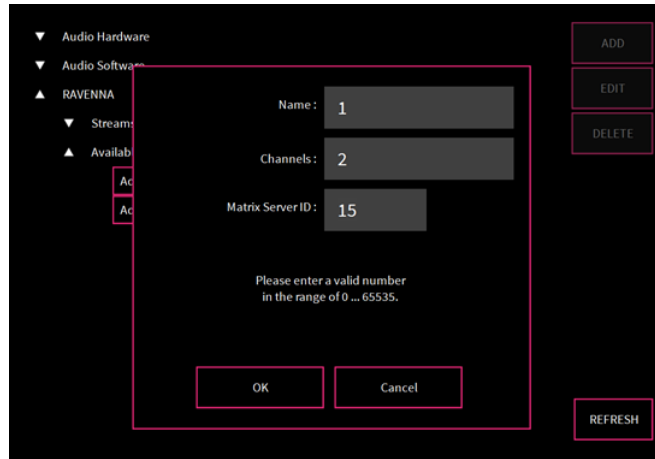
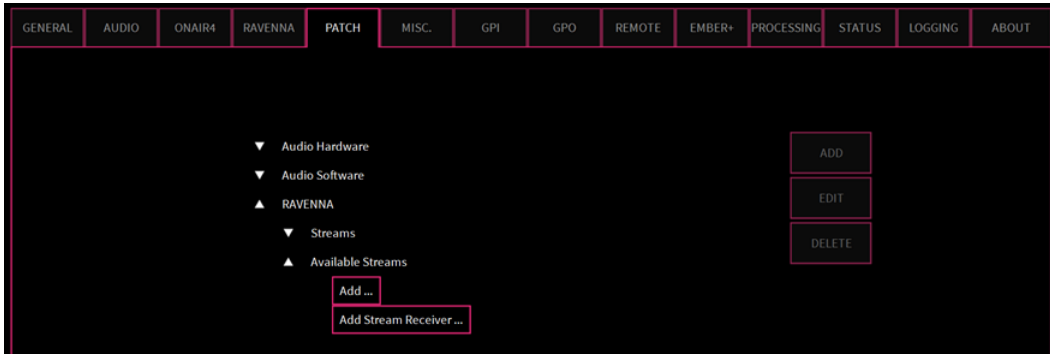
```
[Streaming]
UseEmber=1
```

The value can be set to either 0 (disabled) or 1 (enabled).

Functionality

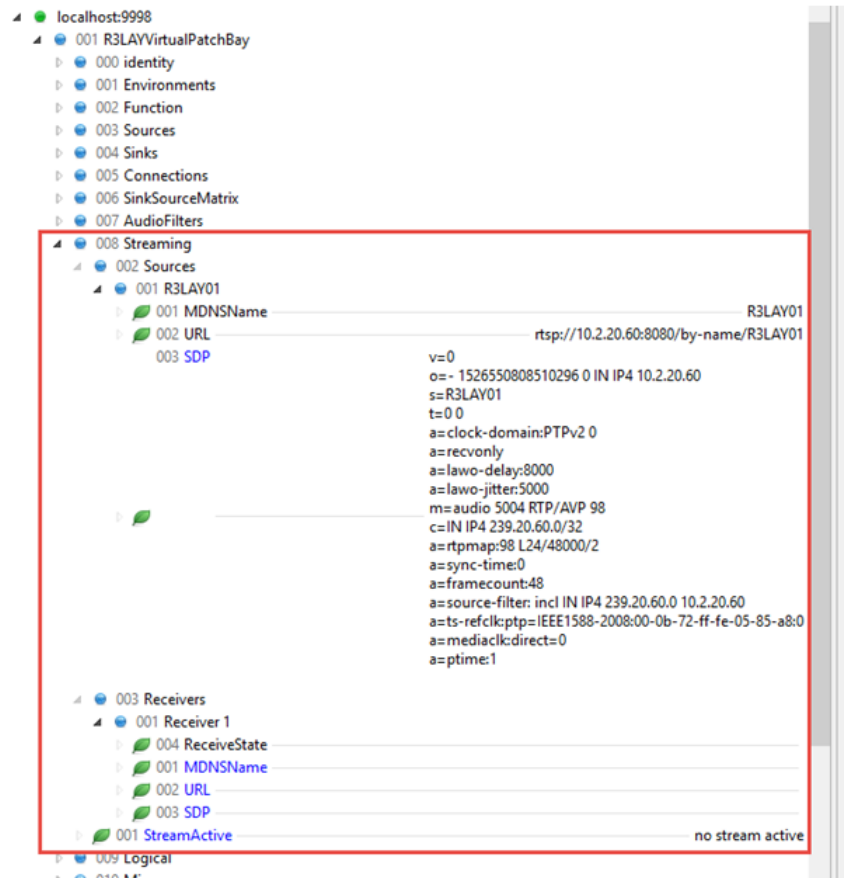
Once enabled, all configured stream parameters will be published to the network via Ember+ (if the Ember+ interface is [enabled](#)). From here they can be used by an Ember+ consuming device

To switch streams into R3LAY you must first add a **Stream Receiver** (from the [Global Settings -> Patch -> RAVENNA](#) menu in Admin Mode) and define its settings:



Then copy the SDP, or RTSP URL, to the corresponding receiver in the Ember+ node.

RELAY Ember+ Tree



```

v=0
o=- 1526550808510296 0 IN IP4 10.2.20.60
s=R3LAY01
t=0 0
a=clock-domain:PTPv2 0
a=recvonly
a=lawo-delay:8000
a=lawo-jitter:5000
m=audio 5004 RTP/AVP 98
c=IN IP4 239.20.60.0/32
a=rtpmap:98 L24/48000/2
a=sync-time:0
a=framecount:48
a=source-filter: incl IN IP4 239.20.60.0 10.2.20.60
a=ts-refclk:ptp=IEEE1588-2008:00-0b-72-ff-fe-05-85-a8:0
a=mediaclock:direct=0
a=ptime:1
  
```

13.2.10 Setup Alert Manager

This option activates the Alert Manager to monitor events that are not obvious to the user. Once enabled, a dialog box will appear if an alert is detected. The Alert Manager detects the following situations:

- NICs using more than one IP address.
- Suddenly missing UDP stream packets.
- Duplicated multicast addresses.

Syntax

To enable the Alert Manager, add the following syntax to the "R3LAYVRX4.ini" file:

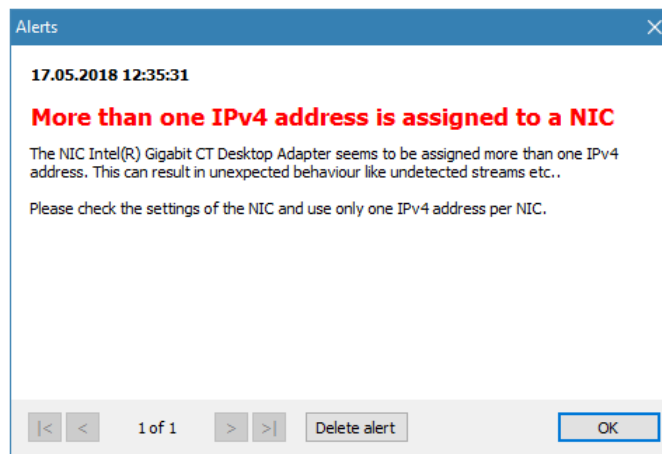
```
[Debug]
```

```
UseAlertManager=1
```

The value can be set to either 0 (disabled) or 1 (enabled).

Functionality

If a problem is detected, then an error message is presented to the user when they click on the Global Settings button. For example:



13.2.11 Using an "*.ini" File Template

A separate *.ini" file can be used to distribute parameters across several workstations or **RELAY** applications. The template can be stored locally or on a centralized file server.

This feature works as follows. On start up, **RELAY** always reads its local "RELAYxxx.ini" file. If a template is specified using the syntax given below, then the template is also read and its entries appended or overwritten to the local file.

Syntax

To enable this feature, add the following syntax to the local "RELAYxxx.ini" files:

```
[IniTemplates]
PathLocalTemplate=\\fileserver\Lawo\R3lay\R3layTemplate.ini
```

The file name used can be any, providing it matches the name and path defined above.

Implementation

Then edit the template "*.ini" file and move it to the specified folder location.

When you next [stop](#) and [start](#) the **RELAY** application on each workstation, the software will update the local ".ini" file contents as described above.

The examples below demonstrate some of the ways you can use this feature.

Example 1: Adding Workstation Names to Stream Names

If the following syntax is added to the "R3layTemplate.ini" file, then the result will be that Bonjour is switched off, and the workstation name will be automatically added to the stream names on all connected workstations:

```
[Debug]
UseBonjour=0
StreamNameAddComputerName=0
```

Example 2: Automatic Editing of Stream Parameters

Similarly, you can use variables to define certain stream parameters. So, if the following syntax is added to the "R3layTemplate.ini" file, the first stream can have a different Name and Multicast Address:

```
[R3layVRX8\RTSPSource\0]
Instance=1
Name=R3LAY%REGISTRY:HKEY_LOCAL_MACHINE\SOFTWARE\DSA\VisTool:StationID:String%_sla
MulticastAddr=230.155.139. %REGISTRY:HKEY_LOCAL_MACHINE\SOFTWARE\Lawo\R3layVRX8:MulticastStream0:DWORD%
```

Example 3: Using Different Templates for Different Workstations and Users

It is also possible to use variables within the template name. Thus you can specify a different template for each workstation or user.

For example, if the following syntax is added to the local "RELAYxxx.ini" files, then each workstation will read its own "*.ini" template from a centralized server:

```
[IniTemplates]
PathLocalTemplate=\\fileserver\Lawo\R3lay\R3layTemplate%REGISTRY:HKEY_LOCAL_MACHINE\SOFTWARE\DSA\VisTool:StationID:String%.ini
```

Similarly, the variable can be based on the environment variable username:

```
[IniTemplates]
PathLocalTemplate=\\fileserver\Lawo\R3lay\R3layTemplate%USERNAME%.ini
```


13.2.12 ".ini" File Options

Stream Setup

Name	Syntax & Description	Values
Setup SPS Connections	<pre>[Debug] StreamingUseHitlessMerge=0</pre> <p>This option enables SMPTE ST2022-7 compatible streaming, otherwise known as Seamless Protection Switching (SPS) or Hitless Merge. Once enabled, you can transmit and receive streams using two NICs: default (NIC 1) and alternate (NIC 2). Note that SPS is NOT supported by RELAY VSC.</p>	0 or 1, default is 0
Setup Automatic Multicast Address Generator	<pre>[Streaming] MulticastIPv4Pattern=239.NIC3.NIC4.n</pre> <p>This option allows you to set your own default pattern for the multicast address generator. The value is an IPv4 pattern, where:</p> <ul style="list-style-type: none"> the number is a fixed value in the range 0 to 255. NIC3 / NIC 4 is the corresponding number of the NIC sending the stream (NIC1 to NIC4 are permitted). n is an increasing number in the range 0 to 255. x is a random number in the range 0 to 255. 	as per description
Define Offset for Second Multicast Address	<pre>[Streaming] SecondMulticastIPv4Offset=0.0.0.1</pre> <p>When sending Hitless Merge streams, you can add an offset to the multicast address for the second stream. The value is an IPv4 pattern which defines the offset for each digit.</p>	as per description
Add Support for Source Specific Multicast (SSM)	<pre>[Streaming] UseStreamSinkSSM=0</pre> <p>This option adds support for Source Specific Multicast (SSM) to the network driver. The driver version must be >= 1.4.0.11 For SSM to work, the value must be set to 1 on all IGMPv3 members. SSM is a method of delivering multicast packets in which the only packets delivered to a receiver originate from a specific source address. Thus, SSM reduces demands on the network and improves security.</p>	0 or 1, default is 0
Define Default RTP Media Payload	<pre>[Ravenna] StreamPayloadType=</pre> <p>This option defines the default RTP media payload type if it is not specified elsewhere (i.e. via Ember+).</p>	leave empty or enter value (95 to 255), default is empty
Direct Audio Switching	<pre>[Debug] UseStreamReceiverDirectConnection=0</pre> <p>This option activates direct audio routing for streams switched to stream receivers. Once enabled, the connections from the receiver itself are used as a template for how to connect the stream.</p>	0 or 1, default is 0
Define WAN Connections (in addition to LAN Connections)	<pre>[Debug] WanNICDefault= WanNICAlternate=</pre> <p>This option supports two additional WAN NICs to support stream translations between LAN and WAN. In this instance, you may have up to two NICs for WAN and two NICs for LAN.</p>	leave empty or enter NIC name
Setup Additional Values	<pre>[Debug] DialogAddStreamSourceNbChannels=1,2,4,8,12,16,24,32,48,64 DialogAddStreamSourceSamplesPerFrame=4,8,12,16,24,32,48,64,96,128,192,240,256,480,512 DialogSettingsHostSamplerates=32000,44100,48000,88200,96000</pre> <p>This option defines the values that appear in the drop-down menus when you add a stream: Channels, Frame Size (samples per packet) and Sample Rate. Any value is permitted, so please take care to enter only reasonable values. For the number of channels, any value can be added from 1 to 64. For sample rates, note that WDM drivers support only 44.1kHz and 48kHz, while ASIO clients and streaming support other options. A typical example is shown above.</p>	as per description
Define New Stream Delay Time	<pre>[Debug] NewStreamInfoDelayMilliSec=5000</pre> <p>This option defines the time (in ms) between the arrival of a stream announcement and the stream being made available inside RELAY.</p>	enter value in ms (0 to 30000), default is 5000

Stream Announcement

Name	Syntax & Description	Values
Setup Bonjour	[Debug] UseBonjour=INT This option defines the type of Bonjour implementation or deactivates Bonjour. The default value (INT) uses the internal C++ flavour. All other values result in Apple's mDNSResponder. (From Version 3.0.0.181, the value DSA is not supported.)	0, 1, TRUE, APPLE or INT, default is INT
Define Node Names	[Debug] BonjourNodeNameDefault= BonjourNodeNameAlternate= This option defines the node names published to the network via Bonjour for your computer's NICs. The alternate name applies if SPS / Hitless Merge is enabled.	leave empty or enter node name
Define Stream Name	[Debug] StreamNameAddComputerName=1 This option adds the computer name to all stream names, resulting in names like "stream01 (on xxxx)". This makes it easy to identify streams on the network.	0 or 1, default is 1
Setup mDNS Announcement Rings	[Debug] UseBonjour=INT UseBonjourAddress1=224.0.0.251 UseBonjourPort1=5353 UseBonjourAddressName1=Ring 1 UseBonjourAddress2=224.0.0.252 UseBonjourPort2=5353 UseBonjourAddressName2=Ring 2 UseBonjourAddress3=224.0.0.253 UseBonjourPort3=5353 UseBonjourAddressName3=Ring 3 UseBonjourAddress4=224.0.0.254 UseBonjourPort4=5353 UseBonjourAddressName4=Ring 4 This option allows you to define up to four separate mDNS announcement rings. The system listens on all of the defined rings for stream announcements, and allows you to select an individual ring or rings when you add a stream. The "UseBonjourAddressName" values name the rings in the GUI.	leave empty or set (as shown)
Setup SAP Support	[Debug] UseSAP=1 (default 0) UseSAPDoSDPSort=1 (default 1) UseSAPAddress1=239.255.255.255 UseSAPPort1=9875 UseSAPAddress2= UseSAPPort2=9875 UseSAPAddress3= UseSAPPort3=9875 UseSAPAddress4= UseSAPPort4=9875 If this option is enabled, the software listens for SAP announcements, and announce streams to the network via SAP. This provides an alternative method of stream detection to the usual mDNS/Bonjour. Up to four SAP announcement rings can be specified. The "UseSAPDoSDPSort" value affects the ordering of SDP lines within the SAP message.	0 or 1, default is 0
Define TTL for mDNS Packets	[Debug] UseBonjourTTL=0 This option defines a TTL for outgoing mDNS UDP packets.	0 to 255, default is 0 (which results in OS default TTL=1)
Define TTL for SAP Packets	[Debug] UseSAPTTL=0 This option defines a TTL for outgoing SAP UDP packets.	0 to 255, default is 0 (which results in OS default TTL=1)
Setup UniCast without RTSP	[Debug] StreamingUseDirectUnicast=0 This option can be used to do unicast without RTSP communication. When the option is enabled, you can enter stream destination IPs which are not multicast. Any IP address can be entered in the Multicast Address field, and there will be no test to check if the value is a valid multicast address.	0 or 1, default is 0

Name	Syntax & Description	Values
Define Send Multicast Join/Leave	<pre>[Debug] StreamSenderJoinMulticast=0</pre> <p>When this option is enabled, the stream senders issue a multicast join/leave. This can be used to avoid UDP packet flooding on certain types of network switch.</p>	0 or 1, default is 0
Send Stream SDPs as mDNS Packet	<pre>[Debug] UseBonjourSDPExtension=0</pre> <p>This option supports an mDNS extension to send stream SDPs directly in a mDNS packet.</p>	0 or 1, default is 0
Define the Media Index inside SDP	<pre>[Ravenna] NICDefaultSDPMediaSelection=MediaIndex:0 NICDefaultSDPMediaSelection=MediaID:primary</pre> <p>This option is needed only in routed networks, such as a Nevon network. It defines the part of the SDP which should be used for the default NIC. The syntax is shown below. For the MediaIndex, enter either an index number (starting from 0) or id (defined in the SDP line "a=mid:...").</p>	as per description
Support Static SDP Stream List	<pre>[SDPStreams] NbStreams=1 [SDPStream_1] Interface=Default Name="Rav.Out8" SDP="v=0\r\no=- 06904238260008 0 IN IP4 10.2.20.90\r\ns=Rav.Out8\r\nt=0 0\r\na=clock-domain\ :PTPv2 0\r\na=ts-refclk\ :ptp=IEEE1588-2008\ :00-0B-72-FF-FE-05-85- A8\ :0\r\na=mediaclk\ :direct=0\r\nm=audio 5004 RTP/AVP 98\r\n c=IN IP4 239.20.90.8/5\r\na=source-filter\ : incl IN IP4 239.20.90.8 10.2.20.90\r\na=rtpmap\ :98 L24/48000/2\r\na=framecount\ :32\r\na=recvonly\r\na=ptime\ :0.66 6\r\na=sync-ime\ :0\r\na=mediaclk\ :direct=0\r\n"</pre> <p>This option supports a static SDP stream list. A typical example is shown above. Please note the SDP escapement.</p>	as per description
Setup Search Text	<pre>[Debug] DialogAddStreamSinkUseSearchAsFilter=0</pre> <p>When this option is enabled, the "Search" field in the 'Available Streams' dialog box can be used to filter the list of streams.</p> <p>Enter your filter text into the "Search" field and press Refresh - all streams which match the filter are shown. Clear the "Search" field and press Refresh again to see the complete list. Note that the search text is case sensitive.</p>	0 or 1, default is 0

Synchronization

Name	Syntax & Description	Values
Set WDM Clock to PTP	<pre>[Debug] UsePTPtoWDMClockSyncFactor=0</pre> <p>This option sets the WDM clock to PTP by transmitting the PTP clock factor from the application to the WDM driver. This options requires a WDM driver version >= 1.6. You can check the WDM driver version from the About menu (click on the Lawo logo and then select "About").</p>	0 or 1, default is 0
Setup PTP Delay Request	<pre>[Debug] PTPUseSyncOnly=1</pre> <p>This option deactivates PTP Delay Request messages. This can slightly improve the precision of PTP. Under normal circumstances, it is not needed.</p>	0 or 1, default is 1
Define PTP "Not Valid" Delay Message	<pre>[Debug] PTPMaxValidMessageTimeoutMilliSec=5000</pre> <p>This option defines the time in milliseconds without receiving PTP before the software reports the sync signal as lost.</p>	enter value in ms (1000 to 300000), default is 5000
Define Minimum Number of Valid PTP Sync Signals	<pre>[Debug] PTPMinSyncs=50</pre> <p>This option defines the minimum number of valid PTP syncs received before the software switches the sync to active.</p> <p>ATTENTION! It is recommended to leave this option unchanged, as setting the value too low can result in sync issues.</p>	enter value (5 to 100), default is 50

Name	Syntax & Description	Values
Define Valid Number of PTP Delay Requests	[Debug] PTPMinDelayRequests=5 This option defines the minimum number of valid PTP delay request responses received before the software switches the sync to active.	enter value (1 to 20), default is 5
Setup Seamless PTP Switching	[Debug] UseSeamlessPTPSwitching=1 When this option is enabled and the PTP master is lost, the software uses the latest computed values until a new valid PTP master is available. Thus, the system switches seamlessly between PTP masters.	0 or 1, default is 1
Setup Internal Streams without PTP	[Debug] UseInternalSyncedStreams=0 This option adds an additional sync mode to send streams based on the internal clock. The option must be enabled in both the sender and receiver. In the receiver, the streams are called "R3lay" streams and are displayed in a separate tab from the Ravenna tab.	0 or 1, default is 0
Define Internal Streams without PTP as Ravenna Streams	[Debug] AnnounceNonPTPStreamsAsRavenna=0 This option announces the internal streams as Ravenna streams even though they are not synchronized to PTP.	0 or 1, default is 0

RTSP

Name	Syntax & Description	Values
Define RTSP URL Escape Characters	[Debug] RtspUrlEscapeCharacters=":/?#[]@!\$%&'()*+,-;= % " This option defines the list of characters to be used for RTSP URL escapement. Please include the reserved characters like ":" and "?". If the list is left empty, then the internal escape characters are used.	leave empty or set (as shown)
Define First RTSP Server Port	[Streaming] InitialRTSPSourcePort=8000 This option defines the port number of the first RTSP server.	enter port number
Setup RTSP Ping Timeout	[Streaming] RTSPPingTimeoutSecs=0 This option defines the RTSP behaviour if the ICMP ping to Unicast receiver fails. The value sets the number of seconds after which the stream is stopped. If the value is 0, then no ICMP ping check is done.	0 to 14400, default is 0
Define RTSP Behaviour for 0 Bytes	[Streaming] RTSPCloseSessionOnEmptyNewBytes=0 This option defines the RTSP behaviour if a remote socket dies and a 0 bytes reading is reported. In this instance, the unicast stream is stopped.	0 or 1, default is 0
Setup RTSP Timeout for 0 Bytes	[Streaming] RTSPLivinessTimeoutSecs=0 This option defines the RTSP behaviour if the connection breaks and there is no further RTSP communication. The value sets the number of seconds after which the unicast stream is stopped. Note that the receiver must send periodic dummy RTSP commands to use this feature.	0 to 14400, default is 0

Network Compensation

Name	Syntax & Description	Values
Setup Wait Time Before Processing Buffer	[Debug] SampleDataBufferTimeout=15 This option sets the wait timeout in milliseconds for data buffers before the buffer is processed.	1 to 1000, default is 15
Setup Wait Time Before Processing Connection	[Debug] SampleDataConnectionTimeout=15 This option sets the wait timeout in milliseconds for data buffers before a connection is processed.	1 to 1000, default is 15

Name	Syntax & Description	Values
Setup Wait Time Before Processing WDM Driver	[Debug] WMDriverTimeout=5 This option sets the wait timeout in milliseconds for WDM drivers before the buffer is processed.	1 to 50, default is 5
Setup Window Resend Size if Packets are too late	[Debug] StreamDiscardPacketsTooLateMilliSecs=0 Packets which are too late by this amount of time are discarded and not sent. The option can be used to avoid heavy packet bursts. A value of 0 means no discarding of packets even if they are late. The time is set in milliseconds.	1 to 100000, default is 15
Define What To Do in Case Of Drifting Streams	[Debug] ClockDriftCompensation=NONE This option defines what happens if a connection needs to be corrected due to under or overruns (caused by drifting clocks or performance jitter). The possible values are "NONE", "CROSSFADE", "CHECKPHASE" or "CHECKCLOCK". The default is "NONE". <ul style="list-style-type: none"> CROSSFADE - a small crossfade is added to smooth the audio correction. CROSSFADE CHECKPHASE - the software performs a phase check to find an appropriate sample position and then adds a small crossfade. CHECKCLOCK - the software attempts to compensate for the different sample clocks by adding or dropping random samples. 	as per description
Setup Cross Fade Behaviour in Case of Drifting Streams	[Debug] DropoutCrossfadeSamples=64 In the case where a crossfade is applied, this option sets the crossfade duration (in samples).	0 to 512, default is 64
Define Search Area for Phase Auto Correction in Case Of Drifting Streams	[Debug] DropoutPhaseSearchSamples=0 In the case where a phase check is performed, this option defines the range of samples searched to find the best match for the audio correction.	0 to 512, default is 0
Define Audio Buffer Size	[Debug] SampleDataBufferSizeMilliSec=-1 This option sets the buffer size for each audio object inside RELAY. Defining a large buffer size can be used to compensate for high jitter values in the incoming or outgoing audio signals.	500 to 30000, or -1 for default

Ember+

Name	Description	Values
Setup Stream Switching via Ember+	[Streaming] UseEmber=0 This option allows stream parameters to be read and controlled via Ember+ . For example, to switch streams to and from RELAY.	0 or 1, default is 0
Define EMBER+ Stream Interval	[Interfaces] EmberStreamInterval=50 This option sets the number of milliseconds until a new value is sent for Ember+ streams (i.e. peakmeter values).	10 to 5000, default is 50
Improved Performance for Large Matrix	[Debug] UseSinkSourceEmberMatrix=0 This option switches the SourceToSink matrix to an Ember+ matrix for each streaming connection. It can be used to improve the performance of a large matrix.	0 or 1, default is 0
VRX: Setup Extended EMBER+ Tree for GUI	[Debug] UseJadeStudioFullEmber=0 This option applies to RELAY VRX4 and VRX8. When enabled, the Ember+ tree is extended to allow control of the complete GUI.	0 or 1, default is 0
VPB: Define Additional EMBER+ Matrix View	[GUI] EmberMenuCommands=0 This option applies to RELAY VirtualPatchBay. It allows you to add individual inputs, outputs and summing points to the Ember+ tree (via the context menu in the VPB routing matrix).	0 or 1, default is 0

Diagnostics

Name	Syntax & Description	Values
Setup Alert Manager	[Debug] UseAlertManager=0 This option activates the Alert Manager to monitor events that are not obvious to the user. Once enabled, a dialog box appears if an alert is detected. The Alert Manager detects the following situations: <ul style="list-style-type: none"> • NICs using more than one IP address. • Suddenly missing UDP stream packets. • Duplicated multicast addresses. 	0 or 1, default is 0
Setup AlarmLog and Matrix Server Connections	[Interfaces] AlarmLogActive=1 AlarmLogNIC1= AlarmLogIPAddress1=x.y.z.t AlarmLogPort1=18200 AlarmLogNIC2= AlarmLogIPAddress2=x.y.z.t AlarmLogPort2=18200 AlarmLogMatrixServerActive=0 AlarmLogMatrixServerIDOffset=0 This option supports connections to a DSA Alarmlog PC and/or Matrix Server. The "AlarmLogActive" and "AlarmLogMatrixServerActive" values can be set to either 0 or 1, the default is 0. The "AlarmLogIPAddress1" and "AlarmLogIPAddress2" values define the IP address of the main and redundant Alarmlog PC. In each case, enter either an IP address or name. The "AlarmLogMatrixServerIDOffset" sets a general offset for all IDs from 0 to 65535.	as per description
Setup Latency Measuring	[Debug] UseLatencyMeasuring=0 This option should only be used by an administrator in the case of latency issues. It can be used to measure and define the total latency of samples received in a stream and sent to a stream.	0 or 1, default is 0

SysLog

Name	Syntax & Description	Values
Setup SysLog	[Interfaces] SysLogActive=0 Activates the sending of some syslog messages.	0 or 1, default is 0
Define SysLog IP	[Interfaces] SysLogIPAddress=127.0.0.1 Defines the IPv4 address of the syslog server.	enter IP address
Define SysLog Port	[Interfaces] SysLogPort=514 Defines the port number of the syslog server.	enter port number

Virtual Machine (VM)

Name	Syntax & Description	Values
Setup VM Mode	[Debug] UseVMWareAPI=0 When this option is enabled, the software tries to load a vmware dll to detect whether it is running on a Virtual Machine and improve migration.	0 or 1, default is 0
Fallback Monitor Rate in VM	[Debug] UseMonitorRefreshRateFallback=0 This option may be needed if the software is running on a Virtual Machine and the monitor refresh rate cannot be detected. If the VM shows an error message such as "The monitor refresh rate could not be detected...", then the option should be set to 1.	0 or 1, default is 0

General

Name	Syntax & Description	Values
Setup Defaults for Silence Detection	<pre>[Debug] SilenceDetectionThresholdHigh=-20 SilenceDetectionTimeoutHigh=0 SilenceDetectionThresholdLow=-50 SilenceDetectionTimeoutLow=5</pre> <p>This option sets the default values for silence detection.</p> <p>This feature can be used to indicate when the signal on a channel falls below a certain level. The silence detection Active state is published to the network via Ember+ (if Ember+ is enabled), and be used by an Ember+ consuming device.</p>	enter threshold in dBFs (-90 to 0), enter timeouts in seconds (0 to 60), default values are as shown.
Setup Audio Plug-in	<pre>[Debug] UseAudioFilterFileSource=0</pre> <p>Adds the possibility to add a plug-in that can playback linear PCM wave files and be controlled via Ember+ (if Ember+ is enabled).</p>	0 or 1, default is 0
Setup Double Touch Event Delay	<pre>[GUI] SuppressDoubleTouchMilliSecs=100</pre> <p>This option determines what happens when the user presses the same button in quick succession. If the time between presses is less than, or equal to, the value, then the software responds only to the first press. If the time between presses is greater than the value, then the software responds to the second press and actions another event. The time is set in milliseconds.</p>	50 to 2000, default is 100
Setup Process Priority	<pre>[Host] ProcessPriority=REALTIME</pre> <p>This option defines the processing priority of RELAY. You can use this to increase the CPU resources allocated to RELAY compared to other PC tasks. The possible values are "NORMAL", "ABOVENORMAL", "HIGH", "REALTIME". The default is "REALTIME".</p>	as per description
Define SRC for ASIO (CPU Load)	<pre>[Debug] ASIOClientsSRC=BEST_QUALITY</pre> <p>This option defines the quality of Sample Rate Conversion (SRC) for ASIO clients running at a different sample rate. Note that a higher quality results in a higher CPU load. The possible values are "BEST_QUALITY", "MEDIUM_QUALITY", "FASTEST", "ZERO_ORDER_HOLD" and "LINEAR". The default is "BEST_QUALITY".</p>	as per description
Setup WLAN NICs	<pre>[Debug] UseNIC=ALL</pre> <p>Enables the use of WLAN NICs.</p> <p>ATTENTION! Only for testing purposes as Admin.</p>	leave empty or set (as shown)
Setup Custom AutoMix Parameters	<pre>[Debug] AutoMixAttackMilliSecs=5 AutoMixReleaseMilliSecs=250 AutoMixFloorDb=-45</pre> <p>This option can be used to define custom parameters for the AutoMix function:</p> <ul style="list-style-type: none"> • Attack Time in ms, from 1 to 1000 (default is 5) • Release Time in ms, from 1 to 2000 (default is 250) • Floor Level in dB, from -100 to 0 (default is -45) <p>Note that AutoMix is NOT supported by RELAY VSC.</p>	as per description
Activate Windows Mixer Volume	<pre>[Debug] WDMDriverUseMixerVolume=0</pre> <p>This option activates the Windows mixer volume for all WDM driver instances. It allows you to use the Windows volume control to adjust the level to RELAY.</p> <p>The WDM driver version must be 1.8.0.5 or later.</p>	0 or 1, default is 0

R3LAY VSC

Name	Syntax & Description	Values
Maximum Connection Latency	[VSC] MaxConnectionLatencyWDMToStream=1024 MaxConnectionLatencyASIOToStream=1024 MaxConnectionLatencyStreamToWDM=1024 MaxConnectionLatencyStreamToASIO=1024 This option applies to R3LAY VSC. It defines the maximum latency for each type of connection. If a value is entered, then this overrides the settings-defined value: "short", "medium" or "long".	leave empty or enter value (64 to 16384), default is empty
Define Fixed RTSP Ports	[Streaming] VSCUseFixedRTSPPortPerSlot=0 This option applies to R3LAY VSC. It assigns a fixed RTSP port for each connection slot.	0 or 1, default is 0

R3LAY VRX

Name	Syntax & Description	Values
Define Preset Workflow with Open Faders	[Debug] MuteChannelOnPresetSwitch=0 This option applies to R3LAY VRX. When enabled, a channel with an open fader mutes when the user changes the signal processing preset.	0 or 1, default is 0
Define User Keys for Stream Connects	[Debug] UseJadeStudioStreamReceiveConnect=0 This option applies to R3LAY VRX. When enabled, VRX user keys can be defined to connect an incoming stream to a stream receiver.	0 or 1, default is 0
Define User Keys to Open Sources	[Debug] UseJadeStudioOpenSource=0 This option applies to R3LAY VRX. When enabled, VRX user keys can be defined to open and close source channels. On opening, the fader returns to its last known position.	0 or 1, default is 0
Define User Keys to Talk	[Debug] UseJadeStudioTalkDirect=0 This option applies to R3LAY VRX. When enabled, VRX user keys can be defined to talk to the direct out.	0 or 1, default is 0
Define PPM	[Debug] PeakmeterType=PPM10 This option applies to R3LAY VRX and affects the PPM metering in the Taskbar. It sets the peak meter characteristics to match those used in Lawo's mc ² Audio Production Consoles. The possible values are "PPM0", "PPM1", "PPM10" and "VU". The default is "PPM10".	as per description
Setup PPM Level for Red Marker	[Debug] StudioRedLevel=-6 This option applies to R3LAY VRX and affects the PPM metering in the Taskbar. It sets the level at which the meter color turns red. The value is set in dBFS from -32 to 0. In VRX8, the default is -6. In VRX4, the default is -3.	as per description
Define Range for Pop-up Arrows	[R3LAYVRX8\Settings\Global\GUI] ButtonUnfoldHeightPercent=50 This option applies to R3LAY VRX. It applies to the four User Keys in the headline of the GUI which support a second function via the pop-up arrow. It defines how much of the button is used for the arrow and how much is left for the main function. When the value is set to 50%, the button is split equally. i.e. users must click on the upper half of the button to action the User Key function, and click on the lower half to open the drop-down menu. If you wish to make it easier to operate the User Key functions, then reduce the value to make the arrows smaller.	enter value (10 to 90), default is 50
Enable switching Fullscreen / WindowMode	[Debug] R3LAYVRXnUseWindow=0 (n = 4 or 8) This option applies to R3LAY VRX. It is a special option which prevents the application switching into full screen view. To activate, click on the TASKBAR icon while pressing left SHIFT + CTRL + ALT.	0 or 1, default is 0

Name	Syntax & Description	Values
Setup Extended EmBER+ Tree for GUI	[Debug] UseJadeStudioFullEmber=0 This option applies to R3LAY VRX. When enabled, the Ember+ tree is extended to allow control of the complete GUI.	0 or 1, default is 0
VRX4: Define Default Support Channel in Taskbar	[R3LAYVRX4\Settings\Global\General] StartupAppBarChannel=PHONES This option applies to R3LAY VRX4. It defines the default channel assigned to the "Channel Selection" box in Taskbar View.	"Phones", "Speaker" or leave empty, default is empty
VRX8: Setup Processing for PGM and REC Bus	[Debug] UseVRX8OutputProcessing=0 This option applies to R3LAY VRX8. It allows you to assign signal processing presets to the PGM and Record busses (in Admin Mode).	0 or 1, default is 0
VRX8: Show Options: Copy RTSP Link & Copy SDP	[Debug] UseStreamClipboardCopy=0 This option applies to R3LAY VRX8 and VPB. By default, the option is disabled. When enabled, it reveals two additional buttons when you add streams to VRX8: Copy RTSP Link and Copy SDP. These options copy the selected information to the clipboard, so that it can be used to setup a new stream. For example, via the Add Stream URL or Add Stream SDP windows in R3LAY VRX8.	0 or 1, default is 0
VRX8: Setup Additional Values for Number of Channels to/from ASIO Client	[Debug] DialogSettingsNbAsioChannels=1, 2, 4, 8, 12, 16, 24, 32, 48, 64 This option applies to R3LAY VRX8. It defines the values that appear in the Number of Inputs and Number of Outputs menus for the R3LAY ASIO Driver (in the Global Settings -> Audio tab). Any value from 1 to 256 is permitted, so please take care to enter only reasonable values. A typical example is shown above.	as per description

R3LAY VPB

Name	Syntax & Description	Values
Define Loop Visibility	[GUI] PreventClientLoops=1 This option applies to R3LAY VPB. When enabled, any connections in the routing matrix that could result in loops are hidden from view.	0 or 1, default is 1
Setup AutoMix Context Menu	[Debug] UseAutoMix=0 This option applies to R3LAY VPB. It adds the AutoMix function to the context menu for summing points, in the routing matrix, so that users can apply automatic level adjustment.	0 or 1, default is 0
Setup Stream Statistics	[Debug] UseShowStatisticsInContextMenu=0 This option applies to R3LAY VPB. It activates a context menu option to open a stream statistics window for the selected stream. To open the statistics window, right-click on a stream and select "Show Statistics...".	0 or 1, default is 0
Show Options: Copy RTSP Link & Copy SDP	[Debug] UseStreamClipboardCopy=0 This option applies to R3LAY VRX8 and VPB. By default, the option is disabled. When enabled, it reveals two additional context menu options in the VPB "Routing" view when you right-click on a stream: Copy RTSP Link and Copy SDP. These options copy the selected information to the clipboard, so that it can be used to setup a new stream. For example, via the Add Stream URL or Add Stream SDP windows in R3LAY VPB.	0 or 1, default is 0

R3LAY Stream Monitor

Name	Syntax & Description	Values
Open App as Window	[Debug] R3LAYStreamMonitorUseWindow=0 This option applies to R3LAY Stream Monitor. When enabled, the application opens as a window that can be resized, minimized, etc. By default the option is disabled so that the application opens in full screen.	0 or 1, default is 0

Name	Syntax & Description	Values
Disable Loudness Measurement	[Debug] UseStreamMonitorLUFS=1 This option applies to RELAY Stream Monitor. It can be used to switch off the loudness measurement to reduce the demand on the computer's CPU. In this instance, the stream monitoring window shows only the peak level metering (in dBFS). By default, the loudness measurement is turned on and so both dbFS and LUFS are shown.	0 or 1, default is 1

OnAir4

Name	Syntax & Description	Values
Setup OnAir4	[Interfaces] OnAir4Active=0 OnAir4UseFixedIPAddress=1 OnAir4FixedIPAddress=a.b.c.d This option activates the connection to an OnAir4 (supported by RELAY VRX4, VRX8 and VPB).	0 or 1, default is 1
VRX8: Setup All Headphones for OnAir4	[Interfaces] OnAir4UseMultiHeadphone=1 This option applies to RELAY VRX8. It activates all four headphone outputs on the OnAir4 with independent level control from the GUI, and via Ember, for each output.	0 or 1, default is 0 for existing and 1 for new installations
Setup Image Check on OnAir4	[Interfaces] OnAir4CheckImageVersion=1 This option suppresses the image check of the OnAir4 (when the value = 0). ATTENTION! Only for testing purposes as Admin.	0 or 1, default is 1

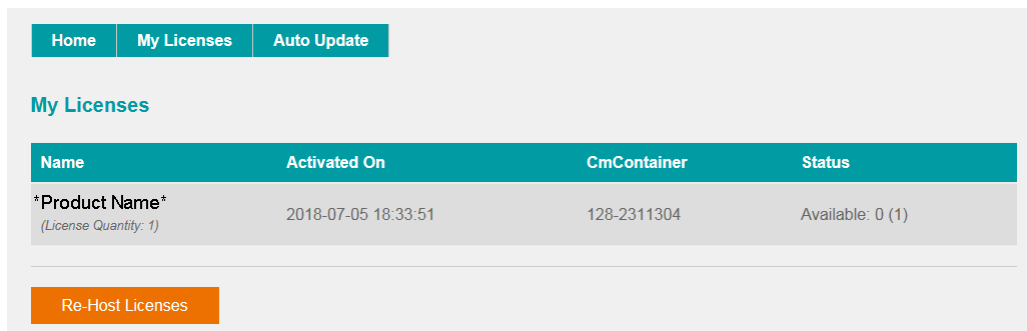
13.3 Advanced Licensing Features

This appendix describes the more advanced features of the CodeMeter Runtime licensing system.

13.3.1 Re-Hosting a License

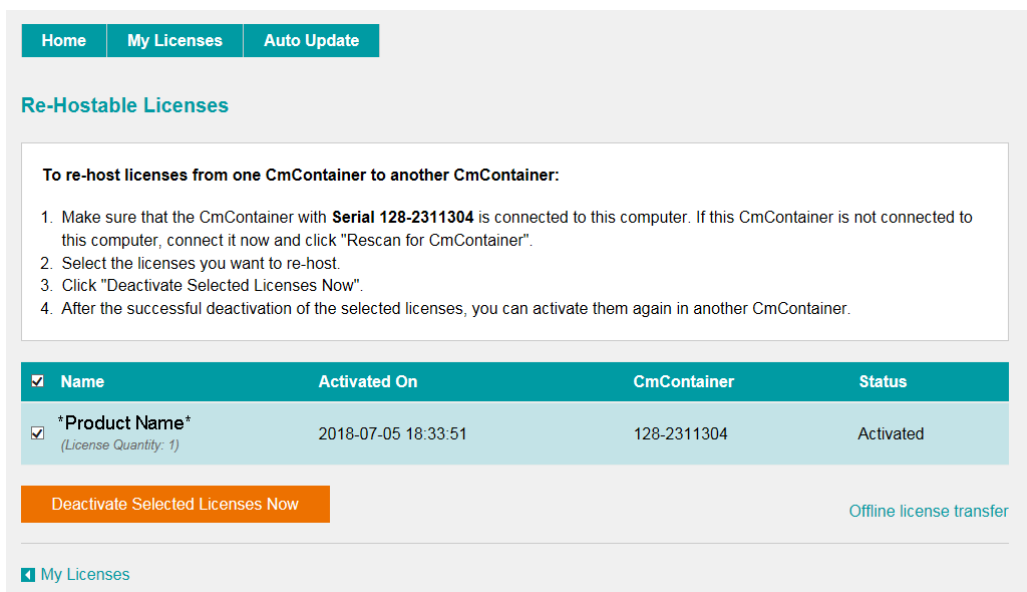
To move a license from one Cm container to another, you will need to re-host the license as follows. This requires you to first de-activate the license from its existing Cm container, and then choose the new storage container.

1. Follow the first two steps from the [online activation](#) method:
 - Open the 'Lawo License' web browser page at <https://licenseportal.lawo.com>.
 - Copy your license ticket number - this is the 25 number code - into the **Ticket** field and select **Next**.
2. At the "My Licenses" summary window, select **Re-Host Licenses**:



Name	Activated On	CmContainer	Status
Product Name <small>(License Quantity: 1)</small>	2018-07-05 18:33:51	128-2311304	Available: 0 (1)

3. Make sure that the Cm container is connected to the computer, select the licenses you wish to re-host and select **Deactivate Selected Licenses Now**.



To re-host licenses from one CmContainer to another CmContainer:

1. Make sure that the CmContainer with **Serial 128-2311304** is connected to this computer. If this CmContainer is not connected to this computer, connect it now and click "Rescan for CmContainer".
2. Select the licenses you want to re-host.
3. Click "Deactivate Selected Licenses Now".
4. After the successful deactivation of the selected licenses, you can activate them again in another CmContainer.

<input checked="" type="checkbox"/>	Name	Activated On	CmContainer	Status
<input checked="" type="checkbox"/>	*Product Name* <small>(License Quantity: 1)</small>	2018-07-05 18:33:51	128-2311304	Activated

Wait for a few seconds - a confirmation pop-up appears once the de-activation is successful.

You can follow steps 3 to 7 from the [online](#) activation method, or perform an [offline](#) license transfer, to activate the license using a new storage container.

13.3.2 Activating a License Offline

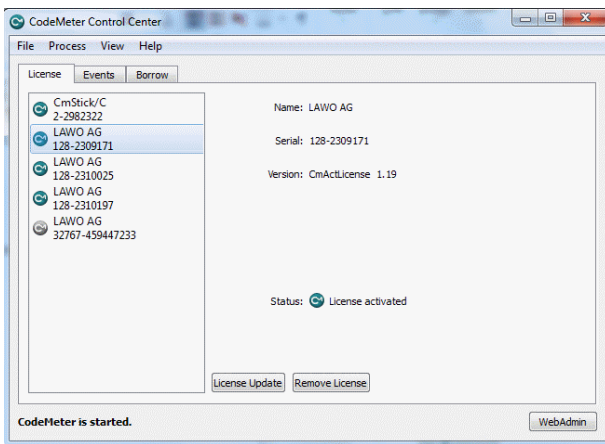
If your PC has no internet access, then you can activate a software license offline. This method involves three stages:

- **Create a license request file** - for the Cm storage container. Then copy the file onto a computer with internet access.
- **Activate the license** - using the 'Lawo License' web portal, copy the license update file back to the original computer.
- **Import the license update file** - to the Cm storage container.

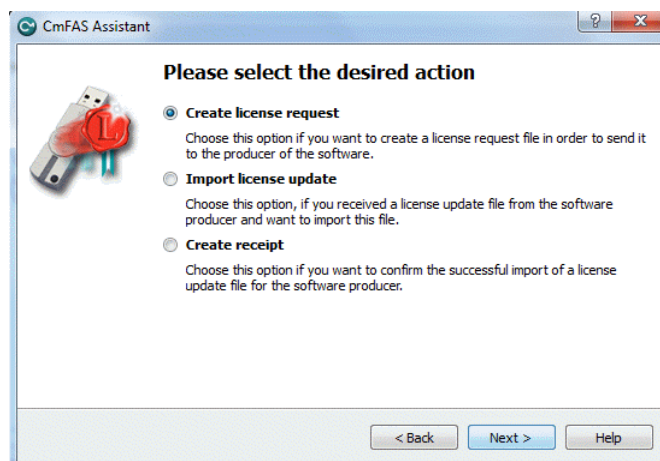
Creating the License Request File

On the computer you wish to license:

1. Open the '[CodeMeter Control Center](#)' (by clicking on the Cm taskbar icon), and select the container you wish to use for the license storage.
2. If the container is empty, select **Activate License**. Or, if the container already holds an active license, select **License Update**. This starts the 'CodeMeter Field Activation Service (CmFAS) assistant':

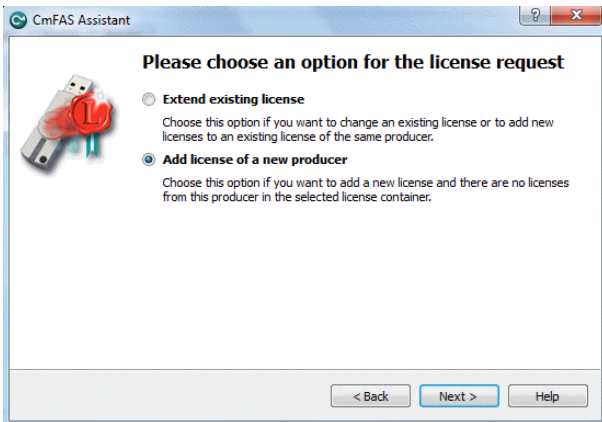


3. Select **Next**: and then **Create license request**:



At this stage, there are two additional steps (to add the correct firmcode) if you have selected a **CmStick** container. Enter the following Lawo FirmCode to create the license request file:

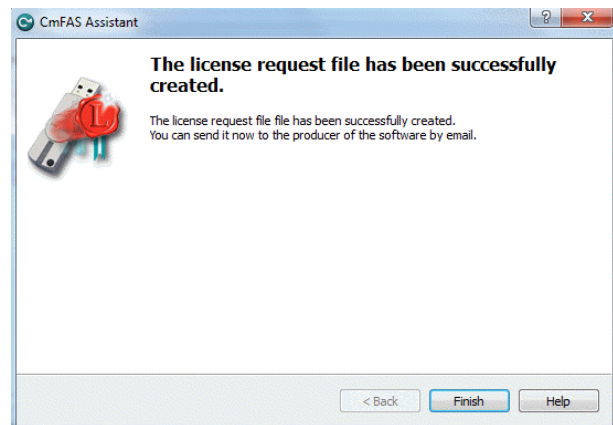
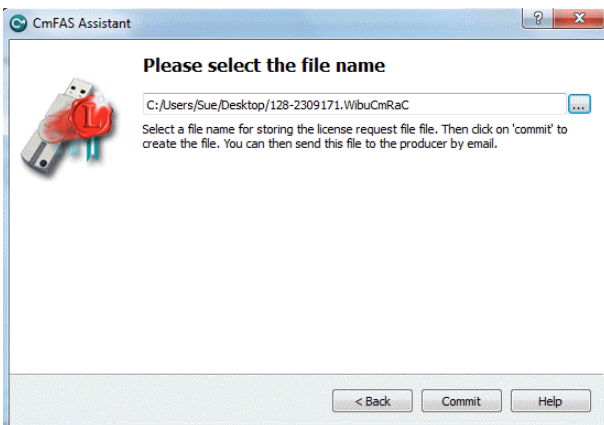
Select Add license of a new producer



Enter the Lawo FirmCode = 102037



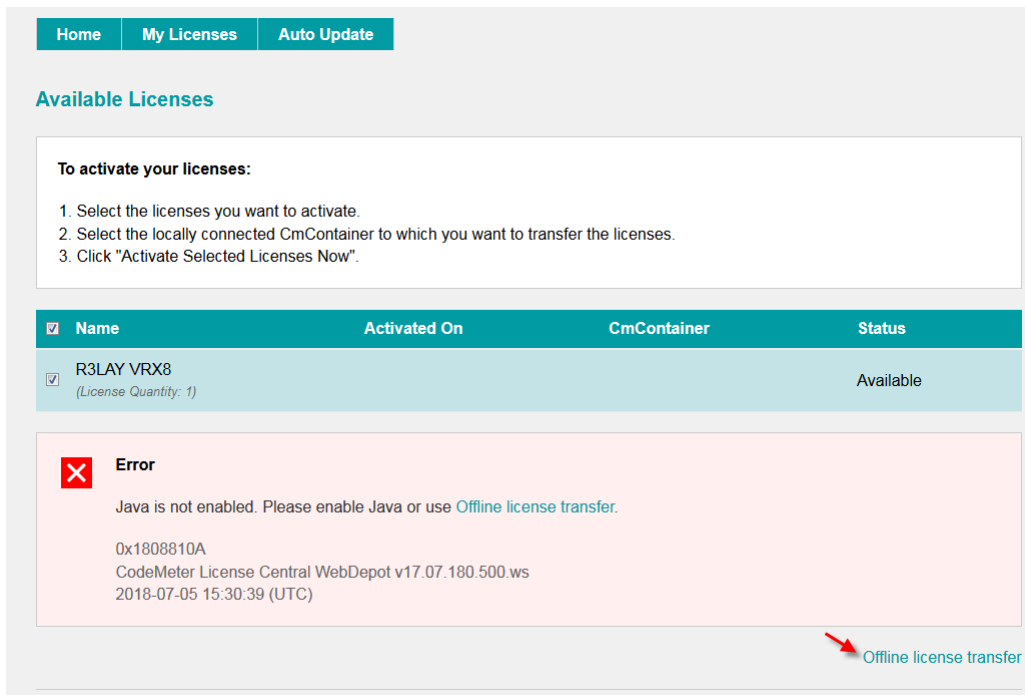
4. Select **Next**, and using Windows Explorer, enter a file path for the license request file. Choose somewhere easy to find, such as the Desktop. Then select **Commit** to create the request file:



5. Select **Finish** and copy the request file onto a computer with internet access. You will need both the license request file and the 25-digit ticket number (received with your license purchase).

Activating the License

1. On a computer with internet access, follow the first four steps from the [online activation](#) method:
 - Open the 'Lawo License' web browser page at <https://licenseportal.lawo.com>.
 - Copy your license ticket number - this is the 25 number code - into the **Ticket** field and select **Next**.
 - When your license is displayed, select **Activate Licenses** to continue.
 - Select the storage method for your license - either USB dongle or single computer.
2. At the **Available Licenses** page, select **Offline license transfer** to continue:



Home My Licenses Auto Update

Available Licenses

To activate your licenses:

1. Select the licenses you want to activate.
2. Select the locally connected CmContainer to which you want to transfer the licenses.
3. Click "Activate Selected Licenses Now".

<input checked="" type="checkbox"/>	Name	Activated On	CmContainer	Status
<input checked="" type="checkbox"/>	R3LAY VRX8 <small>(License Quantity: 1)</small>			Available

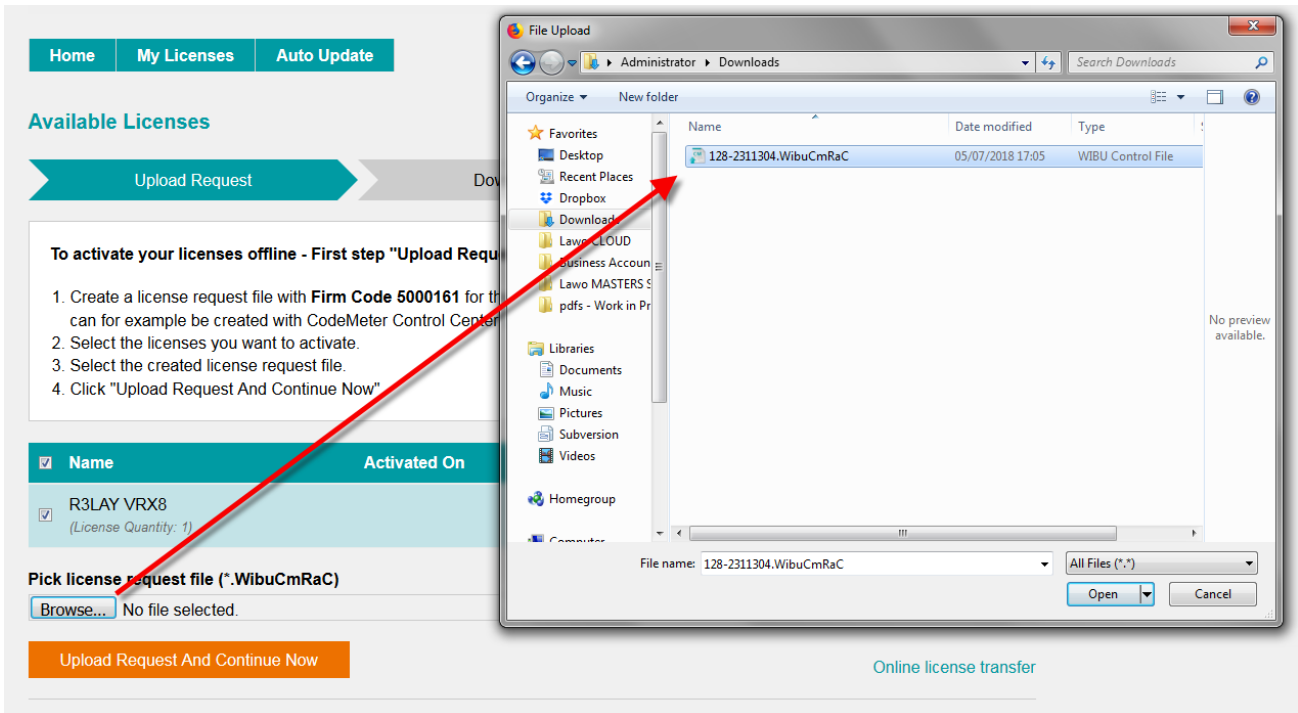
Error

Java is not enabled. Please enable Java or use [Offline license transfer](#).

0x1808810A
CodeMeter License Central WebDepot v17.07.180.500.ws
2018-07-05 15:30:39 (UTC)

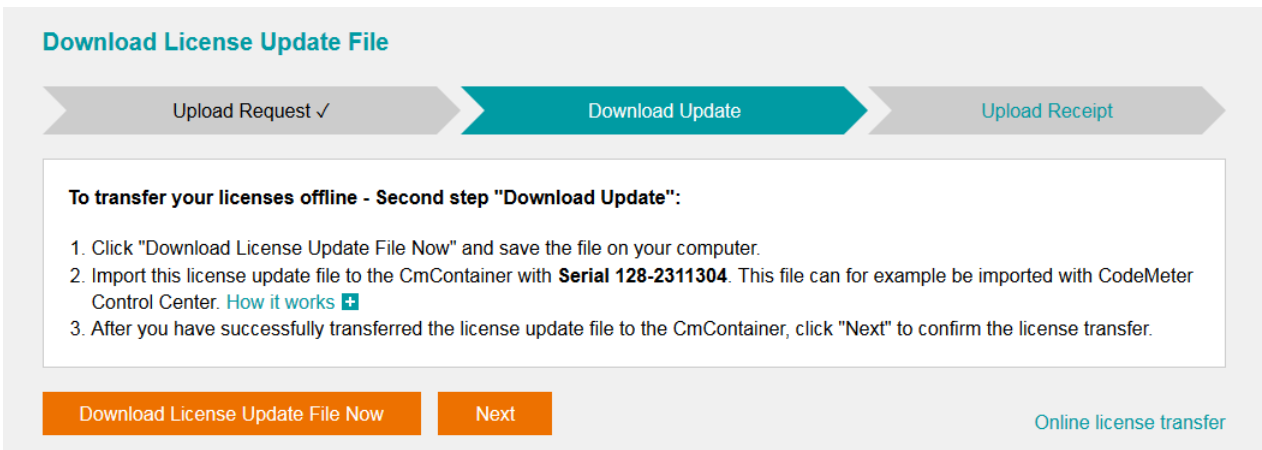
[Offline license transfer](#)

3. On the next page, select the license(s) you wish to activate, select **Browse...** and, using Windows Explorer, choose the request file (created earlier):



The screenshot shows the 'Available Licenses' section with a progress bar indicating the 'Upload Request' step. Below the progress bar, there are instructions for activating licenses offline. A table shows one license, 'R3LAY VRX8', which is checked. Below the table, there is a 'Pick license request file (*.WibuCmRaC)' section with a 'Browse...' button. A red arrow points from this button to a Windows File Upload dialog box. The dialog box shows the 'Downloads' folder with the file '128-2311304.WibuCmRaC' selected. The file name is also shown in the 'File name' field at the bottom of the dialog.

4. Then select **Upload Request And Continue Now** - the license request is processed and, if successful, you will have the option to Download the update:

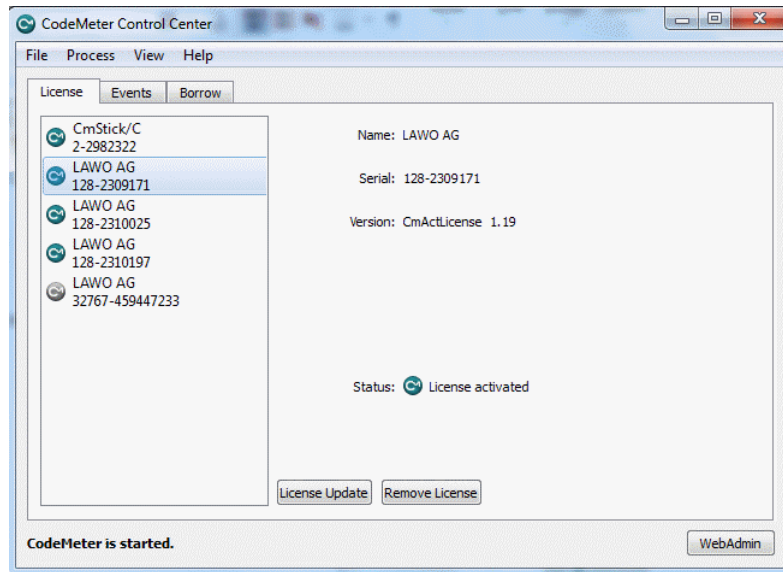


The screenshot shows the 'Download License Update File' section. At the top, there is a progress bar with three steps: 'Upload Request' (completed with a checkmark), 'Download Update' (current step), and 'Upload Receipt'. Below the progress bar, there are instructions for transferring licenses offline. At the bottom, there are two buttons: 'Download License Update File Now' and 'Next'. The text 'Online license transfer' is visible at the bottom right.

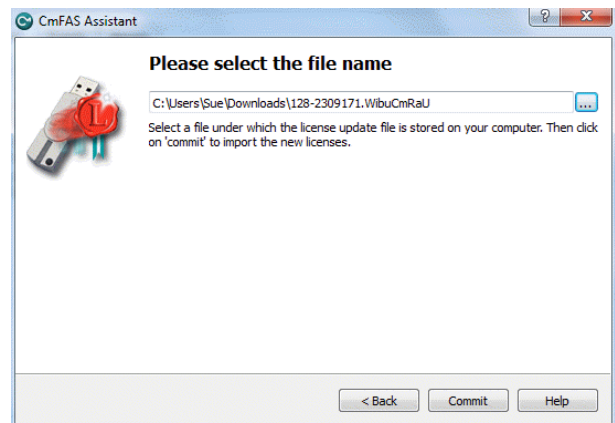
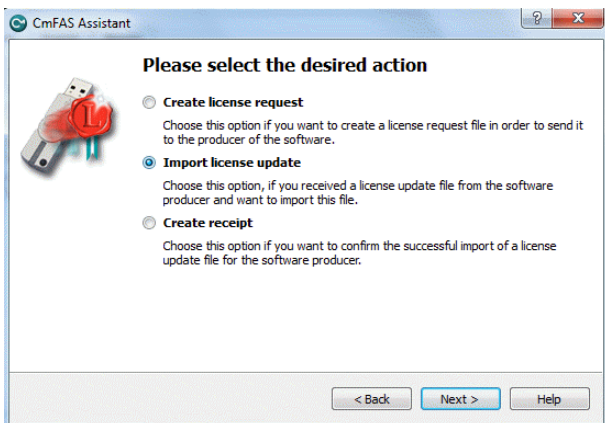
5. Select **Download License Update File Now** and, when prompted, choose the **Save** file option - the file is downloaded.
6. Copy the License Update file back to the original PC.

Importing the License Update

1. On the original computer re-open the 'CodeMeter Control Center' and select the Cm container for the license update. Note that this must be the same container as the one selected earlier (during the License Request).



2. Select **License Update** and follow the instructions given by the 'CmFAS Assistant' - when prompted, select Import License update and choose the update file (downloaded from the License portal):

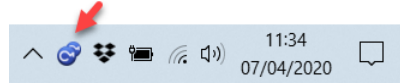


3. Select **Commit** to action the update - the license is activated and you can close the 'CodeMeter Control Center'.
4. You can now return to your Lawo application or install your USB license dongle - all licensed features should be available.

13.3.3 The CodeMeter Control Center

The 'CodeMeter Control Center' is used to manage the license containers and perform a backup or restore.

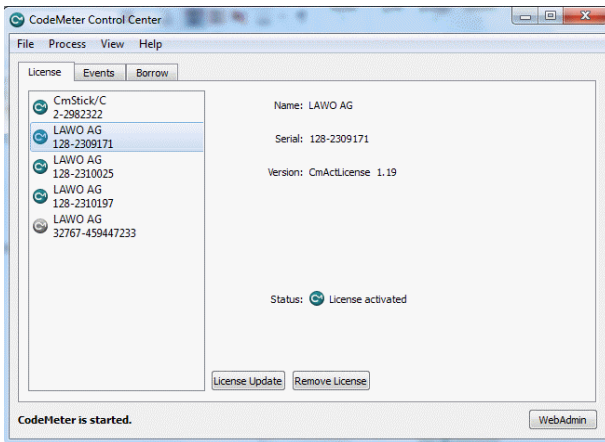
1. Click on the Windows taskbar Cm icon to open the 'CodeMeter Control Center' - the icon may be hidden from view or vary in color (depending on your taskbar configuration).



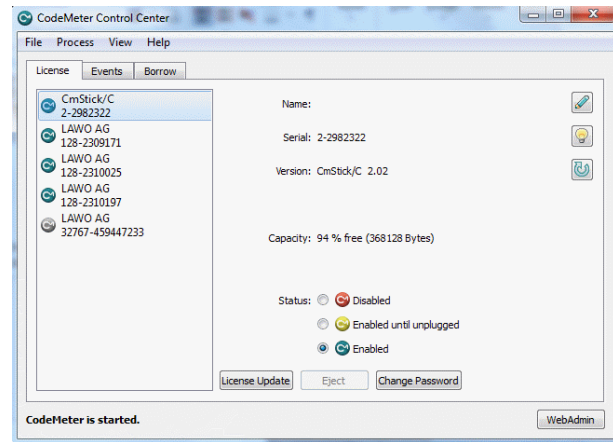
The 'CodeMeter Control Center' shows all the Cm containers which can be used for license storage.

A new local computer container is created each time you run the **CodeMeter Runtime** install wizard. Therefore, if you have installed multiple Lawo products or software versions, you will see several **LAWO AG** containers. If a USB dongle is connected, you will see a container labelled **CmStick**.

Local Computer Container (LAWO AG)



USB Dongle Container (CmStick)

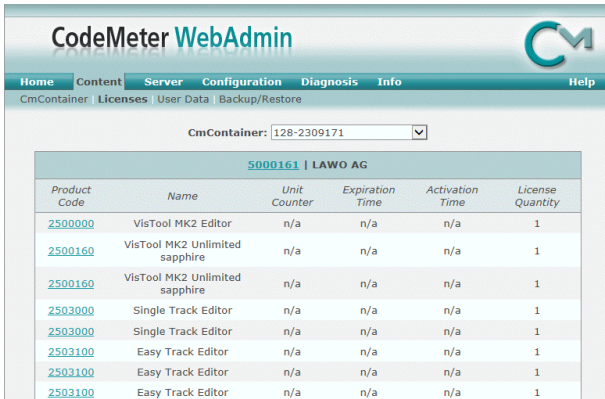


The **Serial** numbers identify each container. The icon colours indicate: green = license activated; grey = container is empty; red = license deactivated.

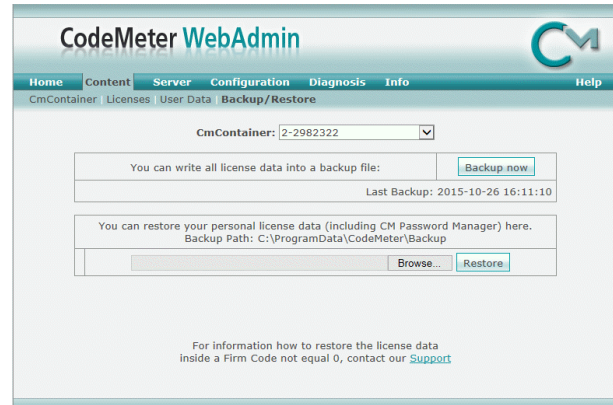
A single Cm container can contain multiple licenses - simply select the same container during the [activation](#) process.

2. Select **WebAdmin** (bottom right) to open the WebAdmin portal in your default browser. The portal has many functions including license interrogation, and backup/restore functions for licenses stored on a **CmStick** (USB Dongle):

WebAdmin Content Cm Container



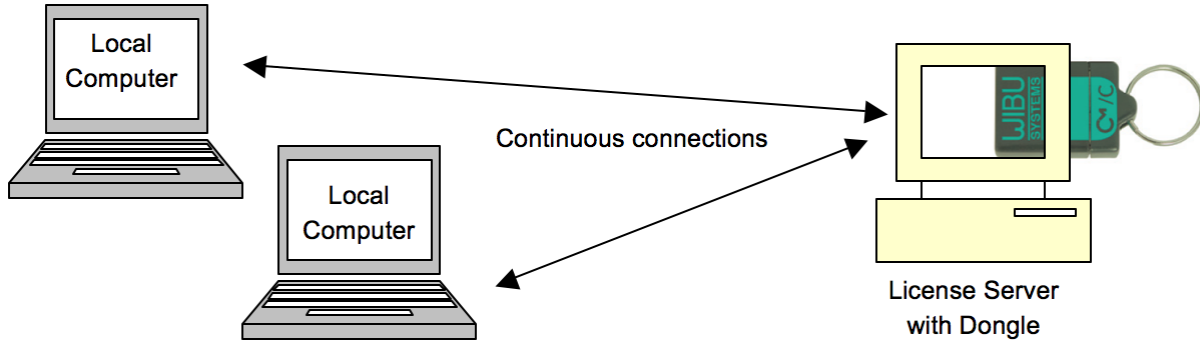
WebAdmin Backup/Restore



For further information, please refer to the **CodeMeter Runtime** documentation at wibu.com.

13.3.4 License Configuration via a Server

This license storage method can be used to administrate licenses centrally within a local network. For example, when starting a Lawo application such as **VisTool**, the local computer asks the server to borrow the relevant license. The license is then used by the **VisTool** client until the application is closed. On closing, the license is handed back to the server where it may then be used by a different **VisTool** client.



Preparing the Server

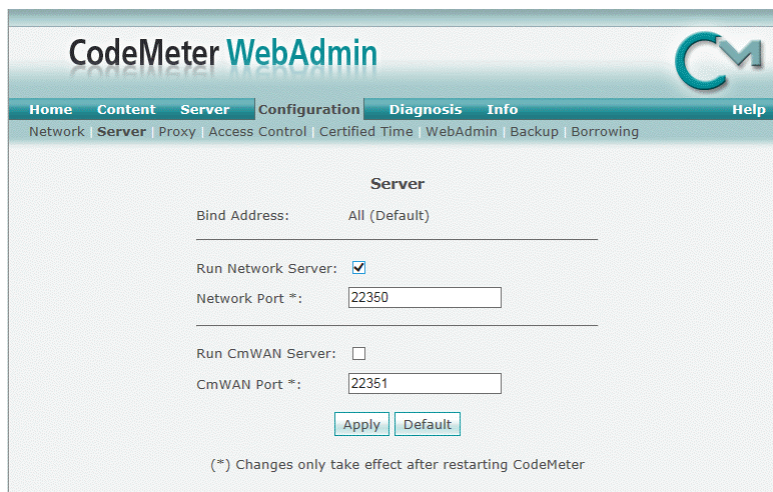
1. First, install the **Codemeter Runtime** software (Version 5.10 or above) on the central server. (Or, on a virtual machine on the server).

The latest release of CodeMeter Runtime can be downloaded from WIBU systems at wibu.com.

2. Activate all licenses in the usual manner.

If a virtual machine is being used, set up a connection between the virtual machine and USB dongle.

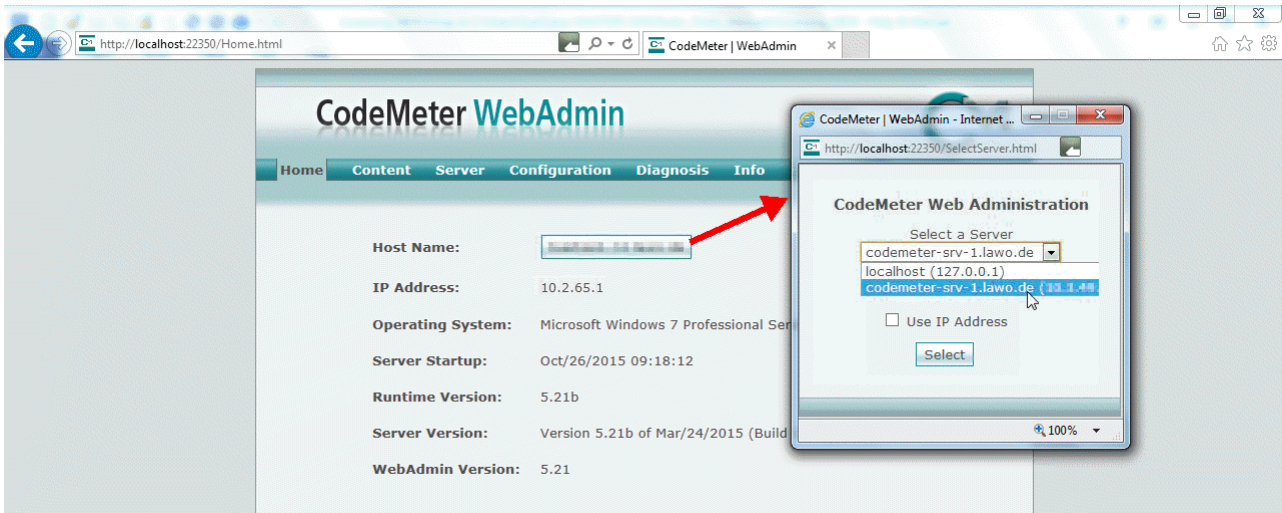
3. Open the [CodeMeter Control Center](#) and select **WebAdmin**.
4. Under **Configuration -> Server**, select the **Run Network Server** checkbox:



5. Click **Apply** and restart the **CodeMeter Runtime** software.

Preparing the Clients

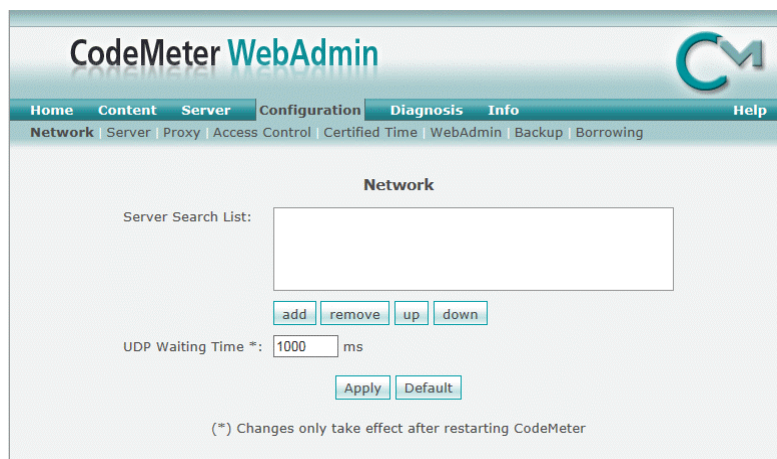
1. Install the **Codemeter Runtime** software (Version 5.10 or above) on each of the client computers.
2. Connect the clients (and server) to the network - on startup, the **CodeMeter Runtime** software sends a broadcast message across the network to find all license servers.
3. On each client computer, open the [Codemeter Control Center](#) and select **WebAdmin**.
4. From the **Home** page, select the name of the computer - a dialogue box should appear listing all the available license servers:



5. Choose the correct server from the drop-down list and click on **Select**.

If the license server is not found, then your firewall or network policy may not allow messages to be broadcast. In this case, you will need to add the server's IP settings to the search list, manually, as follows:

Under **Configuration** -> **Network**, add the correct IP settings into the **Server Search** list:



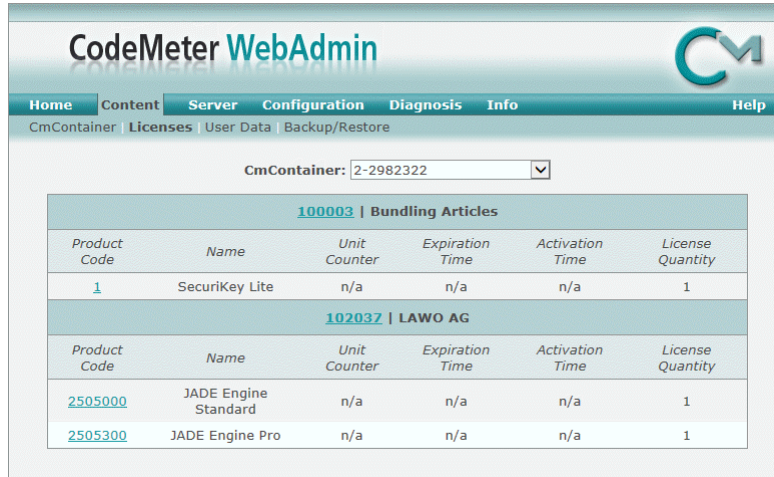
Click **Apply** and restart the **CodeMeter Runtime** software.

Note that once the **Server Search list** has an entry, all other license servers (announced automatically to the network) will be ignored.

Choosing a License

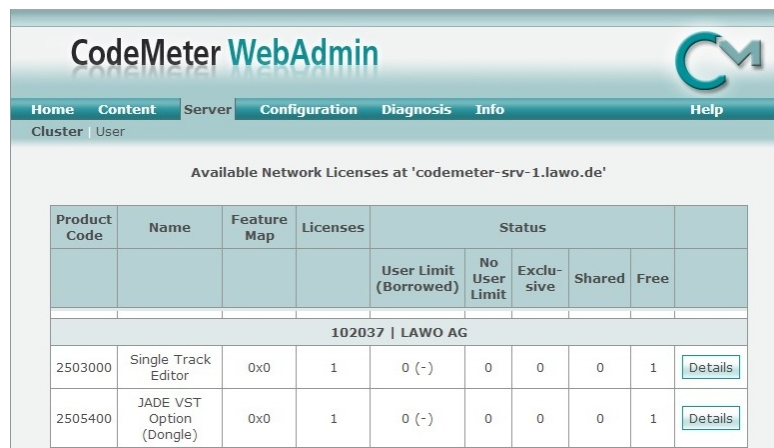
Once a connection to the license server is established, you can borrow one of the server licenses as follows:

1. On the client computer, open the [Codemeter Control Center](#) and select **WebAdmin**.
2. Under **Content** -> **Licenses**, choose the **CmContainer** (holding the server licenses) and select the desired license file:



If the licenses is in use, then a warning message appears.

You can check which licenses are available (free) by selecting **Server** and **Cluster**:

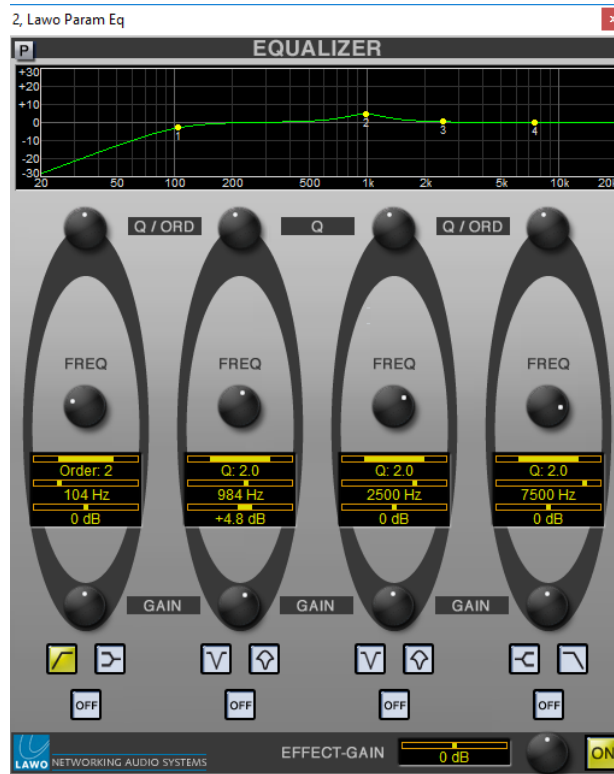


13.4 The LAWO Processing Collection

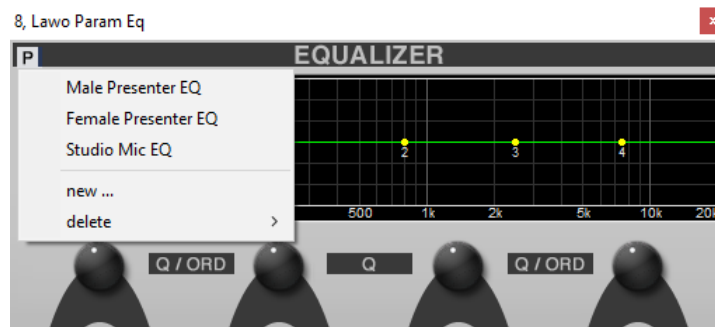
This appendix covers the operation of the LAWO Processing collection, which can be added to source channels via processing presets, see [Global Settings -> Processing](#).

Each signal processor is controlled from its on-screen operating window.

1. Click on the on-screen buttons to turn parameters on or off.
2. Click and drag from left to right, or right to left, to adjust rotary controls. Don't try and turn the control as you would in real life!



3. Click on the **P** button to access the processor's presets:




- Select an option from the drop-down list to load a preset.
- Select **new..** to store the current settings as a preset - you will be asked to enter a filename.
- Select **delete** to delete an existing preset.

13.4.1 Compressor

This plug-in faithfully reproduces the signal processing of Lawo's mc² Compressor section: a great sounding compressor featuring hard or soft knee behaviour. In **VRX**, the Compressor forms part of the [Compressor SCF](#) processor.

Parameters

ATTACK	Attack time from 100µs to 250ms.
RLS	Release time from 1ms to 10s.
LAHDLY	Look Ahead Delay from 0 to 10ms.
RATIO	Ratio from 1:1 to 10:1.
THRS	Threshold from -70dB to +20dB.
GAIN	Make-up gain from -20dB to +20dB
SOFT KNEE	Hard or soft knee operation.
	Mono or stereo operation.
ON	Switches the plug-in on or off.



Operation

The action of the compressor is best described by looking at the top of the plug-in window:

- **GAIN** - the amount of GAIN reduction applied by the compressor.
- **Graph** – a graphical overview of the compressor settings.
- **IN** and **OUT** – the input and output signal levels to and from the compressor plug-in (the power-sum of left and right channels).

As you adjust your settings, the yellow bouncing ball on the graph shows momentary input level versus gain.

Use the Look Ahead Delay (LAHDLY) to delay the main signal path relative to the sidechain. This will result in pleasant dynamics processing even for widely varying dynamic signals.

The **GAIN** reduction metering follows the attack and release settings. So, if you have a very fast attack, the metering will reflect this.

13.4.2 Compressor SCF

This plug-in is identical to the [Compressor](#) but adds two bands of parametric EQ enabling you to equalize or filter the compressor sidechain.



Parameters

Parameters on the right are identical to the [Compressor](#) plug-in. The sidechain EQ parameters, on the left, are adjusted as follows.

For each band of EQ:

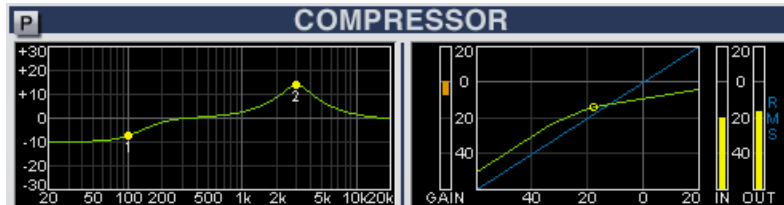
Q / ORD	Quality from 0.1 to 80 (parametric EQ) Or, when operating as a shelving or high/low pass filter, this control sets the order: <ul style="list-style-type: none"> • Order 1 = 6dB per octave. • Order 2 = 12dB per octave • Order 3 = 18dB per octave
FREQ	Frequency from 20Hz to 20kHz.
GAIN	Gain from -24dB to +24dB
EQ Type	These buttons select the EQ type: <ul style="list-style-type: none"> • Parametric EQ • Shelving EQ • High or Low pass Filter
OFF	Switches the band of EQ on or off. Use this button to switch an individual band out of circuit.

For the complete EQ section:

SCF ON	Switches the sidechain equalisation (both EQ bands) on or off.
SCF LSN	Click this button to listen to the sidechain.

Operation

You will see an overview of the sidechain EQ at the top left of the plug-in window:



To equalize the compressor sidechain:

1. Set up your compressor as described [earlier](#).
2. Select the **SCF ON** button (yellow) so that the sidechain EQ is in circuit.

The sidechain EQ graph turns green as shown above. If the **SCF ON** button is off, then the graph is coloured yellow.

3. Make sure that the **OFF** buttons are deselected so that each band of EQ is in operation.
4. Select the EQ type for each of the two bands.
5. Adjust your GAIN, FREQ and Q or ORDER parameters.

You are now listening to the results of the compressor with an equalized sidechain.

6. Deselect the **SCF ON** button to listen to the compressor without sidechain EQ.
7. Or, select **SCF LSN** to audition the sidechain.

You are now listening to the compressor sidechain. Use this mode to adjust your EQ settings accordingly.

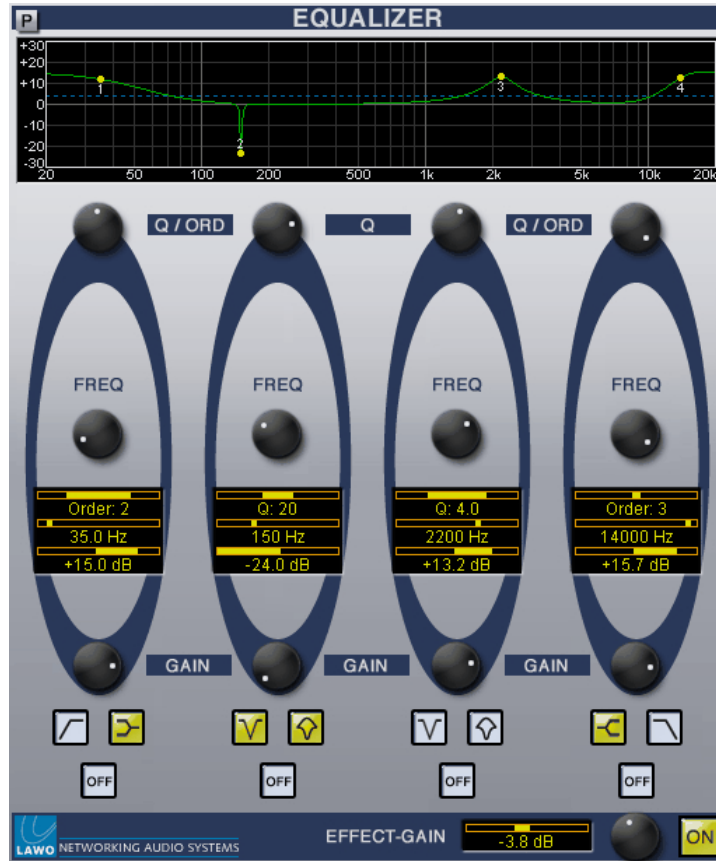
8. Deselect **SCF LSN** to return to the output of the compressor.

For a smoother compressor, set -10dB gain for an Order 1 low shelving filter at around 125Hz to prevent unwanted pumping caused by low frequencies.

The **GAIN** reduction metering follows the attack and release settings. So, if you have a very fast attack, the metering will reflect this.

13.4.3 Parametric Equaliser

This plug-in faithfully reproduces the signal processing of Lawo's mc² EQ section: a 4-band parametric equaliser featuring bell, constant Q, notch, shelving and pass band filter types.



Parameters

For each band of EQ:

Q / ORD	Quality from 0.1 to 80 (parametric EQ) Or, when operating as a shelving or high/low pass filter, this control sets the order: <ul style="list-style-type: none"> • Order 1 = 6dB per octave. • Order 2 = 12dB per octave • Order 3 = 18dB per octave
FREQ	Frequency from 20Hz to 20kHz.
GAIN	Gain from -24dB to +24dB
EQ Type	<p>The two outer bands may operate as:</p> <ul style="list-style-type: none"> • Constant Q (all buttons off) • Shelving EQ (shown opposite) • High or Low pass Filter <p>The two inner bands may operate as:</p> <ul style="list-style-type: none"> • Constant Q (shown opposite) • Notch • Bell
OFF	Switches the band of EQ on or off. Use this button to switch an individual band out of circuit.

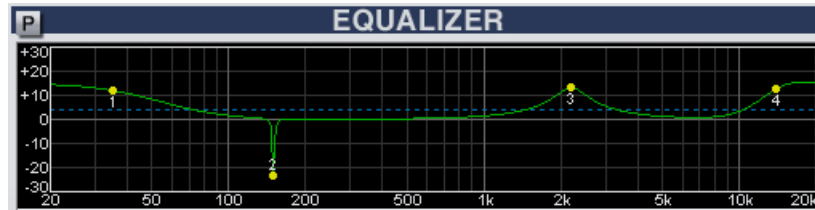
For the complete EQ section:

EFFECT-GAIN	Gain (boosts the output gain of the EQ section) from -24dB to +24dB.
ON	Switches the plug-in on or off.

Operation

All 4-bands of EQ operate across the full frequency range (20Hz to 20kHz), and offer a variety of different EQ types.

The centre, or corner, frequencies for each band (1 to 4) are displayed within the EQ graph at the top of the plug-in window:



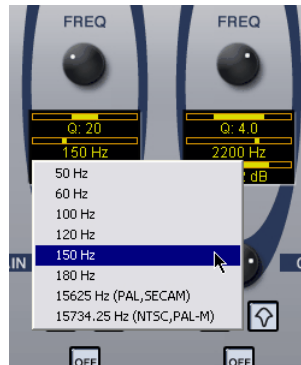
To apply EQ to a signal:

1. Select the **ON** button (yellow) so that the EQ section is in circuit.
2. Make sure that the **OFF** buttons are deselected so that each band of EQ is in operation.
3. Select the EQ type for each band.
4. Adjust your GAIN, FREQ and Q or ORDER parameters.

Note that the ORDER control offers three positions:

- **Order 1** = 6dB per octave.
- **Order 2** = 12dB per octave.
- **Order 3** = 18dB per octave.

Right-click on a frequency value (e.g. **150Hz**) to select from the drop-down menu – this is great for selecting specific frequencies for a notch filter:



5. Use the **OFF** buttons to switch an individual band on/off.
6. Press and hold **[CTRL]** and then click on a rotary control to reset an individual parameter.
7. Use the EFFECT-GAIN control to adjust the output level from the EQ plug-in.

14. Glossary

48kHz or 44.1kHz	See Sample Rate.
ASIO	Audio Stream Input/Output A computer sound card driver protocol for digital audio. Most professional interfaces and applications use ASIO drivers to achieve low latency.
Audio Buffer Size	The buffer size sets the amount of data stored (in memory) before each data packet is transmitted or played out. In an audio system, the smaller the buffer size, the lower the latency, but the more susceptible to drop-outs.
Bargraph	An optical display instrument in the shape of a LED bar for displaying signal level.
dB	deciBel A unit of transmission giving the ratio of two powers. The number of bels is the logarithm to the base 10 of the ratio of the two powers. One decibel equals one tenth of a bel.
dBu	dBu is used to describe levels within the analogue domain, and is a measure of absolute voltage level based on 0dBu = 0.775 Volts (RMS). dBu is often used to indicate nominal broadcast operating levels. For example, in the EBU normal broadcasting level = +6dBu.
dBFS	dB Full Scale dBFS is used to describe levels within the digital domain. 0dBFS describes the system's internal clipping point; this is the maximum level which may be handled by the system without signal distortion. For example, your system may be set for +18dBu = 0dBFS. If your normal broadcast level is +6dBu then this leaves an operating headroom of 12dB.
DSCP	Differentiated Services Code Point DSCP values are used within computer networks to classify and manage different types of network traffic. For example, to provide low-latency for critical network traffic such as media streaming, while providing best-effort services to non-critical services such as web traffic or file transfers.
DLL	Dynamic Link Library An alternative file type to .exe, used in computing to run installer applications in Windows®. In R3LAY , DLLs are used to support the ASIO and MME driver types.
Ember+	A non-proprietary TCP/IP interface protocol. In R3LAY , parameters can be "published" in Ember+, enabling control from a remote device such as a mixing console.
Fader	A potentiometer used to adjust the gain of a signal.
Gain	Adjusting the gain of a signal results in a change in the perceived level or amplitude. An increase in gain (positive values) results in amplification and a reduction in gain (negative values) in attenuation.
GPI	General Purpose Interface (IEEE488) is a standardised platform independent short-range digital interface, to allow switching connections between broadcast equipment from different manufacturers.
Headroom	The amount of operating level which is in reserve between normal operating level and 0dBFS.
HPET	High Precision Event Timer A high precision clock reference provided by your PC.
HTTP	Hypertext Transfer Protocol A networking protocol/URL address, commonly used to exchange or transfer web pages, email, etc.
Insert Point	A connection point which interrupts the signal flow and routes signal to and from the inserted device.

Latency	The amount of time delay between an audio signal entering and emerging from a system.
MME-Interface	Multimedia Extensions Interface (also known as WaveIn/WaveOut) A Windows® driver for digital audio.
Monitor	Term used to describe the outputs and functionality of feeds to loudspeakers or headphones for the purpose of listening to a mix.
ms	milliseconds Unit of time measurement.
NIC	Network Interface Card A computer interface that connects to external network devices.
Nova73	A stand alone routing matrix with networking capabilities; this is a large matrix related to the mc ² series of Lawo consoles.
Overload	Occurs when the signal level is too large for the system, resulting in signal distortion.
PTP	Precision Time Protocol. An ultra-precise, synchronisation method used in data networks. The protocol can be used as the sync reference for all RAVENNA devices in a network.
QoS	Quality of Service The QoS defines the overall performance of a computer network. Several factors are considered: error rates, bandwidth, throughput, transmission delay, availability, jitter, etc.
RAS	Radio Automation System control protocol is Lawo's universal protocol for communication between a mixing console (MIXER) and a radio automation system (RAS).
RAVENNA	A real-time, network-synchronised Audio over IP protocol. RAVENNA offers real-time distribution of audio and other media content within IP-based network environments.
Remote MNOPL	The remote control protocol RemoteMNOPL is a LAN based client-server network byte order protocol to enable third party systems to control Lawo's digital mixing consoles or standalone routers.
Routing	Signal Routing Term used to describe the connection made between an input and output.
RTSP	Real Time Streaming Protocol A networking protocol/URL address, commonly used in establishing point-to-point media sessions.
Sample Rate	The speed at which the Processing of the system takes samples respective to values from a continuous, analogue audio signal to make a discrete, digital one. For example, when running at 48kHz, incoming analogue audio is sampled at a rate of 48000 values per second.
SDP	Session Description Protocol A format for describing streaming media communications parameters.
SIP	Session Initiation Protocol A networking protocol/URL address, commonly used within Voice-over-IP systems.
SOAP	Simple Object Access Protocol. A non-proprietary protocol for XML information exchange. RELAY environments use SOAP scripts to trigger external actions.
TCP	Transmission Control Protocol A protocol that provides reliable, ordered, and error-checked delivery of a stream of octets (bytes) between applications running on hosts communicating via an IP network.

TCP/IP	The Internet protocol suite - Transmission Control Protocol (TCP) and the Internet Protocol (IP) - provides end-to-end data communication specifying how data should be packetized, addressed, transmitted, routed, and received.
TDM	Time-Division Multiplexing A common method of transporting signals via a point-to-point connection. In Lawo devices, TDM is used internally to transport audio along the backplane - e.g. from an IO to DSP card, or vice versa.
TTL	Time to Live A mechanism that limits the lifespan of data within a computer network, in order to prevent data packets from circulating indefinitely.
UDP	User Datagram Protocol A simple connection-less networking protocol which is often used in real-time applications due to its low latency. UDP is suitable for purposes where error checking and correction are either not necessary or performed in the application.
URL	Uniform Resource Locator A networking term for specifying the location of a resource on a computer network. URL types include http, rtsp and sip.
WDM	Windows Driver Model The standard Windows® driver for digital audio. Devices using this driver are presented to RELAY as a single mixed audio stream and pass through the Windows® audio mixer.
WASAPI	Windows Audio Session API (Application Programming Interface) A Windows® driver for digital audio, introduced in Windows Vista.