A__madi4

User Guide

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www.lawo.com/downloads

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1. Introduction

About this Manual

This document describes how to install and configure the **A__madi4**. The specification is valid for Image Version 10.0.2.x.

Other useful resources include the:

- **A__madi4 Data Sheet** - a full technical specification for the device.
- Lawo IP Networking Guide - more about the data network requirements and suitable components for AoIP.

All Lawo manuals are available from the **Downloads** area at www.lawo.com (after **Login**).

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!

Utility Software

Each device is configured via a series of HTML pages. No specific software is required other than a suitable web browser.

Lawo User Registration

For access to the **Download-Center** and to receive regular product updates, please register at:

www.lawo.com/user-registration.

2. 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).

3. Overview

A__madi4 is a member of Lawo's A__line series.

Each 1RU 19-inch unit provides **two bridging modules**, each capable of changing audio formats between MADI and RAVENNA Net, or MADI and RAVENNA Link.

Typical applications include integrating MADI devices into an Audio over IP (AoIP) network; expanding the MADI capabilities of a mc^{2}36 console (via its RAVENNA ports); and connecting an existing DALLIS (with MADI Master Board) to a mc^2/Nova RAVENNA IO Module.

Principal Connections

The principal connections are made to and from the two BRIDGE modules (on the left and right of the front panel):

- **Network** - two ETHERNET ports (A & B) are available for the streaming connections (either RAVENNA Link or RAVENNA Net depending on the conversion mode). When converting to/from RAVENNA Net, by connecting and configuring both ports to discrete network paths, the unit can support redundant streaming via SMPTE 2022-7 Seamless Protection Switching. For each port, you can use either copper or optical fibre connections.
- **MADI** - two MADI ports (1 & 2) are available for the MADI connections. Both ports use SFPs to support a variety of connections.

Conversion Modes

Each BRIDGE module can work in one of three conversion modes:

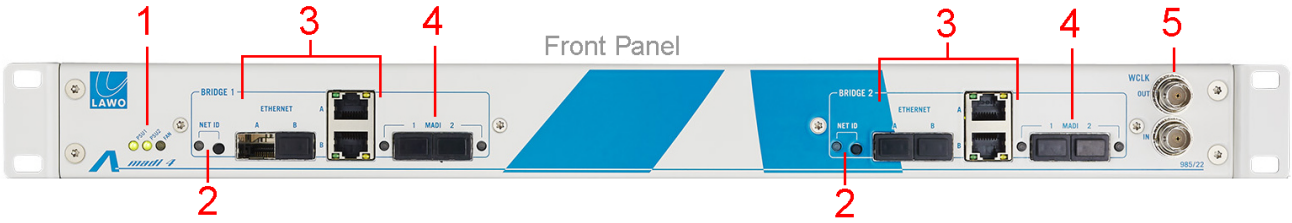
- **RAVENNA Link to/from MADI (DALLIS)** - this mode converts Lawo's RAVENNA Link to MADI; both audio and control are converted. The mode is designed to connect an existing DALLIS (with MADI master board) to a mc^2/Nova RAVENNA IO Module via RAVENNA Link.
- **RAVENNA Link to/from MADI (raw)** - this mode converts Lawo's RAVENNA Link to and from MADI; only audio is converted. It is ideal for converting the three RAVENNA Link ports (on the rear panel of the mc^{2}36 console) to and from MADI.
- **RAVENNA to/from MADI (raw)** - this mode converts RAVENNA Net to and from MADI; only audio is converted. You can use this mode to integrate any MADI device (Lawo or third-party) into an AoIP network.

Configuration

All parameters are accessed via a series of HTML pages. These can be remotely controlled from a computer by opening a web browser connection to the BRIDGE's **ETHERNET A** port. Note that each BRIDGE module is configured independently and so you will need to open a separate connection to each BRIDGE. In each case, the Landing page provides access to all HTML resources. These include the Device Configuration page which selects the conversion mode. If the mode = RAVENNA to/from MADI (raw), then the RAVENNA Web UI must be used to configure the streaming ports.

Once configured, all parameters are accessible via Ember+. From Image Version 10.0.0, this includes the internal Routing Matrix which maps the device's local IO signals to and from the RAVENNA streams.

4. Controls, Connectors & Indicators



1 Status LEDs (PSU1, PSU2 & FAN)

The three LEDs indicate the status of the two internal power supplies and the cooling fan. For the PSUs: green = normal operation; off = PSU error or no power connected. For the fan: off = normal operation; red = fan error detected.

2 NET ID

The NET-ID button and LED can be used to reset the service network IP address or perform a factory reset. For safety reasons, a press and hold is required; a quick press of the button performs no action.

3 ETHERNET A & ETHERNET B

Each BRIDGE module provides two network ports: **ETHERNET A** and **ETHERNET B**. These provide the RAVENNA Link or RAVENNA Net connections depending on the conversion mode.

For each port, you can connect using copper (RJ45, CAT 5 or better) or optical fibre (via SFP).

- **If the conversion mode = RAVENNA Link**, then the ETHERNET A port must be directly wired to the corresponding RAVENNA Link port on the mc^2/Nova system.
- **If the conversion mode = RAVENNA Net**, then either or both ports connect to the streaming network. By connecting both ports (ETHERNET A and ETHERNET B), the BRIDGE can support redundant streaming via SMPTE 2022-7 (SPS).

Please note: each copper port is accompanied by two status LEDs. Active LED: yellow = data transmission; off = no data transmission. Link LED: green = link established; off = no link.

4 MADI 1 & 2

Each BRIDGE module provides two MADI ports: **MADI 1** and **MADI 2**. The connections conform to AES 10, each carrying up to 64 input and 64 output channels.

Both MADI ports use SFP modules to support a variety of connections.

- **If the conversion mode = MADI (raw)**, then both ports can be used. Connect each port to your external MADI device.
- **If the conversion mode = RAVENNA Link to/from MADI (DALLIS)**, then only **MADI 1** can be used. This should connect to the MADI port on the DALLIS Master Board. In this mode, both audio and control are distributed to the DALLIS.

Each MADI port is accompanied by a Lock/Error status LED: green = valid MADI signal detected; red = MADI signal or link error; off = no signal detected.

5 WCLK IN & OUT

The **WCLK IN** can be used to connect an external Wordclock input. This can be used as the external sync reference IF the conversion mode = RAVENNA to/from MADI. Providing Wordclock is selected as the sync input, in the RAVENNA Web UI, then both BRIDGE modules will sync to this input. Note that this option cannot be used in other conversion modes.

The **WCLK OUT** connector provides an output of the active sync source for BRIDGE 1. It can be used in any conversion mode. Note that a sync output from BRIDGE 2 is not accessible.

Both connections use a standard BNC video connector.

Rear Panel

6 Power (PSU 1 & 2)

The unit is fitted with two independent power supplies running in parallel. Only one supply is required for operation. For redundancy, connect both supplies, each to a separate AC mains circuit. The PSU LEDs on the front panel show the status of each supply.

The **CASE** grounding screw should be used to ground the frame.

For power consumption and electrical voltages, please refer to the **A__madi4** Data Sheet.

All devices *MUST* be connected to the mains using the three-cord power leads supplied with the system. When running with two mains supplies (PSU 1 and PSU 2), make sure that both circuits lie on the same ground potential. Otherwise, an internal bridge of two ground wires will lead to a ground loop!

7 Ventilation Holes (Cooling)

The unit is fitted with a single speed-controlled fan. Air is sucked in from the rear panel, and blown out at the sides (left and right).

DO NOT obstruct the ventilation holes as to do so will prevent efficient cooling.

4.1 The NET-ID Button

The NET ID button and LED on the front panel can be used to reset the service network IP address or perform a factory reset. For safety reasons, a press and hold is required; a quick press of the button performs no action.

Resetting the Service Network IP Address

This operation will reset the service network IP address to its default = **192.168.110.253**.

First, make sure that the interface is booted and operating normally - the **NET ID** LED should be blinking yellow. Then, using a pointed object, press and hold the recessed button until the LED lights continuously. When the LED switches off, the reset is complete.

Performing a Factory Reset

While the unit is booting, you can press and hold the **NET ID** button to perform a factory reset. This operation will delete all configuration files AND reset the service network IP address.

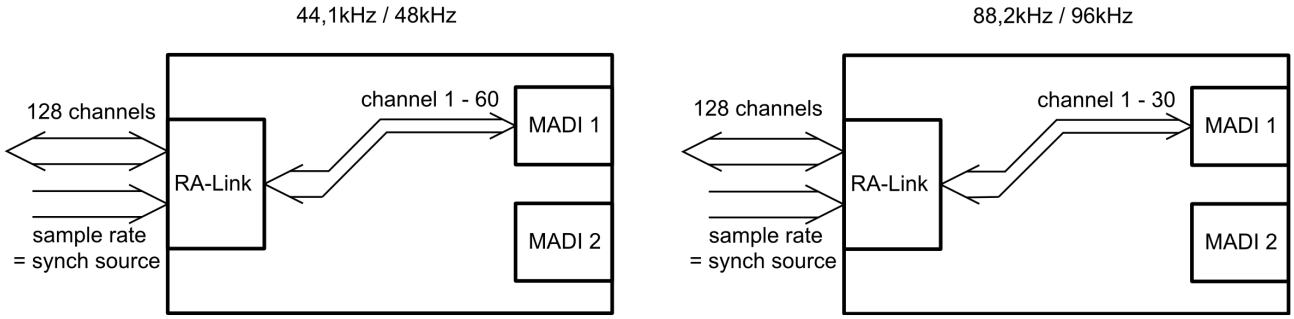
First power cycle the unit to start a reboot. Then press and hold the **NET ID** button, while the LED blinks red, until the LED lights continuously - this indicates that the reset is taking place. When the LED switches off, the reset is complete.

Note that when the unit restarts, there will no conversion mode (indicated by the fast blinking orange MADI port LEDs). Therefore, the next step must be to select the conversion mode for each BRIDGE.

5. The Conversion Modes

Each BRIDGE module can work in one of three conversion modes (selected from the Device Configuration page). Note that the conversion mode for each BRIDGE module can be selected independently.

5.1 RAVENNA Link to/from MADI (DALLIS)



This mode converts Lawo's RAVENNA Link to MADI; both audio and control are converted.

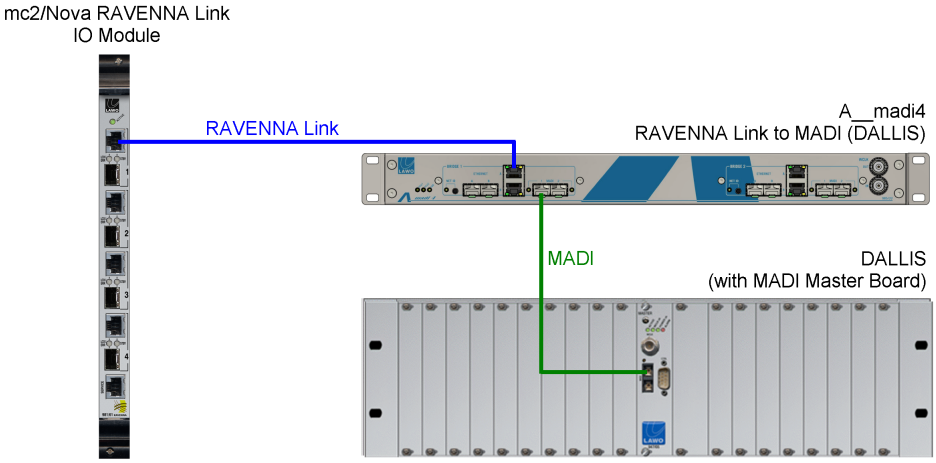
The mode is designed to connect an existing DALLIS (with MADI master board) to a mc^2/Nova RAVENNA IO Module via RAVENNA Link. Note that the inverse use (e.g. connecting a DALLIS with RAVENNA Link master board to a MADI IO Module) is not technically possible.

The connection must be made to the **ETHERNET A** port on the A__madi4. **ETHERNET B** is disabled.

Supported sample rates are: 44,1kHz; 48kHz; 88.2kHz; 96kHz. At sample rates of 88.2kHz and 96kHz, the number of MADI channels are halved.

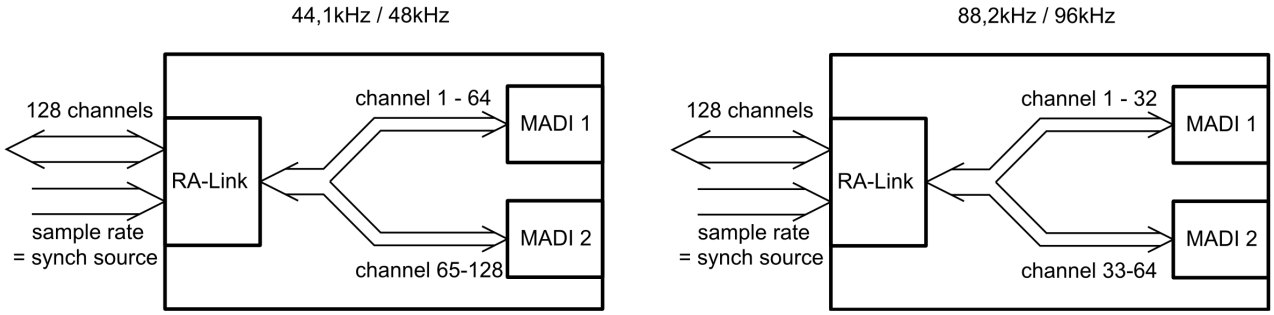
The clock is always taken from the RAVENNA Link connection.

The connection diagram below shows the intended application:



Note that, when the DALLIS is defined in AdminHD, it must be configured for a RAVENNA Link connection, even though the physical unit is fitted with a MADI Master Board. This means some older IO card types are *not* supported and will be greyed out in AdminHD.

5.2 RAVENNA Link to/from MADI (raw)



This mode converts Lawo's RAVENNA Link to and from MADI; only audio is converted.

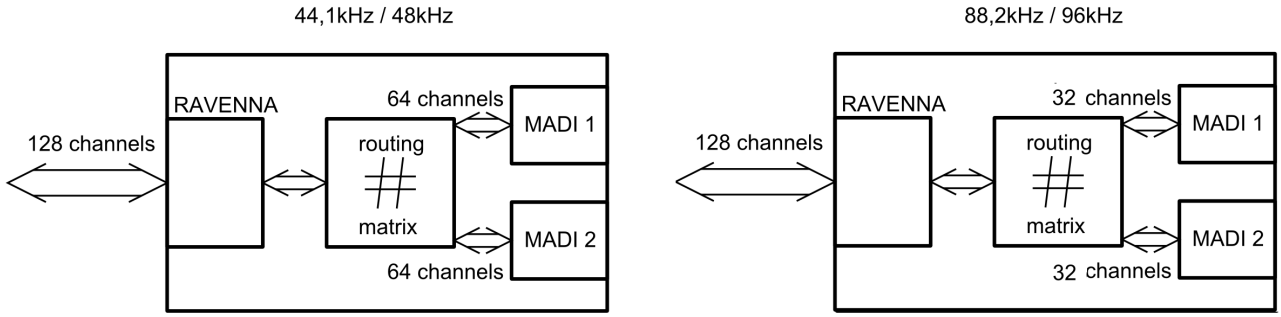
It is ideal for converting the three RAVENNA Link ports (on the rear panel of the mc^{2}36 console) to and from MADI. Note that the inverse use (e.g. connecting a DALLIS with RAVENNA Link master board to a MADI IO Module) is not technically possible.

The connection must be made to the **ETHERNET A** port on the A__madi4. **ETHERNET B** is disabled.

Supported sample rates are: 44,1kHz; 48kHz; 88.2kHz; 96kHz. At sample rates of 88.2kHz and 96kHz, the number of MADI channels are halved.

The clock is always taken from the RAVENNA Link port.

5.3 RAVENNA to/from MADI (raw)



This mode converts RAVENNA Net to and from MADI; only audio is converted.

Use this mode to integrate any MADI device (Lawo or third-party) into an AES67/RAVENNA streaming network.

If both **ETHERNET A** and **ETHERNET B** ports are connected, then the BRIDGE can support redundant streaming via SMPTE 2022-7 (SPS).

Supported sample rates are: 44,1kHz; 48kHz; 88.2kHz; 96kHz. At sample rates of 88.2kHz and 96kHz, the number of MADI channels are halved.

In this mode you will need to use the RAVENNA Web UI to configure the streaming ports. Once defined, the configuration loads at the end of each reboot.

6. The RAVENNA Ports

On each BRIDGE module, the two RAVENNA ports (**ETHERNET A** & **ETHERNET B**) conform to the following specifications. Note that **ETHERNET B** is only active when converting to/from RAVENNA Net.

6.1 RAVENNA Link

All RAVENNA Link interfaces provide:

- RAVENNA Link 1.0: multi-channel digital audio-over-IP.
- Per port: up to 128 bi-directional channels at 48kHz AND 96kHz.

RAVENNA Link connections *must* be directly wired.

Providing the physical connections match the AdminHD configuration, the interface is self-configuring. Thus, once you have connected the ports, no further network configuration is necessary.

To guarantee low latency, reliability and easy setup, do *NOT* connect any other network equipment between RAVENNA Link connections.

6.2 RAVENNA Net

All RAVENNA Net interfaces provide:

- SMPTE 2110-30/31 AES67/RAVENNA: multi-channel digital audio-over-IP.
- Per port: up to 128 bi-directional channels at 48kHz AND 96kHz.
- Per port: up to 128 TX and 128 RX streams.

RAVENNA Net connections *must* be made via the streaming network (i.e. to and from a RAVENNA-compatible network switch). This ensures that the network's PTP clock signal is available to all streaming ports.

RAVENNA streaming requires proper configuration and management of the data network. The network *must* use a suitable architecture; all components must support multicast (as opposed to unicast); a proper Quality of Service (QoS) must be configured; and so on.

Please *DO NOT* attempt to connect RAVENNA interfaces using an unqualifying IP network, as correct streaming operation cannot be guaranteed.

You can find more details about the data network requirements in the Lawo IP Networking Guide.

6.3 Network Cables & Connectors

Each RAVENNA interface (Link or Net) can connect via copper and/or optical fibre, unless otherwise specified.

Copper

Choose an Ethernet cable that meets the following specification:

- CAT 5 or better (CAT 5e/6/7); straight (1:1) or crossed Ethernet cable.
- Connector Type: RJ45.
- 1000, 100 or 10 Base-TX LAN; **1000 Base-TX** (Gigabit Ethernet) is recommended.
- Cable Length: up to 80m.

Optical Fibre (via SFP Modules)

To use the optical fibre ports, please fit one of the Lawo-certified SFP Modules. Note that the SFPs *must* be Lawo-certified. Options include mulit-mode and single-mode fibre, supporting a choice of maximum cable lengths.

If Both Copper and Fibre are Connected

If both copper and fibre are installed at start-up, fibre is the preferred medium. In either case, the second medium can be hot-plugged without disturbing the current operating connection. If a connection breaks, then the interface automatically switches to the second medium (if installed). Note that there will be an audible audio interruption until the automatic stream setup re-establishes the connection. Therefore, the second medium should not be used to provide redundancy.

6.4 SMPTE 2022-7, Seamless Protection Switching (SPS)

This feature is supported when converting to/from RAVENNA Net.

SMPTE 2022-7 is a method of recovering lost data packets when streaming data over an IP network. The technology is also known as Seamless Protection Switching (SPS). Within a RAVENNA installation, it can be used to provide main and redundant paths for audio/video streams and PTP synchronization.

Compatible Devices

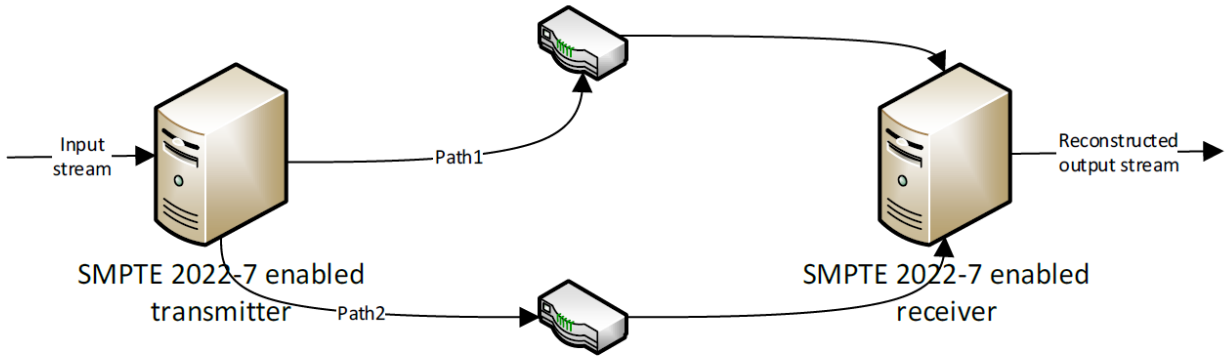
Lawo devices that support SMPTE 2022-7 are:

- 981/61 RAVENNA IO module - fitted to the Nova73, Nova37, mc^{2}36 and mc^2 Micro Core.
- mc^{2}56 MKIII and mc^{2}96 Local IO.
- A__line devices: A__mic8, A__digital8, A__madi4, A__stage48, A__stage64, A__stage80.
- Power Core^{RP} (for mc^2/Nova Remote Production).
- Radio consoles: ruby / Power Core, crystal / Compact Engine.
- Virtual radio applications: R3LAY VRX^4, R3LAY VRX^8 and R3LAY VPB.

SMPTE 2022-7 is supported from mc^2/Nova Version 5.14.0 and Image Version 10.0.0.x onwards.

Concept

The diagram below illustrates the concept in a standard data network:



A SMPTE 2022-7-enabled transmitter duplicates the input stream and sends it via two different paths to the destination receiver. The receiver (also SMPTE 2022-7 enabled) combines the streams from both paths and reconstructs the original stream. If a packet was lost on path 1, the packet is taken from path 2. If path 1 is lost completely, then the entire stream is taken from path 2, and vice versa. The result is that the receiver can switch from one path to the other without impacting upon the stream content.

Configuration

To configure SMPTE 2022-7 within a RAVENNA streaming network, will need to create the two separate paths for each data stream. This means doubling the network's infrastructure and then connecting each sending and receiving device to both paths. Within Lawo systems, the two paths are usually known as the primary (red) and secondary (blue) networks.

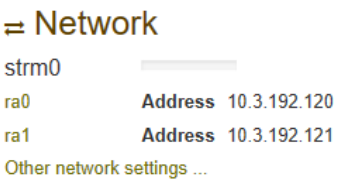
For the A__madi4, the two streaming paths can be created by connecting both of the **ETHERNET A** and **ETHERNET B** ports to the network, and using the RAVENNA Web UI to configure main and redundant streams.

6.5 Port Labeling

On the front connector panel, the two RAVENNA ports are labeled as **ETHERNET A** and **ETHERNET B**. However, within the RAVENNA Web UI, they appear as **ra0** and **ra1**. This is important to know when editing settings for the RAVENNA Net streaming ports using the Web UI:

Front Connector Panel

Network Interfaces (in the Web UI)



Creating SMPTE 2022-7 Compatible Streams

To create the two network paths required for SMPTE 2022-7 (SPS), the ports are paired as indicated in the RAVENNA Web UI:

- **strm0** (ra0 + ra1) = (ETHERNET A + ETHERNET B)

7. Synchronization

7.1 Sync Reference Options

The sync reference options for each BRIDGE module depend on the conversion mode.

Converting to/from RAVENNA Link

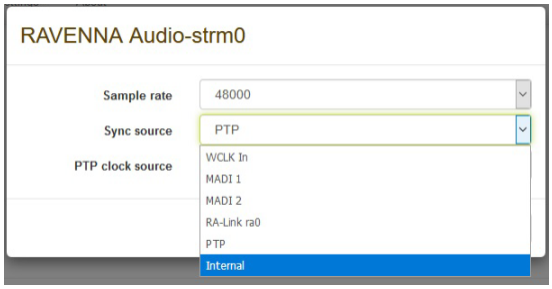
In both RAVENNA Link modes, the master clock source for the BRIDGE is its RAVENNA Link port. Note that neither the MADI port or Wordclock input can be used as an external clock source when operating in this mode. This means that it is not possible to use the device as a MADI to RAVENNA Link converter in an installation where the MADI or Wordclock signal must be the clock master!

Converting to/from RAVENNA Net

When converting to and from RAVENNA Net, there are a number of possibilities including the option to use the A__madi4 as a PTP grandmaster.

The active sync source for each RAVENNA Net BRIDGE is selected using the RAVENNA Web UI:

Sync source options



- **WCLK In** – external wordclock connected to the WCLK IN.
- **MADI 1** or **MADI 2** – connected to the MADI 1 or MADI 2 connectors.
- **RA-Link** – connected to the alternate BRIDGE module.
- **PTP** – arriving from/sending to the RAVENNA streaming network (via ETHERNET A or ETHERNET B).
- **Internal** – the device's own internal sync generator.

To sync to an external reference, the clocking signal *MUST* match the internal sample rate of the **A__madi4**.

If the sync source is set to WCLK In, then both BRIDGE modules will sync to the Wordclock input; it is not possible to sync the two modules independently.

7.2 Using PTP

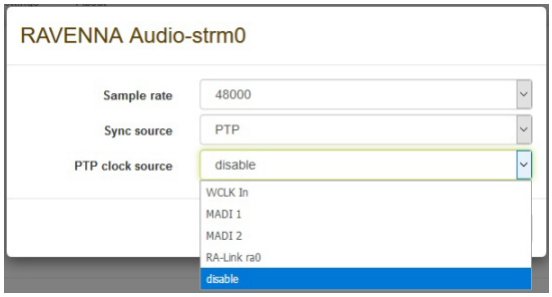
For correct synchronization via PTP, the RAVENNA streaming network requires a PTP master clock source. This can be achieved by using a RAVENNA node or installing a separate grandmaster device. A PTP master should be capable of taking an incoming sync signal and generating PTP clock. Please note:

- PTP uses a master-slave approach in which all master-capable devices elect the best master, called the grandmaster, according to a common algorithm known as the “Best Master Clock Algorithm”.
- At any moment in time, there can be only one PTP master operating on the network.
- For a master-capable device, the RAVENNA Web UI defines the PTP mode: Slave only or master-slave. In master-slave mode, the device will operate as either a master or slave depending on the PTP priorities set within the device itself and all other streaming nodes.

A__madi4 as PTP Master

When operating as a PTP master, the BRIDGE transmits PTP *to* the streaming network via both of its interfaces: ETHERNET A and ETHERNET B. The reference clock for the PTP signal can be selected using the RAVENNA Web UI. For the A__madi4, you can choose Internal, WCLK IN, MADI 1, MADI 2 or RA-Link:

PTP clock source options



To generate PTP from an external reference, the clocking signal *MUST* match the internal sample rate of the device.

A__madi4 as PTP Master (in SMPTE 2022-7 Networks)

For networks utilizing SMPTE 2022-7, it is recommended to use the A__madi4 as a PTP grandmaster. First, configure both BRIDGE modules to transmit PTP to the network (as described above), and then connect each BRIDGE to the two separate networks (red and blue). This brings a number of advantages:

- A__madi4 can transmit PTP to the network via both of its interfaces. Thus supporting the two separate network paths required for SPS.
- A__madi4 provides two independent bridges. Thus it can provide redundancy for the PTP clock source.

To implement this solution, the A__madi4 *must* be clocked to a reliable Wordclock signal. Lawo recommends Rosendahl Wordclock generators.

A__madi4 as PTP Slave

When operating as a PTP slave, the BRIDGE locks to PTP received *from* the streaming network via either of its interfaces: ETHERNET A and ETHERNET B. The device's sync source must be set to PTP using the RAVENNA Web UI (as described earlier).

Installing a Grandmaster Device

If you wish to install a third-party PTP master device, then Lawo recommends Meinberg clock generators.

Checking the PTP Sync Status

Once all of the streaming devices and connected and configured, the PTP sync status can be checked from the "Sync" area of the RAVENNA Web UI Home page.

7.3 Non-PTP Installations

If PTP is not available and all devices support syntonised streaming, then you can use external Wordclock as the sync reference for all streaming nodes.

To support this option, you must have a reliable Wordclock signal that can be distributed to all nodes on the network.

Please note:

- For correct synchronization without PTP, the same sync source *must* be selected at all streaming nodes!
- All nodes *must* support syntonised streaming. This is true for all Lawo RAVENNA interfaces, but must be checked for third-party devices.
- Once WCLK IN is selected as the sync source, both BRIDGE modules will sync to the Wordclock input; it is not possible to sync the two modules independently.

8. Installing the Unit

8.1 Checklist

To install the **A__madi4**, please complete each of the following steps:

1. Unpack and check the contents of the shipping box. You should find:
   - 1 x **A__madi4** unit.
   - 2 x IEC power cables (country-specific)
   - 2 x SFP optical fibre transceivers for the **ETHERNET A** ports (optional)
   - 2 x SFP optical fibre transceivers for the **MADI** ports (optional)
   - 19" rack-mounting kit (optional)

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 rack-mounting ears fitted to the sides of the frame - this is ideal for mounting the unit in a 19" housing.

Front View - with rack mounting ears fitted

Rear View

3. Fit the SFP Modules to the MADI and ETHERNET ports as required.
4. Connect the MADI and WLCK signals. See Controls, Connectors & Indicators.

At this stage, do NOT connect the **ETHERNET** ports to the network, as first you must select their conversion mode (and for RAVENNA Net, configure their IP settings).

5. Connect one or both of the IEC connectors to the mains supply and switch on the PSU(s) to apply power.

The **PSU** status LEDs on the front panel light as soon as power is applied. The unit boots in a few seconds.

8.2 SFP Modules

The following SFP modules are available for the relevant MADI and RAVENNA ports. Note that all SFPs *must* be Lawo-certified (as listed below).

If fitting SFPs to both MADI and RAVENNA ports, take care not to mix up the module types!

MADI SFP Modules

Options include multi-mode and single-mode fibre, and standard coaxial cable. For more details, please refer to the SFP module's data sheet.

SFP Module Description	Part Number
MADI, multi-mode fibre	981/60-80
MADI, single-mode fibre	981/60-81
MADI, coaxial/electrical	981/60-82

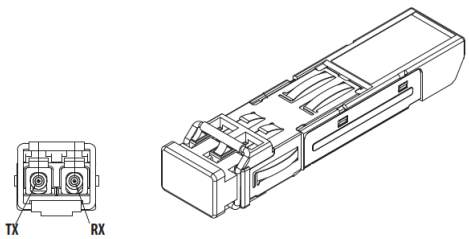
RAVENNA SFP Modules

Options include multi-mode and single-mode fibre. For more details, please refer to the SFP module's data sheet.

SFP Module Description	Part Number
1000 BASE SX: 850nm, -7dBm, multi-mode fibre, 550m	981/60-10
1000 BASE LX: 1310nm, -3dBm, single-mode fibre, 10km	981/60-20
1000 BASE ZX: 1550nm, 0dBm, single-mode fibre, 80km	981/60-30

Installing the SFPs

The SFP modules are hot-pluggable. To install, remove the dust caps from both the port and SFP module. Then, push the module into the rectangular slot. Press gently and firmly until the module locks into position.



Front View

Side View with Dust Cap

CAUTION: Please unlock the SFP module before removing to avoid mechanical damage to the slot.

If a module is removed, please refit the port's dust cap to protect the internal components.

Make sure you use the correct fibre type for your device. Using the wrong fibre type or exceeding the maximum optical input power can result in malfunction of, or damage to, the optical device.

8.3 Getting Operational

Once the unit has booted, the next steps are:

1. Connect a computer directly to BRIDGE 1 via its **ETHERNET A** port and open the Device Configuration page.
2. From here you should check the software version. Then select the conversion mode.

When converting to/from RAVENNA Link, the setup is complete and you can skip straight to step 3. RAVENNA Links will self-configure once they are connected to their partnering devices, according to the AdminHD configuration of the mc^2/Nova system.

When converting to/from RAVENNA Net, open the RAVENNA Web UI to configure the IP address of each streaming port.

> **IMPORTANT**: Each streaming port must be given a unique IP address before it is connected to the network (to avoid IP conflicts).

3. Connect BRIDGE 1 to its partnering device (RAVENNA Link), or to the streaming network (RAVENNA Net).

For RAVENNA Link, the connection should be made using **ETHERNET A**.

For RAVENNA Net, you can connect either or both ports. If you wish to configure SMPTE 2022-7 compatible streams, then both ports must be connected to the network.

4. Once BRIDGE 1 is configured, connect your computer directly to the **ETHERNET A** port of BRIDGE 2 and repeat the steps for the second bridge.
5. When converting to/from RAVENNA Net, re-open the RAVENNA Web UI to define the sync reference, sample rate and TX/RX streams.
6. **Optional**: open the Ember+ Tree Viewer to check the status of Ember+ parameters or switch a parameter manually.

9. Connecting a Service Computer

To open the Landing Page, and other HTML resources, you will need a computer with a LAN connection. There are no special requirements other than a suitable web browser, but it is a good idea to check that the computer meets the RAVENNA Web UI Prerequisites.

1. Connect the computer directly to the BRIDGE module's **ETHERNET A** port.

This will allow you to open the Landing page using the service network IP address (described below).

2. Then configure the TCP/IP settings of the computer's Network Interface Card.

TCP/IP Settings

- **IP Address**

The IP address must be unique, and lie within the same IP address range as that of the port you are connecting to (i.e. the first three fields must match).

For example, if the unit has the default service network IP address of **192.168.110.253**, then set your computer's IP address to **192.168.110.255**.

- **Subnet Mask**

The Subnet Mask must match that of the port you are connecting to. In all Lawo systems, the default Subnet Mask = **255.255.255.0**.

- **Default Gateway**

A Default Gateway setting is required if data packets are to be redirected. For example, if the PC is connected via a network switch with Layer 3 routing capability. If redirection is not required, then the Default Gateway can be left blank.

Check the IP settings carefully. If there is an IP conflict, then the connection will not operate correctly.

Testing the Connection

The simplest way to check the connection is to open the Landing page.

If you are having problems with the network communication, then check your physical connections. Then check both the network settings of the device and the TCP/IP settings of your computer's network interface card. You can also try running a PING test and/or disabling your computer's firewall (if active).

The Service Network IP Address

Each **A__madi4** has a service network IP address which provides a known way of connecting to the device.

The default service network IP address = **192.168.110.253**. This can be edited from the Device Configuration page. If the IP address is unknown, then it can be reset using the NET ID button on the front panel.

10. The Landing Page

The Landing Page provides access to all of resources required to configure the system. Note that the page does not adjust any settings directly, but provides a gateway to the HTML resources.

10.1 Opening the Landing Page

1. Open your browser software, and enter the device's service network IP address into the URL field.

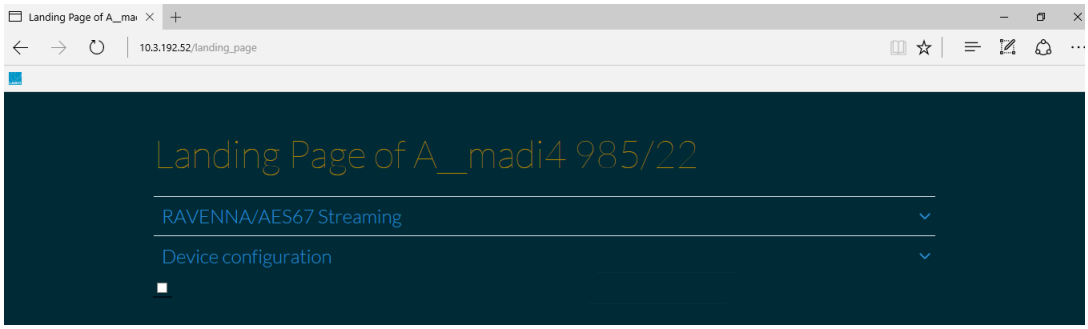
The default = **192.168.110.253** but this can be edited from the Device configuration page. If the IP address is unknown, then it can be reset using the NET ID button on the front panel.

Note that there is only one service network IP address for the complete unit, and so you must make sure that your computer is connected directly to the BRIDGE module you wish to configure.

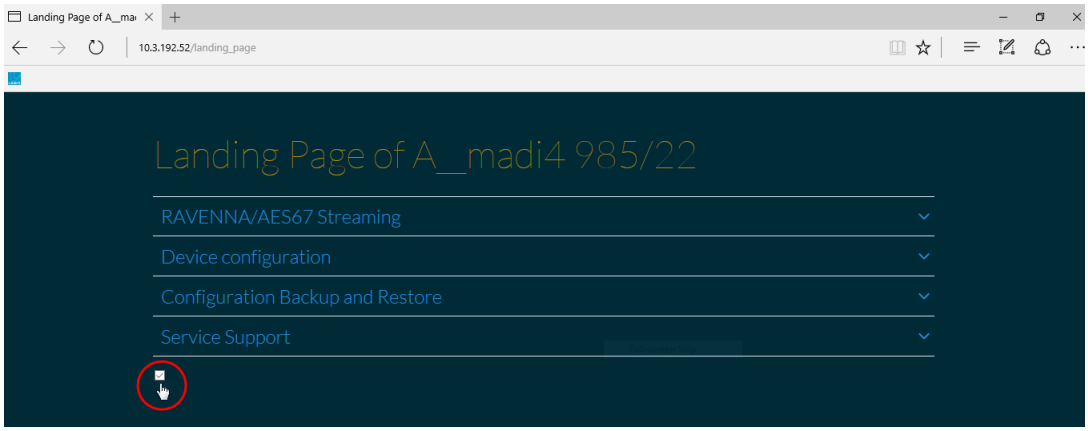
2. Press Enter - the browser connects and the landing page appears.

The text headlines show the resources:

A__madi4 Landing Page



3. Tick the small white checkbox to enter "service mode" - the page updates to reveal more resources:



10.2 Landing Page Resources

For the **A__madi4**, the landing page provides access to:

- **RAVENNA/AES67 Streaming*** - the RAVENNA Web UI.
- **Device configuration** - the main settings including the software version and conversion mode.

*The **RAVENNA/AES67 Streaming** resource only appears if the conversion mode has been set to RAVENNA Net. If there is no mode set, or the conversion mode is to/from RAVENNA Link, then this resource is hidden.

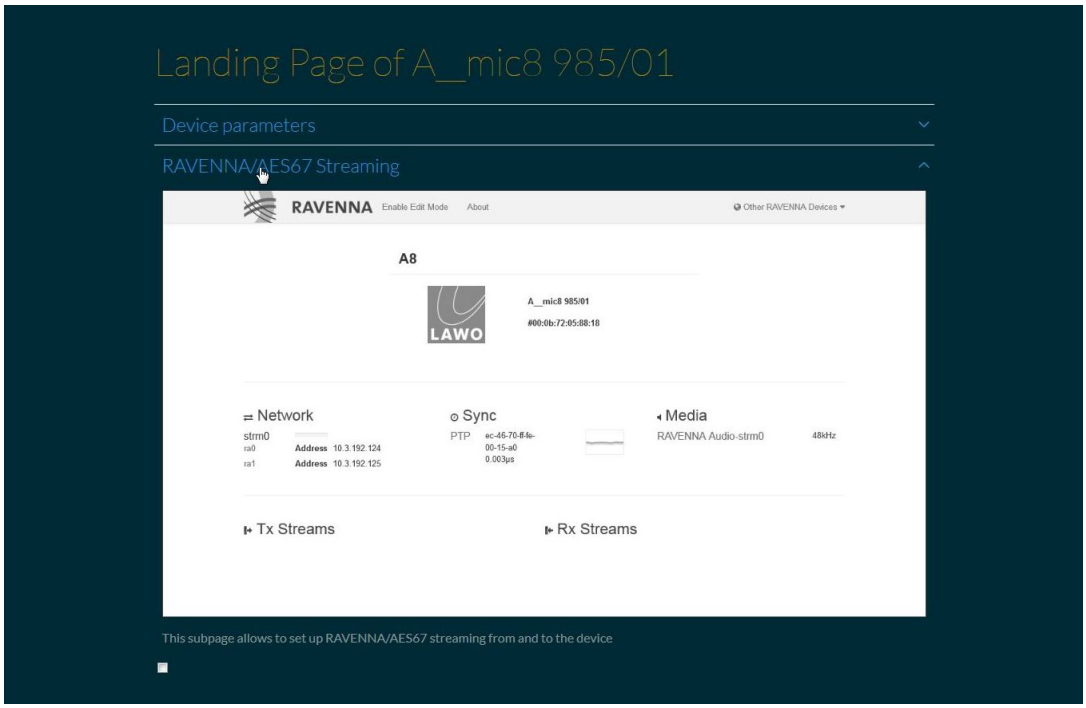
And, in service mode:

- **Configuration Backup and Restore** - backup and restore options (for use when exchanging a unit).
- **Service Support** - can be used to download a snapshot of the settings (useful for Lawo support if there is a problem with the device).

10.3 Opening a HTML Resource

In each case:

1. Click on the headline to show (or hide) a preview:



2. Then click on the image to open the resource in a new browser window.

In our example, this will open the RAVENNA Web UI Home page.

> Note that the previews shown in step 1 use static library images. Therefore, do not expect them to update in real time or represent the actual settings on the connected device!

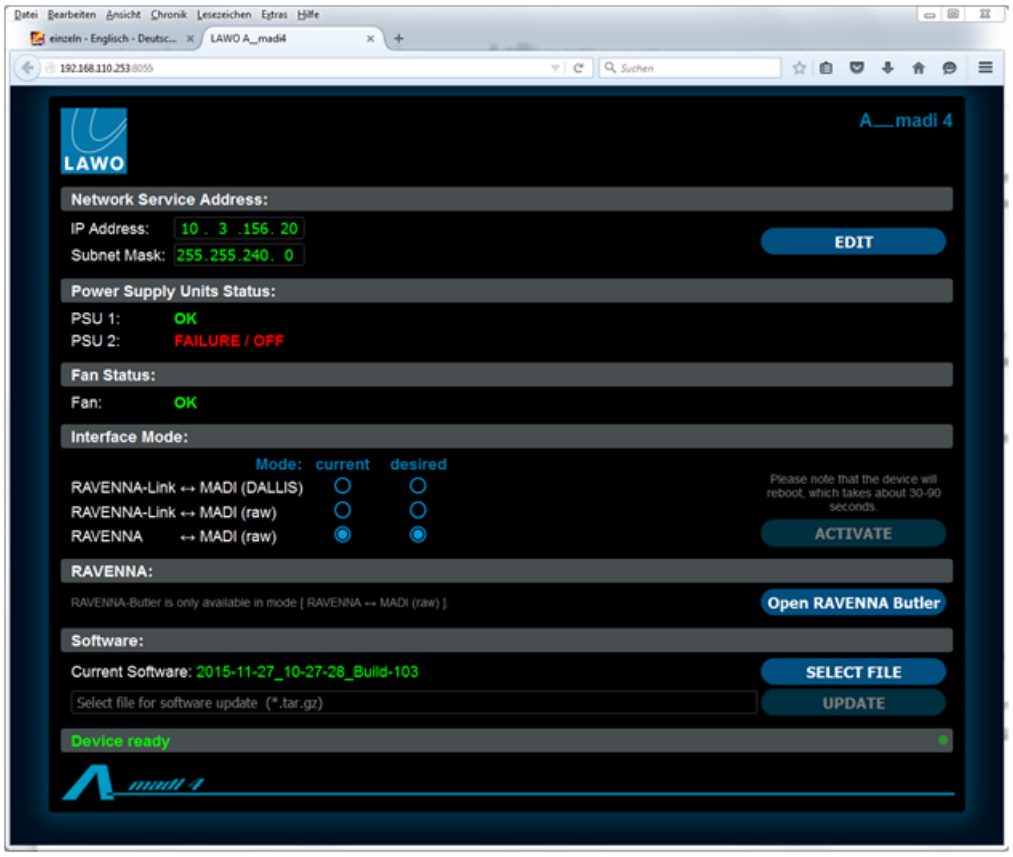
11. Device Configuration

The main settings are configured via the **Device configuration** page.

11.1 Opening the Device Configuration Page

1. Open the Landing page, select **Device configuration** and then click on the graphical preview.

The Device configuration page opens in a new browser tab:



The Network Service Address, Statuses and Software version apply to the complete unit (i.e. to both BRIDGE modules), while the Interface Mode and RAVENNA Butler shortcut are specific to the connected BRIDGE.

Note that the **Open RAVENNA Butler** option will be greyed out if either there is no interface mode or the mode is converting to/from RAVENNA Link.

Configuration Tasks

1. First check, and if necessary update, the software version.
2. Then select the interface mode for the BRIDGE

When converting to/from RAVENNA Link, the setup is complete and you can connect your RAVENNA Link device to the **ETHERNET A** port.

When converting to/from RAVENNA Net, open the RAVENNA Web UI to define the IP settings of the streaming ports, the sync source and sample rate, and the TX/RX streams.

Device Statuses

The Power Supply Units and Fan areas show the status of the two internal power supplies and cooling fan.

At the bottom of the page you will see **Device Ready** when the unit is ready for operation.

11.2 Network Service Address

This area displays the service network IP Address and Subnet Mask.

1. Click on **EDIT** to change the service network IP settings - the device will reboot and you will lose your browser connection.
2. Re-open the Landing and then the Device configuration page to confirm the changes.

The service network IP Address can be reset to its default (**192.168.110.253**) using the NET-ID button on the front panel.

11.3 Interface Mode

This area displays the 'current' conversion mode for the connected BRIDGE. To change the mode:

1. Use the radio buttons in the 'desired' column to choose a new mode.
2. Then click on **ACTIVATE** - the device must reboot to activate the new mode.
3. After the reboot, refresh the browser connection to check that the selected mode is now 'current'.

11.4 RAVENNA

1. Click on **Open RAVENNA Butler** to open the RAVENNA Web UI for the connected BRIDGE.

This is used to configure the streaming ports when converting to and from RAVENNA Net.

It is not required when converting to/from RAVENNA Link.

11.5 Software

The current version is shown in the 'Software' area. Please check this against the latest release, available from the **Downloads** area at www.lawo.com (after **Login**).

To perform an upgrade or downgrade:

1. Download the software update file onto your computer.

Check that the downloaded file ends with **.tar.gz**

Some browsers, such as Safari, tend to unzip the file automatically after download which makes the file invalid. If this is the case, choose "Download as..." in your browser to bypass the automatic unzip function.

2. Read the release notes supplied with the update file.

If settings will be lost as a result of an update, it is strongly recommended that you export your configuration and/or take screenshots so that the current settings can be re-instated once the upgrade/downgrade is complete. Details of which settings will be affected are included in the release notes.

3. Click on **SELECT FILE** and choose the update file.
4. Click on **UPDATE** to start the software update - this will take a few minutes and, when the update is complete, the unit will reboot.
5. Refresh the browser connection to check the new release version and that the Device is Ready (at the bottom of the page).

12. The RAVENNA Web UI

This chapter describes the RAVENNA Web UI, otherwise known as the "Butler" interface.

12.1 Applications

If the conversion mode = RAVENNA to/from MADI (raw), then the RAVENNA Web UI is used for three main tasks:

- To edit the network settings of the streaming ports.
- To edit the BRIDGE's sync source and sample rate.
- To create and manage the TX and RX streams, including SMPTE 2022-7 compatible streams.

Note that the setup must be made separately for each BRIDGE module. The latest settings are stored locally on the device, and are re-instated following a power cycle or reboot.

Any settings changed from the RAVENNA Web UI can be backed up (and restored) using the Backup & Restore Config tool. This is ideal if you need to exchange a device.

12.2 Prerequisites

To run the RAVENNA Web UI, your computer *MUST* meet or exceed the following requirements:

- **Processor:** Pentium 166 or higher
- **RAM:** 64 MB
- **Network Interface Card**: operating at 100 or 1000 Base-T
- **Screen Resolution:** >= 1024 x 786
- **Web Browser**: Microsoft Internet Explorer, Mozilla Firefox, Apple Safari or Google Chrome. Please install the latest version of the browser for best performance.

12.3 Opening the Home page

To open a RAVENNA Web UI connection:

1. Connect a service computer and configure its TCP/IP settings as described earlier.
2. Open the Landing page, select **RAVENNA/AES67** and then click on the graphical preview. Or, from the Device Configuration page, select **Open RAVENNA Bulter**.

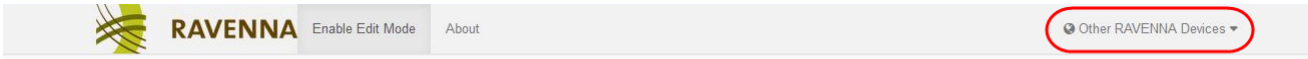
The RAVENNA Home page should appear.

Note that the RAVENNA Web UI is only accessible if the conversion mode is to/from RAVENNA Net.

12.4 Navigating to Other RAVENNA Devices

Once the Home page is open, you can navigate to any other discovered device on the network.

1. Click on **Other RAVENNA Devices** at the top right of the Home page:

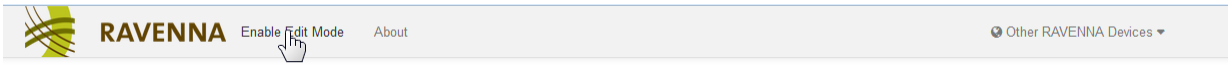


2. Choose an option from the drop-down list of devices - its Home page will open.

12.5 Enabling Expert Mode

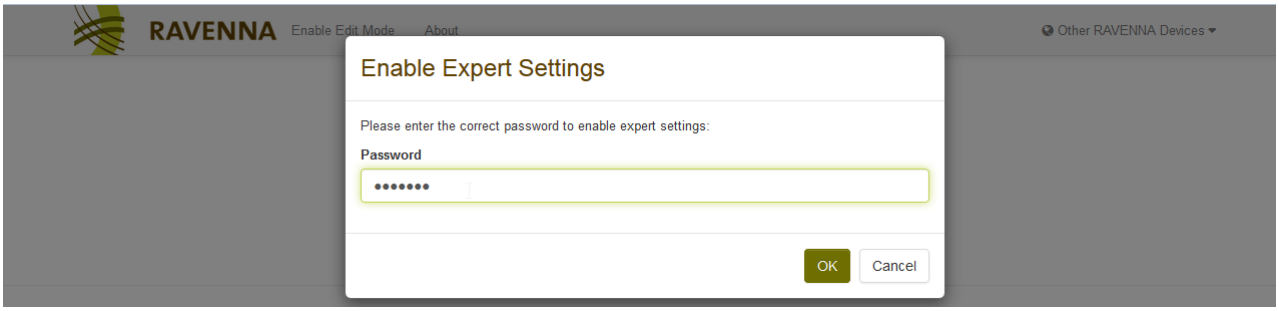
Many operations are hidden from view unless you are running in expert mode. To enable expert mode:

1. Select **Enable Edit Mode** from the headline at the top of the Home page:



A pop-up window appears.

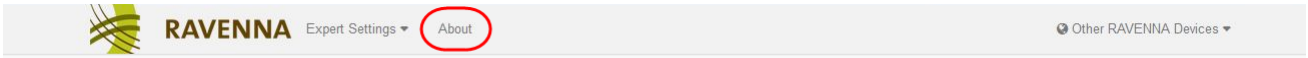
2. Type in the Password - **ravenna -** and click **OK**



The Home page updates to show all of the locked functions, and **Enable Edit Mode** updates to **Expert Settings** (to access to the Expert Settings menu).

12.6 Checking the Firmware Version

To check the firmware version, select **About** from the headline at the top of the Home page:



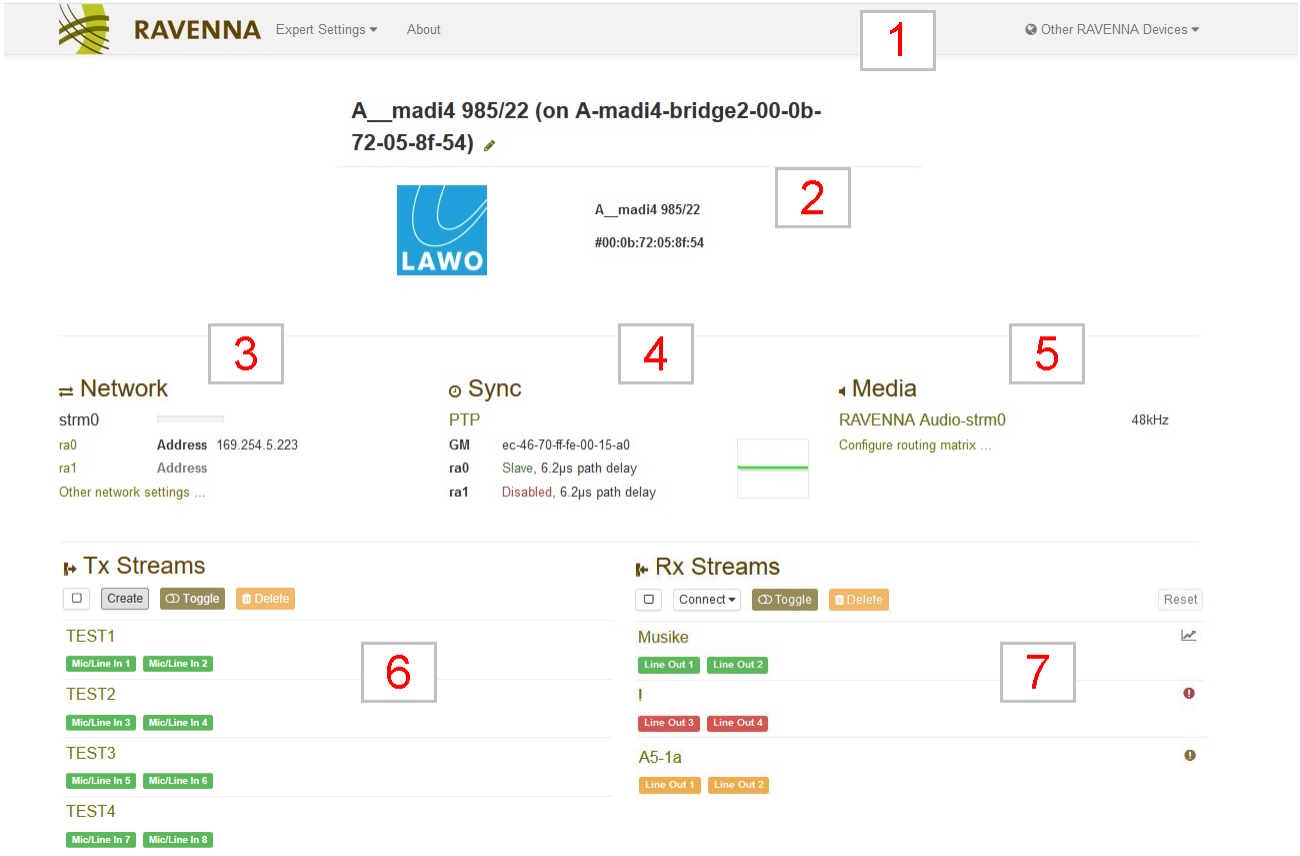
The 'About' dialog box opens. The **Image version** describes the RAVENNA release installed on the device. It is important that all nodes on the network are running compatible Image versions, so if the number is not correct, you will need to update the device.

For an A__madi4, you can update the software from the Device Configuration page, or use the **Expert Settings** -> Firmware update tool.

12.7 The Home Page

The Home page for each RAVENNA IO device is divided into the following areas. Note that some functions only become available once expert mode has been enabled.

A__madi4 BRIDGE RAVENNA Web UI Home Page



1 Headline

- Click on **Enable Edit Mode** (or **Expert Settings**) to enable expert mode (or open the Expert Settings menu).
- Click on **About** to view more information about the RAVENNA release.
- Click on **Other RAVENNA Devices** to navigate to another device's Home page.

2 Device ID (and other details)

This area defines the Device ID.

For the A__madi4, the Device ID can be edited by clicking on the pencil icon and entering a name. 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.

To the right of the Lawo logo, you will also see a description of the device and the MAC address of the **ra0** interface. These fields are for information only and cannot be edited.

3 Network

This area defines the network settings of the streaming ports.

If the device supports SMPTE 2022-7 (streaming redundancy), then the ports are grouped into their SPS pairs. For example: strm0 = ra0 + ra1. Note that the group and port names are fixed and cannot be changed.

For the A__madi4, the IP Address, Network Mask and Gateway of each streaming port must be edited using the Web UI. Note that these settings are separate from the service network IP settings which are shown on the Device Configuration page. Note that ra1 (ETHERNET B) will not be active until the RAVENNA to/from MADI (raw) conversion mode is enabled.

The horizontal bar beside the group name is the Link Load indicator. Once streams are active, this indicates the amount of streaming traffic. The indicator will change from green to orange and then to red.

- Click on an interface (e.g. **ra0**) to view or edit its individual network settings.
- Click on **Other network settings** to view or edit the general settings applied to all ports.

4 Sync

This area shows the status of the PTP clock source. What you see will vary slightly depending on the device's PTP mode: master-slave or slave only:

Master-Slave (device running as PTP Master):

- Beside **ID** you will see the MAC address of the device. Hover your mouse over the MAC address to reveal its IP address.
- The text "**Master**" indicates the interface(s) which are transmitting PTP to the network.

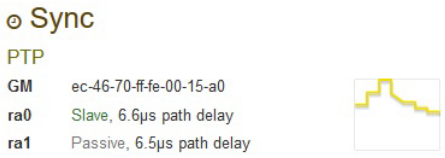
Slave only:

- Beside **GM** you will see the MAC address of the current grandmaster device. Hover your mouse over the MAC address to reveal its IP address.
- Beside each streaming interface, you will see **passive** if the interface is inactive, or **Slave** if the interface is active and operating in Slave only mode. On the A__madi4, you will also see **Disabled** if the ra1 interface is not activated.
- You will also see the amount of **path delay**, otherwise known as the differential delay. This is the delay caused by the time it takes the packets to travel between the PTP master and slave device.

The graphical area monitors the PTP clock source over time:

PTP Signal OK

PTP Signal in error



The graph should be green if the device is receiving or transmitting a valid PTP signal. The graph will change to orange or red if there is a problem with the PTP signal. Hover your mouse over the graph to reveal further information.

- Click on **PTP** to view or edit the PTP Properties for the device.

5 Media

This area lists all of the media which can be used for streaming. If the device supports more than one network interface, then each media is grouped into pairs: e.g. Audio-strm 0 = ra0 + ra1; Audio-strm 1 = ra2 + ra3. Note that this configuration is fixed; you cannot change the network interface allocations to a media.

Any settings adjusted from here affect the complete media (i.e. both ra0 and ra1). The current sample rate is shown beside the media name.

- Click on a media to define its sample rate, sync source and PTP clock source. See Defining the Media.
- Click on **Configure routing matrix** to control the mapping of the device's local audio signals to and from the media (and hence the audio streams). See The Routing Matrix.

6 TX Streams

This area defines the sending streams, which are used to publish audio from the device to the network.

In each case, you will see the TX stream name and the RAVENNA media channels which are being used.

For TX streams, the media channels are color-coded as follows: green = the stream is active; grey = the stream is inactive.

The buttons at the top of the area provide the following functions. These are described in more detail later.

- Click on **Create** to create a new TX stream.
- Click on an existing stream name to interrogate or edit its configuration.
- Click on **SEL ALL** to select all TX streams. Or, click on an individual entry to select or deselect it - the complete line is highlighted whenever a stream is selected.
- Click on **Toggle** to active or deactivate all selected TX streams.
- Click on **Delete** to delete all selected TX streams.

7 RX Streams

This area defines the receiving streams, which are required to use audio from the network.

As for TX streams, you will see the stream name and the RAVENNA media channels which are being used.

For RX streams, the media channels are color-coded as follows: green = correct operation; red = there is either no connection or no data; orange = the stream is being received but there are drop-outs in the data; grey = the stream is inactive.

You will also see an icon on the right of each RX stream which reflects the health statuses:

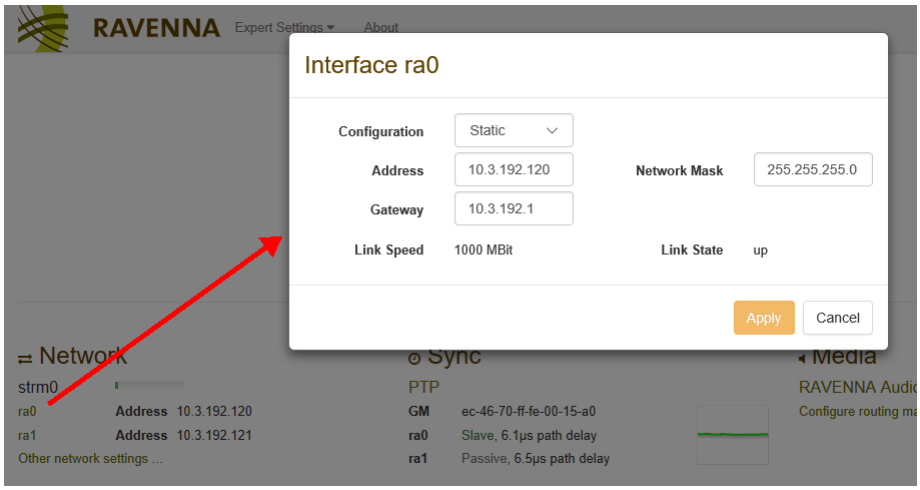
- Click on the icon to open the statistics window for further information.
- To reset all of the error flags for the RX streams, click on the **Reset** button.

The buttons at the top of the area provide the following functions. These are described in more detail later.

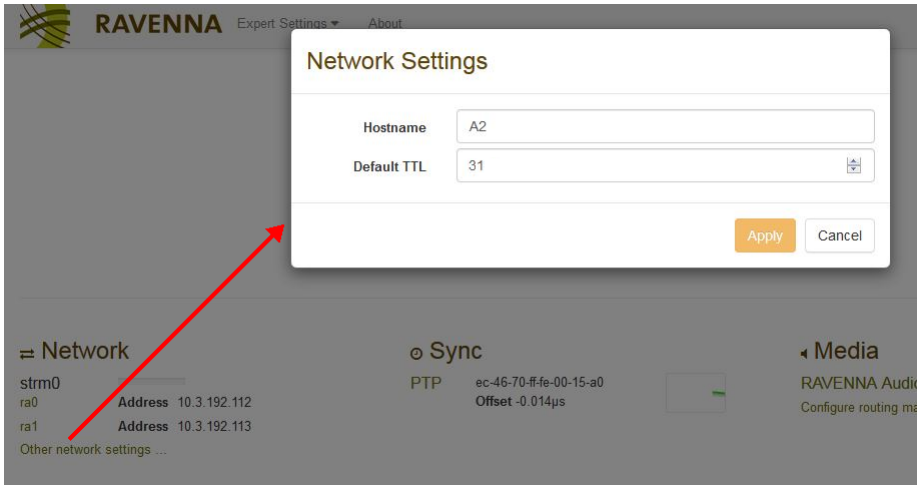
- Click on **Connect** to create a new RX stream.
- Click on an existing stream name to interrogate or edit its configuration.
- Use the **SEL ALL**, **Toggle** and **Delete** buttons to manage the RX streams.

12.8 Defining the Network Interfaces

1. From the **Network** area, click on an interface (e.g. **ra0**) to view its individual settings:



2. Or, click on **Other network settings** to view the general settings applied to all ports:



2. Use the fields to type in a value or select a menu option.
3. If you make a change, select **Apply** to confirm (or **Cancel**).
4. The device must be rebooted before the new settings take affect, which means that you will lose your browser connection.
5. Once the reboot is complete, re-open the RAVENNA Web UI to check the changes.

12.8.1 Network Interface Settings

➢ **Configuration**

The **Configuration** defines the network mode. The options are:

- **Static** - select this mode to enter the IP Address, Network Mask and Gateway manually.
- **DHCP** - select this mode to receive an IP Address automatically from the network's DHCP server.
- **Zeroconf** - 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 Zerconf modes are not supported.

➢ **Address, Network Mask 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). Note that after a factory reset, the ra0 (ETHERNET A) interface is set to Zeroconf mode (as explained above). Therefore, you will need to change the mode to Static and then enter a suitable IP address. Similarly the ra1 (ETHERNET B) interface defaults to off. Therefore, to activate the interface, you will need to enter a suitable IP address.

The **Network Mask** *must* match the Subnet Mask of all other RAVENNA streaming nodes. For the A__madi4, 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.

➢ **Link Speed & Link State**

The **Link Speed** shows the speed of the interface. This must be 1000 MBit (GB Ethernet) or higher; RAVENNA streaming is not supported at 100 MBit (Fast Ethernet).

The **Link State** should be: **up** = correct operation; **down** = the Ethernet link is not connected or invalid.

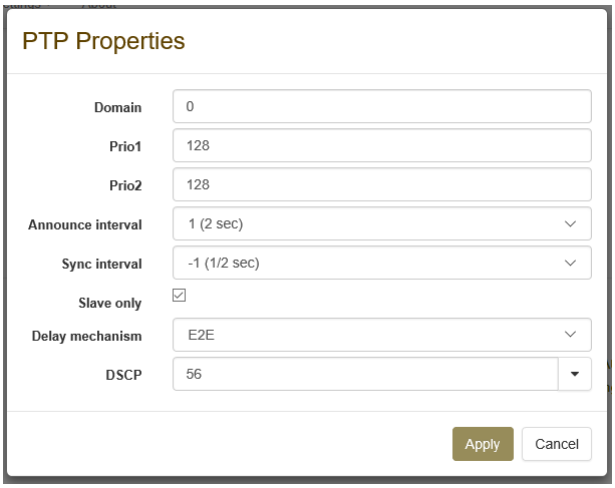
12.8.2 Other Network Settings

The **Hostname** is a unique name which identifies the device to the network. By default it will be the set to the Device ID.

The **Default TTL** sets the default Time To Leave. It can be used to prevent data packets from circulating indefinitely. The default value = **31**.

12.9 Defining the PTP Properties

1. From the **Sync** area, click on **PTP** to open the 'PTP Properties' window:



2. Use the fields to type in a value or select a menu option.
3. If you make a change, select **Apply** to confirm (or **Cancel**).

Please refer to the Lawo IP Networking Guide for a more detailed explanation of PTP and how it should be implemented. Here we will provide a general description of the parameter fields.

➢ **Slave only**

The **Slave only** option determines whether the device will run in Slave only or master-slave mode.

If **Slave only** is enabled, then the device is forced to operate as a PTP slave at all times. The screenshot above shows the default parameter values associated with this mode.

If **Slave only** is disabled, then the device will operate in PTP master-slave mode. In this mode, the PTP priorities set within the device itself and all other streaming nodes determine the current PTP master.

➢ **Prio1 and Prio2**

PTP uses a master-slave approach in which all master-capable devices elect the best master, called the grandmaster, according to a common algorithm known as the “Best Master Clock Algorithm”. The algorithm compares the following parameters in turn:

- **Prio1** - the lower the number, the higher the priority of the device.
- **Clock Class**
- **Prio 2** - as for Prio 1.
- **MAC Address**

For example, if there is no **Prio1** available, then all devices on the network look at the **Clock Class**, then **Prio2** and finally the **MAC address**.

Note that only the **Prio1** and **Prio2** values can be adjusted from the RAVENNA Web UI. The **Clock Class** is not available but may be used by a third-party grandmaster if one is installed.

➢ **DSCP**

The **DSCP** field assigns a DSCP (differentiated services code point) or quality class to the PTP clock stream. The default setting is **56**.

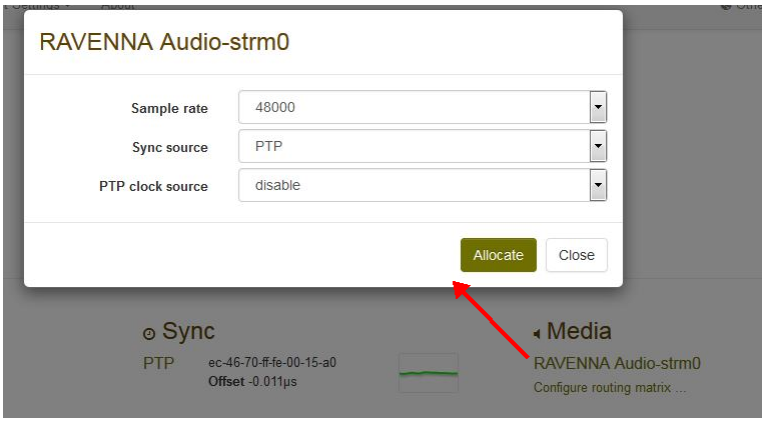
➢ **Other Properties**

The values within the remaining fields - **Domain**, **Announce Interval**, **Sync Interval** and **Delay Mechanism** - vary depending on the PTP profile in use. See the Lawo IP Networking Guide for more details.

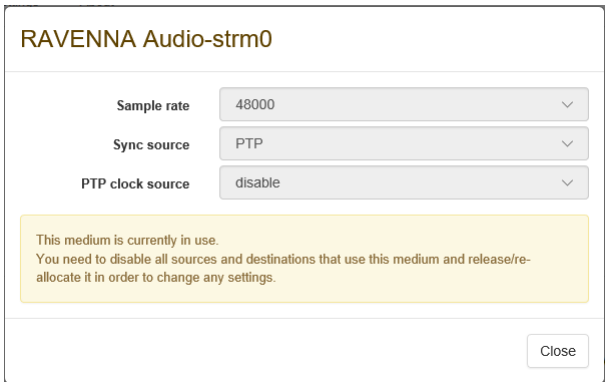
12.10 Defining the Media

1. From the **Media** area, click to view or edit the media's settings - options include the sample rate, sync source and PTP clock source.

Note that these parameters will be applied to all of the media's sending (TX) streams.



If the media has already been assigned to an active TX or RX stream, then it will be locked as shown below:



2. To unlock a media, first close the window and use the Toggle function to stop all active TX and RX streams.
3. Once released, you can re-open the media to select a new option.
4. Then select **Allocate** to apply all changes (or **Close** to cancel).
5. Now use the Toggle function to re-activate any previously-configured TX and RX streams.

12.10.1 Media Settings

➢ **Sample rate**

The **Sample rate** sets the sample rate of the RAVENNA media. For an A__line device, you can choose any of the available options. However, note that to sync to an external reference, the clocking signal *MUST* match the sample rate of the device.

➢ **Sync source**

The **Sync source** sets the sync reference used by the RAVENNA media.

For the A__madi4, you can choose one of the following options:

- **WCLK In** – external wordclock connected to the WCLK IN.
- **MADI 1** or **MADI 2** – connected to the MADI 1 or MADI 2 connectors.
- **RA-Link** – connected to the alternate BRIDGE module.
- **PTP** – arriving from/sending to the RAVENNA streaming network (via ETHERNET A or ETHERNET B).
- **Internal** – the device's own internal sync generator.

➢ **PTP clock source**

If the device is running as a PTP master, then this option selects the reference clock for the PTP signal.

For the A__madi4, you can choose Internal (**disable**), **WCLK In**, **MADI** or **RA-Link** (as described above).

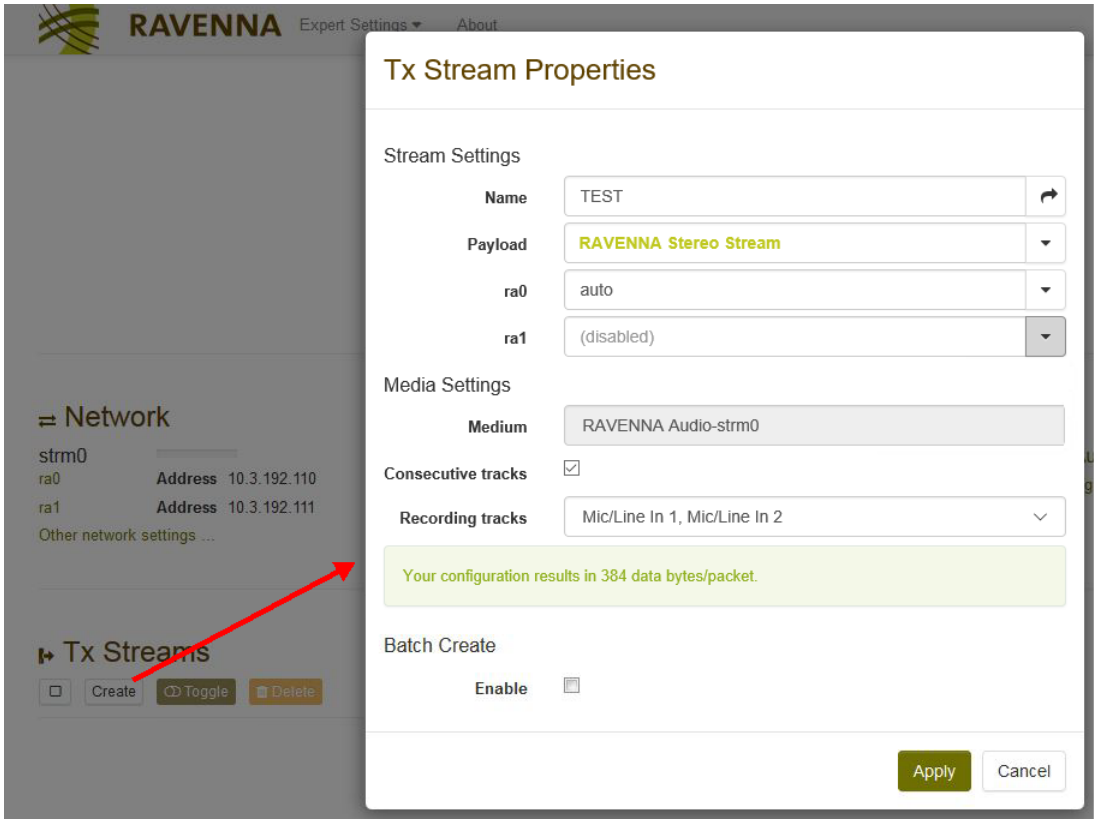
> To generate PTP from an external reference, the clocking signal *MUST* match the internal sample rate of the device.

12.11 TX Streams

12.11.1 Creating a TX Stream

To publish audio from the device to the network, you will need to create a TX stream.

1. Click on the **Create** button to open the TX stream properties:



2. Use the fields to edit the properties.
3. Once you have completed all of the settings, check the network packet size shown in the box that starts "**Your configuration results in ...**".

> The network packet size cannot exceed the the Maximum Transmission Unit (MTU) defined by the Ethernet standard which is 1460 bytes. If the size exceeds the MTU, a warning appears and you *MUST* re-adjust the payload parameters.

4. Click **Apply** to create the stream (or **Cancel**).

The stream is published to the network and appears at the bottom of the **TX stream** list on the Home page.

12.11.2 TX Stream Properties

Stream Settings

➢ **Name**

The **Name** will identify the stream to other network users and, therefore, cannot be edited later. It is recommended to use 6 characters or less with no special characters or spaces.

➢ **Payload**

From the drop-down menu, either choose a preset or select **Custom** to edit the payload parameters manually. Note that the payload will determine the stream's network packet size which, in turn, will affect the latency and network bandwidth.

➢ **ra0 & ra1**

These fields determine which interface, or interfaces, will be used to transmit the stream to the network. In each case, if a multicast IP address is defined, then the interface will be active. To create SMPTE 2022-7 compatible streams, you should choose either **auto** or **manual** to activate both interfaces. If redundant streaming is not required, then one interface can be disabled (as shown above). For each interface, there are three possible options:

- **disabled** = the interface will not be used for this stream.
- **auto** = the interface is active and the stream will be allocated an automatic multicast IP address. You can find out the address later by interrogating the TX stream.
- **manual** = the interface is active, and you will need to enter your own multicast IP address. Choose this option if your network supports a limited IP range. To configure this option, simply type the multicast IP address into the field.

Media Settings

➢ **Medium**

This field defines the RAVENNA media which will be used to publish the stream. On some devices, only one media is available and, therefore, there is nothing to select. If your device supports more than one media, then choose an option from the drop-down menu. For example, for a 981/61 IO module, you can choose either **RAVENNA Audio-strm0** (ra0 + ra1) or **RAVENNA Audio-strm1** (ra2 + ra3).

➢ **Consecutive tracks**

Tick this check box to assign consecutive **Recording tracks**.

➢ **Recording tracks**

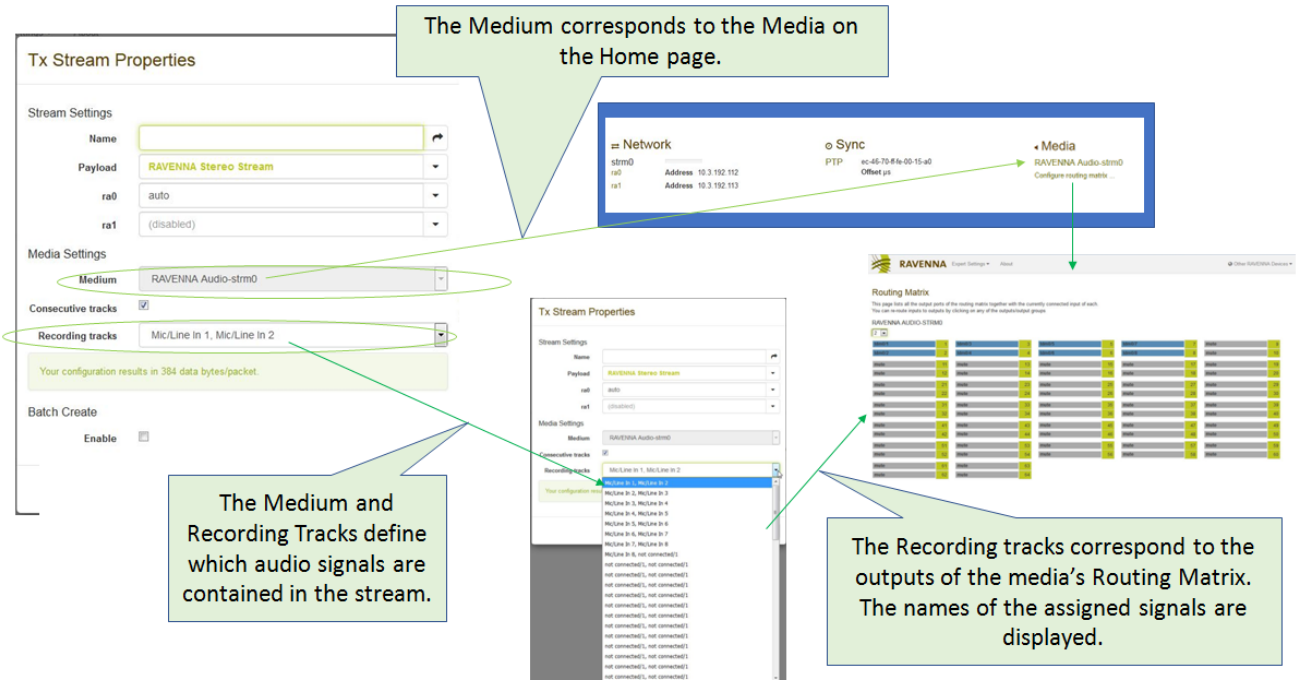
Use this drop-down menu to assign the sending channels for the audio stream.

On an A__line device, the sending channels correspond to the RAVENNA media outputs of the internal routing matrix. So, by assigning the Recording tracks, and then routing local audio to the RAVENNA media outputs via the matrix, you will define the audio contained in the TX stream. For convenience, the names displayed in the drop-down menu show the assigned source signals (e.g. Mic/Line In 1, etc). 64 channels are available.

Batch Create

You can use this function to quickly create a series of similarly-configured TX streams. See Batch Create.

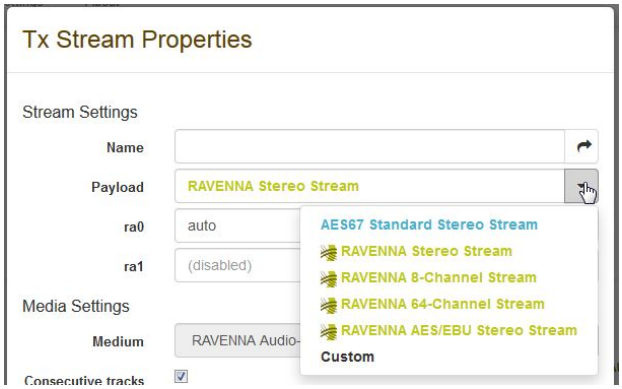
The diagram below illustrates how the TX stream properties relate to other parts of the configuration:



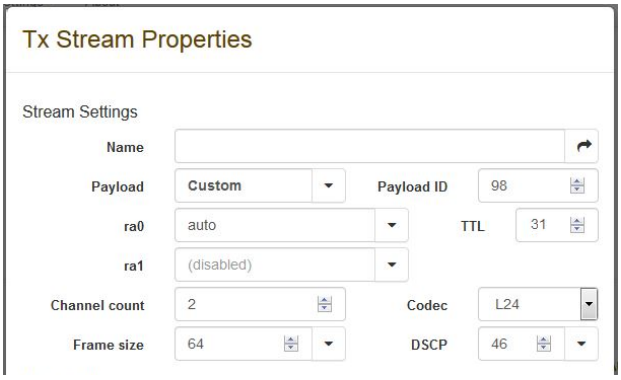
12.11.3 Editing the Payload Parameters

To define the payload, either choose a preset from the drop-down menu, or select **Custom** to edit the parameters manually:

Payload Presets



Custom Payload Parameters



When editing the parameters manually, the payload is determined by three parameters:

- **Frame Size** = the number of samples per channel per network packet. The smaller the frame size, the more often the sender transmits packets. This results in a lower sending latency, but also a higher demand on the network's bandwidth. In Lawo devices, the Frame Size limits the number of TX streams which can be created by each device.
- **Codec** = the encoding method used for the digital audio. For example: **L16** = 16-bit Linear PCM; **L24** = 24-bit Linear PCM; **AM824** = 24-bit Linear PCM + 8-bit metadata, a non-standard format commonly used in AES/EBU.
- **Channel count** = the number of channels to be encoded: mono, stereo, 8-channel, etc.

It is the **Payload** which forms the bulk of the RAVENNA network packet size. In short, the more channels per stream, the bigger the payload.

The other **Custom** parameter fields are:

- **DSCP** - assigns a DSCP (differentiated services code point) or quality class to the stream. The default value = **46**.
- **Payload ID** - describes the format of the transported content. The default value = **98**.
- **TTL** (Time To Leave) - can be used to prevent data packets from circulating indefinitely. The default value = **31**.

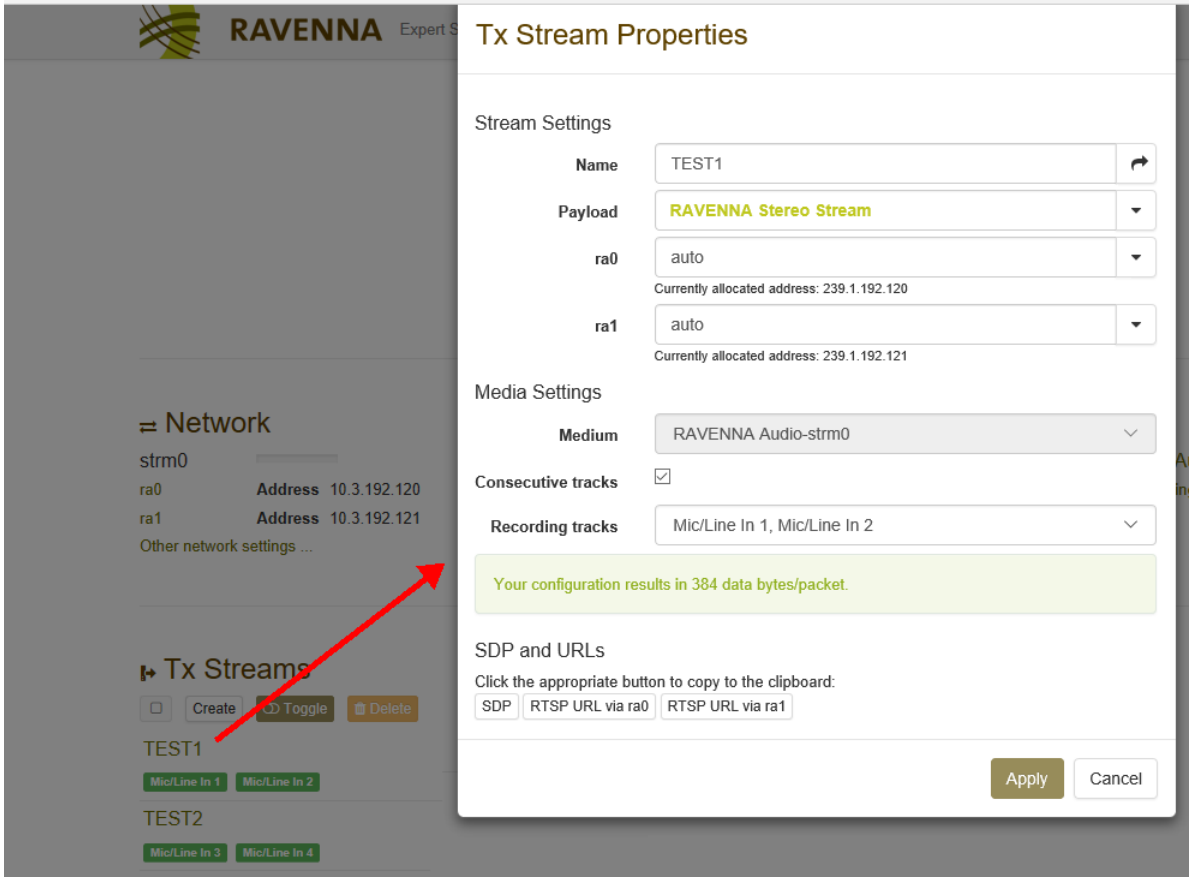
AES67 Compliance

An AES67-compliant stream requires the following parameters:

- **Bits per sample** = 24
- **Frame size** = 48
- **QoS (DSCP)** = 46 (=EF).

The simplest way to create an AES67-compliant stream is to choose the **AES67** preset.

12.11.4 Interrogating & Editing TX Streams



If you click on existing TX stream, then the fields can be edited as described earlier, apart from the following exceptions:

Stream Settings

- **Name** - the name cannot be edited once a stream has been published to the network.
- **ra0** and **ra1** - if you selected **auto** for either of the RAVENNA interfaces, then you will now see the multicast IP address which has been been allocated.

SDP and URLs

These buttons copy the TX Stream's SDP or RTSP URL information to the clipboard.

They are very useful if you need to configure a RX stream on another networked device, as you can open the "RX Stream Properties" and paste in the relevant information. See Copying & Pasting URLs for details.

12.12 RX Streams

12.12.1 Creating a RX Stream

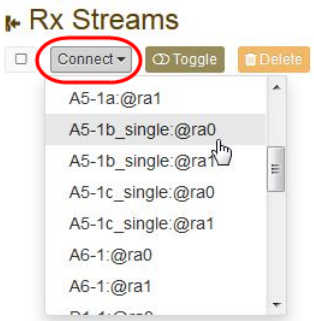
To use audio from the network, you will need to create a RX stream.

1. Click on the **Connect** button and choose a stream name from the drop-down menu - the 'RX Stream Properties' window appears.

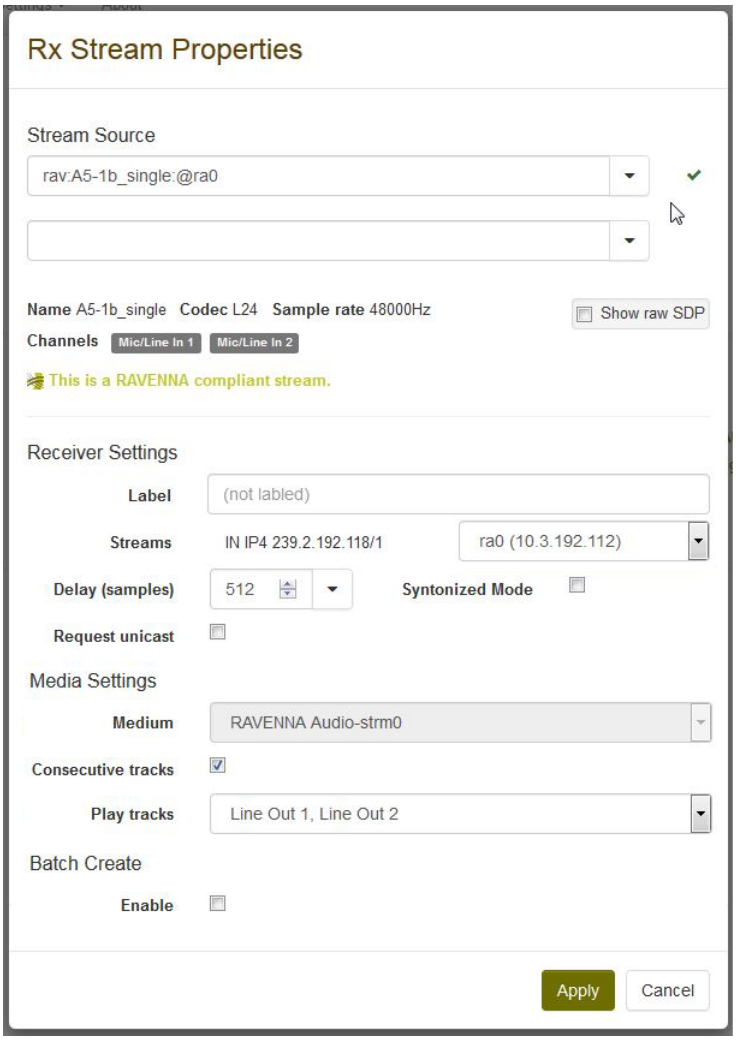
In this instance, the **Stream Source** is completed automatically (from the stream's SDP information), and the **Receiver Settings** are also pre-configured (according to the default settings).

Note that the streams listed in the **Connect** menu are dependent on the TX streams being announced to the network via their SDP information. As this is not always supported by all devices, you can open an empty 'RX Stream Properties' window by selecting the **Using a Custom URL...** option. This method is described later. The **@ra#** suffix indicates on which RAVENNA interface the stream can be received.

Connect Menu



'RX Stream Properties' (pre-configured)



2. Use the fields to check and, if necessary, edit the properties.
3. Once you have completed all of the settings, click **Apply** to create the stream (or **Cancel**).

The stream becomes active and appears at the bottom of the **RX stream** list on the Home page.

12.12.2 RX Stream Properties

Stream Source

This area defines the origin of the stream using its SDP information.

For a non-redundant stream, the SDP should be entered into the upper field with the lower field left blank. For SMPTE 2022-7 compatible streams, it may be necessary to use both fields (as described later). In both cases, providing you have selected a stream from the **Connect** menu, the SDP will be entered automatically. If this is not possible, then see Using a Custom URL.

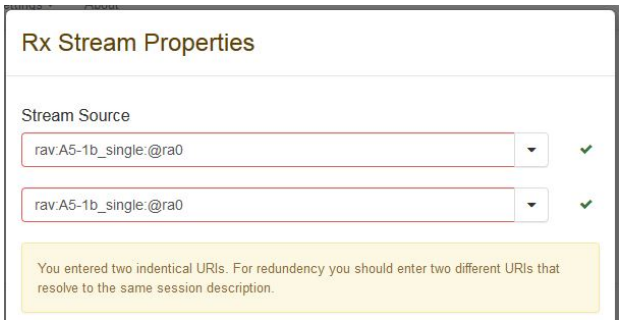
The green tick beside the field indicates that the SDP information is being received correctly. Note that the SDP information can be received via ra0 or ra1. Or, for a 981/61 IO module, ra2 or ra3.

Below the two entry fields is a description of the stream. This comes from the SDP information. Click on **Show raw SDP** to view the SDP data - this can be useful for diagnostics.

Below this you will see any errors or information about the Stream Source configuration. In the example above, there are no errors and we can see that "This is a RAVENNA compliant stream".

Note that it is *NOT* permitted to assign the same SDP or two non-redundant SDPs. In these instances, an error message will appear, and will need to remove the assignment to the second Stream Source field to continue:

Incorrect Configuration: Duplicated SDPs



Incorrect Configuration: 2 x Non-redundant SDPs

For more information on configuring redundant streams, see Creating SMPTE 2022-7 Compatible Streams.

Receiver Settings

- **Label**

This is a local label which is optional. If defined, it is used to label the RX stream on the Home page

- **Streams**

Here you will see the IP address of the stream's source, followed by a menu where you can choose the receiver's RAVENNA interface. By default, the first interface is always pre-configured (e.g. **ra0**). Click to change the interface or unsubscribe from the stream:

If the SDP entered in the Stream Source field contains two SMPTE 2022-7 compatible streams, then a second line for the redundant stream's IP address and receiving interface are displayed. In this instance, assign a different interface to each stream, OR switch one of the interfaces to **not subscribed** to receive the stream without redundancy.

On all Lawo devices, you can use either interface of a streaming pair to receive single streams from the network.

➢ **Delay**

This value adjusts the amount of delay applied, in samples, before audio is played out. In other words, it defines the size of the receiving buffer. It should be large enough to deal with delays in the network such as sending latency and jitter. The **Delay** should should always be larger than the frame size specified by the sender. As a general rule, set the **Delay** to 2 x the sender's **Frame Size**. If you experience drop-outs during playback, then increase the **Delay** time.

➢ **Syntonized Mode**

By default this option is disabled, which means that the receiver is running in synchronized mode. Tick the option to enable syntonized mode, which means that the stream will be free running.

Syntonized mode should be enabled if the clock signal is missing from the SDP information, or if you have a different clock source selected at the sender and receiver.

> Syntonized mode should always be enabled for connections between Lawo audio and V__line devices.
>
> Syntonized mode should be disabled for AES67 or SMPTE 2110-30 compliance.
>
> Any receiving devices which do not support syntonised streaming must connect to the same 981/61 RAVENNA IO module that is transmitting the PTP signal.

➢ **Request unicast**

In the current release, this option should be left disabled as RAVENNA streaming supports multicast addressing only, and not unicast.

Media Settings

➢ **Medium**

This field defines the RAVENNA media which will be used to receive the stream. On some devices, only one media is available and, therefore, there is nothing to select. If your device supports more than one media, then choose an option from the drop-down menu. For example, for a 981/61 IO module, you can choose either **RAVENNA Audio-strm0** (ra0 + ra1) or **RAVENNA Audio-strm1** (ra2 + ra3).

➢ **Consecutive tracks**

Tick this check box to assign consecutive **Play tracks**.

➢ **Play tracks**

Use this drop-down menu to assign the receiving channels for the audio stream.

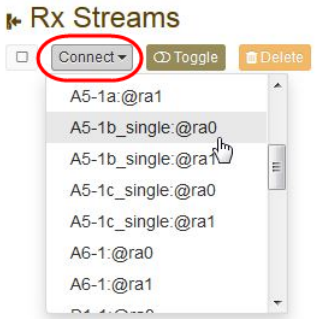
On an A__line device, the receiving channels correspond to the RAVENNA media inputs in the internal routing matrix. So, by assigning the Play tracks, and then assigning the RAVENNA media inputs to local TDM (or MADI) outputs via the matrix, you can play out the audio contained in the RX stream. For convenience, the names displayed in the drop-down menu show the assigned destinations (e.g. Line Out 1, etc). 64 channels are available.

Batch Create

You can use this function to quickly create a series of similarly-configured RX streams. See Batch Create.

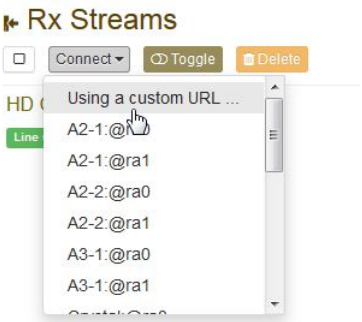
12.12.3 Using a Custom URL

Whenever a TX stream is created, it's SDP (Session Description Protocol) information is announced to the rest of the network using RTSP / mDNS protocols. This means that providing the receiving device uses mDNS to collect SDP information AND can "see" the sending node, the stream will automatically be displayed in the RX Stream **Connect** menu:

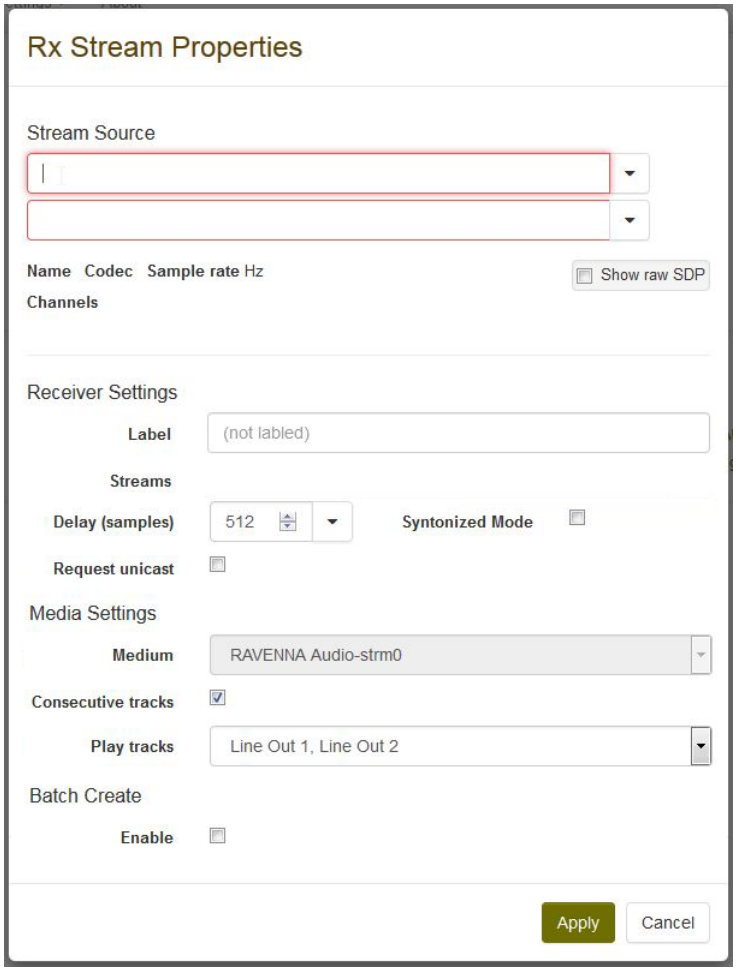


If the receiving device does not use mDNS or cannot "see" the sending device, then the automatic listing of the stream will not happen. In this instance, click on the **Connect** button and choose **Using a Custom URL...** from the drop-down menu - an empty 'RX Stream Properties' window appears:

Connect Menu



'RX Stream Properties'

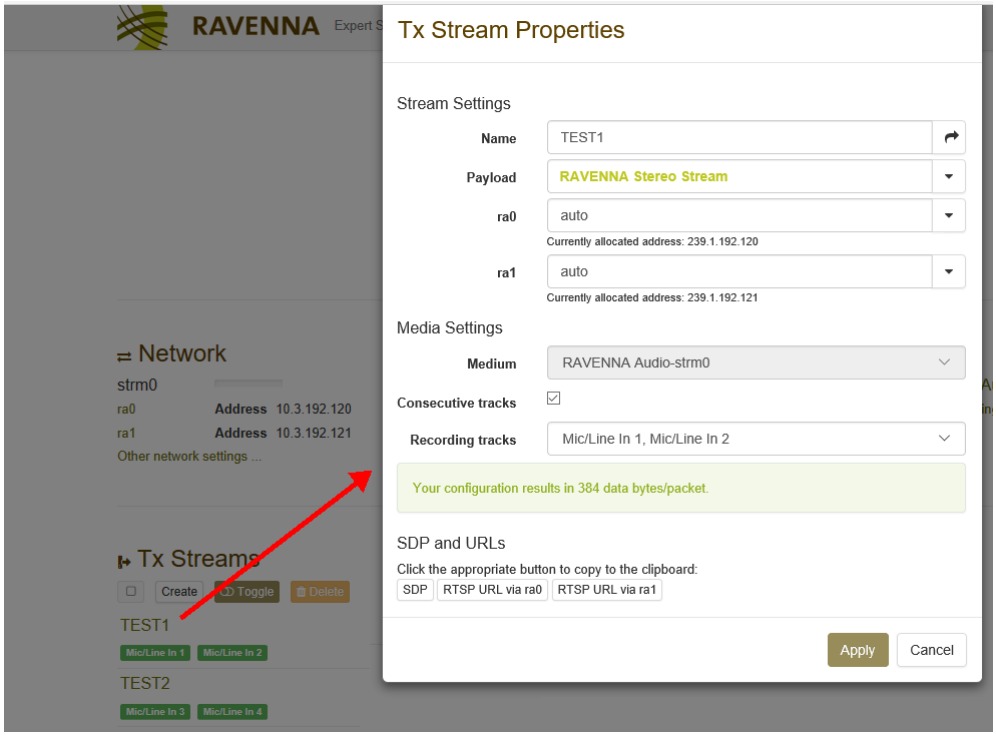


The simplest way to enter the SDP information is to copy and paste the SDP or RTSP URLs from the sending device's Web UI.

12.12.4 Copying & Pasting SDP / RTSP URLs

To copy and paste the SDP information from a sending device:

1. Open a Web UI connection to the sending device, and click on the TX stream:



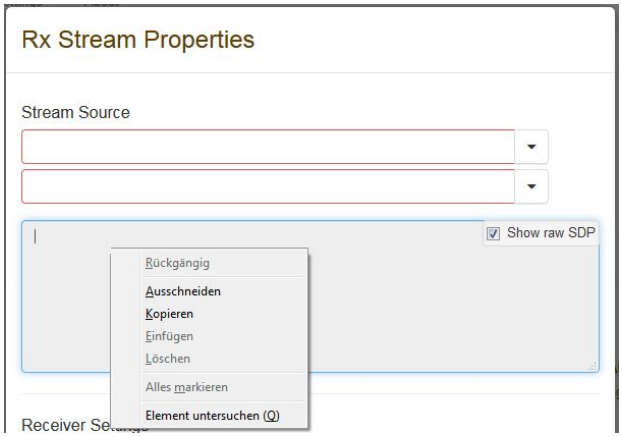
2. At the bottom of the window, click on the **SDP** button to copy the stream's SDP information to the clipboard.

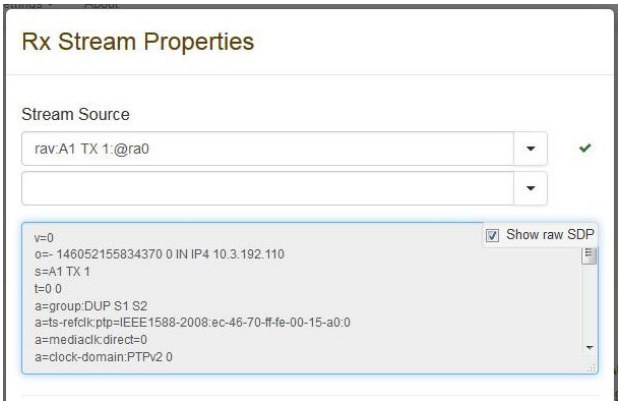
If the stream is redundant, then information about both of the paths is contained in the same SDP.

3. Now open a Web UI connection to the receiving device, and click on the RX stream to open its properties.

4. Select **Show raw SDP** and then right-click anywhere inside the SDP area to paste the contents of the clipboard (or press CTRL + V).

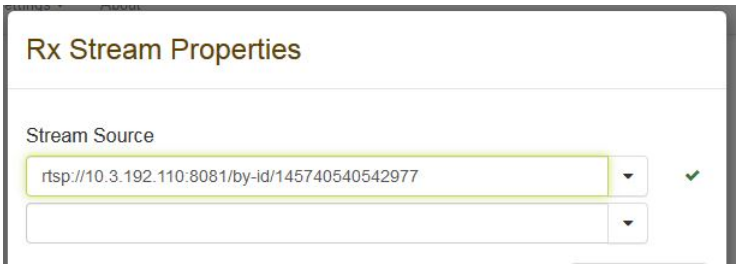
The **Stream Source** fields update according to the SDP information:





A similar method can be used to copy and paste the RTSP URLs:

1. On the sending device, use the **RTSP URL** buttons in the 'TX Stream Properties' window to copy the address for the sending interface.
2. Then on the receiving device, paste the clipboard contents into the **Stream Source** field:



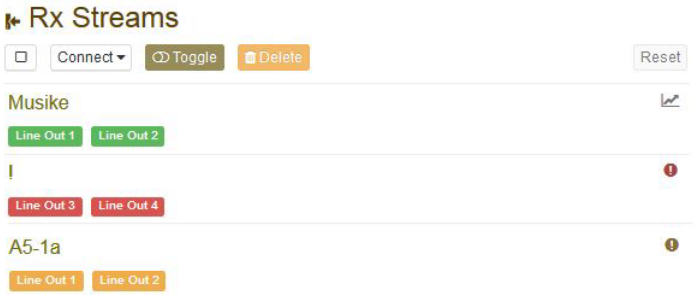
If the TX stream is redundant, copy and paste the URL for the each of the sending interfaces separately - enter the ra0 URL into the upper field and the ra1 URL into the lower field.

The receiving device will now use the RTSP URLs to request the SDP information from the sender.

In both cases, once the 'Stream Source' is defined, the 'Receiver Settings' and 'Media Settings' can be completed in the usual manner.

12.12.5 The Statistics Window

On the Home page, each RX stream name is color-coded to indicate the health of the stream:

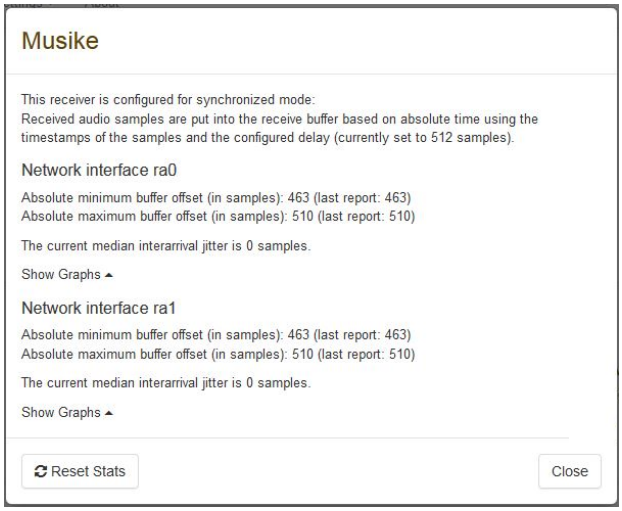


- **Green** = correct operation.
- **Red** = there is either no connection or no data.
- **Orange** = the stream is being received but there are drop-outs in the data.

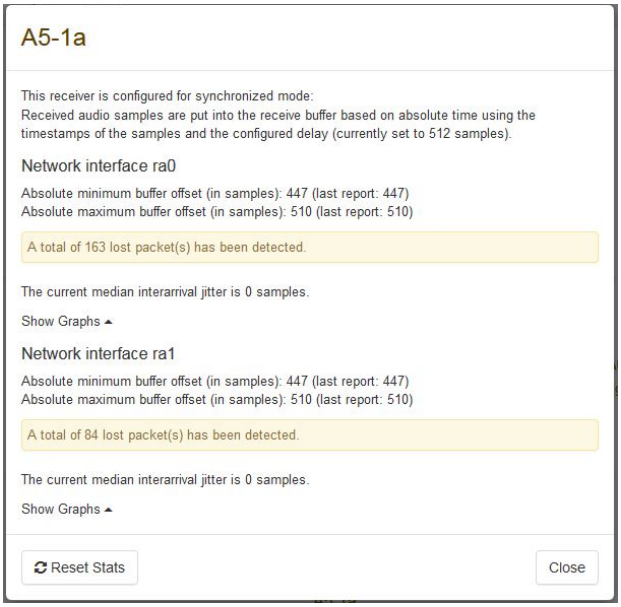
You will also see an icon on the right of each RX stream which reflects the same statuses.

1. Click on the icon to open the Statistics window - this provides more information about the stream.

Healthy RX Stream (green)

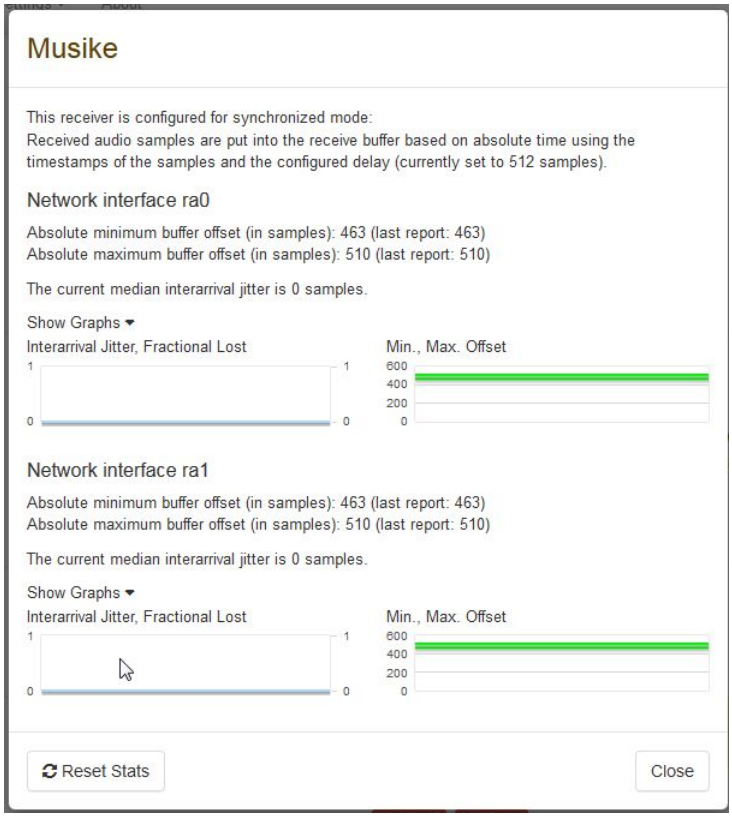


Unhealthy RX Stream (orange)



2. For a healthy stream (green) or one experiencing drop-outs (orange) you can click on **Show Graphs** for further details:

Healthy RX Stream (Show Graphs)



- **Fractional Lost Packets** - the number of lost packets over the last few seconds.
- **Min** & **Max Offset** - information about the receive buffer in samples: on the left is the current value realized every few seconds; on the right is the peak value reached since the last reset.

Note that the **Min Offset** should never reach zero, as this would mean that the buffer was empty. Typically the **Min Offset** should be close to the configured Delay value. The **Max Offset** is dependent on more parameters; critical is the possible maximum buffer - this is 1023 for the 981/61, and 4095 for the 947/21 or 947/22 (DALLIS Master Board).

3. Click on **Reset Stats** to clear the statistics history for the selected stream.

4. Return to the Home page and click on the **Reset** button to clear the statistics history for all RX streams.

12.13 Creating SMPTE 2022-7 Compatible Streams

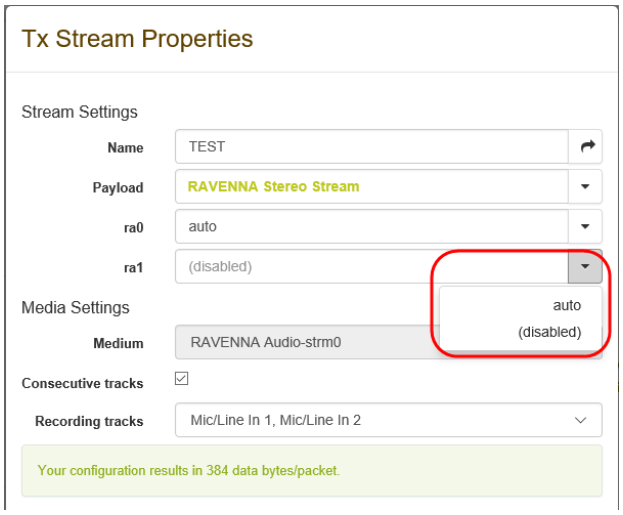
To support SMPTE 2022-7 (streaming redundancy), a stream must be transmitted and received via two separate network paths.

For an A__line device, the TX or RX interfaces are ETHERNET A (ra0) + ETHERNET B (ra1).

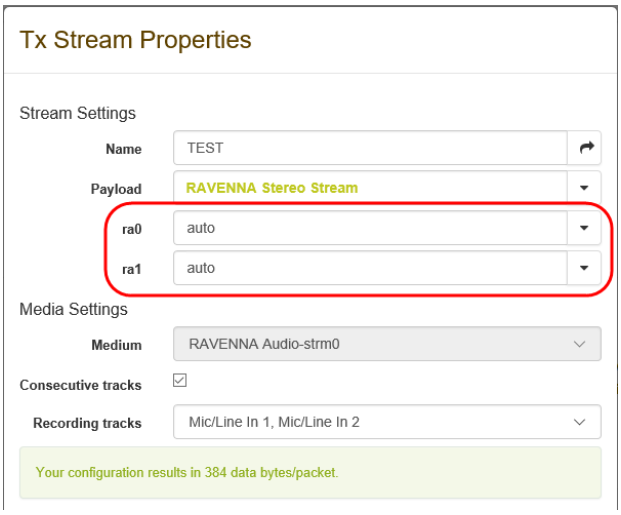
TX Stream Properties

First, open a RAVENNA Web UI connection to the sending device and make sure that the 'TX Stream Properties' are configured to use both RAVENNA interfaces. This means assigning a multicast IP address to both of the **ra0** and **ra1** fields:

ra1 - define multicast IP address



Both ra0 and ra1 should be set to auto



All other properties should be configured as for a non-redundant stream, see TX Stream Properties.

Once you click **Apply**, the TX stream will be duplicated and published separately via both interfaces. Note that information about both streams (main and redundant) is contained in the same SDP information.

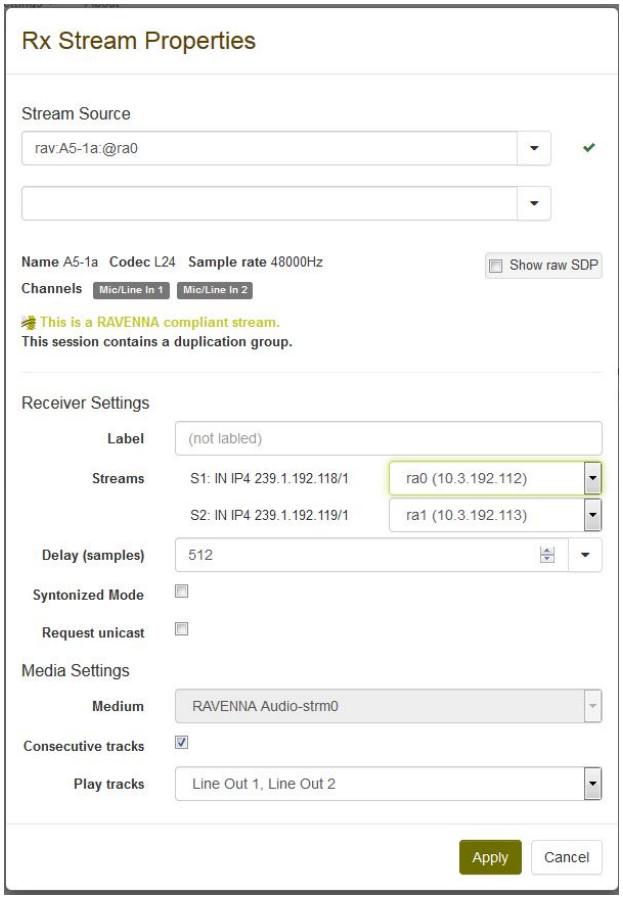
RX Stream Properties: Pre-configured

Now open a RAVENNA Web UI connection to the receiving device and, if possible, select the TX stream from the **Connect** menu - the 'RX Stream Properties' window opens.

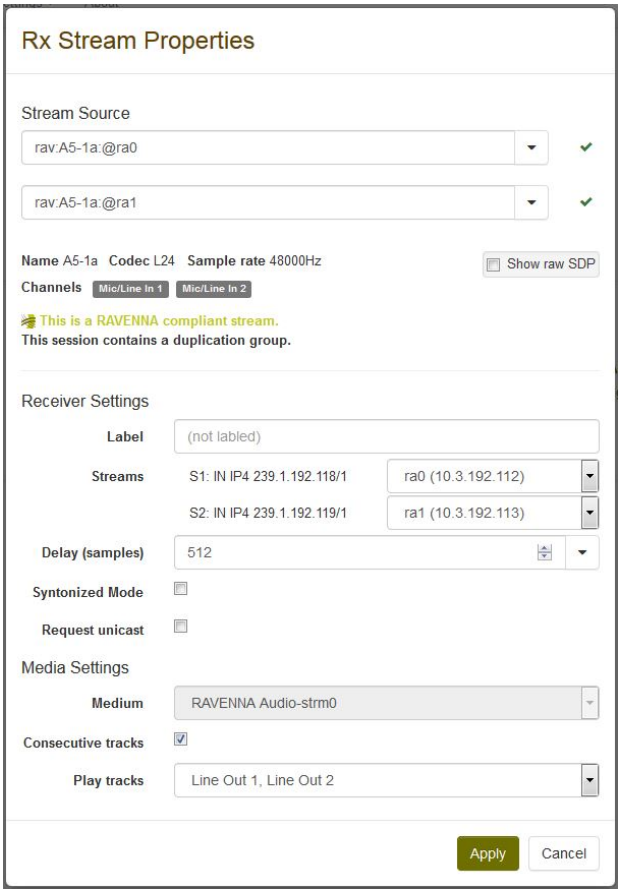
The **Stream Source** will be completed automatically from the stream's SDP information, and the **Receiver Settings** will be pre-configured according to the default settings.

If you need to define two separate paths for the SDP information, then you can enter the redundant stream's SDP path into the lower Stream Source field.

'RX Stream Properties' (single SDP)



'RX Stream Properties' (main & redundant SDP)



The only other difference from a non-redundant stream is that the **Streams** entry, under 'Receiver Settings', shows two lines - one for the main and one for the redundant source. By default, these are assigned to the media's two RAVENNA interfaces (ra0 and ra1), and so there is nothing further to do. If you wish to receive the stream without redundancy, then switch one of the interfaces to **not subscribed**.

All other properties should be configured as for a non-redundant stream, see RX Stream Properties.

When a RX stream is configured for redundancy, you will see the following message in the information area: "This session contains a duplication group".

Once you click **Apply**, the RX stream becomes active and appears at the bottom of the **RX stream** list on the Home page.

The receiver will now combine the data arriving at both of the interfaces to reconstruct the original stream.

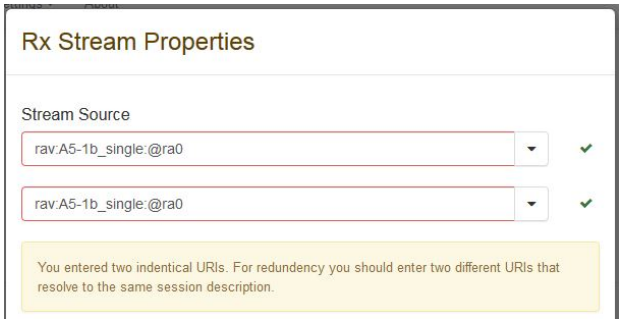
RX Stream Properties: Using a Custom URL

If the TX stream does not appear in the **Connect** menu, then you will need to select Using a Custom URL and define the **Stream Source** fields manually. As before, the simplest way to do this is to copy and paste the SDP or RTSP URLs from the sending device.

Note that the same SDP will announce both streams. If you need to use RTSP URLs, then take care to copy and paste each one separately - enter the ra0 URL into the upper field and the ra1 URL into the lower field.

If you make a mistake, then an error message will appear:

Incorrect Configuration: Duplicated SDPs



Incorrect Configuration: 2 x Non-redundant SDPs

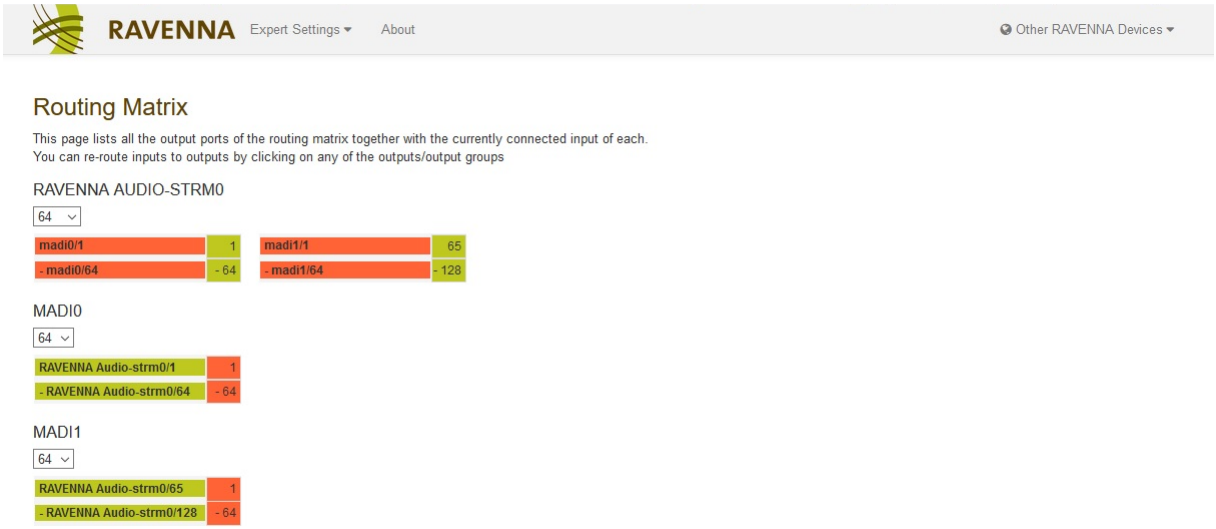
Once the SDP is entered, the 'Receiver Settings' can be edited as described on the previous page.

12.14 The Routing Matrix

The Routing Matrix maps the device's local audio signals to and from the RAVENNA media. Together with the Recording track assignments (for TX streams) and Play track assignments (for RX streams), this determines the audio path to and from the network.

The matrix is organised into separate sections for each RAVENNA media and MADI port. Note that MADI0 and MADI1 on the GUI relate to the physical ports 1 and 2 on the front panel. In each case, the drop-down menus set the multi-channel view. The boxes then represent the output(s), while the color and text inside the box represents their source: orange = MADI (local signals); green = RAVENNA media channels; grey = silence (mute).

For each RAVENNA media, there are 128 inputs and 128 outputs. For each MADI port, there are 64 inputs and 64 outputs. In the example below, the first 64 **RAVENNA AUDIO-STRM0** outputs are fed from MADI0, while the second 64 outputs are fed from MADI1. Similarly, the MADI0 outputs are fed from RAVENNA inputs 1 to 64 and MADI1 outputs from RAVENNA inputs 65 to 128:



To change the matrix allocations:

1. First, click in the drop-down menu to select the multi-channel view.

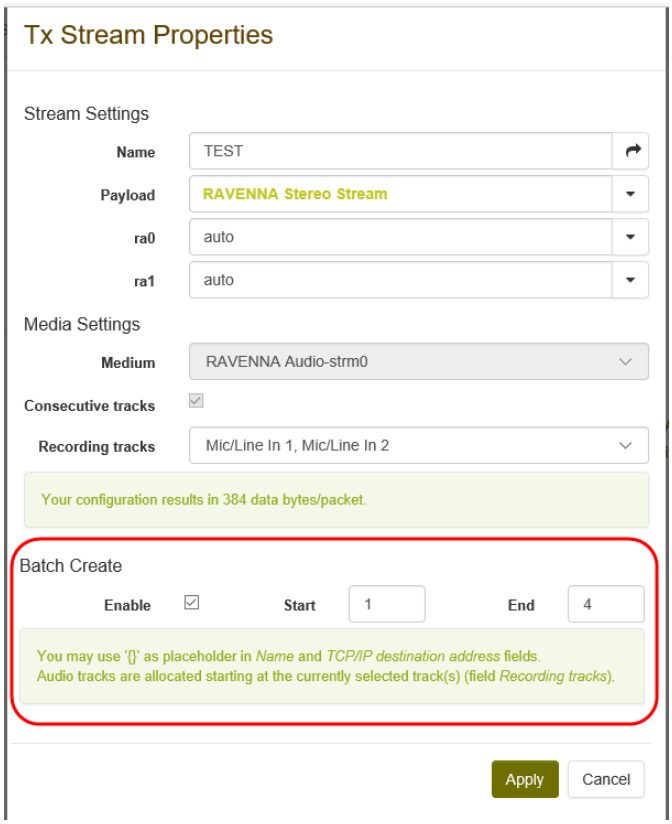
For example, when assigning the MADI outputs, **64** is a good view to use so that the outputs can be assigned as a multi-channel block.

2. Then click on the output block you wish to assign (e.g. on outputs 1 to 64) - the available inputs appear.
3. Select one of the Input options (e.g. a different set of RAVENNA media channels) - the inputs are assigned to the output block, and the output block's color-coding and text updates accordingly.
4. Return to the Home page by clicking on the RAVENNA icon.

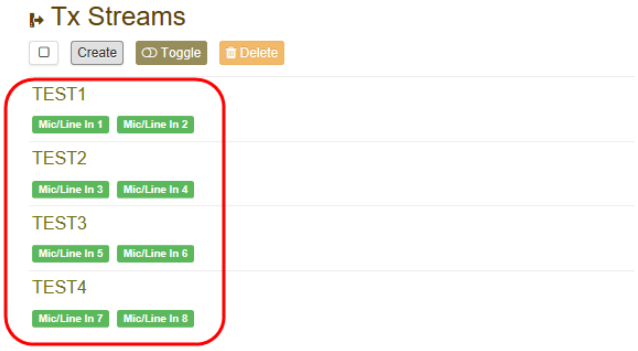
12.15 Batch Create

The **Batch Create** function can be used to quickly create a series of similarly-configured TX or RX streams. For example:

1. Use the Create button to open the 'TX Stream Properties' window and enter the parameters required for the first stream.
2. Under 'Batch Create' tick the **Enable** box.
3. Enter a **Start** and **End** suffix to apply to the stream **Name**.



4. Click **Apply** - a batch of TX streams are added to the Home page:



All properties are applied identically apart from the **Name** which takes the Start and End suffix, and the **Recording tracks** which increment automatically across the batch of streams.

The example above shows the set up for four identical RAVENNA Stereo Streams named "TEST1" to "TEST4", where TEST1 uses Mic/Line In 1&2; TEST2 uses Mic/Line In 3&4; and so on.

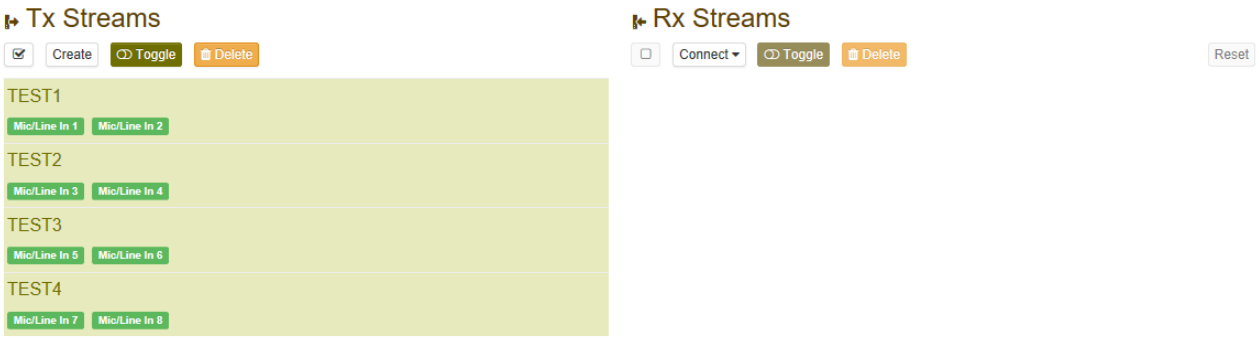
The same principles can be applied to RX streams, but this time it is the stream **Label** which takes the **Start** and **End** suffix, and the **Play tracks** which are incrementally assigned.

12.16 Selecting Streams

You will need to select a stream to delete it or make it active or inactive via the Toggle button. In each case, the following methods can be applied to either TX or RX streams:

1. Click on an individual entry to select (or deselect) the stream - the complete line is highlighted whenever a stream is selected.
2. Press and hold SHIFT to select a consecutive range of streams.
3. Press and hold CTRL to select non-consecutive streams.
4. Click on the "Select All" icon to select (or deselect) all streams.

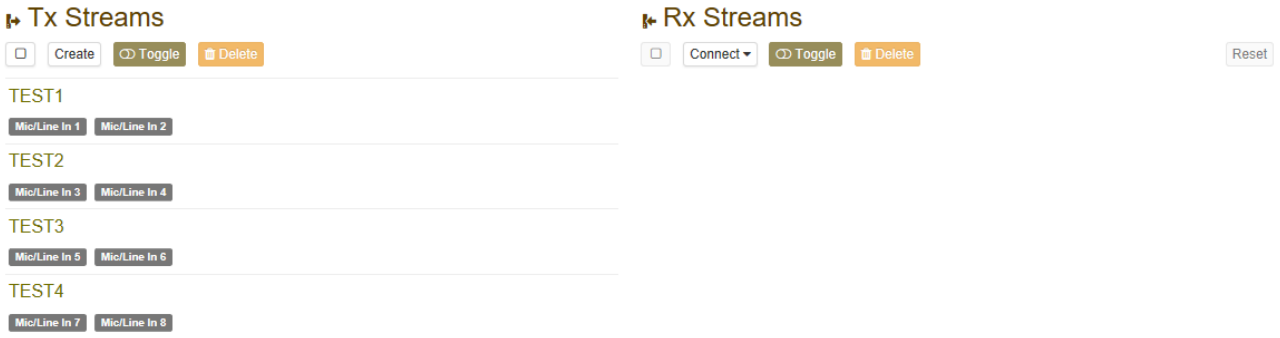
TX Streams - Select All active



12.17 Using the Toggle Function

The **Toggle** button can be used to make TX or RX streams active or inactive. First, select the streams you wish to toggle, and then click on **Toggle** to apply the change.

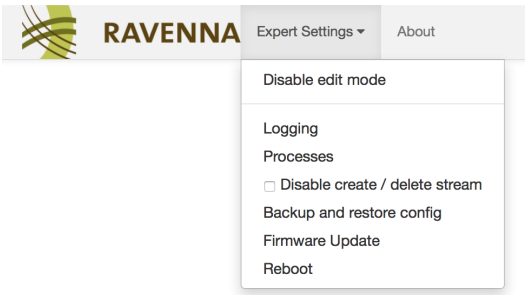
For TX Streams, the names will change from green (active) to grey (inactive):



For RX Streams, the names will change from green, orange or red (active) to grey (inactive). The green, orange and red colors indicate the health of the stream.

12.18 Expert Settings Menu

Once expert mode is enabled, you can click on **Expert Settings** to reveal the following options:



- **Disable edit mode**

Returns to the normal mode of operation. This is ideal if you wish to interrogate the configuration but do not need to edit any settings.

- **Logging**

Select this option to download the RAVENNA log file for the device. The log file can be used for diagnostic purposes.

- **Processes**

Select this option to download the RAVENNA process statuses, which can also be useful for diagnostics.

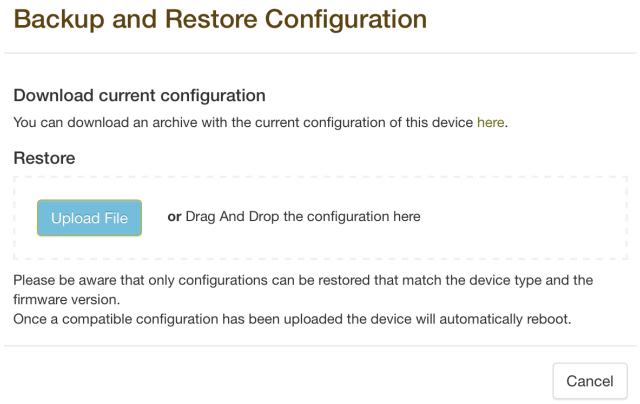
- **Disable create/delete streams**

Enable this option if you wish to edit the configuration in expert mode, but prevent the creation or deletion of TX or RX streams. This is recommended if you are using an external control system, such as VSM, to control the streaming connections.

- **Backup and restore config**

This tool will backup and restore the complete RAVENNA configuration. It is ideal if you need to exchange the device.

1. Select **Backup and restore config** from the **Expert Settings** menu - the following window appears:



2. Click on the link to download the current configuration as a "config-backup.tar.gz" file.
3. Or, click on **Upload File** and follow the on-screen instructions to perform a restore. Once the upload is complete, the device will automatically reboot (which means that you will lose your browser connection).
4. Once the reboot is complete, re-open the RAVENNA Web UI to check the new settings.

When you restore a configuration, you will override all of the device's RAVENNA settings. Therefore, make sure that you are connected to the correct unit before performing a restore!

➢ **Firmware Update**

This tool can be used to upgrade or downgrade the Image version installed on the device.

To check the **Image version**, select **About** from the headline at the top of the Home page to open the 'About' dialog box. To perform an update:

1. Download the update file onto your computer. All releases are available from the **Downloads** area at www.lawo.com (after **Login**).

Please check that the downloaded file ends with **.tar.gz**

Some browsers, such as Safari, tend to unzip the file automatically after download which makes the file invalid. If this is the case, choose "Download as..." in your browser to bypass the automatic unzip function.

2. Read the release notes supplied with the update file.

If settings will be lost as a result of an update, it is strongly recommended that you export your configuration and/or take screenshots so that the current settings can be re-instated once the upgrade/downgrade is complete. Details of which settings will be affected are included in the release notes.

3. Select **Expert Settings** -> **Firmware update**.
4. Select the update file (**.tar.gz**) and then **Start Update**.

After a successful update, the device will automatically reboot (which means that you will lose your browser connection).

5. Once the reboot is complete, re-open the RAVENNA Web UI to check the new **Image version**.

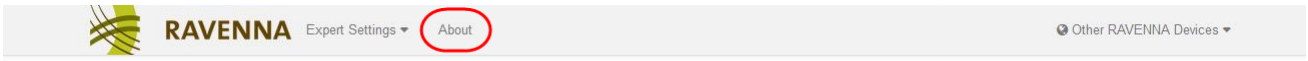
➢ **Reboot**

Select this option to reboot the RAVENNA IO device.

All streaming will cease during the reboot. Once the reboot is complete, all streaming connections will be re-instated according to the RAVENNA configuration stored locally on the device.

12.19 About

Select **About** from the headline at the top of the Home page:



The 'About' dialog box opens.

Under **Version**, the **Image version** describes the RAVENNA release installed on the device. It is important that all nodes on the network are running compatible Image versions, so if the number is not correct, you will need to update the device.

The other version fields describe the:

- **Image type** - the type of RAVENNA interface.
- **RAVENNA version** - the RAVENNA Web UI (Butler) release, which is a subset of the **Image version** release.

Select **Close** to close the information window and return to the Home page.

13. Software Tools & Diagnostics

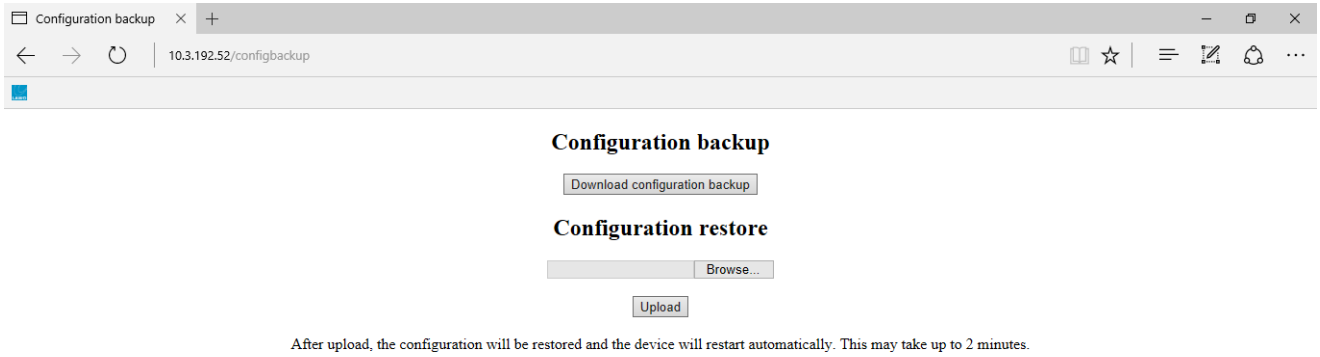
13.1 Configuration Backup & Restore

This tool will backup and restore the complete RAVENNA configuration. It is ideal if you need to exchange a device. Note that this function is identical to the **Backup and restore config** function available from the Expert Settings menu of the RAVENNA Web UI.

➢ **To create a backup:**

1. Open the Landing page in service mode, select **Configuration Backup & Restore** and then click on the graphical preview.

The Configuration backup & restore page opens in a new browser tab:



2. Select **Download configuration backup** - you are asked what to do with the "config-backup.tar.gz" file.
3. Select either **Save** or **Save As** to save the file locally onto your computer.

Once the download is complete, a confirmation message appears.

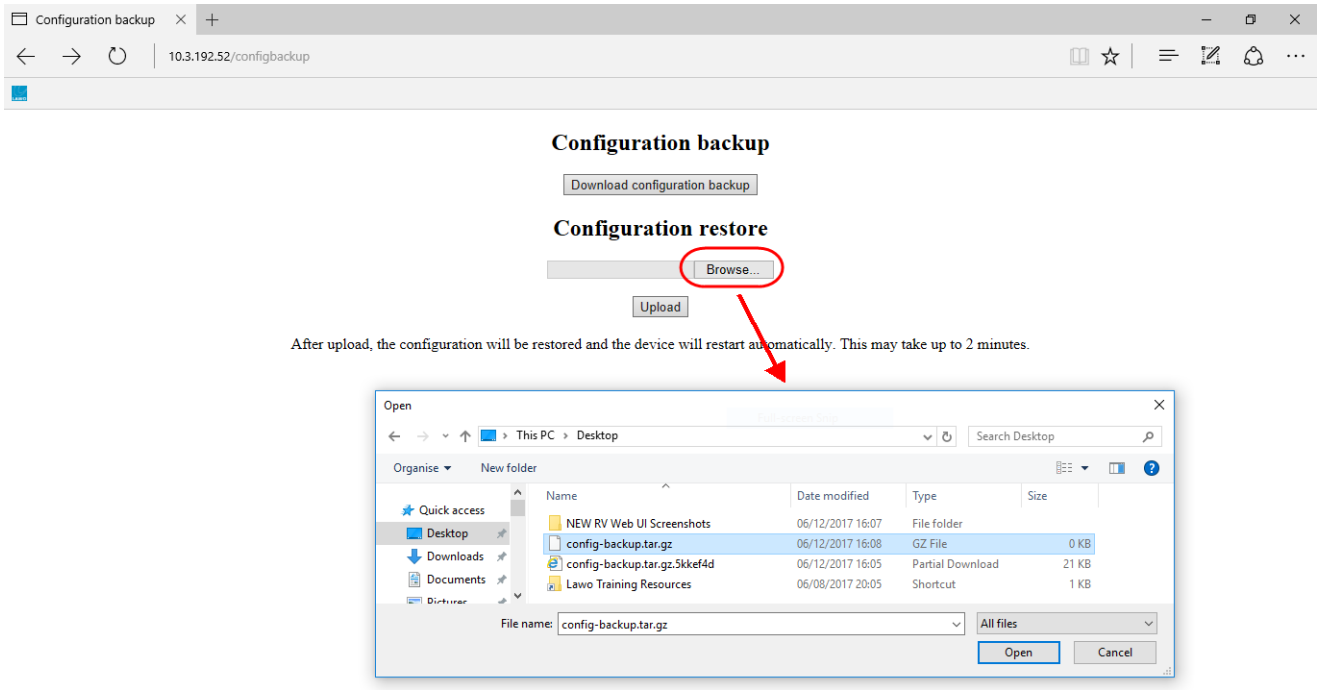
You can now replace the existing unit.

➢ **To restore a configuration file:**

1. Open the Configuration backup & restore home page as before, but this time on the replacement unit.

When you restore a configuration, you will override all of the device's RAVENNA settings. Therefore, make sure that you are connected to the correct unit before performing a restore!

2. Click on the **Browse** button, select the backup file and then click on **Open**.



The selected file appears in the **Configuration restore** file selection field.

3. Select **Upload** to begin the restore.

Once the upload is complete, the device will automatically restart.

4. Re-open the Landing page to check the restored settings.

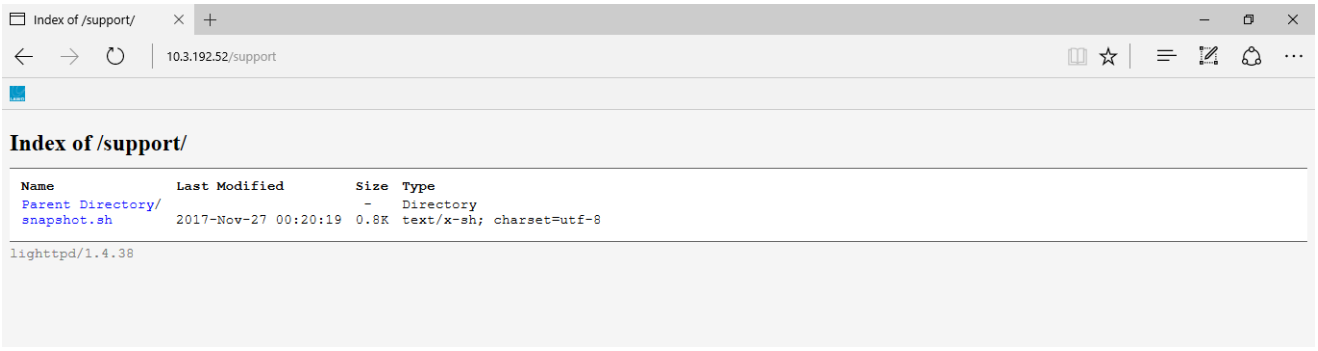
13.2 Service Support

This tool will download a current snapshot of the device settings into a "snaphot.sh" file. The file can be useful for Lawo support when diagnosing a problem.

➢ **To download the snapshot file:**

1. Open the Landing page in service mode, select **Service Support** and then click on the graphical preview.

The Service Support page opens in a new browser tab:



2. Click on the **snapshot.sh** link - you are asked what to do with the file.
3. Select either **Save** or **Save As** to save the file locally onto your computer.

Once the download is complete, a confirmation message appears.

You can now send the file to support@lawo.com along with a short description of the problem.

13.3 Log File Entries & Syslog Server

The following messages are printed into a log file which is stored locally on the device. In each case, there will be an entry for "error" and an entry for "OK again".

- PSU1/2 status
- Fan status
- RAVENNA connection status (RAVENNA Link and RAVENNA Net)
- PLL lock status
- Status of control/streaming connection (RAVENNA Link only)

Note that changes to the MADI port status are not logged.

Configuring the Syslog Server

The entries can be sent in parallel to a syslog server, and the configuration is made by opening a telnet session to the device.

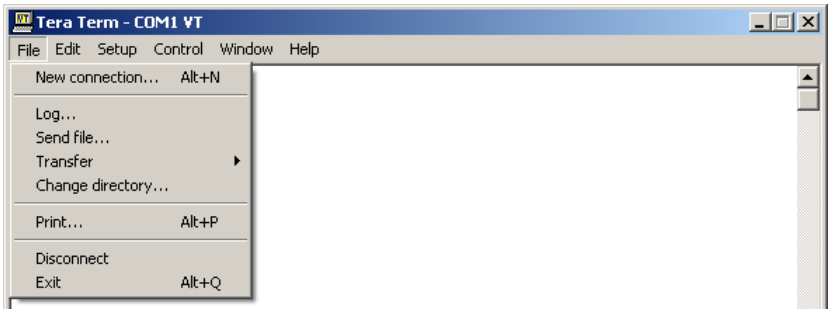
Once you have logged in, the following commands are available:

Telnet Command	Description
`settings syslog show`	shows the syslog configuration
`settings syslog show <logsize/server>`	shows the specified syslog parameter
`settings syslog set/save logsize <max size in MB>`	sets the syslog file size
`settings syslog set/save server <ip[:port]/no>`	enables remote logging for the syslog server
`settings syslog load`	loads/reloads the syslog configuration

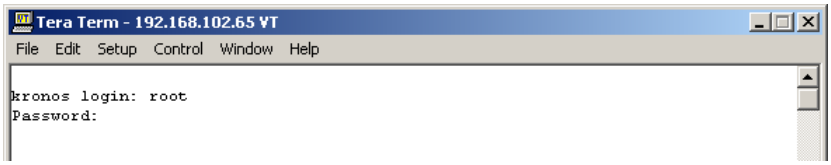
13.4 Opening a Telnet Session

To open a telnet session:

1. Install a telnet client on your computer. We recommend using **Tera Term Pro Web 3.1.3**, a free telnet client for Windows, which can be downloaded from www.ayera.com/teraterm/
2. Connect your computer to the device and configure the TCP/IP settings as described earlier.
3. Open the **Tera Term Pro** Telnet client.
4. Select **TCP/IP** from the **Setup** menu, and add the IP address of your device to the host list.
5. Now open a new Telnet connection using **File -> New connection**:



6. Choose the TCP/IP address of your device.
7. When prompted, enter the login name: **root** and the password: **hong**



The session opens, and you will see the command prompt for the control system.

8. Now follow the specific instructions for the task you wish to perform.

Adjusting parameters via telnet will make low level changes to your system. Therefore, these procedures should *only* be performed by a fully trained member of staff.

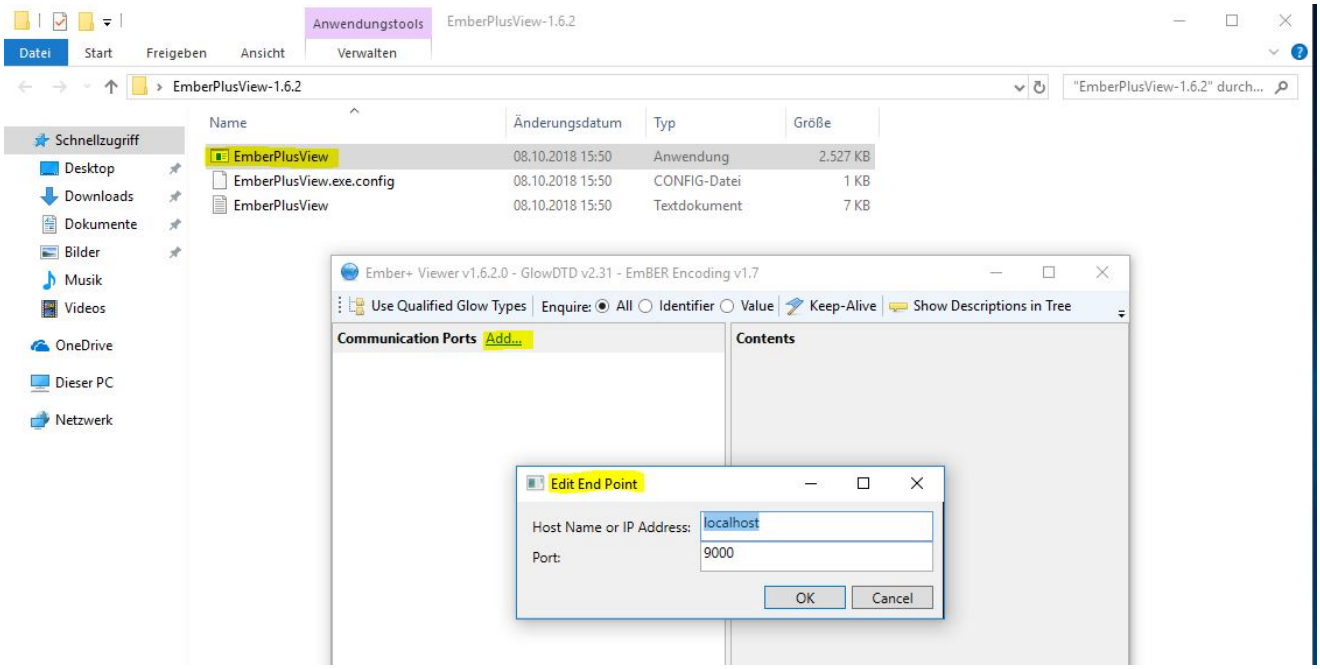
13.5 Ember+ Tree Viewer

All parameters within the A__madi4 are accessible via Ember+. This allows an external control system, such as a Lawo console or VSM, to remotely control or respond to parameter changes within the device. From Image Version 10.0.0, this includes the internal Routing Matrix which maps the device's local IO signals to and from the RAVENNA streams.

Ember+ is a non-proprietery TCP/IP protocol supported by a wide range of Lawo products. More details about the Ember+ protocol can be found at https://github.com/Lawo/ember-plus/wiki.

The Ember+ Tree Viewer can be used to check the status of Ember+ parameters and/or switch a parameter manually within the A__madi4. This can be useful when configuring and testing an Ember+ controlled device. To use the application:

1. Download the ".bz2" or ".xz" archive from the location https://github.com/Lawo/ember-plus/releases and unzip it.
2. Navigate to the folder "tools" and unzip the file "EmberPlusView-X.X.X.zip"
3. Double-click on the file "EmberPlusView.exe" to start the Ember+ Tree Viewer.
4. Once the application is open, click on "Add.." to add a new communication port:



5. Enter the IP Address and Port number of your device.

You can use the IP address of any streaming port. So, for example, on an A__madi4, this can be the IP address of either ETHERNET A (ra0) or ETHERNET B (ra1).

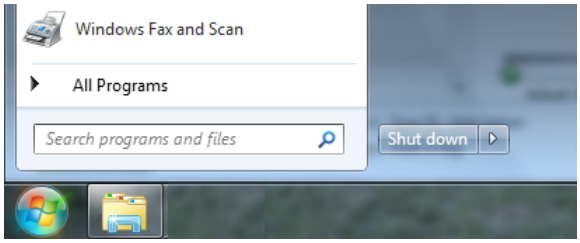
6. Select **OK** to add the device to the Ember+ Viewer - the virtual status LED will turn green once the tree has been fully read.
7. You can now open the branches of the tree and select a parameter to interrogate or alter its status.

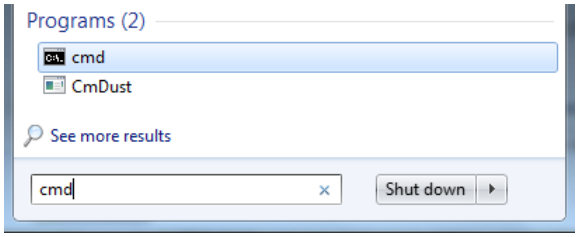
13.6 Running a PING Test

The PING command is a built-in Windows and Mac function, that allows you to test whether you have a valid network connection to and from any networked device.

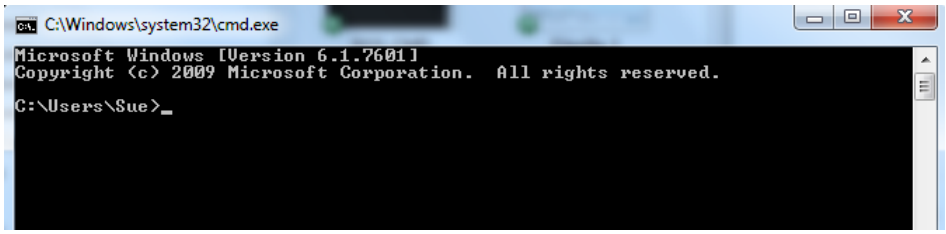
1. Make sure that your computer is connected to the correct network port, and that you have configured the TCP/IP settings of your computer's network interface card.

2. On a Windows 7 PC, type **cmd** into the "*Search programs and files*" field under the **Start** menu and press Enter.





This opens the DOS command prompt window:



Alternatively, on a Mac, open the **Terminal** program (found in the **Applications** -> **Utilities** folder).

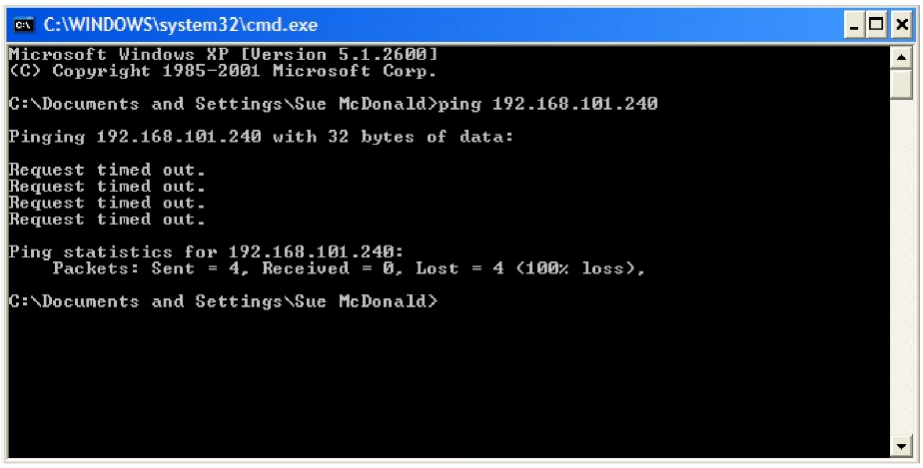
3. On both platforms, perform the ping test as follows:

Type **ping xxx.xxx.xxx.xx** (where **xx..** is the IP address of the device you are trying to connect to) and press Enter.

Your computer will now try to establish communication...

➢ **Ping Test Fail**

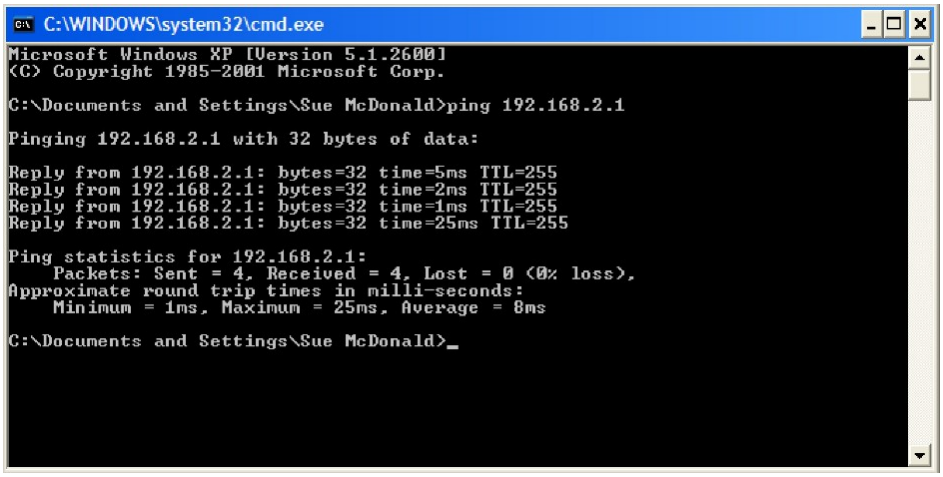
If the ping test fails, then the request will time out, and you will not receive any successful packets:



There is something wrong with your network configuration, so check the network connections, and TCP/IP settings again. Or contact your network administrator.

➢ **Ping Test Success**

If the ping test is successful, then the result will show that the Sent packets have been successfully Received:



This confirms that the network communication is working. If you still cannot connect, then something on your computer is blocking the network connection. Try disabling any firewall and/or antivirus software.

14. Glossary

1000 Base-T
1000 Base-SX
1000 Base-LX

Used in data networks to describe the Ethernet standard. The standard defines the network speed, cable type and length.

For example, 1000 Base-T is a standard for Gigabit Ethernet over copper wiring. The 1000 refers to the network speed (1000 Mbit/s), while the Base-T refers to the cable type and length of connection (e.g. twisted pair CAT5, CAT5e, CAT6, CAT7, up to 100m).

Other common Ethernet standards include 100 Base-TX (Fast Ethernet, twisted pair CAT 5, up to 100m), 1000 Base-SX (Gigabit Ethernet, multi-mode fibre, 220-550 metres), 1000 Base-LX10 (Gigabit Ethernet, single-mode fibre, up to 10km), etc.

AoIP

Audio-over-IP

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.

COMi.MX

The name of Lawo's RAVENNA processing hardware device. The COMi.MX forms a sub component of most of Lawo's RAVENNA IO cards.

DALLIS

Digital and Line Level Interface System.

The name of Lawo's configurable IO device. Each DALLIS frame can be fitted with a combination of plug-in IO cards.

DHCP

Dynamic Host Configuration Protocol

Commonly used in data networks to dynamically allocate IP addresses from a central server.

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. The default DSCP value for RAVENNA streams is 46 (=EF); and for PTP is 56 (=CS7).

Ember+

A non-proprietary TCP/IP interface protocol. An Ember+ provider can "publish" parameters which may then be used by an Ember+ consumer. For example, to display information or enable control from a remote device.

Fast Leave

An option often supported by IGMP network switches, which allows the switch to determine when an output port has left a Multicast group. If this option is not enabled, then Multicast traffic can flood the output port continuously. See IGMP.

HPET

High Precision Event Timer

A high precision clock reference provided by your PC. It is required for proper RAVENNA timing.

HTTP

Hypertext Transfer Protocol

A networking protocol/URL address, commonly used to exchange or transfer web pages, email, etc.

IGMP	Internet Group Management Protocol A communications protocol used by adjacent switches/routers on a network to establish Multicast group memberships. IGMP Querying/Snooping is a technique used by network switches to control the forwarding of Multicast data packets. A switch with IGMP Querying/Snooping will forward Multicast data packets only to the ports that are members of the Multicast group. Whereas, a switch without IGMP Querying/Snooping will broadcast Multicast data to all of its output ports. As a result, the volume of Multicast traffic will be significantly reduced if a network switch supports IGMP Querying/Snooping.
IP Address	Internet Protocol address. All devices connected to a data network must have a unique IP address. In IPv4, a 32-bit number is used and a typical address looks like this: **192.168.101.240**. In IPv6, a 128-bit number is used. In IPv4, subnets are used to divide the IP address range. For example, a subnet mask of **255.255.255.0** effectively filters the first three fields of the address. So, providing the subnet masks match, a device with an IP address = **192.168.101.xxx** can communicate with another device using an IP address = **192.168.101.xxx** (where **xxx** is a unique number between **1** and **254**) without any further configuration or routing. A Class C IPv4 address range runs from **0** to **255**. However, **.0** is usually reserved for use as a gateway and **.255** as a broadcast address (by network switches). Therefore, this type of network supports 254 clients/nodes. If communication is required outside of the broadcast domain - for example, to a device with an IP address = **192.168.102.xxx -** then the data packets must be redirected using a network switch with Layer 3 routing capability.
IPv4	Internet Protocol Version 4 - see IP Address.
IPv6	Internet Protocol Version 6 - see IP Address.
LAN	Local Area Network A data network that interconnects devices within a small geographic area (e.g. a home, school or office building). LANs differ from WANs (Wide Area Networks) in that they do not require leased telecommunications lines (i.e. there is no need for an external service provider).
Latency	The amount of time delay between an audio signal entering and emerging from a system.
Layer 2/3	See Network Switch.
Multicast	In a multicast data network, data is copied and distributed by the network switch/router. This means that packets sent from a single device can be received by multiple nodes at the same time (i.e. one to many). This differs from a unicast data network where data packets are addressed to a single receiving node (i.e. one to one).
Network Router	See Network Switch.
Network Switch	A device used in data networks to interconnect multiple nodes. A Layer 2 network switch conforms to the OSI Layer 2 model, meaning that they can handle the physical and data link layers (i.e. cabling and basic packet transmission). This differs from a Layer 3 network router which also handles the network layer (i.e. it can redirect network packets).
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.

PTP	Precision Time Protocol. An ultra-precise, Synchronization method used in data networks. The PTPv2 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. See also DSCP.
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.
RTP	Real-time Transport Protocol A networking protocol that defines a standard packet format for delivering audio and video over data networks.
RTCP	Real-time Transport Control Protocol Works in conjunction with RTP. While RTP carries the media streams (audio and video), RTCP is used to monitor the transmission statistics and Quality of Service (QoS).
RTSP	Real-time Transport 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.
SFP	Small Form-factor Pluggable transceiver. A hot-pluggable device which can be used to offer a choice of connection methods - e.g. multi-mode fibre, single-mode fibre, etc.
SIP	Session Initiation Protocol A networking protocol/URL address, commonly used within Voice-over-IP systems.
SMPTE 2022-7	SMPTE 2022 is a standard from the Society of Motion Picture and Television Engineers (SMPTE) that describes how to send digital video over an IP network. The standard is published in seven parts. The seventh part (SMPTE 2022-7) describes the Seamless Protection Switching of SMPTE ST 2022 IP datagrams. Within a RAVENNA streaming network, the technology is used to provide redundant streaming between two nodes.
SPS	Seamless Protection Switching. See SMPTE 2022-7.
Subnet	See IP Address.
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 a IO or DSP card to the routing matrix, and vice versa.
TTL	Time to Leave 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.
vLAN	virtual Local Area Network A tool supported by some network switches/routers to separate network traffic "virtually" when connected to the same physical LAN.
WAN	Wide Area Network A data network that covers a broad area (e.g. linking regional, national or international boundaries) using leased telecommunications lines (i.e. supported by a service contract from an external provider).