Power Core

User Manual

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This user manual describes all aspects of Power Core. It contains information for users, technicians and system integrators.

1 Power Core - General Information

Before you start working with Power Core, please read the following information.

- Power Core - About this Documentation
- Power Core - Important Safety Instructions
- Power Core - Important Cleaning Instructions

1.1 Power Core - About this Documentation

This documentation represents the latest state of information. Subject to availability, manuals covering former versions are provided via the Lawo Download-Center (after login).

General Safety & Important Notes

When working with our hardware components, it is important to read and observe all of the instructions provided in the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

The same symbols are used in the product documentation so please look out for them as follows. The letter in brackets before the signal word denotes the language version: e.g. (E) = English.

(E) WARNING - warnings or mandatory actions.

These instructions **must always be observed** to ensure the personal safety of the user, and to protect your system and the work environment from potential damage.

(E) IMPORTANT NOTE - important information for proper functioning.

Other Informational Icons

When reading about our software or the general operation, you may also see the following icons.

General information and points of clarification. Please take note.

Useful tips and shortcuts. Feel free to follow if you like.

Notes. To avoid getting stuck, make sure you follow.

Important actions. To keep the system operational, you should always follow.

Further Information

Mechanical drawings and data sheets (including weights and dimensions) are available from the Lawo Download-Center (after login). We also recommend that you carefully observe the release notes for your product/system.

Lawo User Registration

For access to the Lawo Download-Center, and to receive regular product updates, please register at: www.lawo.com/registration.

Contact Details

If you need further assistance, the Lawo Support Department can be contacted by email at support@lawo.com, or by telephone during normal working hours - please visit the Support area of the Lawo website for the most up-to-date contact details.

1.2 Power Core - Important Safety Instructions

When working with our hardware components, please read and observe all of the instructions provided in the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

Click on the link below to read or download the booklet as a pdf.

Lawo_Safety.pdf

1.3 Power Core - Important Cleaning Instructions

Before cleaning your Lawo devices, please read and observe all of the following instructions.

(E) ATTENTION

DO NOT spill liquids into any system components!

DO NOT clean the front panels or operational surfaces with sharp instruments.

(F) ATTENTION

NE PAS renverser de liquides dans les composants du système!

NE PAS nettoyer les panneaux avant ou les surfaces opérationnelles avec des instruments pointus.

(E) IMPORTANT NOTE

General Cleaning / Disinfecting Requirements

Lawo hardware products are made from a variety of different materials, and each material might have specific cleaning requirements. Therefore, a general allowance for the disinfection of product surfaces with disinfectants containing alcohol cannot be given.

Our front panels and operational surfaces are not entirely approved for treatment with chemical cleaning agents and disinfectants. Component surfaces, buttons and electronics can be permanently damaged by treatment with such agents and the lifespan can be dramatically shortened. Please note that some substances can lead to discoloration of surfaces.

Lawo is not responsible for damage caused by the unauthorized use of disinfectants on our products and surfaces. Damages caused by unspecified treatment of modules and components are not covered by regular or extended warranties or SLA regulations.

This is a general instruction and recommendation for cleaning that applies to all Lawo products:

- Before cleaning the device, unplug all external power sources.
- Clean the device with a soft cloth, dipped lightly in warm to hot soapy water.
- Do not use any liquid cleaning agents or spray cleaners that may contain flammable materials.
- Do not get moisture into any openings.
- Do not use aerosol sprays, bleaches, or abrasives.
- Do not spray cleaners directly onto the item.

The above information and our technical application advice are given to the best of our knowledge.

2 Power Core - Getting Started

If you are new to Power Core, then please read the following topics to get started.

- Power Core - Powering On
- Power Core - Controls, Connectors and Indicators
- Power Core - Setup Quick Start

3 Power Core - Hardware

This chapter describes the Power Core frame and its hardware components.

- Power Core - Hardware Revisions
- Power Core - Frame Description
- Power Core - Power Supplies
- Power Core - Grounding
- Power Core - Expansion I/O Cards
- Power Core - Audio I/O Extender
- Power Core - SFP Transceivers

3.1 Power Core - Hardware Revisions

There have been three revisions of Power Core since its first introduction. The table below summarizes the main differences.

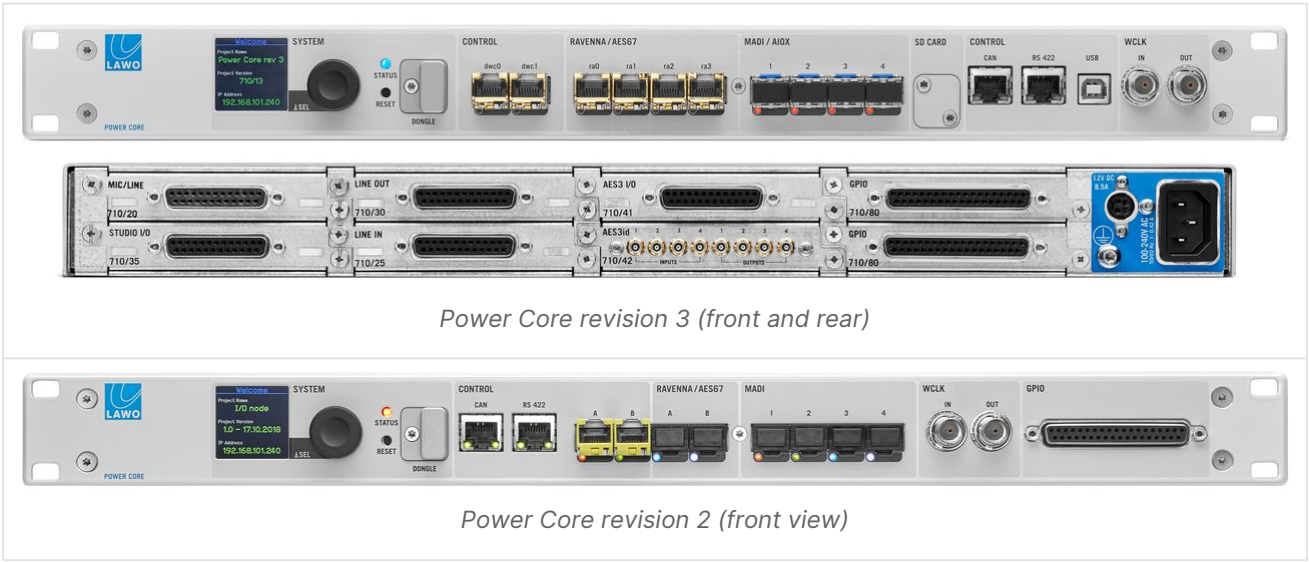
This user manual describes the current revisions (2 and 3) unless otherwise stated. Note that all Power Core devices are configured and operated in a similar manner.

Power Core Frame	Type Number	Summary
Revision 3, Current	710/13	Changes from revision 2: • Added 2 x RAVENNA/AES67 interfaces (ra2, ra3). This doubles the maximum number of streams/AoIP channels. • Easy access to SD card (from front) for data backup/ exchange. • New USB type B server port (at front) for diagnostics. • Removed GPIO (from front) to make way for new features. GPIOs can be added via rear expansion I/O cards.
Revision 2, Current	710/11	Changes from revision 1: • All network interfaces changed from RJ45 to SFPs, to support a range of cable types and connectors. • Added 1 x network control interface (dwc1).
Revision 1, Discontinued	710/10	First release. • 1 x network control interface (dwc0). • 2 x RAVENNA/AES67 interfaces (ra0, ra1). • All network interfaces available via RJ45. • GPIO included (at front).

3.2 Power Core - Frame Description

Power Core comes with a number of standard components (at the front) and eight expansion I/O slots (at the rear). The images below show the front and rear of a fully populated frame.

This topic covers both of the current hardware revisions. Note that the front panel controls differ slightly, while the rear panel is the same for both revisions.



Power Core revision 3 (front and rear)

Power Core revision 2 (front view)

Key Facts

- Frame size = 19" / 1RU. The frame is designed for indoor use and rack mounting.
- Dual-power feeds are included: 1 x AC and 1 x DC. To use the DC input, you will need to order the external DC power supply (optional).
- Temperature-controlled cooling fans.
- The available resources are determined by the main and add-on license(s). These are installed onto a USB memory stick connected to the DONGLE port.
- At maximum capacity, a single Power Core provides:
  - Up to 96 DSP channels for input sources.
  - Up to 80 summing busses with 32 assignable DSP blocks.
  - Up to 1,920 x 1,920 matrix crosspoints.
  - Up to 1,280 audio inputs, outputs and GPIO, via the front panel (included), rear I/O cards (optional) and Audio I/O Extender (optional).
- All configurable functions are defined by the system configuration. This is stored on Power Core and read during boot-up. The configuration can be edited using the ON-AIR Designer software and uploaded to the device via the network.
- If a control surface is connected and configured, then all resources can be controlled from the console.
- Power Core supports a range of remote control options (via TCP/IP) including Lawo's VisTool and the API Ember+.
- Each frame can sync to PTP (from the network), Wordclock (connected to the front panel), MADI (connected to front panel port 1) or internal clock (to free-run).

Components

Each frame has the following user-serviceable components:

- Expansion I/O cards (fitted to the rear).
- USB dongle (fitted to the front).
- SD Card, revision 3 only (fitted to the front).
- Other internal components can be replaced by removing the top cover.

(E) WARNING

- For safety reasons, and to ensure efficient cooling, Power Core must not operate without a fully-closed frame. i.e. any spare expansion I/O slots must be closed with cover plates (at the rear).
- You must disconnect the unit from its power source before removing the top cover of the frame.

Ordering Information

To specify a new system, please follow these steps:

1. Order the Power Core frame using the following part number: 710/13 (revision 3) or 710/11 (revision 2).
2. Optional: add an external DC power supply for the frame(s). See Power Core - Power Supplies.
3. Add the required number of expansion I/O cards - to populate the frame(s).
4. Don't forget the SFP modules for the network CONTROL, RAVENNA/AES67 and MADI/AIOX port(s).

Further Information

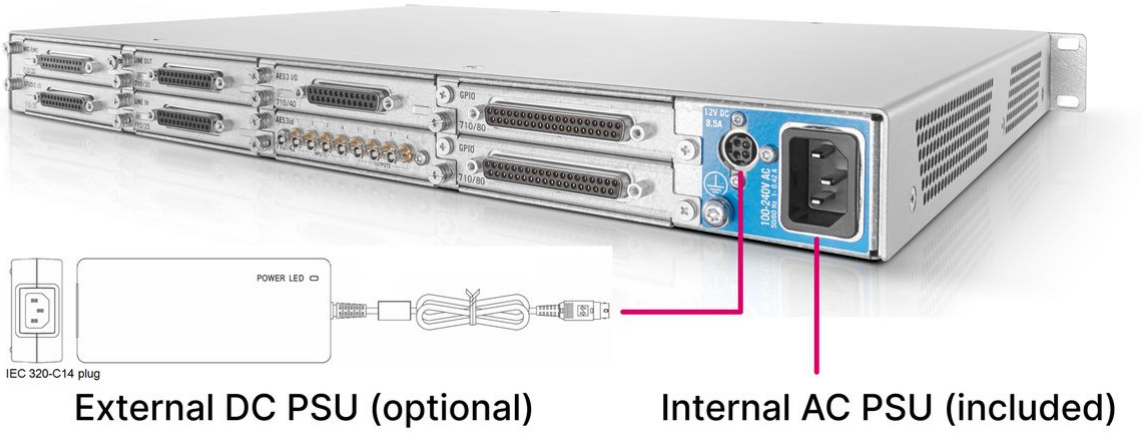
For dimensions, weight, power, etc. see Power Core - Technical Specification.

For installation information, see Power Core - Installation.

Additional information can be found in the data sheet for the Power Core frame and for each of the expansion I/O cards. All data sheets are available from Lawo Download-Center (after login).

3.3 Power Core - Power Supplies

Power Core comes with dual power feeds: AC and DC. If both inputs are connected, then the two feeds provide main and redundant power. The image below shows the connectors (at the rear of the frame).



Power Supply Options

The frame includes an integrated wide-ranging AC power supply. To use the DC input, you will need the external DC power supply (shown above). This is optional and must be ordered separately.

Permitted DC Power Supplies:

- 1 x **955/50-80** - external DC power supply.

Permitted AC Power Supplies:

- 1 x **436-9917-000** - internal AC power supply.

Electrical Specification

For input voltages and power consumption, see Power Core - Technical Specification.

IEC Power Cables

The frame is delivered with 1 x IEC power cable to connect mains power to the AC input. If the external DC supply is ordered, then this is delivered with its own IEC power cable. The IEC power cables are country-specific. The table below describes all permitted options.

Name	Part Number	Description
IEC Lock Schuko	436-7206-000	Power Cord with European connector for e.g. D, AU, F, Benelux.
IEC Lock Open Ends	436-7207-000	Power Cord with open wire ends.
IEC Lock US	436-7208-000	Power Cord with connector for USA.
IEC Lock UK	436-7209-000	Power Cord with connector for United Kingdom.
IEC Lock AUS	436-7218-000	Power Cord with connector for Australia.
IEC Lock JPN	436-7219-000	Power Cord with connector for Japan.

Using the Power Supplies

Before connecting power to the frame, please read and observe all of the instructions in the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

(E) WARNING

The AC input(s) MUST be connected to the mains using the power cable(s) supplied with the system.

Disconnect all power sources to completely disconnect power from the system. e.g. before you open the unit for maintenance and service.

Take care that the protective earth (PE) connection of each PSU is individually connected to the PE connection of the building installation (e.g. wall socket). It is forbidden to use IEC Y-cables, or connect both PSUs to the same multiple-socket outlet. This measure guarantees that there is no shared PE connection (whose failure would lead to a summation of the leakage current from both PSUs to the housing).

(F) AVERTISSEMENT

La ou les entrées CA DOIVENT être connectées au secteur à l'aide du ou des câbles d'alimentation fournis avec le système.

Déconnectez toutes les sources d'alimentation pour couper complètement l'alimentation du système, par exemple avant d'ouvrir l'unité pour la maintenance et l'entretien.

Veillez à ce que la connexion de terre de protection (PE) de chaque PSU soit connectée individuellement à la connexion PE de l'installation du bâtiment (par exemple, une prise murale). Il est interdit d'utiliser des câbles en Y IEC, ou de connecter les deux PSU à la même prise multiple. Cette mesure garantit qu'il n'y a pas de connexion PE partagée (dont la défaillance entraînerait une sommation du courant de fuite des deux PSU vers le boîtier).

Connecting the AC Input

1. Using the IEC cable provided, connect your mains supply to the AC input on the rear panel.

Connecting the DC Input

1. Start by connecting the external power supply to the DC input on the rear panel.
2. Then, using the IEC cable provided, connect your mains supply to the external PSU.
3. The PSU has an LED that lights (green) when mains power is detected.

Powering On

Power Core has no on/off switch and starts automatically when power is applied. What happens next is described later. See Power Core - Powering On.

Status LEDs

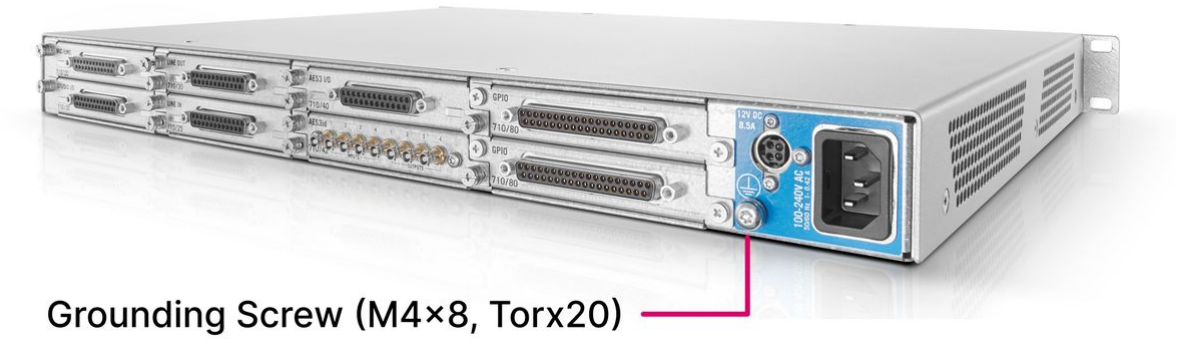
The **STATUS** LED (at the front of the frame) lights once power is applied. The color-coding of the LED is described later. See Power Core - Controls, Connectors and Indicators.

3.4 Power Core - Grounding

The Power Core frame must be grounded for EMC reasons.

Grounding Instructions

A grounding screw is provided beside the power connectors (at the rear of the frame).



To ground the frame, please read and observe all of the instructions in the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

(E) CAUTION

Each frame must be on the same potential as all other system devices.

ALWAYS use a grounded mains connection, to prevent the device from being grounded through Ethernet or other signal connections.

The device must be connected to an additional fixed protective ground if it is conductively connected with more than 20 other devices. i.e. more than 20 copper I/O connections. For more information, please refer to the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

Use the M4x8 screw to fasten the grounding cable to the housing. You should use a Torx T20 driver for this purpose.

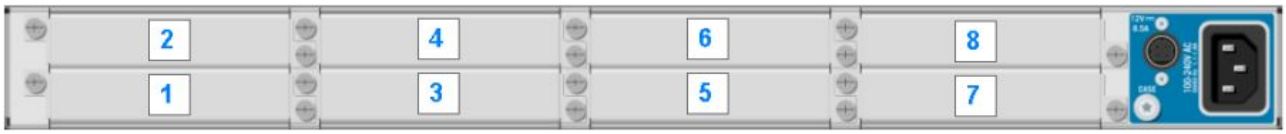
3.5 Power Core - Expansion I/O Cards

Optionally, Power Core can be fitted with up to eight expansion I/O cards. These are designed to provide audio inputs, audio outputs and GPIOs that are local to the frame.

The I/O cards are hot-pluggable and so it is possible to add or replace a card while the frame is powered.
See Replacing an I/O Card for instructions.

Expansion Slots & Conditions

The image below shows how the expansion slots are numbered (when viewed from the rear).



Before ordering or fitting an I/O card, it is important to observe the following slot conditions:

- Due to heat emissions, **a maximum of four MIC/LINE IN cards are permitted**. These must be fitted to even numbered slots only (i.e. the top row).
- In addition, **a maximum of two GPIO cards are permitted**. These must be fitted to slots 7 and 8 only (right-hand side, viewed from rear).
- There are no limitations when fitting the other card types.

Ordering Information

All I/O cards are optional and must be ordered separately from the frame (using their type number). The table below describes all available options.

Please note: To connect a Power Core AIOX device to a rear MADI/AIOX port, you must fit a MADI I/O card (710/50). The MADI SRC I/O (710/60) cannot be used for AIOX.

Expansion I/O Card	Type No.	Description	Connector	Max. per Frame
MIC/LINE IN	710/20	8 x mono Mic/Line inputs	1 x DB-25*	4 (even slots only)
LINE IN	710/25	8 x mono or 4 x stereo Line inputs	1 x DB-25*	8
LINE OUT	710/30	8 x mono or 4 x stereo Line outputs	1 x DB-25*	8
STUDIO I/O	710/35	2 x mono Mic/Line inputs 1 x stereo Line output 2 x stereo Headphone outputs	1 x DB-25*	8
AES3 I/O	710/41	4 x stereo AES3 inputs with SRC 4 x stereo AES3 outputs Bit-transparent	1 x DB-25*	8

Expansion I/O Card	Type No.	Description	Connector	Max. per Frame
	710/40	as for 710/41 but not bit transparent. This card is discontinued; existing cards can be replaced with the 710/41.		
AES3id I/O	710/42	as for 710/41 but with HD-BNCs	8 x HD-BNC	8
MADI I/O	710/50	2 x MADI ports (64 I/O channels per port), supports AIOX	depends on SFP	8
MADI SRC I/O	710/60	1 x MADI port (64 I/O channels with SRC)	depends on SFP	8
DANTE I/O	710/55	2 x DANTE ports (dual-redundant, 64 I/O channels in total with SRC)	2 x RJ45	8
GPIO	710/80	8 x GPI (optocouplers) 8 x GPO (silent and self-healing relays) 2 x VCA (voltage-controlled inputs)	1 x DB-37	2 (slots 7 & 8 only)

*All DB-25 connectors are wired according to the AES59 (TASCAM) standard, except for the Headphone outputs on the STUDIO I/O card.

For wiring information, see Power Core - Connector Pin-Outs.

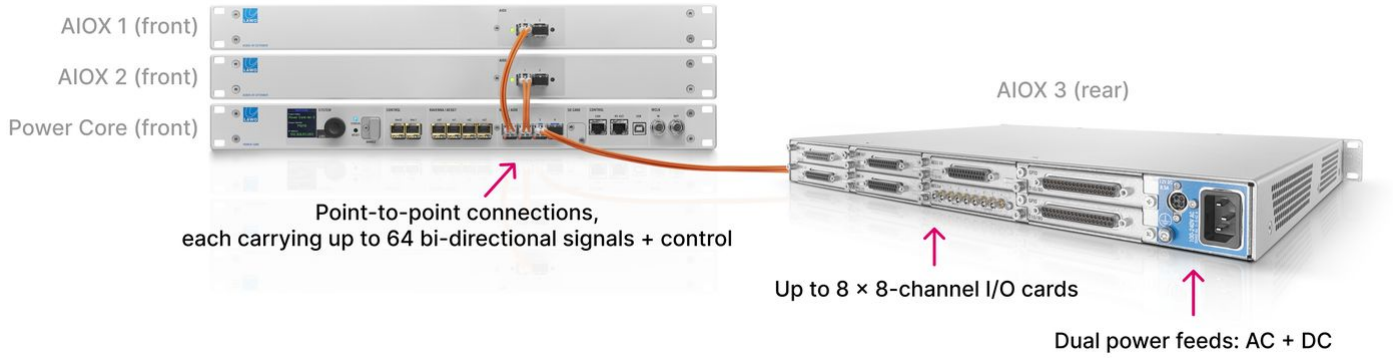
Additional information can be found in the data sheet for each I/O card. All data sheets are available from the Lawo Download-Center (after login).

3.6 Power Core - Audio I/O Extender

The audio (and GPIO) capabilities of Power Core can be expanded further by adding one or more Audio I/O Extenders.

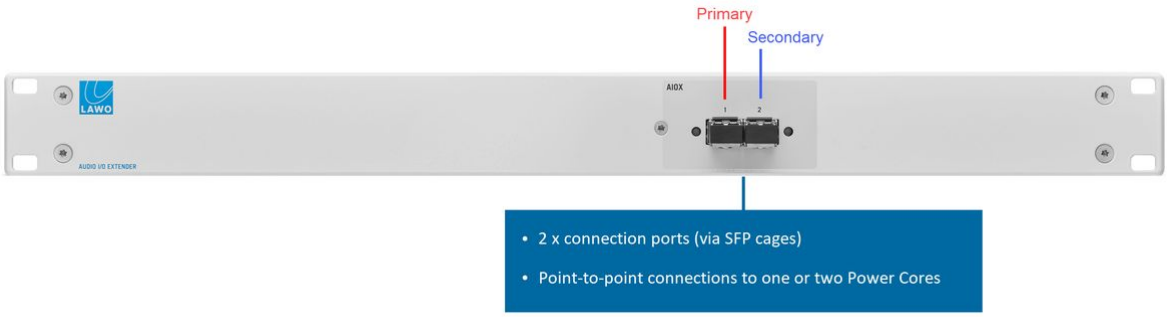
Each Audio I/O Extender (AIOX) is a separate 1RU device that delivers up to 64 channels of I/O. Each device connects to the main frame using any available MADI/AIOX port (front or rear). Up to 20 AIOX devices can connect to a single Power Core, expanding its I/O capability to up to 1,280 audio inputs, outputs and GPIO.

The image below shows an example with three AIOX devices.



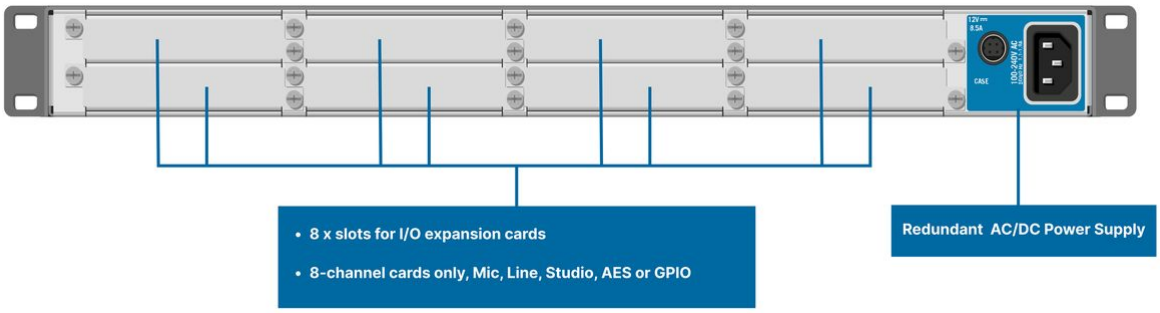
AIOX Frame

Each AIOX device uses the same frame/housing as a standard Power Core and comes with 2 x AIOX ports (at the front).



I/O Cards

The rear of the frame can be fitted with up to 8 x 8-channel expansion I/O cards. These are identical to the expansion I/O cards described earlier. Options include Mic/Line In, Line Out, Studio I/O, AES3 I/O and GPIO. Note that the MADI and DANTE I/O cards are not supported (as the maximum capacity of the AIOX connection is 64 channels).



Power

The AIOX frame is powered in the same manner as the main frame (as described earlier). If both AC and DC inputs are connected, then the two feeds provide main and redundant power.

Connecting the Main Frame

The connection to the main frame is always point-to-point, and is made using a proprietary high-speed, low-delay audio and control protocol. You will need 1 x MADI port for each connection. This can be any of the four MADI/AIOX ports on the front panel, or a MADI port on a rear expansion I/O card (if available). The port(s) must be configured for AIOX operation (by editing the system configuration using ON-AIR Designer).

To configure redundancy, you must connect both ports from the AIOX device. If these connections are made to two separate Power Core frames, then the system can be configured for full redundancy.

The type of connection, and its maximum length, is determined by the SFP module fitted to the frame. SFPs for coax, copper or single- and multi-mode fiber connections are available. For more information, see Power Core - SFP Transceivers.

Ordering Information

To specify the AIOX option, please follow these steps:

1. Order the required number of AIOX frame(s) using the following part number: Power Core AIOX (970/12).
2. Optional: add an external DC power supply for the AIOX frame(s). See Power Core - Power Supplies.
3. Add the required number of expansion I/O cards - to populate the AIOX frame(s). All 8-channel card options are supported.
4. Don't forget the SFP modules for the MADI/AIOX port(s) in the main frame and AIOX device.

Please note: To connect a Power Core AIOX device to a rear MADI/AIOX port on the main frame, you must use a MADI I/O card (710/50). The MADI SRC I/O (710/60) cannot be used for AIOX.

Backwards Compatibility

Power Core AIOX can be added to any revision of the Power Core main frame: 710/13, 710/11 or 710/10.

Further Information

Additional information can be found in the data sheet for the AIOX device (710/12). This is available from the Lawo Download-Center (after login).

3.7 Power Core - SFP Transceivers

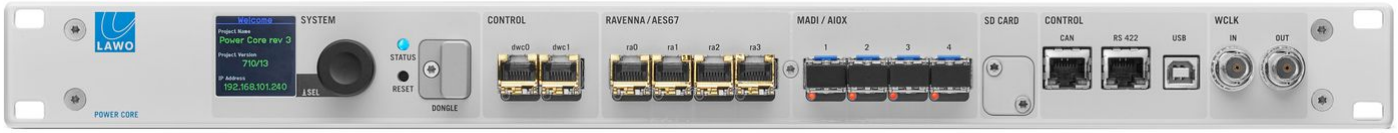
To use the network or MADI/AIOX ports, you must fit the correct SFP transceivers. These must be Lawo-certified and ordered separately from the frame.

Available Interfaces (via SFP)

You will need:

- 1 x Network Interface SFP - for each CONTROL port (dwc0 & dwc1).
- 1 x Network Interface SFP - for each RAVENNA/AES67 port (ra0 to ra3).
- 1 x MADI Interface SFP - for each MADI/AIOX port at the front (1 to 4) and rear (if MADI I/O cards are fitted).

The image below shows an example with all of the front SFP cages populated.



Ordering Information

All SFP modules must be ordered separately from the frame (using their type number). The tables below describe all available options.

(E) WARNING

- If a device has SFP slots, the UL approval of the device is valid only if the used SFP modules are UL-certified and comply with the category NWGQ, NWGQ2, AZOT, or AZOT2. The classification of SFPs must be FDA 21 CFR 1010 or CFR 1040 for products with laser class 1 (I) or IEC 60825-2 for products with LED class 1.
- For all other approvals of the device (e.g. CE), the SFP used must have the classification according to IEC 60825-2 for LED class 1 products.

(F) ATTENTION

- Si un appareil possède des emplacements SFP, l'homologation UL de l'appareil n'est valable que si les modules SFP utilisés sont certifiés UL et conformes à la catégorie NWGQ, NWGQ2, AZOT ou AZOT2. La classification des SFP doit être conforme à la norme FDA 21 CFR 1010 ou CFR 1040 pour les produits avec laser de classe 1 (I) ou IEC 60825-2 pour les produits avec LED de classe 1.
- Pour toutes les autres homologations de l'appareil (par exemple CE), le SFP utilisé doit avoir la classification selon IEC 60825-2 pour les produits à LED de classe 1.

Network Interface SFPs

Please order 1 x SFP for each network port you wish to use: CONTROL or RAVENNA/AES67.

Type Number	Cable	Max. Distance	Standard
981/60-10	Multi-mode fiber: 850nm, -7dBm	550m	1000 Base-SX
981/60-20	Single-mode fiber: 1310nm, -3dBm	10km	1000 Base-LX
981/60-30	Single-mode fiber: 1550nm, 0dBm	80km	1000 Base-ZX
981/60-61	Copper, RJ45	100m	100/1000 Base-T
981/60-60 (Discontinued)	Copper, RJ45	100m	1000 Base-T

MADI Interface SFPs

Please order 1 x SFP for each MADI port you wish to use: MADI or AIOX.

Type Number	Cable	Max. Distance	Protocol
981/60-80	Multi-mode fiber: 1310nm	2km	MADI or AIOX
981/60-81	Single-mode fiber: 1310nm	20km	MADI or AIOX
981/60-82	Copper, HD-BNC (75 ohm)	100m	MADI or AIOX
981/60-65	Copper, RJ45	100m	MADI or AIOX

Please note: To connect the Power Core main frame to an AIOX device using an RJ45 cable, you must use the 981/60-65 transceivers.

4 Power Core - Licensed Feature Sets

This chapter describes the licensing options for Power Core.

- Power Core - Licensing Model
- Power Core - License Chart

4.1 Power Core - Licensing Model

Power Core must be installed with a valid license to "unlock" the system resources. Several main licenses are available. You must choose one of these for the system to operate. Optionally, this can be expanded by purchasing one or more add-on licenses.

The main license plus any add-ons must be installed onto a USB memory stick connected to the DONGLE port. For more information on the activation procedure, see License Activation. Here we describe how the licensing model works and the available options.

Important: When preparing the system configuration it is important that the configured options match the licensed feature set.

Main Licence Packages

In the current release, there are six main license packages. For a side-by-side comparison, please see the Power Core - License Chart. Below is a short description of each option.

EDGE

The EDGE license delivers the smallest system package. It is designed for stand-alone audio distribution applications such as an Audio-over-IP node (with low latency monitoring) or small-scale signal router. i.e. applications that do not require any audio processing or a physical surface.

Super Audio Node (SAN)

This package is larger than "EDGE". It is designed for stand-alone applications such as a small intercom matrix.

Console (Compact)

This package is larger than "Super Audio Node". It is designed for small to medium-scale studio consoles.

Console (L)

This package is larger than "Console Compact". It is designed for large-size studio consoles. If used stand-alone, it is suited to a mid-size networkable DSP, signal supervisor and router; or mid-size intercom matrix.

Console (XL)

This is the largest package (resource-wise). It is designed for extra-large studio consoles and provides 5.1 mixing suitable for TV production. If used stand-alone, it is ideal as a large-scale networkable DSP, signal supervisor and router; or intercom matrix.

Console (MAX)

This package is identical to "Console XL" but adds the ability to control Power Core from up to four independent surfaces and/or virtual interfaces. The connected devices share the resources. Thus, they can be any permitted size and layout as long as the total number of resources does not exceed those given in the license chart.

Add-on Licenses

In the current release, there are seven add-on licenses. Note that not all add-ons apply to all systems so please check your hardware revision and main license before making a purchase. For more information, please refer to the Power Core - License Chart.

GPIO

The GPIO license applies to Power Core revision 1 and revision 2 systems that are running an EDGE, SAN or Console Compact main license. It can be used to activate the physical GPIOs that are wired from the front panel: 8 x GPI and 8 x GPO.

Note that if you are running one of the larger main license packages, then this license is not necessary (as the GPIOs are enabled automatically).

Licensing Requirements (per device):

- 1 x Power Core Add-on license: GPIO - enables all front panel GPIOs.
- Applies to hardware revisions 1 and 2 only.
- Can be added to the following main licenses: EDGE, Super Audio Node or Console Compact.

MiniMixer

The MiniMixer license adds 64 instances of the "Minimixer TB Input" element. These work in a similar way to a standard minimixer but have a freely selectable talkback input.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: MiniMixer - adds 64 x "Minimixer TB Input" elements.
- Applies to all hardware revisions.
- Can be added to any of the main license packages.

N-1

The N-1 license adds 64 dedicated N-1 return feeds. It can be used to expand the N-1/mix minus capability.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: N-1 - adds 64 x N-1 returns
- Applies to all hardware revisions.
- Can be added to any of the main license packages except EDGE.

Conference Assign

The Conference Assign license makes it is possible to control the level of the associated source to the N-1 bus and to include or exclude sources from N-1 busses.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: Conference Assign - enables source level control and include/exclude options for all N-1 buses.
- Applies to all hardware revisions.
- Can be added to any of the main license packages except EDGE.

Loopbacks

The Loopback license allows you to enable 128 loopbacks for every 8-channel I/O card. Please note that these are signal loopbacks only, and do not support the silence detect functionality of the standard DMS Metering / Loopback elements.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: Loopbacks - enables the signal loopback option for all 8-channel I/O cards.
- Applies to all hardware revisions.
- The total number of loopbacks available depends on the specification of the extension I/O cards.
- Can be added to any of the main license packages.

Aux Pan

The Aux Pan license makes it possible to control the panning of individual sources onto each Aux bus.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: Aux Pan - enables the aux send pan option for all sources.
- Applies to all hardware revisions.
- Can be added to any of the main license packages, except EDGE.

RAVENNA Plus (RAV+)

The RAVENNA Plus license applies to Power Core revision 3 systems. It can be used to activate the second pair of RAVENNA/AES67 interfaces on the front panel: ra2 and ra3.

Licensing Requirements (per device):

- 1 x Power Core Add-on license: RAV+ - enables the ra2 and ra3 network interfaces.
- Applies to hardware revision 3 only.
- Can be added to the following main licenses: Console XL or Console MAX.

4.2 Power Core - License Chart

The table below describes the main and add-on licenses for Power Core.

Main License Packages							
Category	**Description**	**EDGE**	**Super Audio Node**	**Console Compact**	**Console L**	**Console XL**	**Console MAX**
AUDIO INTERFACING							
	Front MADI ports and channels *	2x64/64	4x64/64	2x64/64	4x64/64	4x64/64	4x64/64
	RAVENNA/AES67 I/O channels *	128/128	128/128	128/128	128/128	256/256	256/256
	RAVENNA/AES67 streams	64	64	64	64	128	128
	RAVENNA/AES67 redundancy (SMTPE 2022-7)	YES	YES	YES	YES	YES	YES
	Max. number of expansion cards supported	8	8	8	8	8	8
	Power Core Audio I/O Extender support (AIOX)	YES	YES	NO	YES	YES	YES
AUDIO PROCESSING (click here for additional info)							
	Configurable assignable fader sources	0	32	96	128	254	254
	Parallel DSP inputs (AutoMix EQ, Dyn, DeEsser, Limiter and Delay) *	0	16	32	48	96	96
	AutoMix groups	0	1	1	2	8	8
	Sum and conference buses (no processing) *	0	20	32	40	80	80
	Additional N-1 returns *	0	Optional Add-On; see below				
	Bus DSP processing (EQ, Comp and Limiter) *	0	0	8	16	32	32

	Bus delay	NO	NO	NO	NO	YES	YES
	PFL buses	0	1	1	2	5	5
	VCA groups	0	0	1	1	16	16
	5.1 mixing and processing	NO	NO	NO	NO	YES	YES
	Utility tool MiniMixer	0	64	64	64	64	64
	Utility tool MiniMixer with free selectable talkback input	Optional Add-On; see below					
	DMS channels (PPM/Loudness meters, silence detects and loopback) *	128	128	128	128	256	256
	Loopback function, only per 8ch I/O card *	Optional Add-On; see below					
CONTROL / SETUP							
	Individual Access Groups	0	1	1	1	1	4
	Max. number of fader modules supported	0	15	15	15	15	15
	Second layer	N/A	YES	YES	YES	YES	YES
	Built-In GPIO (only applicable for Rev1 and Rev2)	Optional Add-On; see below			8 GPI + 8 GPO	8 GPI + 8 GPO	8 GPI + 8 GPO
	KSC panel support	YES	YES	YES	YES	YES	YES
	VisTool control	YES	YES	YES	YES	YES	YES
	Logic elements	200	8.000	4.000	8.000	15.000	15.000
NETWORKING							

	GPIO over audio channels	64	64	64	64	128	128
	GPIO NET elements	8	40	40	40	80	80
	External matrix remote control (KPF/ Ember+ / NTP-DOT)	YES (via Ember+)	YES	YES	YES	YES	YES
	Automation system control interface (RAS)	NO	NO	YES	YES	YES	YES
	MACKIE HUI support	NO	NO	NO	NO	YES	YES
	Max. number of Ember+ providers	1	1	1	1	5	5
	Max. number of Ember+ consumers	0	0	4	4	15	15
	LACP	YES	YES	YES	YES	YES	YES
SIGNAL DISTRIBUTION							
	Routing matrix *	1280 x 1280	1728 x 1728	1728 x 1728	1728 x 1728	1920 x 1920	1920 x 1920
	Intercom matrix – number of clients	0	16	16	38	78	78
Add-On Licenses (optional)							
GPIO (Power Core revisions 1 & 2)		8 GPI + 8 GPO	8 GPI + 8 GPO	8 GPI + 8 GPO	-	-	-
MiniMixer		64 instances	64 instances	64 instances	64 instances	64 instances	64 instances
N-1		N/A	64 return feeds	64 return feeds	64 return feeds	64 return feeds	64 return feeds
Conference Assign		N/A	YES	YES	YES	YES	YES

Loopback (per 8ch I/O card) *	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks
Aux Pan	N/A	YES	YES	YES	YES	YES
RAVENNA Plus (Power Core revision 3)	N/A	N/A	N/A	N/A	adds 256/256 channels * OR 128 streams	adds 256/256 channels * OR 128 streams
Listed numbers with “*” are mono equivalent						

Audio Processing Resources

When interpreting the "Audio Processing" resources, please note that the number of **Parallel DSP Inputs** determines the maximum number of sources that can be summed together simultaneously (i.e. the number of sum inputs).

Each **Parallel DSP Input** is a fully-featured source channel with input gain, signal presence indicator, direct out, insert, fader, aux send (with pre/post) switching, pan/balance and AutoGain (for mic inputs). The DSP blocks provide:

- EQ – 3-band parametric EQ plus High and Low Pass Filters.
- Dynamics – Gate, Expander and Compressor.
- Limiter – independent limiter.
- Delay – sync delays (adjustable in milliseconds, meters or frames).
- AutoMix and De-Essing – automatic mixing of selected sources; de-essing to reduce sibilance. If more than one **AutoMix group** is available, then independent automixes can be achieved.
- Loudness Metering - conforming to EBU R128.

Each **bus** can be used as Sum Bus, Conf Bus, General Purpose or additional PFL. The **DSP blocks** provide EQ, Dynamics and Limiter functions. **Delays** are specified separately. Loudness Metering (EBU R128) is included. By purchasing the **N-1** add-on license, you can add 64 dedicated N-1 returns.

Each utility tool **Minimixer** is a 2-in-2-out mixer with controls for level, dim, mute, balance, and talkback (TB) insertion. Two types of Minimixer are available. They are identical except for the talkback insertion:

- **MiniMixer** (standard) - up to two talkback inputs can be selected from eight system-wide talkback sources.
- **MiniMixer with free selectable talkback input** (available via add-on license) - the talkback source can be freely selected from any audio input.

The **DMS Channels** are required to display PPM and Loudness metering in VisTool (via DMS). Note that each resource includes a silence detect function and audio loopback. Additional **loopbacks** can be added by purchasing the Loopback add-on license.

5 Power Core - Installation

This chapter describes how to install the Power Core hardware.

- Power Core - Installation Instructions
- Power Core - Unpacking
- Power Core - Installing the Frame
- Power Core - Fitting the SFP Transceivers
- Power Core - Wiring
- Power Core - Synchronization

5.1 Power Core - Installation Instructions

We recommend that you read all of this chapter in full before starting the installation.

Mechanical drawings and data sheets (including weights and dimensions) are available from the Lawo Download-Center (after login).

(E) WARNING

Please read and observe ALL of the Lawo - Important Safety Instructions BEFORE installing or servicing any component.

(F) AVERTISSEMENT

Veuillez lire et respecter TOUTES les consignes de sécurité importantes AVANT d'installer ou d'entretenir un composant.

Once you are ready to begin, it is recommended to complete the tasks in the following order.

- Unpack
- Fit the Expansion I/O Cards
- Install the Frame
- Fit the SFP Modules
- Cable the system
- Check the synchronization

The rest of this chapter describes each task in more detail.

If you need further assistance, the Lawo Support Department can be contacted by email at support@lawo.com, or by telephone during normal working hours - please visit the Support area of the Lawo website for the most up-to-date contact details.

5.2 Power Core - Unpacking

Each Power Core frame is delivered in its own box with all included accessories. If you have ordered any expansion I/O cards or the DC power supply, then these are packaged separately, along with the optical transceivers.

The license codes for all software licenses can be found on the delivery note (included with the shipment).

A list of serial numbers for the hardware components is also included. Please keep this list for your records.

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

Packing List

The contents of the shipment will vary depending on the component(s) ordered.

Included

The following items are included with each Power Core frame:

- 1 x 2m IEC power cable (country-specific) - to connect AC mains to the frame.
- 1 x USB license dongle (250-5998-000).
- Dust caps for the Network Interface and MADI SFP cages - these will be mounted in the frame.
- 1 x USB memory card - containing the latest software and configuration files.

If you have ordered a revision 2 frame, then you will also find 1 x serial cable (485-0700-000) - to connect to the RS 422 port (for diagnostics).

Note that the Power Core license code (for the USB dongle) can be found on the delivery note.

Optional

The following items are optional and must be ordered separately:

- Up to 8 x rear expansion I/O cards - for audio and GPI/O interfacing.
- 1 x external DC power supply (955/50-80) with 2m IEC power cable (country-specific) - to connect DC power to the frame.
- 1 x USB license dongle safety cap.
- Optical transceivers - for the network interface and MADI ports.

As a first step, any expansion I/O cards should be fitted into the frame. See Fitting an I/O Card for instructions.

Not Included

The following items are not included and must be provided by the customer or installer:

- Ethernet cable(s), optical and/or copper - to connect the media and management ports to the network, or directly to an IP control surface.
- CAN bus cable(s) - to connect external KSC or GPIO panels, and/or a CAN-bus control surface.

If you are planning to control Power Core from VisTool, then the following items are also required:

- Windows 64-bit host PC - to run the Lawo application VisTool.
- Ethernet cable(s) - to connect the host PC to the network.

The following document contains more information about the host PC requirements: Vistool PC Config.pdf.

5.3 Power Core - Installing the Frame

Power Core is designed for indoor use in a dust-free environment. The frame should be mounted, horizontally, in a 19-inch equipment rack (as described below).

Please install supporting slide bars to hold the weight of the unit, and use the locking devices provided. For recessed rack-mounting, use standard, third-party, 1RU recessed rack adapters such as the ones shown below.

Recessed Rack Adaptors

When fitting the rack adapters and slide bars, you must make sure that there is sufficient airflow around the device for cooling.

Connectors are located at the front and rear of the unit. Therefore, when using 19-inch racks with doors please leave enough room for the cables.

Installing the I/O Cards

As standard, the frame is delivered with metal cover plates to close the rear slots. Therefore, before mounting the frame, you must fit the rear I/O cards.

How to do this is described later. See Fitting an I/O Card for instructions.

Dimensions and Weight

Mechanical data can be found in the data sheet for the Power Core frame, available from Lawo Download-Center (after login).

The table below describes a Power Core revision 3 frame without expansion I/O cards.

Width	483 mm (19")
Height	> 44.0 mm (1 RU)
Depth (inc locking devices)	385 mm
Weight (without expansion IO cards)	4.5 kg

Airflow Requirements

Power Core is cooled by temperature-controlled fans for minimum noise emission.

Ventilation holes are provided on the left and right. You must make sure that there is sufficient airflow around the frame for cooling.

The current temperature of the device's internal components can be checked on the front panel display and Web UI. The recommended tolerances can be found in the data sheet for the Power Core main frame. In particular, the temperature of the FPGA chip must NOT exceed 85° C.

(E) ATTENTION

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

(F) ATTENTION

- N'obstruez PAS les trous de ventilation, car cela empêcherait un refroidissement efficace.

Power Consumption and Electrical Voltage

See Power Core - Power Supplies.

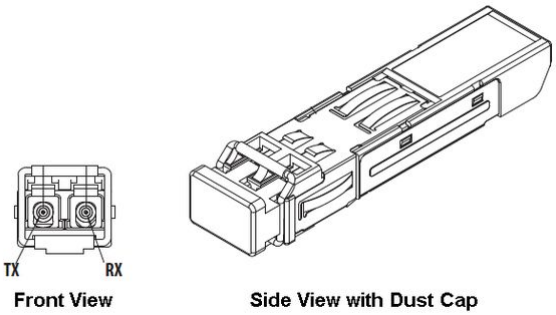
5.4 Power Core - Fitting the SFP Transceivers

In order to connect the CONTROL, RAVENNA/AES67 or MADI/AIOX ports, they must be fitted with the correct SFP transceivers. These must be Lawo-certified (as described earlier).

Overview

The SFPs are hot-pluggable, so they can be fitted or exchanged while the device is powered.

When fitting SFPs to both network interface and MADI ports, take care not to mix up the module types. The image below shows an example of an optical transceiver.



Front View | Side View with Dust Cap

SFP Installation

Before fitting or removing a transceiver, please read and observe the following important safety information.

(E) CAUTION

This equipment may use Class 1 Laser products. It emits invisible laser radiation that may lead to eye injury.

- Never look directly into optical components or optical fibre cables.
- Keep optical components closed by protection plugs when unused.
- For your safety connect all fibre cables first before turning on the equipment.

(F) ATTENTION

Cet équipement peut utiliser des produits laser de classe 1. Il émet un rayonnement laser invisible qui peut entraîner des lésions oculaires.

- Ne regardez jamais directement dans les composants optiques ou les câbles à fibres optiques.
- Gardez les composants optiques fermés par des bouchons de protection lorsqu'ils ne sont pas utilisés.
- Pour votre sécurité, connectez d'abord tous les câbles à fibres optiques avant d'allumer l'équipement.

(E) IMPORTANT NOTE

- Before removal, please unlock the transceiver to avoid mechanical damage to the slots.
- If a transceiver is removed, please refit the device's dust cap to protect the internal components.
- When fitting an optical transceiver, you must use the correct fiber type for your remote device. Using the wrong fiber type, or exceeding the maximum optical input power, can result in a malfunction of, or damage to, the device.

Instructions (for insertion)

SFP modules must only be inserted when there is no cable connected.

1. Disconnect the cable from the SFP module or remove its dust cap (as applicable).

We recommend that you label the cable before it is disconnected (for easy reconnection to the correct port at a later time).

Please watch out for locks on the cable connector, and unlock these to release the cable. In some cases, this must be done while pulling the cable out of the SFP.

You must take care to prevent electrostatic discharge to the SFP module. This can be done by grounding yourself and taking ESD measures. Do not touch the contacts of the SFP.

When disconnecting the cable from an optical transceiver, take care to cover the unplugged optical cable with a dust cap.

2. Remove the dust cap from the SFP cage on the device.

Any spare dust caps should be stored carefully so that they can be replaced if a module is removed.

3. Before inserting the SFP, flip the extraction lever (at the front) up to its rest position.

4. Slide the SPF gently into the slot.

Please note: if the SFP is upside down, then it will not glide in easily.

The SFP module must slide in smoothly without force. When done correctly, the contacts of the SFP glide into the contacts of the device. At this moment, press firmly until the module locks into position (you will hear a click).

5. Check that the SFP is locked by pulling on it without lifting the extraction lever.

- If the module cannot be removed, it is installed correctly.
- If the module can be removed, then check its orientation: perhaps the SFP is inserted upside down.
- Repeat step 4 until the module is securely latched into the SFP cage.

6. After inserting an optical transceiver, take care to immediately connect the optical cable or fit a dust cap.

When connecting a cable, make sure that the cable connector locks into position correctly (you will hear a click).

Instructions (for removal)

SFP modules must only be removed when there is no cable connected.

1. Disconnect the cable from the SFP module.

We recommend that you label the cable before it is disconnected (for easy reconnection to the correct port at a later time).

As before, watch out for locks on the cable connector, and unlock these to release the cable. In some cases, this must be done while pulling the cable out of the SFP.

You must take care to prevent electrostatic discharge to the SFP module. This can be done by grounding yourself and taking ESD measures. Do not touch the contacts of the SFP.

When disconnecting the cable from an optical transceiver, take care to cover the unplugged optical cable with a dust cap.

2. Before removing the SFP, flip the extraction lever (at the front) down. Then use the lever to pull out the SFP.

3. Pull firmly until the contacts of the SFP glide out of the contacts of the device.

From this point onwards, the SFP must slide out smoothly without force.

4. After removing the SFP module, take care to refit a dust cap immediately to the device's SFP cage (to protect the internal components) and to the SFP module (if the transceiver is optical).

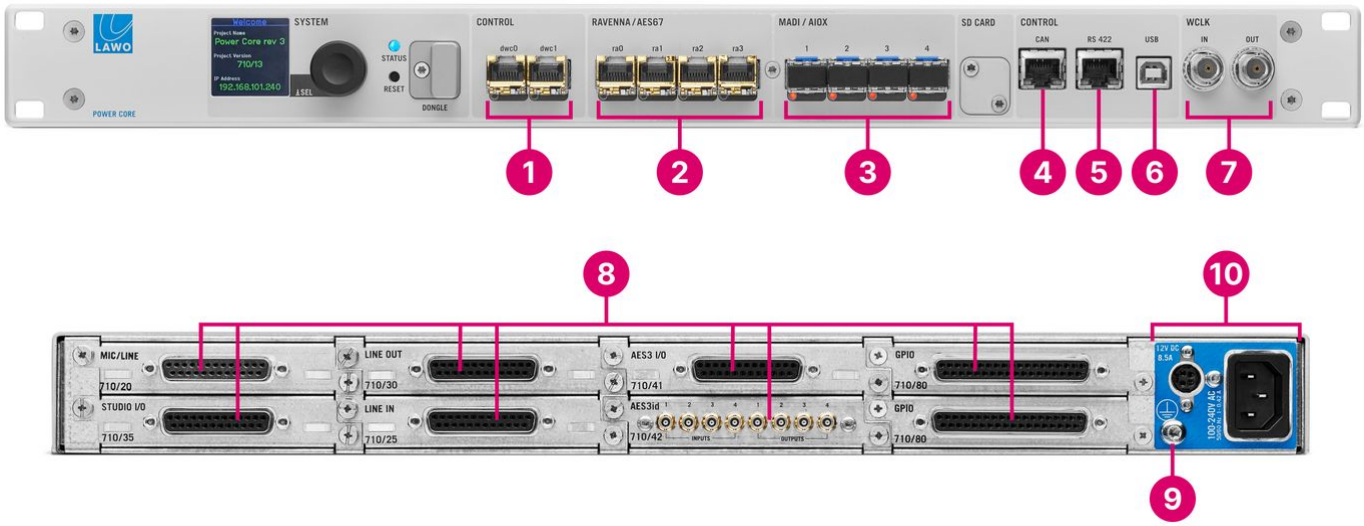
5.5 Power Core - Wiring

Once the frame is populated and mounted, you are ready to cable the device. This topic describes all possible connections to Power Core. To configure the system, only power (10) and control (1) are required.

This topic covers both of the current hardware revisions. Note that the front panel connectors differ slightly, while the rear panel is the same for both revisions.

- Connector Summary, Revision 3
- Connector Summary, Revision 2

Connector Summary, Revision 3



1. CONTROL : 2 x 1GbE control ports (via SFP) - used to connect Power Core to the control network/surface via IP. One connection is essential to configure the device.

2. RAVENNA/AES67: 4 x 1GbE streaming ports (via SFP) - used to stream audio and GPIO signals to and from the media network (optional).

3. MADI/AIOX: 4 x MADI or AIOX ports (via SFP) - used to connect local MADI or Audio I/O Extenders (optional).

4. CAN : 1 x 500Kb/s CAN port (CAT5e, RJ45) - used to connect local CAN bus devices such as a ruby control surface or KSC/GPIO panel (optional).

5. RS-422 : 1 x serial port (RJ45) - used to remotely control Power Core (optional).

6. USB (revision 3 only): 1 x USB port - used for debugging (optional). On a revision 2 frame, the RS-422 serial port may be used for debugging.

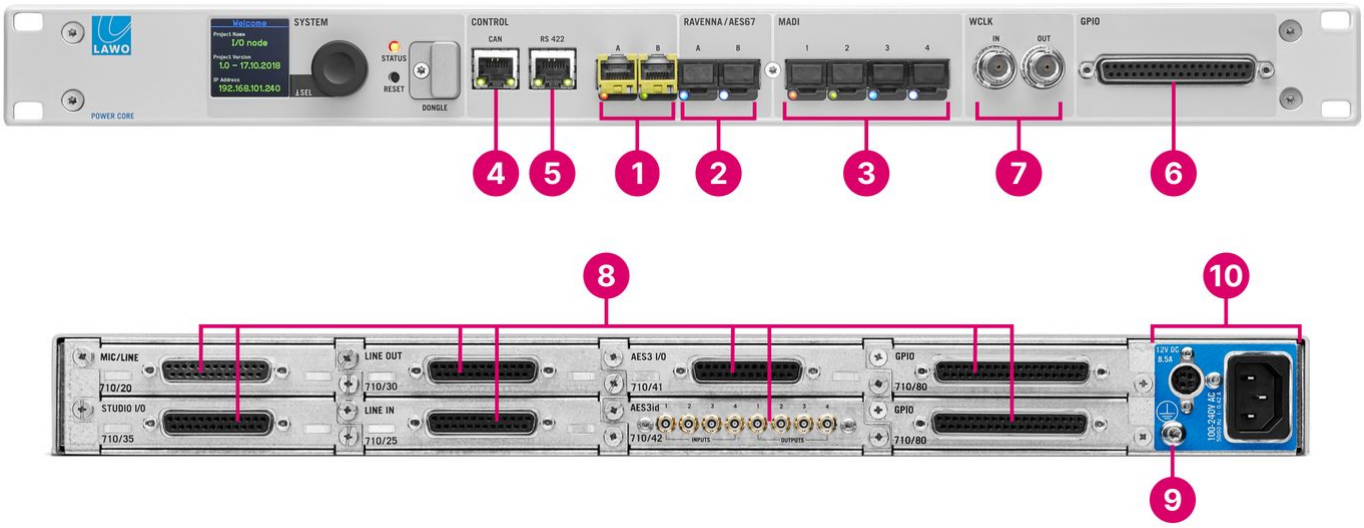
7. WCLK : IN & OUT (BNC) - used to connect an external sync reference (optional).

8. Expansion I/O (various) - used to connect local audio and GPIO signals (optional).

9. Grounding Screw (M4x8) - used to ground the frame (essential).

10. Power Inputs: AC & DC (IEC & Kycon) - used to connect power to the frame. One connection is essential; the other provides redundancy.

Connector Summary, Revision 2



1. CONTROL : 2 x 1GbE control ports (via SFP) - used to connect Power Core to the control network/surface via IP. One connection is essential to configure the device.

2. RAVENNA/AES67: 4 x 1GbE streaming ports (via SFP) - used to stream audio and GPIO signals to and from the media network (optional).

3. MADI/AIOX: 4 x MADI or AIOX ports (via SFP) - used to connect local MADI or Audio I/O Extenders (optional).

4. CAN : 1 x 500Kb/s CAN port (CAT5e, RJ45) - used to connect local CAN bus devices such as a ruby control surface or KSC/GPIO panel (optional).

5. RS-422 : 1 x serial port (RJ45) - used to remotely control Power Core (optional).

6. GPIO (revision 2 only): 8 x GPI and 8 x GPO (DB-37) - used to connect local GPIO signals (optional).

7. WCLK : IN & OUT (BNC) - used to connect an external sync reference (optional).

8. Expansion I/O (various) - used to connect local audio and GPIO signals (optional).

9. Grounding Screw (M4x8) - used to ground the frame (essential).

10. Power Inputs: AC & DC (IEC & Kycon) - used to connect power to the frame. One connection is essential; the other provides redundancy.

The rest of this topic describes the connections. For pinning information, see Connector Pin-Outs.

- CONTROL Ports
- RAVENNA/AES67 Ports
- MADI/AIOX Ports
- CAN Bus Port
- RS-422 Serial Port
- USB Service Port (revision 3 only)
- Wordclock IN & OUT
- GPIO
- Expansion I/O
- CASE Grounding Screw
- Power Inputs: AC & DC

CONTROL Ports: dwc0 & dwc1

The two network CONTROL ports (dwc0 & dwc1) are used for administration and control. They can be used to remotely control Power Core via TCP/IP; to network Power Core to other devices; and to update the system firmware and configuration.

On a Power Core revision 2 frame, the ports provide the same functionality but are labelled differently: CONTROL A = dwc0 and CONTROL B = dwc1.

At least one port must be connected initially to configure the device's network settings. The port(s) can then be used to connect Power Core to a dedicated control network (for out-of-band control). Usually, only the first port (dwc0) is connected. If both ports are used, then redundancy can be implemented via LACP. If you are using in-band control, then the control ports are addressed via the streaming ports/network (and the physical CONTROL ports can be left unconnected).

- **dwc0** & **dwc1** – always active: 2 x 1GbE* (via SFP).

The connection(s) can be made either directly or via a network switch.

When connecting via a network, then this can be shared with other devices, such as in the regular "house network" of a typical broadcast facility. Routers are permitted as long as the minimum requirements of the network interfaces are met. By using routers, or similar devices, the latency of the communication will increase.

*

The control network interfaces can operate at 1000, 100 or 10 BASE-T, depending on the SFP. The network switch/router port(s) MUST meet the following requirements:

- **Speed =** 1Gb/s, 100Mb/s or 10Mb/s; **1Gb/s is recommended**
- **Duplex mode = Full Duplex**

⚠ It is important to keep the control network separate from the streaming network connected to the RAVENNA/ AES67 ports (2).

To use the control network ports, you must fit the correct SFP modules. These must be Lawo-certified (as described earlier). The SFP determines the cable type, maximum distance and connector.

Each port has an LED which indicates the following information.

CONTROL Port LED	Meaning
Off	link down
Green	link up, speed = 100 Mb/s
Blue	link up, speed = 1000 Mb/s

RAVENNA/AES67 Ports: ra0, ra1, ra2, ra3

The four RAVENNA/AES67 ports stream audio to and from an IP network. The first pair of interfaces are enabled as standard: **ra0** & **ra1**. The second pair of interfaces can be enabled by purchasing the optional AddOnRAV+ license: **ra2** & **ra3**.

On a Power Core revision 2 frame, there are two streaming interfaces: ra0 & ra1. They provide the same functionality but are labelled differently: RAVENNA A = ra0 and RAVENNA B = ra1.

The streams are fully compatible with SMPTE ST2110-30/31, AES67 and RAVENNA. To achieve redundant streaming, compatible with SMPTE ST2022-7, you must use both interfaces: **ra0**/**ra1** (or **ra2**/**ra3** on revision 3).

Using the first pair of interfaces only, the total Audio over IP capacity of a single Power Core is up to 256 I/O channels (depending on the main license). This can be split into up to 128 streams, where each stream can be mono, stereo or multi-channel. For each stream you can decide whether it will be transmitted or received via the primary, secondary or both interfaces.

If the second pair of interfaces are enabled (on revision 3), then the total Audio over IP capacity doubles: up to 512 I/O channels or up to 256 streams.

- **ra0** & **ra1** – always active: 2 x 1GbE (via SFP).
- **ra2** & **ra3** (revision 3 only) – requires the AddOnRAV+ license: 2 x 1GbE (via SFP).

The connection(s) must be made via a network switch and not directly to another streaming port. You can find more details about the data network requirements and suitable components in the Lawo IP Networking Guide.

> ⚠ The media network must be properly managed and configured. i.e. it must use a suitable network 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 the streaming ports using an unqualifying IP network, as correct operation cannot be guaranteed.

The senders and receivers are defined by the system configuration. For information about how to set up the streams, see Setting Up RAVENNA_AES67.

To use the streaming network ports, you must fit the correct SFP modules. These must be Lawo-certified (as described earlier). The SFP determines the cable type, maximum distance and connector.

Each port has an LED which indicates the following information.

RAVENNA/AES67 Port LED	Meaning
Off	link down
Green	link up, speed = 100 Mb/s
Blue	link up, speed = 1000 Mb/s

MADI/AIOX Ports: 1, 2, 3, 4

Each of the four MADI/AIOX ports has two possible modes of operation: either MADI (conforming to AES10) or AIOX (a proprietary protocol).

In **MADI mode**, the ports can be used to connect multi-channel digital audio to Power Core.

- Each port conforms to AES10 and carries up to 64 bi-directional channels (at 48kHz).
- Ports 1&2 and 3&4 can be dual-redundant.
- Dual-redundancy and the number of transmitted channels (56 or 64) is defined by the ON-AIR Designer (via the "System -> Definition -> Parm = MADI" branch of the 'Tree Definition').

In **AIOX mode**, the ports can be used to connect a Power Core Audio I/O Extender (described earlier).

- The AIOX protocol carries both audio and control to the external device.
- Ports 1&2 and 3&4 can be dual-redundant.
- Dual-redundancy is defined by the ON-AIR Designer (via the "System -> Definition -> Parm = AIOX" branch of the 'Tree Definition').

It is possible to mix and match the two modes. For example, to use ports 1 & 2 for a dual-redundant MADI connection and ports 3 & 4 for two non-redundant connections to two audio I/O extenders. The mode of operation is defined by the ON-AIR Designer (via the "Frame → System Core" configuration).

- **1, 2, 3, 4** – always active: 4 x MADI or AIOX (via SFP).

All MADI and AIOX connections must be point-to-point.

To use a MADI or AIOX port, you must fit the correct SFP module. These must be Lawo-certified (as described earlier). The SFP determines the cable type, maximum distance and connector.

Each port has an LED which indicates the following information.

MADI/AIOX Port LED	Meaning
Off	not configured
Red	signal not present
Green	signal present
Blue	signal present & active
Light Blue	signal present & not active

CAN Bus Port

The CAN port can be used to connect a local CAN bus device such as a ruby control surface or external KSC/GPIO panel. If you have more than one device, then the CAN bus can be daisy-chained (as described in the control surface/key panel documentation).

The port provides a low-speed CAN connection that operates at 500Kb/s. Note that it cannot be used to connect a diamond frame/surface.

- **CAN** - always active:1 x 500Kb/s CAN (CAT5e, RJ45)

All CAN bus connections must be point-to-point; a switch or hub is not allowed. Use a standard (straight 1:1) network cable: STP-CAT 5e with RJ45 connectors. The maximum length of the CAN bus connection is 60 meters.

The port has two LEDs which indicate the following information.

CAN Port LEDs	Color, State	Meaning
LED 1 (left)	Green, flashing	data received
LED 2 (right)	Green, flashing	data transmitted

RS-422 Serial Port

The RS-422 serial port can be used to connect remote devices which do not support TCP/IP Ethernet. For example:

- A legacy Radio Automation System (RAS).
- A DAW running the Mackie HUI protocol to remotely control Power Core (via a Serial-to-MIDI connection).

On a Power Core revision 2 frame, the RS-422 serial port can also be used for debugging.

The connection uses a RS-422 9-pin D-type cable with RJ45 connector. The maximum cable length is 10 meters.

The port has two LEDs which indicate the following information.

RS-422 Port LEDs	Color, State	Meaning
LED 1 (left)	Green, flashing	data transfer
LED 2 (right), System Run	Green, flashing	control system running

---

USB Service Port

The USB (type B) port is included on revision 3 frames only. It can be used to connect a service computer for debugging.

The port supports plug and play operation so, after connecting your computer, the device should be assigned a Com port number automatically. Enter this into your terminal emulation software tool to establish a connection. For step-by-step instructions, please see Power Core - USB Service Port.

Wordclock IN & OUT

The system can sync to external wordclock by connecting the clock signal to WCLK IN. The system reference is defined by the ON-AIR Designer (via the "System -> Definition -> Parameter = Sync" branch of the 'Tree Definition').

The **WCLK OUT** provides an output of the current system reference: PTP, WCLK IN, MADI or internal clock. This port is always active.

In both cases, connections are made using standard 75 ohm BNC connectors. The maximum cable length depends on the equipment you are connecting to.

See Power Core - Synchronization for more information.

GPIO

The front panel GPIO connector is included on revision 2 frames only. It provides 8 x GPI (optocouplers) and 8 x GPO (silent and self-healing relays).

On a Revision 3 frame, GPIOs can be added by fitting up to two rear expansion GPIO cards (described below). Note that rear expansion GPIO cards can also be added to revision 2 frames (to expand the number of GPIOs).

Expansion I/O Cards

Power Core supports up to 8 expansion I/O cards (described earlier). In each case, the functionality is defined by the configuration. For more information, see the ON-AIR Designer configuration chapters: Audio I/O, Sources and GPIO.

All rear panel I/O cards, except MADI, DANTE and GPIO, break out on DB-25 connectors that are wired according to the AES59 (TASCAM) standard.

MIC/LINE IN

All MIC/LINE IN connections are electronically balanced and floating (suitable for balanced or unbalanced use). They feature a discrete class-A preamplifier with superb performance at both low (mic) and high (line) levels. In addition to variable microphone pre-amp gain, each input comes with switchable 48V phantom power, a high-pass filter and 20dB PAD. The pre-amp gain can be automatically adjusted using the AutoGain feature. The maximum analog input level (with the PAD enabled) is +24dBu.

LINE IN & LINE OUT

All LINE IN and LINE OUT connections are electronically balanced and floating (suitable for balanced or unbalanced use). For LINE OUTs, the maximum analog level can be adjusted to +12, +15, +18, +21 or +24 dBu relative to digital full scale (dBFS). This is a factory-configured setting; +24dBu is recommended.

AES3

All AES3 connections conform to the stereo AES3 standard. The inputs have sample rate conversion (SRC).

MADI

The two ports on a MADI I/O card (710/50) meet the same specification as the front panel MADI/AIOX ports. This allows them to use for either MADI or an Audio I/O Extender. See MADI/AIOX.

The single port on a MADI SRC I/O card (710/60) provides 64 bi-directional channels with SRC on the inputs. Note that this card does not support AIOX and so it cannot be used for an Audio I/O Extender.

DANTE

The DANTE card provides 1 x DANTE Brooklyn III module with 1 main + 1 redundant port.

Each port supports up to 64 bi-directional channels (at 48kHz).

The connector and cable type is RJ45, CAT 5 or better (CAT 5e/6/7); straight or crossed Ethernet cable. The supported standard is Gigabit Ethernet (1000 Base-Tx). The maximum cable length is up to 80m.

The configuration of the DANTE Brooklyn modules depends on their firmware version. Please refer to your Lawo software release notes for the latest information.

For more information about DANTE networking, please refer to the manufacturer's website at: https://www.audinate.com/

GPIO

The GPIO card provides 8 x GPI (optocouplers) and 8 x GPO (silent and self-healing relays) for local signaling and switched functions, plus two VCA inputs to remotely control variable parameters.

- GPI = 8 x optocouplers (3-36V DC / 8mA @ 36V)
- GPO = 8 x Opto-MOS relays (50V AC / 120mA @ 50V)
- 2 x voltage-controlled inputs.

The connector is a 37-pin D-type (DB-37), female.

CASE Grounding Screw

The M4x8 grounding screw must be used to ground the frame for EMC reasons.

See Power Core - Grounding.

Power Inputs: AC & DC

Power Core comes with dual power feeds: AC and DC. To use the DC input, you will need the external DC power supply which must be ordered separately. If both inputs are connected, then the two feeds provide main and redundant power.

- **12V In** (Kycon) – DC input
- **100-240V In** (IEC) - AC input

Before connecting power to the device, please read and observe all of the important safety information in the Power Core - Power Supplies topic.

5.6 Power Core - Synchronization

Power Core can sync to a PTP grandmaster or boundary clock available on the streaming network, an external reference signal or its own internal sync generator.

Usually, PTP (Precision Time Protocol) is the preferred option. If PTP is not available, then use either an external Wordclock signal (connected to WCLK IN) or an incoming MADI signal (connected to MADI/AIOX port 1). If there is no PTP or external reference, then Power Core can sync to its internal sync generator. Be aware that streaming requires PTP and so, in this mode, Power Core can act as a PTP Master, but only on ra0.

The sync reference switching can be automated by enabling more than one option in the configuration. This works as follows.

- Each of the external sync reference options can be independently enabled or disabled.
- If disabled, Power Core ignores the sync source even if it receives a valid signal. It is possible to enable one or multiple sync options for the device.
- If multiple external sync options are enabled, then it is possible to choose a priority order for PTP, Wordclock and MADI. The device then always use the highest prioritized sync source. If none are present, then the device defaults back to internal clock. The switching between the enabled sync options and internal clock is handled automatically.
- By disabling all external sync options, Power Core can act as a sync master and distribute its internal clock via PTP, Wordclock or MADI to other devices.

The sync options are configured using the ON-AIR Designer (via the "System -> Definition -> Parameter = Sync" branch of the 'Tree Definition'). From here it is possible to enable/disable each external sync option and also set the internal sync generator to run at either 48kHz or 44.1kHz.

> **Please note**: if Power Core has been synchronized once to a PTP master, then it will NOT automatically switch to another sync source but try to re-establish its connection to the external PTP master. While doing this, it becomes PTP master itself, and uses the pre-aligned internal clock as the reference.

Sync Reference Options

The sync reference options for Power Core are:

- **PTP** - arriving from the streaming network (via the front panel RAVENNA/AES67 ports).
- **Wordclock** – connected to WCLK IN on the front panel.
- **MADI** – incoming MADI from front panel port 1 (or port 2 if redundancy is configured and port 2 is active). Note that other MADI ports cannot be used for synchronisation.
- **Internal Clock** – set to 48kHz or 44.1kHz by the configuration.

Whether each option is enabled is defined by the configuration (as explained above).

Checking the Sync Status

The sync status can be checked either from the device (using the STATUS LED) or from the Power Core Web UI.

Using the STATUS LED

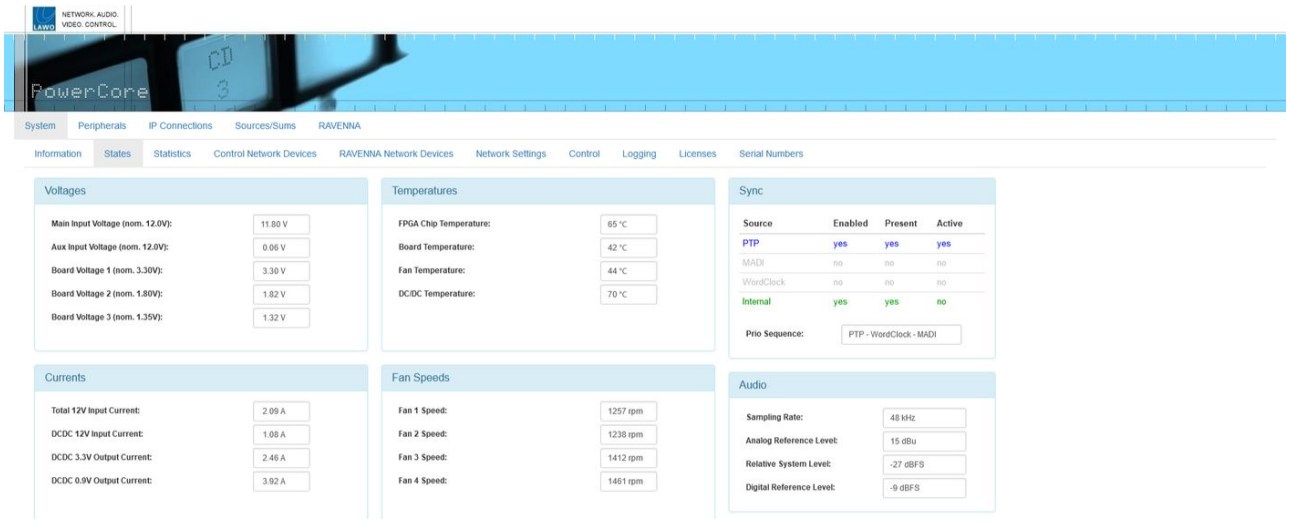
The **STATUS** LED (on the front panel) indicates the health of the device and sync status. If the LED is blinking at regular intervals, then the device is working properly and the LED color indicates the sync status.

STATUS LED meanings

Blinking STATUS LED	Meaning
Blue ↔ Off	Synchronized to PTP master
Yellow ↔ Off	Trying to sync to PTP master
Red ↔ Off	Synchronized to internal clock
Green ↔ Off	Synchronized via Wordclock
Magenta ↔ Off	Synchronized via MADI
Red ↔ white	Device is PTP Master, sync source = internal
Green ↔ white	Device is PTP Master, sync source = Wordclock
Magenta ↔ white	Device is PTP Master, sync source = MADI

Using the Web UI

On the right of the "System → States" page (in the Web UI), you will see information about each of the **Sync** sources.



The columns show whether the sync source is **Enabled** (in the configuration), **Present** (a valid signal has been detected), and **Active**.

The color coding indicates:

- **Blue** = sync source is enabled, present and active.
- **Green** = sync source is enabled and present, but not currently active.
- **Red** = sync source is enabled but not present.
- **Light Grey** = sync source is disabled in the configuration.

The **Prio Sequence** box shows the priority of the external sync sources as defined by the configuration - in our example, PTP, Wordclock and then MADI.

Using the Sync Output

The WCLK OUT connector on the front panel provides an output of the current system reference: PTP, Wordclock, MADI or Internal (free-running).

So, for example, if PTP is current reference, Power Core can provide a wordclock signal to other non-PTP devices.

6 Power Core - System Setup

This chapter describes how to set up the system once all of the hardware components are installed.

- Power Core - Setup Quick Start
- Power Core - Control Network Requirements
- Power Core - Configuration Tools
- Power Core - Opening a Web UI Session
- Power Core - Network Settings
- Power Core - Updating the Firmware
- Power Core - License Activation
- Power Core - Uploading a Configuration
- Power Core - System Date and Time
- Power Core - Network Security

6.1 Power Core - Setup Quick Start

This topic describes the recommended workflow to configure a system from scratch.

Prerequisites

The instructions below describe how to install Power Core as a stand-alone device (without a control surface). If a control surface is to be connected, then please configure the Power Core first and then the surface (as described in the system setup chapter for the surface, e.g. diamond - System Setup).

If Power Core is to be networked to other devices, it is expected that all switches/routers meet the network requirements described here.

Instructions

To set up the system you will need a PC that is installed with a suitable web browser and Lawo's ON-AIR Designer software. How to prepare the configuration PC is described here.

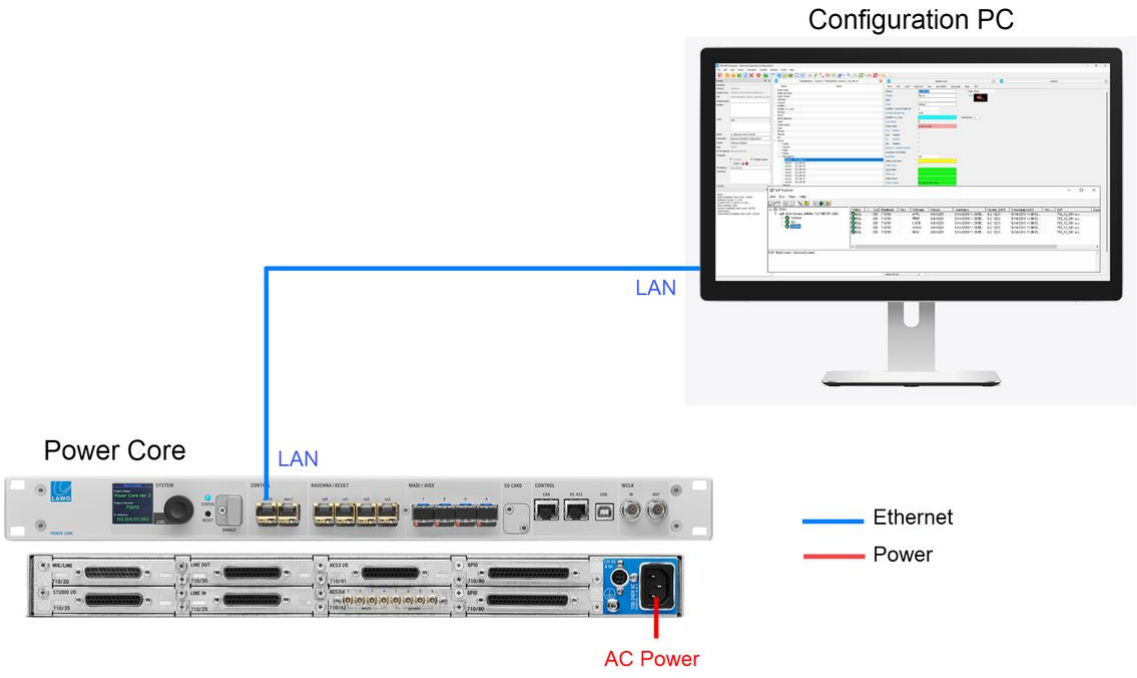
1. To boot and configure the system, the device must be powered.

Once power is applied, Power Core boots in a few seconds. The boot-up progress is shown on the front panel display.

2. Start the configuration by connecting your PC's LAN port directly to Power Core (as shown below).

It is recommended to use the first control port: **dwc0** (so that you can use its default IP address **192.168.101.240**).

For the cabling and network requirements, see Power Core - Wiring: CONTROL.



3. Configure the network settings of the first control port.

This step is necessary if you wish to fit Power Core into an existing network OR install more than one Power Core device (to avoid IP conflicts).

The settings are edited by opening a Web UI connection to Power Core and adjusting the "Device dwc0" parameters (in the "System → Control Network Devices" tab).

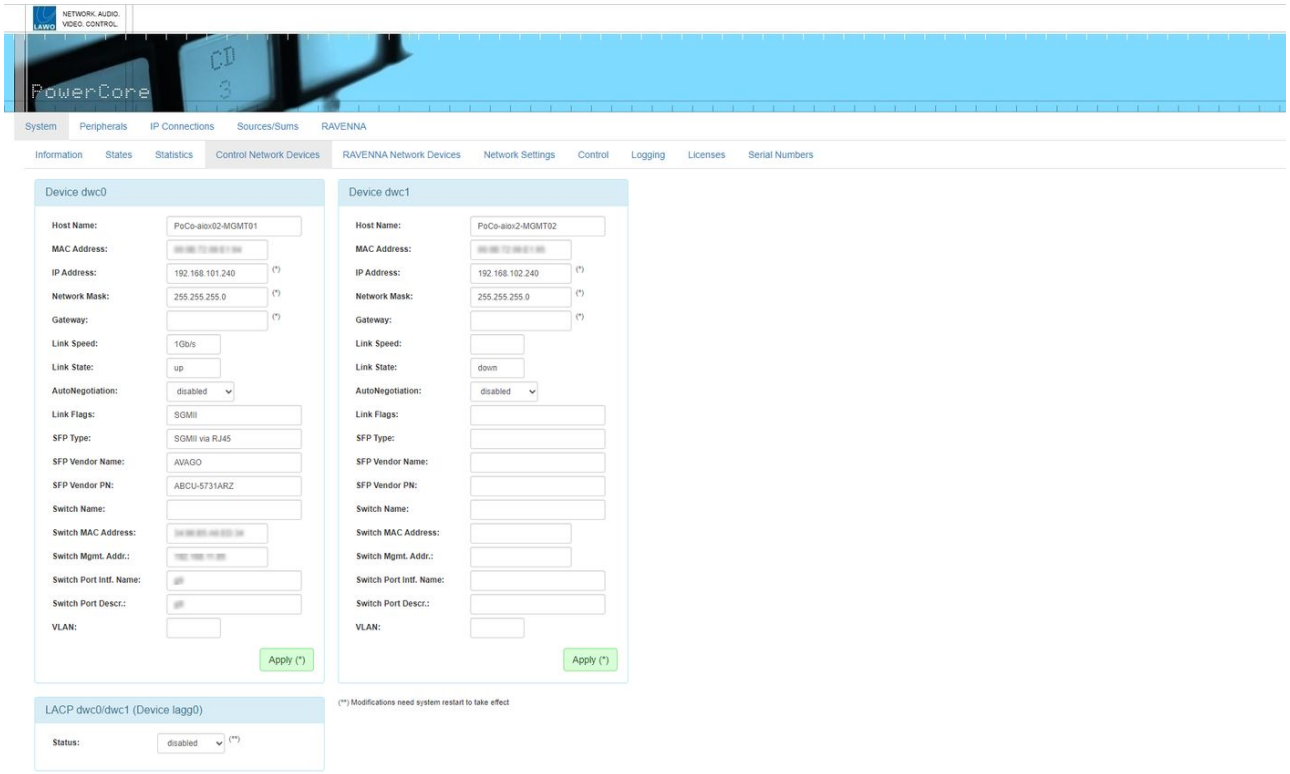
- The Web UI can be reached by entering the current IP address: 192.168.101.240

- Log in as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.
- Open the "System → Control Network Devices" tab and enter the required network settings.

Device dwc0 defines the first control port. If you are using the second control port, then edit the parameters for **Device dwc1**.

The following fields can be edited: **IP Address**, **Network Mask** and **Gateway**. Type in the new value(s) and select **Apply** to save the changes.

The screenshot below shows an example.



For more information, see Power Core - Network Settings.

At this stage, you can reconnect your devices via the control network OR continue on (if networking is not required).

It is recommended to check the network connection to your configuration PC by re-opening the Power Core Web UI.

4. Check and update the system firmware (using SoP Explorer).

See Power Core - Updating the Firmware.

5. Activate the software license(s) for the system and install them to the Power Core DONGLE port.

See Power Core - License Activation.

6. Upload a configuration (using ON-AIR Designer).

See Power Core - Uploading a Configuration.

Important: When preparing the system configuration, it is important that the configured options match the licensed feature set. Otherwise, if the license limits are exceeded, the Power Core alarm will sound.

Next Steps

Once you have completed the steps above, the system is ready for operation.

If you haven't done so already, connect and check your sync reference. Optionally, you may wish to set the system date and time or configure the network security.

Then go to Power Core - Operation to learn more about the functionality of the device.

6.2 Power Core - Control Network Requirements

To configure or control Power Core via TCP/IP Ethernet, you will need to make a connection to the control port (dwc0 or dwc1). This connection can be made either directly (point-to-point) or via a network (LAN or WAN).

When connecting via a network, then this can be shared with other devices, such as in the regular "house network" of a typical broadcast facility. Routers are permitted as long as the minimum requirements of the network interfaces are met. By using routers, or similar devices, the latency of the communication will increase.

The control network interfaces can operate at 1000, 100 or 10 BASE-T, depending on the SFP. The network switch/router port(s) MUST meet the following requirements:

- **Speed =** 1Gb/s, 100Mb/s or 10Mb/s; **1Gb/s is recommended**
- **Duplex mode = Full Duplex**

6.3 Power Core - Configuration Tools

This topic describes how to prepare the configuration PC.

Overview

To set up the system, you will need a PC with a network interface card (NIC). The PC must be installed with a suitable web browser and Lawo's ON-AIR Designer software.

The web browser is used to open the Power Core Web UI. The Lawo software installs two applications: ON-AIR Designer and SoP Explorer.

During the initial setup, these tools are used as follows.

- The Web UI can be used to edit the network settings (to add the device to an existing network).
- SoP Explorer is used to check and update the firmware (for all hardware components).
- ON-AIR Designer is used to edit and upload a configuration (to define the functionality of the system).

Host PC Requirements

To install and run the ON-AIR Designer, your PC must meet the following requirements:

- Windows 10 or 11 operating system*
- Core-I5 (or higher) CPU
- 2GB RAM, minimum

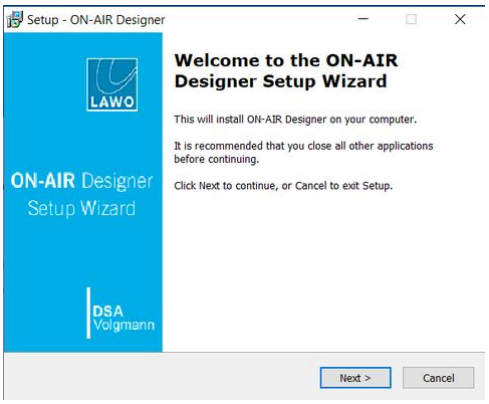
*For the operating system, we recommend Windows 10 or Windows 11, although the ON-AIR Designer software will also run on Windows 7, 8 and 8.1.

If you are planning to install a VisTool application on the same machine, then please also refer to the VisTool MK2 requirements (in the VisTool documentation).

Installing the Software

The latest version of the **onair-designer.exe** installer is available from the Lawo Download-Center (after login).

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

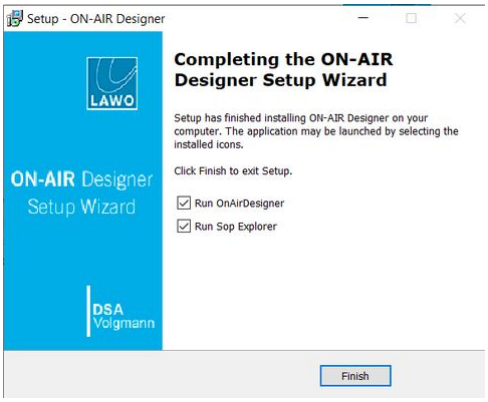


2. Follow the on-screen instructions, accepting the default options provided.

3. When you reach the 'Summary' window, check the options and click **Install** - the software is installed onto your computer; this may take a few minutes.

By default, files are installed in the location: 'C:\Program Files\OnAirDesigner'.

4. When the installation is complete, the following window appears.



5. It is recommended to leave the default "Run" options selected and click on **Finish**.

This launches the ON-AIR Designer and SoP Explorer applications. In both cases, the next step is to configure a valid network connection to the Lawo system.

Getting Connected

To establish a network connection to the Lawo system, you will need to configure the network settings for your PC's LAN port.

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

You can check the current network settings for Power Core on its front panel display, and those for diamond from the surface displays during boot-up.

The default IP addresses are:

- Power Core = 192.168.101.240
- diamond = 192.168.101.241

The **Subnet Mask** should be identical to that of the port you are connecting to.

The default subnet mask = 255.255.255.0

A **Default Gateway** setting is required if data packets are to be redirected. For example, if the computer is connected via a network switch with Layer 3 routing capability.

If redirection is not required, then the Default Gateway can be left blank.

To test the connection, open a web browser application and enter the system's IP address into the URL field. e.g. 192.168.101.240 - if the connection is successful, the Web UI "Login" screen appears.

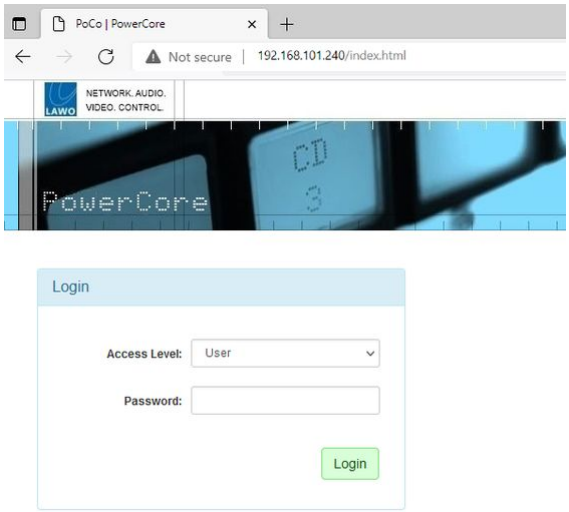
6.4 Power Core - Opening a Web UI Session

This topic describes how to open a Web UI connection and log in.

1. Open a web browser application and enter the system's IP address into the URL field.

For example, enter **192.168.101.240** for Power Core or **192.168.101.241** for diamond.

Following a successful connection, the "Login" screen appears. The example below shows the login screen for Power Core.



2. Select an Access Level and enter the Password.

There are three possible Access Levels.

- **User** (no password required, leave blank).

  Information is displayed as "read-only" with no editable fields.

- **Supervisor** (default password = *orion*).

  Allows pertinent fields to be edited, such as the IP settings in the "System → Network Devices" tab.

- **Administrator** (default password = *hydra*).

  As for Supervisor, but with access to Supervisor and Administrator passwords in the "System → Control" tab.

For security reasons, it is recommended to change the Administrator and Supervisor passwords from the defaults after the device is set up.

3. Click on the green **Login** button.

Following a successful login, the current information is loaded from the device, and the "System → Information" tab appears.

Power Core has many system parameters and so it will take a few seconds for the information to load. Some of the information is displayed as a "snapshot" of the current data, so it is only as current as the latest refresh.

6.5 Power Core - Network Settings

This topic describes how to configure the network settings for Power Core.

Active Network Ports

Power Core (revision 3) is equipped with six network interfaces: two control and four streaming ports.

- The two control ports (dwc0 and dw1) and first pair of streaming ports (ra0 and ra1) are always active.
- The second pair of streaming ports (ra2 and ra3) can be enabled if there is a valid RAV+ add-on license.

Power Core (revision 2) is equipped with four network interfaces that are always active: two control ports (dwc0 and dwc1) and two streaming ports (ra0 and ra1).

Default Network Settings

By default, the network interfaces are assigned the following IP addresses. Note that Power Core can handle static IP addresses only; DHCP is not supported.

Network Port	IP Address		Subnet Mask	Gateway
Power Core - dwc0	Static only	192.168.101.240	255.255.255.0	0.0.0.0
Power Core - dwc1	Static only	192.168.102.240	255.255.255.0	0.0.0.0
Power Core - ra0	Static only	192.168.99.240	255.255.255.0	0.0.0.0
Power Core - ra1	Static only	192.168.98.240	255.255.255.0	0.0.0.0
Power Core - ra2	Static only	192.168.199.240	255.255.255.0	0.0.0.0
Power Core - ra3	Static only	192.168.198.240	255.255.255.0	0.0.0.0

Current Network Settings

The network settings for the first control port (**dwc0**) are shown on the front panel display.

Editing the Network Settings

The network settings for the control and streaming ports can be edited by opening a Web UI connection to Power Core. You will need to do this if you are installing more than one device (to avoid any IP conflicts).

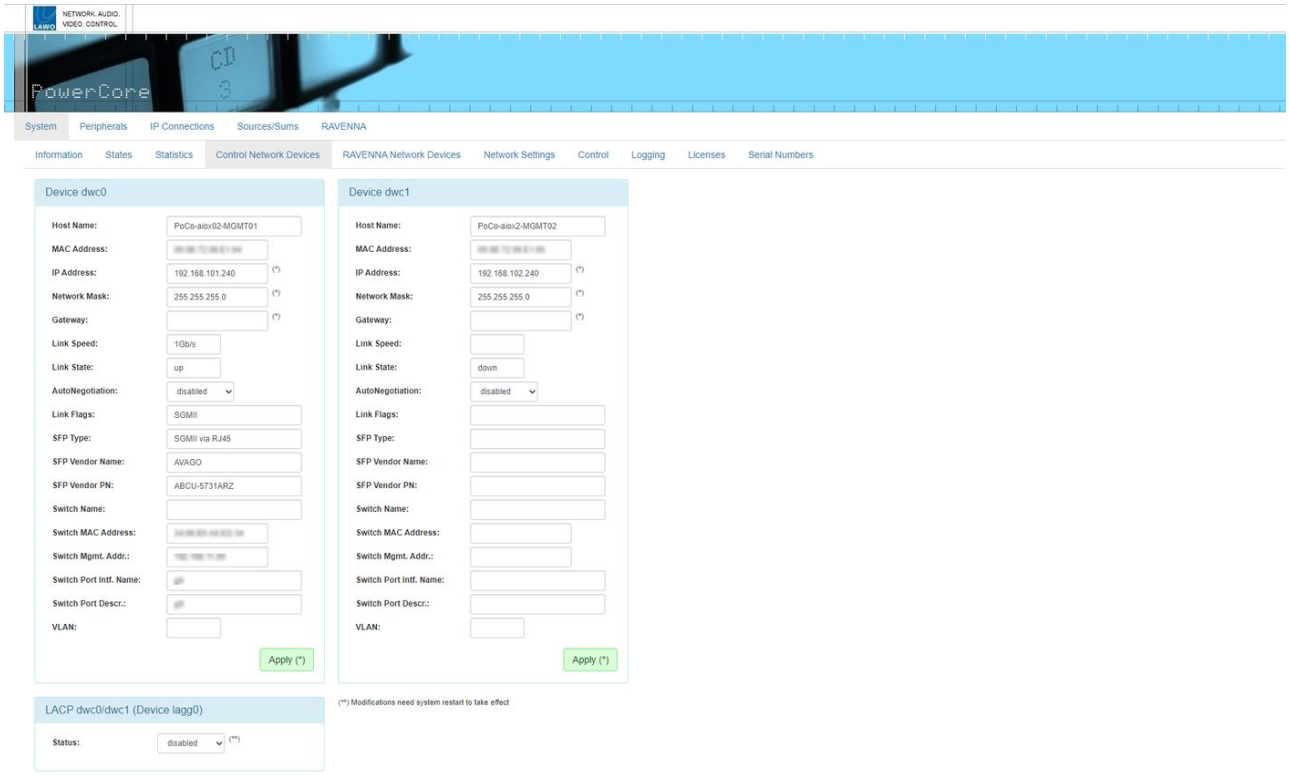
1. For the initial setup, best practice is to connect your configuration PC directly to the first control port: **dwc0**.
2. The Web UI can be reached by entering the IP address of the connected port.

- For Power Core (dwc0), the default IP = 192.168.101.240

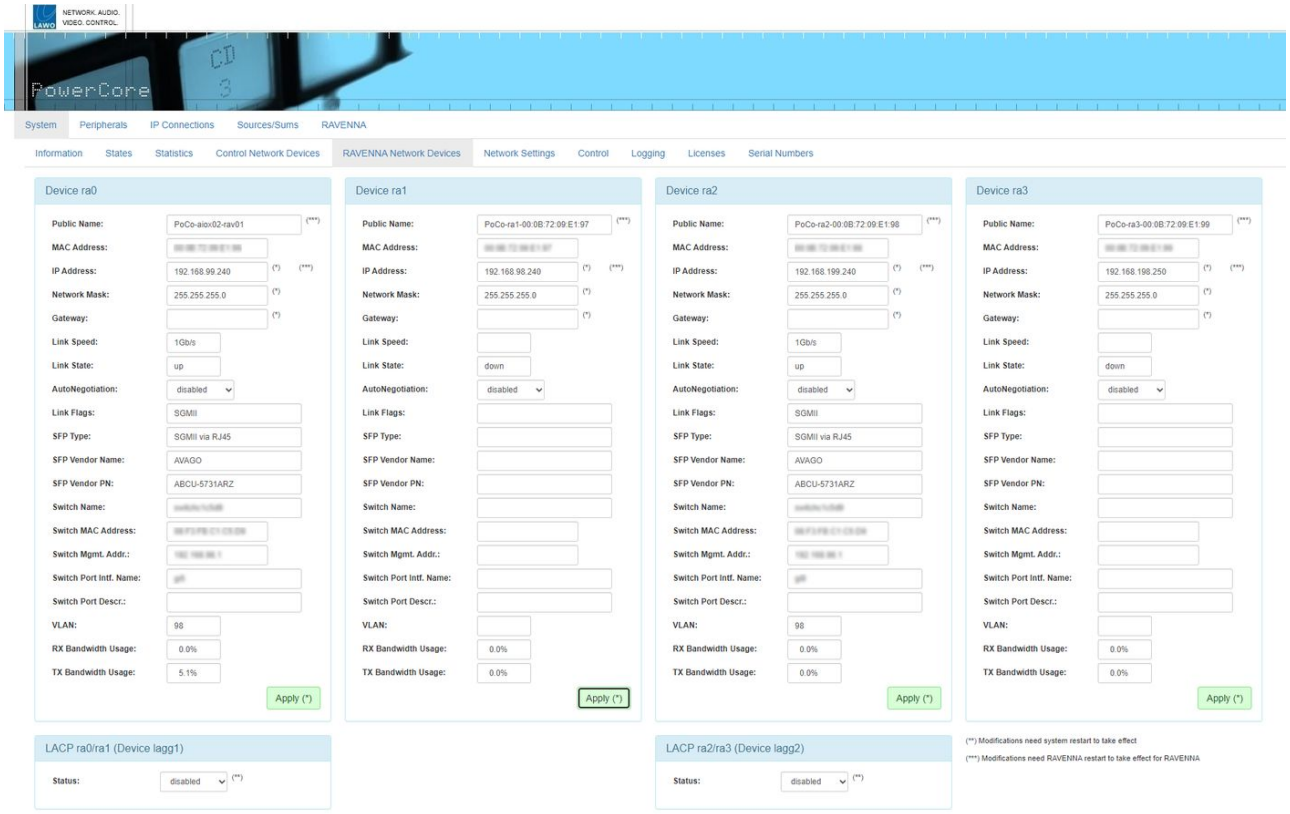
Log in as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.

3. Select either "System → Control Network Devices" or "System → RAVENNA Network Devices".

The first page shows the settings for the control network interfaces: **Device dwc0** and **Device dwc1**.



The second page shows the settings for the streaming network interfaces: **Device ra0** and **Device ra1** (plus **Device ra2** and **Device ra3** if these ports are enabled/available).



Important: After updating the system to a new version, it is recommended to clear the cache of the web browser (to avoid old information being displayed).

The editable fields are marked with an asterisk (*) and include the IP Address, Network Mask and Gateway.

4. Type in the new value(s) and select **Apply** to save the changes.

For the control ports (dwc0 and dwc1), IP address changes are made immediately, and so you will lose your browser connection once settings are applied. It is recommended to check the communication by re-opening the Web UI using the new IP address.

For the streaming ports (ra0, ra1, ra2 and ra3), IP address changes require a restart, and so you will need to reboot the device after settings are applied. This can be done using the **Reboot (Warmstart)** button in the "System → Control" tab.

A Domain Name Server, NTP Server or Syslog Server can be entered via the "System → Network Settings" tab.

5. Once the correct settings are in place, you can connect Power Core to the control network.
6. To continue with the setup, enter the new IP address into your browser and log in again (as described above).

Backup and Restore

It is possible to make a backup of the current network settings by copying the **parm.xml** file from the SD card (via ftp). This can then be copied back to the system if a restore is required.

The **parm.xml** file can be found in the following location on the SD card: **/media/mmcsd-0-0/parm**

After replacing the file, you will need to reboot Power Core using a cold start. This can be done using the **Reboot (Coldstart)** button in the "System → Control" tab.

6.6 Power Core - Updating the Firmware

This topic describes how to check and update the system firmware using SoP Explorer.

Overview

SoP Explorer is the firmware update tool for Lawo on-air systems. It can be used to check and update the firmware versions on the Core, expansion I/O cards and, where applicable, the control surface and key panels.

You will need to run SoP Explorer whenever you update to a new version of software. The latest firmware files are copied onto the PC by the software installer. When SoP Explorer connects to the Lawo system, it compares the versions. If updates are required, data is transferred firstly to the Core, and then onto the other components.

Important: You should never update system while it is operational! The hardware will reset several times during the update process, causing interruption to the operation and audio.

Prerequisites

SoP Explorer must be installed onto the configuration PC using the **onair-designer.exe** installer (as described earlier). Both the configuration PC and Power Core must be connected to the control network.

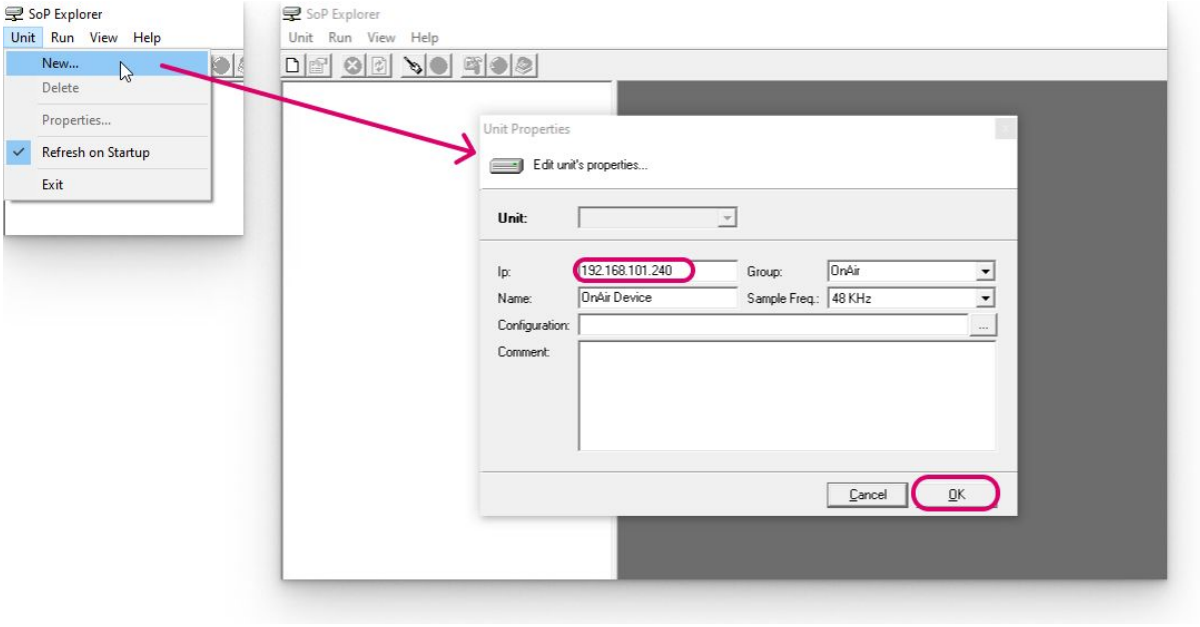
First Steps

Before you begin, check that the expansion I/O cards are installed and that any surface components, including key panels, are connected.

1. Start the software.

SoP Explorer starts automatically at the end of the ON-AIR Designer software installation procedure. It can also be started from the desktop icon or Windows START menu.

If this is the first time you have launched SoP Explorer, then the "Unit Properties" window opens automatically. Alternatively, select **Unit → New...** (from the main menus).



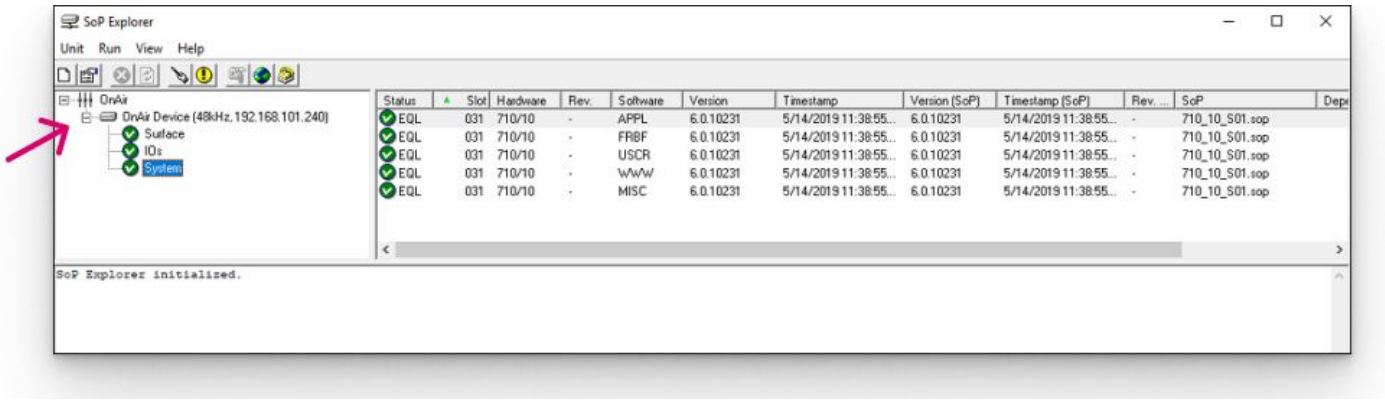
2. Edit the 'Unit Properties' to define the system you wish to connect to.

Usually it is enough to enter the **IP** address of the Core and leave the other fields at their default values. In a larger network with multiple devices, it can be useful to edit the **Name** field (to help identify the device in the system tree).

Select **OK** - the unit is added to the **OnAir** device group in the system tree. SoP Explorer connects to the device and analyses the current firmware revisions.

If a white cross on a red background appears beside the unit name, then SoP Explorer cannot connect to the device. Check that the IP address (entered in the "Unit Properties") matches that of the remote device. Then check the IP settings of the configuration PC and the network cabling.

3. Once a connection is established, you can use the **+** and **-** signs (in the system tree) to reveal the components.



For a Power Core system, you will see up to three components: **System** (for internal components), **IOs** (for expansion I/O cards) and **Surface** (for control surface modules and/or key panels). If the **Surface** branch is missing, then the surface components are not connected.

Editing the 'Unit Properties'

Once a unit is defined, you can re-open the 'Unit Properties' by selecting **Unit → Properties...** (from the main menus) or clicking on the button (from the toolbar).

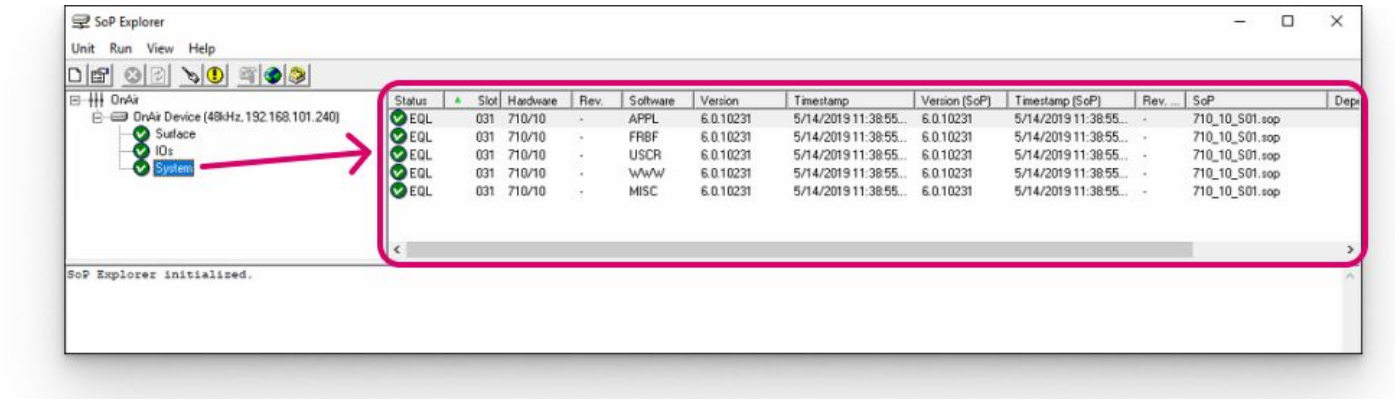
If more than one device has been added to SoP Explorer, then you can use the **Unit** drop-down menu to select a different system.

The remaining fields can be edited as follows.

- **Ip** - defines the IP address of the Lawo control system. This must be entered correctly, otherwise network communication cannot be established.
- **Name** - identifies the system within SoP Explorer. A default name of **OnAir Device** is given to each new unit. It is a good idea to edit the name so that systems can be easily identified.
- **Group** - is reserved for future implementation; the default group is always **OnAir**.
- **Sample Freq** - this field is used to select the sample frequency for **sapphire** or **Nova17**. It has no function for other systems.
- **Configuration** - this field is optional. It can be used to enter the file path for the system configuration. You do not have to enter a configuration, but if you do, you will able to open the ON-AIR Designer configuration by selecting **Run → Configuration** (from the main menus) or clicking on the button (from the toolbar).
- **Comment** - this field is optional. It can be used to enter notes about the system.

Checking the Current Revisions

Once the unit is defined, select a component (e.g. **System**) to interrogate its software modules.



Several columns of information are provided: "Status", "Slot", "Hardware", etc. These are described in more detail later.

For now, use the "Status" column to check the firmware revisions. The table below describes all possible states.

Status	Meaning	Actions
EQL	Software is up to date.	No action required.
UPD	Software requires an update.	Update the module using one of the update methods.
NEW	Software is newer than the SoP Explorer release.	SoP Explorer cannot be used to downdate the software. Please contact the Lawo Support Department for assistance.
FIX	Software cannot be updated by the SoP Explorer release.	Please contact the Lawo Support Department for assistance.
OLD	Software cannot be identified. This may occur if you have not updated the system for a while.	Please update the module and then refresh the connection.

Repeat to interrogate each component as applicable: **System**, **IOs** and **Surface**.

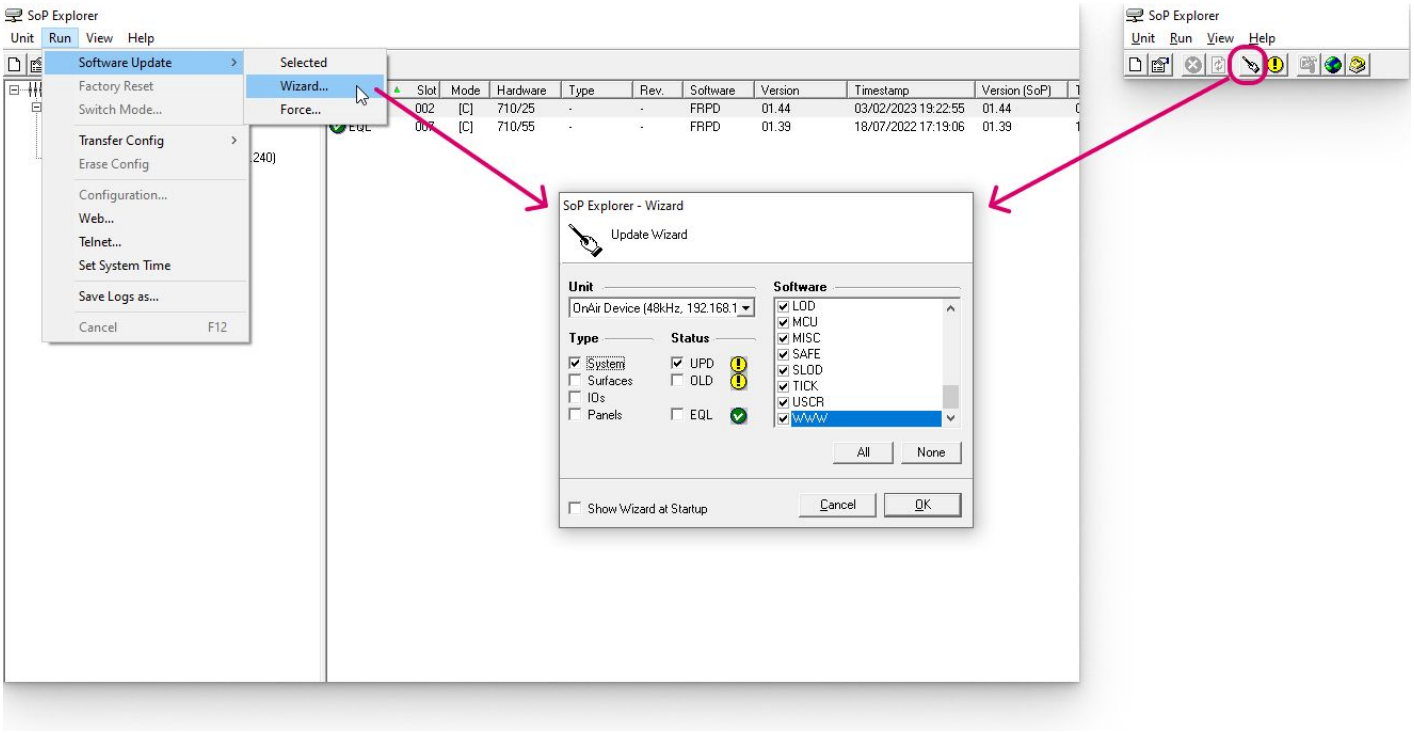
If all modules on all components are up to date, then you can close SoP Explorer. Alternatively, use the 'Software Update Wizard' to update the components.

Using the Software Update Wizard

SoP Explorer support three software update methods: Selected, Wizard and Force. Unless otherwise advised, it is recommended to use the 'Update Wizard'.

> **Important**: While it is possible to update all components at once, it is strongly recommended that you update the components individually in the following order: **System**, **IOs** and then **Surface**.

1. Start by opening the 'Software Update Wizard', either from the main menus (**Run → Software Update → Wizard...**) or toolbar.



2. Check that the correct unit is selected (in the drop-down **Unit** menu).
3. Then use the **Type**, **Status** and **Software** options to prepare the update as follows.

Start by selecting **System** (in the Type column) + **UPD** (in the Status column) + **All** (in the **Software** modules list).

4. Select **OK** - a confirmation window appears.
5. Select **Continue** to start the update.

Software updates can take several minutes. The progress is shown in the status bar at the bottom of the SoP Explorer window. Once the update is complete, the system cold starts.

6. Wait for the system to reboot and then click on the refresh button on the toolbar .
7. Now check the status of the **System** modules.

All modules should be equalized indicating that their software is up to date.

8. Repeat the process but this time select **IOs** (in the Type column) to update the expansion I/O cards fitted to the Core.
9. If a control surface is connected, repeat the process again but this time select **Surfaces** (in the Type column).

Once all software modules on all components are equalized, the firmware updates are complete and you can close SoP Explorer.

In the unlikely event that the 'Software Update Wizard' fails, you can try one of the alternative update methods.

6.7 Power Core - License Activation

This topic describes how to install the software license(s).

Overview

Power Core requires a main license and, optionally, one or more add-on licenses to "unlock" the system resources.

All licenses must be installed onto a USB memory stick that is connected to the front panel DONGLE port. A specially-configured USB memory stick is supplied for this purpose.

The licenses are activated using the **CodeMeter Runtime** licensing system from WIBU systems. The license codes can be found on the delivery note shipped with the system. Once the activation process is complete, the USB dongle can be fitted to the device and all licensed features become available.

It is possible to upgrade or downgrade the DSP resources available to your system by installing a new main license or add-on(s). For more information about the license options, please see Power Core - Licensed Feature Sets.

Important: When preparing the system configuration, it is important that the configured options match the licensed feature set. Otherwise, if the license limits are exceeded, the Power Core alarm will sound.

About the Dongles

All dongles are specially-configured USB memory sticks that must be purchased from either Lawo or WIBU systems.

The dongles supplied for software and hardware products ship with different file systems, so **it is important not to mix up the dongle types**.

If you have purchased a dongle for a Lawo software application such as VisTool, then this will have a metal "LAWO logo" tag attached as shown below. Multiple software products can be licensed from a single dongle.

USB dongle for Lawo software

The dongle supplied for hardware products such as Power Core are stand-alone (with no metal tag).

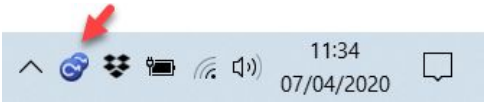
Preparing for Activation

To activate a license, you will need:

- A PC with an internet connection (and USB port if using a dongle). If your PC does not have an internet connection, then the offline activation method can be used. The PC must be installed with **CodeMeter Runtime** (as described below).
- The WIBU systems USB memory stick (if using a dongle).
- The license code. This can be found on the delivery note shipped with the system.

Installing CodeMeter Runtime

To activate a license, your PC must be installed with **CodeMeter Runtime** (from WIBU systems). The correct version is installed automatically with the setup software for your product. You can check the installation by looking in the Windows taskbar where you should see the following icon.



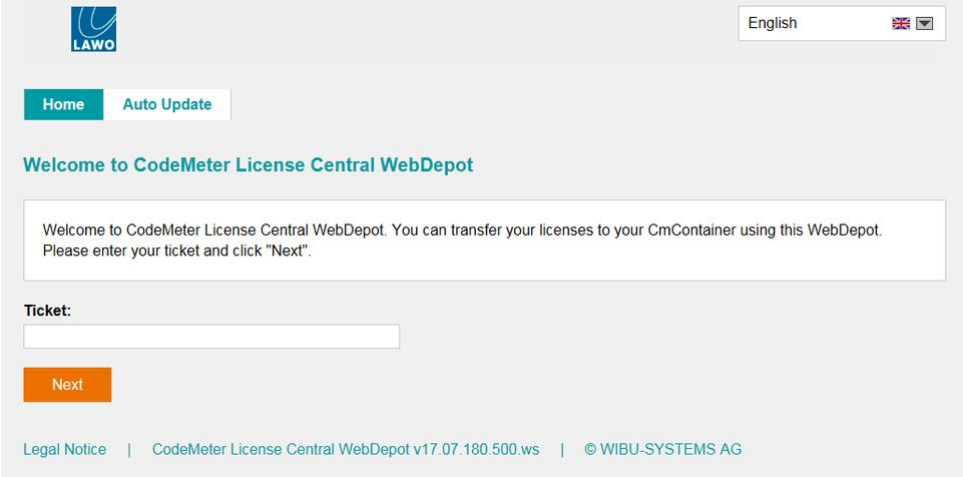
This shows that a Cm container (for local license storage) has been installed.

Activating a License Online

To use this method, your PC must have an internet connection. If this is not possible, then the offline activation method can be used.

When installing onto a dongle, the dongle must be connected to the PC's USB port.

1. Open the Lawo licensing web page at https://licenseportal.lawo.com



TIP: You can change the language using the drop-down menu at the top right of the page.

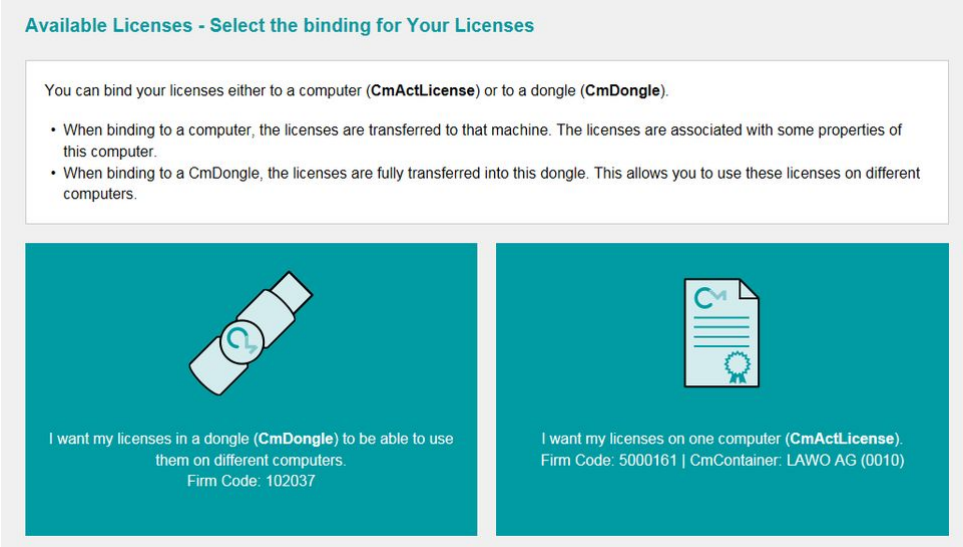
2. Copy your license ticket number into the 'Ticket' field and select **Next**.

The license code can be found on the delivery note shipped with the system. It takes the form of a 25-digit ticket number such as the one shown below.

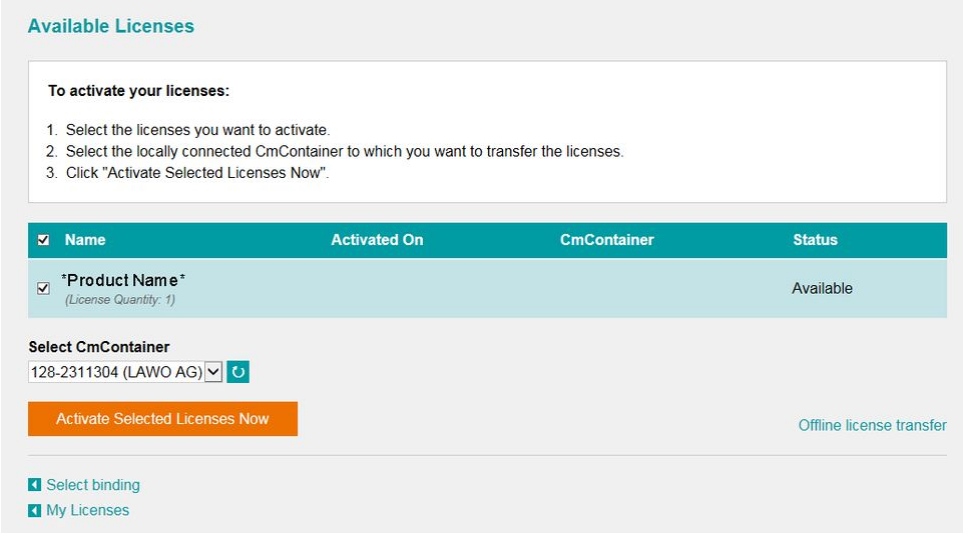
3. The WebDepot searches for and displays your licenses. Select **Activate Licenses** to continue.
4. At the next page, select the storage method for your license.

There are two possibilities:

- **CmDongle** - to create a USB dongle.
- **CmActLicense** - to bind the license to the local computer.



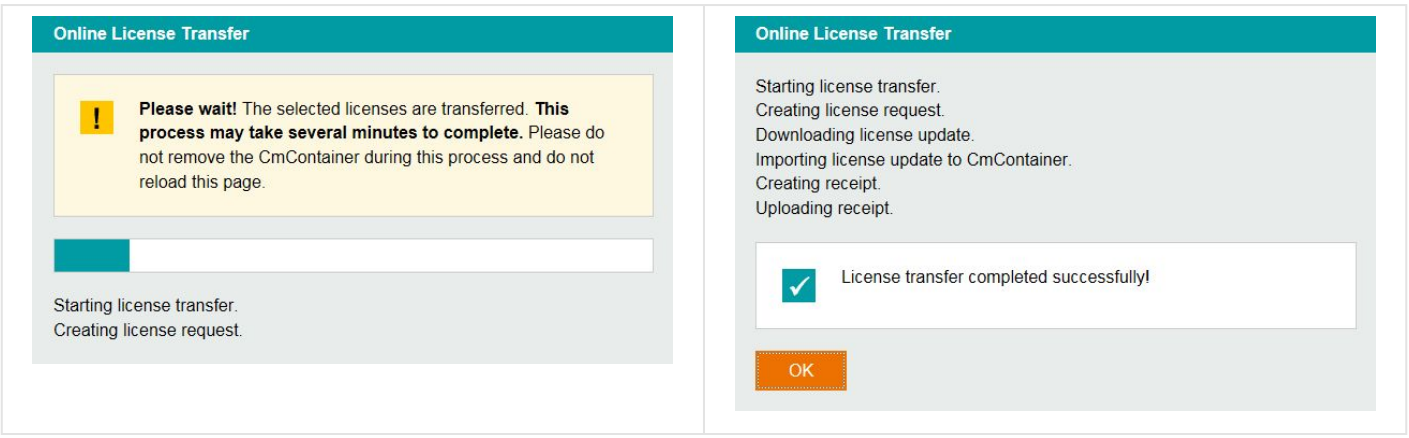
5. At the next page, select the licenses you wish to activate and the CmContainer to be used for the license storage.



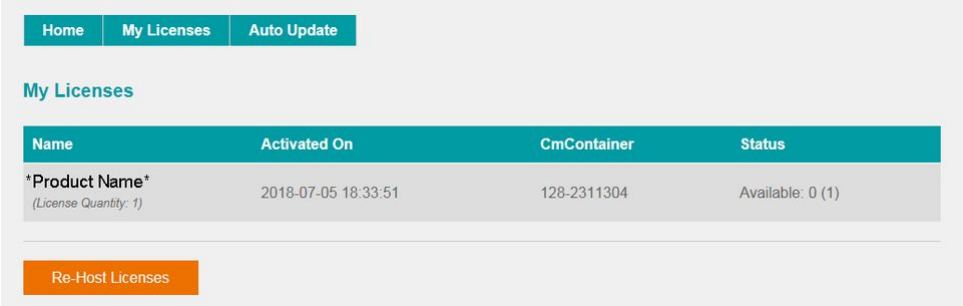
You can store multiple licenses in the same container. If no Cm containers are available, then you will see an option to "**Get CmContainer automatically**".

6. Click on **Activate Selected Licenses Now** and wait for a few seconds.

A confirmation message appears once the activation is successful.



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



8. You can now close the browser and return to your Lawo software application or install the USB dongle.

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

Installing the License Dongle

Once the license(s) are activated, it is time to connect the USB memory stick to the DONGLE port. This is located on the front panel (next to the **STATUS** LED).

If the optional safety cap is fitted, you will need a T10 star tool to remove and replace the cap.

Next Steps

All licensed features become available once the dongle is fitted and a valid license is detected.

Usually, you will need to edit the system configuration to enable the licensed features. This is explained in more detail later in Power Core - Configuration Examples. For now, it is recommended to upload a basic configuration to get the system operational (as described in the next topic).

Further Information

The licensing system supports a number of other features including re-hosting a license, offline activation, backup/restore and using a license server. These are described in the "Licensing" documentation, see License Activation.

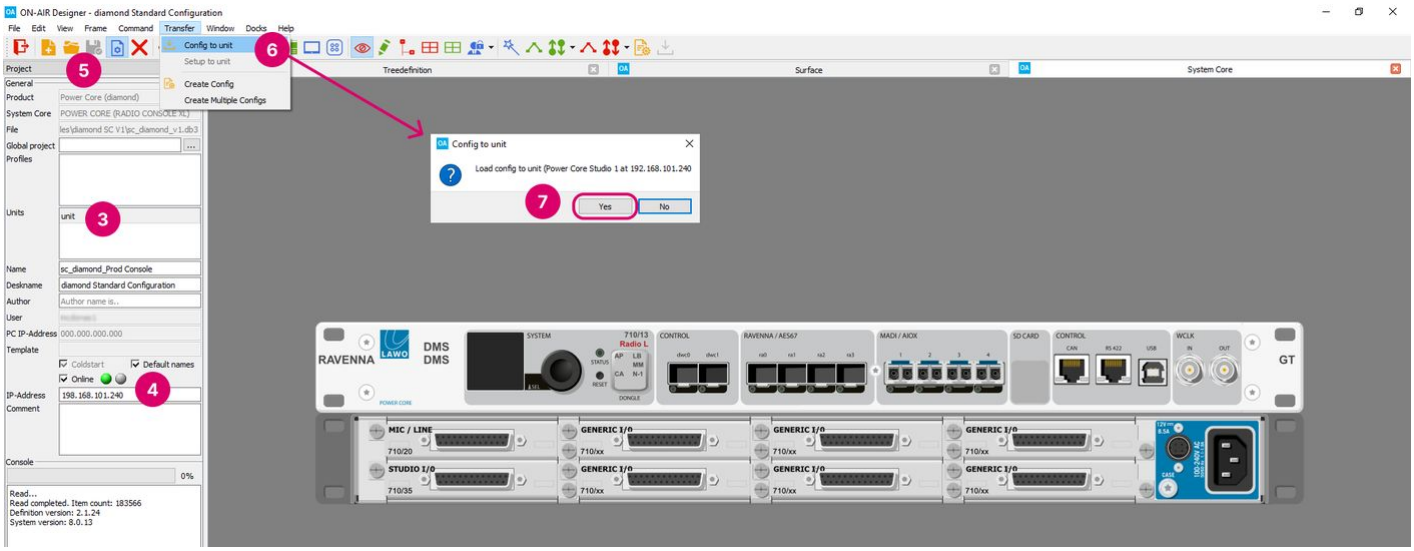
6.8 Power Core - Uploading a Configuration

To get the system operational, you will need to transfer a suitable configuration using ON-AIR Designer.

For now, it is recommended to transfer one of the standard configurations available from the **Downloads** area at www.lawo.com (after Login). Alternatively, you can create a simple configuration using the 'New Project Wizard'.

The instructions below describe how to transfer the configuration to a single device. Note that it is possible to transfer the configuration to multiple devices if the project uses substitutions. This is explained in the ON-AIR Designer documentation, see Configuring Multiple Units.

The screenshot below shows where to find steps 3 to 7.



1. Start the software.

ON-AIR Designer starts automatically at the end of the software installation procedure. It can also be started from the desktop icon or Windows START menu.

The application opens with a blank operating window.

2. Open the project you wish to transfer using one of the following methods.

- Select **File → Open** from the main menus.
- Click on the Toolbar icon.
- Press CTRL + O on your computer keyboard.

3. In the 'Project' window, select the unit from the **Units** field (if multiple units are configured).

4. Then tick the **Online** checkbox and make sure that you have a valid network connection to the device - the green indicator should be lit.

If the red indicator is lit, then check the IP address of the device and edit the **IP-Address** field to match - the online indicators will update.

5. If any changes have been made to the configuration, then these must be saved before the transfer.

Use either "File → Save" or "File → Save As" to save the project. You can use any file name and location, as long as the file type (.db3) remains unchanged.

> If you edit the **IP Address** field in the 'Project' window, then the file must be saved, closed and re-opened.

6. Select **Transfer -> Config to unit** from the top menu bar, or click on the Toolbar icon.

If the option is greyed out, then there is no network communication to the device. Go back to step 4 until this is resolved.

7. A confirmation box appears. Check the details and select **Yes** to start the transfer.

The software now compiles the necessary files and transfers them to the device. The progress is shown in the **Console** status area at the bottom of the 'Project' window.

Once the transfer is complete you will see the lines "File loaded to unit" and "Sending restart". The device will go offline while it restarts. This is perfectly normal but may take a few seconds.

All systems perform a cold start, except for the Nova29 which warm starts (to keep all matrix crosspoints in place).

8. The new configuration data is loaded at the end of the boot-up sequence and the transfer is complete.

If your computer's firewall prevents the transfer, then change your firewall settings and retry.

9. You should now test the operation thoroughly to check that the system is working as expected.

For more information about how to configure Power Core using ON-AIR Designer, see Power Core - Configuration.

6.9 Power Core - System Date and Time

The system date and time is provided by your network's NTP server (if present), or by the device's internal Real Time Clock (RTC). In both cases, a different time zone can be applied. This topic describes how to define the NTP server, reset the date/time manually and change the time zone.

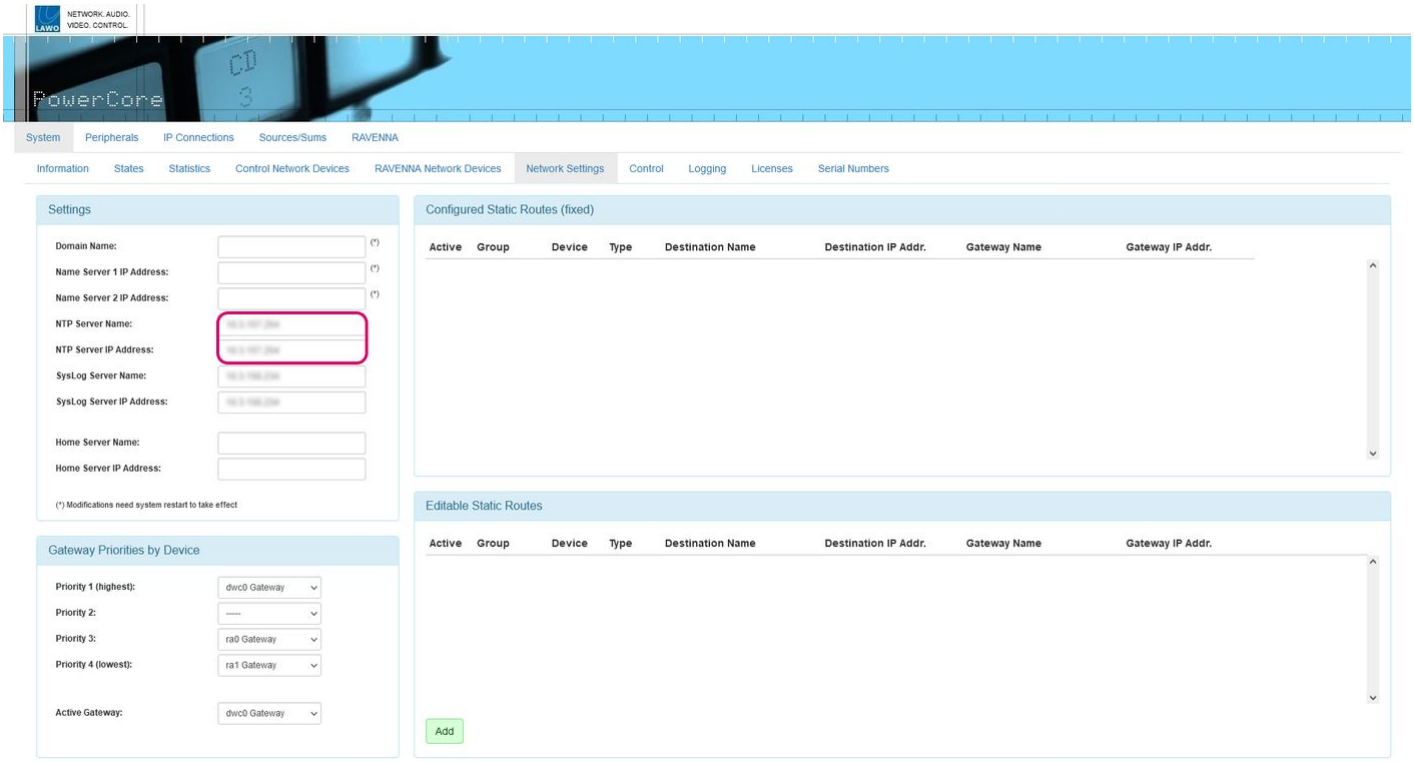
Defining an NTP Server

The network's NTP server can be defined in the "System → Network Settings" page of the Power Core Web UI. Once present, the system uses the NTP server to provide the system date and time.

1. Open a Web UI session for Power Core (as described earlier).

2. Log in as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.

3. Select the "System → Network Settings" page.



4. Use the **NTP Server Name** or **NTP Server IP Address** fields to define the server.

If you type "ntp.internal" in the Server Name box, then the IP Address is automatically filled.

Setting the Date/Time Using SoP Explorer

SoP Explorer can be used to transfer the date and time from your configuration PC to the Lawo device. The transfer is done as a one-shot snapshot, so start by checking the current settings on your PC before you begin.

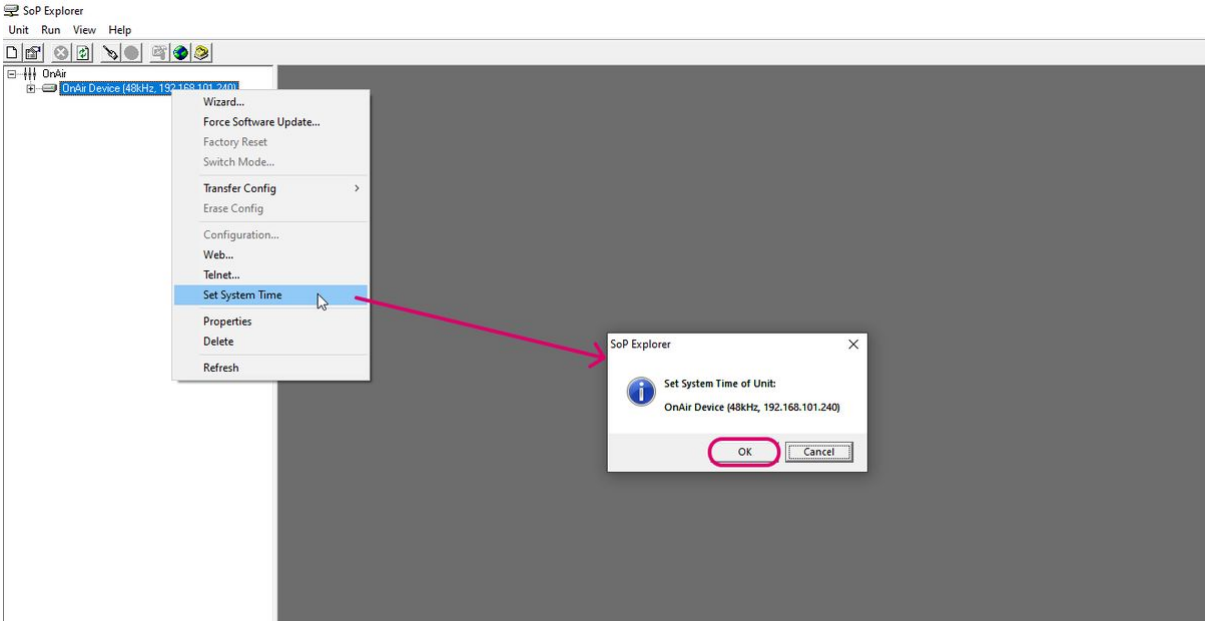
1. If SoP Explorer is not already open, start the application from either its desktop icon or Windows START menu.

All units that have been previously defined appear in the system tree (on the left).

If the unit you wish to configure is not listed, then select **Unit → New...** (from the main menus), enter the **IP** address of the Core and select **OK** - the unit is added to the "OnAir" device group in the system tree. SoP Explorer connects to the device and analyses the current firmware revisions.

If a white cross on a red background appears beside the unit name, then SoP Explorer cannot connect to the device. Check that the IP address (entered in the "Unit Properties") matches that of the remote device. Then check the IP settings of the configuration PC and the network cabling.

2. Right-click on the unit and select **Set System Time**. Confirm by selecting **OK**.



The software now sets the system date and time to match that of the configuration PC. The success (or failure) of the reset is shown in the SoP Explorer status bar area.

Changing the Time Zone

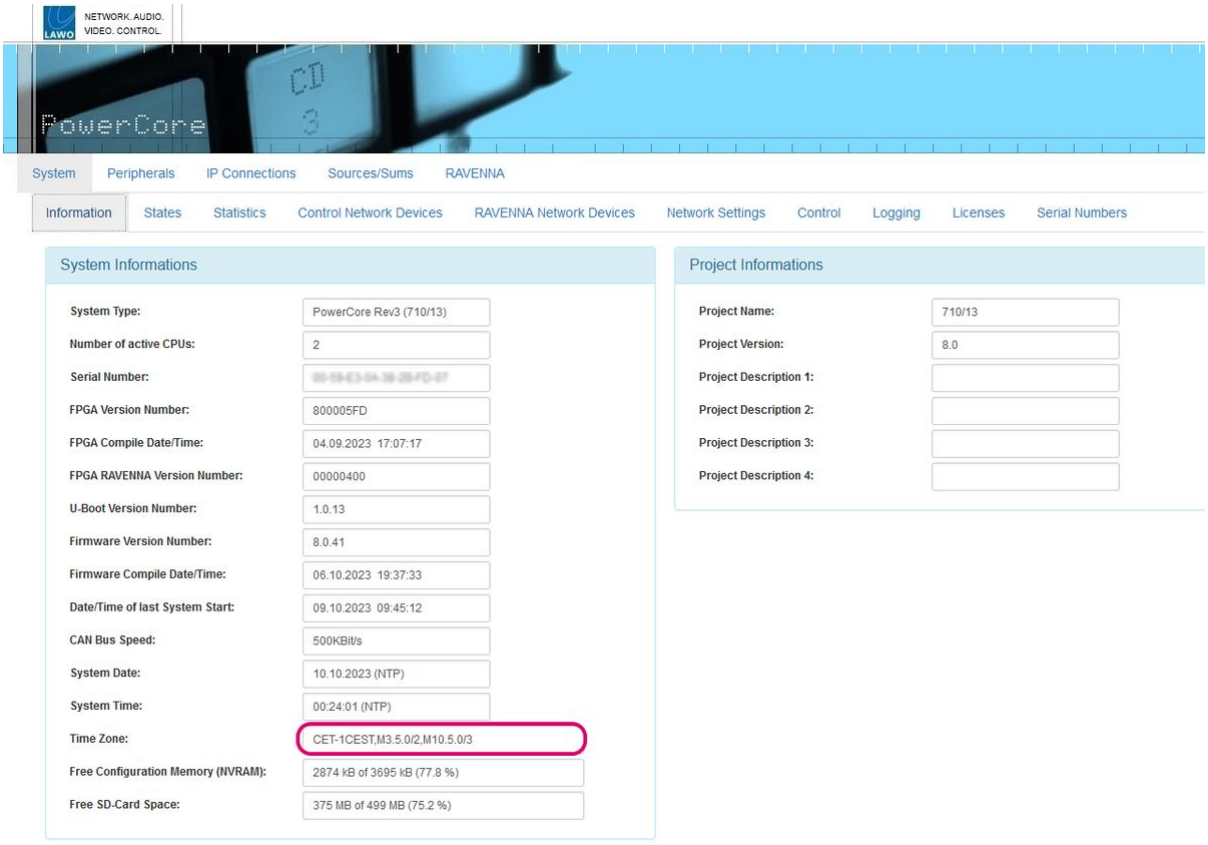
The time zone can be edited by opening a Web UI connection to the device.

1. Open a Web UI session for Power Core (as described earlier).

2. Log in as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.

3. Select the "System → Information" page.

4. Click to edit the **Time Zone** value - any change takes immediate effect and so a restart is not required.



The time zone should be specified relative to Central European Time (CET).

For example, "CET+5CEST,M3.2.0/2:00,M11.1.0/2:00" is suitable for US East Coast, where CET is 5 hours ahead.

The second part of the syntax specifies the start and end of Central European Summer Time (CEST). e.g. from month 3, week 2, day 0, time 2am (the second Sunday in March) until month 11, week 1, day 0, time 2am (the first Sunday in November).

6.10 Power Core - Network Security

To make the system more secure, the following features are supported.

User Login for the Web UI

To open the Web UI, you must login as a User, Supervisor or Administrator. In User mode, all fields are visible but cannot be edited. Thus, settings can only be changed by entering Supervisor or Administrator mode. For security reasons, it is recommended to change the Administrator and Supervisor passwords from the defaults once the device is set up. This can be done from the System -> Control tab once you are logged in as Administrator.

"https" for the Web UI (optional)

This option allows you to use a secure connection for the Web UI. It can be achieved by storing the required SSL certificates on the Power Core device. The steps required to prepare the device are described later. Once the certificates are in place, the Web UI can be opened using a "https" connection. Apart from the connection method, there is no difference in the functionality.

Ember+ Provider Clients Whitelist (optional)

This option can be used to make sure that only devices with a defined IP can access the Ember+ providers. The option is enabled, in the ON-AIR Designer configuration, by entering at least one IP address in the Ember+ Provider Clients Whitelist. If the list is empty, then the feature is disabled and access is permitted from consumers with any IP address. For testing purposes, the whitelist can be temporarily disabled from the Web UI (via the System -> Control tab).

Network Port Restrictions (optional)

This option can be used to restrict the network ports used for the different protocols: Telnet, WebUI, Netcom, DMS, MNOPL and EmBER+. The option is set from the Web UI (via the System -> Control tab). In each case, you can choose either **any** (to allow access via any control network port) or **dwc0** (to restrict access to the first control port). Note that if you choose **dwc0**, then the restriction also applies to the local host and so access is not permitted via 127.0.0.1. By default, all protocols are available on all interfaces.

Ember+ Denial-of-service Attack Blocker

This feature is always implemented, and protects the Ember+ provider from unwanted service requests. If there are more than 10 "GetDir" requests from the same node in quick succession, then the connection to the consumer is terminated. The connection can then be re-established by the consumer.

Please note: encryption adds calculation time and so some parameters are updated more slowly than without encryption. A difference will be noticed if the stream destinations are monitored with and without SSL (as Packet Increase is updated more frequently without SSL).

7 Power Core - Operation

This chapter describes how to operate the system once the initial setup is complete.

- Power Core - Powering On
- Power Core - Controls, Connectors and Indicators
- Power Core - SYSTEM Display

7.1 Power Core - Powering On

Power Core has no on/off switch and starts automatically when power is applied. The system can also be restarted remotely using a Web UI or Telnet connection, see Power Core - Restarting the System.

The boot-up progress is shown on the front panel:

1. First, the SYSTEM display and **STATUS** LED are black and unlit.
2. Then, the Lawo logo appears and the **STATUS** LED lights in white.
3. As soon as boot-up is complete, the **Welcome** page appears and the **STATUS** LED starts to blink; its color reflects the sync status.

If the **STATUS** LED does not start to blink, then the device has an internal problem. Please reboot the device (using the RESET button) as a first step.

At the end of the boot-up, Power Core loads the latest settings (stored at shut-down). This is known as the warm start data, and it means that the system returns to whatever the settings were at the last power off.

There are two exceptions: PTP parameters that have been edited using the Web UI and output stream parameters that are changed during runtime via Ember+. In this instance, the changes are not warm start persistent and the parameters reset to the values stored in the configuration.

Please note:

- If you perform a cold start, then the system ignores the warm start data and resets all settings to the default values stored in the configuration.
- If this is the first time you have powered the device "out of the box", then the system loads a very basic configuration that allows Power Core to boot. To get the system operational, you will need to upload the standard configuration or a custom configuration using the ON-AIR Designer.

Powering Off / Shutdown

There is no special shutdown procedure for the hardware. So, to power down, turn off the mains power.

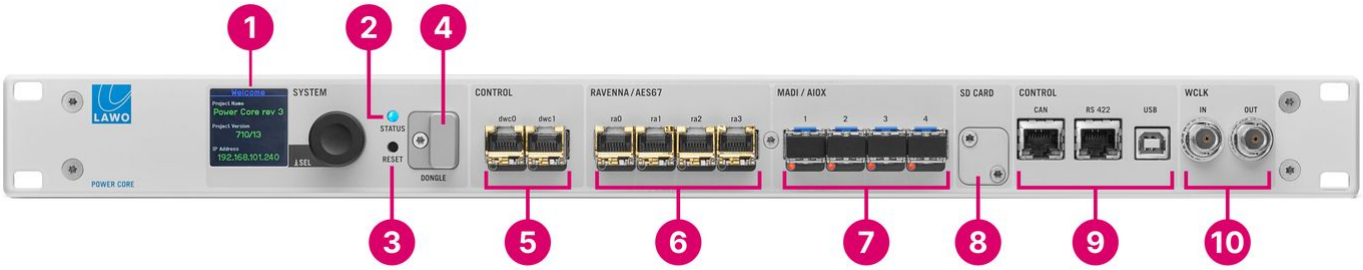
7.2 Power Core - Controls, Connectors and Indicators

The descriptions below provide a quick guide to the controls, connectors and indicators. For more information about how to connect the device, see Power Core - Wiring.

This topic covers both of the current hardware revisions. Note that the front panel controls differ slightly, while the rear panel is the same for both revisions.

- Front View, Revision 3
- Front View, Revision 2
- Rear View (all revisions)
- Comparison of Revisions

Front View, Revision 3



1. SYSTEM Display & Menu Control

The front panel display can be used to edit local device parameters such as the IP address.

2. STATUS LED

The **STATUS** LED indicates the health of the device and sync status.

- If the LED is blinking at regular intervals, then the device is working properly and the LED color indicates the sync source/status.
- If the LED is lit and static, then either the device is booting or there is an internal problem.

The table below describes all possible meanings.

Blinking STATUS LED	Meaning
Blue ↔ Off	Synchronized to PTP master
Yellow ↔ Off	Trying to sync to PTP master
Red ↔ Off	Synchronized to internal clock
Green ↔ Off	Synchronized via Wordclock
Magenta ↔ Off	Synchronized via MADI
Red ↔ white	Device is PTP Master, sync source = internal
Green ↔ white	Device is PTP Master, sync source = Wordclock
Magenta ↔ white	Device is PTP Master, sync source = MADI

Static STATUS LED	Meaning
Off	System powered off
White	System starting
Color (not white)	System failure

3. RESET button

The **RESET** button can be used to reboot the device and load the warm start data. The button is recessed to prevent accidental operation.

> This operation should NOT be performed while the device is live on-air!

4. DONGLE

The **DONGLE** port should be used to connect the USB memory stick containing your system's WIBU license(s). A safety cap is available to prevent accidental removal of the dongle. If fitted, you will need a T10 star tool to remove the cap.

5. CONTROL Network Ports

The **dwc0** and **dwc1** network ports are used for administration and control.

Applications include remote control via TCP/IP; networking to other products; updating firmware and uploading a configuration. Usually, only the first port (dwc0) is connected. If both ports are used, then redundancy can be implemented via LACP.

The control network must be separate from the streaming network connected to the RAVENNA/AES67 ports (6).

6. RAVENNA/AES67 Network Ports

The **ra0**, **ra1**, **ra2** and **ra3** interfaces can be used to stream audio to and from the IP network. The first pair of interfaces are enabled as standard. The second pair of interfaces can be enabled by purchasing the optional AddOnRAV+ license.

The streams are fully compatible with SMPTE ST2110-30/31, AES67 and RAVENNA. To achieve redundant streaming, compatible with SMPTE ST2022-7, you must use both interfaces: ra0/ra1 or ra2/ra3.

The streaming network must be properly managed and configured.

7. MADI/AIOX Ports

The four MADI ports can be used to connect multi-channel digital audio to the device (up to 64 bi-directional MADI channels per port). Ports 1&2 and 3&4 can be dual-redundant (defined by the ON-AIR Designer).

Alternatively, the ports can be used to connect a Power Core Audio I/O Extender (mounted externally) for additional I/O expansion.

8. SD Card

The SD card stores all of the system software and configuration data. It can be accessed by removing the safety cover (included).

It can be quickly inserted into a replacement device (if you are exchanging the hardware). Or, removed and copied (to create a backup of the system data).

9. Other CONTROL Ports

Power Core revision 3 supports three other control data ports.

- **CAN** - this port can be used to connect local CAN bus devices such as a ruby control surface or KSC/GPIO panel.

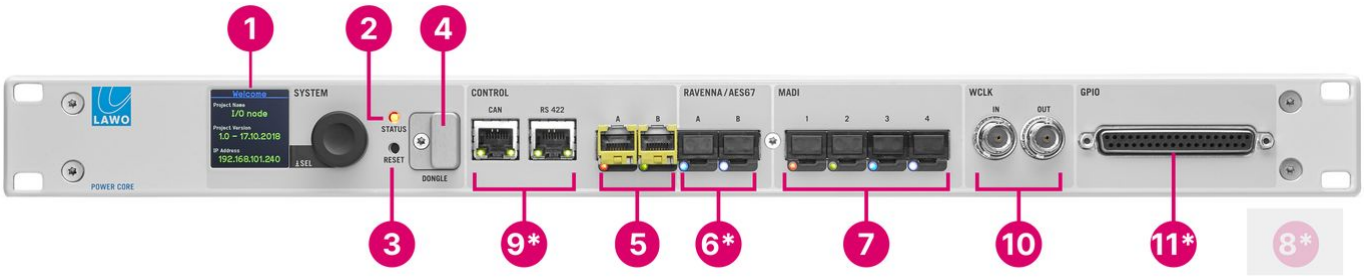
- **RS-422** - the serial port can be used for remote control (e.g. of a playout system) or MACKIE HUI interfacing to a Digital Audio Workstation.
- **USB** - the USB port can be used for debugging.

10. WCLK IN & OUT

The two WCLK connectors can be used for external synchronization:

- **WCLK IN** can be used to connect an external wordclock reference signal. (Other reference options are PTP, MADI or Internal.)
- **WCLK OUT** always provides an output of the current system reference.

Front View, Revision 2



The asterisks (*) indicate a difference in functionality from a revision 3 frame: fewer RAVENNA/AES67 ports (6); no access to SD card (8); no USB port (9); GPIOs are included (11). All other controls work in an identical manner, with some variations in the connector labelling.

1. SYSTEM Display & Menu Control

The front panel display can be used to edit local device parameters such as the IP address.

2. STATUS LED

The **STATUS** LED indicates the health of the device and sync status.

- If the LED is blinking at regular intervals, then the device is working properly and the LED color indicates the sync source/status.
- If the LED is lit and static, then either the device is booting or there is an internal problem.

The table below describes all possible meanings.

Blinking STATUS LED	Meaning
Blue ↔ Off	Synchronized to PTP master
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Green ↔ Off	Synchronized via Wordclock
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Red ↔ white	Device is PTP Master, sync source = internal
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Static STATUS LED	Meaning
Off	System powered off
White	System starting
Color (not white)	System failure

3. RESET button

The **RESET** button can be used to reboot the device and load the warm start data. The button is recessed to prevent accidental operation.

> This operation should NOT be performed while the device is live on-air!

4. DONGLE

The **DONGLE** port should be used to connect the USB memory stick containing your system's WIBU license(s). A safety cap is available to prevent accidental removal of the dongle. If fitted, you will need a T10 star tool to remove the cap.

5. CONTROL Network Ports

The **CONTROL A** (dwc0) and **CONTROL B** (dwc1) network ports are used for administration and control.

Applications include remote control via TCP/IP; networking to other products; updating firmware and uploading a configuration. Usually, only the first port (CONTROL A) is connected. If both ports are used, then redundancy can be implemented via LACP.

The control network must be separate from the streaming network connected to the RAVENNA/AES67 ports (6).

6. RAVENNA/AES67 Network Ports

The RAVENNA/AES67 **A** and **B** interfaces can be used to stream audio to and from the IP network.

The streams are fully compatible with SMPTE ST2110-30/31, AES67 and RAVENNA. To achieve redundant streaming, compatible with SMPTE ST2022-7, you must use both interfaces: ra0/ra1.

The streaming network must be properly managed and configured.

7. MADI/AIOX Ports

The four MADI ports can be used to connect multi-channel digital audio to the device (up to 64 bi-directional MADI channels per port). Ports 1&2 and 3&4 can be dual-redundant (defined by the ON-AIR Designer).

Alternatively, the ports can be used to connect a Power Core Audio I/O Extender (mounted externally) for additional I/O expansion.

9. Other CONTROL Ports

Power Core revision 2 supports two other control data ports.

- **CAN** - this port can be used to connect local CAN bus devices such as a ruby control surface or KSC/GPIO panel.
- **RS-422** - the serial port can be used for remote control (e.g. of a playout system) or MACKIE HUI interfacing to a Digital Audio Workstation. It can also be used for debugging.

10. WCLK IN & OUT

The two WCLK connectors can be used for external synchronization:

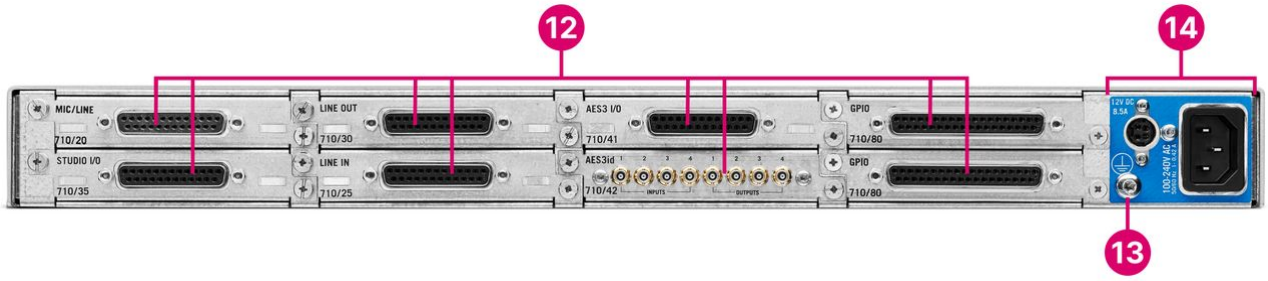
- **WCLK IN** can be used to connect an external wordclock reference signal. (Other reference options are PTP, MADI or Internal.)
- **WCLK OUT** always provides an output of the current system reference.

11. GPIO

The front panel GPIO connector provides 8 x GPI (optocouplers) and 8 x GPO (silent and self-healing relays) for local signaling and switched functions.

Depending on your main license package, you may need to purchase the GPIO add-on license to activate these signals.

Rear View (all revisions)



12. Expansion I/O Cards

Up to 8 expansion I/O cards can be fitted to the slots at the rear of the frame. All cards are hot-pluggable. Options include: Mic/Line In, Line Out, Studio I/O, AES3 I/O, dual MADI, MADI SRC, DANTE and GPIO.

13. CASE Grounding Screw

The **CASE** screw is used to ground the frame. See Power Core - Grounding.

14. Power Inputs: AC & DC

Power Core comes with dual power feeds: AC and DC. To use the DC input, you will need the external DC power supply which must be ordered separately. If both inputs are connected, then the two feeds provide main and redundant power.

See Power Core - Power Supplies.

Comparison of Revisions

The table below compares the current hardware revisions; all differences are highlighted in **bold**.

		Revision 3	Revision 2	Notes
1.	SYSTEM Display & Menu Control	yes	yes	
2.	STATUS LED	yes	yes	
3.	RESET button	yes	yes	
4.	DONGLE port	yes	yes	
5.	CONTROL Network Ports	2	2	dwc0 = CONTROL A; dwc1 = CONTROL B
6.	**RAVENNA/AES67 Network Ports**	**4**	**2**	ra0 = RAVENNA A; ra1 = RAVENNA B
7.	MADI/AIOX Ports	4	4	
8.	**Front panel access to SD card**	**yes**	**no, access is internal**	
9.	**USB service port**	**yes**	**no, use RS-422 port**	
10.	WCLK IN & OUT	yes	yes	
11.	**Front panel GPIO**	**no**	**yes**	GPIO can be added via the rear expansion I/O cards

7.3 Power Core - SYSTEM Display

The front panel display and rotary encoder can be used to view or edit device parameters. The same parameters can be accessed via the Power Core Web UI.

There are four navigation levels: page select, parameter select, parameter edit and character edit. In each case, turn the rotary encoder to scroll through the available options and push down to select.

1. Page Select.

Turn the encoder to scroll through the available pages. Push down to select the highlighted page.

2. Parameter Select.

Turn the encoder to scroll through the available parameters. Push down to select the highlighted parameter, or return to the previous level (if nothing is highlighted).

3. Parameter Edit.

Turn the encoder to scroll through the parameter fields/characters. Push down to edit the highlighted character, or return to the previous level (if nothing is highlighted).

4. Character Edit.

Once a character is highlighted, turn the encoder to change its value. Push down to accept the change.

Once all characters have been edited, push down and hold to save the changes. Alternatively, push down (when no character is highlighted) to cancel and return to the previous level.

You can use the following commands to insert, delete or clear all characters:

- Select the up arrow to insert a new character.
- Select the down arrow to delete the selected character.
- Select "¤" to clear all.

If you push down and hold the encoder during boot-up, the device will reset to a default firmware image and empty configuration.

Identifying a Power Core

The "Identify" function can be used to send a message to the front panel display so that a Power Core can be easily identified. The message can be sent in one of three ways:

- via Ember+ - using Provider 1: / Ruby / System / Identify (1.29.20)
- via the Web UI - select "Identify" on the System → Control tab.
- via the console command: sys_id \[y | n\]
- via the HOME Web UI - using the Identify Hardware function.

Once activated, the display shows "HELLO I AM \[dwc0 IP Address\]". The message disappears once you de-activate "Identify" or push down on the encoder.

8 Power Core - Configuration

This chapter describes how to configure the system using ON-AIR Designer.

- Power Core - Configuring the System
- Power Core - Load Project from Unit
- Power Core - Open an Existing Project
- Power Core - Create a New Project
- Power Core - Checking the Online Status
- Power Core - Configuration Examples

8.1 Power Core - Configuring the System

This topic describes how to change the functionality of Power Core using ON-AIR Designer.

Overview

The Power Core resources are defined by a configuration file that is stored on the Core and read during boot-up. All systems ship with a very basic configuration that allows the Core to boot. This should be replaced by one of the standard configurations, available from the **Downloads** area at www.lawo.com (after Login), or a custom configuration created for the installation.

In both cases, you must use the **ON-AIR Designer** software to prepare the configuration offline, and then upload it to the Core via the control network. You will need to do this during the initial setup to get the system operational, and subsequently to make changes to the functionality.

How to upload one of the standard configurations is described in the System Setup chapter, see Power Core - Uploading a Configuration. In this topic we cover how to edit the configuration to change the functionality of a device.

Prerequisites

ON-AIR Designer must be installed onto the configuration PC (as described earlier).

It is mandatory that the software version of the system matches the software version of ON-AIR Designer. Otherwise the configuration may contain options which are not supported by the Lawo system (and functionality may be ignored). To make sure everything runs smoothly, first run the installer (to update ON-AIR Designer) and then use SoP Explorer to check and update the firmware running on the hardware components.

What you will need

To change the functionality of an existing system, you will need a copy of the current **.db3** project file. You can then use ON-AIR Designer to open, edit and save the file; and transfer the modified configuration back to the Core.

For Power Core systems, it is recommended to download a copy of the current project from the device (using 'File → Load Project from Unit'). Alternatively, you can use one of the standard configurations available from the **Downloads** area at www.lawo.com (after Login).

If you plan to use **VisTool** with your device, then it is a good idea to edit the VisTool and ON-AIR Designer configurations in parallel. For more information on editing a VisTool project, see VisTool - Editing a VisTool Configuration.

Configuring Multiple Systems

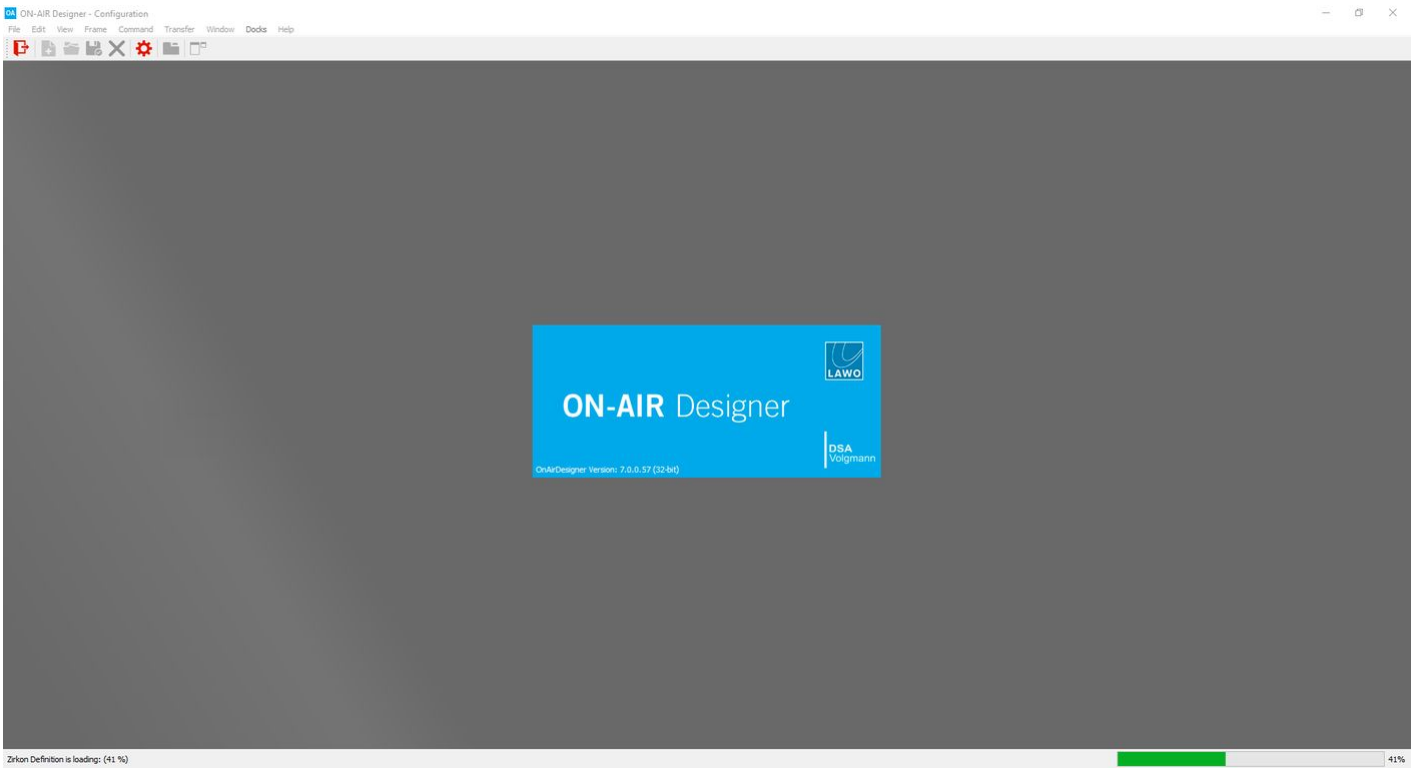
If the installation contains more than one system, then you may wish to apply similar configuration parameters so that each system operates in the same manner. This can be achieved by using local and/or global substitutions. This feature makes it easy to maintain the configuration(s) for a large installation as, if something changes, the change needs only be applied once. It also allows configuration data to be transferred to multiple devices in one operation (to save time and effort).

For more information about this feature, please refer to ON-AIR Designer - Configuring Multiple Units. The rest of this topic describes how to configure a single device.

First Steps

1. Start the software.

ON-AIR Designer starts automatically at the end of the software installation procedure. It can also be started from the desktop icon or Windows START menu. You can check the version of ON-AIR Designer while the software is starting.



2. Open a project using one of the following methods.

- File → Load Project from Unit - downloads a copy of the project stored on the device (recommended).
- File → Open - opens an existing project stored locally on your computer.
- File → New - creates a new configuration using the 'New Project Wizard'.

Please click on the links above for full instructions.

Editing the Configuration

Once you have opened a project, you can use the 'Frame' and 'Treedefinition' windows to make the required changes.

For a complete guide to all of the configuration possibilities, please refer to Configuring Power Core in the "ON-AIR Designer User Manual". In this chapter, we include a few examples.

- Power Core - Changing the Hardware Revision
- Power Core - Configuring the Main License

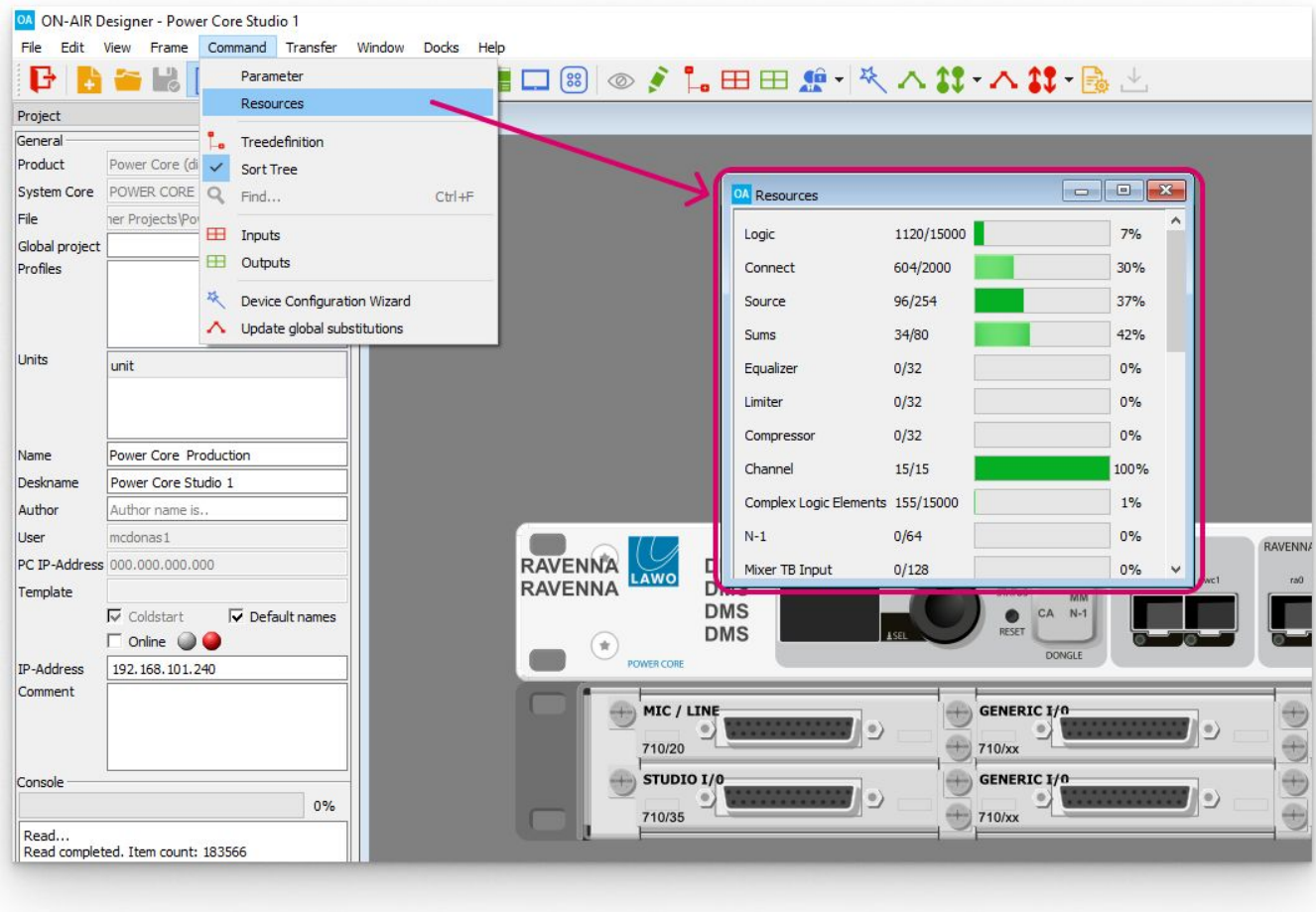
Important: In the current release of ON-AIR Designer, the default **System Core** is set to **710/11** (which is correct for Power Core revision 2 systems).

To configure a revision 3 system, this must be changed to **710/13** (to ensure that the correct options are available in ON-AIR Designer). Please see Changing the Hardware Revision for instructions.

Monitoring the Resources

While you are working, it can be useful to open the 'Resources' window (to check the DSP resources used by the project).

To do this, select **Command → Resources** from the main menus. The 'Resources' window appears either as a new tab (in Tabbed View) OR as a floating window that can be positioned and resized.



The counters show how many resources are left out of the maximum available.

The maximum numbers vary depending on the main license. Note that the add-on license resources such as **N-1** and **Mixer TB Input** are displayed regardless of whether the add-on is enabled or disabled.

If you try to add a resource which exceeds any of the limits, the software warns you by displaying the message: 'No resources available'.

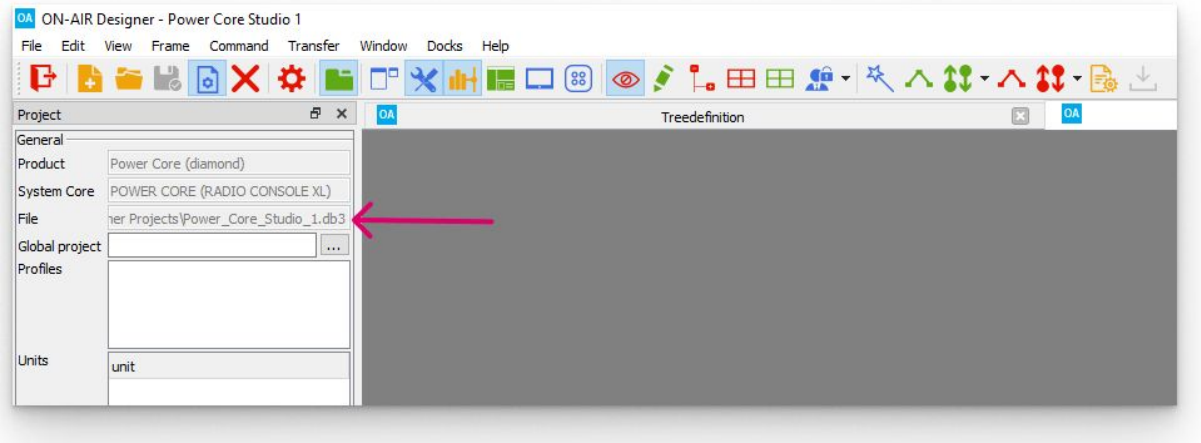
Saving the Project

It is recommended that you save your work at regular intervals, and also use "save as" to keep a copy of the project at different revision stages. This will allow you to upload and test the configuration and revert to an earlier version if necessary.

To overwrite the current project, use one of the following methods.

- Select **File → Save** from the main menus.
- Click on the Toolbar icon.
- Press CTRL + S on your computer keyboard.

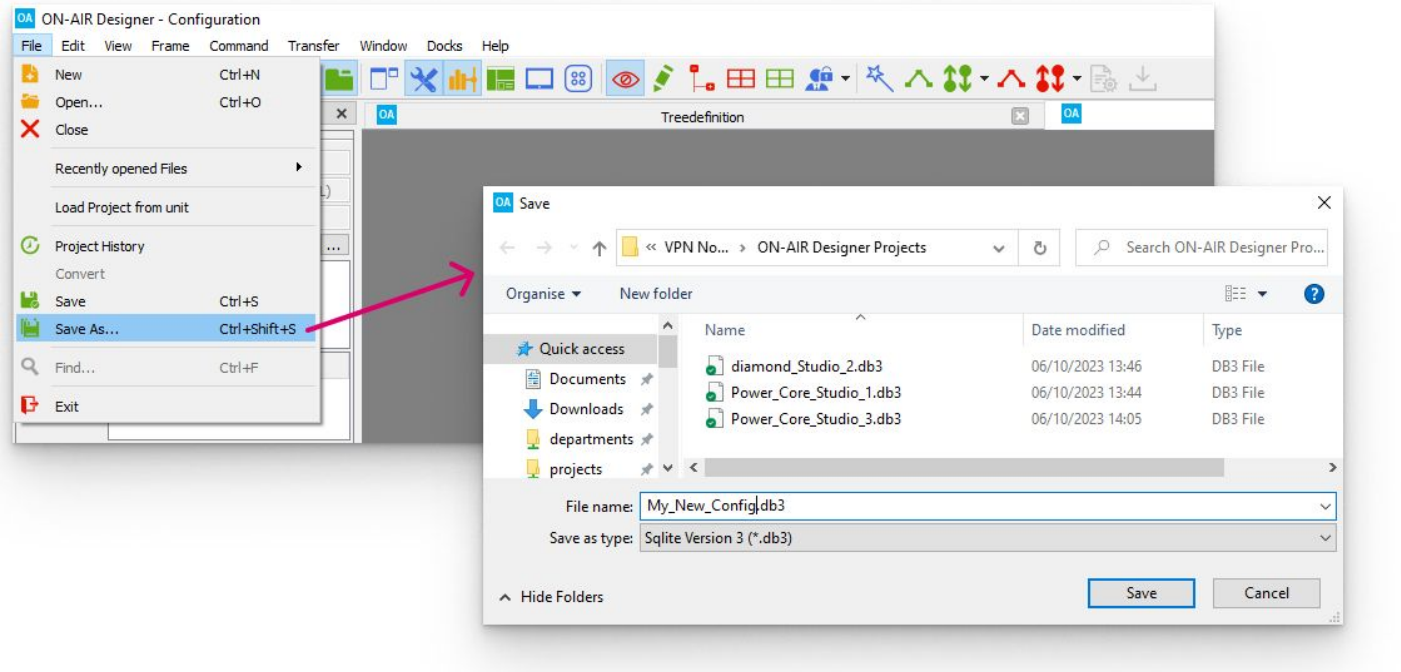
This overwrites the current file (specified in the "File" field in the 'Project' window).



To save into a new project file, use "save as" as follows.

1. Open the "Save" dialog box using either of the following methods.

- Select **File → Save As...** from the main menus.
- Press CTRL + SHIFT + S on your computer keyboard.



2. Choose a folder location and enter a suitable file name.

The default file type is **.db3** which is fine for all current products.

For compatibility with legacy systems, the file type can be changed to **.mdb** using the **Save as type** option at the bottom of the dialog box. Note that a project containing substitutions cannot be saved as a **.mdb** file.

3. Select **Save** to save the file.

Uploading the New Configuration

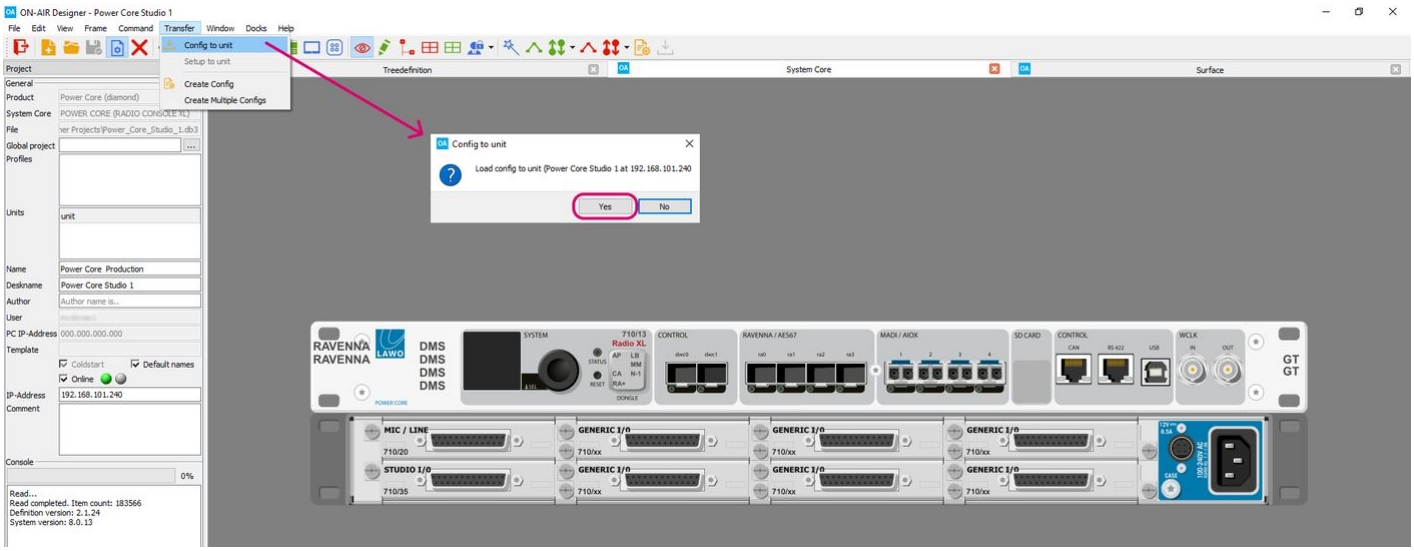
Once you have finished editing the project, it is time to transfer the configuration back to the Core.

To do this, you must have a valid network connection to the device and any changes to the project must be saved (as described above).

> If you edit the **IP Address** field in the 'Project' window, then the file must be saved, closed and re-opened.

1. Start by selecting **Transfer -> Config to unit** from the top menu bar, or click on the Toolbar icon.

If the option is greyed out, then there is no network communication to the device. In this instance, check the IP settings of both the configuration PC and Power Core. Then check your network cabling.



2. A confirmation box appears. Check the details and select **Yes** to start the transfer.

The software now compiles the necessary files and transfers them to the device. The progress is shown in the **Console** status area at the bottom of the 'Project' window.

Once the transfer is complete you will see the lines "File loaded to unit" and "Sending restart" (in the **Console** status area). The device will go offline while it restarts. This is perfectly normal but may take a few seconds.

All systems perform a cold start, except for the Nova29 which warm starts (to keep all matrix crosspoints in place).

3. The new configuration data is loaded at the end of the boot-up sequence and the transfer is complete.

If your computer's firewall prevents the transfer, then change your firewall settings and retry.

4. You should now test the operation thoroughly to check that the system is working as expected.

8.2 Power Core - Load Project from Unit

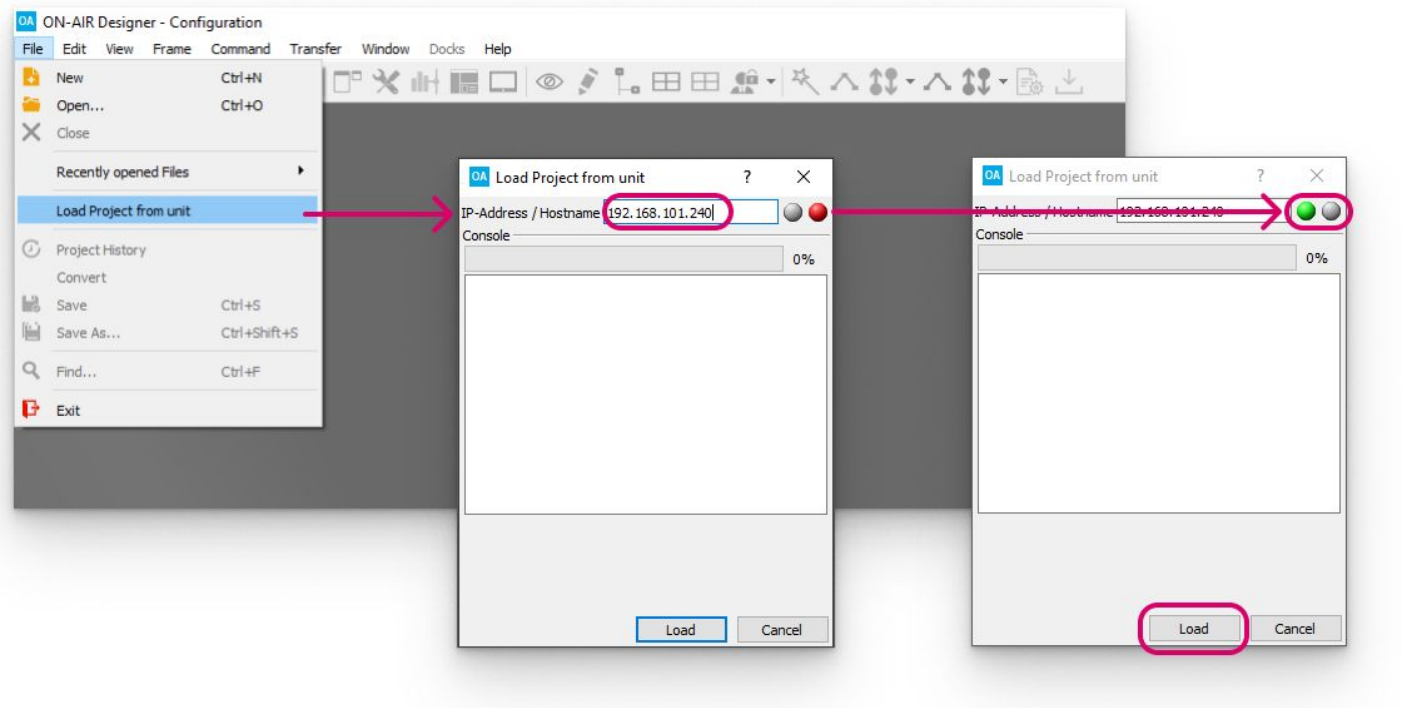
This topic describes how to download a copy of the project stored on the device.

Overview

On Power Core, whenever you transfer a configuration to the unit, an editable version is stored on the device. This allows you to download a copy to your computer at a later time.

To use this method, you will need a valid network connection to the device.

Instructions



1. From the main menus, select **File -> Load Project from unit** - a dialog box appears.
2. Enter the **IP Address** or **Hostname** of the device's control network port, and press TAB to establish a connection.

The software attempts to connect to the device. This can take a few seconds.

3. Wait for the two circle indicators to update and check the status of the network connection.

The green (online) indicator must be lit to continue.

If the red indicator is lit, check the IP settings of both the configuration PC and Power Core. Then check your network cabling.

4. Once a connection is established, select **Load** to proceed.

The project downloads from the unit which may take a few seconds. During this time, the status is shown in the "progress" bar (below **Console** in the 'Project' window).

5. Use **File → Save As...** to save a copy of the project locally on your computer.

You can now edit the parameters in the usual manner.

8.3 Power Core - Open an Existing Project

This topic describes how to open a project stored locally on your computer. For example, a project that you saved earlier or have received from the Lawo configuration team.

To open one of the standard configurations for Power Core, start by downloading the **.db3** file from the **Downloads** area at www.lawo.com (after Login).

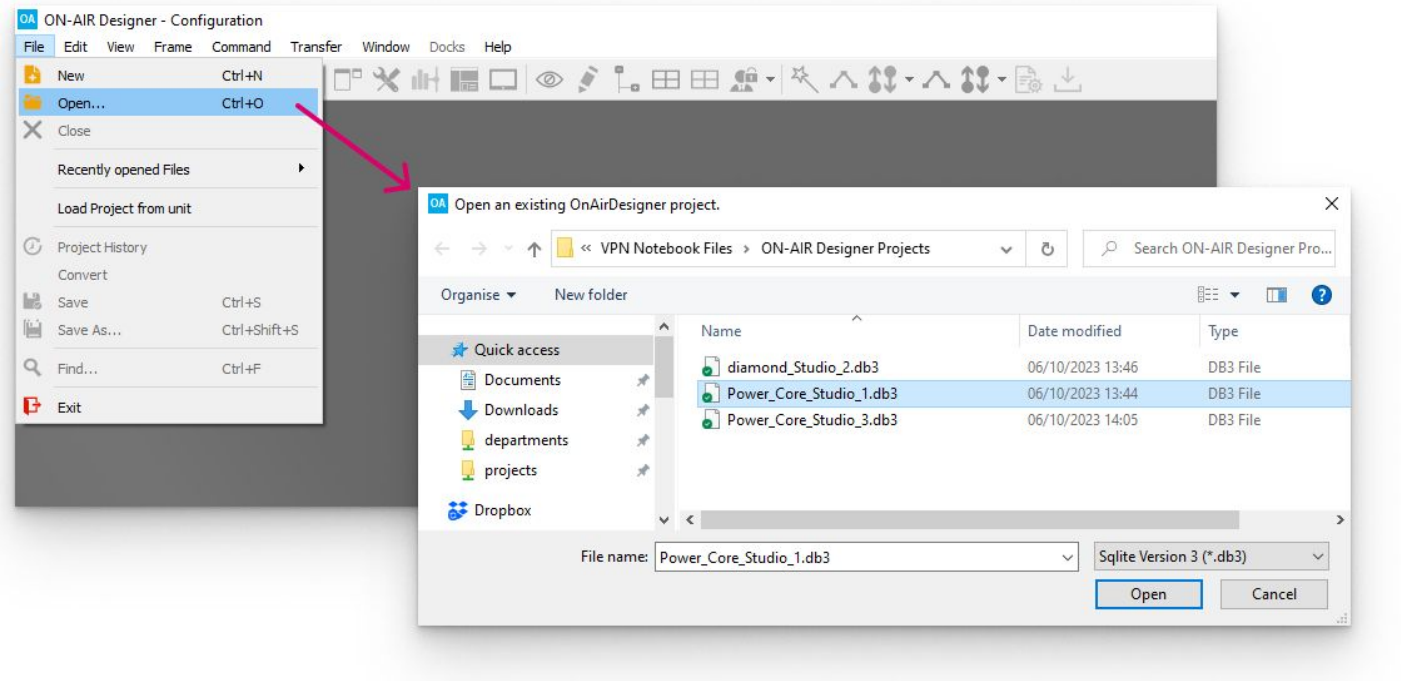
1. Open the 'File Explorer' window, using one of the following methods.

- Select **File → Open** from the main menus.
- Click on the Toolbar icon.
- Press CTRL + O on your computer keyboard.

2. Use the 'File Explorer' to select a valid configuration file.

By default, you will only see **.db3** files (which is fine for all current systems).

If you wish to open an older configuration of the type **.mdb**, then change the option selected in the "file types" drop-down menu (above **Open** and **Cancel**)..



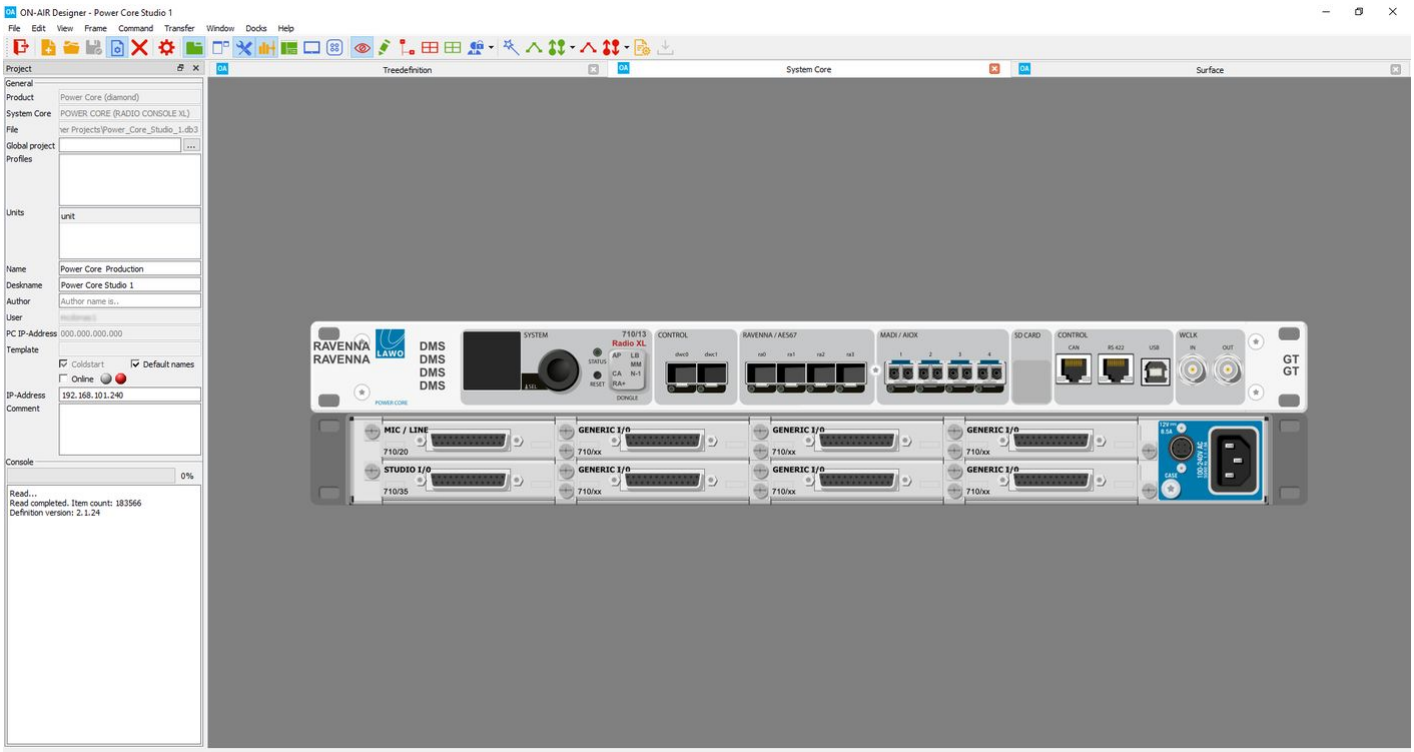
3. Click on **Open** to open the project.

This can take a few seconds. During this time, the status is shown in the "progress" bar (below **Console** in the 'Project' window).

If the configuration was created using a different definition version, then you will be asked if you wish to convert the project - select **Yes** to continue.

If you see an error stating that the project is already open then navigate to the project folder (using Windows Explorer) and delete any "projectname.txt" files. Then try opening the file again.

4. The project opens with the same workspace layout and docking options as at the last file save.



You can now edit the parameters in the usual manner.

8.4 Power Core - Create a New Project

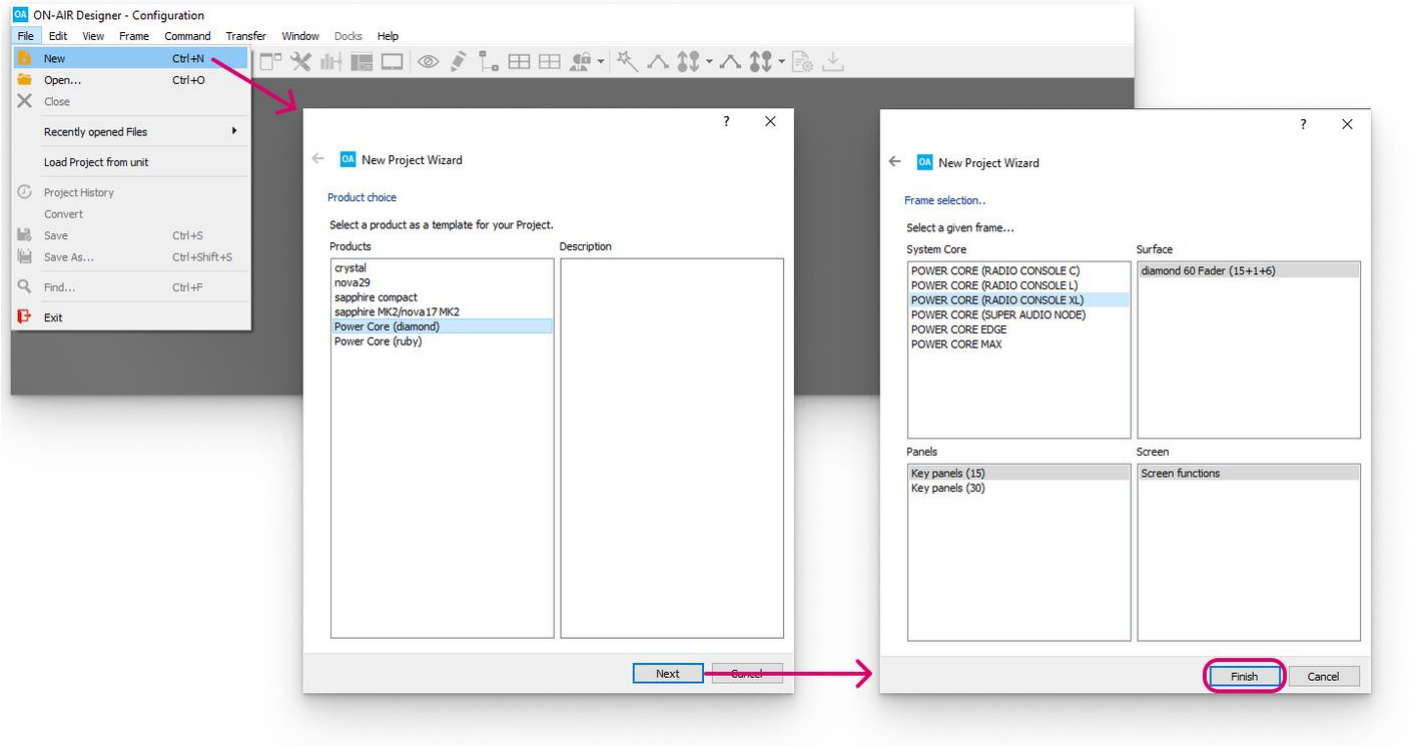
This topic describes how to create a new configuration from scratch.

Please note: this method creates a very simple configuration that defines the device type and main license package only. You will need to configure all other elements manually: sources, sums, logical functions, etc.

For this reason, it is recommended to download and open one of the standard configurations as a starting point (to reduce the amount of configuration effort).

The 'New Project Wizard' can be used to produce a quick configuration for testing purposes or to start from a clean (empty) project.

Instructions



1. Open the 'New Project Wizard' using one of the following methods.

- Select **File → New** from the main menus.
- Click on the Toolbar icon.
- Press CTRL + N on your computer keyboard.

2. Select your product type from the available options.

For diamond OR stand-alone Power Core systems, you should choose **Power Core (diamond)**. If Power Core is connected to a ruby surface, choose **Power Core (ruby)**.

3. Click on **Next** - the 'Frame selection' window opens.

4. Use the four 'Frame' areas to define the system as follows.

- **System Core** - defines the main license package. This must match the active license installed to the DONGLE port (as described earlier) or the license you intend to purchase.
- **Surface** - defines the maximum control surface size, where the numbers in brackets indicate the number of Fader Modules + Central Modules (full mode) + Central Modules (monitor mode). Please select the maximum configuration required.

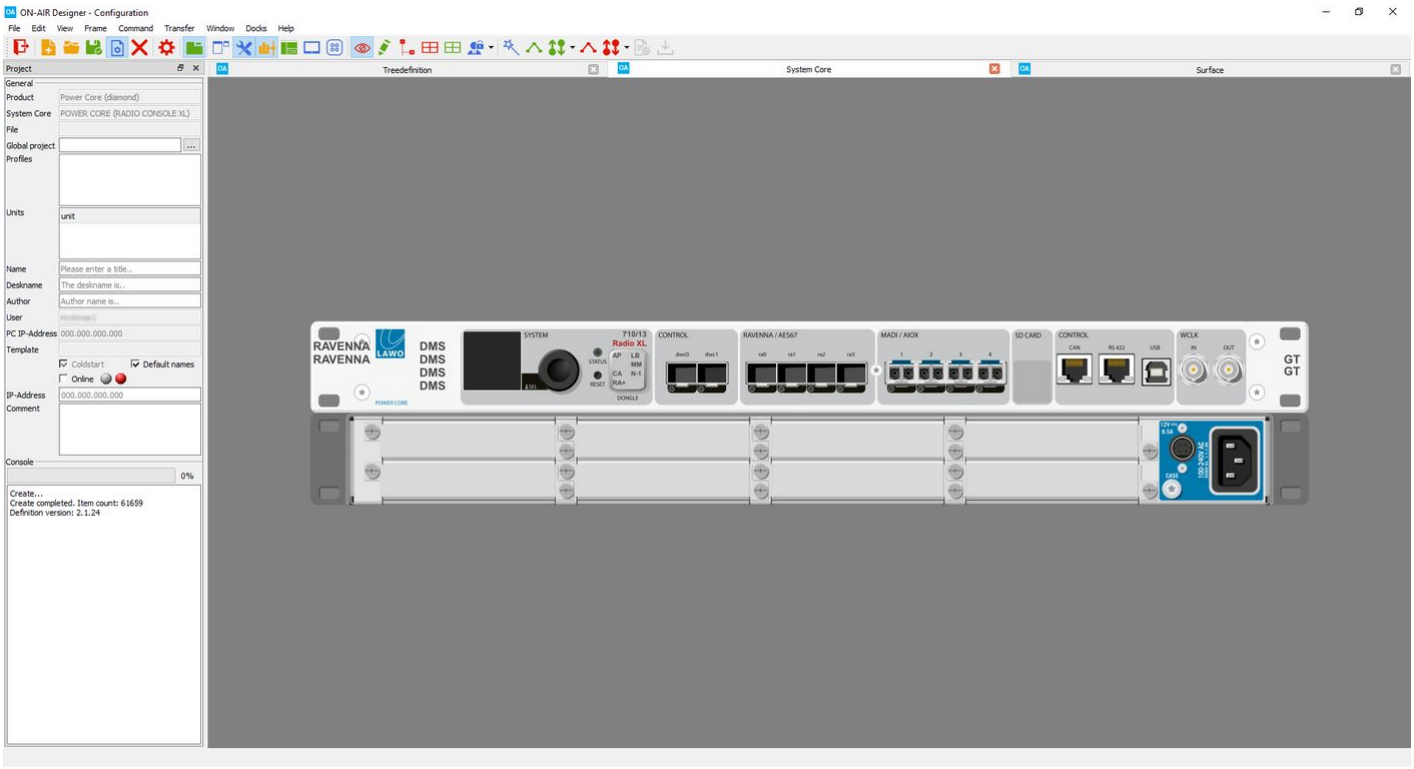
- **Panels** - defines the maximum number of key panels connected to the system. Please select the maximum configuration required.
- **Screen** - is always set to **Screen functions** to support VisTool functions.

The specification can be changed later (by selecting **Frame → Change Frame**). So, for example, if you purchase a larger main license package, you can change the **System Core** frame to unlock the additional resources.

5. Once you have specified the 'Frame', click on **Finish**.

The software creates the new project - this will take a few seconds. During this time the status is shown in the "progress" bar (below **Console** in the 'Project' window). Once the configuration windows open, the project is ready to use.

In the example below, we can see the 'Project' window (on the left), plus the 'System Core' (in the main working area).



6. Use **File → Save** to save the project.

You can now edit the parameters in the usual manner.

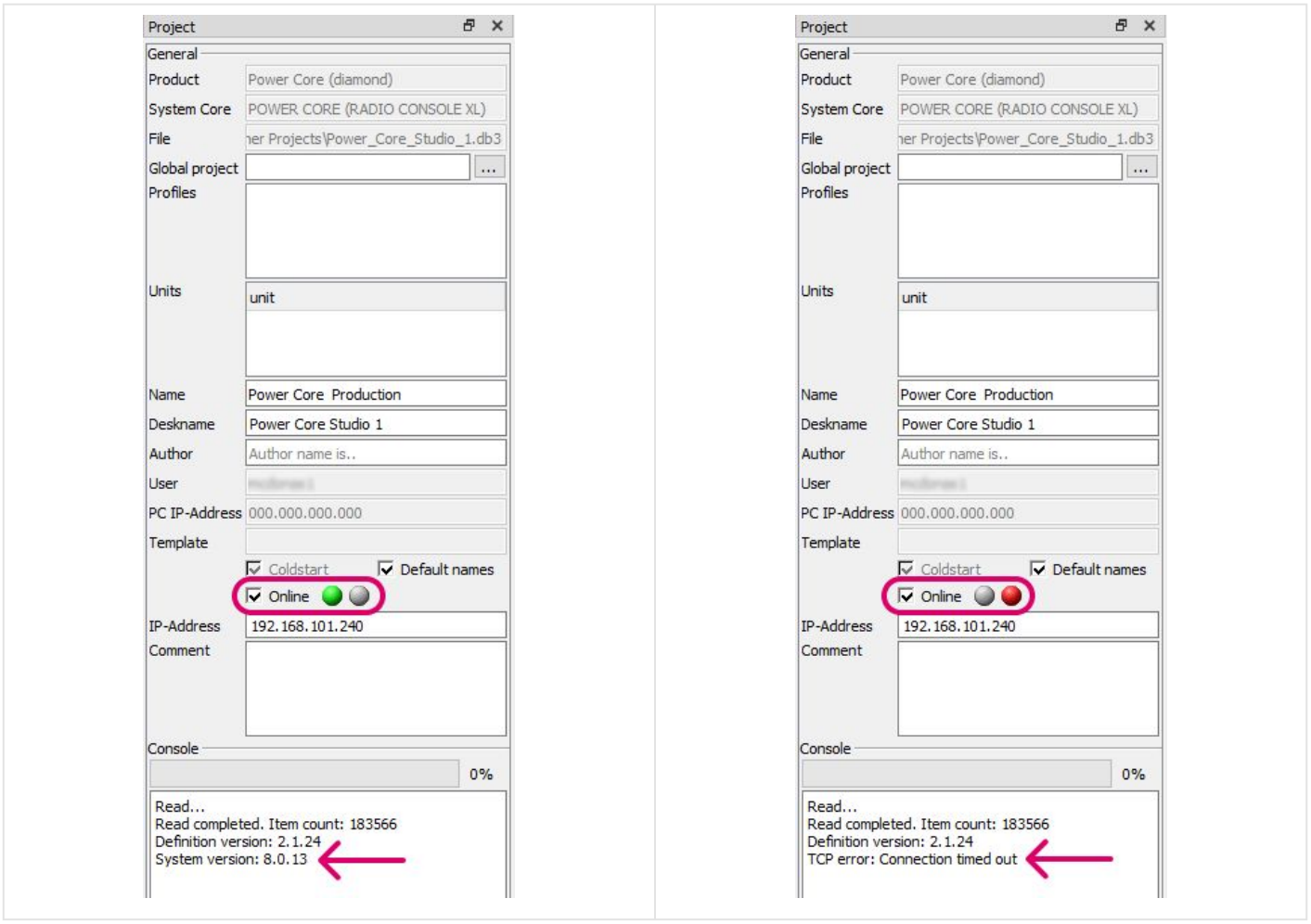
8.5 Power Core - Checking the Online Status

You can check the network connection to Power Core from the ON-AIR Designer 'Project' window. This usually appears on the left of the main working area.

Tick the **Online** checkbox to open a connection to device using the **IP-Address** specified. This must match the IP address of the device's control network port (e.g. 192.168.101.240).

The two circle indicators update to show the status of the network connection: green = ok; red = not connected; yellow = device needs updating.

In the first example (on the left), the network communication is ok. In the second example (on the right), there is a no communication.



If there is a valid network connection (green indicator), then the '**Console**' text area displays the **System version**. Everything is good and no action is required.

If the firmware needs updating (yellow indicator), then use SoP Explorer to update the device firmware.

If there is a problem with the network communication (red indicator), then check the IP settings of both the configuration PC and Power Core. Then check your network cabling. If everything looks correct, try running a Windows PING test.

8.6 Power Core - Configuration Examples

This section describes how to perform some of the basic configuration tasks. For a complete guide to all of the configuration possibilities, please refer to Configuring Power Core in the "ON-AIR Designer User Manual".

- Power Core - Changing the Hardware Revision
- Power Core - Configuring the Main License
- Power Core - Enabling the Add-on Licenses

Power Core - Changing the Hardware Revision

When configuring Power Core, it is important that the correct hardware revision is specified (to ensure that all permitted options are available in ON-AIR Designer).

The revision is displayed on the front of the 'System Core' as a part number:

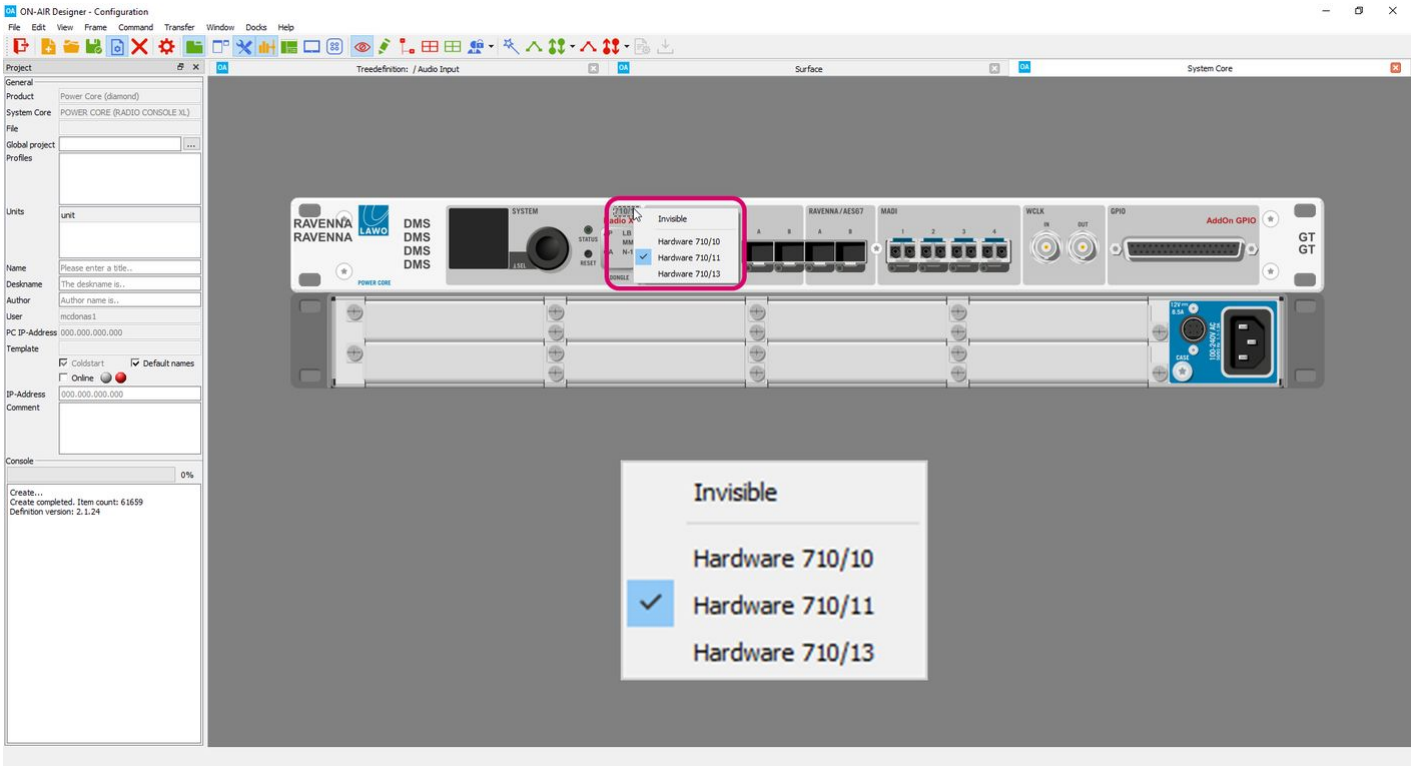
- **710/10** - Power Core revision 1
- **710/11 -** Power Core revision 2
- **710/13** - Power Core revision 3

Follow the instructions below to change the revision.

1. Open the 'System Core' configuration window using one of the following methods:

- Select **Frame → System Core** from the main menus.
- Click on the Toolbar icon.

2. Right-click on the current part number (e.g. **710/11**) - a drop-down menu appears.



3. Choose the correct revision number for your system (e.g. **710/13**).

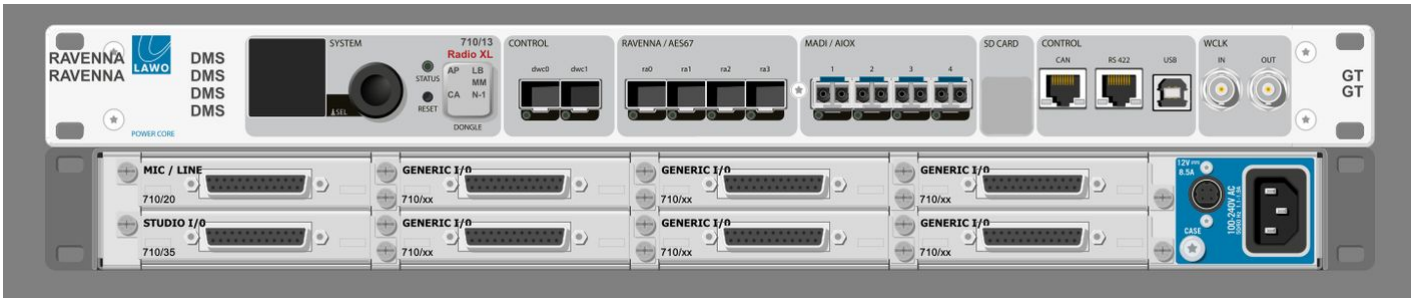
The project converts which takes a few seconds.

4. Once the conversion is complete, the front of the 'System Core' updates.

Power Core - Configuring the Main License

When configuring Power Core, it is important that the correct license package is specified (to ensure that the configured options match the licensed feature set). If this not the case and the license limits are exceeded, the Power Core alarm will sound.

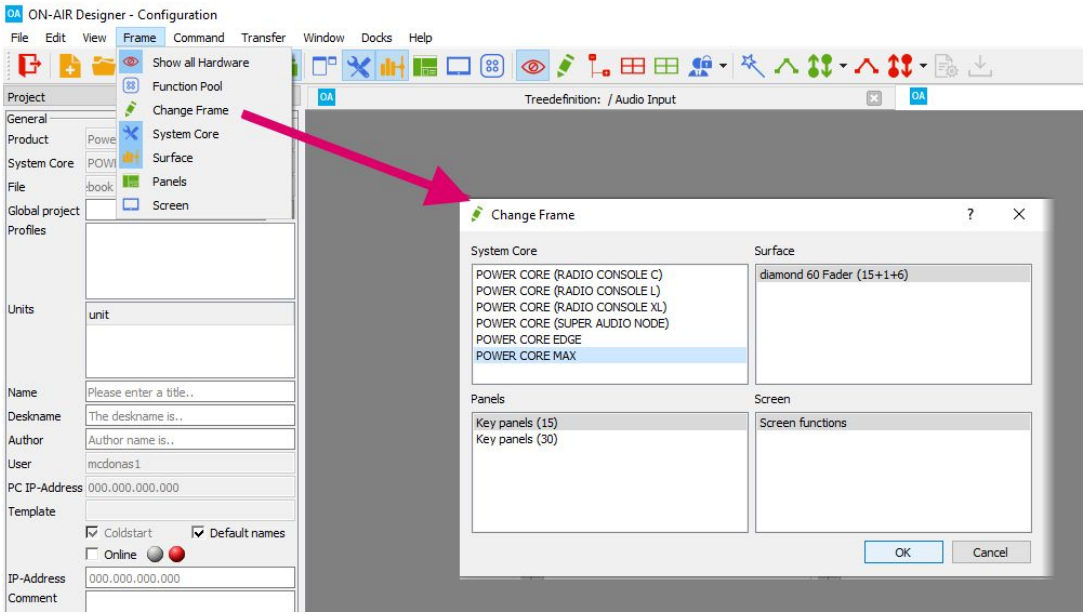
The main license is defined, initially, when you create a new project and shown using magenta text (above the DONGLE cover) on the front of the 'System Core'. In the example below, the license is **Radio XL**.



If you need to change the license later, then this can be done as follow.

1. Open the 'Change Frame' configuration window using one of the following methods.

- Select **Frame → Change Frame** from the main menus.
- Click on the Toolbar icon.



2. Under 'System Core' choose a different license package and select **OK**.

The project converts which takes a few seconds.

3. Once the conversion is complete, the front of the 'System Core' updates.

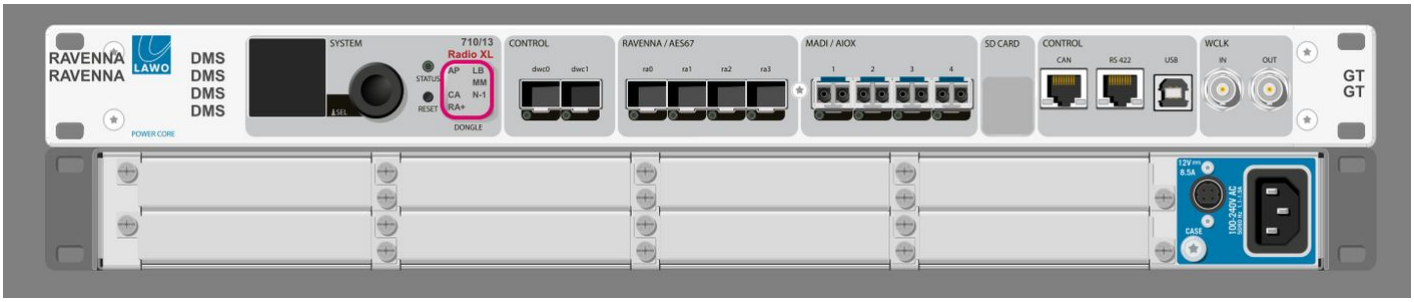
You can now configure the resources in the usual manner.

> If the change lowers the specification of an existing configuration, then parameters are loaded to the available resources.

Power Core - Enabling the Add-on Licenses

The Power Core hardware revision and main license package determine which add-on licenses are available. By default, all add-ons are disabled after creating a new project or upgrading the main license/hardware revision.

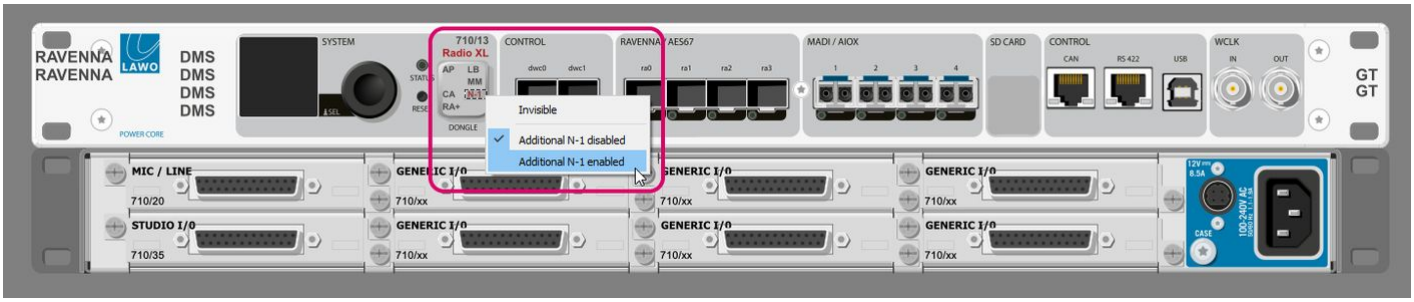
You can check or modify their status using the text acronyms on the DONGLE cover on the front of the 'System Core': **magenta** = license enabled; **black** = license disabled; **text missing** = license not supported or made invisible by ON-AIR Designer.



The licensed features are abbreviated as follows.

- **AP** = Aux Pan
- **CA** = Conference Assign
- **RA+** = RAVENNA Plus (Power Core revision 3 only)
- **LB** = additional Loopbacks
- **MM** = additional Mix Minus
- **N-1** = additional N-1

In each case, right-click to make a change. The example below shows how to enable the additional N-1s.



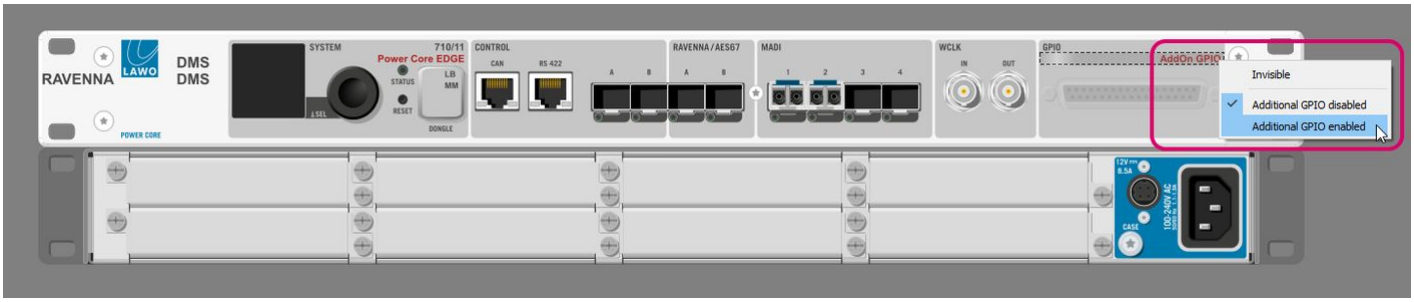
The project converts which takes a few seconds.

Once the conversion is complete, the front of the 'System Core' updates and the new resources can be configured in the usual manner. Please follow the links below for more information on each option.

- **Aux Pan (AP**) -
- Conference Assign (CA) -
- **RAVENNA Plus (RA+)**
- **Loopbacks (LB)** - double-click on an 8-channel I?O card and select the "Module" tab to turn on the "Enable MADI Loopbacks" option. Note that loopbacks are available for physical IO cards only, and not the General I/O card option.
- **Minimixers (MM)** - in the 'Tree Definition', right-click on the "Minimixer" branch to insert up to 64 "Minimixer TB Input" elements.
- **N-1** - in the 'Tree Definition', right-click on the "N-1" branch to insert up to 64 "N-1" elements.

If the change lowers the specification of an existing configuration, then the parameters are still stored by the project file and can be reinstated by enabling the add-on.

Note that the GPIO add-on license (available for Power Core revision 1 and 2) is configured using the **AddOn GPIO** text above the front panel GPIO connector.



In this instance, double-click on the GPIO connector (on the front of the Core) to access the GPIO parameters.

9 Power Core Max

This chapter describes a Power Core Max system.

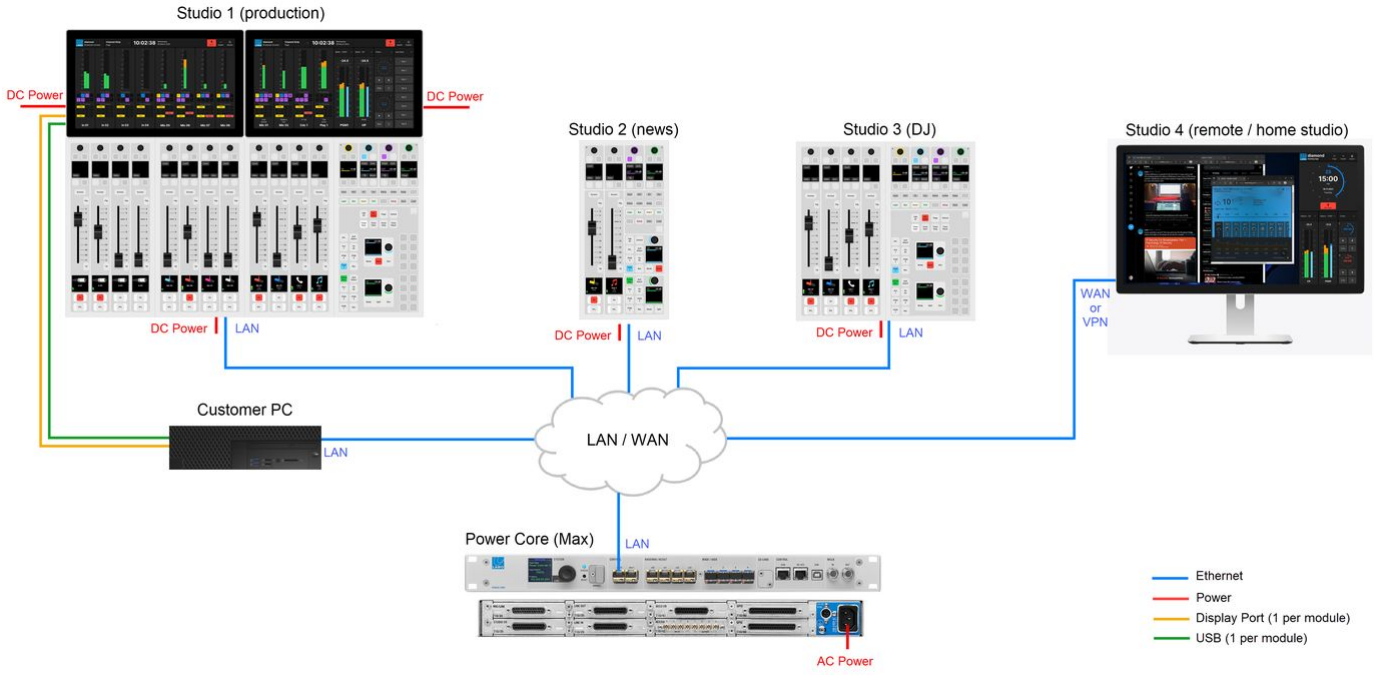
- Power Core Max - Product Overview

9.1 Power Core Max - Product Overview

The **Power Core Max** software license allows Power Core to be controlled from up to four independent control surfaces. The connected surfaces share all available resources. They can be any permitted size and layout as long as the total number of resources do not exceed those given in the Power Core Max column of the license chart (described earlier).

The system is similar to a split-frame surface but adds support for up to four independent Central or Combo Modules and four independent VisTool instances. Each surface and VisTool is assigned an Access Group from 1 to 4. This allows certain functions to be controlled independently so that the system can operate as four separate consoles.

A typical installation could look as follows.



System Setup

The surface connection(s) to Power Core can be achieved in one of two ways:

If the surface consists of more than one frame, then the network communication with Power Core can be achieved in one of two ways:

1. The first diamond frame connects to Power Core via IP, and the second frame is daisy-chained to the first using an external CAN bus cable (CAN A).
2. Each diamond frame connects individually to Power Core via IP.

This is explained in more detail in the documentation for your surface. See diamond - Configuring the IP Connection to Power Core. For the cabling requirements, see diamond - Wiring.

Each control surface requires its own DC power supply. See diamond - Power Supplies.

To run multiple VisTool instances, Power Core must connect to each VisTool PC via the control network. See Power Core - Control Network Requirements.

Configuration

When configuring Power Core Max, please note that the real-time input measurement for the channel in ACCESS is supported by Access Group 1 only, and not Access Groups 2 to 4. This affects the dynamic signal level visualizations on the

GUI such as the bouncing balls in the diamond Dynamics 'Source Parameter' dialog box. So, in the example above, these visualizations are available for Studio 1 only, and not Studios 2 to 4.

For this reason, it is recommended to use Access Group 1 for the most important surface / the surface with a Virtual Extension.

10 Power Core - Software Tools and Diagnostics

This chapter describes the tools available for fault finding and diagnostics.

- Power Core - Restarting the System
- Power Core - Web UI
  - Power Core - System Menu
  - Power Core - Peripherals Menu
  - Power Core - IP Connections Menu
  - Power Core - Sources/Sums Menu
  - Power Core - RAVENNA Menu
  - Power Core - Preparing a Secure Connection (for https)
- Power Core - Stream Tuning
- Power Core - USB Service Port
- Power Core - RS-422 Serial Port
- Power Core - Telnet Sessions
- Power Core - File Transfer via FTP

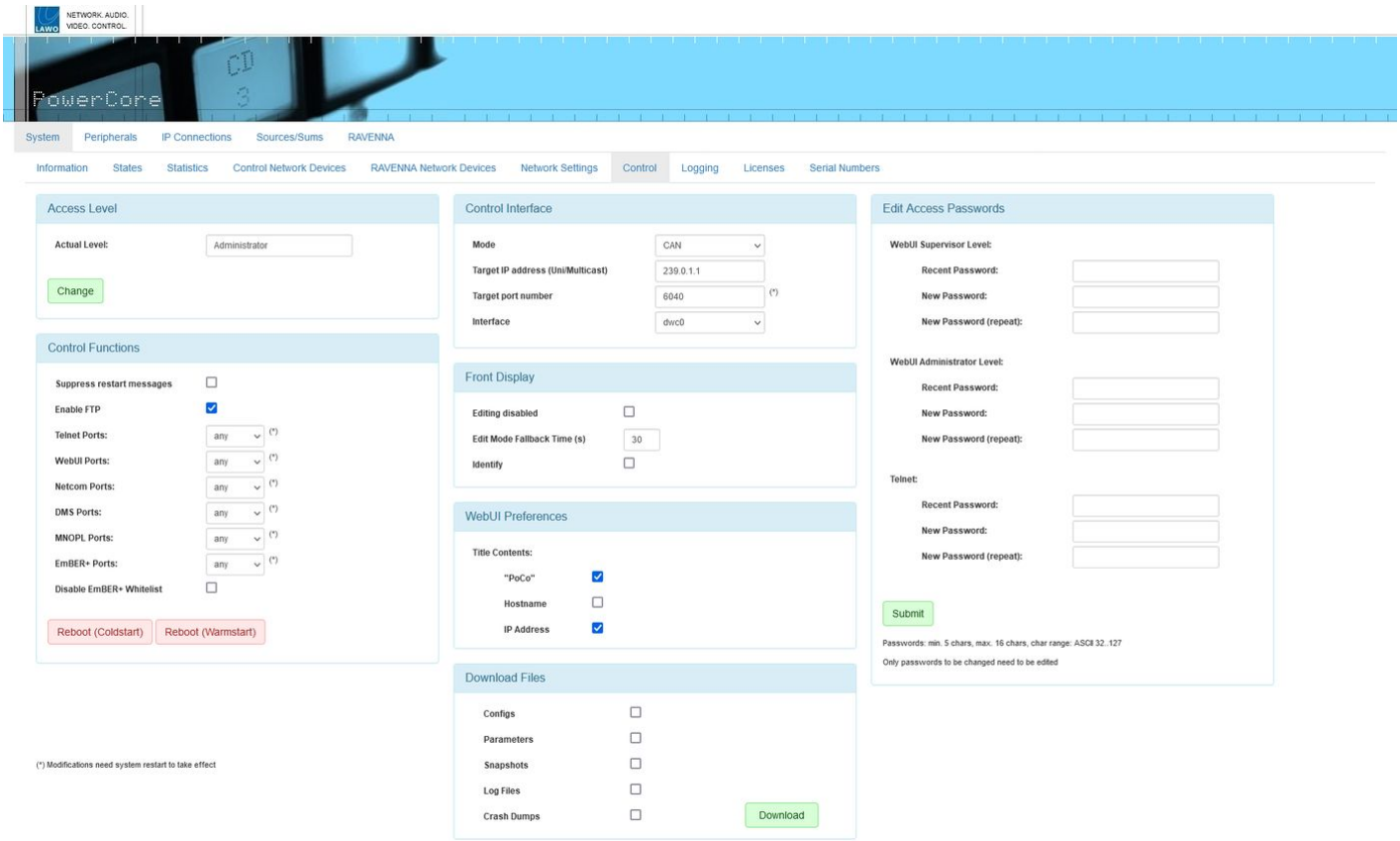
10.1 Power Core - Restarting the System

This topic describes how to restart the system.

How to Restart Power Core

Power Core has no on/off switch and starts automatically when power is applied. The system can also be restarted remotely using the Web UI (described below) or a Telnet session (described later).

1. Open a Web UI connection to the Power Core control port.
2. Log in as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.
3. Select the **System → Control** tab and look for the **Reboot (Coldstart)** and **Reboot (Warmstart)** buttons (at the bottom of the "Control Functions" area).



Reboot (Warm Start)

By default, the system performs a warm start whenever you apply power, press the recessed **RESET** button (on the front panel), choose **Reboot (Warmstart)** from the Web UI or type "sys_rb" into a Telnet session.

The boot-up progress is shown on the front panel:

1. First, the SYSTEM display and **STATUS** LED are black and unlit.
2. Then, the Lawo logo appears and the **STATUS** LED lights in white.
3. As soon as boot-up is complete, the **Welcome** page appears and the **STATUS** LED starts to blink; its color reflects the sync status.

If the **STATUS** LED does not start to blink, then the device has an internal problem. Please reboot the device (using the RESET button) as a first step.

At the end of the boot-up, Power Core loads the latest settings (stored at shut-down). This is known as the warm start data, and it means that the system returns to whatever the settings were at the last power off.

There are two exceptions: PTP parameters that have been edited using the Web UI and output stream parameters that are changed during runtime via Ember+. In this instance, the changes are not warm start persistent and the parameters reset to the values stored in the configuration.

Please note:

- If you perform a cold start, then the system ignores the warm start data and resets all settings to the default values stored in the configuration.
- If this is the first time you have powered the device "out of the box", then the system loads a very basic configuration that allows Power Core to boot. To get the system operational, you will need to upload the standard configuration or a custom configuration using the ON-AIR Designer.

Reboot (Cold Start)

As explained above, a cold start ignores the warm start data, and resets all internal logic states and audio parameters to the default values stored in the configuration.

A cold start happens automatically whenever you transfer a new configuration to Power Core (using ON-AIR Designer) or update its firmware (using SoP Explorer). It can also be triggered manually using the **Reboot (Coldstart)** button on the Web UI.

Reboot (Default Mode)

If Power Core boots in default mode, then it loads a very basic configuration stored on the SD card. This can be useful if the customer's configuration is stopping the system from booting (e.g. there is a loop in the ON-AIR Designer configuration and you need to exit out of the loop).

To activate default mode:

1. Press and hold the encoder on the front panel and, while holding, press the RESET button.
2. Once the Lawo logo appears, you can release the encoder - the device now boots up in default mode.
3. Once boot-up is complete, you can use SoP Explorer to reload all system firmware and ON-AIR Designer to transfer a different configuration.

10.2 Power Core - Web UI

The Power Core Web UI can be used to provide status information about the system and perform a number of administrative and diagnostic tasks.

It can be reached by entering the IP address or hostname of Power Core into a web browser (e.g. **192.168.101.240** if the default IP is in use). In User mode (no password). The computer you use must be connected to the same control network as Power Core. For more information, see Power Core - Configuration Tools and Opening a Web UI Session.

In User mode, information is displayed as "read-only" with no editable fields. If you wish to edit or access the permitted options, then you must login as either Supervisor or Administrator. The default passwords are *orion* for Supervisor and *hydra* for Administrator.

Once you have opened a connection and logged in, you will see the available pages/tabs.

> Optionally, the Web UI can be opened using a secure connection. The steps required to prepare the device are described later. Once the SSL certificates are in place, the Web UI can be opened using a "https" connection. Apart from the connection method, there is no difference in the functionality.

In the current release, there are five main menus each containing several sub pages/tabs. The rest of this section describes all available pages plus how to prepare a secure connection. Alternatively, use the quick links (below) to learn more about a particular function.

- Power Core - System Menu
- Power Core - Peripherals Menu
- Power Core - IP Connections Menu
- Power Core - Sources/Sums Menu
- Power Core - RAVENNA Menu
- Power Core - Preparing a Secure Connection (for https)

Quick Links

The table below provides quick links to some of the most useful functions.

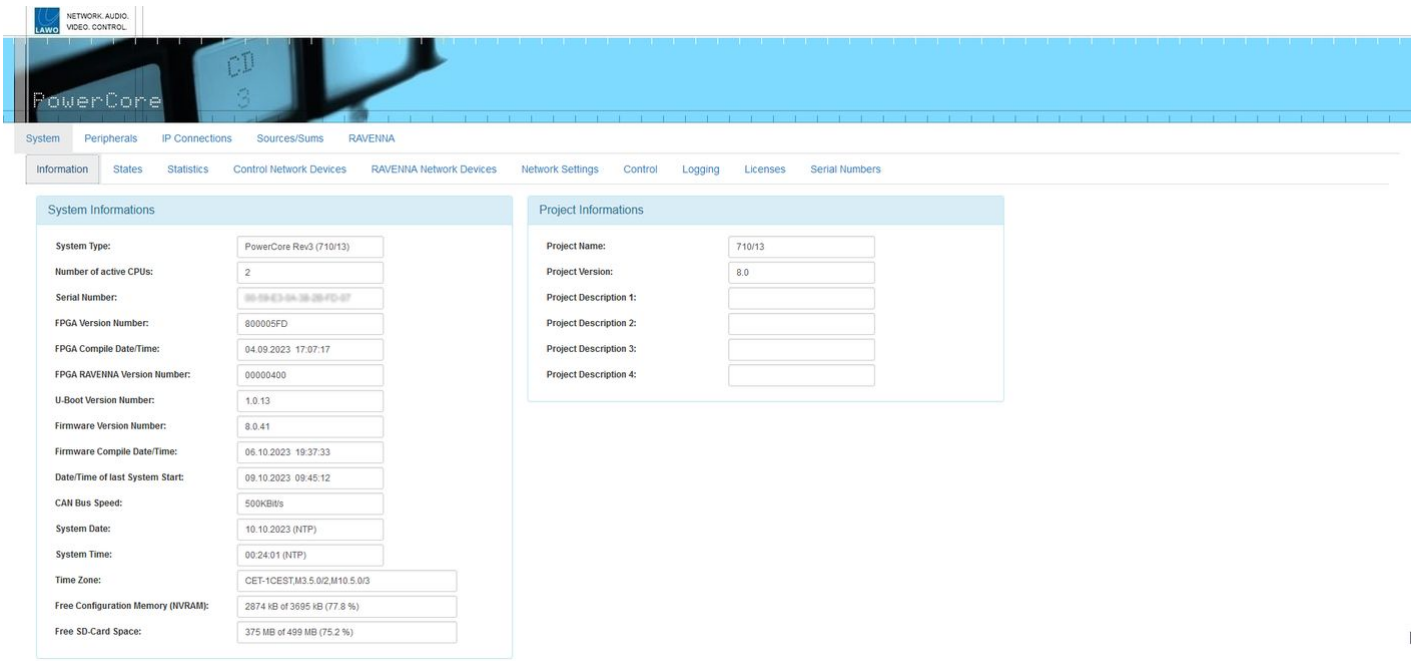
How to...	
Change the time zone	Edit the **Time Zone** field in "System → Information".
Check the sync status	Look at the **Sync** area in "System → States".
Check the status of the hardware components	Look at the "System → States" page (for the main frame) and "Peripherals" pages (for other components: MADI ports, I/O cards, AIOX devices, control surface and key panels).
Change the IP address of the control and streaming ports	Edit the **IP Address** fields in the "System → Control Network Interfaces" and System → RAVENNA Network Interfaces tabs.
Identify the Power Core device	Press the **Identify** button in "System → Control".
Reboot the device	Press the **Reboot (Warmstart)** button in "System → Control".
Change the passwords (for Supervisor and Administrator)	Use the **Edit Access Passwords** area in "System → Control".

Power Core - System Menu

In the System menu, there are ten pages/tabs. They provide status information about the main unit and its peripherals. Most of the information is for diagnostic purposes only. Values which can be modified are noted for each tab.

- System → Information
- System → States
- System → Statistics
- System → Control Network Devices
- System → RAVENNA Network Devices
- System → Network Settings
- System → Control
- System → Logging
- System → Licenses
- System → Serial Numbers

System → Information



The **System → Information** tab is the first tab to be shown following a successful login.

On the left, you will see basic information about the device such as the serial number, software / firmware version numbers and system date and time. The system date and time is provided by your network's NTP server (if present), or by the device's internal Real Time Clock (RTC). In User mode, all fields are non-editable. In Supervisor or Administrator mode, you can edit the time zone (as described below).

On the right, the "Project Information" area shows the project name, version and description defined by the ON-AIR Designer configuration.

Setting the Time Zone

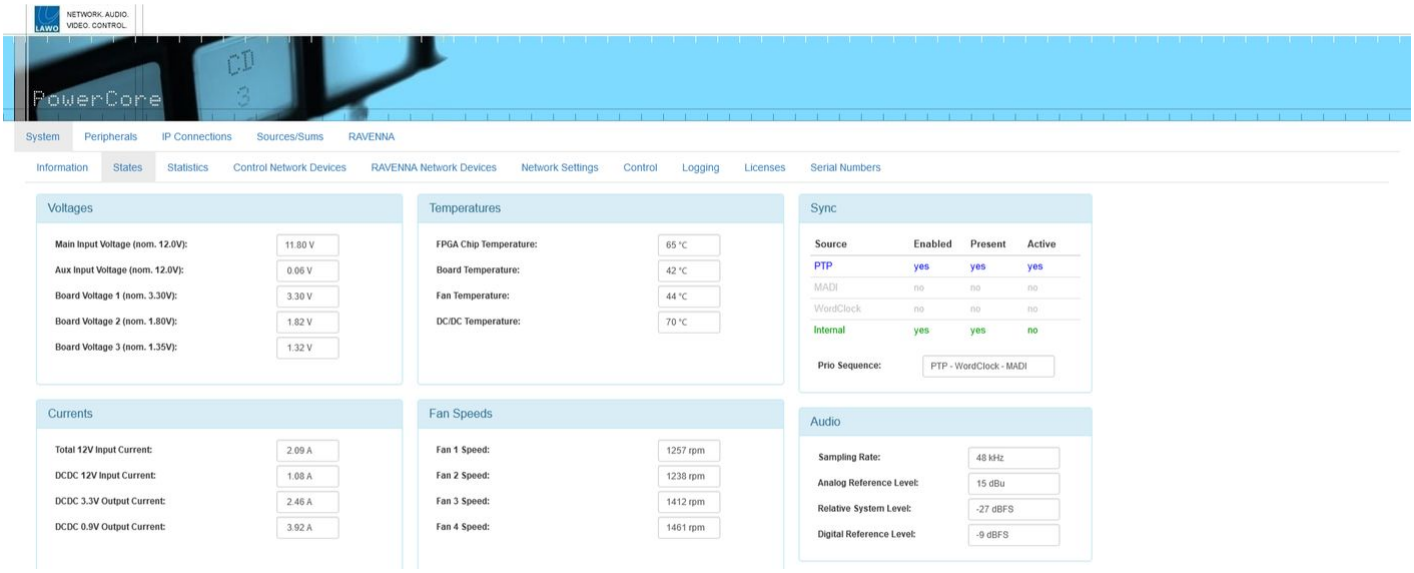
In Supervisor or Administrator mode you can edit the current **Time Zone** value. Type in a new value - any change takes immediate effect and so a restart is not required.

The time zone should be specified relative to Central European Time (CET).

For example, "CET+5CEST,M3.2.0/2:00,M11.1.0/2:00" is suitable for US East Coast, where CET is 5 hours ahead.

The second part of the syntax specifies the start and end of Central European Summer Time (CEST). e.g. from month 3, week 2, day 0, time 2am (the second Sunday in March) until month 11, week 1, day 0, time 2am (the first Sunday in November).

System → States

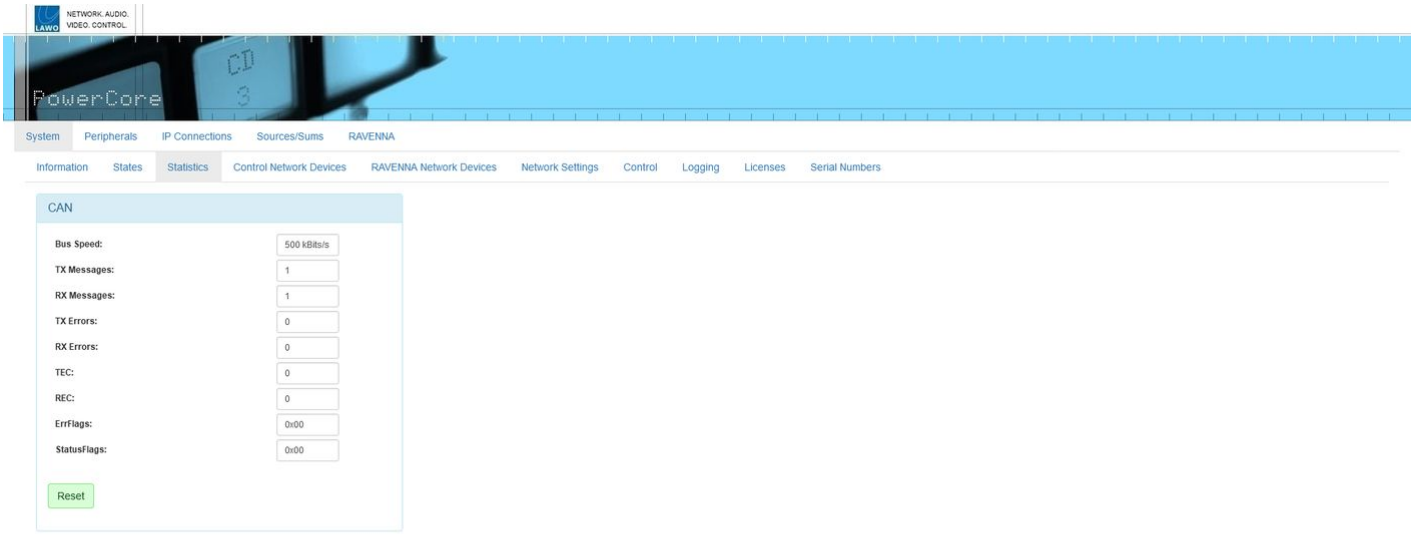


The **System → States** tab shows information about the physical state of the Power Core hardware. It is for diagnostic use only; there are no editable fields.

In the "Sync" area (on the right), you will see information about each of the sync sources defined in the ON-AIR Designer configuration. The color-coding indicates:

- **Blue** = sync source is enabled, present and active.
- **Green** = sync source is enabled and present, but not currently active.
- **Red** = sync source is enabled but not present.
- **Light Grey** = sync source is disabled in the configuration.

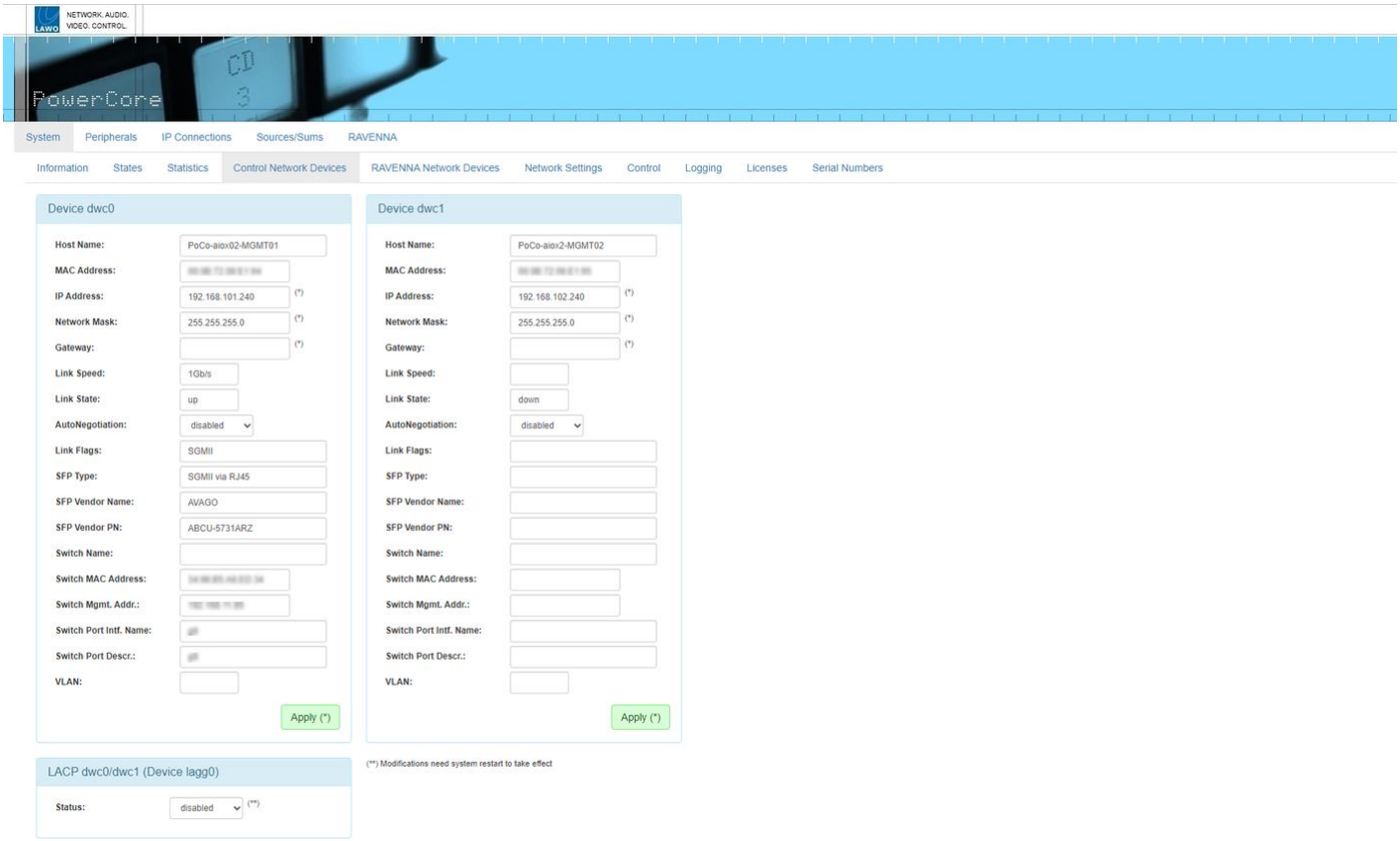
System → Statistics



The **System → Statistics** tab shows information about the CAN bus. It can be used to analyse the number of messages sent and received, and if there are any TX or RX problems.

To reset all of the message/error/flag counters to zero, click on the **Reset** button at the bottom of the page.

System → Control Network Devices



This tab provides access to the settings for the two control ports: **Device dwc0** and **Device dwc1**.

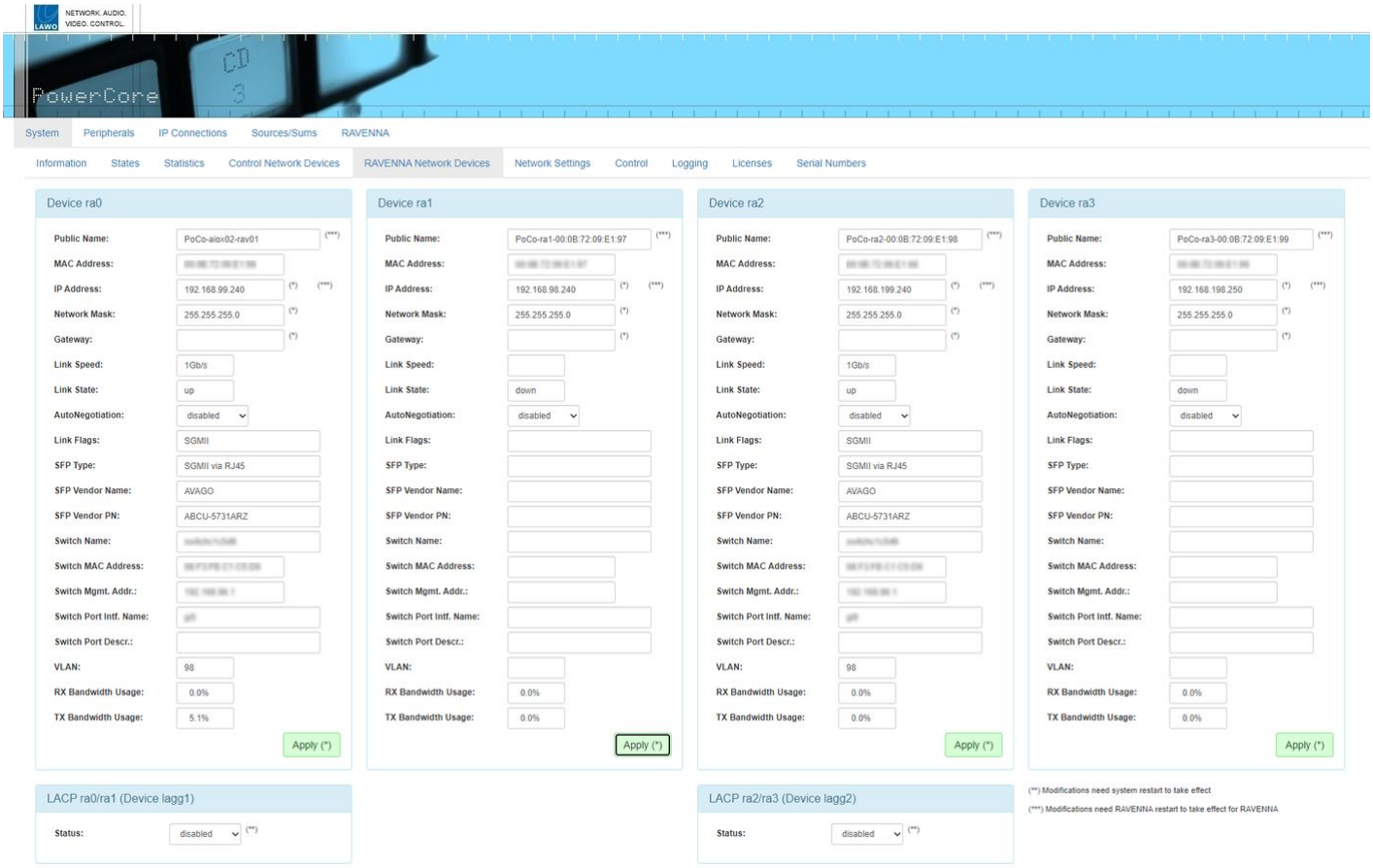
Each "Device" section displays the port's Host Name (defined by the ON-AIR Designer configuration) and MAC address, plus the network IP Address, Network Mask and Gateway (if used). The Link Speed and State show the speed of the connection and its current status (up or down). You will also see information about the SFP module fitted to the port and the network switch connection (if a switch is in use).

In User mode, all fields are non-editable. In Supervisor or Administrator mode, you can enter a new IP Address, Network Mask and/or Gateway. If any settings are changed, you must click **Apply** to save the changes. IP Address changes are made immediately and so you will lose your browser connection once the settings are applied. To continue with the system administration, enter the device's new IP address into your browser and login again (from the Login screen).

Using LACP

LACP *MUST* be configured in the network switch as well as in Power Core. Otherwise you will not be able to reach Power Core via its CONTROL ports.

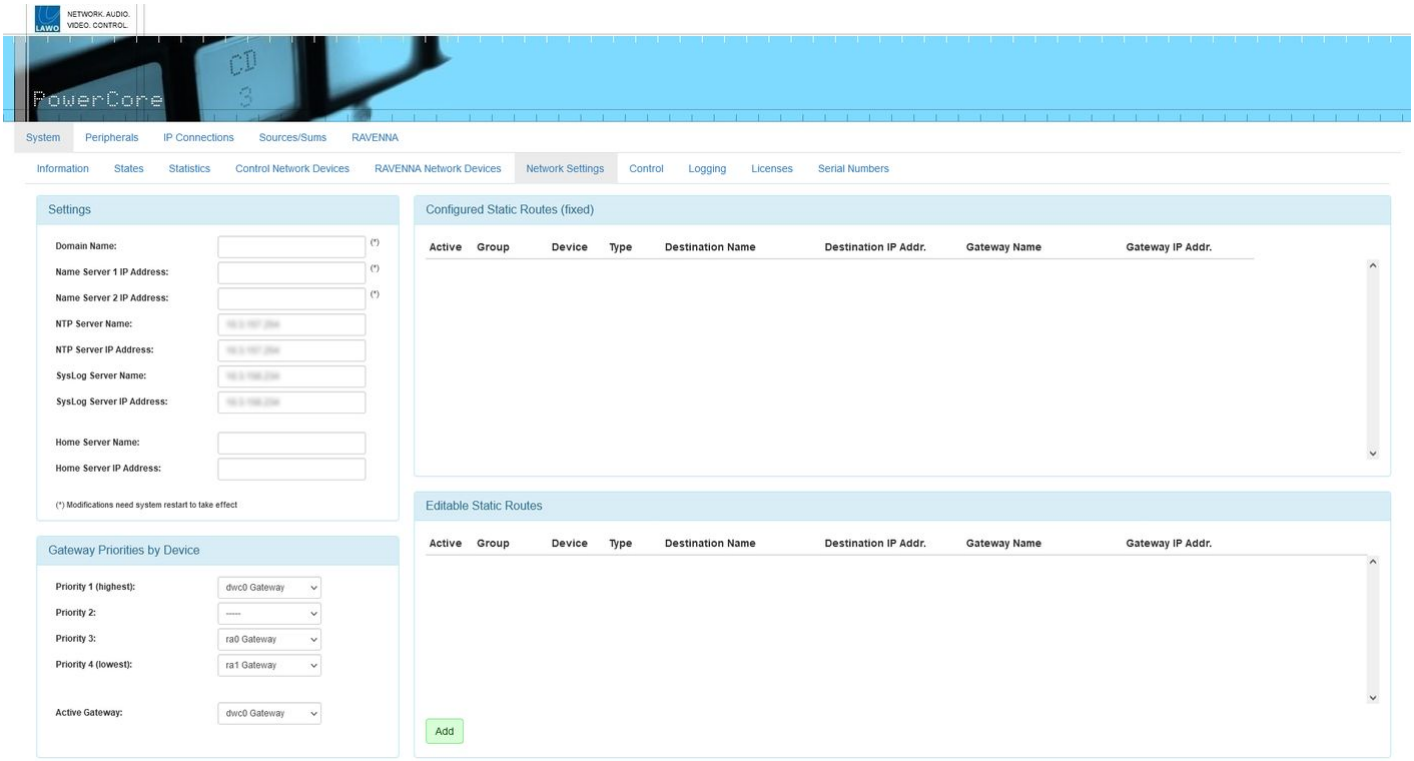
System → RAVENNA Network Devices



This tab contains similar settings for the streaming ports. The first two network interfaces (**Device ra0** and **Device ra1**) are always available. The second pair of interfaces (**Device ra2** and **Device ra3**) are supported by Power Core revision 3 with a valid RAVENNA Plus license/configuration.

As above, in Supervisor or Administrator mode, it is possible to change the IP Address, Network Mask and Gateway, plus the Public Name (a friendly name displayed during network searches). Remember to click **Apply** to save any changes. For the streaming ports (ra0, ra1, ra2 and ra3), IP address changes require a restart, and so you will need to reboot the device after settings are applied. This can be done using the **Reboot (Warmstart)** button in the "System → Control" tab.

System → Network Settings



This tab provides access to Power Core's control network settings. It can be used to define a Domain Name Server, NTP Server or Syslog Server, the gateway priorities (should the primary control link fail) and any static network routes.

Settings

Using the fields in this area, you can enter the Domain Name of your network and DNS Name Server IP Addresses. In addition, you can configure settings for a NTP, SysLog and Home server.

- Your NTP server can be configured either by entering its name in the Server Name box, or its IP Address in the Address box. If you type "ntp.internal" in the Server Name box, the IP Address will be automatically filled.
- Your Syslog and Home server can be configured in a similar manner. Type "syslog.internal" or "home.internal" into the Server Name box to complete the IP address automatically.

Gateway Priorities By Device

These options allow you to determine which of Power Core's network ports will be used as the control port should the primary link be interrupted. Priority 1 is generally assigned to the "dwc0" port; use the remaining Priority fields to prioritize fallback ports.

Configured Static Routes (fixed)

This area shows any static routes which have been configured for your network (via the "Logic -> Static Network Route" element in the ON-AIR Designer configuration).

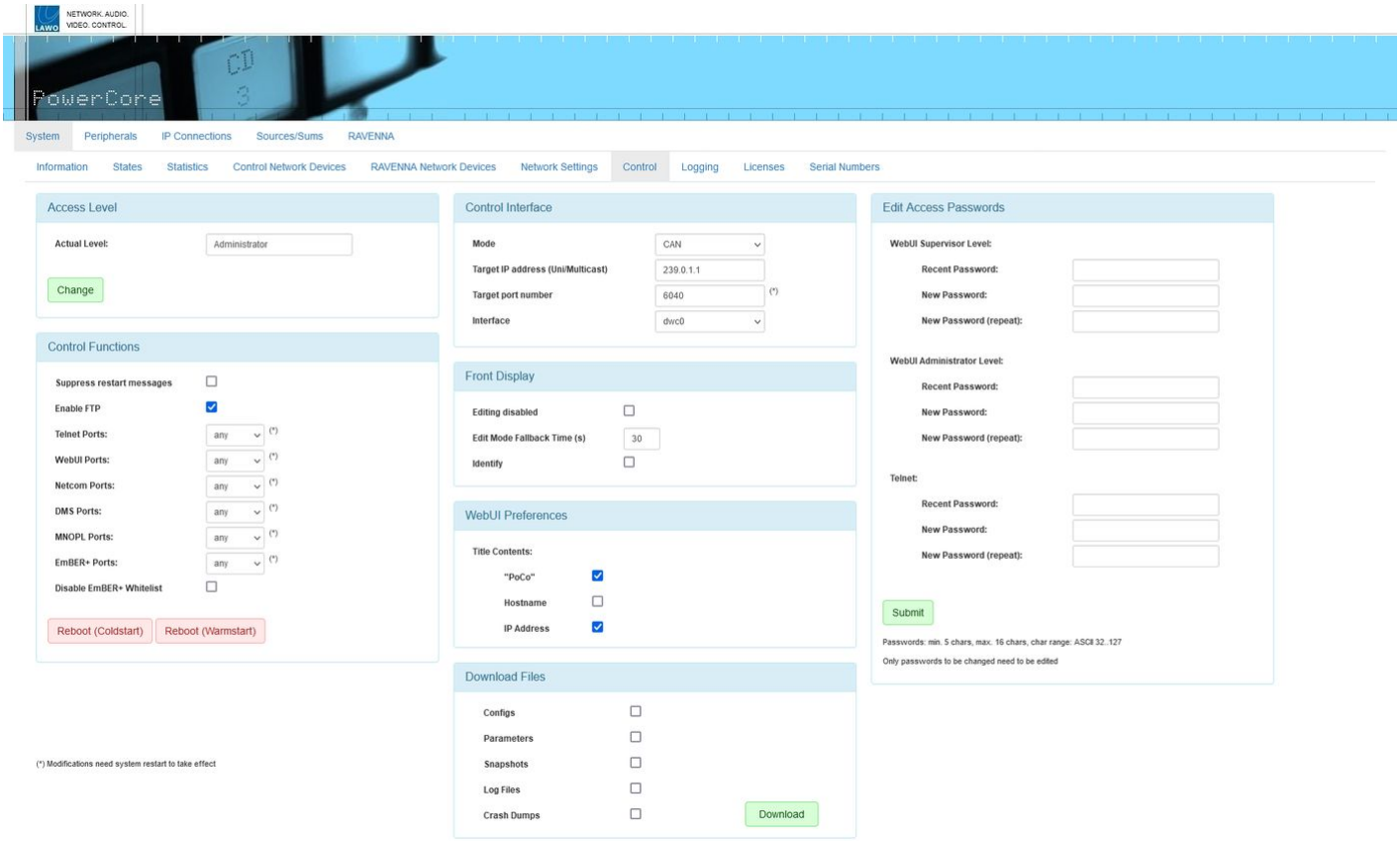
Editable Static Routes

Here you can add an editable static route by clicking **Add** and completing the dialog box.

If a Home server is defined, then the following information is made available (via MQTT heartbeat): system_type; project_name; project_version; serial_number; ember_target; timestamp; and timestamp_utc. The ember_target is always

Provider 1. Therefore, it is mandatory to configure the Ember+ Local Provider (in "System -> Definition -> Parameter = Control Settings" and anything else used by Home) to Provider 1.

System → Control



The **System → Control** tab can be used to configure the device's external control options. For example, to permit access via FTP, etc., reboot the device, define the control surface connection, permit editing or identify the device from the front panel display, and/or edit the passwords for the various user modes.

The options shown are determined by the current "Access Level". In User mode, this is the only section visible. In Supervisor mode, you will also see "Control Functions". In Administrator mode, there are more options in the "Control Functions" plus sections for the "Control Interface", "Front Display", "WebUI Preferences", "Download Files" and "Edit Access Passwords".

Access Level

The current user mode is displayed in the **Actual Level** field.

To change the current access level, click on **Change** - this opens the Login screen. Select a different **Access Level** and enter the **Password**:

- **User** (no password required).
- **Supervisor** (default password = *orion*).
- **Administrator** (default password = *hydra*).

Now re-select the **System → Control** tab to return to this page.

Control Functions

In Supervisor and Administrator modes, the "Control Functions" section becomes visible. Note that the following options are only visible in Administrator mode: **Enable FTP**, **Telnet Ports** and **WebUI Ports**.

- **Suppress restart messages** - by default, an on-screen message appears whenever the system restarts. You can turn the messages off by selecting this option.

- **Enable FTP** - by default, this option is turned on to allow file transfers to Power Core via FTP. Turn this option off to prevent FTP access.
- **Telnet Ports**, **WebUI Ports**, **Netcom Ports**, etc. - these options define which network port(s) can be used for Telnet, the Web UI, Netcom, DMS, MNOPL and EmBER+ communication. In each case, you can choose either **any** (to allow access via any network port) or **dwc0** (to restrict access to CONTROL A only). Note that if you choose **dwc0**, then the restriction also applies to the local host and so access is not permitted via 127.0.0.1. The default setting for all protocols is **any**.
- **Disable EmBER+ Whitelist** - the Ember Whitelist+ (configured in ON-AIR Designer) can be used to restrict the access to the Ember+ providers so that only devices with a defined IP can talk to Power Core (via Ember+). For convenience, you can temporarily deactivate the whitelist by selecting this option. This will allow access from consumers with any IP address.

The two red buttons at the bottom of the area can be used to restart the system as follows:

- **Reboot (Coldstart)** - reboots the unit and loads the base configuration parameters (as defined by the ON-AIR Designer). This will clear any temporary changes made from the Web UI.
- **Reboot (Warmstart)** - reboots the unit keeping temporary changes intact.

Control Interface

In Administrator mode, the "Control Interface" section becomes visible. These parameters define the IP connection to the control surface (if applicable). Please refer to the documentation for your control surface. e.g. diamond - Control Interface Settings.

Front Display

In Administrator mode, the "Front Display" section becomes visible. These options affect the SYSTEM display on the device's front panel.

- **Editing disabled** - by default, this option is turned on. It can be turned off to permit editing of the unit's IP Address and other settings from the front panel. Lawo recommends keeping the option selected.
- **Edit Mode Fallback Time (s)** - when using the front panel controls, inactivity causes the display to return to its normal status. You can set a timeout period for this action by entering a value, in seconds, in this field.
- **Identity** - you can use this box to send a message to the front panel display so that a Power Core can be easily identified. Once activated, the display shows "HELLO I AM \[dwc0 IP Address\]". The message disappears once you de-activate "Identify" or push down on the encoder.

Web UI Preferences

In Administrator mode, the "Web UI Preferences" section becomes visible. These options adjust what is shown in the browser's "title" for the Web UI session. If nothing is selected, then the page address (URL) is shown. Any changes take affect after a refresh of the browser page.

Download Files

In Administrator mode, the "Download Files" section becomes visible. You can use these options to download files from Power Core to your computer. To proceed, first select the tick boxes and then click on the green **Download** button.

Edit Access Passwords

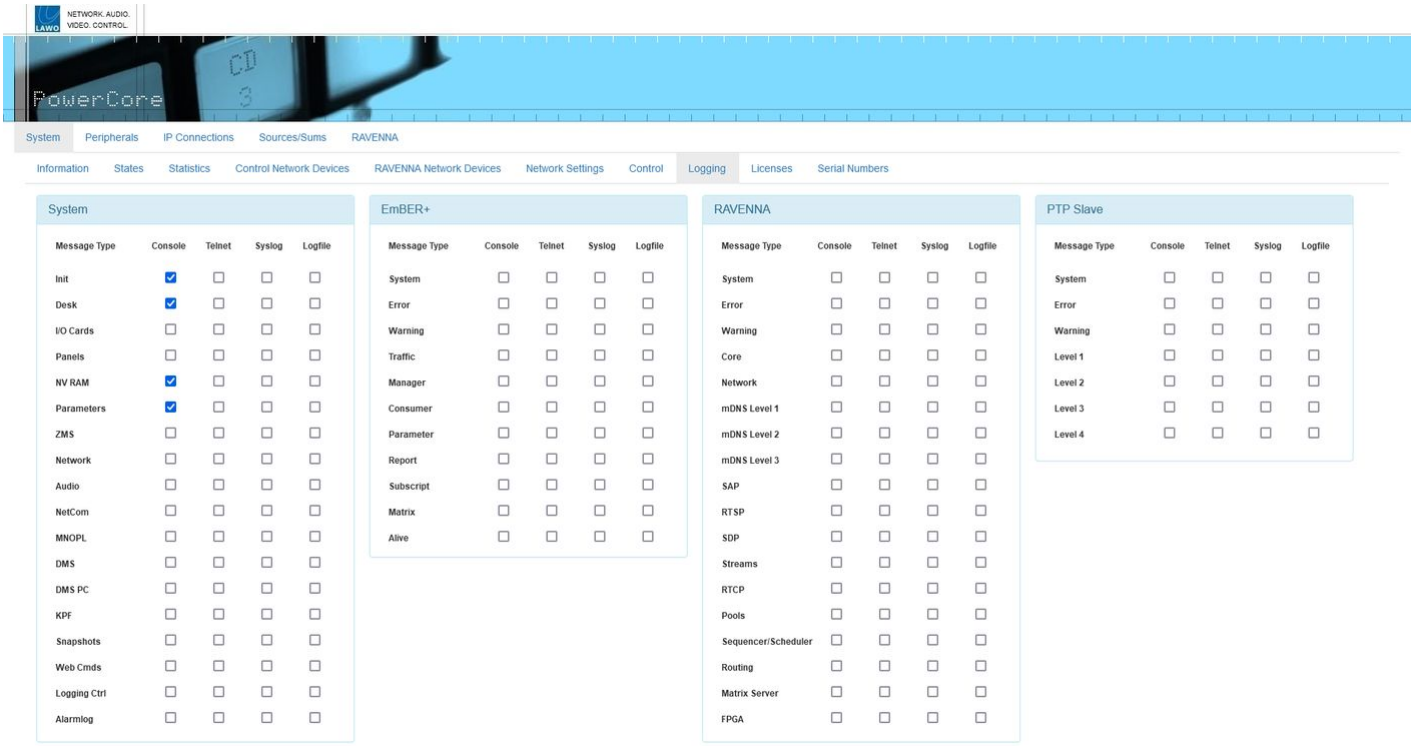
In Administrator mode, the "Edit Access Passwords" section becomes visible.

This area can be used to edit the passwords for the Supervisor and Administrator modes in the Web UI, and/or the device's Telnet login. In each case:

- Enter the current password into the "Recent Password" field, followed by the new password into the two "New Password" fields.

- The new password must meet the following requirements: minimum of 5 characters; maximum of 16 characters; permitted character range: ASCII 32..127.
- Click on **Submit** to apply the changes - an on-screen message appears to confirm (or deny) the operation.

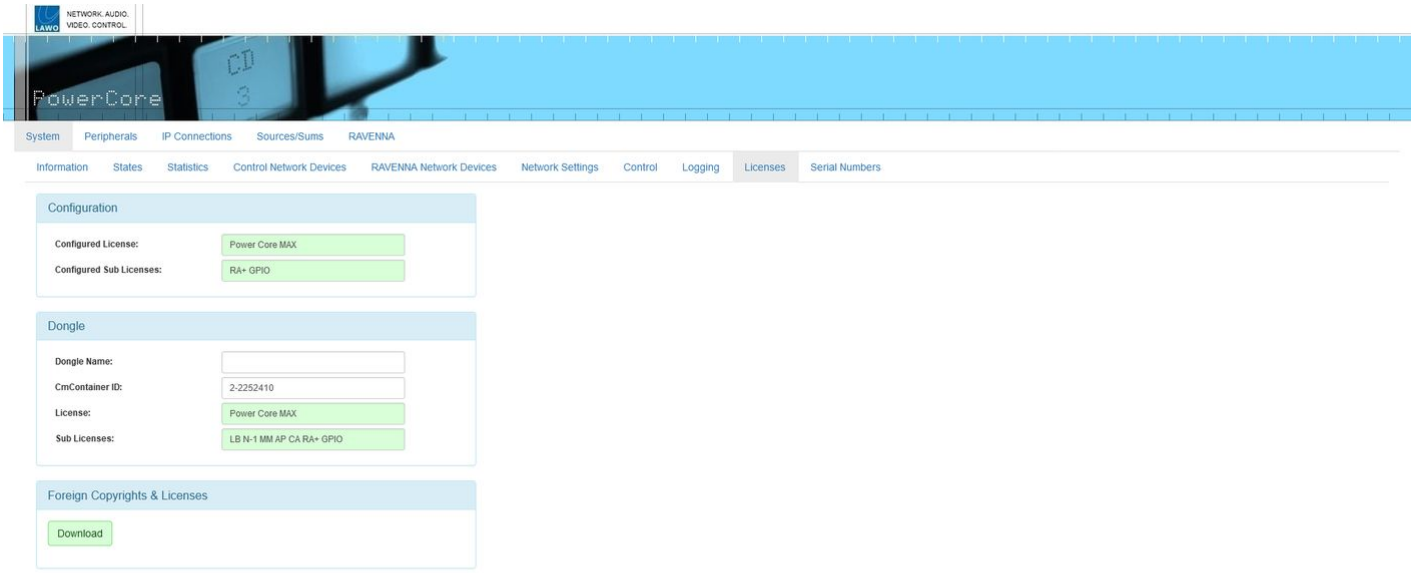
System → Logging



The options here are used for diagnostics. Please keep all options at their default values unless instructed otherwise by Lawo support.

Log files can be obtained from the system by connecting your PC to the debugging port. How to do this is described later in Power Core - USB Service Port.

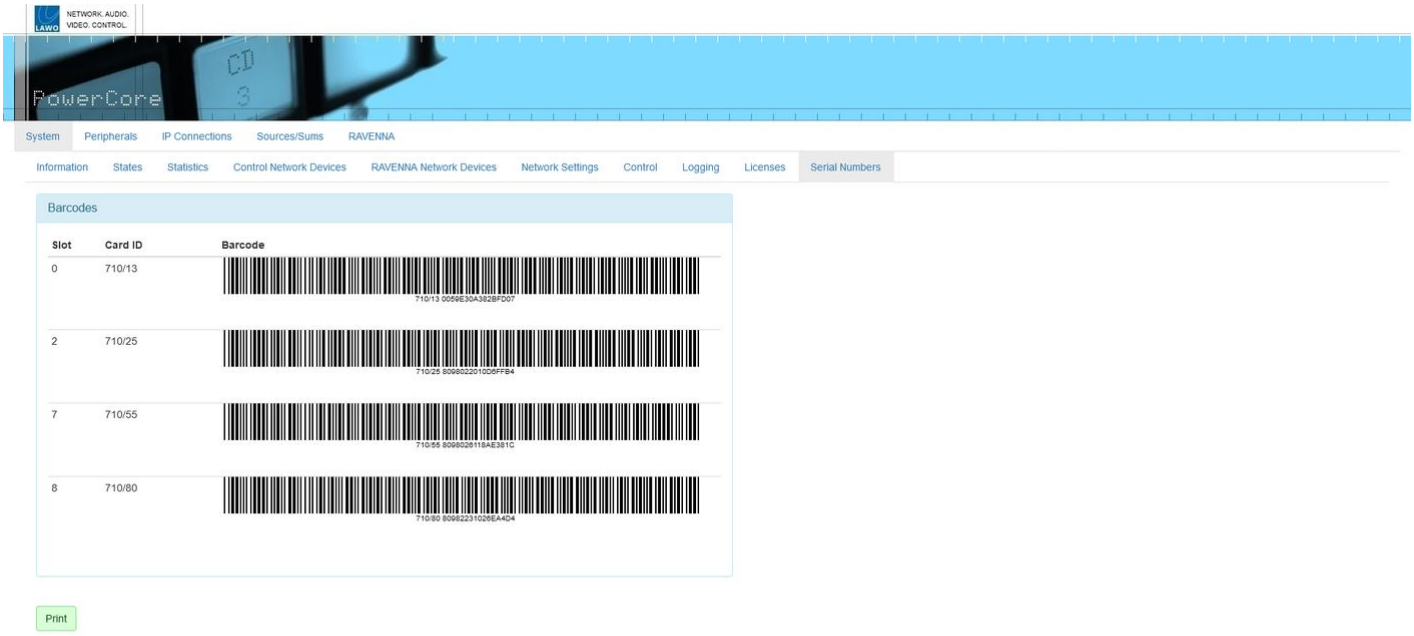
System → Licenses



This tab displays two sets of licensing information describing what is configured (by ON-AIR Designer) and what is detected (on the USB dongle). In each case, the **License** field describes the main license, while the **Sub Licenses** list any active add-ons.

The **Download** button can be used to download a copy of the copyright and license information.

System → Serial Numbers



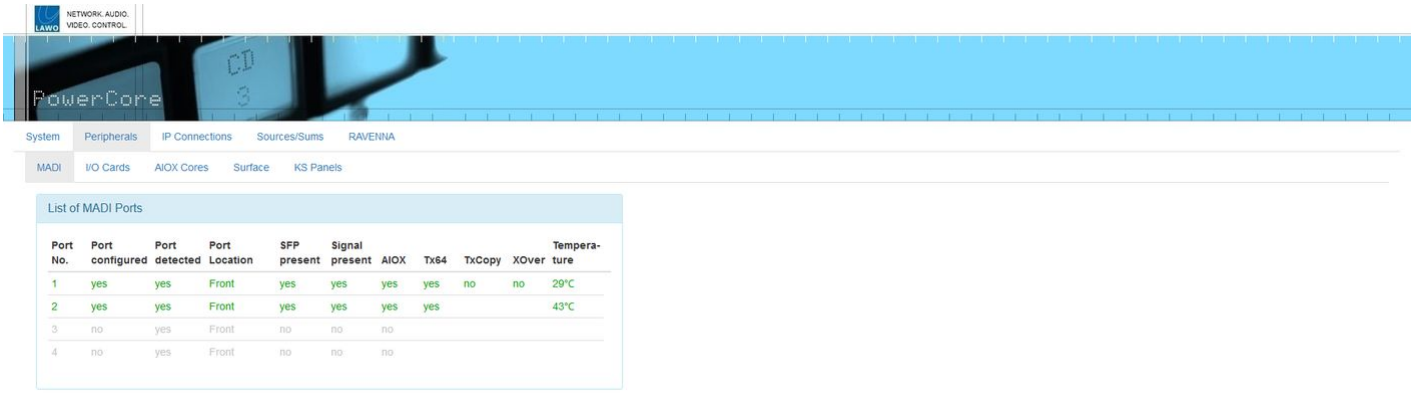
This tab shows the barcodes and serial numbers of the Power Core frame and expansion I/O cards. The **Print** button can be used to print a copy for your system documentation.

Power Core - Peripherals Menu

In the **Peripherals** menu, there are five pages/tabs. They provide status information about the device's peripherals. All pages are for diagnostic use only; there are no editable fields.

- Peripherals → MADI
- Peripherals → I/O Cards
- Peripherals → AIOX Cores
- Peripherals → Surface
- Peripherals → KS Panels

Peripherals → MADI



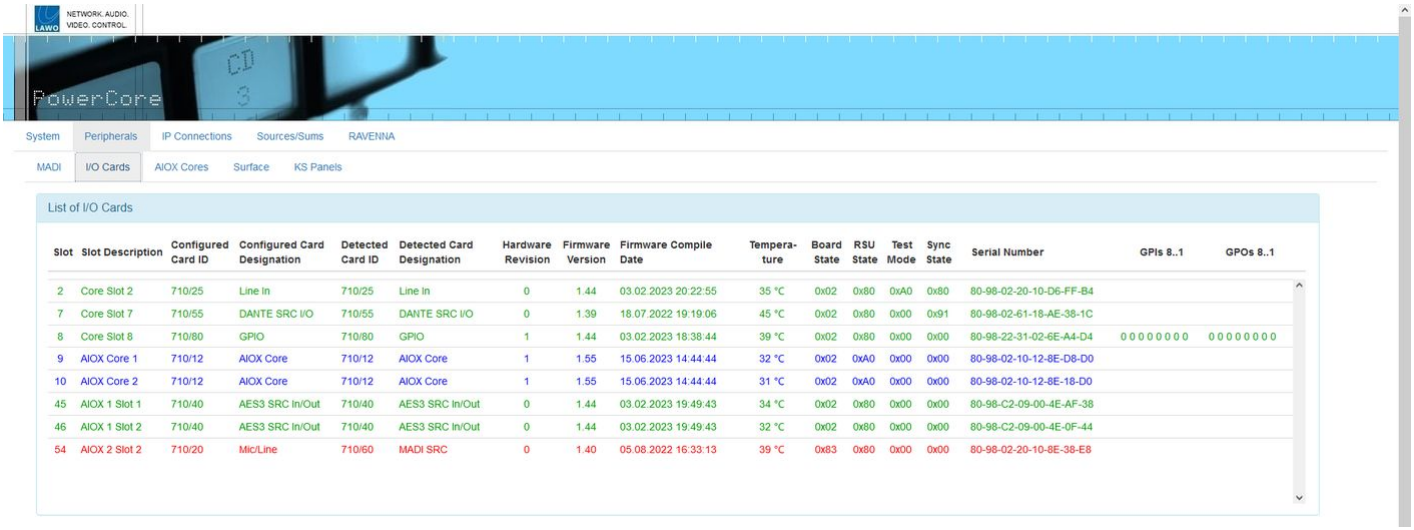
The **Peripherals** → **MADI** tab shows information about all available MADI/AIOX ports. The rows are color-coded to indicate the present state of the connection.

- Green = the port is configured and a valid signal is present. (no redundancy configured).
- Blue = the port is configured and a valid signal is present AND active. (redundancy configured).
- Light Blue = the port is configured and is a valid is present but not active. (redundancy configured).
- Red = the port is configured but a valid signal is NOT present. e.g. an SFP is not fitted or there is no connection.
- Grey = the port is not configured (by the ON-AIR Designer configuration).

The columns show the following information.

- **Port No.**: shows the port number.
- **Port configured**: shows whether the port is configured (in ON-AIR Designer): yes or no.
- **Port detected**: shows whether the port is detected by the hardware: yes or no.
- **Port Location**: indicates the physical location of the port: Front or Rear.
- **SFP Present**: shows whether an SFP module is installed: yes or no.
- **Signal present**: confirms port signal activity: yes or no.
- **AIOX**: shows whether AIOX mode is active: yes or no.
- **Tx64**: shows whether Tx64 mode is active: yes or no. If "no", then Tx56 mode is in use.
- **TxCopy** & **XOver**: shows whether the port is mirrored with another port for signal redundancy. This setting is selected using the ON-AIR Designer.
- **Temperature**: if an SFP is installed, this field displays the current temperature of the SFP.

Peripherals → I/O Cards



The **Peripherals → I/O Cards** tab shows information about the expansion I/O cards and, on Power Core revision 2, the internal GPIOs.

List of I/O Cards

This area shows information about the expansion I/O cards. Slots 1 to 8 refer to the I/O cards fitted to the rear panel. Slots 9 upwards refer to any AIOX Cores, connected to Power Core, and their I/O cards.

For the I/O cards, the rows are color-coded to indicate the present state of the card.

- Green = the I/O card is configured and active.
- Red = the I/O card is configured but NOT active. e.g. no card fitted or different card detected (ID mismatch).

The columns show information about the I/O card such as its slot number, hardware revision, firmware version, temperature, serial number, etc. Most important are the configured and detected card IDs as these must match for correct operation. If they differ, then you will need to change the I/O card (fitted) or modify the configuration (using ON-AIR Designer).

For a GPIO card, you can check the present state of all 8 GPIs and 8 GPOs:1 = high; 0 = low.

For the AIOX Cores, the rows are color-coded to indicate the present state of the connection.

- Blue = the AIOX Core is configured and present.
- Red = the AIOX Core is configured but NOT detected.

In this instance, the columns show information about the AIOX frame such as its hardware revision, firmware version, temperature, serial number, etc. Further information can be viewed using the **Peripherals → AIOX Core** tab (described below).

Expansion I/O Slot (numbering)

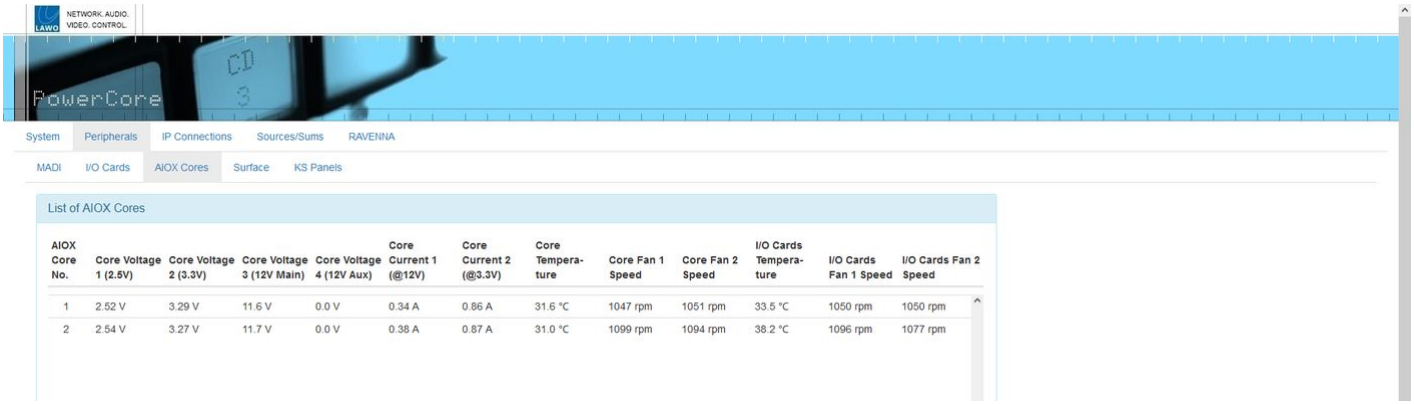
Slot #	I/O Card or Device
1 - 8	Power Core I/O Cards (rear slots 01 to 08)
9 - 12	AIOX Core 1 to 4 (connected via front MADI/AIOX ports 1 to 4)
13 - 28	AIOX Core 5 to 20 (connected via rear MADI/AIOX ports in slots 01 to 08)
45 - 52	AIOX 1 I/O Cards (rear slots 01 to 08)

Slot #	I/O Card or Device
53 - 60	AIOX 2 I/O Cards (rear slots 01 to 08)
61 - 68	AIOX 3 I/O Cards (rear slots 01 to 08)
69 - 76	AIOX 4 I/O Cards (rear slots 01 to 08)
77 - 84	AIOX 5 I/O Cards (rear slots 01 to 08)
85 - 92	AIOX 6 I/O Cards (rear slots 01 to 08)
93 - 100	AIOX 7 I/O Cards (rear slots 01 to 08)
101 - 108	AIOX 8 I/O Cards (rear slots 01 to 08)
109 - 116	AIOX 9 I/O Cards (rear slots 01 to 08)
117 - 124	AIOX 10 I/O Cards (rear slots 01 to 08)
125 - 132	AIOX1 11 I/O Cards (rear slots 01 to 08)
133 - 140	AIOX 12 I/O Cards (rear slots 01 to 08)
141 - 148	AIOX 13 I/O Cards (rear slots 01 to 08)
149 - 156	AIOX 14 I/O Cards (rear slots 01 to 08)
157 - 164	AIOX 15 I/O Cards (rear slots 01 to 08)
165 - 172	AIOX 16 I/O Cards (rear slots 01 to 08)
173 - 180	AIOX 17 I/O Cards (rear slots 01 to 08)
181 - 188	AIOX 18 I/O Cards (rear slots 01 to 08)
189 - 196	AIOX 19 I/O Cards (rear slots 01 to 08)
197 - 204	AIOX 20 I/O Cards (rear slots 01 to 08)

Internal GPIO Card

This area appears for Power Core revision 1 and 2 systems only. It shows the present state of the internal GPIO closures that break out on the front panel GPIO connector. There are two possible states for each input and output: 1 = high; 0 = low.

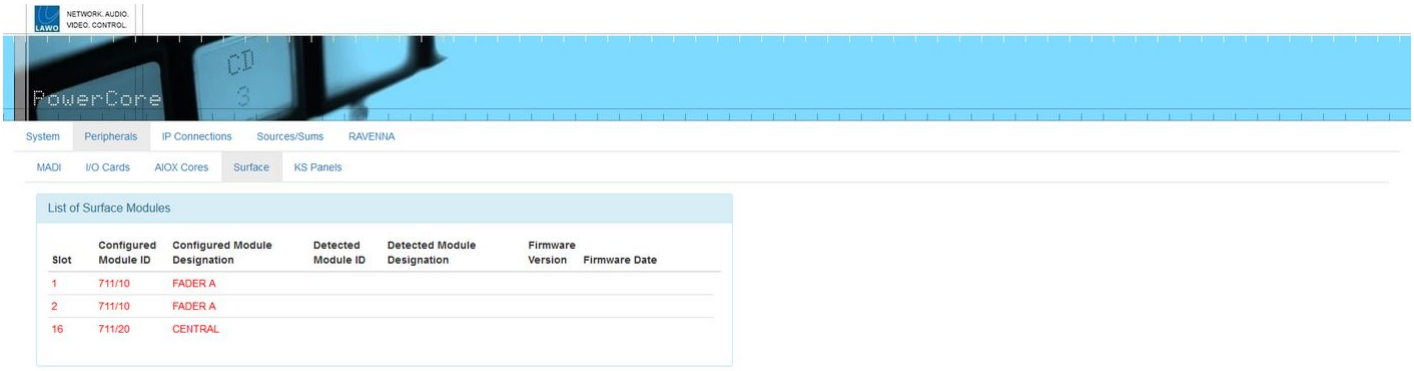
Peripherals → AIOX Cores



AIOX Core No.	Core Voltage 1 (2.5V)	Core Voltage 2 (3.3V)	Core Voltage 3 (12V Main)	Core Voltage 4 (12V Aux)	Core Current 1 (@12V)	Core Current 2 (@3.3V)	Core Tempera-ture	Core Fan 1 Speed	Core Fan 2 Speed	I/O Cards Tempera-ture	I/O Cards Fan 1 Speed	I/O Cards Fan 2 Speed
1	2.52 V	3.29 V	11.6 V	0.0 V	0.34 A	0.86 A	31.6 °C	1047 rpm	1051 rpm	33.5 °C	1050 rpm	1050 rpm
2	2.54 V	3.27 V	11.7 V	0.0 V	0.38 A	0.87 A	31.0 °C	1099 rpm	1094 rpm	38.2 °C	1096 rpm	1077 rpm

The **Peripherals → AIOX Cores** tab shows information about any Audio I/O Extenders connected to Power Core. The columns show information about the present state of the device such as its internal temperature and fan speed.

Peripherals → Surface

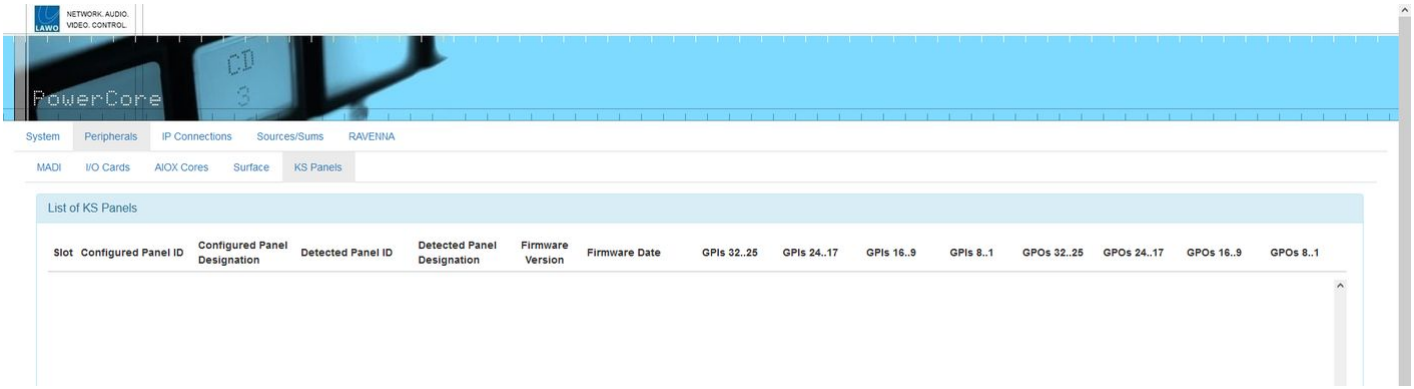


The **Peripherals** → **Surface** tab shows information about any control surface modules which are defined in the configuration. The rows are color-coded to indicate the present state of the module.

- Green = the control surface module is configured and active.
- Red = the control surface module is configured but not active. e.g. the module is not fitted to the frame OR there is a problem with its connection.

The columns show information such as the module's slot ID and firmware version. Most important are the configured and detected module IDs as these must match for correct operation. If they differ, then you will need to change the module (fitted) or its slot ID (to match the ON-AIR Designer configuration). If you need to change a slot ID, then please refer to the documentation for your surface. e.g. diamond - Slot IDs.

Peripherals → KS Panels



The **Peripherals** → **KS Panels** tab shows information about any external key panels which are defined in the configuration. The rows are color-coded to indicate the present state of the panel.

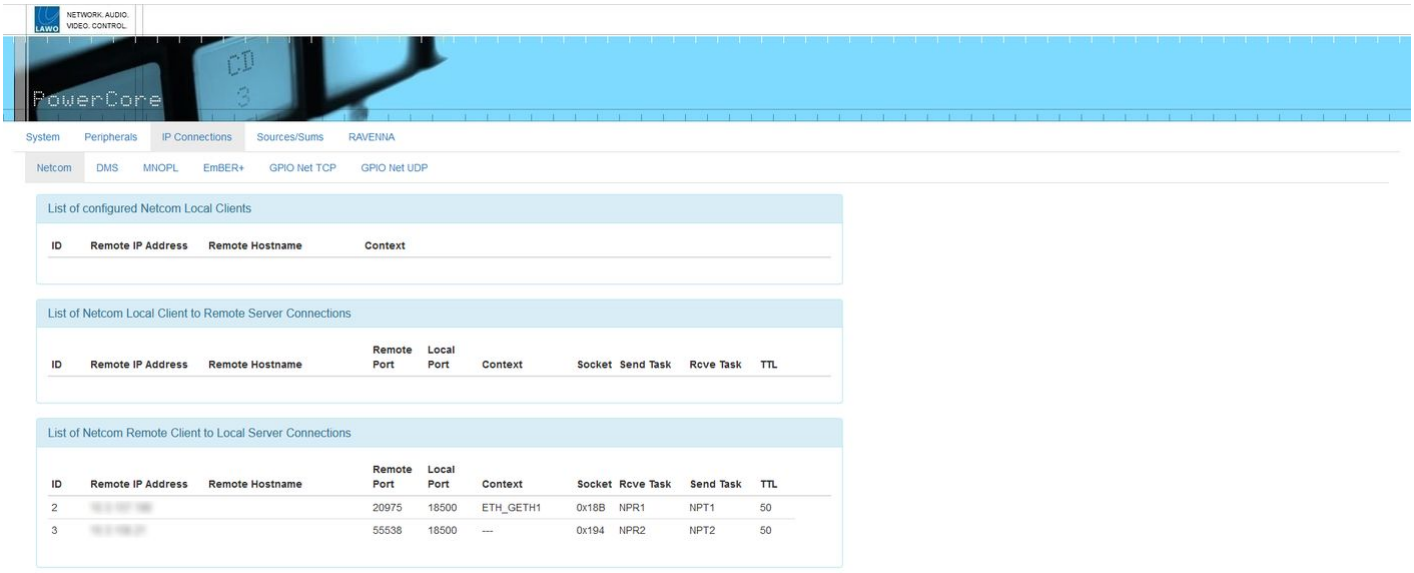
- Green = the key panel is configured and active.
- Red = the key panel is configured but not active. e.g. there is a problem with its connection.

Power Core - IP Connections Menu

In the **IP Connections** menu, there are six pages/tabs. They provide status information about the network connections to Power Core. All pages are for diagnostic use only; there are no editable fields.

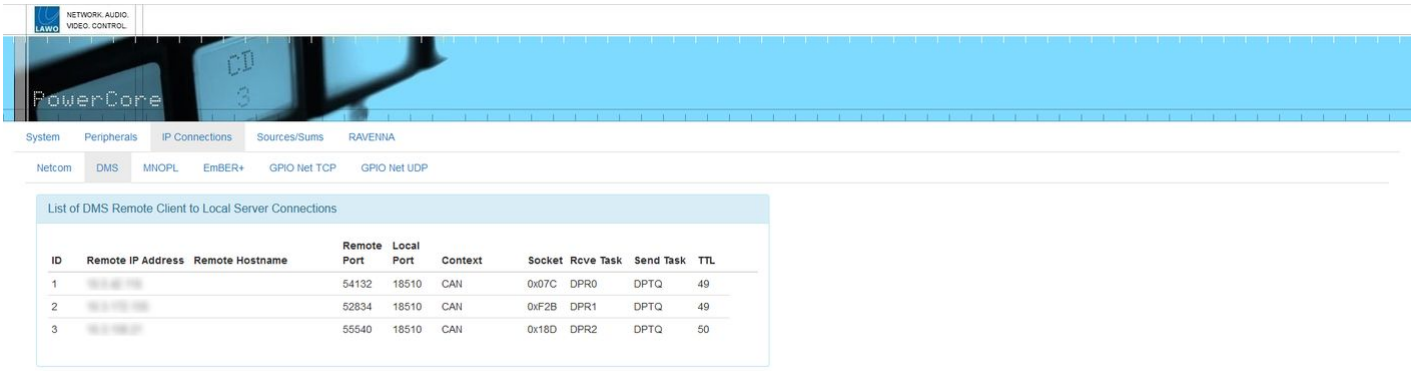
- IP Connections → Netcom
- IP Connections → DMS
- IP Connections → MNOPL
- IP Connections → Ember+
- IP Connections → GPIO Net TCP & UDP

IP Connections → Netcom



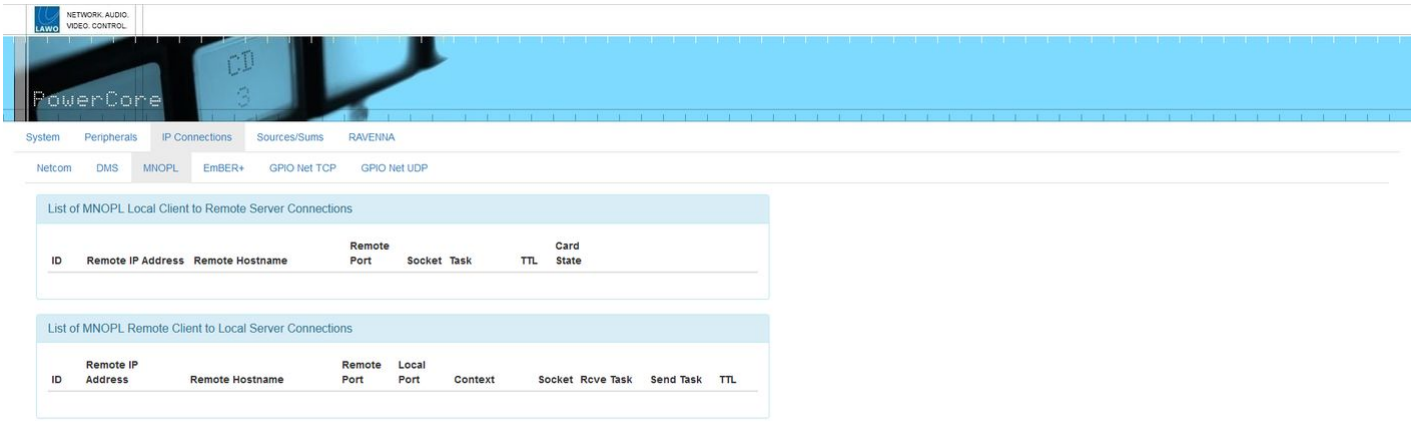
The **IP Connections → Netcom** tab displays a list of all configured Netcom systems and their connections. For example, another Power Core that is configured for GNET (GPIO over network) communication.

IP Connections → DMS



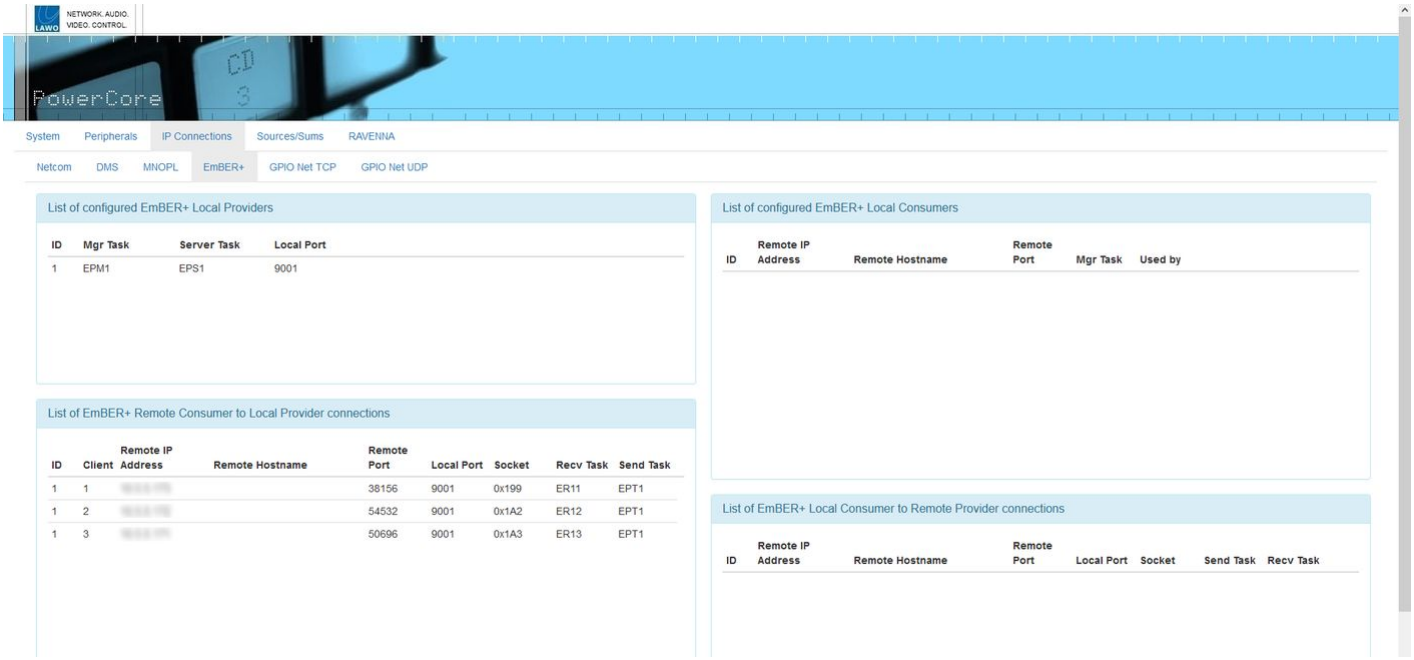
The **IP Connections → DMS** tab displays a list of all systems connected via DMS. For example, a VisTool host PC.

IP Connections → MNOPL



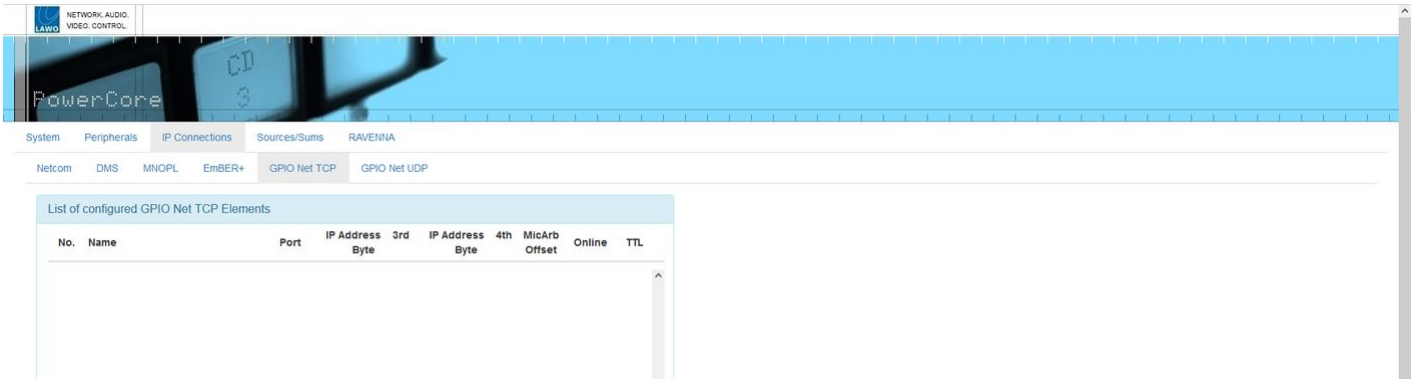
The **IP Connections → MNOPL** tab displays a list of all systems connected via MNOPL. For example, Lawo's Nova series of routers.

IP Connections → Ember+



The **IP Connections → Ember+** tab displays a list of all configured Ember+ systems and their connections. For example, a VSM control system.

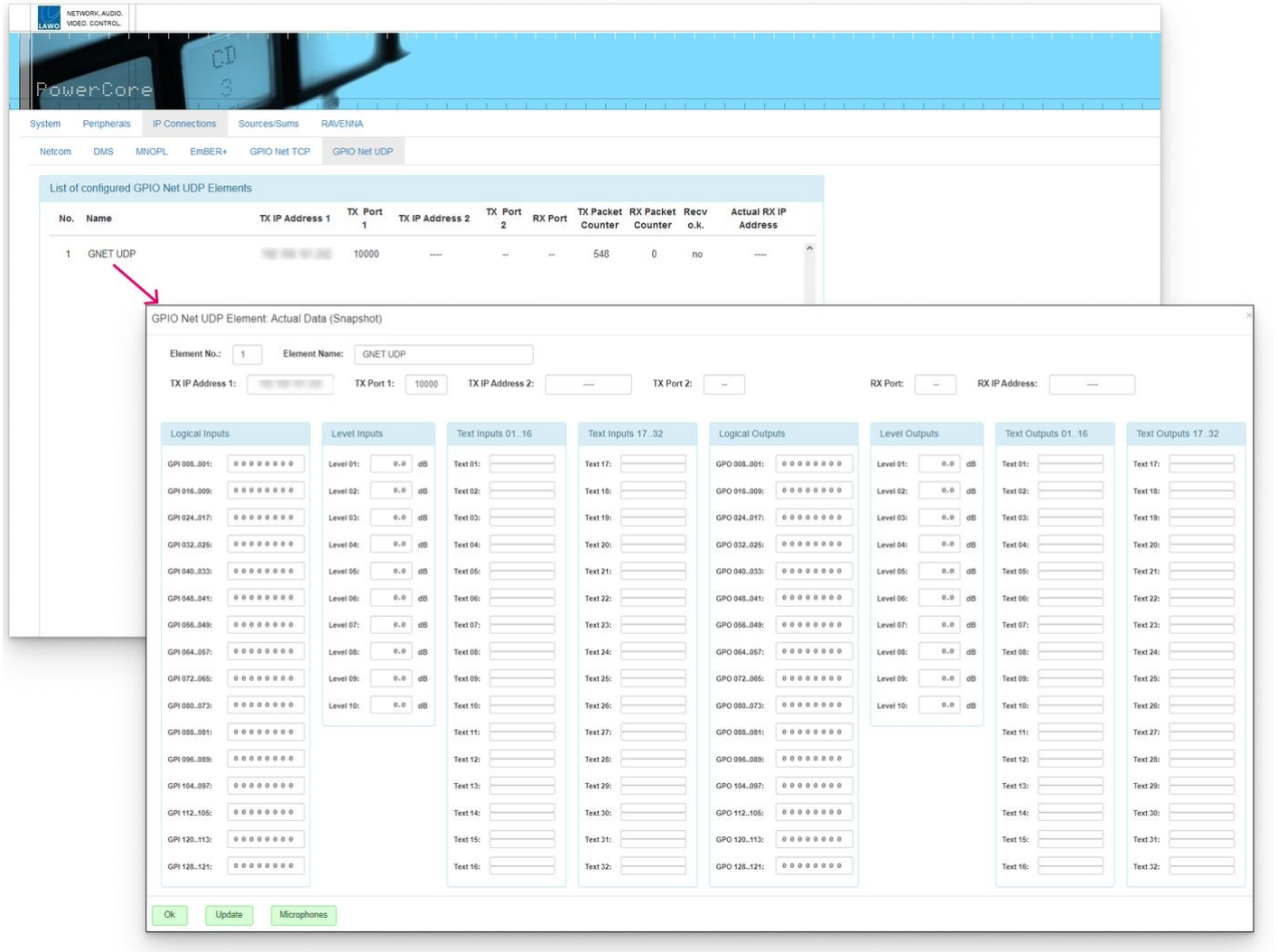
IP Connections → GPIO Net TCP & UDP



The last two tabs in the **IP Connections** menu display a list of all configured **GPIO Net TCP** (and **GPIO Net UDP**) elements. They can be used to monitor the status of any GNET elements (that are used to exchange GPIO signals over the control network).

Power Core supports GNET via both TCP and UDP. This means that it can communicate with other Power Cores (usually via UDP) and legacy systems (that support TCP only).

From the **GPIO Net UDP** tab (shown below), you can click on the element's name field to open a more detailed view. This can be used to check the present state of the logical I/Os and text inputs/outputs.

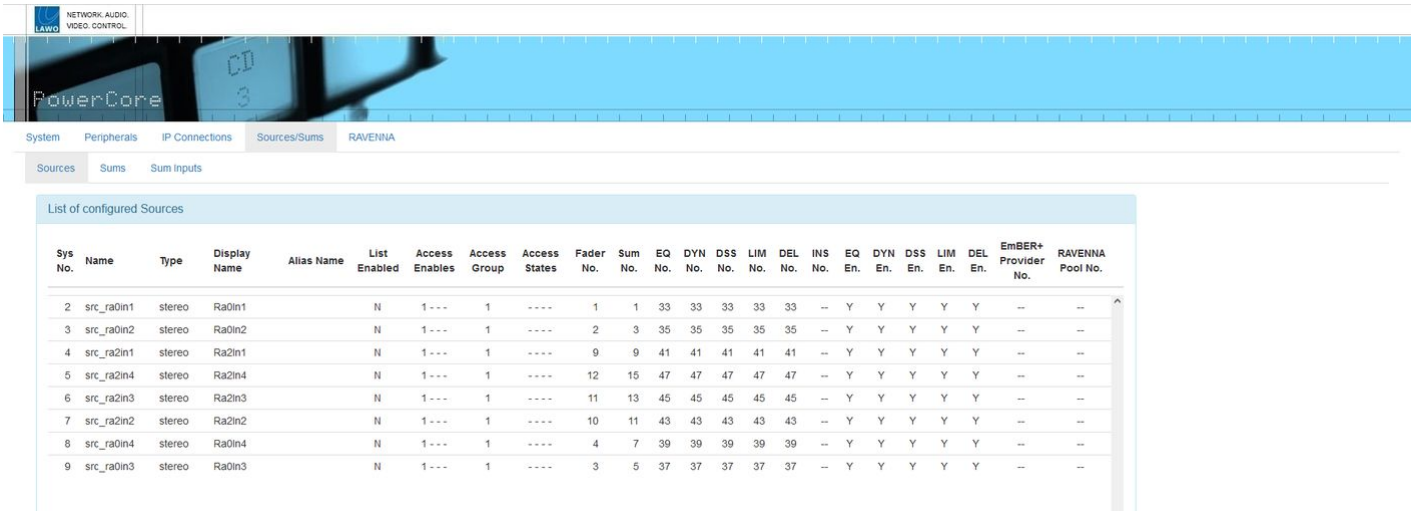


Power Core - Sources/Sums Menu

In the **Sources/Sums** menu, there are three pages/tabs that provide information about the DSP resources. All pages are for diagnostic use only; there are no editable fields.

- Sources/Sums → Sources & Sums
- Sources/Sums → Sum Inputs

Sources/Sums → Sources & Sums



Sys No.	Name	Type	Display Name	Alias Name	List Enabled	Access Enables	Access Group	Access States	Fader No.	Sum No.	EQ No.	DYN No.	DSS No.	LIM No.	DEL No.	INS No.	EQ En.	DYN En.	DSS En.	LIM En.	DEL En.	EmBER+ Provider No.	RAVENNA Pool No.
2	src_ra0in1	stereo	Ra0In1		N	1 - - -	1	- - - -	1	1	33	33	33	33	33	--	Y	Y	Y	Y	Y	--	--
3	src_ra0in2	stereo	Ra0In2		N	1 - - -	1	- - - -	2	3	35	35	35	35	35	--	Y	Y	Y	Y	Y	--	--
4	src_ra2in1	stereo	Ra2In1		N	1 - - -	1	- - - -	9	9	41	41	41	41	41	--	Y	Y	Y	Y	Y	--	--
5	src_ra2in4	stereo	Ra2In4		N	1 - - -	1	- - - -	12	15	47	47	47	47	47	--	Y	Y	Y	Y	Y	--	--
6	src_ra2in3	stereo	Ra2In3		N	1 - - -	1	- - - -	11	13	45	45	45	45	45	--	Y	Y	Y	Y	Y	--	--
7	src_ra2in2	stereo	Ra2In2		N	1 - - -	1	- - - -	10	11	43	43	43	43	43	--	Y	Y	Y	Y	Y	--	--
8	src_ra0in4	stereo	Ra0In4		N	1 - - -	1	- - - -	4	7	39	39	39	39	39	--	Y	Y	Y	Y	Y	--	--
9	src_ra0in3	stereo	Ra0In3		N	1 - - -	1	- - - -	3	5	37	37	37	37	37	--	Y	Y	Y	Y	Y	--	--

The first two tabs provide a comprehensive listing of Power Core's input sources and summing buses.

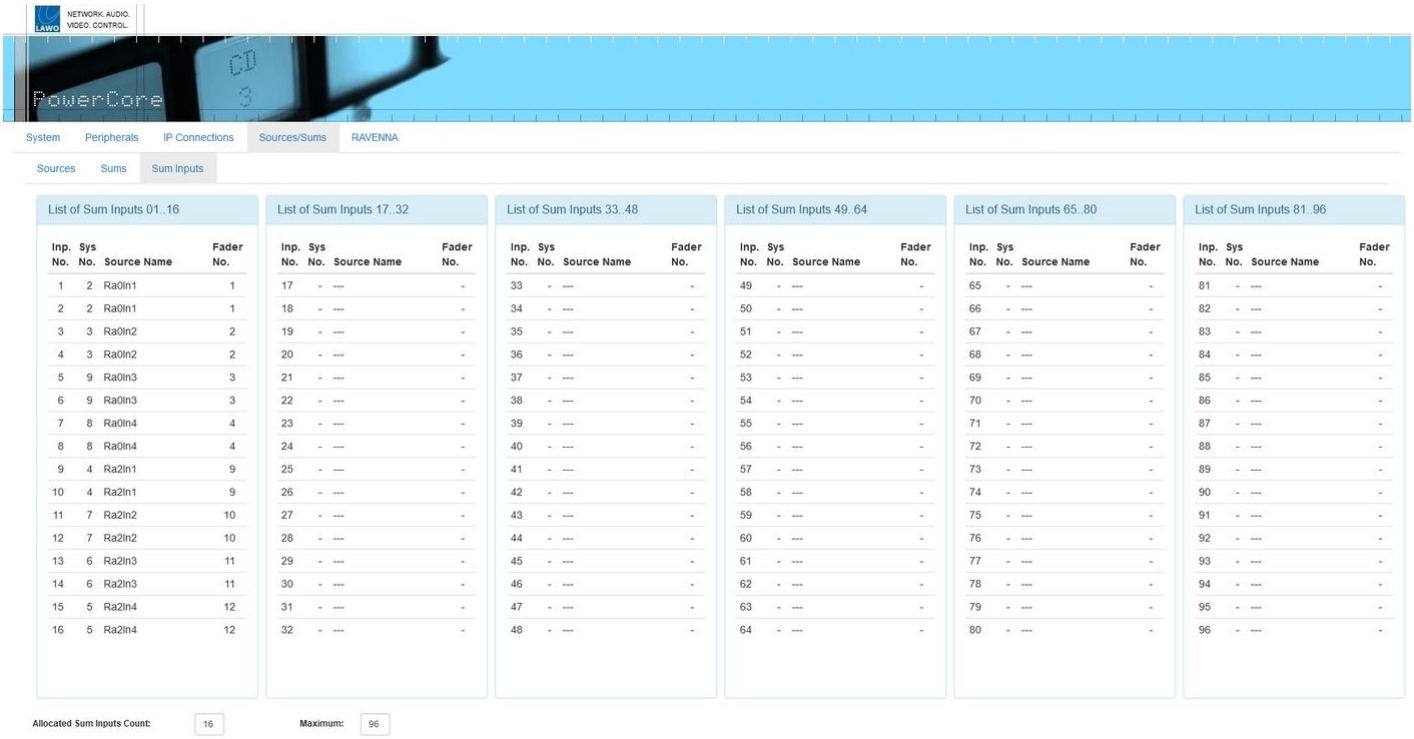
The **Sources** tab shows all of the configured sources (defined by the ON-AIR Designer). Here you check information such as the source's names, format and Access Group; which fader number the source is assigned to; and whether DSP is configured and enabled.

The **Sums** tab shows similar information for all of the configured summing buses.

The lists can be sorted by **Sys No**, **Name**, etc. by clicking on a column header. Click again to reverse the sorting order.

To make changes to the sources or buses, you must edit and save the configuration offline (using ON-AIR Designer) and then upload the edited version to the Core. How to do this is described in Power Core - Configuration.

Sources/Sums → Sum Inputs



The **Sources/Sums → Sum Inputs** tab lists the available summing points and shows how they are utilised.

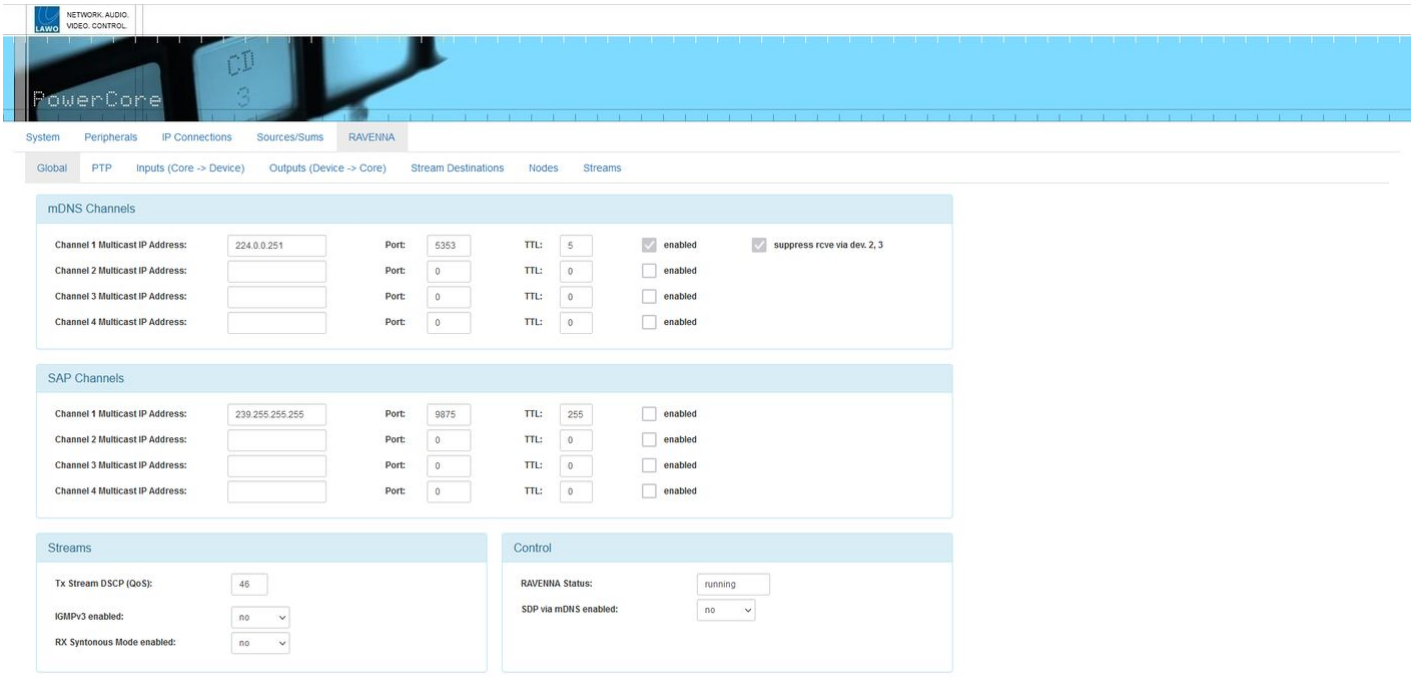
Note that the **Maximum** number of parallel mix inputs is determined by the main license (described in the Power Core - License Chart).

Power Core - RAVENNA Menu

In the **RAVENNA** menu, there are seven pages/tabs. They can be used to check and troubleshoot the Audio-over-IP streams. Most of the information is for diagnostic purposes only. Values which can be modified are noted for each tab.

- RAVENNA → Global
- RAVENNA → PTP
- RAVENNA → Inputs
- RAVENNA → Outputs
- RAVENNA → Stream Destinations
- RAVENNA → Nodes
- RAVENNA → Streams

RAVENNA → Global



The **RAVENNA → Global** tab displays Power Core's global RAVENNA settings. The parameters are configured by the ON-AIR Designer; there are no editable fields.

mDNS & SAP Channels

The first two areas define the mDNS and SAP channels used for stream announcement:

- **mDNS Channels** use the multicast Domain Name System defined in IETF RFC 6762.
- **SAP Channels** use the Session Announcement Protocol defined in IETC RFC 2974.

For each channel, you will see the "Multicast IP Address", "Port" number and "TTL" value (in seconds). The "enabled" checkbox shows if the channel is enabled or disabled.

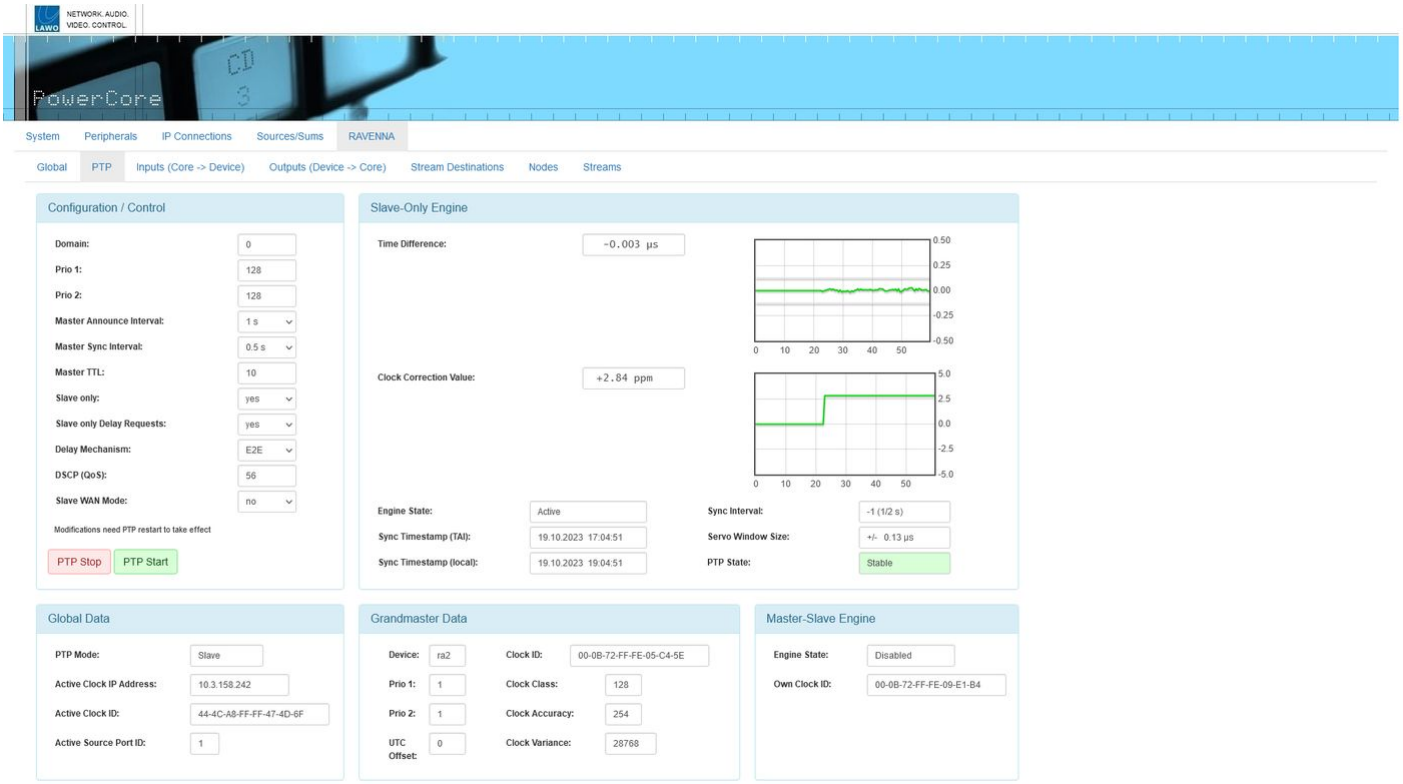
Streams

This area shows the global options for streams.

Control

Here you will see the status of the RAVENNA service and the global options for control.

RAVENNA → PTP



The **RAVENNA → PTP** tab shows statistics and options for the system's PTP clocking.

For convenience, you may enter new temporary PTP settings (as described below). However, to make permanent changes, it is recommended to edit the values defined in the configuration (using the ON-AIR Designer). This ensures that the changes remain in place after a cold start.

Configuration / Control

This area defines the PTP mode and its associated parameters. Power Core supports two possible PTP modes: slave only and master-slave. If **Slave only** is enabled, then Power Core is forced to operate as a PTP slave at all times. If **Slave only** is disabled, then Power Core will operate in PTP master-slave mode, whereby the PTP priorities set within the device itself and all other streaming nodes determine the current PTP master.

To make a temporary change, either choose a different option from the drop-down menus or type in a new value into the permitted fields. Any changes require a PTP restart to take effect, so press **PTP Stop** and then **PTP Start**. Any changes will remain in place until the next cold start.

Slave-Only Engine

The two graphs in this area monitor PTP jitter across the system. This is useful for system analysis and debugging. As a rule of thumb, the "Clock Connection Value" display should be stable with little variance over time as an indication of good system health. High activity in the "Time Difference" display is normal and to be expected.

> For Power Core to sync correctly to PTP, PTP 2-step must be used (as opposed to PTP 1-step).
> In PTP 2-step, the time stamp message is sent separately after the sync message. This allows devices such as Power Core to calculate the network delay of the route.

Global Data

This area shows the system's PTP mode, the active clock ID and address, and the grandmaster clock ID. These IDs may differ if your system uses a boundary clock.

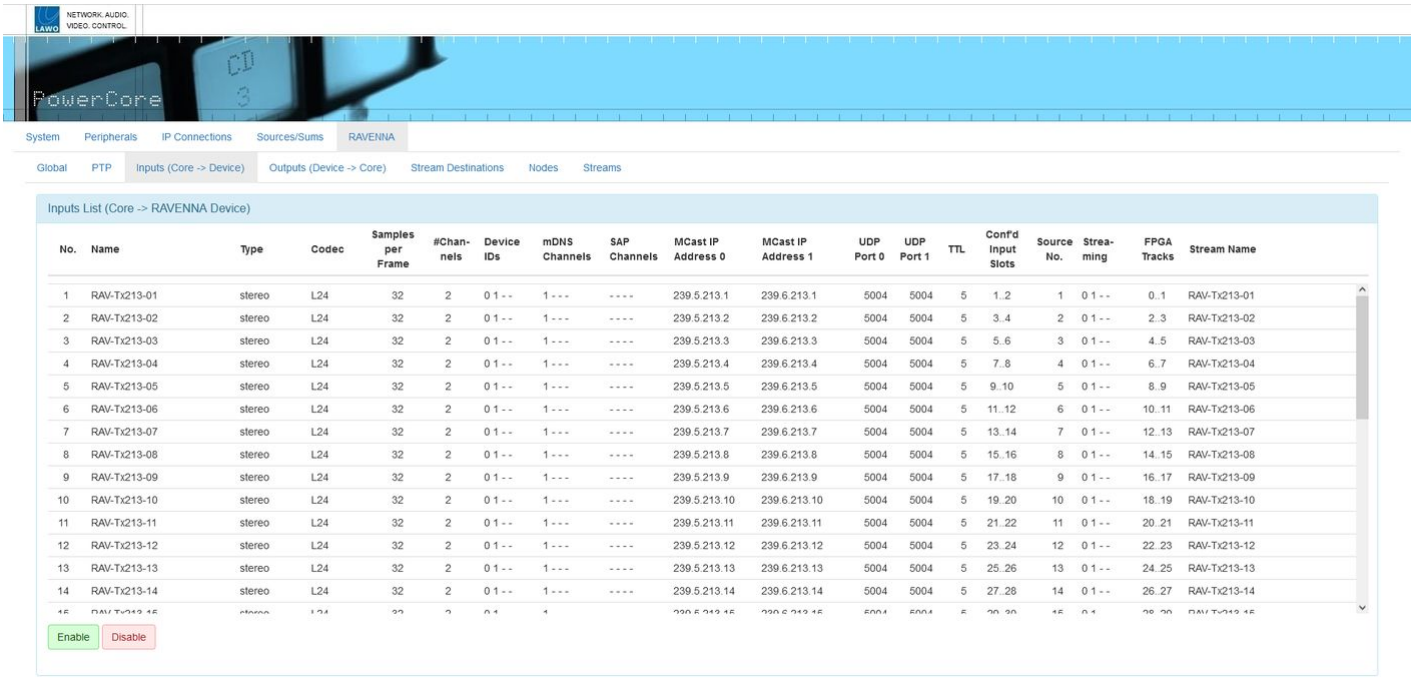
Grandmaster Data

This area shows information about the grandmaster clock.

Master-Slave Engine

This area shows whether the master-slave engine is active, and displays the clock ID (used if master-slave is enabled).

RAVENNA → Inputs

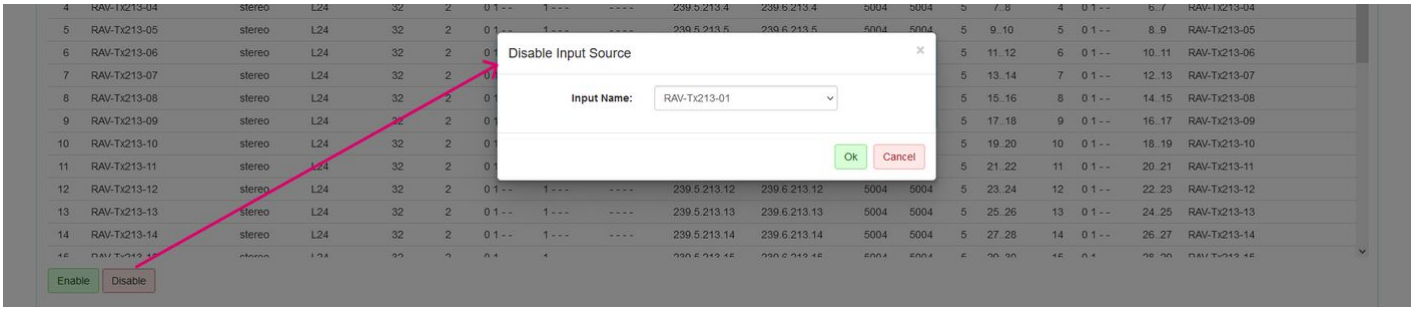


The **RAVENNA → Inputs** tab lists all of the RAVENNA senders (i.e. the streams supplied by Power Core to the network). The parameters are configured by the ON-AIR Designer; there are no editable fields.

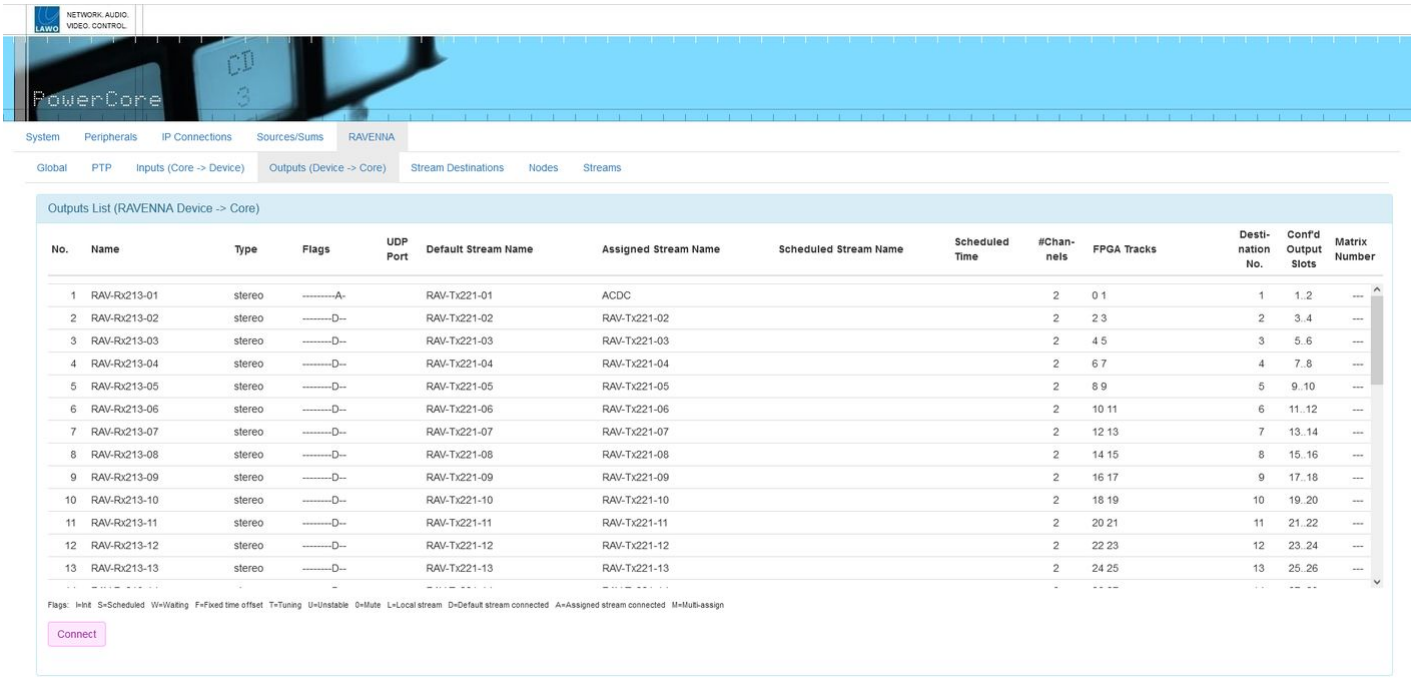
The information includes the name, type, codec, audio sample rate, RAVENNA announcement protocol used, multicast stream address, UDP port number, stream TTL value (in seconds), the input slots of the RAVENNA device, and the tracks they use.

The "Streaming" column shows whether streams are in fact actually being transmitted from Power Core's RAVENNA interfaces. The four positions correspond to the front panel ports: ra0, ra1, ra2, ra3. A value indicates that the port is active: "0" for primary and "1" for secondary ports. If both "0" and "1" are present, then the stream is configured for redundancy (sending from both primary and secondary ports).

At the bottom of the page, the **Enable** and **Disable** buttons can be used to manually start and stop the sending of a stream. They should be used for troubleshooting only, and not for controlling senders during operation. In each case, the button opens a pop-up window where you can select the stream you wish to enable or disable. If the "Input Name" field is empty, then all of the senders are in the opposite state.



RAVENNA → Outputs



No.	Name	Type	Flags	UDP Port	Default Stream Name	Assigned Stream Name	Scheduled Stream Name	Scheduled Time	#Channels	FPGA Tracks	Destination No.	Conf'd Output Slots	Matrix Number
1	RAV-Rx213-01	stereo	---------A-		RAV-Tx221-01	ACDC			2	0 1	1	1..2	---
2	RAV-Rx213-02	stereo	---------D--		RAV-Tx221-02	RAV-Tx221-02			2	2 3	2	3..4	---
3	RAV-Rx213-03	stereo	---------D--		RAV-Tx221-03	RAV-Tx221-03			2	4 5	3	5..6	---
4	RAV-Rx213-04	stereo	---------D--		RAV-Tx221-04	RAV-Tx221-04			2	6 7	4	7..8	---
5	RAV-Rx213-05	stereo	---------D--		RAV-Tx221-05	RAV-Tx221-05			2	8 9	5	9..10	---
6	RAV-Rx213-06	stereo	---------D--		RAV-Tx221-06	RAV-Tx221-06			2	10 11	6	11..12	---
7	RAV-Rx213-07	stereo	---------D--		RAV-Tx221-07	RAV-Tx221-07			2	12 13	7	13..14	---
8	RAV-Rx213-08	stereo	---------D--		RAV-Tx221-08	RAV-Tx221-08			2	14 15	8	15..16	---
9	RAV-Rx213-09	stereo	---------D--		RAV-Tx221-09	RAV-Tx221-09			2	16 17	9	17..18	---
10	RAV-Rx213-10	stereo	---------D--		RAV-Tx221-10	RAV-Tx221-10			2	18 19	10	19..20	---
11	RAV-Rx213-11	stereo	---------D--		RAV-Tx221-11	RAV-Tx221-11			2	20 21	11	21..22	---
12	RAV-Rx213-12	stereo	---------D--		RAV-Tx221-12	RAV-Tx221-12			2	22 23	12	23..24	---
13	RAV-Rx213-13	stereo	---------D--		RAV-Tx221-13	RAV-Tx221-13			2	24 25	13	25..26	---

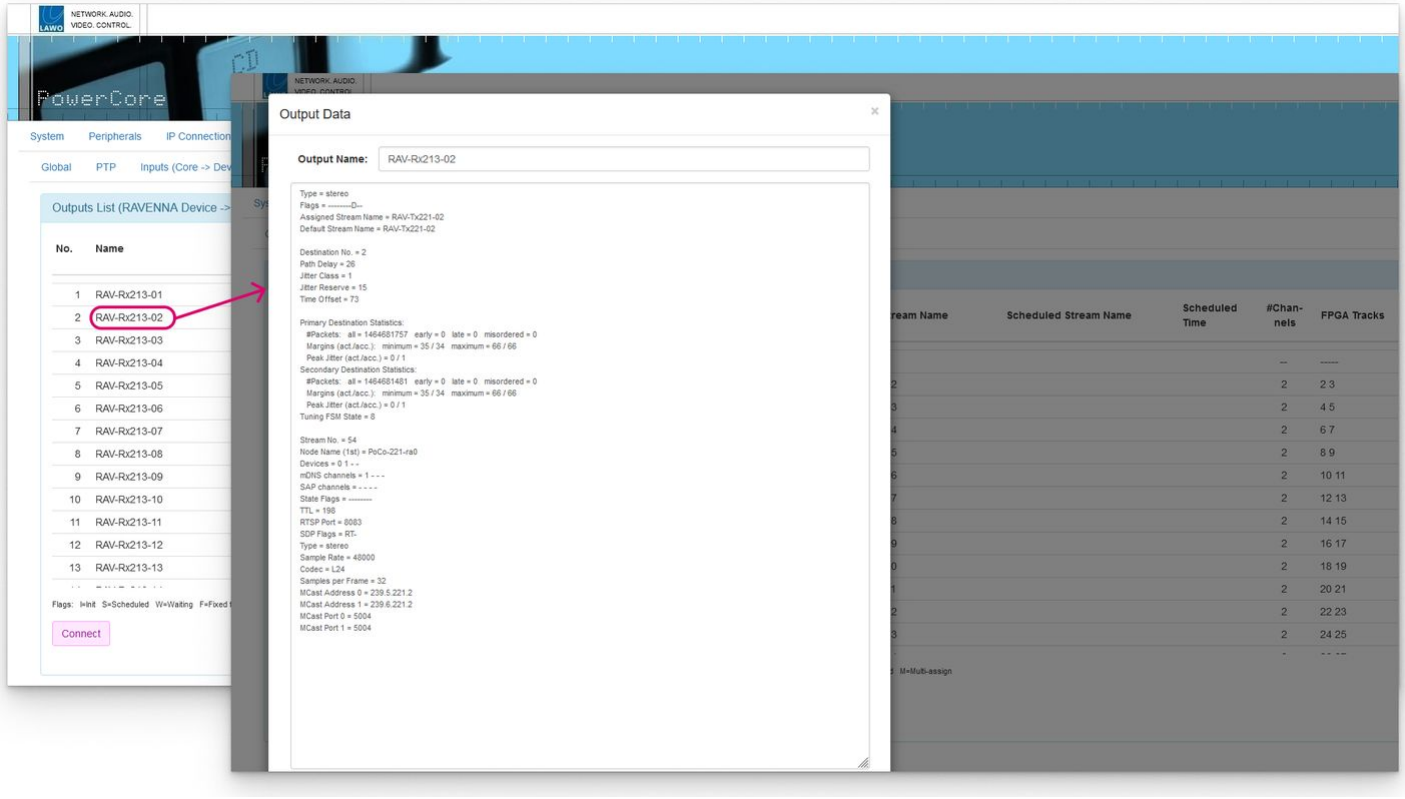
The **RAVENNA → Outputs** tab lists all of the RAVENNA receivers (that can consume streams from the network). As above, the parameters are configured by the ON-AIR Designer; there are no editable fields.

Of particular note are:

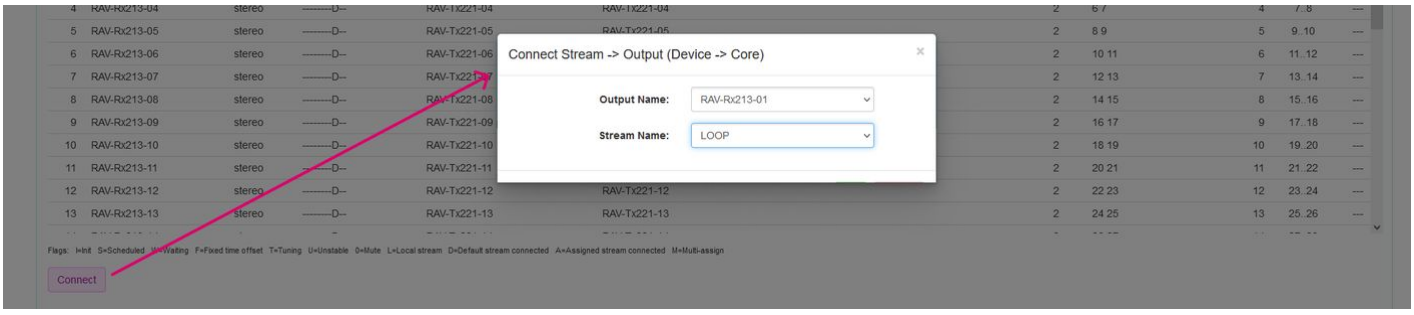
- **Name** & **Type** show the name and format of the receiver.
- **Flags** show information about the receiver (e.g. **D** = the default stream is connected). There is a key at the bottom of the page which explains the meaning of each flag.
- **Default Stream Name** shows the name of the stream that the receiver should subscribe to.
- **Assigned Stream Name** shows the name of the assigned stream following a successful subscription.
- **Scheduled Stream Name** shows the name of the scheduled stream (if make-before-break is enabled for the receiver).
- **UDP Port** shows the port number used by the receiver.
- **#Channels** and **FPGA Tracks** show the number of channels connected from the incoming stream and which tracks they use.

The "Default Stream Name" is optional (in the configuration) and can be used to permanently link the receiver to a stream. If a matching stream name is found, the receiver will automatically subscribe to it. In this instance, you will see the same name in both columns. If a Default Stream Name is not entered, then a stream subscription must be established using a different method. For example, by selecting a pool source on the console surface; using internal logic or external control via Ember+; or by manually connecting a stream via the **Connect** button (described below).

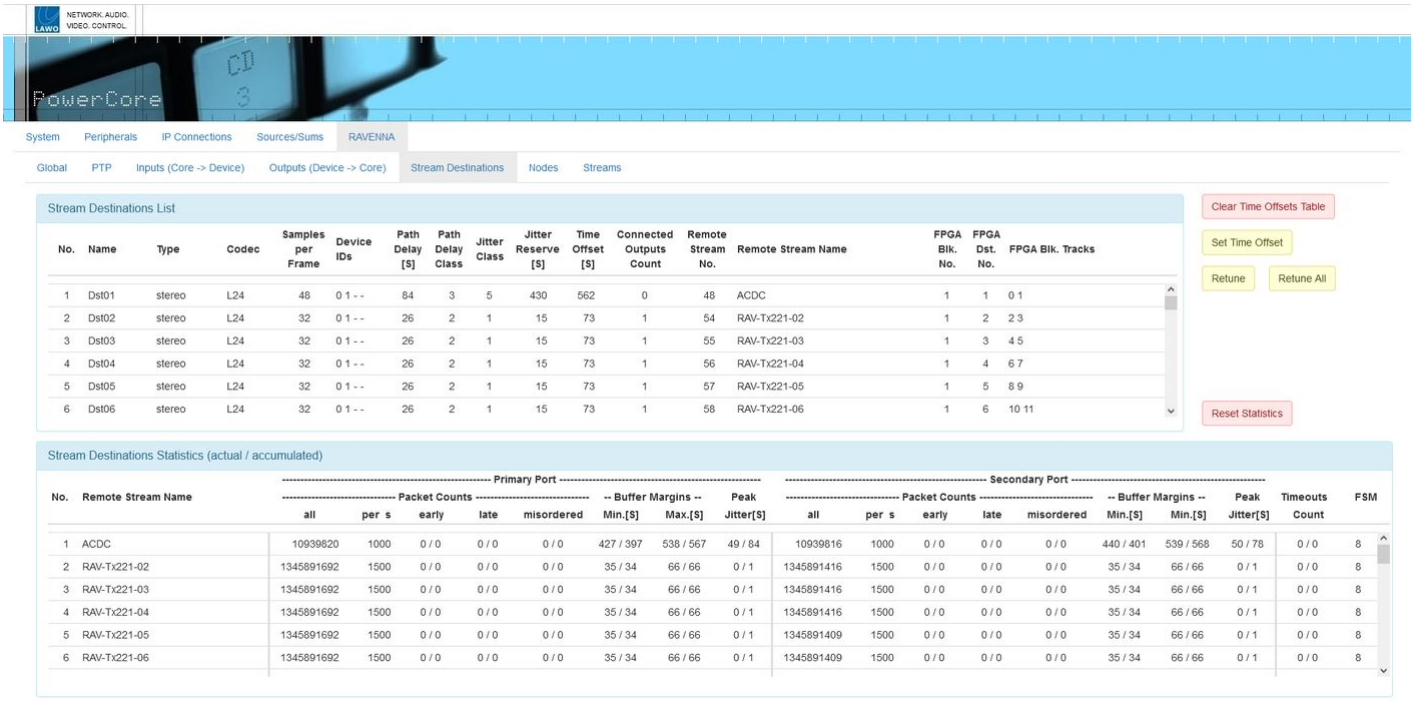
Clicking on a name in the "Name" column opens a pop-up window containing output data (information about the receiver and its connected stream).



At the bottom of the page, the **Connect** button can be used to connect an incoming stream to one of the configured receivers. It should be used for troubleshooting only, and not as an operational tool. The button opens a pop-up window where you can select a receiver (in the "Output Name" field), and then the "Stream Name" you wish to subscribe to. The list of available streams is determined by the mDNS or SAP channel announcement.



RAVENNA → Stream Destinations



No.	Name	Type	Codec	Samples per Frame	Device IDs	Path Delay [S]	Path Delay Class	Jitter Class	Jitter Reserve [S]	Time Offset [S]	Connected Outputs Count	Remote Stream No.	Remote Stream Name	FPGA Blk. No.	FPGA Dst. No.	FPGA Blk. Tracks
1	Dst01	stereo	L24	48	0 1 - -	84	3	5	430	562	0	48	ACDC	1	1	0 1
2	Dst02	stereo	L24	32	0 1 - -	26	2	1	15	73	1	54	RAV-Tx221-02	1	2	2 3
3	Dst03	stereo	L24	32	0 1 - -	26	2	1	15	73	1	55	RAV-Tx221-03	1	3	4 5
4	Dst04	stereo	L24	32	0 1 - -	26	2	1	15	73	1	56	RAV-Tx221-04	1	4	6 7
5	Dst05	stereo	L24	32	0 1 - -	26	2	1	15	73	1	57	RAV-Tx221-05	1	5	8 9
6	Dst06	stereo	L24	32	0 1 - -	26	2	1	15	73	1	58	RAV-Tx221-06	1	6	10 11

No.	Remote Stream Name	Primary Port								Secondary Port								Timeouts Count	FSM
		Packet Counts					-- Buffer Margins --		Peak Jitter[S]	Packet Counts					-- Buffer Margins --		Peak Jitter[S]		
		all	per s	early	late	misordered	Min.[S]	Max.[S]		all	per s	early	late	misordered	Min.[S]	Min.[S]			
1	ACDC	10939820	1000	0 / 0	0 / 0	0 / 0	427 / 397	538 / 567	49 / 84	10939816	1000	0 / 0	0 / 0	0 / 0	440 / 401	539 / 568	50 / 78	0 / 0	8
2	RAV-Tx221-02	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
3	RAV-Tx221-03	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
4	RAV-Tx221-04	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
5	RAV-Tx221-05	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891409	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
6	RAV-Tx221-06	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891409	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8

The **RAVENNA → Stream Destinations** tab shows the statistics for all of the stream destinations which are in use (i.e. all subscribed streams). It can be used to view information about stream latency and stability, and to "retune" streams which are not performing properly.

Stream Destinations List

This section shows information pertaining to individual RAVENNA streams. Data includes the number of audio channels, codec used, sample rate, number of subscribers listening to the stream, the Remote Stream name and number, and the numerical designations for the audio channels supplied. Streams with blank Remote Stream Name values are inactive or unavailable.

Of particular note are the Jitter Class, Path Delay Class and Time Offset values which are applied during stream tuning.

The Time Offsets for all streams can be cleared by clicking on the **Clear Time Offsets Table** button.

The **Set Time Offset**, **Retune** and **Retune All** buttons can be used to manually retune streams (as described later).

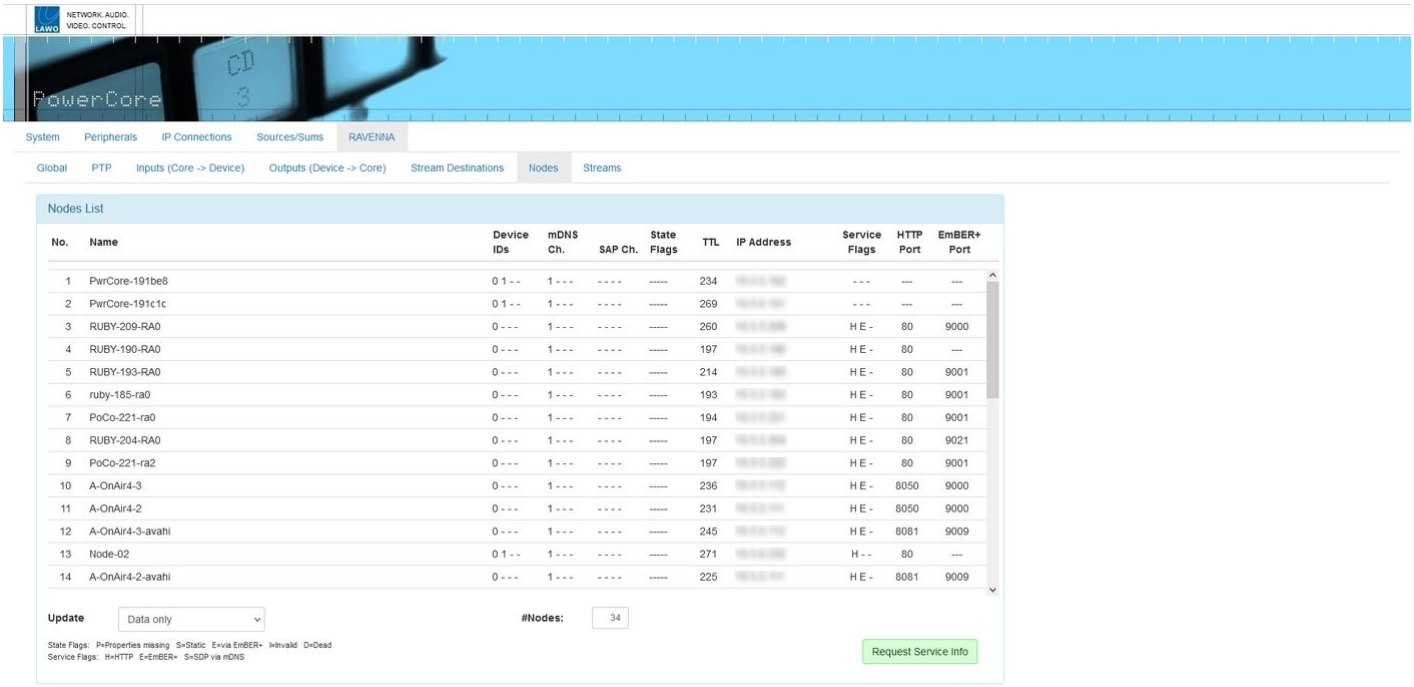
Stream Destinations Statistics

This section provides statistics that report on the health of the received Primary and Secondary streams. Data includes the Packet Counts for Early, Late and Misordered Packets, Buffer Margins and Peak Jitter.

Of particular importance are the Primary Port Early and Late Packets Counts. If large numbers are seen in these columns, along with degraded audio performance, the stream should be retuned to fix the problem. The FSM column indicates the status of the retuning process.

The stream statistics can be cleared by clicking on the **Reset Statistics** button.

RAVENNA → Nodes



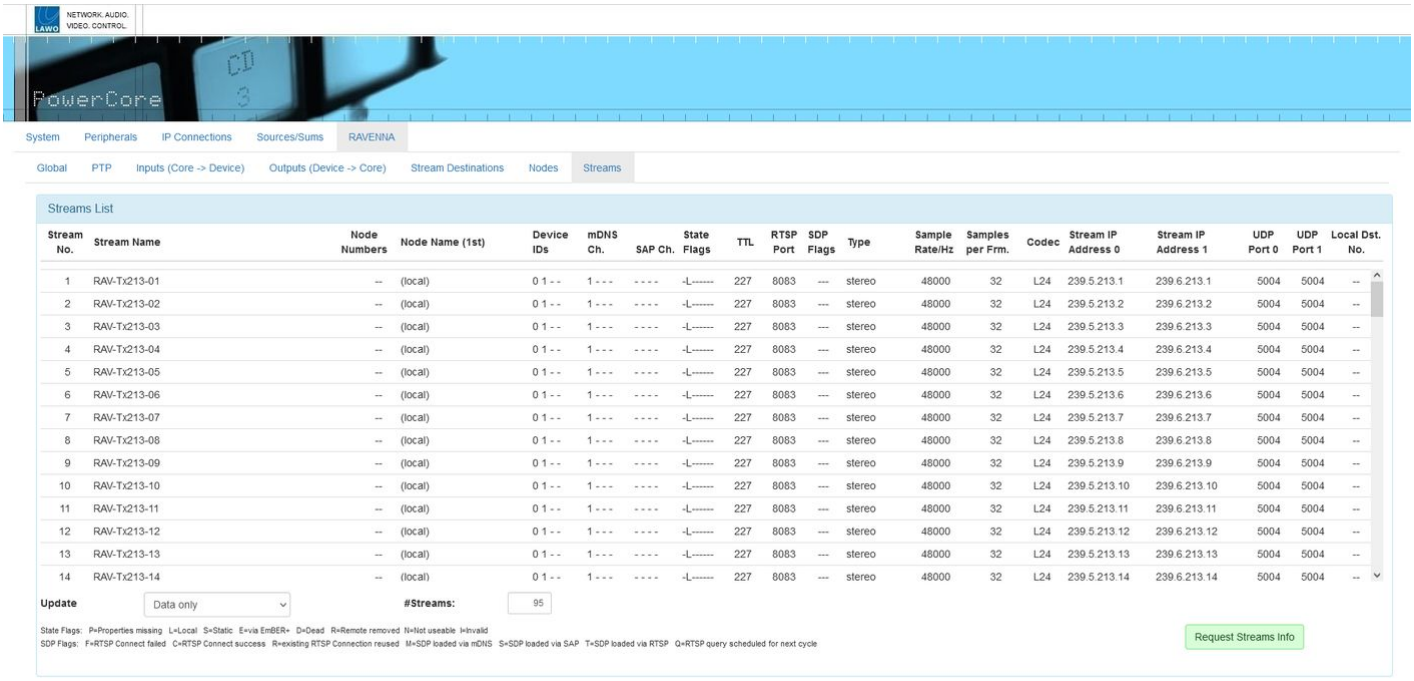
The **RAVENNA → Nodes** tab lists all available network nodes, showing their Device ID, announcement method (mDNS or SAP), TTL (in seconds), and IP address. Note that if static streams have been created using Ember+, then these are included in the list.

Pay particular attention to the "State Flags" as these show the condition of the network node. There is a key at the bottom of the page which explains the meaning of each flag.

Clicking on a name in the "Name" column opens the device's Web UI. You can use this to access further information in the usual manner.

At the bottom of the page is the **Update** selector. This can be set to one of two possibilities: **Data only** (the default) or **Data + TTL**. This defines what happens when the transmitter's MDNS / SAP announcement for a stream is made. If **Data + TTL** is selected, then the TTLs will be reset to the "Nodes List TTLs" value defined in ON-AIR Designer. Once the TTL count-down has expired, the node will remove the associated stream. This is generally needed only for diagnostic purposes.

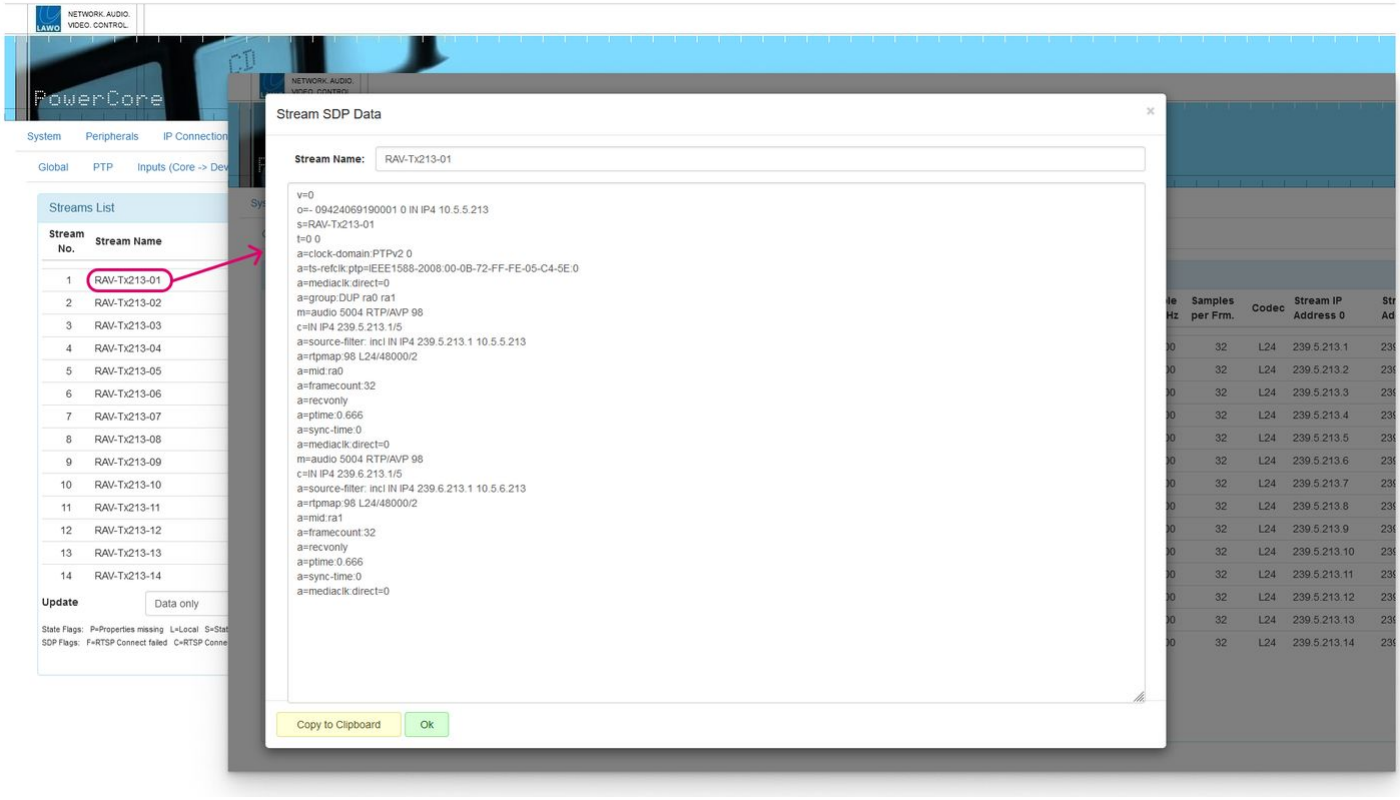
RAVENNA → Streams



The **RAVENNA → Streams** tab lists all available network streams which have been announced to Power Core.

Pay particular attention to the stream "State Flags" which show the condition of the stream. There is a key at the bottom of the page which explains the meaning of each flag.

Clicking on a name in the "Stream Name" column opens a pop-up window where you can view and copy the stream's SDP (using **Copy to Clipboard**).



At the bottom of the page is the **Update** selector. This can be set to one of two possibilities: **Data only** (the default) or **Data + TTL**. This works in a similar manner to the **Update** function in the Nodes tab, but the TTLs are reset to the "Streams List TTLs" value (defined in ON-AIR Designer).

Power Core - Preparing a Secure Connection (for https)

The Web UI can be opened with a secure connection (SSL) if the required certificates are stored on the Power Core device. This topic describes how to prepare the device. Once the SSL certificates are in place, the Web UI can be opened using a "https" connection. Apart from the connection method, there is no difference in the functionality.

You can find more information about OpenSSL at the following website: https://www.freebsd.org/cgi/man.cgi?query=openssl+

What you will need

The setup requires you to create the keys, requests and, if required, a self-signed certificate (using OpenSSL). The commands can be entered using a PC connected to Power Core either via telnet or the USB* port. You will also need to a suitable FTP client in order to perform the file transfers.

For more information, see Power Core - Telnet Sessions, Power Core - USB Service Port and Power Core - File Transfer via FTP.

*For Power Core revision 1 and 2 systems, you can use the RS-422 serial port for the command line instructions.

Overview

In summary, the steps are:

- Create or adapt a config file, and copy this to Power Core using a suitable FTP client.
- Create the necessary keys, requests and, if required, a self-signed certificate (using OpenSSL). To enter the commands, you can either:
  - Connect your PC to the control network and open a telnet session.
  - Connect your PC directly to the RS 422 port and open a serial connection.
- Let an external CA sign the certificate - by downloading, signing and uploading the certificate.
- Clean up the files.
- Cold start the device.

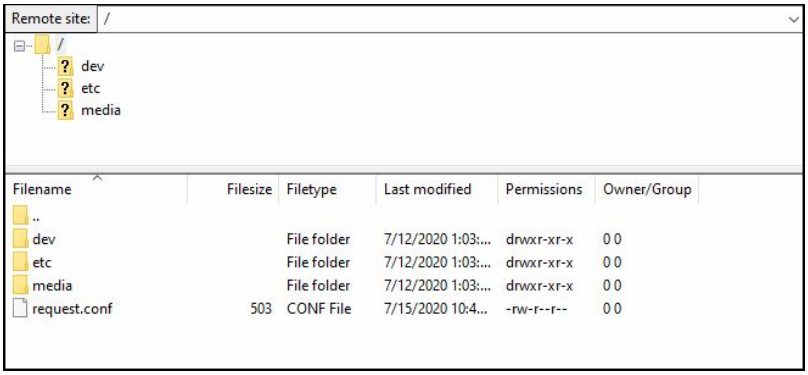
Important: it is recommended not to use keys larger than 1024 bit, as to do so may affect the system performance.

Instructions

The instructions below provide more detail.

1. Create or adapt a config file (.conf), and copy this to Power Core using your FTP client.

The file should be created on, or copied to, the root directory. The screenshot below shows the Power Core root directory. In this example, the config file is named "request.conf".



A sample configuration is as follows.

```
[req]
distinguished_name=req_distinguished_name
req_extensions=req_ext
prompt=no

[req_distinguished_name]
C=DE
ST=Nordrhein-Westfalen
L=Troisdorf-Spich
O=DSA-Volgmann
OU=Development
CN=POWERCORE-DSA-DWC0-240.internal

[req_ext]
extendedKeyUsage = clientAuth,serverAuth
subjectAltName = @alt_names

[alt_names]
DNS.1 = POWERCORE-DSA-DWC0-240.internal
#DNS.2 = [fqdn2]
#DNS.3 = [fqdn3]
#DNS.4 = [fqdn4]
IP.1=192.168.101.240
#IP.2=192.168.101.242
#IP.3=192.168.101.243
#IP.4=192.168.101.244
```

2. Now open a connection to the Power Core control system either using telnet or the USB service port.
3. Once login is complete, type the following command to create a RSA key with openssl genrsa.

```
openssl genrsa -out webs.key.pem 1024
```

Press ENTER. The confirmation message "Generating RSA private key..." appears.

4. Type the following command to create a request with openssl.

```
openssl req -batch -new -key webs.key.pem -out webs.csr -config request.conf
```

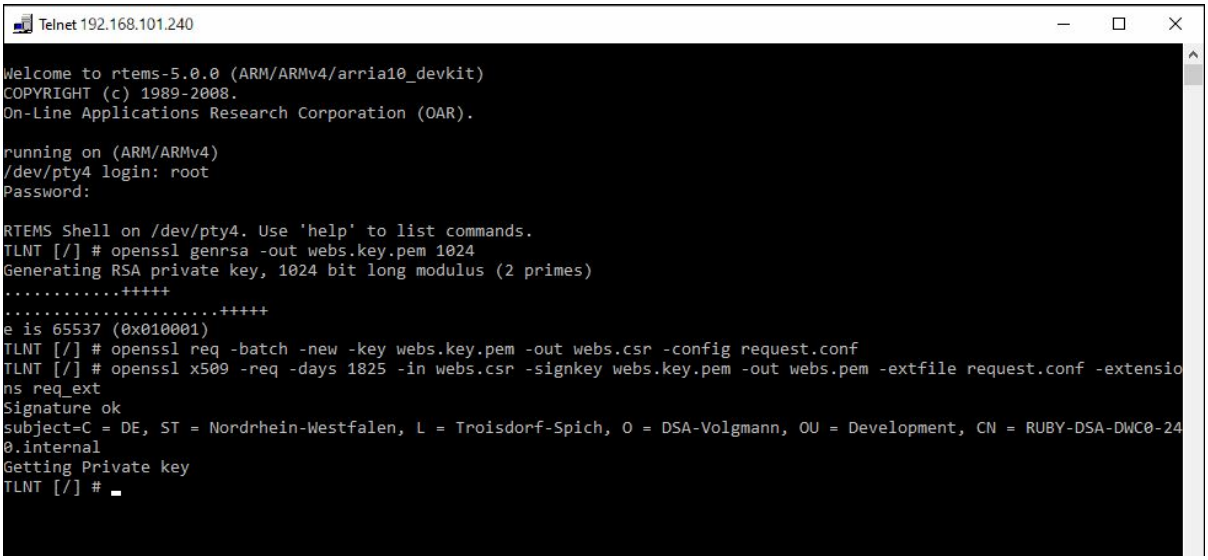
Press ENTER. There is no message following this command.

5. Type the following command to create a self-signed certificate with openssl.

```
openssl x509 -req -days 1825 -in webs.csr -signkey webs.key.pem -out webs.pem -extfile request.conf -extensions req_ext
```

Press ENTER. The confirmation message "Signature ok...." appears.

The screenshot below shows the complete telnet session.

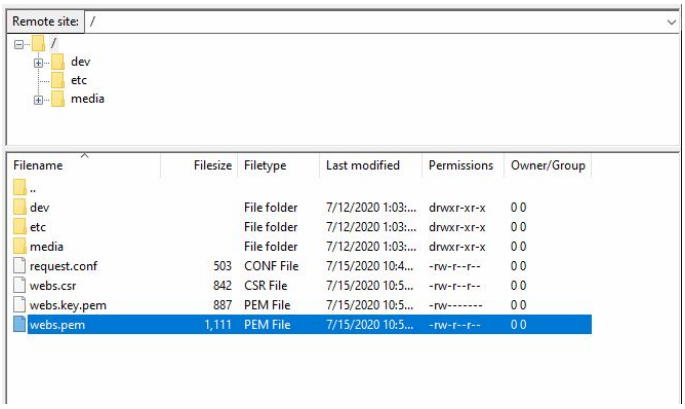


6. Using your FTP client, copy the resulting certificate "webs.pem" (in the root directory) to "/media/mmcsd-0-0/certs".

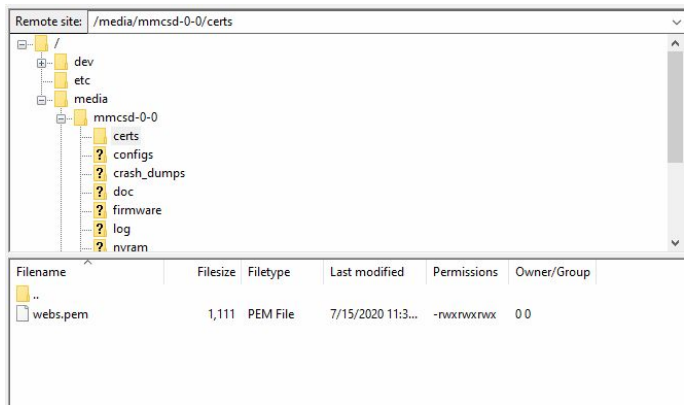
- You will need to create the "certs" directory (via a right-click), and refresh the FTP client connection to see the new files.
- To copy a file, download it to your computer (via a right-click); navigate to the new location on Power Core; then upload the file (via a right-click).

The screenshots below show the file/directory locations.

From



To



7. Now let an external CA sign the certificate as follows.

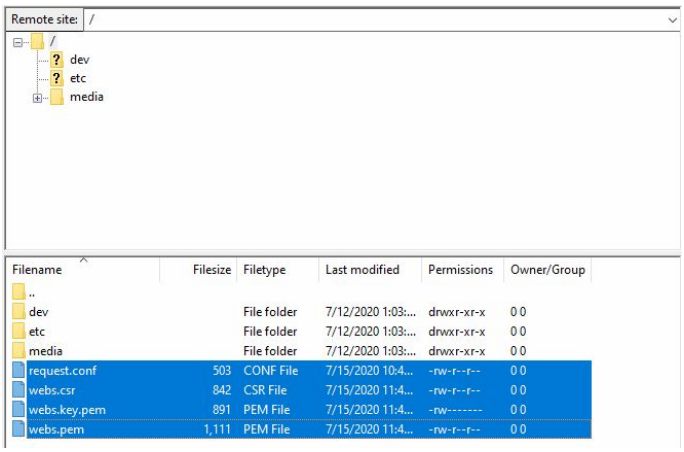
- Using your FTP client, download the file "request.csr"
- Let it sign from CA
- Upload the certificate "webs.pem" to "/media/mmcsd-0-0/certs"

8. Using your FTP client, clean up the files.

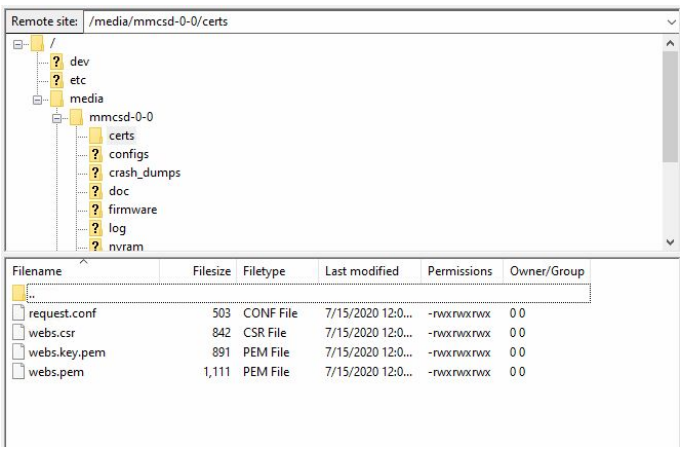
Copy all of the files "webs.pem", "webs.key.pem", "webs.csr" and "request.conf" to "/media/mmcsd-0-0/certs", and delete the originals.

The screenshots below show the file/directory locations.

From



To



9. Cold start the Power Core control system by typing the following commands.

- Type `sys_cs` (press ENTER).
- Then type `YES` (and ENTER) to confirm.

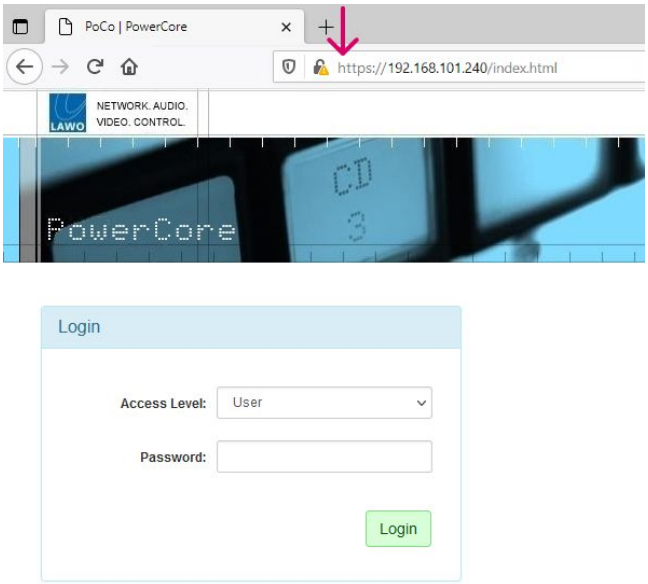
If you are connected via telnet, you will lose your connection as soon as the device reboots.

If you are connected to the serial port, then you will see the following confirmation messages.

```
DSK system: init: ---------- Starting Webserver -------------
DSK system: init: Web Server started, result = 0
DSK system: init: Starting Webserver completed
WEBS system: init: Webserver bind https (certficate found)
```

10. Test the connection by opening a Web UI session and logging in.

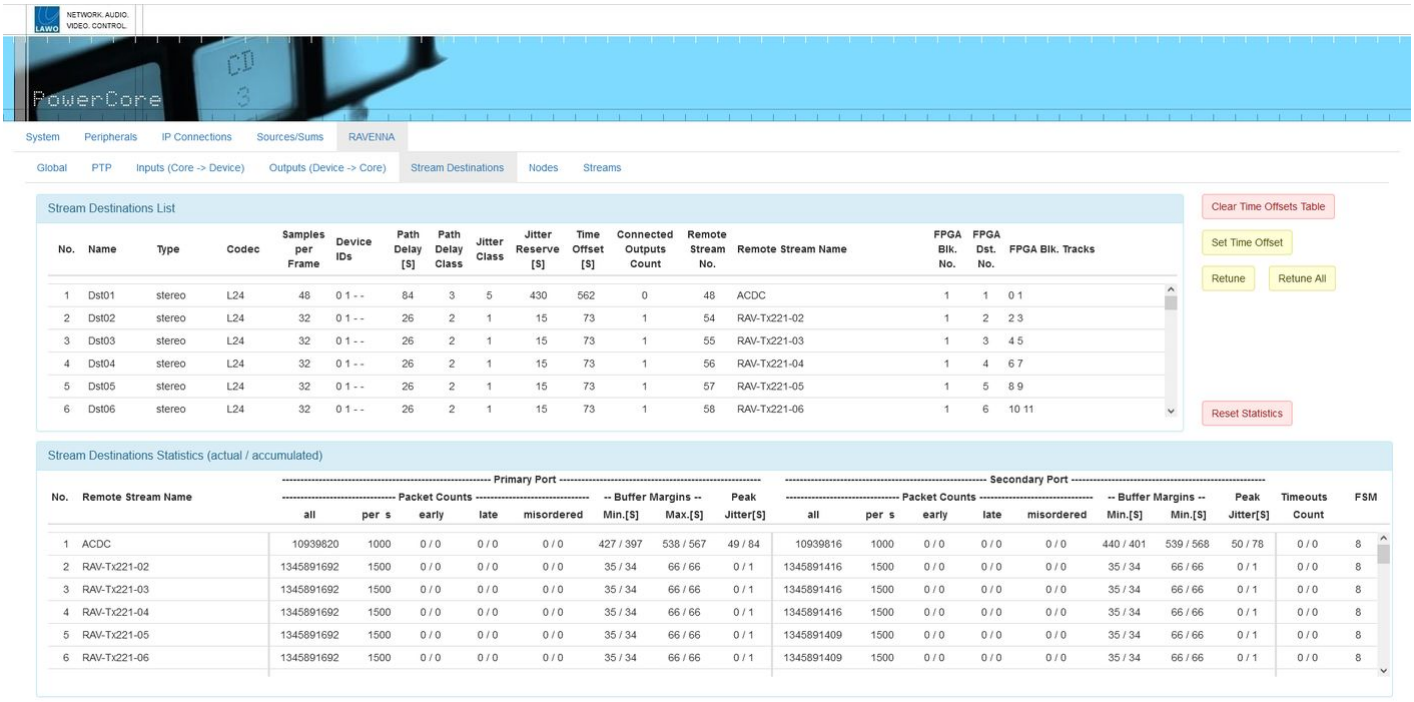
The padlock icon and "https" prefix indicates that the connection is secure.



10.3 Power Core - Stream Tuning

This topic describes what happens when a RAVENNA stream is connected to a receiver and how to adjust the stream tuning.

It may help to open the **RAVENNA → Stream Destinations** tab in the Power Core Web UI and the "System -> Definition → RAVENNA" parameters in the ON-AIR Designer. The Web UI page is shown below.



No.	Name	Type	Codec	Samples per Frame	Device IDs	Path Delay [S]	Path Delay Class	Jitter Class	Jitter Reserve [S]	Time Offset [S]	Connected Outputs Count	Remote Stream No.	Remote Stream Name	FPGA Blk. No.	FPGA Dst. No.	FPGA Blk. Tracks
1	Dst01	stereo	L24	48	0 1 - -	84	3	5	430	562	0	48	ACDC	1	1	0 1
2	Dst02	stereo	L24	32	0 1 - -	26	2	1	15	73	1	54	RAV-Tx221-02	1	2	2 3
3	Dst03	stereo	L24	32	0 1 - -	26	2	1	15	73	1	55	RAV-Tx221-03	1	3	4 5
4	Dst04	stereo	L24	32	0 1 - -	26	2	1	15	73	1	56	RAV-Tx221-04	1	4	6 7
5	Dst05	stereo	L24	32	0 1 - -	26	2	1	15	73	1	57	RAV-Tx221-05	1	5	8 9
6	Dst06	stereo	L24	32	0 1 - -	26	2	1	15	73	1	58	RAV-Tx221-06	1	6	10 11

No.	Remote Stream Name	Primary Port								Secondary Port								Timeouts	FSM
		Packet Counts					Buffer Margins		Peak	Packet Counts					Buffer Margins		Peak		
		all	per s	early	late	misordered	Min.[S]	Max.[S]	Jitter[S]	all	per s	early	late	misordered	Min.[S]	Min.[S]	Jitter[S]	Count	
1	ACDC	10939820	1000	0 / 0	0 / 0	0 / 0	427 / 397	538 / 567	49 / 84	10939816	1000	0 / 0	0 / 0	0 / 0	440 / 401	539 / 568	50 / 78	0 / 0	8
2	RAV-Tx221-02	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
3	RAV-Tx221-03	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
4	RAV-Tx221-04	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891416	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
5	RAV-Tx221-05	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891409	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8
6	RAV-Tx221-06	1345891692	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	1345891409	1500	0 / 0	0 / 0	0 / 0	35 / 34	66 / 66	0 / 1	0 / 0	8

Overview

Each time a stream connects it goes through an automatic "tuning" process whereby a Time Offset is applied to compensate for network latency and jitter.

The **Time Offset** is calculated as follows:

> Time Offset = Samples per Frame (packet size) + Path Delay + Jitter Reserve

where the **Jitter Reserve** is determined by the following ON-AIR Designer parameters:

> Jitter Reserve = Time-Offset Base Margin + Time Offset Addition (for the Jitter Class) + Time Offset Addition (for the Path Delay Class)

Power Core supports five jitter classes, where Class 1 is for low-jitter devices (such as a Power Core), and Class 5 is for high-jitter devices (such as a R3LAY PC with a RAVENNA virtual sound card).

Similarly, there are five path delay classes, where Class 1 is for close network nodes (connected to the same switch), and Class 5 is for distant network nodes (passing through several switches or routers). The class allocation is dependent on the Jitter and Path Delay values measured by the receiver (and shown in the **Stream Destinations Statistics** area in the Web UI).

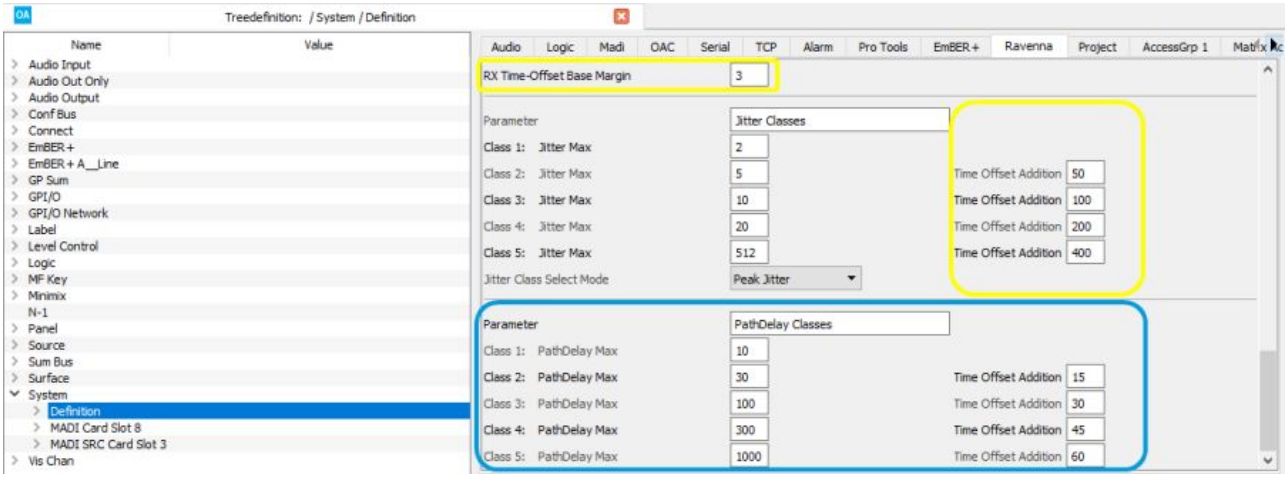
The resultant Jitter Class, Path Delay Class, Jitter Reserve and Time Offset values are all shown in the **Stream Destinations List** (in the Web UI).

Time Offset Example

The screenshots below illustrate the following example:

Time Offset (57) = Samples per Frame (48) + Path Delay (6) + Jitter Reserve (3)

The parameters are defined using the "System → Definition" (RAVENNA tab) in the ON-AIR Designer.



The resultant values in the **Stream Destinations List** look like this.

No.	Name	Type	Codec	Samples per Frame	Path Delay	Path Delay Class	Jitter Class	Jitter Reserve	Time Offset	Connected Outputs Count	Remote Stream No.	Remote Stream Name	Tracks
1	Dst01	stereo	L24	48	6	1	1	3	57	1	1527	SRV1 PTG:var	0 1
2	Dst02	stereo	L24	48	6	1	1	3	57	1	1449	SRV2 PTG:var	2 3

⚠ High **Time Offset** values mean high latency which may affect stream performance.

Retuning Streams

If changes are made to the network infrastructure after the initial tuning process, then the Jitter Class, Path Delay Class and Time Offset values may no longer be correct. In this instance, audio from the RAVENNA streams may be degraded or inaudible, and you should manually retune the streams. This can be done using the buttons on the right of the **RAVENNA → Stream Destinations** page:

- **Retune** - select this button to individually retune a stream.
- **Retune All** - select this button to retune all streams.
- **Set Time Offset** - this button allows manual entry of a Time Offset for a single selected stream. This is an advanced function which should only be used when instructed by Lawo Support personnel. Values entered using this button are cleared after every reboot.

The retuning process goes through three phases which are displayed on-screen (via the FSM column in the **Stream Destinations Statistics** area). The full sequence is described in the table below.

If audio on a selected stream was not previously present, it should be restored immediately. Once a value of 8 has been reached, retuning is complete and the stream's new Time Offset value is shown in the **Stream Destinations List**.

FSM value	Meaning
0	RAV_RTCP_TUNE_INIT = 0
1	RAV_RTCP_TUNE_WAIT
2	RAV_RTCP_TUNE_COARSE
3	RAV_RTCP_TUNE_FINE
4	RAV_RTCP_TUNE_CHECK_1, -> check results stage 1
5	RAV_RTCP_TUNE_STATS_ACQ -> acquire
6	RAV_RTCP_TUNE_STATS_EVAL, -> evaluate
7	RAV_RTCP_TUNE_CHECK_2, -> check results stage 2
8	RAV_RTCP_TUNE_FINISHED -> tuning value stored / finished

⚠ If Power Core is NOT set to slave only in the PTP engine, then streams are retuned on every reconnect

Stream Tuning Options

The following options are supported by the ON-AIR Designer: defining a fixed Time Offset and defining Jitter in the SDP.

Defining a Fixed Time Offset

By configuring a "Logic → RAVENNA Static Stream" element, it is possible to define a fixed Time Offset using the **Fixed Jitter Reserve** field.

Once a non-zero value is entered, a fixed Time Offset is applied (instead of automatic or manual tuning). The value entered must include the path delay and desired minimum buffer margin as follows:

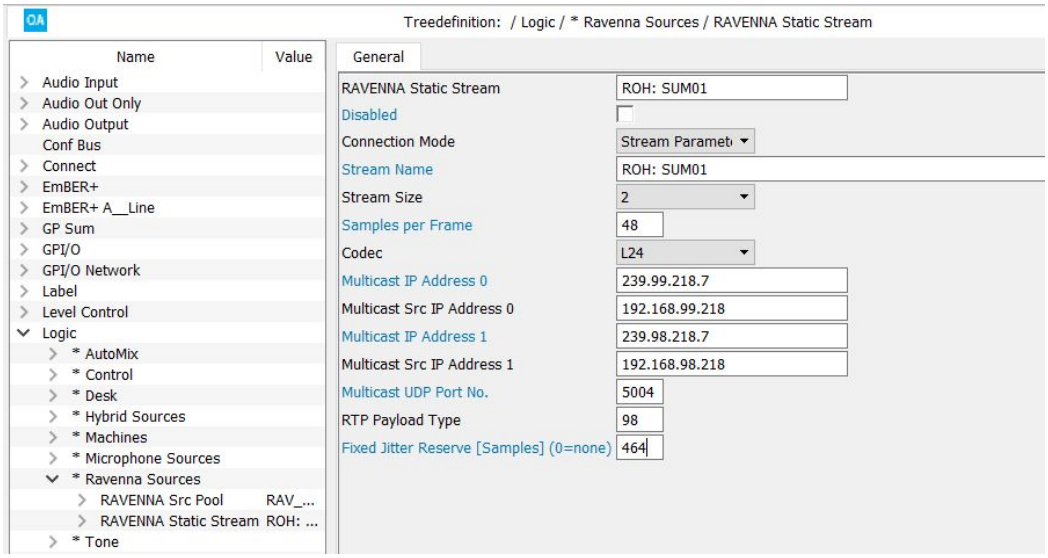
Fixed Jitter Reserve = Path Delay + minimum Buffer Margin.

The resulting Time Offset is then calculated from the configured value and the packet size of the incoming stream:

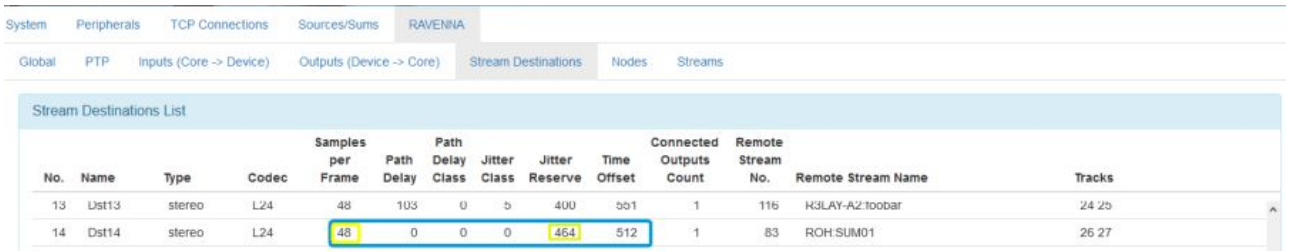
Time Offset = Samples per Frame (packet size) + Fixed Jitter Reserve

If you want to define a fixed playout time, you have to subtract the packet size from the fixed jitter reserve.

The screenshot below shows an example.



In the **Stream Destinations List** (in the Web UI), the Path Delay is displayed as 0 (as there is no measurement) and is included in the displayed Jitter Reserve.



You can tell whether a fixed Time Offset has been defined by the configuration or Web UI by looking at the Path Delay and Jitter Reserve fields.

- Path Delay = 0 and Jitter Reserve > 0 indicates that the ON-AIR Designer **Fixed Jitter Reserve** field is active (> 0).
- Path Delay = 0 and Jitter Reserve = 0 indicates that the Web UI **Set Time Offset** button has been used to set the offset.

If the Time Offset of a stream with a Fixed Jitter Reserve is changed via the Web UI, then it will be reset to the configured value (instead of automatic tuning) if late packets arrive repeatedly at the receiver.

Defining Jitter in the SDP Information

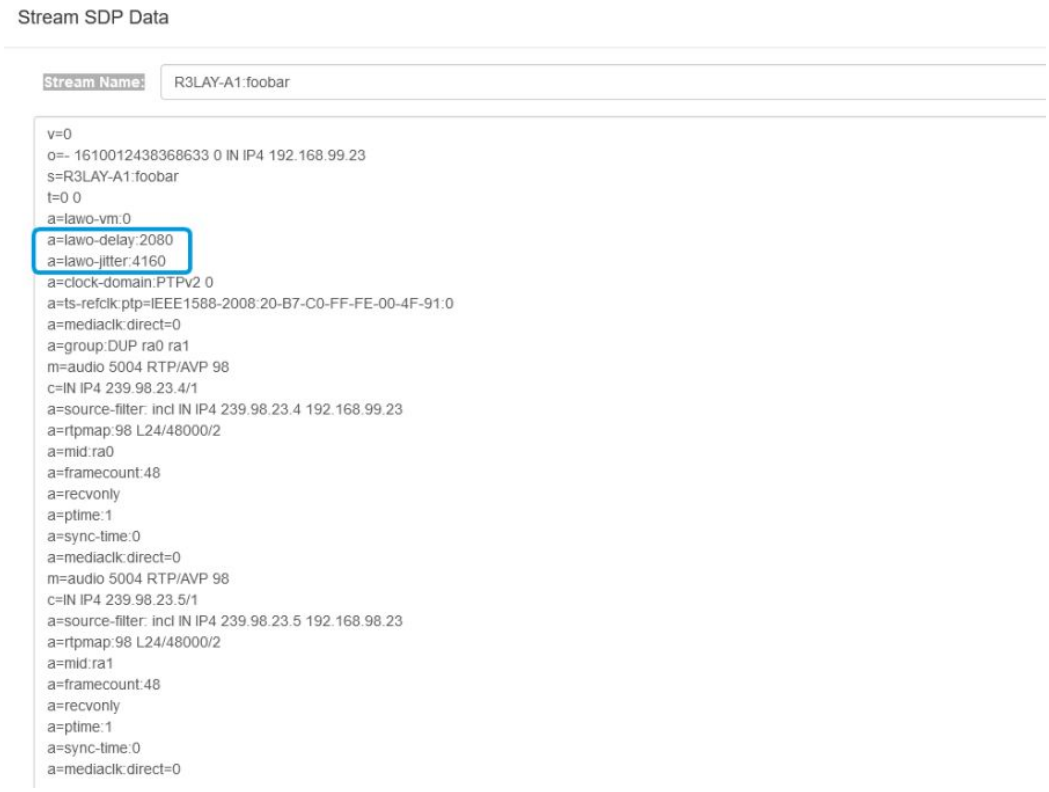
If the parameters "lawo-delay" and "lawo-jitter" are contained in a stream's SDP information, then Power Core measures only the Path Delay and not the Jitter. This allows you to keep the Time Offset Addition values low (for the Jitter Classes), while still connecting computer-based stream sources (such as R3LAY).

Start by measuring the jitter on the sending device (using a third-party tool), and enter the following parameters into the stream's SDP information:

a = lawo-delay: 2080

a = lawo-jitter: 4160

The SDP parameters must be defined in microseconds. The screenshot below shows an example.



In R3LAY the values can be configured using the ".ini" file as follows.

[DEBUG]
StreamLawoDelayMicrosecs = 2080
StreamLawoJitterMicrosecs = 4160

If Power Core receives a stream containing this SDP information, then only the Path Delay is measured and the Jitter Class is set to 0. This results in a single Time Offset Addition (for the Path Delay Class). In this instance, the Jitter Reserve is calculated as follows:

Jitter Reserve = lawo-delay (from SDP) + lawo-jitter (from SDP) + Time Offset Addition (for Path Delay Class)

The Time Offset is then calculated in the usual manner:

Time Offset = Samples per Frame (packet size) + Path Delay + Jitter Reserve

Streams that have been tuned using the new parameters are marked with a Jitter Class of 0 in the **Stream Destinations List** (in the Web UI).

Stream Destinations List

No.	Name	Type	Codec	Samples per Frame	Path Delay	Path Delay Class	Jitter Class	Jitter Reserve	Time Offset	Connected Outputs Count	Remote Stream No.	Remote Stream Name	Tracks
1	Dst01	stereo	L24	48	6	1	1	3	57	1	1527	SRV1 PTG:var	0 1
2	Dst02	stereo	L24	48	6	1	1	3	57	1	1449	SRV2 PTG:var	2 3
3	Dst03	stereo	L24	48	5	1	1	3	56	1	911	R204:Sum02	4 5
4	Dst04	stereo	L24	48	71	3	0	330	449	1	106	R3LAY-A1:foobar	6 7

10.4 Power Core - USB Service Port

This topic describes how to use the USB service port (on Power Core revision 3 systems).

Overview

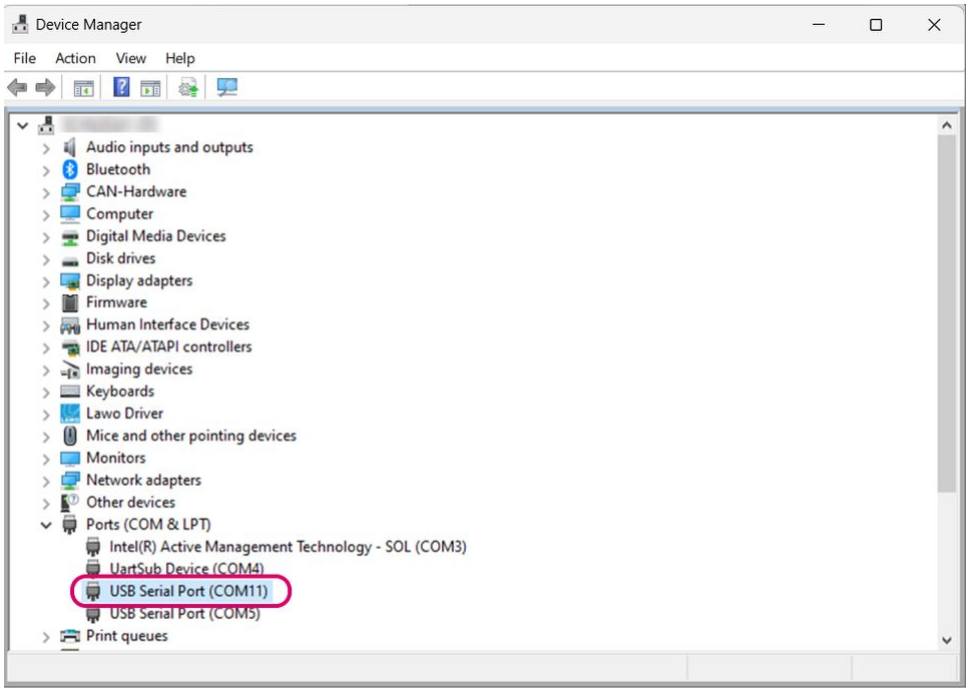
The USB port, on Power Core revision 3, can be used for debugging and/or downloading log files. Note that, on Power Core revision 1 or 2 systems, you must use the RS-422 port for this purpose.

Opening a Connection to the System

The instructions below describe how to set up a connection to Power Core revision 3 for debugging.

1. Using a USB cable, connect your PC to the USB port on the Power Core front panel.

The required drivers are installed automatically. Once this is done, you will see a message (from Windows), that the COM port is ready to use. It is recommended to open the **Device Manager** (in Windows) and check that you can see the newly installed COM port.



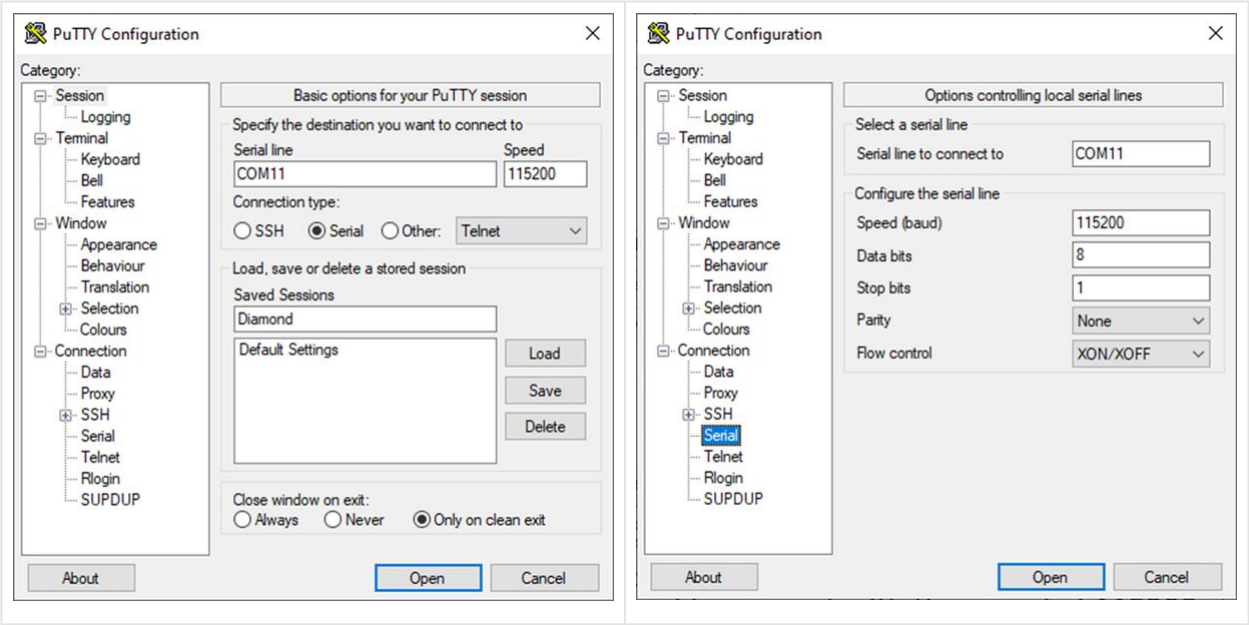
2. On your computer, open a suitable ssh/telnet application.

We recommend using **PUTTy**, a free ssh/telnet client for Windows. The latest version can be downloaded from the internet.

3. Set up the serial connection for the COM port using the following credentials.

- Speed (baud): **115200**
- Data bits: **8**
- Stop bits: **1**
- Parity: **XON/XOFF**

The correct settings for PUTTy are shown below.



4. Once the software connects to the system, you will see a new window.

5. Press ENTER and you will see the syntax: "SHLL [/] #“.

You can now follow the instructions for the task you wish to perform.

10.5 Power Core - RS-422 Serial Port

This topic describes how to set up a connection to the RS-422 serial port.

Overview

The RS-422 port, on Power Core revision 3, can be used for remote control (e.g. of a playout system) or MACKIE HUI interfacing to a Digital Audio Workstation.

Note that, on Power Core revision 1 or 2 systems, the RS-422 port is also used for debugging and to download logging files. On Power Core revision 3, you must the USB port for this purpose.

What you will need

A special serial cable, article number **485-0700-000**, is required to connect the RS-422 port. Please contact the Lawo Support Department to obtain one.

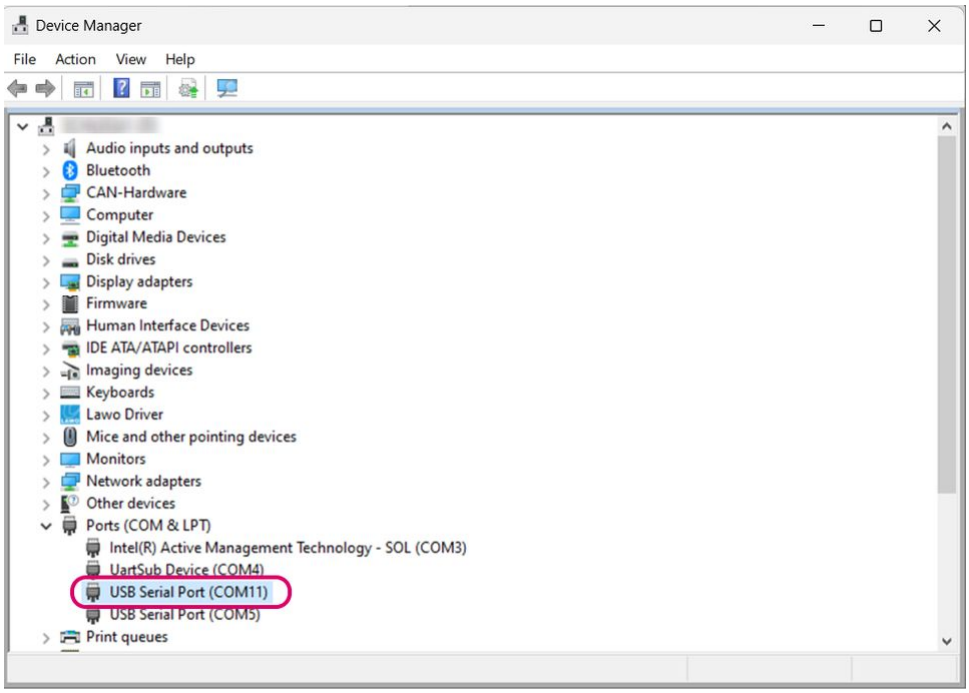
The cable comes with a RJ45 connector (for Power Core) and a D-type connector (for the PC). If your PC does not support a D-type connector, then you will need to provide a serial to USB converter such as the one shown below.

Opening a Connection to the System

The instructions below describe how to set up a connection to Power Core revision 1 or 2 for debugging.

1. Using the serial cable (described above), connect your PC to the RS 422 port on the Power Core front panel.

The required drivers are installed automatically. Once this is done, you will see a message (from Windows), that the COM port is ready to use. It is recommended to open the **Device Manager** (in Windows) and check that you can see the newly installed COM port.



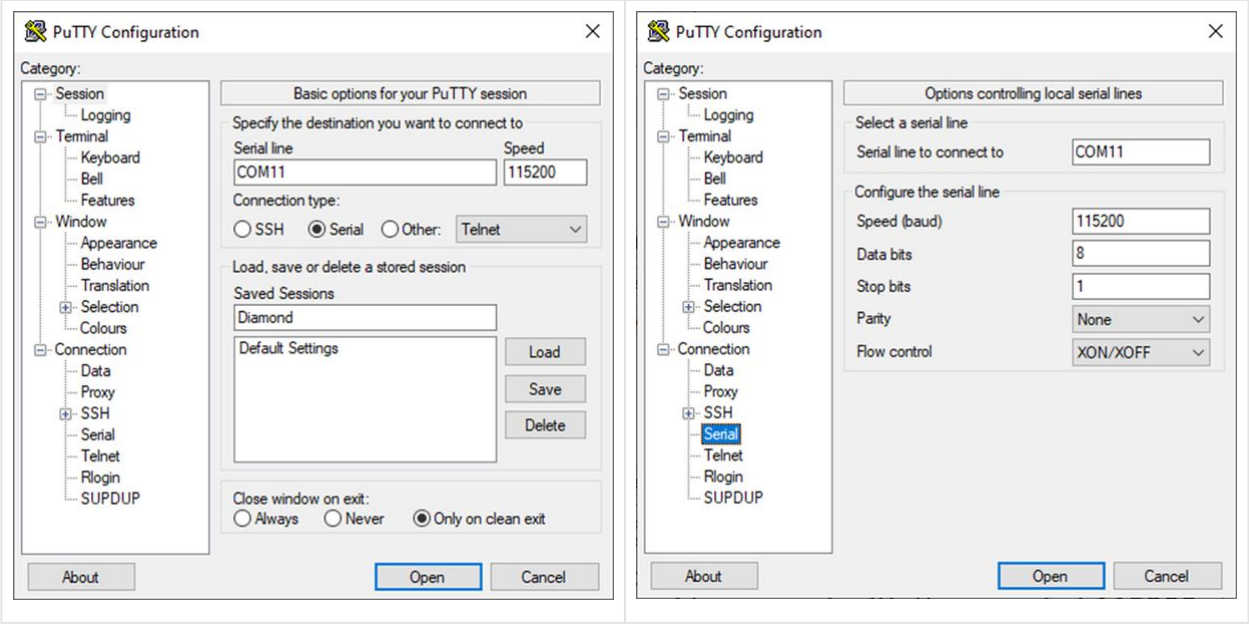
2. On your computer, open a suitable ssh/telnet application.

We recommend using **PUTTy**, a free ssh/telnet client for Windows. The latest version can be downloaded from the internet.

3. Set up the serial connection for the COM port using the following credentials.

- Speed (baud): **115200**
- Data bits: **8**
- Stop bits: **1**
- Parity: **XON/XOFF**

The correct settings for PUTTy are shown below.



4. Once the software connects to the system, you will see a new window.

5. Press ENTER and you will see the syntax: "SHLL [/] #".

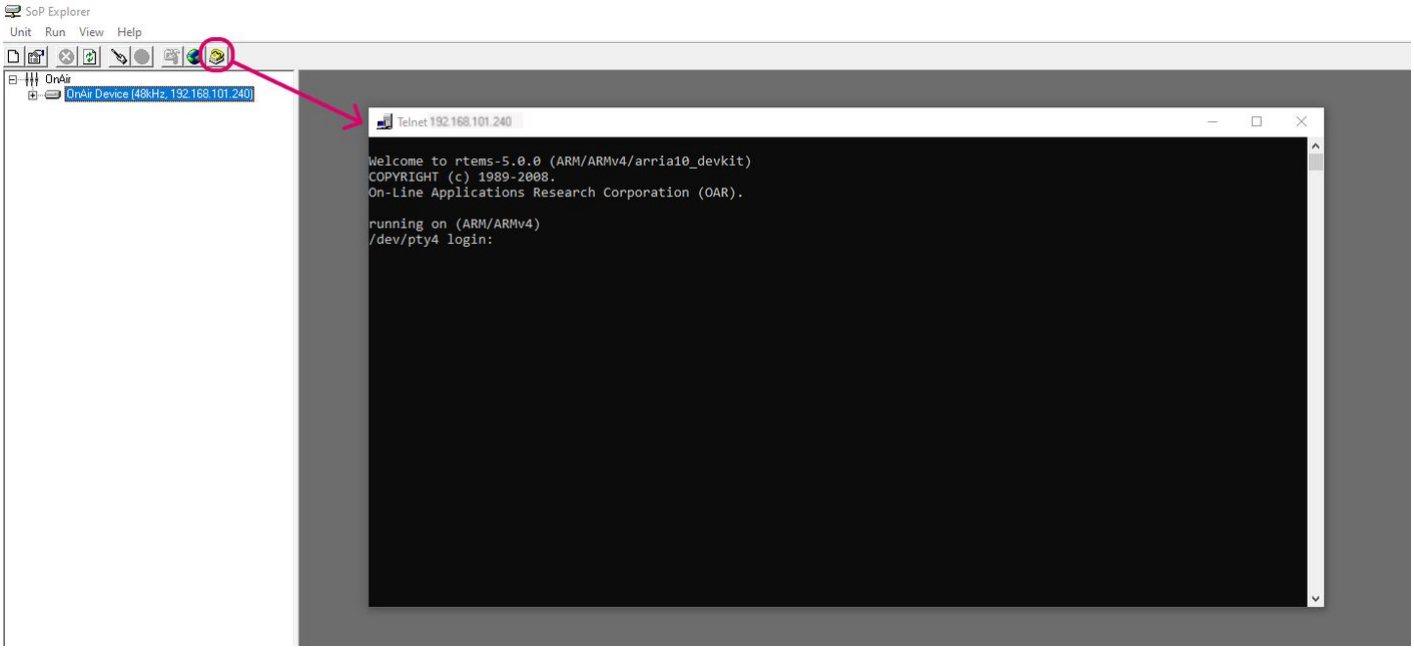
You can now follow the instructions for the task you wish to perform.

10.6 Power Core - Telnet Sessions

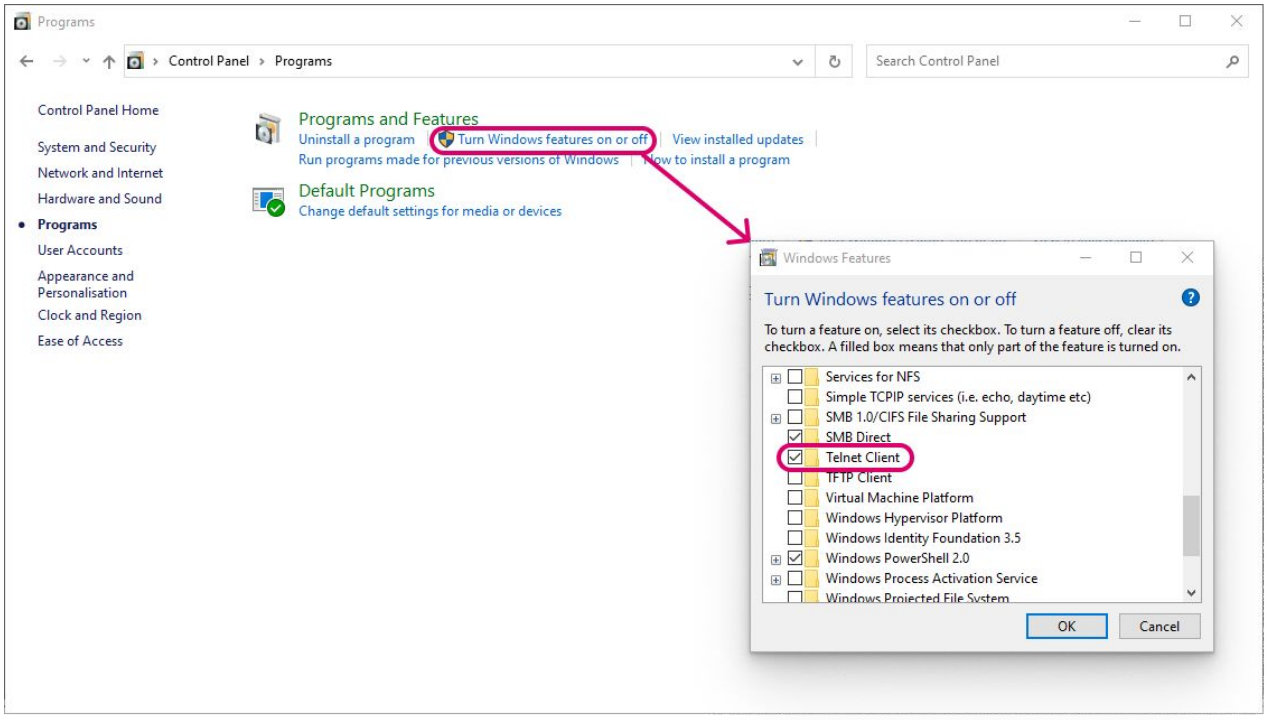
To adjust certain parameters on Power Core, you may need to open a telnet session to the control system.

Opening a Connection to the System

1. The simplest way is to open SoP Explorer (as described earlier) and click on the "run telnet application" icon in the Toolbar.



If the telnet window does not appear, then the "Telnet Client" option may be disabled in Windows. This can be remedied by turning on the Telnet Client option in your Windows Control Panel.



If the Telnet Client option is activated and a Telnet session still does not appear, then try disabling any Anti-virus or Firewall applications running on the PC.

2. When prompted, enter the login name: "*root*" (press ENTER), and password "*tomtom*" (press ENTER).

Note that the telnet password can be changed from the Power Core Web UI (via the System -> Control tab) in Administrator mode.

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

Useful Commands

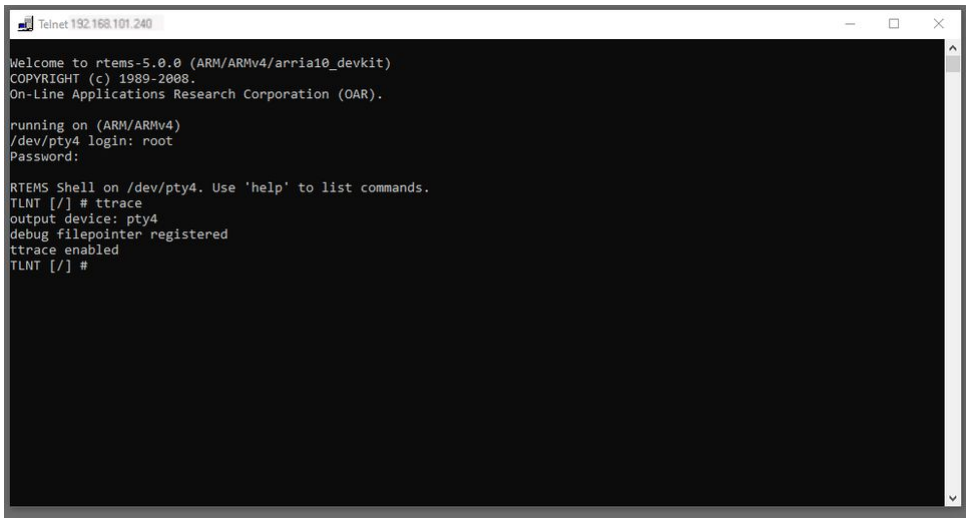
Once you see the command prompt, the following commands can be entered. In each case, type in the syntax and press ENTER.

- "sys_rb" - reboots the system (warm start).
- "ttrace" - enables/disables logging messages (as described below).

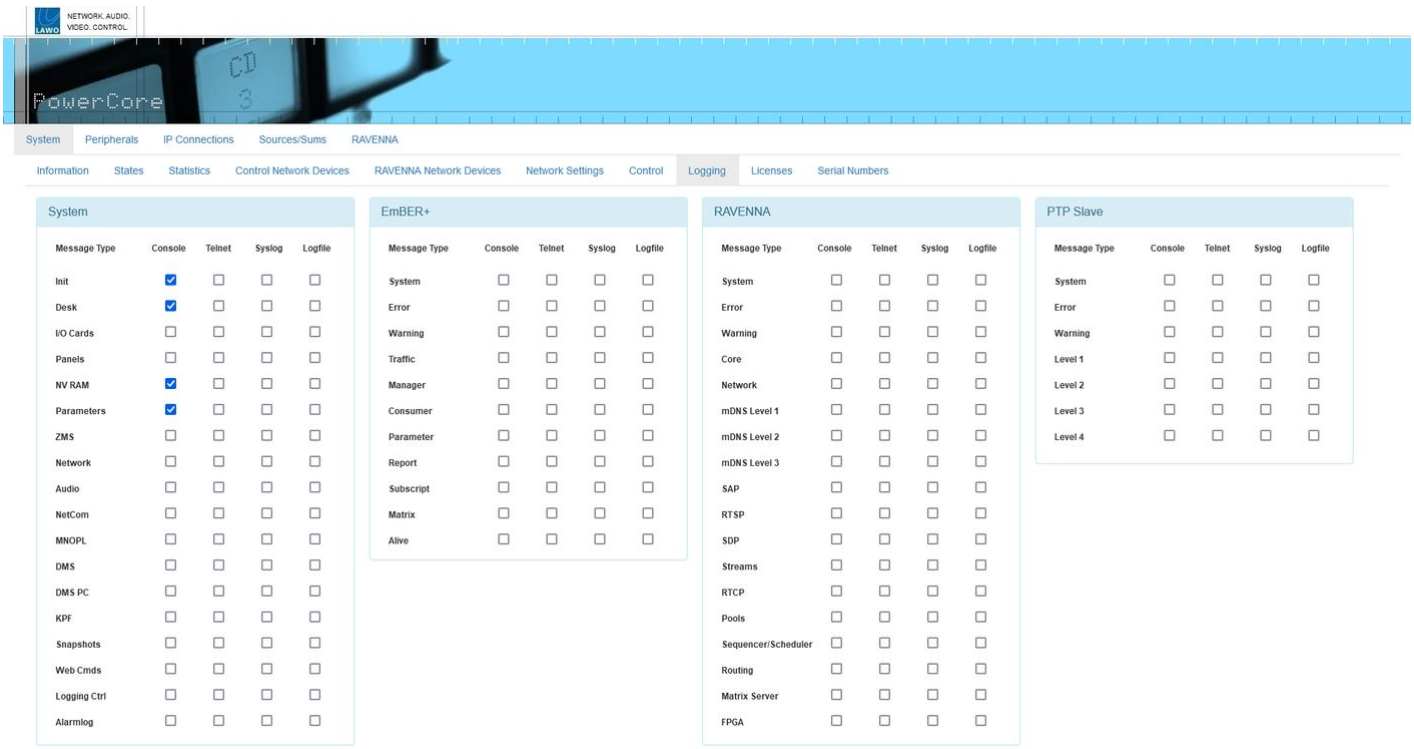
Displaying Logging Messages via Telnet

The "ttrace" command can be used to display logging messages in the Telnet window.

1. Type "ttrace" after the command prompt.



2. Open the System → Logging tab in the Web UI, and select the messages you wish to view (using the Telnet tick boxes).



3. To turn off the display of logging messages, type the same syntax "trrace".

10.7 Power Core - File Transfer via FTP

All files stored on the Power Core control system can be accessed by a suitable FTP client. This topic describes how to perform a file transfer.

1. Install a suitable FTP client on your computer.

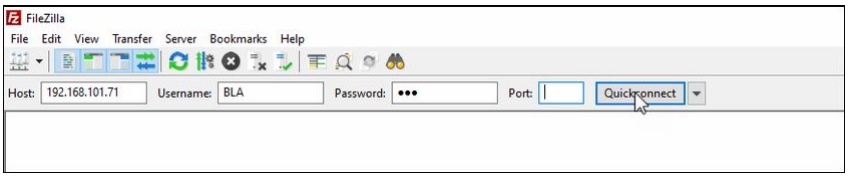
We recommend using **Filezilla**, a free FTP client for all platforms, which can be downloaded from www.filezilla-project.org

2. Connect your configuration PC to Power Core via the control network (as described earlier).

3. Open the Filezilla FTP client, and enter the following information:

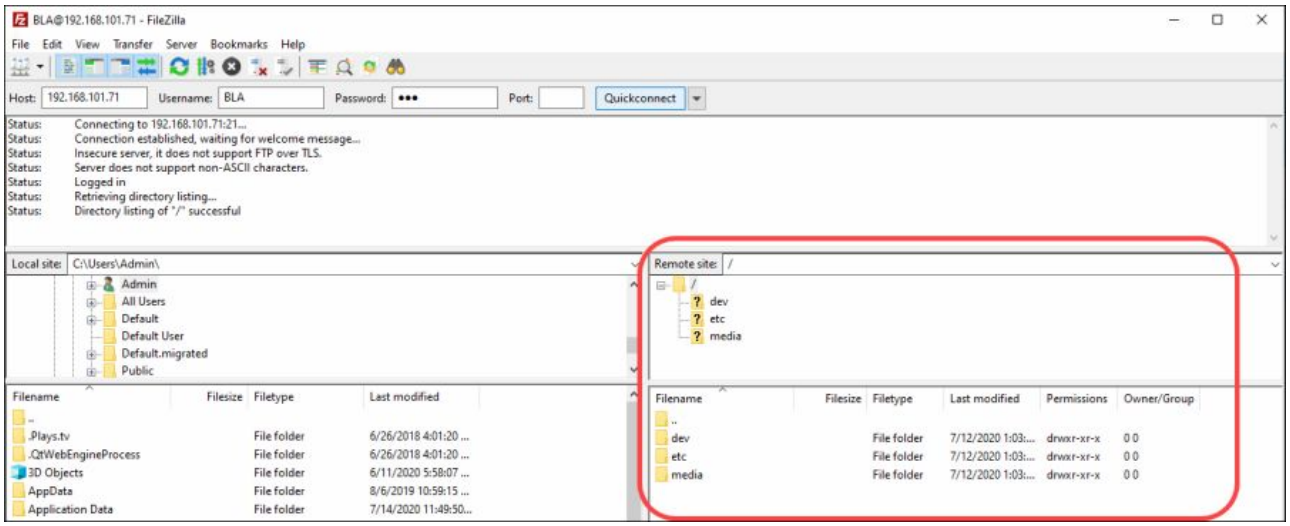
- Host = the IP address of your control system
- Username = **BLA**
- Password = **BLU**

If you leave the **Port** field blank, then the default port number of 21 will be used.

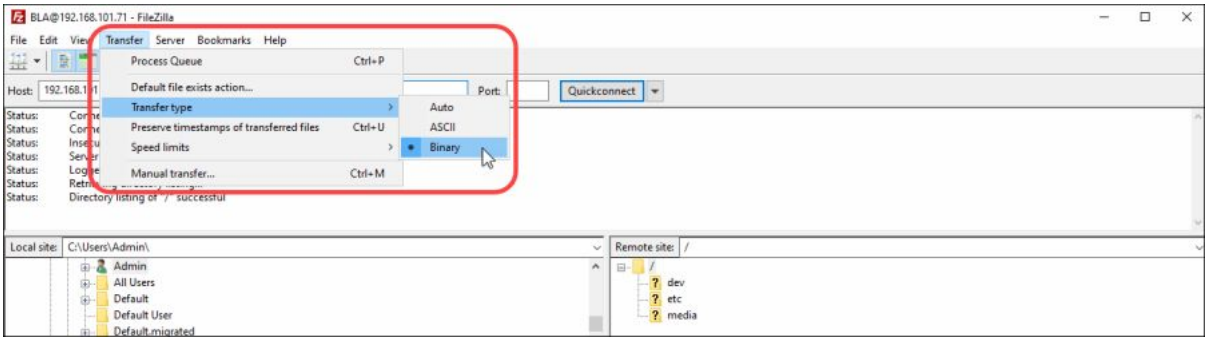


4. Click on **Quickconnect** to make the connection.

The session opens, and you will see the filing system of Power Core on the right (under **Remote Site**).



5. BEFORE transferring files, check that the **Transfer Type** is set to **Binary**.



Important: it is important that file transfers use "Binary" mode, and not "ASCII".

6. You can now transfer files from Power Core (the **Remote site**) to your computer (the **Local site**), or vice versa:

- Use the upper areas to navigate through the filing structure - the contents of the selected folder are displayed beneath (under **Filename**).
- Right-click on a filename and select **Upload** or **Download** - the file is transferred to/from the selected folder.

11 Power Core - Service Procedures

This chapter describes the service procedures available for the Power Core hardware.

- Power Core - Using the Service Procedures
- Power Core - Replacing an I/O Card

11.1 Power Core - Using the Service Procedures

This topic describes how to use the service procedures.

We recommend that you read each topic in full before starting a procedure.

(E) WARNING

Please read and observe ALL of the Lawo - Important Safety Instructions BEFORE installing or servicing any component.

(F) AVERTISSEMENT

Veuillez lire et respecter TOUTES les consignes de sécurité importantes AVANT d'installer ou d'entretenir un composant.

Mechanical drawings and data sheets (including weights and dimensions) are available from the Lawo Download-Center (after login).

The following procedures are covered in this chapter.

- Replacing an I/O Card

If you need further assistance, the Lawo Support Department can be contacted by email at support@lawo.com, or by telephone during normal working hours - please visit the Support area of the Lawo website for the most up-to-date contact details.

11.2 Power Core - Replacing an I/O Card

The following procedure can be used to fit or exchange an expansion I/O card.

Overview

Each Power Core frame can be fitted with up to 8 x expansion I/O cards (fitted to the rear).

The I/O cards are hot-pluggable and so it is possible to add or replace a card while the frame is powered.

Cards can be installed in any slot position as long as the frame meets the requirements stated earlier (i.e. a maximum of 4 MIC/LINE cards per frame, fitted to even slots only).

What you will need

To remove and replace the screws you will need a small flat-blade screwdriver (not supplied).

Instructions

Please read the following important safety information and then follow the step-by-step instructions.

(E) WARNING

Please read and observe ALL of the Lawo - Important Safety Instructions BEFORE installing or servicing any component.

(F) AVERTISSEMENT

Veuillez lire et respecter TOUTES les consignes de sécurité importantes AVANT d'installer ou d'entretenir un composant.

(E) CAUTION

If a frame is not fully populated, then any spare slots must be closed with cover plates. For safety reasons and to ensure efficient cooling, the frame must not be operated with an empty slot.

(F) ATTENTION

Si un cadre n'est pas entièrement rempli, les emplacements libres doivent être fermés par des panneaux d'obturation. Pour des raisons de sécurité et pour assurer un refroidissement efficace, le cadre ne doit pas être utilisé avec un emplacement vide.

1. Remove the existing I/O card (or cover plate).

- Disconnect and remove all of the I/O card cables.
- Using a Phillips PH1 screwdriver, unfasten the two diagonally opposite screws which hold the card, or cover plate, in place.

Note that there are two types of card/plate: one where the screws can be removed (and reused), and one where the screws remain attached to the card/plate. When removing the first type of card/plate, take care to store the screws safely.

- Carefully, pull out the card from the frame (or remove the cover plate).
- Store any cover plates safely (as they may be required in the future to close the frame).

2. Fit the new I/O card (or cover plate).

- Take the I/O card out of its packaging and slide it carefully into the guide rails (at the rear of the frame). Make sure that the card glides in smoothly and sits flush wth the rear panel casing.
- If you are hot-plugging a card, then after a few seconds, the card will boot. You can check the status of the new card using the Power Core Web UI (via the "System → States" page).
- Secure by tightening the two screws to fix the card in place.
- A cover plate can be fitted in a similar manner.

3. The installation is now complete, and you can reconnect the cables and test the operation.

Once all cards are installed, check that they are all screwed into the frame and that any empty slots are closed with metal cover plates.

12 Power Core - Data and Specifications

This chapter contains data to work with such as specifications, drawings and schematics.

- Power Core - Part Numbers
- Power Core - System Reference Levels
- Power Core - Connector Pin-Outs
- Power Core - Matrix Numbers
- Power Core - Mackie HUI Parameters
- Power Core - Ember+ Tree
- Power Core - Technical Specification

Mechanical drawings and data sheets (including weights and dimensions) are available from the Lawo Download-Center (after login).

Please use the Power Core - Part Numbers to locate the correct information.

12.1 Power Core - Part Numbers

This topic lists the part numbers for Power Core.

Power Core		Part Number	Description
Frames	Main frame (revision 3)	710/13	See Power Core - Hardware Revisions.
	Main frame (revision 2)	710/11	See Power Core - Hardware Revisions.
I/O Cards	MIC / LINE IN	710/20	8 x mono mic/line in
	LINE IN	710/25	4 x stereo line in
	LINE OUT	710/30	4 x stereo line out
	STUDIO I/O	710/35	2 x mono mic/line in 1 x stereo line out 2 x stereo headphones out
	AES3 I/O	710/41	4 x stereo AES3 inputs with SRC 4 x stereo AES3 outputs Bit-transparent
		710/40	as for 710/41 but without bit transparency. This card is discontinued; existing cards can be replaced with the 710/41.
	AES3id I/O	710/42	as for 710/41 but with HD-BNCs
	MADI I/O	710/50	2 x MADI ports (64 I/O channels per port); can be configured for dual-redundant operation.
	MADI SRC I/O	710/60	1 x MADI port (64 I/O channels with SRC)
	DANTE I/O	710/55	2 x DANTE ports, dual-redundant (64 I/O with SRC)
	GPIO	710/80	8 x GPI (optocouplers) 8 x GPO (silent and self-healing relays) 2 x VCA (voltage-controlled inputs)
Software Licenses	RAVENNA Plus (RAV+) Add-on License	250-7130-000	See Power Core - Licensed Feature Sets.
Accessories	SFP modules	981/60-xx	See Power Core - SFP Transceivers.
	DC power supply	955/50-80	See Power Core - Power Supplies.
Spare Parts	USB dongle	250-5998-000	1 x LAWO USB dongle for Power Core.
	Replacement screws for I/O card	271A0106-000	2 x screws for new type I/O card/cover plate. See Power Core - Replacing an I/O Card.

12.2 Power Core - System Reference Levels

The **Relative System Level** and **Analog Reference Level** are options that are defined in the configuration. They combine to set the operating levels (analog and digital) for the system.

With **Relative System Level (dBFS)** you define the relative working point internally within the system. This value can be calculated with the formula "RSL = - digital headroom - 18" or "RSL = working point -18dB".

For example, the working point (0 dBr) for the ARD (German Broadcasters' Network) is at -9 dBFS. From this follows a **Relative System Level (dBFS)** of -27.

Note that the working point is important as dynamics and limiter modules refer to this value. When the threshold value is set to 0 dB, the absolute level equals the working point.

The table below shows the values required to comply with the DIN and SMPTE metering standards.

	DIN	**SMPTE**	**EBU**
ON-AIR Designer: Relative System Level (dBFS)	-27	-38	-36
ON-AIR Designer: Analog Ref Level (dBu)	15	24	24
Operating Level: Analog	+6 dBu	+ 4 dBu	0 dBu
Operating Level: Digital	-9 dBFS	-20 dBFS	-18 dBFS

The ON-AIR Designer options can be edited via the "System -> Definition -> Parameter = Meter" branch of the 'Tree Definition'.

12.3 Power Core - Connector Pin-Outs

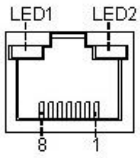
This topic describes the pinning information for each of the main frame connectors and expansion I/O cards.

- Main Frame Connectors
  - CAN
  - RS-422
  - DC Power IN
  - GPIO on front panel (revision 2 frames only)
- Expansion I/O Cards
  - MIC/LINE IN (710/20), LINE IN (710/25), LINE OUT (710/30)
  - STUDIO I/O (710/35)
  - AES3 I/O (710/41, 710/40)
  - AES3id I/O (710/42)
  - MADI I/O (710/50)
  - MADI I/O SRC (710/60)
  - DANTE I/O (710/55)
  - GPIO (710/80)

Main Frame Connectors

CAN

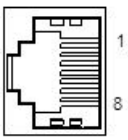
8-pin RJ45 connector, female.



PIN No:	FUNCTION
1	BUS high
2	BUS low
3	GND
4	n.c.
5	n.c.
6	n.c.
7	n.c.
8	n.c.
LED1	CAN Rx
LED2	CAN Tx

RS-422

8-pin RJ45 connector, female.

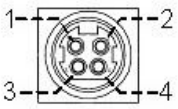


SERIAL RS422

PIN No.	RAS/NTP.(1)	DEBUG
1	n.a.	Tx +
2	n.a.	Tx -
3	n.a.	Rx +
4	Tx +	n.a.
5	Tx -	n.a.
6	n.a.	Rx -
7	Rx +	n.a.
8	Rx -	n.a.

DC Power IN

4-pin Kycon connector, female.

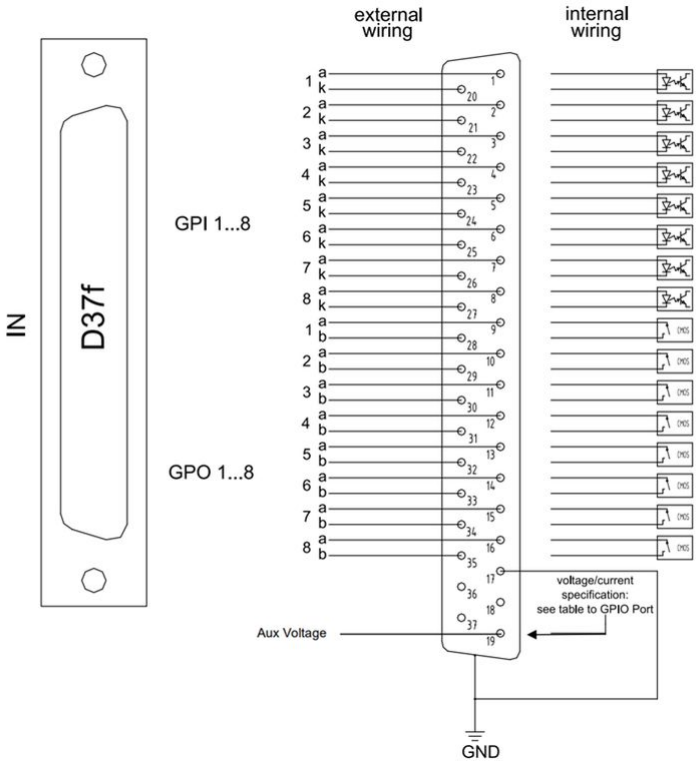


PIN No:	FUNCTION
1	+ 12 VDC
3	+ 12 VDC
2	GND
4	GND

GPIO on front panel (revision 2 frames only)

37-pin D-type connector, female.

For voltage/current specifications, please refer to the data sheet for the Power Core frame (710/11).

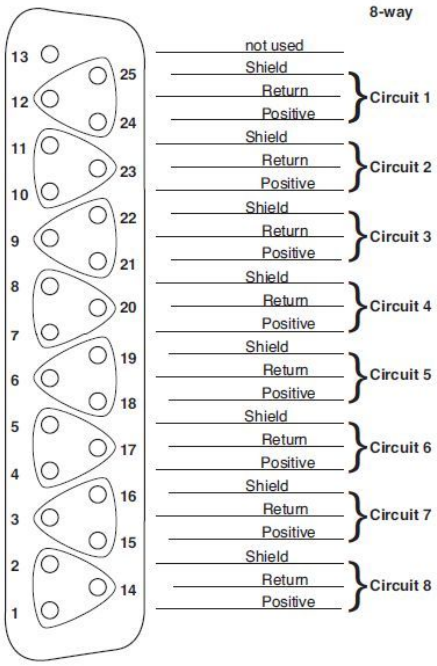


Expansion I/O Cards

MIC/LINE IN (710/20), LINE IN (710/25), LINE OUT (710/30)

25-pin D-type connector (DB25), female.

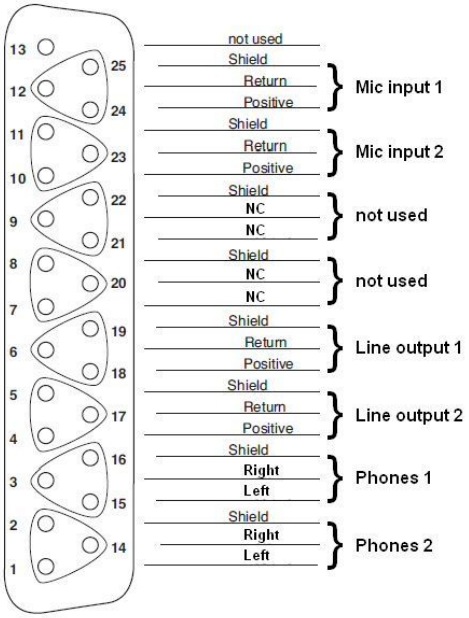
Pinning and gender according to AES59 (TASCAM) standard. All shields are internally connected to system ground.



STUDIO I/O (710/35)

25-pin D-type connector (DB25), female.

Pinning and gender according to AES59 (TASCAM) standard, except for Phones. All shields are internally connected to system ground.

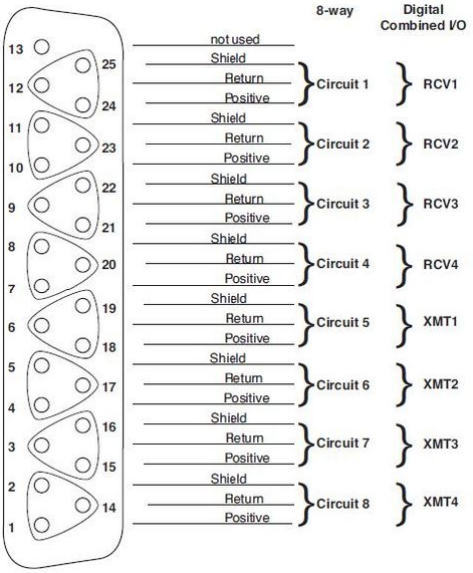


AES3 I/O (710/41, 710/40)

25-pin D-type connector (DB25), female.

AES3 inputs 1..4 (RCV1..4), AES3 outputs 1..4 (XMT1..4).

Pinning and gender according to AES59 (TASCAM) standard. All shields are internally connected to system ground.



AES3id I/O (710/42)

8 x HD-BNC, 75 ohm.

AES3 inputs 1..4, AES3 outputs 1..4.

MADI I/O (710/50)

2 x MADI optical (via SFP).

Connector and fiber types depend on the SFP module.

MADI I/O SRC (710/60)

1 x MADI optical (via SFP).

Connector and fiber types depend on the SFP module.

DANTE I/O (710/55)

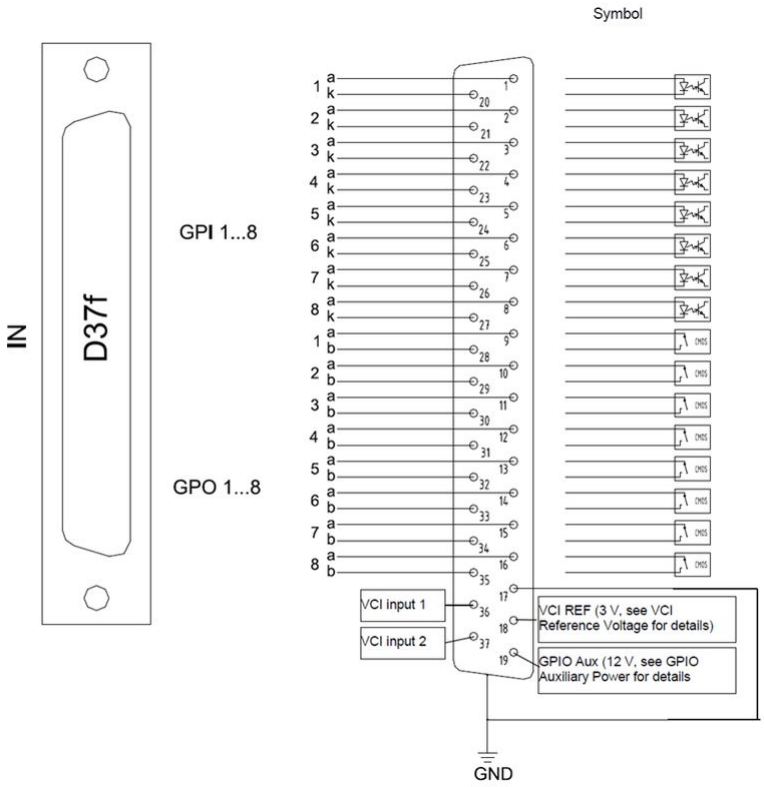
2 x DANTE (dual-redundant ports).

RJ45 connector, standard pinning for CAT5 cabling.

GPIO (710/80)

37-pin D-type connector, female.

For voltage/current specifications, please refer to the data sheet for the I/O card (710/80).



12.4 Power Core - Matrix Numbers

When using matrix functions, the inputs and outputs within the Lawo system are addressed using the numbers described in the table below. Note that there are some additional numbers for Power Core (revision 3) to address the two optional RAVENNA ports: ra2 and ra3.

The matrix address is the same as the **ID** number shown in the 'Command -> Inputs/Outputs' lists (in the ON-AIR Designer). Hence, this can be a useful way to determine the address for an individual signal. To control crosspoints within an external matrix, please contact the manufacturer for details on their matrix addressing system.

Matrix Address	Power Core (revision 3)	Power Core (revisions 1 & 2)
1	IO CARDS	IO CARDS
65		
129	MADI 1	MADI 1
193	MADI 2	MADI 2
257	MADI 3	MADI 3
321	MADI 4	MADI 4
385	MADI SLOT 1	MADI SLOT 1
449		
513	MADI SLOT 2	MADI SLOT 2
577		
641	MADI SLOT 3	MADI SLOT 3
705		
769	MADI SLOT 4	MADI SLOT 4
833		
897	MADI SLOT 5	MADI SLOT 5
961		
1025	MADI SLOT 6	MADI SLOT 6
1089		
1153	MADI SLOT 7	MADI SLOT 7
1217		
1281	MADI SLOT 8	MADI SLOT 8

Matrix Address	Power Core (revision 3)	Power Core (revisions 1 & 2)
1345		
1409	RAVENNA (ra0, ra1)	RAVENNA (ra0. ra1)
1473		
1537		
1601		
1665	LOOPBACKS	LOOPBACKS
1729		
1793		
1857		
1921	GT	GT
1985		
2049	UDP	UDP
2113	RAVENNA (ra2, ra3)	not applicable
2368		

12.5 Power Core - Mackie HUI Parameters

The following table lists the Mackie-HUI™ protocol Central Control functions which can be remotely controlled from Power Core. For a detailed description of each function, please consult your DAW manual.

Group	Name	Lawo System -> DAW	DAW -> Lawo System
V-Pot Assign	Input	Yes	Yes
V-Pot Assign	Output	Yes	Yes
V-Pot Assign	Pan	Yes	Yes
V-Pot Assign	Send A	Yes	Yes
V-Pot Assign	Send B	Yes	Yes
V-Pot Assign	Send C	Yes	Yes
V-Pot Assign	Send D	Yes	Yes
V-Pot Assign	Send E	Yes	Yes
Global	Channel <	Yes	Yes
Global	Channel >	Yes	Yes
Global	Bank <	Yes	Yes
Global	Bank >	Yes	Yes
Global	Assign	Yes	Yes
Global	Default	Yes	Yes
Global	Suspend	Yes	Yes
Global	Flip	Yes	Yes
Global	Mute	Yes	Yes
Global	Bypass	Yes	Yes
Global	Rec/Rdy	Yes	Yes
Auto Enable	Plug-In	Yes	Yes
Auto Enable	Pan	Yes	Yes
Auto Enable	Fader	Yes	Yes
Auto Enable	Send Mute	Yes	Yes
Auto Enable	Send	Yes	Yes

Group	Name	Lawo System -> DAW	DAW -> Lawo System
Auto Enable	Mute	Yes	Yes
Auto Mode	Trim	Yes	Yes
Auto Mode	Latch	Yes	Yes
Auto Mode	Read	Yes	Yes
Auto Mode	Off	Yes	Yes
Auto Mode	Write	Yes	Yes
Auto Mode	Touch	Yes	Yes
Window	Mix	Yes	Yes
Window	Edit	Yes	Yes
Window	Transport	Yes	Yes
Window	Mem-Loc	Yes	Yes
Window	Status	Yes	Yes
Window	Alt	Yes	Yes
Keyb. Shortcuts	Ctrl/Clutch	Yes	Yes
Keyb. Shortcuts	Shift/Add	Yes	Yes
Keyb. Shortcuts	Edit	Yes	Yes
Keyb. Shortcuts	Undo	Yes	Yes
Keyb. Shortcuts	Alt/Fine	Yes	Yes
Keyb. Shortcuts	Option/All	Yes	Yes
Keyb. Shortcuts	Edit-Tool	Yes	Yes
Keyb. Shortcuts	Save	Yes	Yes
Functionkeys	F1	Yes	Yes
Functionkeys	F2	Yes	Yes
Functionkeys	F3	Yes	Yes
Functionkeys	F4	Yes	Yes
Functionkeys	F5	Yes	Yes

Group	Name	Lawo System -> DAW	DAW -> Lawo System
Functionkeys	F6	Yes	Yes
Functionkeys	F7	Yes	Yes
Functionkeys	F8/ESC	Yes	Yes
Status/Group	Phase	Yes	Yes
Status/Group	Monitor	Yes	Yes
Status/Group	Auto	Yes	Yes
Status/Group	Suspend	Yes	Yes
Status/Group	Create	Yes	Yes
Status/Group	Group	Yes	Yes
Edit	Paste	Yes	Yes
Edit	Cut	Yes	Yes
Edit	Capture	Yes	Yes
Edit	Delete	Yes	Yes
Edit	Copy	Yes	Yes
Edit	Separate	Yes	Yes
Transport	Talkback	Yes	Yes
Transport	Rewind	Yes	Yes
Transport	FastFwd	Yes	Yes
Transport	Stop	Yes	Yes
Transport	Play	Yes	Yes
Transport	Record	Yes	Yes
Transport	Down	Yes	Yes
Transport	Left	Yes	Yes
Transport	Mode	Yes	Yes
Transport	Right	Yes	Yes
Transport	Up	Yes	Yes

Group	Name	Lawo System -> DAW	DAW -> Lawo System
Transport	Scrub	Yes	Yes
Transport	Shuttle	Yes	Yes
Transport	RTZ	Yes	Yes
Transport	End	Yes	Yes
Transport	Online	Yes	Yes
Transport	Loop	Yes	Yes
Transport	Quickpunch	Yes	Yes
Transport	Audition	Yes	Yes
Transport	Pre	Yes	Yes
Transport	In	Yes	Yes
Transport	Out	Yes	Yes
Transport	Post	Yes	Yes

12.6 Power Core - Technical Specification

This topic provides technical data for Power Core

- Power Core Frame (revision 3)
  - Dimensions
  - Weight
  - Power: AC PSU (included)
  - Power: DC PSU (optional)
  - Environmental Specifications

Power Core Frame (revision 3)

Dimensions

- Height x Width x Depth: 44,0 mm (1RU) x 483 mm (19”) x 385 mm (15,2")
- Depth measured includes locking devices.

Weight

- Frame without rear expansion I/O cards: 4.5kg (9.9lb)

Power: AC PSU (included)

- Connector: 1x IEC
- Input Voltage: nominal 1x 100-120V AC / 1x 200-240V AC, +/- 10%, 50/60Hz
- Max consumption: < 90W

Power: DC PSU (optional)

External DC power supply, 955/50-80:

- Height x Width x Depth: 72 mm (2,8") x 35 mm (1,38”) x 175 mm (6,9")
- Weight: 0.67kg (1.5lb)
- Connector: see Power Core - Power Supplies.
- Cable length, without plug: 1200 mm (47,2")
- Input Voltage: nominal 1x 12V DC
- Indicators: 1 x status LED (power)
- Max consumption: < 90W

Environmental Specifications

- Operating temperature: 0°C to +30°C (+32°F to + 86°F)
- Storage temperature: -20°C to +70°C (-4°F to +158°F)
- Relative humidity: < 85% non-condensing
- Ventilation/Airflow: from right to left cooling in frame