Power Core

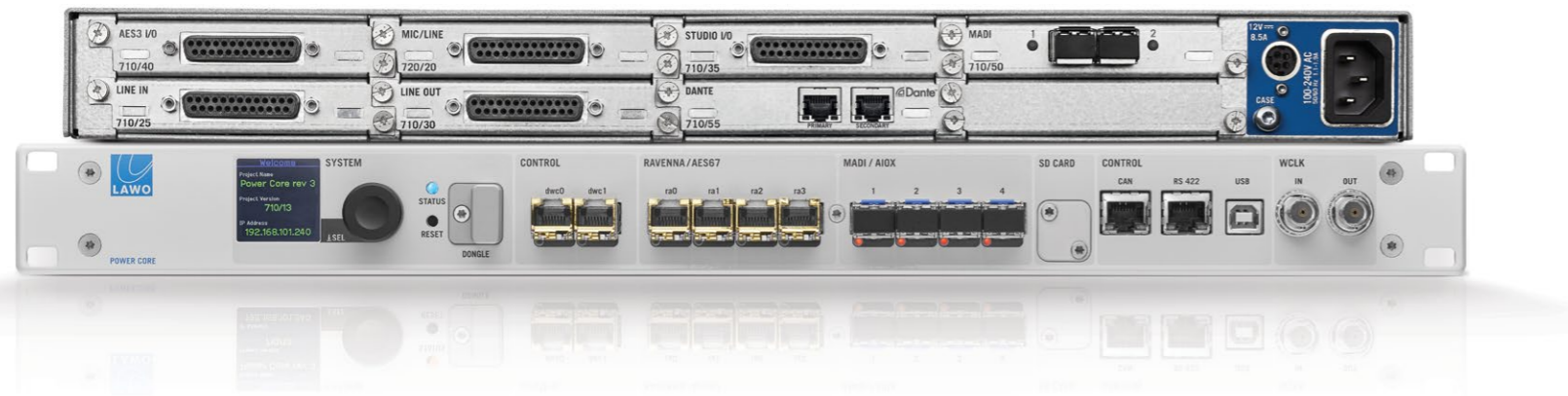## SCALABLE HIGH-DENSITY I/O, MIXING, PROCESSING & ROUTING ENGINE

LAWO

CONVERT
CONTROL
COLLABORATE

The infrastructure hero

While everyone else was waiting for AoIP's "next big thing" to appear, Lawo built it. Meet Power Core, the state-of-the-art 1RU AoIP I/O gateway, routing engine and DSP processor from Lawo. Power Core catapults studio infrastructure forward, leveraging today's powerful DSP resources to dramatically increase flexibility and capability, while shrinking costs and rack space requirements.

Power Core may be the most powerful audio signal processor ever made for broadcast. With multiple high-density RAVENNA / AES67 and MADI interfaces, standard, it's the perfect choice for broadcasters migrating from baseband to IP. Choose up to 8 modular mic, line, AES3 and DANTE interfaces to customize your signal mix even further. Route it all using the internal matrix of up to 1,920 x 1,920 crosspoints.

Audio shaping? Power Core is packed with DSP horsepower — so much that you can use it as a networked, whole-plant provider of audio processing on-demand. As many as 96 channels of DSP input processing can be unlocked to supply EQ, dynamics, de-essing, limiting and delay at a moment's notice.

There's more. Power Core is also a console mixing engine like no other. Not only can it power traditional consoles as large as 60 physical plus 60 virtual faders, Power Core can actually provide mixing services for as many as four independent control surfaces simultaneously, reducing the engine-to-console ratio as much as 75%. Which significantly reduces installed costs as well.

To serve very large production centers, there's Power Core AIOX (Audio I/O Extender), which lets you add as many as 64 more channels of audio in a slim 1RU expansion frame. Connect as many as 20 AIOX units to a single Power Core to ingest and control up to 1,280 more analog or digital audio or GPIO channels — the ultimate modular approach to signal density.

Best of all, Power Core's capabilities are software-defined. Choose from multiple tiered license options that balance cost and capabilities, tailoring Power Core to fit your exact operational needs.

Waiting for the future of AoIP to show up? Wait no longer. Power Core has arrived.

Power Core

DSP MIXING ENGINE + I/O GATEWAY

Don't let its size fool you

MEET THE RACK SPACE REDUCER

Never judge a book by its cover — or a mixing engine by its rack size. At just 1RU, Power Core's compact form belies the immense capabilities inside; capabilities that dramatically increase signal capacity, reduce rack space requirements and expand operational flexibility – while helping to reduce installed cost.

Standard front-panel I/O in Power Core Rev3 includes 4 RAVENNA / AES67 Ethernet ports with SFP, capable of up to 256 bi-directional AoIP streams (512 audio channels). Or use them to provide LAN segment separations or LAN-WAN gateway applications using bi-directional Unicast streams. 4 high-density MADI ports supply up to 256 total channels of audio, making Power Core perfect for native MADI-to-AES67 AoIP conversion. A high-resolution color display gives status and setup information, while USB and SD Card access simplify maintenance operations; two Ethernet control ports plus CAN and serial control ports complete the scene.

Around back, 8 expansion slots accept a variety of optional I/O interface cards. Auto-switching, redundant power connections are standard; Power Core's internal auto-ranging AC power supply is complemented by a 12VDC backup power supply inlet.

Where Power Core really shines in raw audio processing horsepower. A single Power Core can handle thousands of simultaneous signals. As many as 96 channels of DSP input processing can be unlocked to use for anything from EQ to de-essing, from dynamics to delay sync. Depending on license package, Power Core boasts resources enough to power as many as 4 independent mixing consoles (hardware or software).

SOFTWARE-DEFINED FLEXIBILITY

Because Power Core is so agile, we use software to configure it for different applications. A variety of license packs are available to tailor Power Core to any performance or budget requirement. Used with a Lawo control surface, it's a powerful mixing / routing engine with an internal routing matrix of up to 1,920 x 1,920 crosspoints. By itself, it can be an "Über-Node" capable of ingesting massive amounts of audio to make available to your AES67 AoIP network. In its most advanced configuration, Power Core's massive DSP capabilities can be unlocked to apply audio correction to vast numbers of signals plant-wide. And the MAX license allows connection of as many as four independent mixing surfaces to a single Power Core engine — a unique ability perfectly suited to today's multi-studio radio facilities. Whatever your workflow, Power Core is always optimized for the task at hand.

AUDIO STANDARDS @ HOME

Power Core is standards-based from the ground up. It uses RAVENNA, the standards-based advertising and discovery protocol that's AES67 compliant. It employs the open-source EMBER+ control protocol to connect and control any studio hardware or software. ST2110-30 compliance ensures seamless operation in combined radio/TV broadcast plants, while ST2022-7 Seamless Protection Switching enables simultaneous, redundant network links. And naturally Power Core works with Lawo HOME, the management platform for IP-based media infrastructures, benefitting from all of HOME's next-generation management features: user access control, quarantining of unknown devices, stream and audio routing, and real-time health monitoring.

MAXIMUM DSP

Power Core DSP features include a unique low-latency Loudness Leveler that matches audio to a pre-set loudness target, a self-keyed side-chain filter for dynamics processing, realtime de-essing with adjustable trigger frequency and AutoGain for each mic input, high-granularity EQ with extended "Q" values for fine-tuning and five parameters: three fully-parametric bands and two semi-parametric bands that can be high- and low-shelf filters, plus gate, expansion, limiting and compression. There's additional support for up to 8 AutoMix groups and 16 VCA groups; up to 5,280 ms of synchronization delay with switchable units (milliseconds, meters, or frames) is also available.

EXPANDABLE I/O, À LA CARTE

Power Core comes with a staggering amount of AES67 and MADI I/O, but you can easily add more I/O. 8 rear-panel slots accommodate a variety of audio and control modules. Simply pick the I/O cards you need and slide them into Power Core's waiting expansion ports — it couldn't be simpler.

| Card	Description	Card	Description
8x MIC / LINE IN	Switchable inputs with Phantom power	**STUDIO I/O**	2 Mic / Line in, 2 Line outputs, 2 HP outputs
8x LINE IN	Eight mono / four stereo inputs	**4x AES3 I/O**	4 inputs and outputs on DB25 (bit-transparent; SRC on inputs)
8x LINE OUT	Eight mono / four stereo outputs	**4x AES3 I/O**	4 HD-BNC inputs and outputs (bit-transparent; SRC on inputs)
8x GPIO	8 GPI+8 GPO and 2 VCA inputs	**2x MADI I/O**	64 channels per SFP connection
DANTE I/O inc. SRC	Two redundant ports; 64 total channels	**1x MADI I/O incl. SRC**	64 channels I/O with Sample Rate Conversion

RAVENNA   EMBER+   lives @ HOME

Power Core AIOX

AUDIO I/O EXTENDER
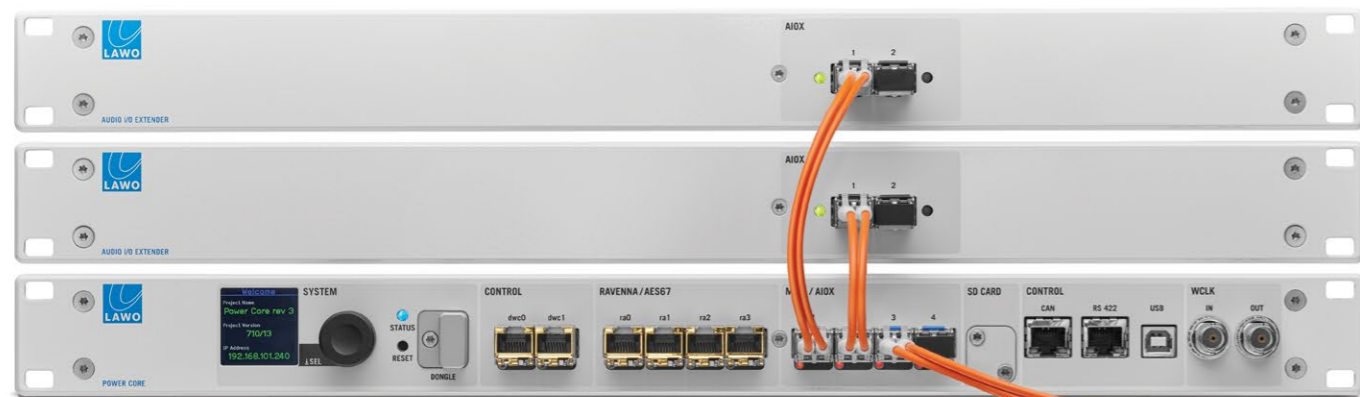
Super simple scalability

Power Core already handles a prodigious amount of audio I/O — as evidenced by its built-in 1,920x1,920-crosspoint routing matrix. But what if you need to ingest even more audio? Meet AIOX, the 1RU Audio I/O Extender for Power Core. Together they provide the ideal audio gateway for today's consolidated broadcast houses.

AIOX embodies Lawo's philosophy of "smaller is better." AIOX delivers up to 64 channels of I/O in just 1RU - a distinct advantage over conventional I/O conversion boxes of 3RU or more. This signal density equals significant savings — in rack space required, in power consumed, in cost-per-input.

Like Power Core, AIOX has 8 rear-panel slots that can host nearly any combination of modular 8-channel I/O cards. With these, you can easily expand your RAVENNA / AES67 networks by choosing *a la carte* from a large selection of microphone, line, and digital audio cards, and a useful GPIO logic card.

As many as 20 AIOX units can connect to a single Power Core, using a new proprietary high-speed, low delay point-to-point audio and control protocol. This unique comms mode utilizes the Power Core's

MADI ports to exchange bi-directional audio between devices with an ultra-low latency of only 3 samples per direction; perfect for live production workflows. It also eliminates installation hassles with zero-configuration, plug-and-play deployment.

Combining the maximum 20 AIOX units with a Power Core engine concentrates an entire facility's worth of audio I/O – up to 1,280 additional analog or digital audio inputs, outputs and GPIO – within just half the space of a typical TOC rack.

Of course, AIOX doesn't have to live in the central rack. You can distribute AIOX as edge devices, using copper links (up to 100 meters), coax, or fiber links that support Single and/or Multi-mode operation (depending on SFPs used). Audio and control share the same link.

Uninterrupted operation is paramount in large-scale operations, so AIOX features redundant power supplies and dual audio / control ports on the front panel which can operate in either single-mode or redundant-mode.

QUICK CONNECT
AIOX units connect easily to the Power Core engine via its built-in front-panel MADI ports, or rear-panel MADI extension cards if you like. SFPs for coax, copper or single- and multi-mode fiber connections are available.

MAXIMUM FLEXIBILITY
There are innumerable ways to easily expand your facility with AIOX. Put one in your newsroom with 8 Mic or Line I/O cards for all the mic and monitor channels you'll ever need. Place two together in a main On-Air studio to guarantee fully-redundant I/O. Install an AIOX in cross-campus studios, or in performance spaces as a 64-channel stagebox or edge I/O device. The possibilities are endless.
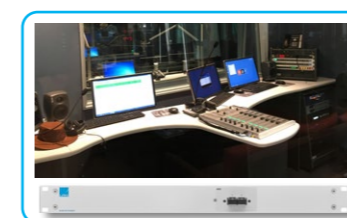
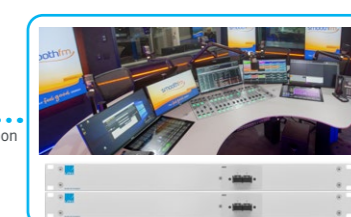Local I/O for News Studios

Point-to-point connection

Central Rack Power Core

Local I/O for Typical Studios

Point-to-point connection   Point-to-point connection

Redundant I/O For Critical Studios

Sweeten audio with a touch

Power Core is an I/O workhorse. But along with all that audio conversion muscle comes a copious amount of DSP brains — up to 96 channels of DSP* (depending on license package chosen). Each DSP input channel has adjustable input gain and is equipped with a 5-parameter equalizer with 3 fully-parametric bands plus 2 semi-parametric bands, which can be configured as shelf, HP or LP filters. Gate, expansion, compression, limiter, de-essing and delay functions are also available. Each channel also includes direct outs, inserts, aux sends with Pre / Post switching, pan & balance control, and AutoGain to perfectly set the gain of each mic input automatically.

When paired with a Lawo diamond mixing console, all of these paramaters can be adjusted with a fingertip using the touchscreen diamond Virtual Extension module or diamond Desktop App (using the standard or touchscreen monitor of your choice).

There's more. Some Power Core licenses* include 4 individual AutoMix groups and up to 96 channels, which allow creation of multiple independent mixes. Automate large talkshows, or assign automation sources to an AutoMix group for flawless unattended playout with perfect levels every time. All sources and busses can be metered onscreen either locally or remotely, using EBU R128 Loudness Metering and/or PPM.

You can even apply a full DSP channel with EQ, Dynamics and delay functions to as many as 16 stereo or 32 mono mixing busses* (depending upon license chosen). With Power Core, the power to create is truly just a touch away.

A complete comparison chart of Power Core license options with all DSP features appears later in this brochure.

STATUS AT A GLANCE
Graphical representations of EQ curves, realtime compression and limiting displays, as well as gain controls, pan settings and onscreen output metering make it easy to apply the DSP you need to get the results you want. Beautiful displays built using LUX (Lawo Unified Experience) deliver a consistent visual environment throughout the entire Lawo portfolio.
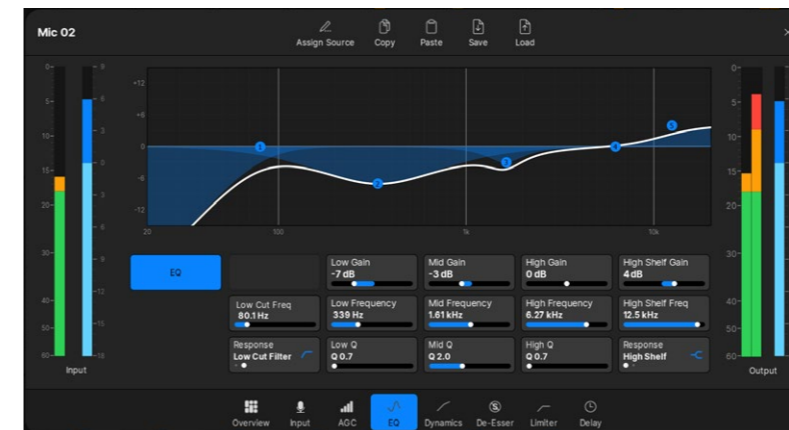
GRANULAR CONTROL
Today's broadcast production environments are more demanding than ever. "A little EQ" isn't good enough. That's why Power Core's DSP controls give you fine control over every available option. Use the touchscreen Virtual Extension module for Lawo diamond consoles, or use the monitor of your choice to fine-tune your audio.

TRUE LOUDNESS METERING
Nearly every AoIP engine has metering. But what values are those meters showing? With Power Core there's no guesssing. Choose EBU R128 Loudness Metering, PPM metering, or both. Every active audio source and mixing bus can be metered to ensure output levels are exactly where they should be.

Power Core

Tailored to your needs

No two broadcast installations are alike. Some are rich in audio source inputs, while others need mainly mixing capabilities. Some depend on flexible N-1 capabilities, while others need support for multiple consoles. Power Core's flexible license packages let you choose the configuration that matches your needs, whether it's pure I/O, mixing, routing, or physical & virtual mixing interfaces. And licenses can be upgraded; as your facility's needs grow, your Power Cores' capabilities grow as well.

EDGE - distributed networked I/O

A Power Core with the EDGE license is an excellent way to provide audio I/O for news and voice recording booths, baseband-to-AoIP translation - anywhere I/O is needed but mixing or DSP is not. EDGE provides 2x64 MADI channels & and 128 RAVENNA / AES67 channels, supports 8 I/O expansion cards, and has an integrated 1,280 x 1,280 routing matrix.
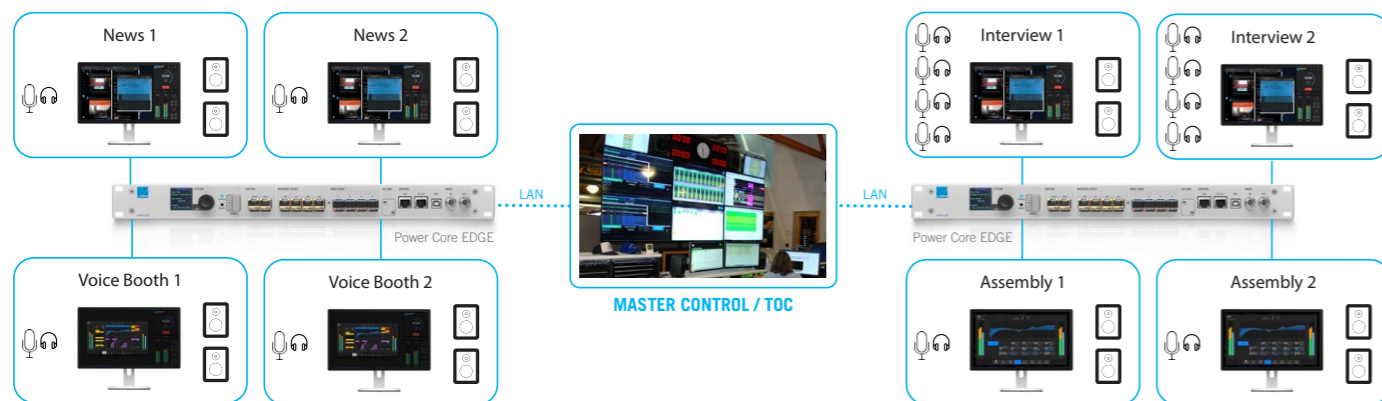

SAN - the Super Audio Node

The SAN (Super Audio Node) license adds to the EDGE license with 32 fader-assignable resources accessible to mixing surfaces or software controllers, 16 channels of DSP (EQ, dynamics, limiting etc.), and AutoMix capability. Use it to provide I/O and AoIP connectivity to OB vans, remote production facilities, interview studios, et cetera. 4x64 MADI channels, 128 RAVENNA / AES67 channels, 1,728 x 1,728 routing matrix.
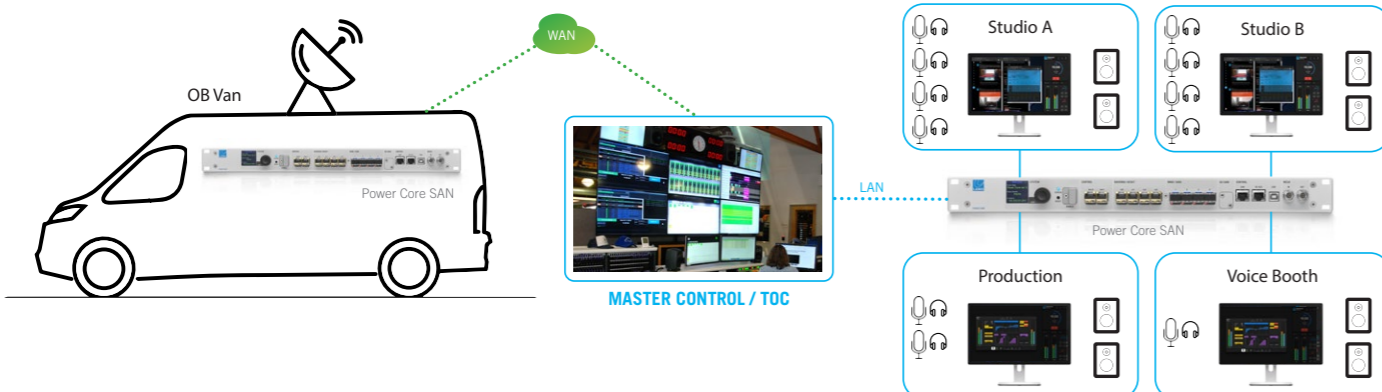
CONSOLE COMPACT - for smaller-to-medium studios

For small-to-medium radio applications, Power Core with the COMPACT license is the perfect fit, supporting console sizes of 2 to 16 faders. Ideal for small self-op studios, talk studios, remote production and OB vans.

The COMPACT Power Core license provides 64 RAVENNA / AES67 streams, 96 fader-assignable resources, a large 1,728 x1,728 routing matrix, and 32 sum/conference buses. 32 DSP inputs are provided for audio shaping, and Lawo's famous AutoMix is ready to help provide the perfect mix during hectic talk shows and multi-source productions.
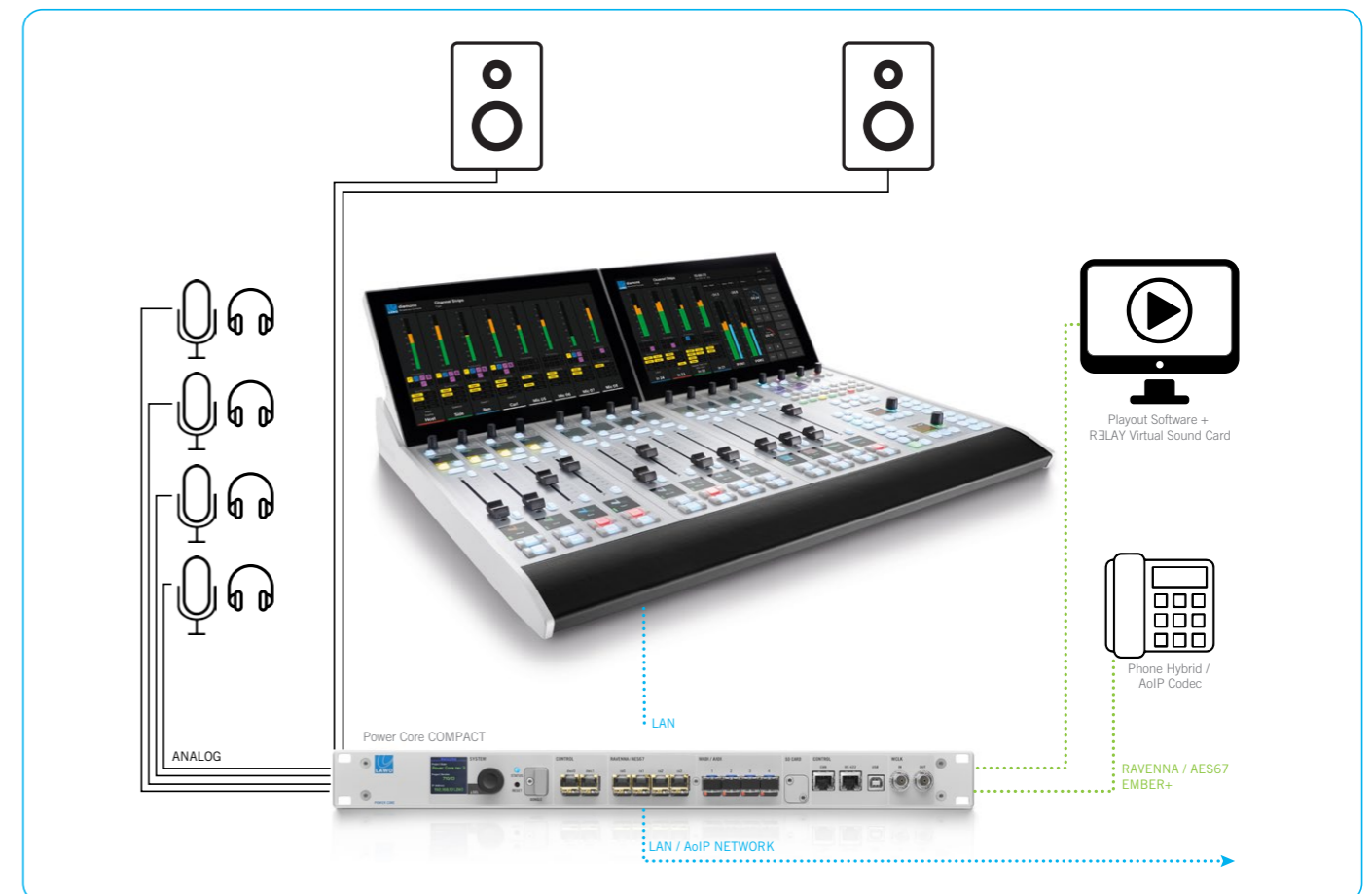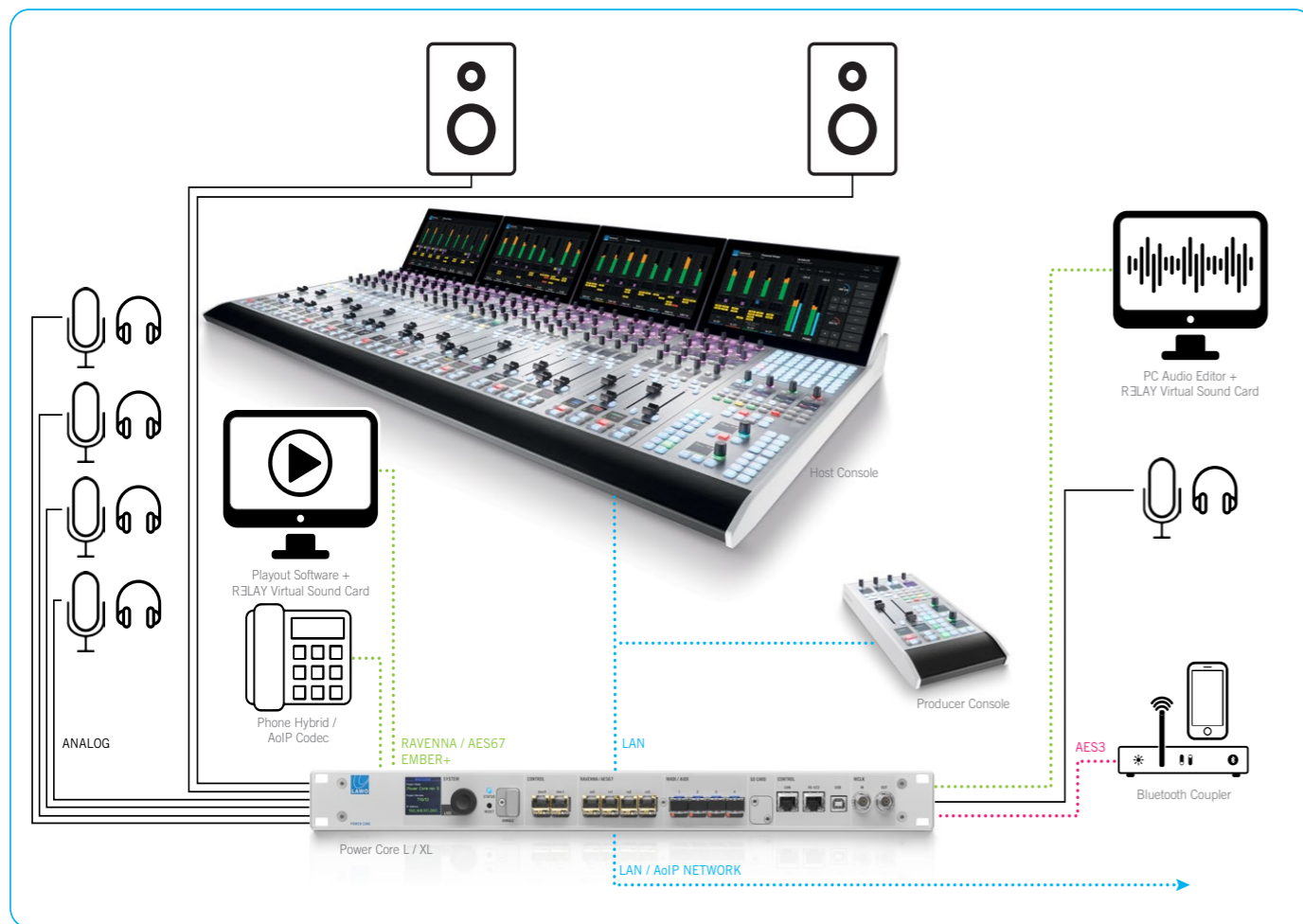
Power Core
LICENSE PACKAGES

CONSOLE L - for larger studios

Large studios that host multiple on-air personalities, or are regularly used for large audio productions, require maximum flexibility. The Power Core CONSOLE L license delivers, supporting consoles of up to 60 physical faders (120 virtual) in single or split-surface layout, with dual-layer operation. For I/O, CONSOLE L provides 4x64 MADI channels, 128 RAVENNA / AES67 channels, and has 128 fader-assignable resources, a 1,728 x 1,728 routing matrix, 48 DSP inputs, 2 AutoMix groups, 40 sum/conference/intercom buses, and 16 channels of bus DSP processing — enough to handle even the most demanding productions.

PC Audio Editor +
RƎLAY Virtual Sound Card

Host Console

Playout Software +
RƎLAY Virtual Sound Card

Phone Hybrid /
AoIP Codec

Producer Console

ANALOG

RAVENNA / AES67
EMBER+

LAN

AES3

Bluetooth Coupler
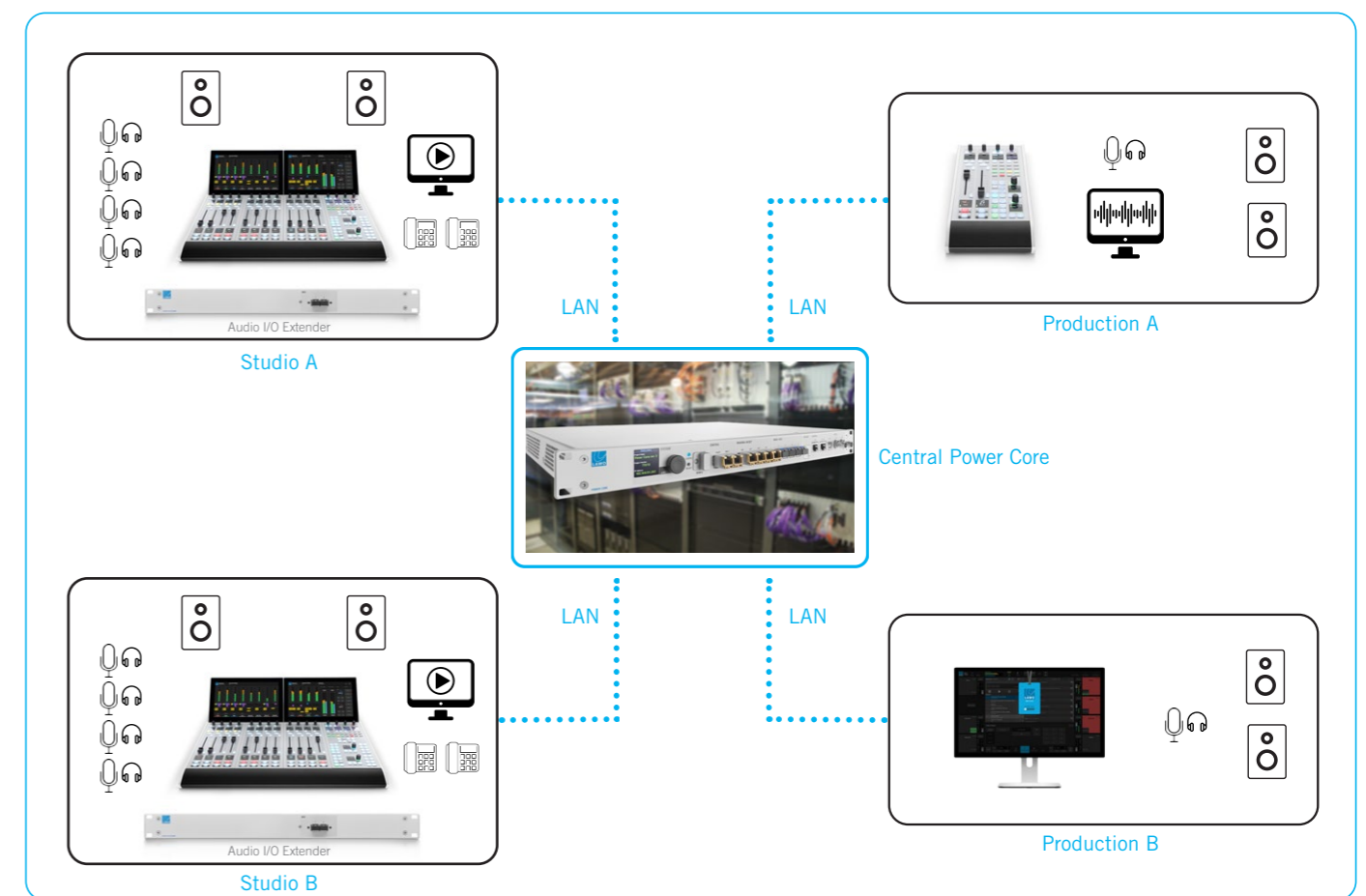
Power Core L / XL

LAN / AoIP NETWORK

CONSOLE XL - for power users

Choose the CONSOLE XL license when planning for TOC, Master Control or other demanding radio & TV production environments like live-action sports coverage, or in-studio musical performances. 4x64 MADI channels and 256 RAVENNA / AES67 channels, with 254 fader-assignable resources, 96 DSP inputs, 8 AutoMix groups, 80 sum & conference buses, 32 channels of bus DSP, 5 PFL buses, 16 VCA groups, 78 intercom clients, and a massive 1,920 x 1,920 routing matrix, With XL you can conquer the world (or at least broadcast to it).

CONSOLE MAX (multiple access) - one core, many studios

The Power Core MAX license is a game-changer for today's multi-studio AoIP facilities. MAX harnesses all the power and capabilities found in the CONSOLE XL license - but enables multiple, simultaneous access by up to 4 typically-sized consoles (either physical, or virtual). A single Power Core MAX easily supplies all of the I/O, DSP, mixing buses, Intercom, clean feeds and routing needed — 254 fader-assignable resources, 96 DSP inputs, 8 AutoMix groups, 80 sum & conference buses, 32 channels of bus DSP, 5 PFL buses, 16 VCA groups, 78 intercom clients, a 1,920 x 1,920 routing matrix. In addition to Power Core's 8 rear-panel expansion slots, you can expand further using Lawo AIOX units. With the power of MAX and the native scalability of AoIP, even the largest facilities are within reach.

Studio A

Audio I/O Extender

LAN   LAN

Production A

Central Power Core

LAN   LAN

Studio B

Audio I/O Extender

Production B

Add-On license packages

Power Core's software-defined-hardware approach gives unprecedented choice in specifying and configuring your facility. But no two projects are the same, so Add-On packages are available to customize available features even further. There are packages to extend GPIO, add utility software MiniMixers, increase N-1 and conferencing capacity, add RAVENNA channel capacity, bus panning, and more. Please refer to the detailed chart on the following page to discover all currently available license features and options.

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	NO	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
	Power Core Audio I/O Extension support (AIOX)	YES	YES	NO	YES	YES	YES
AUDIO PROCESSING	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 Power Core Rev1 and Rev2)	Optional Add-On; *see below*			8 GPI x 8 GPO	8 GPI x 8 GPO	8 GPI x 8 GPO
	KSC panel support	YES	YES	YES	YES	YES	YES
	VisTool control	YES	YES	YES	YES	YES	YES
	Logic elements	200	8	4	8	15	15
NETWORKING	GPIO over audio channels	64	64	64	64	128	128
	GPIO NET elements	8	40	40	40	80	80
	External matrix remote control	YES (via Ember+)	YES	YES	YES	YES	YES
	(KPF/ Ember+ / NTP-DOT)						
	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 License Packages							
OPTIONAL	GPIO (only applicable to Power Core Rev1 and Rev2)	8 GPI x 8 GPO	8 GPI x 8 GPO	8 GPI x 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	Available	Available	Available	Available	Available
	Loopback (per 8ch I/O card)*	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks	128 loopbacks
	Aux Pan	N/A	Available	Available	Available	Available	Available
	RAVENNA Plus (only available for Power Core Rev3)	N/A	N/A	N/A	N/A	512/512 channels* (256 streams)	512/512 channels* (256 streams)

Listed numbers with "*" are mono equivalent
Lawo AG reserves the right to change specifications at any time without notice. Last Update: 29 August 2023

SIGNAL PROCESSING - POWER CORE

- Maximum of 96 Input channels, each with Input gain, a signal presence indicator, direct outs, Inserts, Aux sends with Pre/Post switching, pan/balance, AutoGain for each mic input
- 5-parameter equalizer: 3 fully-parametric bands plus 2 semi-parametric bands (can also be shelf, high-pass or low-pass filters. High-granularity EQ with extended "Q" values
- Dynamics: gate, expander, limiter, compression with self-keyed side-chain filter, De-Esser with adjustable trigger frequency
- Maximum of 8 individual AutoMix groups (up to 96 channels each) and 16 VCA groups allow creation of multiple independent mixes
- All sources and all busses may be metered onscreen using EBU R128 Loudness Metering and/or PPM
- Sync delays of up to 5,300 ms with switchable units (meters, milliseconds, frames)
- Up to 80 summing busses depending on license, configurable as Program, Record, Aux, Group, Mix-Minus (clean feed) or General Purpose. A full DSP channel with EQ, Dynamics and Delay functions may be applied to any of these busses (up to 16 stereo or 32 mono busses)
- Channels and busses may be grouped into Stereo and 5.1 Surround bundles

SOFTWARE DEFINED FUNCTIONS

- Some features described are extra-cost options. Power Core may be configured as a pure audio I/O device, mixing console engine, shared core for up to 4 independent mixing consoles (MAX version), or a router with extensive DSP capabilities. Ask your Lawo representative for detailed options and prices.

SYNCHRONISATION

- PTP (IEEE 1588)
- BMCA-PTP interface support
- Wordclock input and output
- MADI input and internal generator
- 48 kHz or 44.1 kHz

STANDARD AUDIO INTERFACES

- 4 MADI (each 64 channels I/O) with SFP cages (MADI ports 1 / 2 and 3 / 4 can be grouped as redundant interfaces)
- 4 RAVENNA / AES67 with SFP (up to 256 bi-directional streams with up to 512 I/O channels in total). May be grouped as redundant interfaces using SMPTE 2022-7 standard or LACP
- ST2110-30 compliant for seamless audio interchange in combined radio / TV broadcast plants
- Some interfaces may not be active with certain license packages. Please consult your Lawo representative for details.

AVAILABLE I/O EXPANSION CARDS

- 8 Mic / Line inputs
- 8 Mono / 4 Stereo Line inputs
- 8 Mono / 4 Stereo Line outputs
- 4 Stereo AES inputs with SRC + 4 AES output (bit-transparent)
- 4 HD-BNC AES inputs with SRC + 4 HD-BNC AES outputs (bit-transparent)
- GPIO: 8 GPI & 8 GPO + 2 VCA inputs
- 2 Mic / Line in + 2 Line out + 2 Stereo Headphone out
- 2 MADI (64 I/O channels each) with SFP cages
- 1 MADI incl. SRC (64 I/O channels) with SFP cage
- 2 DANTE (two redundant connections, 64 total channels)

CONTROL

- RAVENNA / AES67 discovery, connection management, and dynamic stream patching
- Ember+ and RAS control protocols for integration with automation, playout, hybrid and codec applications
- Integration with and control via Lawo VisTool, HOME, VSM, A__ devices, DSA Line Scheduler and RAVENNA matrix server
- Programmable logic core for external "On-Air" tallies, Fader Start commands, Talkback integration and Studio Environment
- IP multicast control protocol in solutions featuring multiple diamond frames and panels
- TCP/IP, CAN, and RS422 control protocols supported

Power Core

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