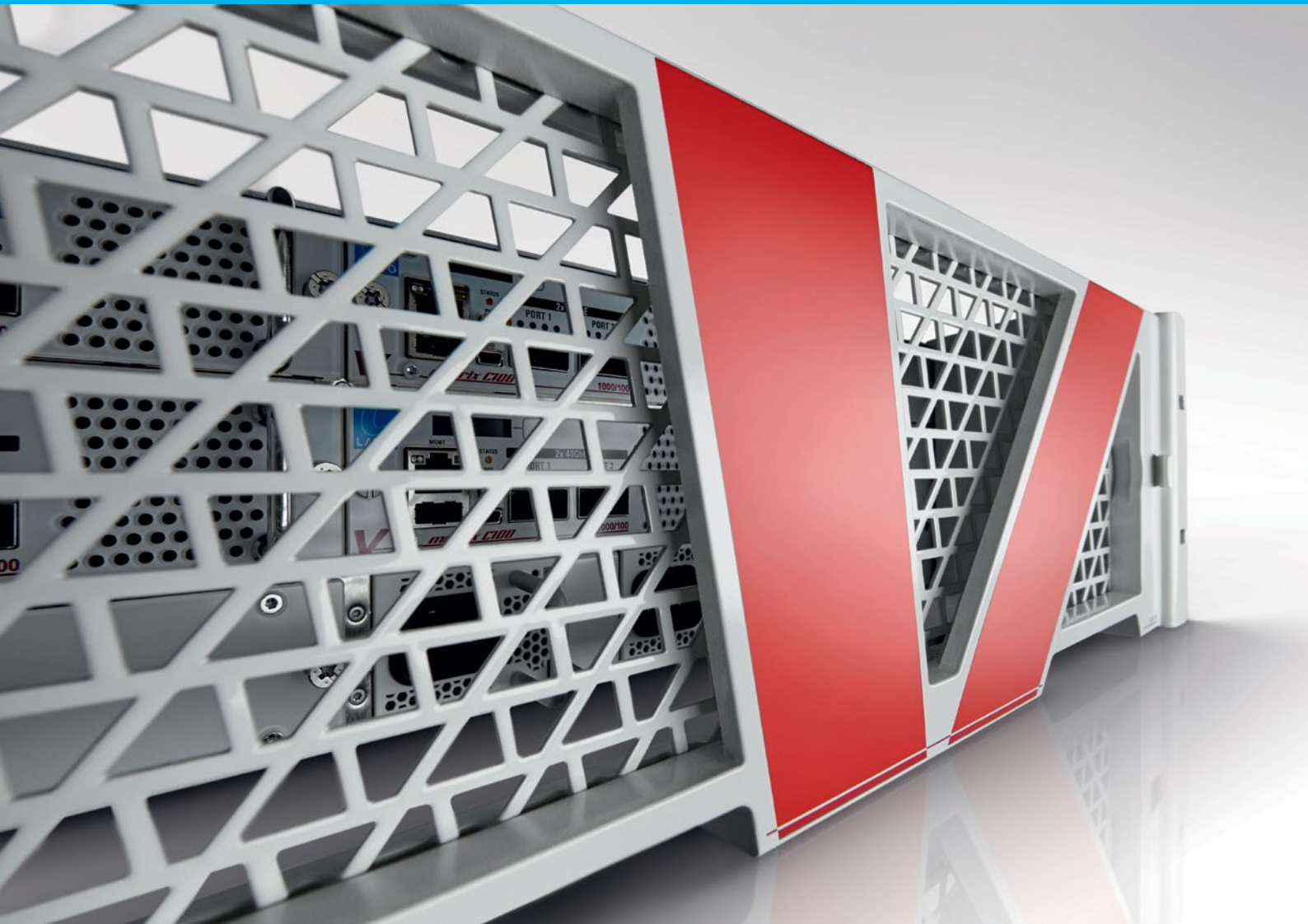


V_matrix



SOFTWARE-DEFINED IP
PROCESSING & MULTI-VIEWING
PLATFORM



FLEXIBLE
FORCEFUL
FUTURE-PROOF



V__matrix

SOFTWARE-DEFINED IP PROCESSING & MULTI-VIEWING PLATFORM

Some call it cloud, some call it virtualization – we call it: V__matrix. This new IP broadcast video core infrastructure product will change your idea of what a broadcast facility looks like from legacy to future, quickly transforming any broadcast installation into a flexible, future-proof production facility, addressing a wide range of workflows and supporting your transition to a totally IP-based environment.

Free from the restrictions of legacy hardware platforms, V__matrix offers a completely virtualized real-time routing and processing infrastructure. Instead of connecting single-purpose modular products in elaborate production chains, the V__matrix is based on the data center principles of flexibility, fabric computing and COTS economics and makes these available to any live production broadcast environment. Whether in an OB truck, a TV studio or a broadcast operation center, V__matrix creates a fully virtualized facility infrastructure.

The V__matrix ecosystem is based on generic, high-capacity FPGA-based processing blades upon which Virtual Modules (VM) are loaded to create the functionality required. Multiple cores are connected through redundant 40GE (or 4x 10GE) Ethernet interfaces to an IP network to form a distributed IP routing and processing matrix that provides frame-accurate, clean switching just like a legacy baseband matrix.

The V__matrix ecosystem scales linearly from tens to thousands of I/O and processing functions, which make it ideal for any size live broadcast facility, small or large. Capabilities easily scale as well. An entire production workflow can be remapped in minutes when requirements change from production to production.

The functionality of any processing blade can be changed, enabling system capabilities to easily be modified or upgraded to address your constantly changing business requirements. The V__matrix pool of generic processing blades provides ultimate flexibility; with software-defined functionality they can be configured and called upon to handle the peaks and troughs of seasonal production demands. With Lawo's innovative licensing model, Virtual Modules can be assigned to a particular processing blade or be stored in an on-site license server allowing for unprecedented flexibility.

PROUDLY SUPPORTING:



lives@HOME

OUR DEFINITION OF FUTURE-PROOF: SOFTWARE-DEFINED HARDWARE

The V__matrix ecosystem can be divided into two parts: the physical and the virtual. The physical consists of the C100 processing blade and associated hardware which provides the compute and processing capacity of the platform. Simply put: the more compute power you have the more functions you can run.

The virtual world is centered on the software: it defines the functionality of the platform. The software packages are called Virtual Modules (VM) and in the V__matrix they allow the function-agnostic core processing hardware to build complex workflows by simply running the appropriate VM—typical broadcast processing functionality normally only found in dedicated hardware is instead defined by the various VMs.

The abilities of the system and the functionality of the signal chains are no longer defined by the hardware and its physical interconnectivity, but rather by the VMs and the way the control system connects multiple VMs together over a COTS IP network to build workflows and processing chains. And as all functions can easily be changed and all VMs are connected to each other over the IP network, these workflows and processing chains can easily be changed on-the-fly during runtime as demands change.

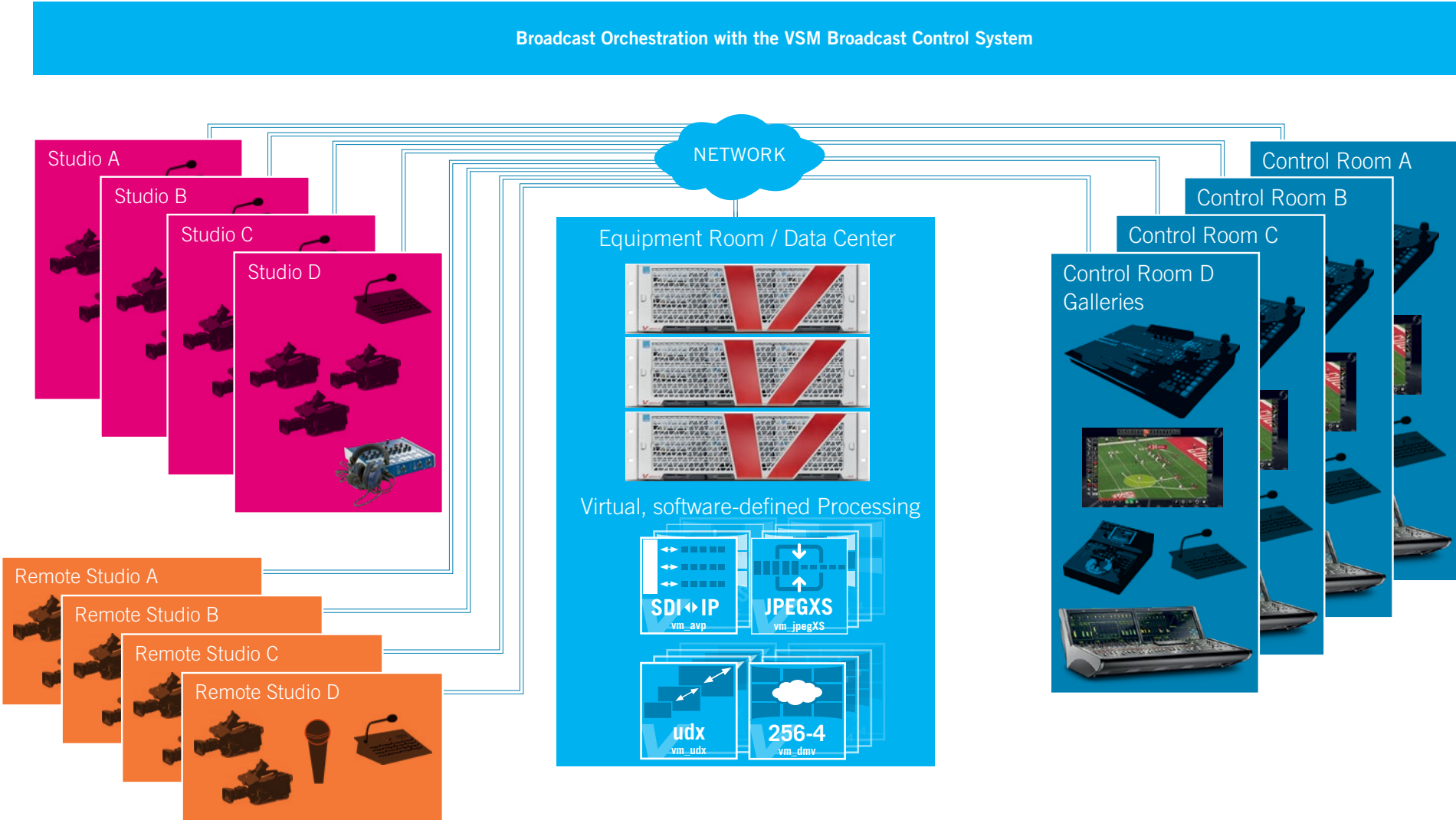
Since V__matrix is a fully IP-based platform, the C100 processing blade can be placed anywhere there is an IP network. It can be decentralized and spread over one or more facilities or centralized in a core facility or OB truck. A hybrid approach is also possible where some core equipment is kept on-site while a pool of processing power is kept in a remote data center. This decentralized approach allows, for example, the technical operation center to be situated in a purpose-built data center in a location where space, power and cooling is inexpensive, while talent and studios can be in another area. V__matrix is

not only game-changing in increasing the flexibility of broadcast installations in OB trucks, fly-away kits or studios – it delivers a truly future-proof core infrastructure based on open standards with significantly less rack-space, less power consumption and fewer restrictions for broadcast operations.

In a nutshell: V__matrix opens the door to an entire format and function agnostic infrastructure that finally provides broadcasters the flexibility and capability to cope with the challenges of the future.

V__matrix KEY FEATURES

- World’s 1st virtualized broadcast ecosystem with software defined functionality based on high-capacity generic compute modules
- Unified routing, processing & multi-viewing core infrastructure. Support for source-timed and destination-timed deterministic frame-accurate clean switching
- Distributed processing over multiple networked processing blades
- Seamless SDI-to-IP migration utilizing one unified control system (VSM)
- High-density IP conversion for legacy SDI equipment (up to 160 I/O in 3RU)
- Optimum utilization of resources: Significantly reduced footprint, power consumption, spare pooling and cabling
- Sophisticated multi-layer redundancy for signal, network, control and hardware layers
- Designed for both decentralized operation and data center style centralized operation
- Fully based on open standards in-line with the AIMS roadmap: ST2110-10/20/21/22/30/31/40, ST2022-6/-7, ST2042 (VC-2), AES67



SMALL NUMBER OF COMPONENTS, A WEALTH OF POSSIBILITIES



V__matrix FRAMES

The V__matrix frames provide power and protected housing for the V__matrix processing blades. Each frame has a dedicated 1GE management port that provides connectivity for control and monitoring to all installed processing modules of the frame. Although the V__matrix ecosystem is designed for IEEE1588 / PTP synchronization, each frame also has a central video reference input (blackburst or tri-level) that optionally distributes sync to each card slot if required.

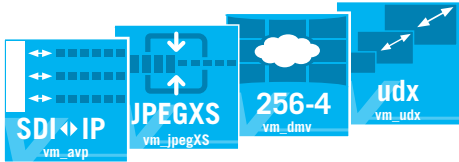
V__matrix frames are available in 1RU, 2RU and 3RU versions, with slots for 2, 5 or 8 C100 processing blades respectively. A 2RU Silent Frame for two V__matrix C100 processing blades is available for applications in noise-sensitive places such as control rooms or audio booths.



V__matrix C100 PROCESSING BLADE

The C100 processing blade forms the powerful epicenter of the V__matrix ecosystem and is the generic compute core upon which all the various virtual modules are loaded. Each blade has dual front-serviceable 40GE QSFP+ ports for connectivity to redundant IP core switches. In addition, each C100 module has a dedicated 1GE management port, a USB port for saving and loading configurations, and a mini-USB serial console port.

The C100 processing blade slots in from the front of the V__matrix frame into the midplane and optionally into a rear-mounted I/O interface plate. In combination with Lawo's VSM Broadcast Control solution, invisible, multiple C100 processing blades form a fully scalable, large, distributed routing and processing ecosystem with software-defined functions, workflows and signal chains.

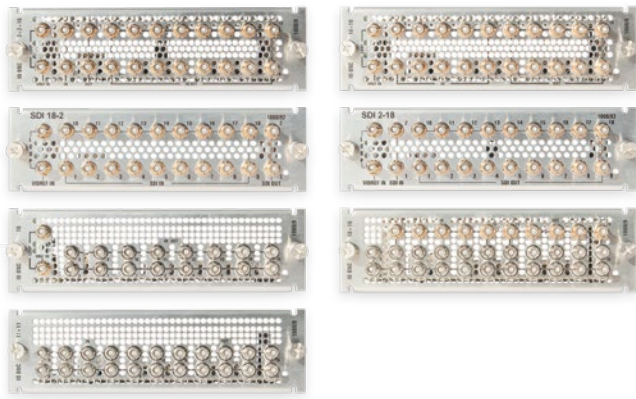


V__matrix_vm VIRTUAL MODULES

The V__matrix Virtual Modules are the brains and intelligence of the V__matrix system allowing the user to build elaborate signal chains that fulfill all processing requirements in a fully virtualized environment. As all V__matrix core functionality resides in the software-based Virtual Modules, the platform is prepared from the start for the development of additional processing functions.

V__MATRIX REAR-PLATE I/O MODULES

The V__matrix rear-plate I/O modules provide additional interfaces on the back of the processing blade. These rear-plates house a variety of application-specific physical interface connectors in order to provide connectivity to legacy broadcast equipment such as baseband video and audio components. All IP native processing functions are automatically handled from the dual front mounted 40GE QSFP+ ports. The design of the V__matrix platform allows the processing blade to be replaced from the front without touching any of the physical connectors on the back, greatly simplifying maintenance.



Like C100 processing blades, rear-plate I/O modules are hot swappable.

* The BNC connectors can also be configured for MADi interfacing (48kHz, 64 channels) by adding the +madi option for vm_avp, vm_pegXS or vm_udx.

AVAILABLE REAR PLATES:

Rear plate	BNC connectors	12G/3G/HD/ SD inputs	12G/3G/HD/ SD outputs	3G/HD/SD inputs	3G/HD/SD outputs	Bidirectional* 12G/3G/HD/SD	Bidirectional* 3G/HD/SD	Analog Ref. input	Ref. Loop
io_bnc_10+10	22	5	5	5	5	0	0	Yes	Yes
io_bnc_2+18	22	1	9	1	9	0	0	Yes	Yes
io_bnc_18+2	22	9	1	9	1	0	0	Yes	Yes
io_bnc_2+2+16	22	0	0	2	2	0	16	Yes	Yes
io_bnc_11+11	22	11	11	0	0	0	0	—	—
io_bnc_16+16	32	11	11	5	5	0	0	—	—
io_bnc_16_BiDi	16	0	0	0	0	16	0	Yes	Yes

(*) Can be configured as either inputs or outputs.

VSM IP BROADCAST CONTROL SYSTEM

Lawo's Virtual Studio Manager (VSM) Control System forms the orchestration and control layer of the V__matrix platform. VSM enables operators to switch and route signal flows in both the IP and the SDI domains. With support for a wide range of 3rd party equipment, VSM is the perfect control system to integrate a V__matrix platform to any legacy broadcast environment. Its intuitive and customizable user interface allows operators to continue working in a familiar environment while production capabilities can gradually migrate to an IP infrastructure at a pace that makes sense both logistically and economically.



Virtual Modules

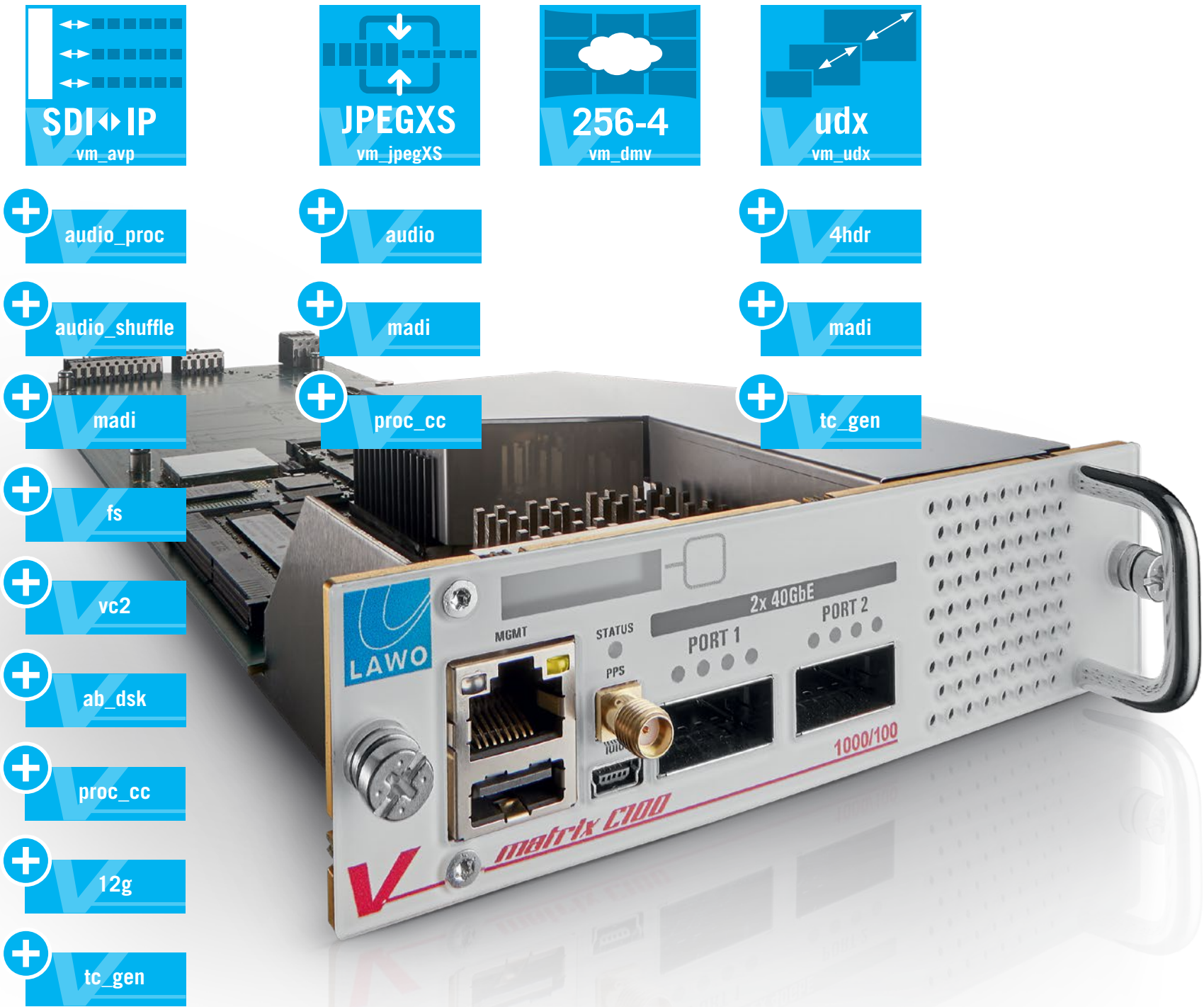
FLEXIBLE SIGNAL CHAINS – FOR TODAY, TOMORROW & BEYOND

If the processing blades are the muscle, the Virtual Modules are the brain of the V__matrix platform. Combining VMs allows the creation of complete production chains fulfilling all broadcast requirements in a fully virtualized environment. As all functions of the V__matrix ecosystem are software-defined it is the ultimate future-proof platform. Changing the functionality of your broadcast plant is as easy as changing the software modules loaded onto the processing blades. By cascading multiple VMs together, the V__matrix scales linearly to up to thousands of SDI I/O and audio/video processing functions for unparalleled scalability, flexibility, versatility and cost-efficiency.

The current line-up of V__matrix Virtual Modules includes the apps shown right.

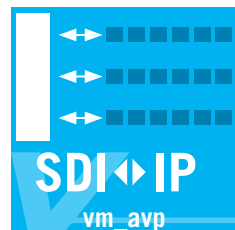


theWALL – SMART DRAG&DROP MULTIVIEWER CONTROL
The V__matrix vm_dmv multiviewer app (see page 16) was designed to be controlled by Lawo's groundbreaking touch-operated configuration system "theWall". This unique HTML5 based GUI makes mosaic configuration with borders, colors, UMDs, tally etc. a simple case of drag and drop.



4K/HDR Streaming & Processing

vm_avp – SDI-to-IP Gateway and more



The V__matrix vm_avp virtual module is a versatile audio and video processing software application that provides routing, processing and glue functionality for the V__matrix ecosystem when loaded on a C100 processing blade.

As base functionality the vm_avp app provides encapsulation and de-encapsulation of 3G, HD and SD-SDI (ST2022-6/7 only) to IP ST2022-6 and ST2110-20/21/30/31/40. With its feature set, vm_avp is the logical choice for both gateway and purely IP-based A/V processing, providing up to 160 SDI<->IP conversions in 3RU.

vm_avp includes ST2022-7 seamless protection switching as standard, IP stream format conversion and frame-accurate video switching using destination-timed clean and quiet switching (MBB & BBM) with audio V-fades during switching.

Designed as a complete IP infrastructure solution the vm_avp app provides a multitude of audio and video processing functions. On the audio side, shuffling and routing as well as audio sample rate conversion and audio gain are available through the +AUDIO_PROC and +AUDIO_SHUFFLE licenses for up to 128TX and 88RX audio transceivers and an internal audio router of up to 5,312 x 5,312.

Users who need to exchange audio signals with a MADI environment can install the +MADI license option and conveniently switch BNC connector(s) on the rear plates from SDI to MADI operation.

The +FS license enables frame syncing and delay for video as well as sample-rate conversion and delay for audio. In response to numerous V__matrix user requests, the FrameSync/Video Delay Processing block features a mode for 12G square-division merging (SQD).

The +VC2 license option equips vm_avp with 20x VC-2/DiracPro ultra low-latency video codecs and supports single-link streaming as well as compression ratios of up to 6.6:1 and 8:1 for monitoring purposes, with less than 20 lines of end-to-end delay. This turns it into a welcome add-on for remote production scenarios where bandwidth is limited and minimal delay is of the essence.

A +AB_DSK option is also available. It adds video mixing and keying to the V__matrix offering by unlocking 8 video mixing/keying instances @3G per vm_avp instance. Each instance can work in one of four modes: AB Mix (blends between two sources), AB Mix Independent (source blending over color matte), LUMA Keyer (linear keying), or LUMA Keyer Advanced (linear keying supporting shaped keying). Multiple instances can be cascaded.

KEY FEATURES

- High-density IP/SDI gateway with up to 160 conversions in 3RU
- 4K/HDR 12G-SDI en-/decapsulation to/from ST2110 as well as conversion between quad-link (2SI) and single-link
- Up to 5,312x5,312 mono audio matrix with full audio embedding/de-embedding and shuffling between SDI/IP, IP/IP and SDI/SDI with ST2110-30/-31/RAVENNA/AES67.
- Provides common glue and processing functionality such as framesync, RGB/YUV color correction, audio gain and test signal generation
- 20 instances of VC-2/DiracPro ultra low latency codec enables high quality ultra-low latency compression
- Designed for WAN environments with hitless merge protection and large receive buffers
- Built-in programming and configuration capabilities
- Deeply integrated management and control through Lawo VSM makes operation imperceptible from a traditional baseband environment while maintaining all of the benefits of an IP system

OPTIONS



audio_proc

This option adds AES67/RAVENNA/ST2110-30/31 audio streams for a total of 40 RX and 40 TX instances as well as 5120 audio level adjustments ($-\infty$ to +24dB) with phase flip and 384 pooled SRCs (mono equivalent). The audio mixing engine supports mono and stereo summing as well as 5.1 > stereo and 7.1 > stereo downmixing. The total summing capability amounts to 2048 mono-equivalent inputs into 256 mono-equivalent summing busses. 20x small audio crossbars.



audio_shuffle

All the specifications of +audio_proc, with additional AES67/RAVENNA/ST2110-30/31 audio streams for a total of 88x RX and 128x TX instances, 5x large audio crossbars, 197 audio essence inputs (1~80 mono-equivalent channels per essence), 100 audio essence outputs (1~80 mono-equivalent channels), and full mono-channel shuffling per crossbar.



madi

Option that allows to use selectable BNC inputs and outputs for interfacing with MADI signals (AES10, 48kHz, 64 channels).



fs

Adds framesync, frame phaser, sample rate conversion and audio/video delay functionality for both IP and baseband video inputs. Pool of approx. 30 seconds @3G assignable across the 24 video delay instances (each 12G 4K signal uses 4 instances). Pool of approx. 49 seconds @16chan@48kHz assignable across 64 audio delay instances). Also provides Dolby-E auto-alignment functionality.



vc2

Option that adds visually lossless VC-2/DiracPro low-latency encoding and decoding (20 pooled instances @ 3G-SDI; 12G 4K signals require 4 instances). ST2042 low-delay profile with RAW headers. Compression configurable between 2.50/3.33/4.00/4.44/6.60/8.00 to 1. Latency < 20 lines.



ab_dsk

Adds video mixing and keying to the V__matrix offering, with 8 video mixing/keying instances @3G per vm_avp instance. Each instance can work in one of four modes. Multiple instances can be cascaded.



proc_cc

Option that adds YUV & RGB color correction, test pattern generator/ inserter, and test tone generator. 8 pooled @ 3G-SDI (a 12G UHD signal uses 2 instances).



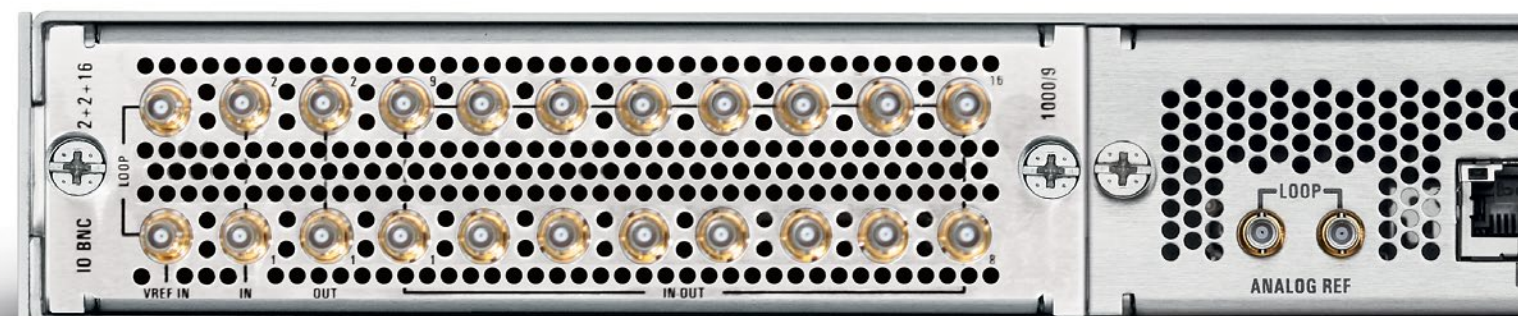
12g

Option that adds support for 12G video standards (2160p 23.976;24;25;29.97; 50;59.94;60Hz SMPTE ST2081, 2082). It also provides cross-conversion and splitting capabilities between UHDTV1 Single-Link and Quad-Link (2SI).



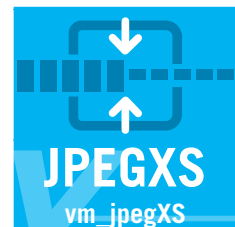
tc_gen

Generates timecode flavors from PTP or other time sources and provides up to 3 independent generators. Generated ancillary timecode (ATC) formats, which can be embedded into TX and SDI outputs, include VITC1, VITC2, and LTC. Linear timecode (LTC) can be generated as a digital audio signal.



JPEG XS Compressed Streaming

vm_pegXS – Interoperable JPEG XS Compression Gateway



In response to strong market demand, the V__matrix ecosystem adds a powerful video compression solution to its future-proof portfolio: vm_pegXS is a dedicated virtual-module app for C100 processing blades that delivers the popular JPEG XS video compression technology.

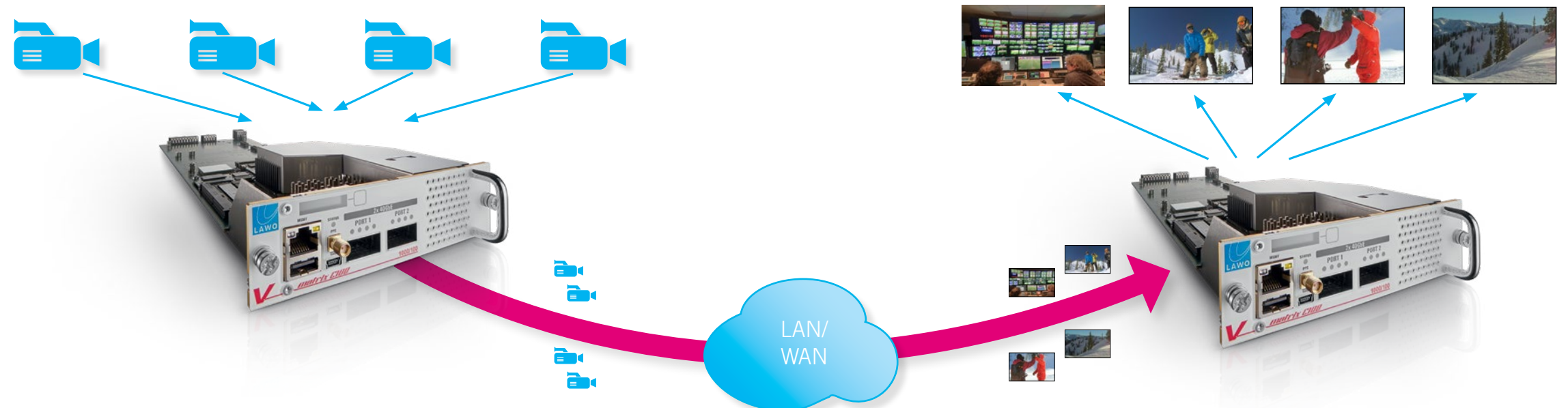
Based on the TicoXS codec (ISO/IEC2112-1-compliant), the vm_pegXS app solves two customer goals: it provides comprehensive ST2110 compatibility for perfect interoperability, and it offers higher video compression ratios.

vm_pegXS provides 4x encoding + 4x decoding from, and to, JPEG XS (ST2110-22). Uncompressed signals can be interfaced with SMPTE ST2110, ST 2022-6 or SDI.

Thanks to its basic feature set derived from other V__matrix apps, vm_pegXS is a versatile audio and video tool with ample processing and glue functionality for V__matrix applications where bandwidth-conscious WAN video transport is required. Audio delay, shuffling, mixing, audio SRC and color correction are included.

This virtual module app supports compression ratios between 5:1 and 36:1. Built-in image-quality optimization modes include Peak S/N Ratio and Visual Optimization.

SMPTE ST2022-7 seamless protection switching, ST2110-30/31 support for IP audio interfacing, ST2110-40 compatibility for ancillary data, IP stream format conversion, and frame-accurate video switching using destination-timed clean and quiet switching (MBB and BBM) with audio V-fades are provided as standard.



Depending on the connected rear plate, vm_pegXS can synchronize to PTP or a video reference. A test pattern (100% color bar) and a test tone generator (1kHz, 440Hz, 400Hz @ -6dB/-18dB or -20dB) are available for convenient audio and video testing purposes.

Optional add-on licenses allow users to unlock additional interfacing and processing features.



audio

This option adds more AES67/RAVENNA/SMPTE2110-30/31 audio streams for a total of 88x RX and 256x TX instances, with 64x audio instances that can be switched between audio delay and Dolby-E aligner; 5120 audio level adjustments from $-\infty$ to +24dB (64 instances of 80 channel bundles); pooled SRCs (max. 384 mono channels), audio mixing with 4 different summing types; 294x audio shuffler instances (one instance with 80x mono ins and 80x mono outs).



madi

Option that allows to use selectable BNC inputs and outputs for interfacing with MADI signals (AES10, 48kHz, 64 channels).



proc_cc

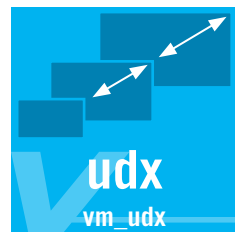
Option that adds YUV & RGB color correction, a test pattern generator/ inserter, and a test tone generator. 8 pooled instances @ 3G-SDI.

KEY FEATURES

- Broadcast-grade low-latency IP and SDI/JPEG XS compression gateway app for V__matrix C100 processing blades
- TicoXS (JPEG XS, ISO/IEC 21122-1 compliant) intra-frame video compression for formats up to 3G.
- Support for IP and SDI sources in 3G, HD and SD—rear plate/format dependent
- Encoding for up to 4x IP video transmitters and decoding for up to 4x IP video receivers
- Compression ratios: 5:1 – 36:1, visually lossless up to 6.66:1

4K/HDR Format Converter

vm_udx – IP Up/Down/Cross and Color Space Converter



The V__matrix vm_udx virtual module is a software application (app) that provides format conversion between SD, HD, 3G and UHD formats in the V__matrix eco-system when loaded on a C100 core processing blade. In addition to up, down and cross conversion the

vm_udx also provides audio embedding/de-embedding, proc amp and RGB/YUV color correction and color space conversion (SDR to/from HDR) functionality.

Designed with IP networking in mind the vm_udx app natively supports both ST2022-6 and ST2110-20 IP video as well as ST2110-30/-31/AES67 and Ravenna IP audio streams. Conversion between IP video and IP audio standards is also possible, e.g. ST2022 to ST2110. To ensure high availability ST2022-7 seamless protection switching is natively supported.

The vm_udx app provides a format conversion engine capable of processing four SD, HD, 3G or one UHD path for IP and/or SDI signals.

Each path provides audio embedding/de-embedding/shuffling functionality. Audio gain, delay and sample rate conversion can be accessed through independent processing blocks, which can be inserted at any point of the processing chain. Equally, eight instances of broadcast quality RGB and YUV color correction and video processing are also available as processing blocks for use by any video source, whether it's SDI or IP, and available both pre- and post-format conversion.

The +HDR option enables four instances of SDR<->HDR color space conversion using 3D LUTs. A large selection of LUTs especially developed for live production is included, and custom LUTs can also be uploaded and used. The included LUTs allow for conversion between SDR and HDR in HLG and PQ.

With the optional io_bnc rear-plates for the C100, connection to legacy SD-, HD-, 3G- and UHD-SDI is possible. vm_udx supports both single-link as well as quad-link (2SI) 12G-SDI.



The +4hdr option adds professional quality High Dynamic Range (HDR) to Standard-Dynamic Range (SDR) conversion using 3D LUTs for both HLG and PQ formats to the vm_udx app. It offers 4 pooled instances @3G (12G UHD signals require 2 instances), a selection of 3D LUTs developed for live production in HLG, and PQ transfer functions. Custom LUTs 12 can also be uploaded.



Option that allows to use selectable BNC inputs and outputs for interfacing with MADI signals (AES10, 48kHz, 64 channels).



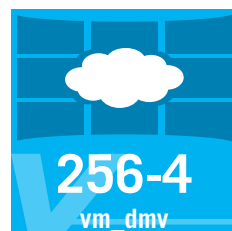
Generates timecode flavors from PTP or other time sources and provides up to 3 independent generators. Generated ancillary timecode (ATC) formats, which can be embedded into TX and SDI outputs, include VITC1, VITC2, and LTC. Linear timecode (LTC) can be generated as a digital audio signal.

KEY FEATURES

- Four instances of up/down/cross conversion between SD/HD/4K (1 instance when converting to/from 4K)
- HDR <-> SDR conversion with 3D LUTs via the +4HDR option
- Audio matrix with full audio embedding/de-embedding and shuffling between SDI/IP, IP/IP and SDI/SDI, with ST2110-30/-31/RAVENNA/AES67 audio support
- Includes RGB/YUV color correction and proc-amp
- 4K 12G-SDI single-link inputs/outputs when combined with the io_bnc rear-plates
- Built-in programming and configuration capabilities
- Deeply integrated management and control through Lawo vsmStudio provides baseband-like operation while leveraging all benefits of an IP system

Distributed 4K IP Multiviewer

vm_dmv – WORLD'S 1ST FLEXIBLY EXPANDABLE MULTIVIEWER



Lawo's vm_dmv is the next-generation multiviewer solution for the V__matrix IP routing & processing platform. It turns the V__matrix C100 software-defined processing blade into a distributed, flexibly expandable, true IP multiviewer.

The vm_dmv multiviewer is based on a distributed architecture where

multiple modules network together. These modules can be hosted together in the same V__matrix frame, in different frames or even at different geographical locations. Basically anywhere as long as they are networked together via IP.

Every vm_dmv has an input stage capable of receiving up to 24 sources in any combination of 4K/3G/HD/SD, which is limited only by the physical connectors (up to 18 SDI inputs) or network I/O (2x 40GbE). These sources are downscaled by the vm_dmv and returned to the network as Lawo LiveView™ IP streams.

In parallel to the input stage, vm_dmv also features an output stage capable of creating up to four 3G mosaics (or one 4K mosaic) with up to 64 PiPs each. The output stage compiles a mosaic from the appropriate LiveView™ streams needed, automatically taking into account the size the user requests for the PiPs. The output stage can use LiveView™ streams that it

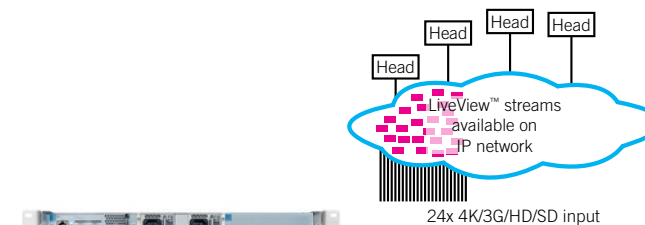
has generated from its own input stage or subscribe to other LiveView™ streams on the network.

As any vm_dmv can use any LiveView™ stream from any other vm_dmv on the network, it scales linearly with each vm_dmv app that is added to the network. This results in an “infinitely” expandable and distributed multiviewer. Adding more heads or sources is a simple matter of adding C100 blades running the vm_dmv app.

The result is not only the world's 1st expandable multiviewer: this solution significantly reduces rack-space, weight and power-consumption. In addition, Lawo's V__matrix platform is already renowned for its software-defined functionality where C100 blades can be retasked at run-time by loading different virtual modules.

KEY FEATURES

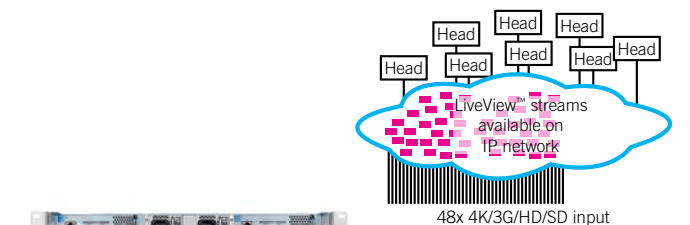
- Broadcast-quality low-latency IP and SDI multiviewer app for V__matrix C100 core processing blades
- Support for IP and SDI sources in 4K, 3G, HD and SD* (*not via ST2110) — rear plate/format dependent
- Designed for monitoring IP video and audio with support for ST2022 and ST2110
- Intuitive control via the touch-supported HTML5 GUI in “theWALL”
- Creates 4 mosaic output heads at 3G or 1 mosaic output head at 12G
- Support for high-density mosaic layouts with up to 64 PiPs per 3G or UHD head
- Unique LiveView™ signal distribution allows for bandwidth-optimized resource sharing across multiple mosaics
- Output heads can be streamed as IP (ST2022 or ST2110) or SDI (using an optional C100 I/O rear plate)
- Unique cluster solution manages all sources and heads in an IP cloud for unparalleled system architecture and scaling flexibility



24-4*

1RU
1x V__matrix C100 processing blade

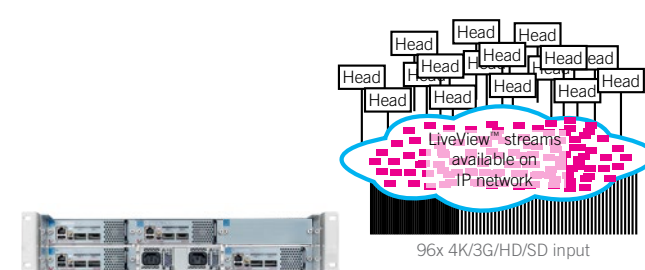
Input Stage: up to 24 x4k/3G/HD/SD signals
Mipmaps created and available: 24
Output Stage: 4x heads with max. 64 sources/PiPs each



48-8*

1RU
2x V__matrix C100 processing blades
(in same frame, different frames, or at geographically distant locations)

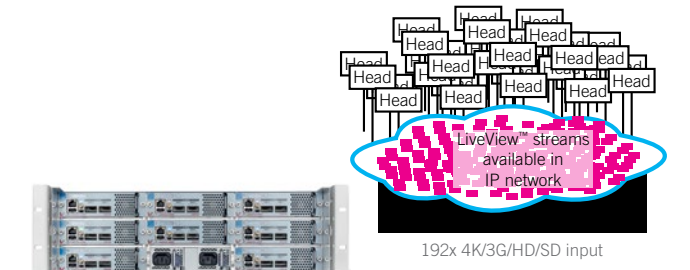
Input Stage: up to 48 x4k/3G/HD/SD signals
Mipmaps created and available: 48
Output Stage: 8x heads with max. 64 sources/PiPs each



96-16*

2RU
4x V__matrix C100 processing blades
(in same frame, different frames, or at geographically distant locations)

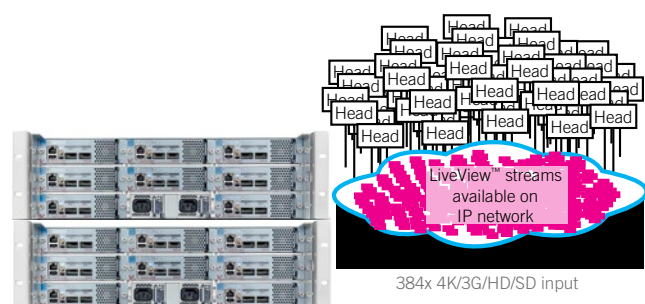
Input Stage: up to 96 x4k/3G/HD/SD signals
Mipmaps created and available: 96
Output Stage: 16x heads with max. 64 sources/PiPs each



192-32*

3RU
8x V__matrix C100 processing blades
(in same frame, different frames, or at geographically distant locations)

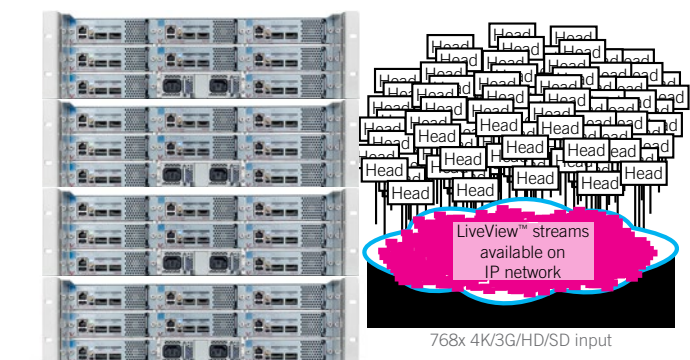
Input Stage: up to 192x 4k/3G/HD/SD signals
Mipmaps created and available: 192
Output Stage: 32x heads with max. 64 sources/PiPs each



384-64*

6RU
16x V__matrix C100 processing blades
(in same frame, different frames, or at geographically distant locations)

Input Stage: up to 384x 4k/3G/HD/SD signals
Mipmaps created and available: 384
Output Stage: 64x heads with max. 64 sources/PiPs each



768-128*

12RU
32x V__matrix C100 processing blades
(in same frame, different frames, or at geographically distant locations)

Input Stage: up to 768x 4k/3G/HD/SD signals
Mipmaps created and available: 768
Output Stage: 128x heads with max. 64 sources/PiPs each

* The number of inputs depends on the video format, the interfacing type, and additional factors. The stated number of heads refers to 3G operation. The quantity of processing blades needs to be calculated based on specific customer requirements.

HARDWARE OVERVIEW

Building a V__matrix solution is incredibly simple. Just choose the number of processing modules and associated Virtual Modules needed to meet your requirements and then populate them into the frame-size that works best for your application, be it a stagebox, an OB truck, a studio or a broadcast operations data center.

V__matrix 2



V__matrix 5



V__matrix 8



V__matrix Silent Frame



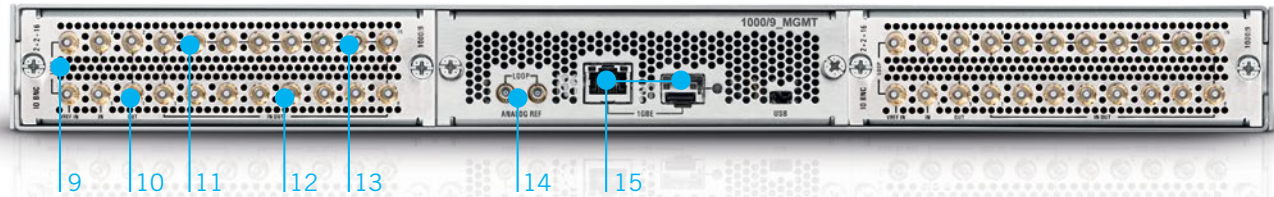
V__matrix 2 – FRONT VIEW (with front cover)



V__matrix 2 – FRONT VIEW (without front cover)



V__matrix 2 – REAR VIEW



- 1 Secure lock
- 2 Integrated cable duct
- 3 1 Gigabit Ethernet (control & monitoring)
- 4 USB port
- 5 Mini-USB as serial console port
- 6 2x 40Gigabit Ethernet (QSFP+)
- 7 Fan
- 8 Redundant power supplies (hot-swappable)
- 9 Video reference input & loop-thru (blackburst or tri-level)
- 10* 5x SDI inputs (12G/3G/HD/SD)**
- 11* 5x SDI inputs (3G/HD/SD)**
- 12* 5x SDI outputs (12G/3G/HD/SD)**
- 13* 5x SDI outputs (3G/HD/SD)**
- 14 Video reference input & loop-thru; blackburst or tri-level distributed via backplane to all I/O modules in a frame
- 15 1x 1 Gigabit Ethernet available through RJ45 or SFP+ for control and monitoring (allows centralized access to all core processing blades in a frame)

* V__matrix_io10+10. Actual input/output configuration depends on type of I/O card.
** The BNC connectors can also be configured for MADI interfacing (48kHz, 64 channels) by adding the +madi option for vm_avp, vm_jpegXS or vm_udx.

VSM and vsmSOUL

UNIFIED CONTROL AND ORCHESTRATION OF
V__matrix, IP AND LEGACY SDI



VSM is the ideal orchestration system for broadcasters with legacy baseband infrastructures that are considering expanding into SDN and IP with a hybrid IP/SDI plant. With support for more protocols and devices than any other control system on the market, VSM makes transitioning from SDI to IP a seamless, step by step process at your own pace without disruption for the operators.

For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager and deeply integrated with the V__matrix. vsmSOUL manages the routing of audio and video streams across any vendor IP network and is compatible across individual interfaces and technical solutions from 3rd party sources.

HITLESS MERGE
A network with vsmSOUL guarantees Hitless Merge (ST2022-7). This requires that a signal is packaged in two different streams and traverses two separate networks, with vsmSOUL acknowledging both branches and stream addresses. Operationally, it appears that a single crosspoint is presented, but with two alarms, two sources and two multicast addresses.

ROUTING STATE RECOVERY
In case of a system failure or reboot, vsmSOUL can recall the network’s routing status. After a reboot, inconsistencies in stream flows are indicated and can be corrected.

SOPHISTICATED REDUNDANCY
Both vsmStudio and vsmSOUL support active-active redundancy, meaning that two systems run in parallel, with the secondary system actively monitoring all system status live. The secondary system is always ready to seamlessly assume control.

POOLING SIMPLIFIES SIGNAL MANAGEMENT
VSM simplifies and automates operation by automatically inserting a free ‘pooled’ device dynamically (such as a frame synchronizer) and automatically setting the device so that the signal arrives at the target in the correct format. These ‘pooled’ devices can include any physical 3rd party device as well as virtual devices and functions of the V__matrix. As broadcast operations are mission critical, if one of the currently used pooled devices should fail, VSM will automatically re-route the signal to another spare device without user intervention.

‘BOXING’ MAKES TRUCKS OR STUDIOS HANDY AS BOXES
As resources become centralized, system capabilities dramatically increase in size, thus becoming difficult to manage. Virtualizing temporary setups of both physical and virtual resources in V__matrix, which can then be recalled to any studio environment in a preset, simplifies resource management even for the largest of systems. “Boxing” the resources into virtual environments means moving complete productions from one studio to another is as simple as one button push – workflow optimization at its best! Any available studio now becomes a backup for a production even if equipment is different – the ultimate disaster/recovery solution.

KEY FEATURES OF vsmSTUDIO AND vsmSOUL

- Perfect integration with Lawo V__line units
- A single control interface for numerous devices – learn one not many
- Dynamic router and IP tie line management that includes transparent Tally logic
- “Boxing” complete studios allows fast switching to emergency backup studios on the fly
- Automatic resource management with administration and user rights
- Combine hardware and software control interfaces for simplified control
- Virtual signal paths provide unbeatable speed and flexibility for a constantly changing environment
- Bundle different signal types together logically to route multiple signals from a device at the press of a button
- Simple and flexible control panel design to adapt to or optimize existing production workflows
- Strong redundancy architecture designed for 24/7 non-stop operation
- Sophisticated SNMP and alarm management to avoid problems before they become critical
- Northbound abstraction of the network through standard router protocols
- Switch-API support southbound, with access to multicast routing
- Agnostic to various switching mechanisms. Supported switching modes: Patching, Make-before-break, Break-before-make...
- Supports ST2110, ST2022-6, ST2022-7, AES67, RAVENNA
- Intuitive GUI for fast configuration

V__matrix

SPECIFICATIONS

V__MATRIX FRAMES

CENTRALIZED VIDEO REFERENCE INPUT

- 1x Analog genlock high definition trilevel sync SMPTE-274M/296M or Analog Genlock SD 1V BB SMPTE-170M/318M or SDI, 1x reference loop-back

CENTRALIZED MANAGEMENT PORTS

- 1x RJ45 100/1000Base-T, 1x SFP slot

FRAME MECHANICS

- DIMENSIONS: (H x W x D): 44/88/132mm, (1/2/3 RU) x 482mm (19“) x 535mm (21“)
- WEIGHT: V__matrix2: 5kg (11lb), V__matrix5: 7kg (15.5lb), V__matrix8: 8kg (18lb)
- INDICATORS: 2x power status per PSU
- POWER: Connector: 2x IEC redundant, Input Voltage: nominal 100-240V, AC +/- 10%, 50/60Hz, Hot swappable: Yes
- MAX. CONSUMPTION: V__matrix2 < 400W, V__matrix5 < 1,000W, V__matrix8 < 1,000W

C100 PROCESSING BLADE

INTERFACES

- 2x QSFP+: Each configurable as 40GE Ethernet or 4x 10GE Ethernet, 1x RJ45 100/1000Base-T Dedicated management port, 1x USB Console port, 1x PPS pulse per second output

VIDEO REFERENCE

- IEEE1588 PTPv2 / SDI / Analog Video Ref (Tri-Level, BB) / IP Vid-stream

PROCESSING

- Max. 36 Gbps of incoming (RX) traffic when in SPS mode or 54 Gbps when in discrete mode.
- Max. 40 Gbps of outgoing (TX) traffic when in SPS mode or 80 Gbps when in discrete mode.

MANAGEMENT AND MONITORING

- PROTOCOLS: HTTP, SNMPv2 & v3, WS/JSON API, Syslog, User interface: Embedded HTML5 user interface, Management interface: Out-of-band and in-band management with guaranteed min bandwidth for inband management & control
- INDICATORS: 1x status LED, 4x status LED: per QSFP+ port, 1x OLED status display: monochrome display with touch point

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: < 90% non-condensing,
- VENTILATION/AIR-FLOW: front-to-back cooling, prerequisite airflow > 26 qbm/h per C100 blade, max 320 qbm
- NOISE EMISSION: < 58 dBA per C100 processing blade,
- ELECTROMAGNETIC ENVIRONMENT: E2 (EN55103-1,-2)

I/O REAR PLATES

CONNECTORS:

- Micro BNC connectors. See page 7 for the number of connectors, the formats they support and whether they support analog reference signals

RETURN LOSS:

- SD: >15dB; HD: >15dB; 3G-HD: >15dB 5MHz-1.485GHz, >10dB 1.485GHz~2.97GHz

CABLE LENGTH:

- SD: >350m (using Belden1694A), HD: >180m (using Belden 1694A), 3G-HD: >120m (using Belden1694A)



LIVE ON AIR...

V__matrix, vm_dmv, theWALL, VSM/vsmSOUL and mc² 96/56 are the building blocks for countless broadcasters and broadcast service providers.

V__matrix

SOFTWARE-DEFINED IP PROCESSING & MULTI-VIEWING PLATFORM

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