V_matrix
SOFTWARE-DEFINED IP PROCESSING & MULTI-VIEWING PLATFORM

FLEXIBLE
FORCEFUL
FUTURE-PROOF
INTRODUCTION

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.

SOFTWARE-DEFINED IP PROCESSING & MULTI-VIEWING PLATFORM

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.
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.

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: ST2110-10/2021-22/30/31/40, ST2022-6/-7, ST2042 (VC-2), AES67

System Overview

Broadcast Orchestration with the VSM Broadcast Control System
**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.

**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.

*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.*

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(*) Can be configured as either inputs or outputs.
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 **_matrix** *vm_avp* virtual module is a versatile audio and video processing software application that provides routing, processing and glue functionality for the **_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 AV 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.

Text continues.

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**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 (→ 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 276 mono-equivalent summing busses. 20k small audio crossovers.

**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.

**audio_shuffle**

All the specifications of *audio_proc*, with additional AES67/RAVENNA/ST2110-30/31 audio streams for a total of 188 RX and 128 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).

**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 (5G).

**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 @16ch@48kHz assignable across 64 audio delay instances. Also provides Dolby-E auto-alignment functionality.

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In response to strong market demand, the V__matrix ecosystem adds a powerful video compression solution to its future-proof portfolio: vm_jpegXS 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_jpegXS app solves two customer goals: it provides comprehensive ST2110 compatibility for perfect interoperability, and it offers higher video compression ratios.

vm_jpegXS 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_jpegXS 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.

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; 512x audio level adjustments from –∞ 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).

VM芗matrix
VIRTUAL MODULES: COMPRESSED STREAMING

JPEG XS Compressed Streaming
vm_jpegXS – Interoperable JPEG XS Compression Gateway

Depending on the connected rear plate, vm_jpegXS 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.

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 platter 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

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 at 3G (12G UHD signals require 2 instances), a selection of 3D LUTs developed for live production in HLG, and PQ transfer functions. Custom LUTs can also be uploaded.

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 vm_udx app 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.
## Distributed 4K IP Multiviewer

vm_dmv – WORLD’S 1ST FLEXIBLY EXPANDABLE MULTIVIEWER

Lawa’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-SDI, 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 “infinite” 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 re-tasked 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 plateformat 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

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* 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.

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**V__matrix 2**

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 40 Gigabit Ethernet (QSFP+)
7. Fan
8. Redundant power supplies (hot-swappable)
9. Video reference input & loop-thru (blackburst or tri-level)

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**V__matrix 5**

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)

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**V__matrix 8**

* V__matrix 8xI/O. Actual in/out 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. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager. For control of the V__matrix, Lawo’s Seamless Orchestration and Unification Layer (vsmSOUL) is the ideal orchestration manager.

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.

POOLED 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 pushing one button – 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.

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.

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**V__matrix**

**SPECIFICATIONS**

**V__MATRIX FRAMES**

**CENTRALIZED VIDEO REFERENCE INPUT**

- 1x Analog genlock high definition tri-level 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 / 132 mm, (1 / 2 / 3 RU) x 482 mm (19") x 535 mm (21")
- **WEIGHT:** V__matrix2: 5 kg (11 lb), V__matrix5: 7 kg (15.5 lb), V__matrix8: 8 kg (18 lb)
- **INDICATORS:** 2x power status per PSU

**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

**ENVIRONMENTAL SPECIFICATIONS**

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

**I/O REAR PLATES**

**CONNECTORS:**

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

**CABLE LENGTH:**

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

**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

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