VN-Matrix®

REAL-TIME STREAMING OVER IP NETWORKS

Low Delay, High Quality AV Streaming and Recording Solutions

PURE 3® CODEC
OPTIMIZED FOR NETWORKS

▶ PURE3 codec for interactive, real-time streaming applications

▶ Supports resolutions up to 1920x1200 and 1080p/60 with 4:4:4 color space

▶ Extremely low latency – encode and decode are 35 ms each

▶ Choice of Constant quality or Peak bit rate and other controls for bandwidth optimization

▶ Error concealment provides immunity from network errors

Extron® Electronics
INTERFACING, SWITCHING AND CONTROL

Introduction

Traditionally, the routing and distribution of video, audio, and graphics content for AV presentation has been accomplished through the use of hardware-based matrix switchers such as the Extron CrossPoint Series. This distribution method requires the use of a dedicated cable plant, fixed endpoints, and bounded input and output capacity. The Extron VN-Matrix® takes the one-to-one, one-to-many, many-to-many flexibility of the traditional matrix switcher and extends it to standard IP networks, making possible the real-time transmission of high resolution audio visual content without the restrictions of geography or I/O size. The VN-Matrix encodes video or graphical image content at resolutions up to 1080p/60 and 1920x1200, delivers it across the network, and decodes it back to the original source resolution, utilizing the revolutionary Extron PURE3® Codec, a unique wavelet-based compression technology optimized for AV presentation, monitoring, and collaboration.

The Extron PURE3 codec addresses many of the challenges associated with AV streaming by providing equal support for video and computer graphics sources. It offers a unique combination of high image quality, low latency, efficient bit rates, and a high immunity to network errors, making the VN-Matrix ideal for use in remote collaborative, live events, and high-level conferencing applications. VN-Matrix can be used on uncorrected networks and provides visually lossless picture quality to support applications where high definition video or high resolution computer graphics are shown on large displays and applications with the most demanding quality requirements.

The VN-Matrix offers a number of tools designed to optimize image quality and effectively manage network bandwidth requirements. Error Concealment ensures reliable video quality, even without a corrected network connection. Both unicast point-to-point and multicast one-to-many transport protocols are supported. VN-Matrix simplifies complex systems by integrating streaming of video, graphics, audio, and control signals over existing network infrastructure, and can be more economical and easier to deploy than dedicated point-to-point systems with very large scale or long transmission distances.

The Rise of Streaming Media

The Evolution of Networking protocols, hardware, and infrastructure has caused a dramatic rise in the consumption of streamed video. The popularity of streamed content has mirrored the progression of video playback technology and is attributable to video being easily accessible on personal computers, netbooks and tablet PCs, cell phones, and many other platforms.

VN-Matrix is ideally suited to fulfill a very wide range of demanding applications that require streaming and playback of high quality images with exceptionally low latency, including:

Control Rooms: For broadcast, surveillance, command and control, and monitoring

Training and Education: For real-time visualization and simulation environments

Contribution & Collaboration: For broadcast, post-production, scientific, military, product design, oil and gas exploration

Computer Graphics	HD Video	Recording
• Visual Collaboration • Command and Control • Virtual Switching and Routing on Networks	• Video Contribution • Remote Multiviewer Monitoring • Remote Video Device Control	• After Action Review • Training and Simulation • Documenting and Archive

PURE3® Codec

The Extron PURE3® Compression Codec

The PURE3 codec was developed for use in IP streaming solutions to deliver performance that could not be fulfilled using other video compression technologies. The PURE3 codec targets very high image quality, low latency, highly efficient bit rates, and a high immunity to network errors. PURE3 delivers all of these qualities together. Alternative compression technologies typically target specific applications and sacrifice one or more of the qualities delivered by PURE3. For example, a low bit rate is targeted in one product, but at the expense of latency and vulnerability to network errors. Another product is positioned to deliver very high quality and low delay, but at the cost of high bit rates. All IP streaming products must contend with the fact that networks experience errors and packet loss. The most common method of dealing with this is to apply forward error correction. This adds latency and bandwidth overhead, which makes fulfilling real-time applications more challenging.

The PURE3 codec meets a unique set of performance objectives for supporting interactive, real-time communication with demanding image quality requirements streaming video or computer graphic inputs. PURE3 fulfills the following performance criteria:

Visually Lossless Image Quality
The PURE3 codec utilizes DWT – discrete wavelet transform, rather than the more common DCT – discrete cosine transform, to achieve the best results with both moving pictures and computer graphic images. By using DWT, full 4:4:4 sampling ensures that image detail is not lost in the transform process. The result is highly efficient, visually lossless coding of images. In addition, the PURE3 codec supports the capture and preservation of both video and computer graphic formats at their native resolution, aspect ratio, and frame rate, maintaining all of the pixel detail and motion. This ensures accurate reproduction of any input format or resolution.

Low Latency
The PURE3 codec performs its transform with a single pass through the data, delivering low and consistent latency. Encode and decode are 35 ms each.

Highly Efficient Compression
The PURE3 codec uses a highly efficient method of compression profiling that exploits the visual perception characteristics of the human eye to optimize compression efficiency. Through the use of compression profiles, the user can determine the degree and nature of compression so that it may be optimized for both the target bit rate and the streaming application.

Users can select between Constant, Peak Bit Rate, and other controls to fit the available network performance. By controlling the rate at which data is released to the network, short, high bursts of data are avoided, minimizing the possibility of overloading switching and routing equipment, and the possibility of lost data.

Advanced Error Concealment
Real-world, switched, IP networks are prone to unpredictable bit errors, jitter, and out-of-order or dropped data packets. The PURE3 codec includes an Error Concealment system that ensures robust picture delivery for video streams. The system retains picture data from previous frames that are used as a reference point for subsequent frames. If an error in the data stream occurs, the retained picture data is used to conceal the error until new image data is received from successive frames. The PURE3 error concealment system maintains video imagery under heavy packet loss and the errors are rarely visible. When errors occur, only a small portion of the picture is affected and the duration is typically very short. In applications where real-time video is delivered from dedicated connections to switched and routed IP networks, the stability that the PURE3 error concealment system provides is a clear benefit to the user.

SME 100
H.264 Streaming Media Encoder
Applications that call for standards-based H.264 encoding can use the SME 100 to stream live video or computer video to a variety of decoding platforms. Potential applications include:

AV Systems: For systems monitoring or meeting/lecture overflow delivery

Corporate or Enterprise Broadcast: For corporate, educational, or government facilities

Integration with Content Delivery Networks: Delivering video broadly across the Internet in commercial, government, or consumer applications

MODEL	VERSION	PART#
SME 100	DVI, RGB & Video Over IP H.264 Encoder	60-1061-01

Application 1: Video Collaboration

Video collaboration and peer or client review needs are common to industries ranging from financial services to scientific to film and video post-production. Organizations and businesses have highly skilled personnel located at great distances from each other or their customers. In this application, for post-production content review, account management and the customer are able to work collaboratively in real-time, allowing the completion of work faster and more efficiently than possible travelling to meet or using traditional communication methods. While in this example, collaboration is required between New York and Los Angeles, the end points could just as easily be New York and London, or Los Angeles and Tokyo.

Workflow

The creative staff at a New York-based production facility has prepared content and is ready to play it for client review. In Los Angeles, account management meets with the client to review and discuss the content. Because of the nature of the work, HD-SDI video with embedded multi-channel audio is required for the review.

Delivery and Functional Requirements

Network switches supporting Layer 3 switching in the local area networks and an enterprise WAN will connect the two facilities. Sustained bandwidth of up to 100 Mbps may be required through the full connection path to support streaming of high definition video at full frame rate and full fidelity. Far lower bit rates can be used if the content is standard definition video or if work can be carried out at slower frame rates. Codecs must be configured to operate within defined bit rates when in use.

Very low delay must be maintained so that as individuals are discussing and working at each location, they are both referring to identical material. IP networks do not guarantee 100% packet delivery, so the streaming solution must maintain a stable picture, with reliable picture quality, even under packet loss conditions.

System Design Solution

Video production equipment is used to prepare and play back high definition video content with embedded audio, which is presented on color-accurate, broadcast quality flat panel displays. The displays are capable of presenting 1080p video with 10-bit color depth and 4:2:2 color information. The monitors are frequently color corrected to ensure the truest color is presented.
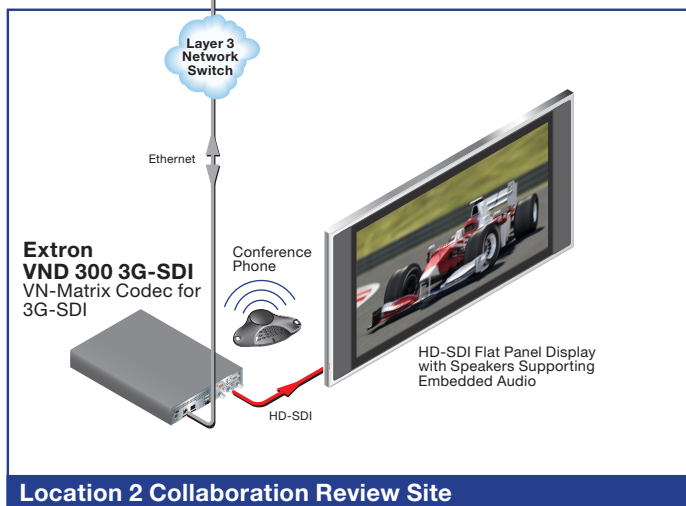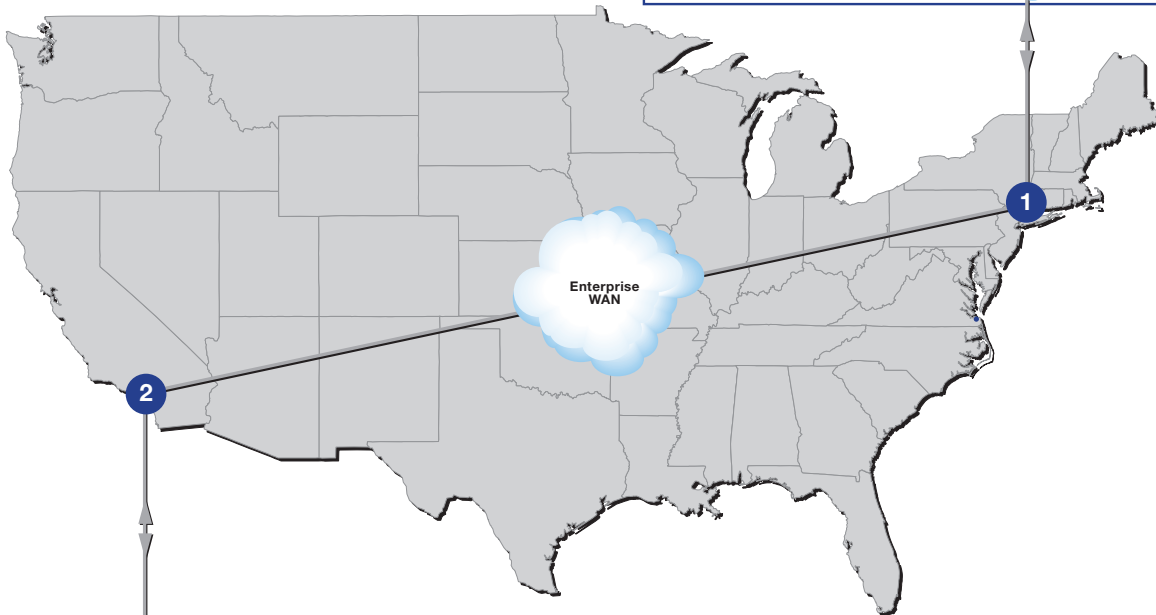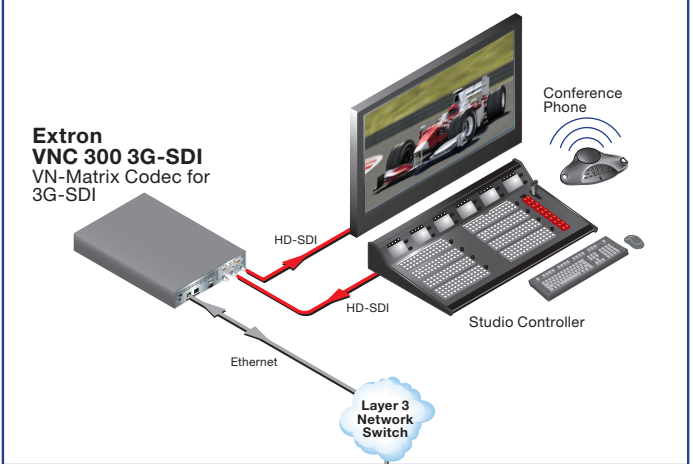
At the production facility in New York, Extron **VN-Matrix 300** Codecs for SDI, HD-SDI, and 3G-SDI employing the PURE3 codec are used to interface the video production equipment with the network. HD-SDI with embedded audio is encoded with low, 35 ms delay. The encoder maintains the 10-bit, 4:2:2 color information contained in the HD video signal, critical to preserving the image quality that will be delivered to the far location. A variety of compression and bit rate controls allow delivery of the best picture at the required bit rate.

Professional LAN switches with Layer 3 switching and routing capabilities, and 1000BaseT network connections are interfaced to the VN-Matrix codec. A firewall at each location and an enterprise WAN ensure that the SD or HD video can be delivered at the sustained bit rates required, up to 100 Mbps. Network bandwidth for the production quality HD video may range from 50 to 90 Mbps; a block of four audio channels requires an additional 16 Mbps.

In Los Angeles, Extron VN-Matrix 300 Codecs are used to decode the audio and video signals rapidly, with only 35 ms needed to decode the stream. Audio and video are synchronized, and the low delay of the video stream across the network ensures that when individuals at both sites discuss the material, they are both referring to the same piece of content. Error concealment in the PURE3 codec maintains a reliable, stable picture even when bit errors, jitter, or lost packets are experienced on the network. Image compression is visually lossless, preserving full image resolution, color depth, and color space. Broadcast-quality, HD-SDI flat panels are used for client review. The monitors are capable of presenting 10-bit color depth and are color-corrected to ensure accurate reproduction of the decoded video signal.

Location 1 HD Video Production Equipment

**Extron
VNC 300 3G-SDI**
VN-Matrix Codec for
3G-SDI

Conference
Phone

HD-SDI

HD-SDI

Studio Controller

Ethernet

Layer 3
Network
Switch

1

Enterprise
WAN

2

Layer 3
Network
Switch

Ethernet

**Extron
VND 300 3G-SDI**
VN-Matrix Codec for
3G-SDI

Conference
Phone

HD-SDI Flat Panel Display
with Speakers Supporting
Embedded Audio

HD-SDI

Location 2 Collaboration Review Site

The United States Federal Government and Department of Defense rely on a major U.S. defense contractor to manage large aeronautic, defense, space, and IT programs. Many of these programs conduct real-time collaborative experiments, training missions, or operations that use information supplied from facilities across the US. The ability to view identical situation awareness and operational imagery simultaneously at locations thousands of miles apart is critical to unifying team effort during these events.

Workflow

Specially-trained staff and equipment for simulation, training, visualization, and audio visual presentation systems are located at different facilities, and cannot be moved to a single location. Each site is equipped with computers and image-generating equipment, which create detailed and sophisticated imagery. Inputs include standard definition video, multi-graphic windowing processors and a variety of computer resolutions from 1024x768 to 1920x1200. Content is presented on a variety of flat panels, large screen projection systems, or videowall displays at each site.

Delivery and Functional Requirements

The defense contractor's IT department manages the network traffic, security, encryption, and usage policies. Customer data must remain secure, and bandwidth produced by image streaming must remain within defined limits. Network encryption equipment exists at each location where sensitive data and experiments are conducted.

The streaming solution must allow equipment operating at each site to operate independently with local control or as an enterprise solution with multiple sites linked together on a temporary basis. Devices must be controllable from any endpoint location.

Each site may contribute one to five video/graphic signals, which are available for viewing at any of the other sites. The capability to encode or decode is required so each endpoint can be reconfigured for different applications. One presentation may require a site to send more information than receive, and another event may require the opposite. Content can be any video or graphic resolution, and include full-motion or static images. The streaming codecs must be capable of preserving the desired quality and holding the bit rate to defined limits. Images must be presented at native resolution whenever possible. Far end displays may or may not be the same resolution as the source.

Finally, documentation and archiving of the experiment or training exercise is desirable. Audio and video/graphic imagery, presented on multiple screens, is to be recorded and played back, maintaining tight synchronization screen to screen, preserving the original resolution, detail, and quality experienced during the real event. Recorded material must be exportable for use in media player or video playback files for use in training or promotional materials.
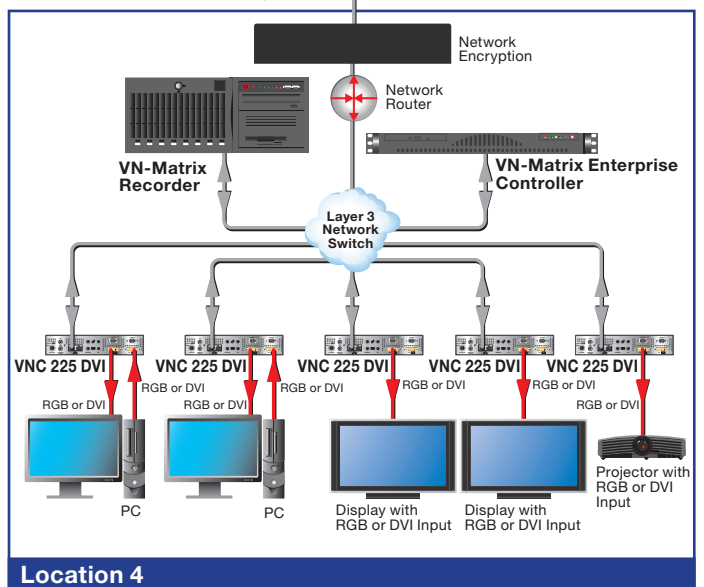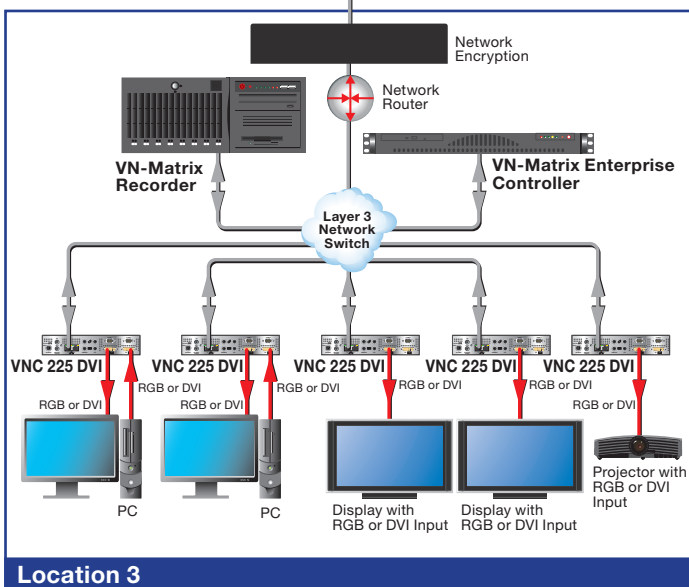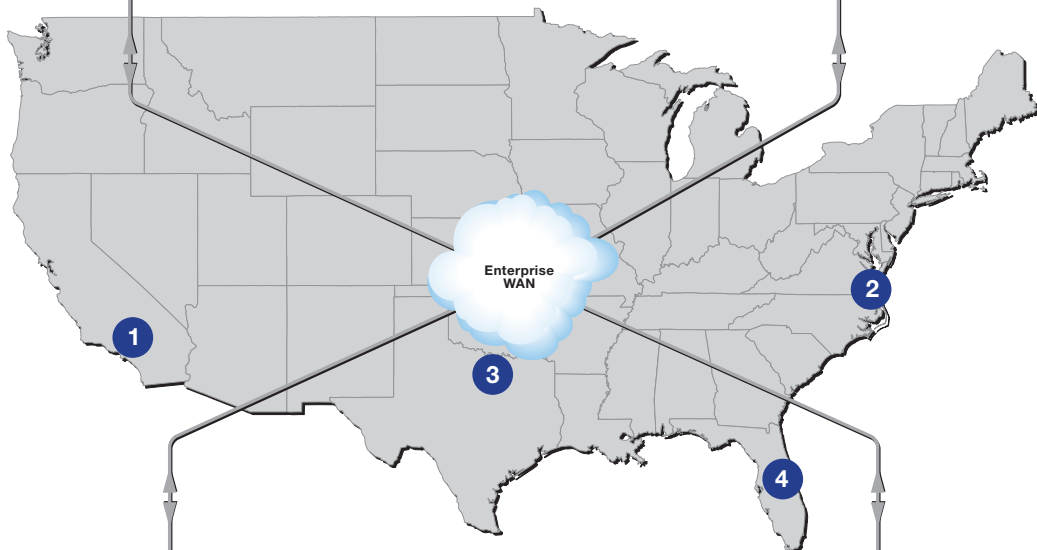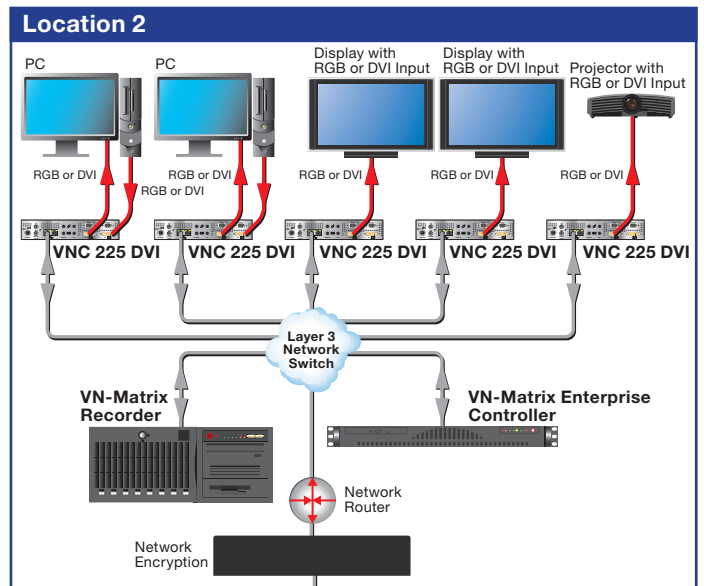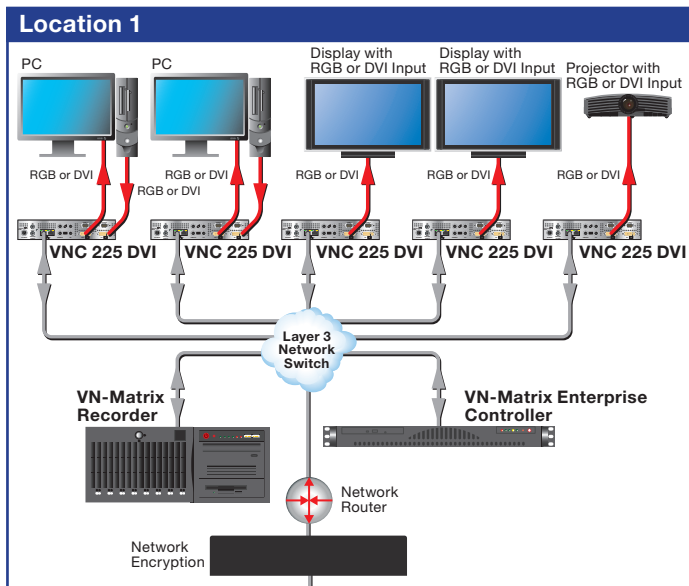
System Design Solution

Extron **VN-Matrix 225 DVI & RGB** over IP Codecs, capable of acting as encoders or decoders and employing the PURE3 codec, are located at each site. They are interfaced to the simulation systems and high resolution computers with RGB or DVI-D outputs. S/PDIF digital audio signals are interfaced directly to VN-Matrix 225 Codecs. Inputs are encoded rapidly in 35 ms at the native video/graphic resolution. Full 4:4:4 color resolution is preserved to ensure that single pixel detail is maintained. A variety of compression and bit rate controls manages streaming bandwidth. Many video/graphic signals are limited to 1 - 5 Mbps bit rate. Other high-motion inputs containing video or simulator motion may be set to 15 - 25 Mbps.

VN-Matrix Recorders are interfaced to the network in both primary and remote locations, and are configured to record and play back streaming data from up to five encoders. All PURE3 streams use RTCP - Real-time Transport Control Protocol and are time stamped. This, coupled with absolute frame coding, allows playback of multiple streams maintaining close synchronization. A content export tool allows selected material to be converted to sequential JPEG Frames for use in video editing systems or media player files.

Extron VN-Matrix 225 Codecs decode the audio and video/graphic signals rapidly with a 35 ms decode process. The error concealment system in the PURE3 codec preserves a reliable, stable picture even when network bit errors are experienced. VN-Matrix 225 Codecs supply RGB or DVI inputs to flat panels, projection displays, and multi-graphic processors at native resolution or scaled to the display resolution. Audio that is decoded is interfaced to digital S/PDIF audio inputs or converted to analog through S/PDIF-analog converters.

Systems comprised of multiple VN-Matrix units are easily managed by a **VN-Matrix Enterprise Controller**, which can also be configured into a redundant system using a second unit for mission-critical applications. An Enterprise Controller can be configured as a system master, managing a local system of VN-Matrix units and other sites during larger experiments. External control systems can interface with the Enterprise Controller to manage switching of inputs to outputs across multiple systems as though they are one large routing switcher.

Location 1

PC   PC   Display with RGB or DVI Input   Display with RGB or DVI Input   Projector with RGB or DVI Input

RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI

VNC 225 DVI   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**

Layer 3 Network Switch

VN-Matrix Recorder   **VN-Matrix Enterprise Controller**

Network Router

Network Encryption

Location 2

PC   PC   Display with RGB or DVI Input   Display with RGB or DVI Input   Projector with RGB or DVI Input

RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI

VNC 225 DVI   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**

Layer 3 Network Switch

VN-Matrix Recorder   **VN-Matrix Enterprise Controller**

Network Router

Network Encryption

Enterprise WAN

1

2

3

4

Location 3

Network Encryption

Network Router

VN-Matrix Recorder   **VN-Matrix Enterprise Controller**

Layer 3 Network Switch

VNC 225 DVI   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**

RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI

PC   PC   Display with RGB or DVI Input   Display with RGB or DVI Input   Projector with RGB or DVI Input

Location 4

Network Encryption

Network Router

VN-Matrix Recorder   **VN-Matrix Enterprise Controller**

Layer 3 Network Switch

VNC 225 DVI   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**   **VNC 225 DVI**

RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI   RGB or DVI

PC   PC   Display with RGB or DVI Input   Display with RGB or DVI Input   Projector with RGB or DVI Input

Contemporary worship centers deploy large format projection systems, large scale audio systems, and broadcast-quality video production equipment to enhance the worship experience. As congregations grow, streaming technology is utilized to extend the experience, particularly the reach of a charismatic teaching pastor, to satellite worship centers. Streaming technology helps to connect the worship centers in real time and bring sermons to a broader audience over IP networks.

Workflow

Because of the immediate, live, and non-repeatable nature of the worship service, full-time and volunteer staffs manage the lighting, audio, video production, and projection systems utilized during worship. On occasion, pre-produced high definition and standard definition video may be incorporated into the service as well, often with synchronized audio.

Delivery and Functional Requirements

Satellite congregations may be located 20 to 50 miles from the primary worship center. A combination of public and private IP networks is used to connect the worship centers. Sufficient bandwidth must be available to support the delivery of both high definition and standard definition video, and multiple audio channels. Video streaming equipment must be configurable to operate within defined bandwidth limits.

Large format displays are used in both the primary and satellite worship centers. An immersive audio-visual experience is desired to help foster the connection between the teaching pastor and the remote congregations. Any artifacts or degradation of the imagery will detract from that experience.

Very low delay is required to support interaction between sites, allowing both local and remote congregants to interact as if they were worshipping in the same space.

The audio and video must maintain reliable delivery and quality, even if network errors are experienced or data packets are dropped. Audio and video presented on the far end must maintain lip-sync for the video and if multiple video streams are sent, they must be synchronously locked.

System Design Solution

A combination of standard definition and high definition broadcast video cameras are used to capture the worship service. Real time production equipment delivers video with effects and graphic overlays, and mixed and equalized audio is embedded into the digital video signal.
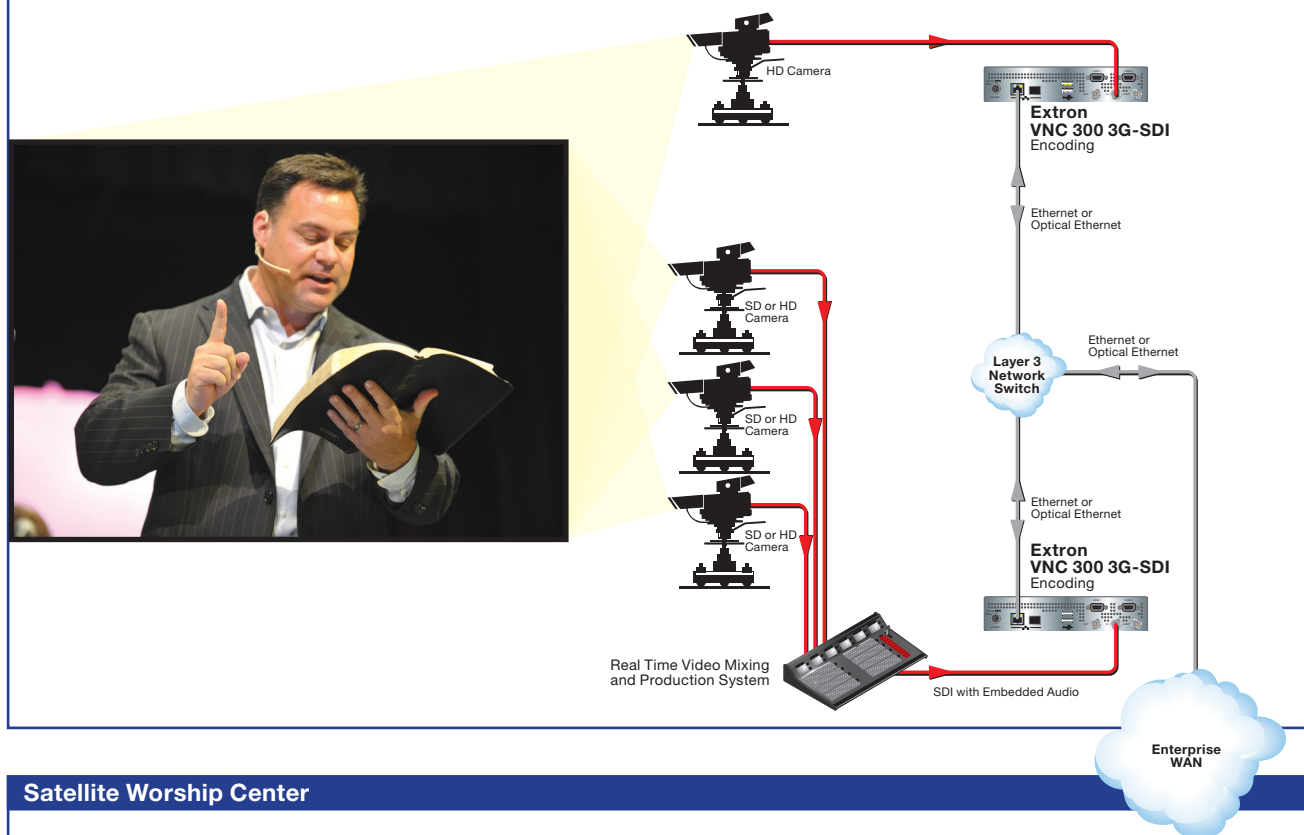
Extron **VN-Matrix 300 3G-SDI** Codecs, employing the PURE3 codec, are used to interface the program feed supplied from the video production system. Video is encoded with low, 35 ms delay and the encoder preserves the 10-bit, 4:2:2 color information contained in the serial digital video signal, critical to maintaining the image quality that will be delivered to the far locations. The VN-Matrix 300 Codecs are interfaced to a Local Area Network to deliver the audio/video streams. A variety of compression and bit rate controls allow delivery of the best picture possible at the available network bandwidth.

High-quality Local Area Network switches with Layer 3 switching and routing capabilities and 100/1000BaseT network connections are interfaced to the VN-Matrix codecs. Codecs operate behind firewalls securing them from external threats. The network connection provides 150 Mbps bandwidth to support the high definition video bit rate, which may be between 50 to 90 Mbps; a block of four audio channels requires an additional 16 Mbps. SD video may require 15 to 20 Mbps and a block of four audio channels of embedded audio uses 8 Mbps.
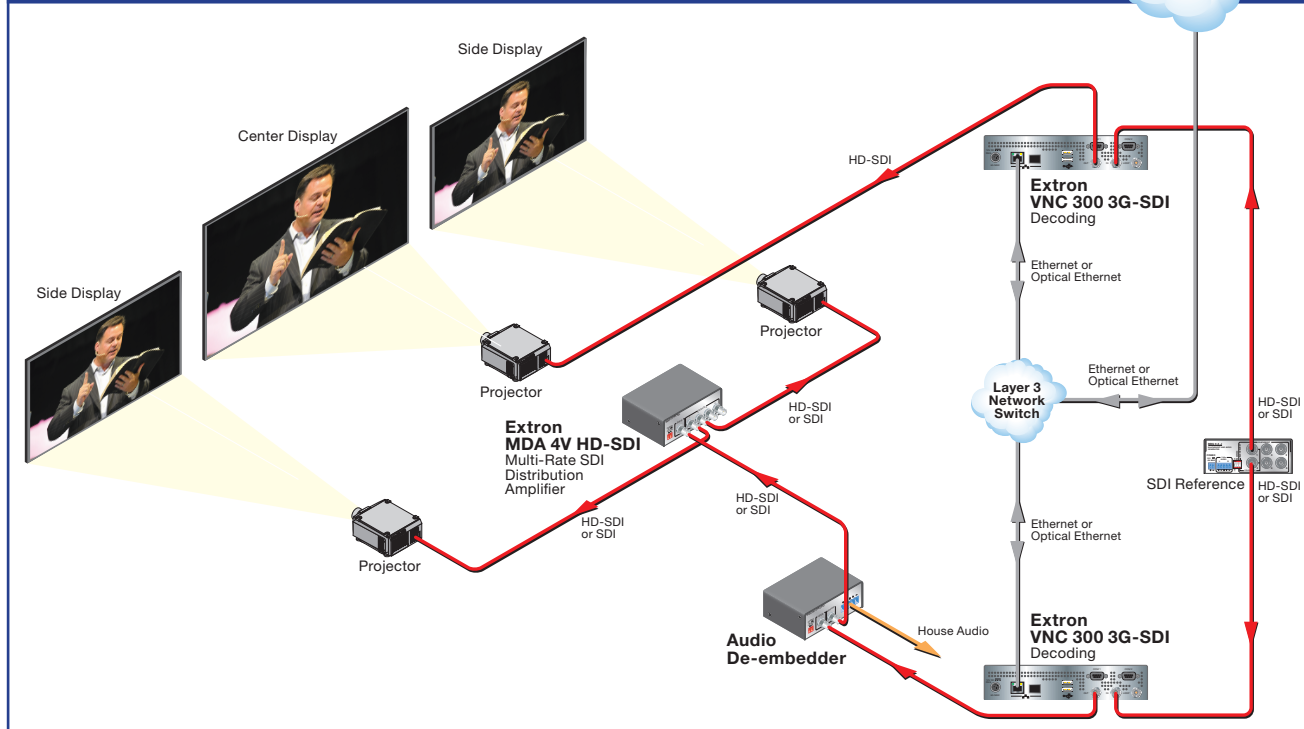
In the satellite worship centers, Extron VN-Matrix 300 3G-SDI Codecs are used to decode the audio and video signals rapidly, with a 35 ms decode process. The low delay supports natural interaction between congregants in the primary and satellite worship centers. Error concealment in the PURE3 codec preserves a reliable, stable picture even when bit errors, jitter, or lost packets are experienced at the decode point. Audio and video delivery is synchronized and multiple decoders are genlocked by connecting a serial digital video reference signal with the same format to each unit. Visually lossless image compression by the VN-Matrix 300 codecs and PURE3 error concealment ensures a very high quality image will be presented on very large screens.

A large format, 1080p projector with HD-SDI input serves as the primary display in each of the worship centers. The large display is flanked by smaller screens to ensure clear lines of sight for all congregants.

Central Worship Center

HD Camera

**Extron
VNC 300 3G-SDI**
Encoding

Ethernet or
Optical Ethernet

SD or HD
Camera

SD or HD
Camera

SD or HD
Camera

Ethernet or
Optical Ethernet

**Layer 3
Network
Switch**

Ethernet or
Optical Ethernet

Ethernet or
Optical Ethernet

**Extron
VNC 300 3G-SDI**
Encoding

Real Time Video Mixing
and Production System

SDI with Embedded Audio

**Enterprise
WAN**

Satellite Worship Center

Side Display

Center Display

HD-SDI

**Extron
VNC 300 3G-SDI**
Decoding

Side Display

Projector

Ethernet or
Optical Ethernet

Projector

**Extron
MDA 4V HD-SDI**
Multi-Rate SDI
Distribution
Amplifier

HD-SDI
or SDI

Ethernet or
Optical Ethernet

**Layer 3
Network
Switch**

HD-SDI
or SDI

Projector

HD-SDI
or SDI

HD-SDI
or SDI

SDI Reference

HD-SDI
or SDI

**Audio
De-embedder**

House Audio

Ethernet or
Optical Ethernet

**Extron
VNC 300 3G-SDI**
Decoding

Application 4: Videowall Recording

Videowalls or multi-display systems are often employed to conduct and monitor real-world events or experiments in which the content displayed can be a combination of real-time sources such as simulators, various data acquisition and measurement systems, remote cameras, live television broadcasts or webcasts, and more. The ability to record, document and replay such presentations can be highly valuable for analysis, training or insurance purposes, since re-creating the event or experience is impractical or too expensive.

Workflow

The real-time video, data and visualization material from television, cameras, computers or simulation systems are presented on the videowall in a variety of arrangements during operational events, experiments or capability demonstrations. At the start of each event, recording of the audio and video presented on the videowall is initiated. Later, this material is played back and in real time, at higher speeds or frame by frame for analytical review or re-presentation of the event to individuals not present earlier.

Recording and Playback Functional Requirements

The system must be capable of recording and playing back the high resolution computer video outputs from a multi-screen processing system plus accompanying audio. Audio and video material must be synchronized and the video playback across screens must maintain a close synchronization screen to screen. The recording system must have a simple user interface to record or select presentation events to playback as well as an analytical interface that allows non-real-time playback at high speeds or frame by frame. Tools must exist to export video material in formats supported by common video production systems or viewing of live streams from PCs.
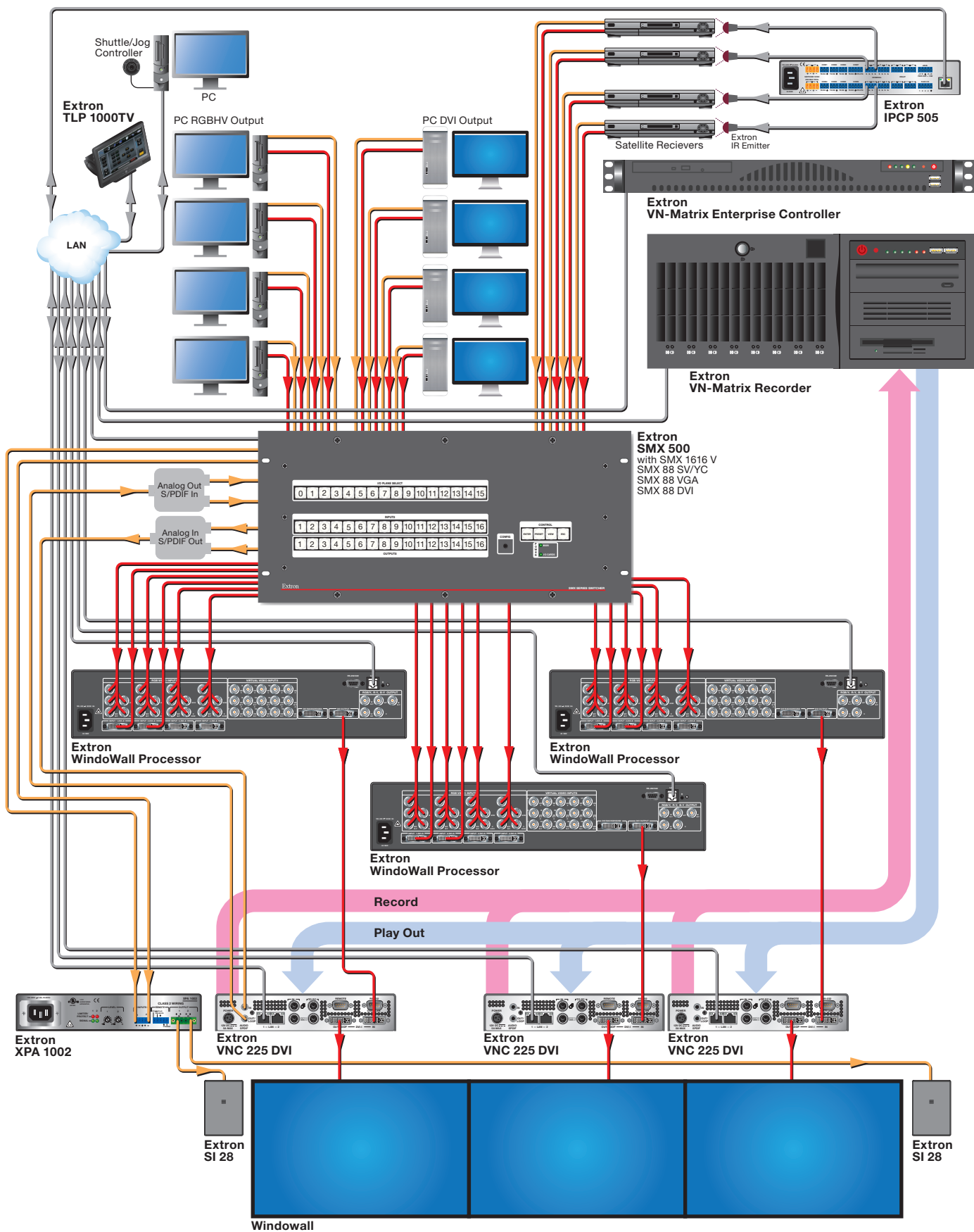
System Design Solution

The display system to be recorded is a 1x3 WindoWall® videowall with multiple video and computer video inputs. The WindoWall presents a wide variety of windowed image combinations, presenting up to 12 different images across the three screens at resolutions which may be from 1024x768 to 1920x1200. VN-Matrix 225 codecs are interfaced to the WindoWall outputs and the loop out connection is supplied to the projectors. When an experiment or event is underway, **VN-Matrix 225** units operate as encoders streaming audio and video to the **VN-Matrix Recorder** over a Gigabit LAN in the PURE3 format. Later, after the event is over, After-Action-Review and forensic data review is conducted by streaming the video from VN-Matrix Recorder to the VN-Matrix 225 units which are reconfigured as decoders. VN-Matrix Recorder provides over 30 hours of content storage using 50 Mbps for each of the three streams. Network Attached Storage - NAS can be added to provide inexpensive archive storage.

Playback of the three PURE3 streams maintains a close frame synchronization screen to screen. This is accomplished through absolute frame encoding and use of RTP - Real-time Transport Protocol and RTCP - Real-time Transport Control Protocol which apply timestamps to the streamed data packets managed by VN-Matrix Recorder. VNM Recorder provides a tool to export sequential JPEG frames for use in video production systems and streams can also be viewed using VNM Software Decoder on PCs.

Audio is recorded in and played out synchronized with the video streams through analog-to-S/PDIF converters. An Extron VNM Enterprise Controller provides system control over the VN-Matrix codecs and VNM Recorder as a system. An Extron TLP 100TV TouchLink™ touchpanel interface and IPCP 505 IP Link® Control Processor manage the VN-Matrix system through the VNM Enterprise Controller as well as other AV system elements. A dedicated PC with a jog/shuttle controller provides full analytical control over the playback of the system through the VNM Enterprise Controller via a high level interface protocol. With the jog/shuttle controller, a user can quickly scan through recorded content by going forward or jumping back at speeds such as 2x or 4x real-time speed, or slowly advancing forward or backward frame-by-frame.

This recording solution maintains the high spatial detail of the original high resolution content along with full motion support. The image documentation quality combined with the easy-to-use record and playback interface and non-real-time playback control of the jog/shuttle interface provides a powerful tool for reviewing highly detailed multi-source, multi-screen presentation systems.

Shuttle/Jog
Controller

PC

**Extron
TLP 1000TV**

PC RGBHV Output

PC DVI Output

Satellite Recievers

Extron
IR Emitter

**Extron
IPCP 505**

LAN

**Extron
VN-Matrix Enterprise Controller**

**Extron
VN-Matrix Recorder**

**Extron
SMX 500**
with SMX 1616 V
SMX 88 SV/YC
SMX 88 VGA
SMX 88 DVI

Analog Out
S/PDIF In

Analog In
S/PDIF Out

I/O PLANE SELECT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

INPUTS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

OUTPUTS

CONTROL

Extron

SMX SERIES SWITCHER

**Extron
WindoWall Processor**

**Extron
WindoWall Processor**

**Extron
WindoWall Processor**

Record

Play Out

**Extron
XPA 1002**

**Extron
VNC 225 DVI**

**Extron
VNC 225 DVI**

**Extron
VNC 225 DVI**

**Extron
SI 28**

**Extron
SI 28**

Windowall

VN-Matrix Series

VN-Matrix® 225 Series
DVI & RGB Video Over IP Encoders & Decoders

The VN-Matrix® 225 Series provides real-time transmission of high resolution audio visual content across standard IP networks for live viewing, collaboration, storage, and playback. The VN-Matrix 225 Series encodes video or graphics sources at resolutions up to HD or WUXGA, streams the video and audio over an IP network, then decodes the content back to the original source resolution. VN-Matrix applies Extron's PURE3® Codec, a unique wavelet-based compression technology. The VN-Matrix 225 Series offers real-time performance and low latency, making it ideal for remote collaborative and interactive or control applications. It can be deployed in live event streaming and high level collaboration for specialized projects.

FEATURES:
- Supports up to WUXGA resolution 1920x1200
- HD video over IP up to 1920x1080p
- Low delay streaming - 35 ms encode and 35 ms decode
- Supports refresh rates from 24 to 85 Hz
- Dual 1 Gigabit network interfaces
- Compatible with the VN-Matrix Recorder for real-time recording, storage, and playback
- S/PDIF digital audio interface
- Extensive bit rate management
- Analog RGB, Component HD, or DVI-D input
- Analog RGB or DVI-D output
- High immunity to network errors

VNC 225 DVI
Codec for DVI-I, Audio/Keyboard/Mouse

UNIQUE FEATURES:
- Switchable encoder/decoder
- Supports DVI-I video, S/PDIF digital audio, RS-232, and keyboard & mouse command data

MODEL	VERSION	PART#
VNC 225 DVI	Codec for DVI-I, Audio/Keyboard/Mouse	60-1118-02

VNE 225 DVI
Encoder for DVI-I & Digital Audio

UNIQUE FEATURES:
- Encoder-only model
- Supports DVI-I video and S/PDIF digital audio

MODEL	VERSION	PART#
VNE 225 DVI	Encoder for DVI-I & Digital Audio	60-1119-02

VND 225 DVI
Decoder for DVI-I & Digital Audio

UNIQUE FEATURES:
- Decoder-only model
- Supports DVI-I video and S/PDIF digital audio

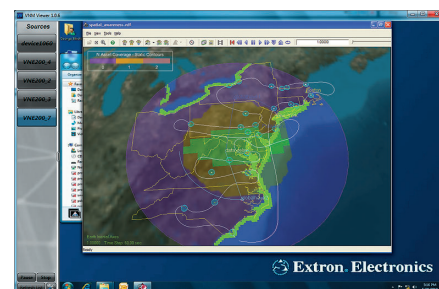| MODEL	VERSION	PART#
VND 225 DVI	Decoder for DVI-I & Digital Audio	60-1120-02

VNM Software Decoder
Software Decoder for VN-Matrix®225 Series

The VNM Software Decoder application lets users view live PURE3® streams on a PC. The streams can originate from VN-Matrix 225® encoders as well as any active playback streams from VNM Recorder. The VNM Software Decoder application includes a plugin that operates with Windows Media Player to decode PURE3 streams. VNM Software Decoder identifies and lists available VN-Matrix encoders and any active playback streams from VNM Recorder in buttons which can be selected for viewing in the application window. Connections to VN-Matrix 225, PURE3 streams can also be initiated from the embedded VN-Matrix Web browser interface.

FEATURES:

- Operates in conjunction with Microsoft® Windows Media Player
- Software decoder application provides basic source selection
- Decodes content from VN-Matrix 225 products
- Compatible with Microsoft® Windows
- Installs quickly and simply on any standard PC
- Install decoder on as many endpoints as desired
- Number of live decodes is licensed
- For use on LANs or private networks supporting multicast traffic

MODEL	VERSION	PART#
VNM Software Decoder	VN-Matrix 225 Series Software Viewer	29-098-01

VN-Matrix® 300 Codec
SDI, HD-SDI & 3G-SDI Over IP Codec

The VN-Matrix® 300 Codec streams SDI, HD-SDI, and 3G-SDI video over IP networks. It produces excellent image quality at highly efficient bit rates with low latency. The VN-Matrix 300 Codec utilizes Extron's PURE3 Codec which exceeds many of the performance characteristics of existing compression formats, delivering visually lossless imagery with low latency providing exceptionally robust protection against network errors, making it ideal for quality-critical application.

FEATURES:

- Streams serial digital video with embedded audio
- Supports 3G-SDI, HD-SDI, SDI video, and embedded audio
- Video Bit Rates from 6 Mbps to 150 Mbps
- 10-bit YCrCb 4:2:2 encoding
- Supports resolutions up to 1080p/60 Hz
- Low latency streaming - 35 ms encode and 35 ms decode
- Codec switchable between encode and decode operation
- Decoder Genlockable and frame-lockable to external SDI reference

MODEL	VERSION	PART#
VNC 300 3G-SDI	Codec for SDI, HD-SDI & 3G-SDI	60-1124-01

VN-Matrix Recorder

The VN-Matrix® Recorder is a network appliance used to digitally record and play back high-definition computer graphics, video, audio, and data streams encoded to the IP network via VN-Matrix units. The Recorder is ideally suited for any VN-Matrix application requiring the documentation, archive, review, and playback of highly-sophisticated or demanding imagery.

Up to five PURE3® streams can be recorded or played back simultaneously per Recorder. PURE3 streams recorded together will maintain tight synchronization on playback. Link multiple Recorder units together for applications requiring more than 5 streams.

FEATURES:

- Records multiple visually lossless PURE3 encoded IP streams
- Record or play back up to 5 PURE3 streams simultaneously
- Digitally record and playback video, audio, & data
- Mission-critical imagery
- Networked storage architecture makes systems scalable and flexible
- Link multiple recorder units together for applications requiring recording for more than 5 streams.
- Playback controls include: search, locate, variable speed playback - forward and reverse, single frame advance.

Model	Version	Part#
VNM Recorder	Recorder	60-1121-01

VNM Enterprise Controller

The **VN-Matrix® Enterprise Controller** is a dedicated controller for VN-Matrix systems. Enterprise Controller simplifies management of large VN-Matrix deployments, providing the ability to view, manage, and dynamically control multiple VN-Matrix systems and networked VN-Matrix domains from a single user interface.

Every VN-Matrix system includes a basic embedded Web browser interface for configuring the operational settings for encoders and decoders. This interface is useful when control is limited to a few units and the system is configured and left in a fixed operational state. Enterprise Controller provides greater processing capacity that is required to efficiently manage, configure, and dynamically control large VN-Matrix systems. The Enterprise Controller allows all devices in a system to be organized and sorted based on different properties such as: unit status or type, operating mode, source, controller, or firmware version. Units can be selected into groups allowing configuration properties or firmware to be uploaded in one action. Multiple Enterprise Controllers can be configured in a system to provide control over independent domains of VN-Matrix units or one large system.

Two VN-Matrix controllers can be configured together as a redundant system for mission-critical applications. One unit is configured as the primary unit and the other as a secondary unit. System data is synchronized between them. The secondary unit continually monitors the primary unit's system health and takes over control seamlessly when required. Control is returned to the primary unit in the same manner if the system health of the secondary unit requires it, maintaining transparent communications and control over the VN-Matrix system.

The VN-Matrix Enterprise Controller is required if:

• More than 10 VN-Matrix units are configured into a system

• VN-Matrix Recorder is integrated into a system

• A system of VN-Matrix units are interfaced to an external control system requiring dynamic control of the units in a switching solution

• Preset configurations must be prepared and recalled

• Multiple domains of VN-Matrix units must be configurable into one large system or independent clusters

Features

• Monitor, configure, and manage all VN-Matrix and VN-Matrix Recorder units as a system

• High level interface provides single point of control for external control systems

• Manage multiple VN-Matrix systems in combined or independent domains

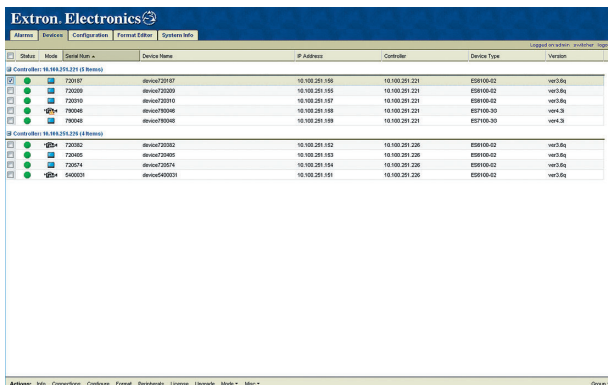• Provide redundant control for mission-critical applications

Model	Version	Part#
VNM Enterprise Controller	VN-Matrix Enterprise Controller	60-1133-01

VN-Matrix Enterprise Controller Device Manager page

VN-Matrix Enterprise Controller Switcher utility connects encoder inputs to decoder

VN-Matrix Series Accessories

VNM PS
VN-Matrix Replacement Power Supply

FEATURES:
- Replacement or spare power supply for VN-Matrix 225 or VN-Matrix 300 units

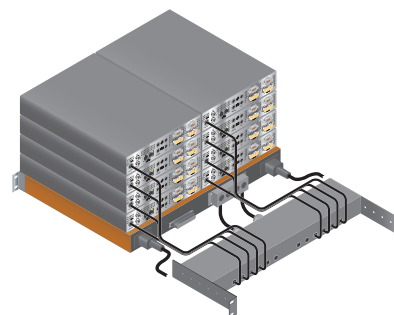| MODEL	VERSION	PART#
VNM PS	VN-Matrix Replacement Power Supply	70-761-01

VNM 12 PS & VNM 12 PSR
12 Unit Power Supply

The VN-Matrix® 12-Unit Power Supply provides an efficient method to connect redundant power to multiple VN-Matrix codecs, encoders, or decoders in 19" equipment racks. The 1U frame houses hot-swappable power supply modules and a 12-way breakout panel attaches to the rear of the equipment rack. Cables are provided for use between the breakout panel and encoder/decoder units.

FEATURES:
- Compatible with VN-Matrix codecs, encoders, and decoders
- Provides redundant power to multiple VN-Matrix encoder/decoder units in a single equipment rack
- Simplifies rack mount wiring
- Modular, hot-swappable design enables fast replacement without powering down the entire system

MODEL	VERSION	PART#
VNM 12 PSR	12 Unit Power Supply with Redundancy	70-762-01
VNM 12 PS	12 Unit Power Supply	70-763-01

VN-Matrix 225 Mounting Hardware Accessories

MODEL	VERSION	PART#
MBU 149	1U Full Rack Low-Profile Mount Kit	70-222-01
MBD 129	1U 1/4, 1/2 Rack Width, Through-Desk Kit	70-077-02
RSU 129	1U 9.5" Deep Universal Rack Shelf, Gray	60-190-01

Extron
VNC 225 DVI
VN-Matrix Codec

Extron
RSU 129
1U Univerisal Rack Shelf
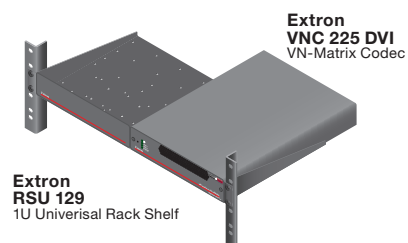
VN-Matrix 300 Mounting Hardware Accessories

MODEL	VERSION	PART#
VNM Dual RMK	VNC 300 Dual Rack Mount Kit -Front Plate	60-1129-01
VNM Dual RMK	VNC 300 Dual Rack Mount Kit - Shelf	60-1130-01
VNM Quad RMK	VNC 300 Quad Rack Mount Kit - Shelf	60-1131-01
VNM MBU	VNC 300 Under Desk Mounting Bracket	60-1132-01

Extron
VNM MBU
VN-Matrix Under-Desk
Matrix Mounting Kit

Extron
VNC 300 3G-SDI
VN-Matrix Codec 3G-SDI
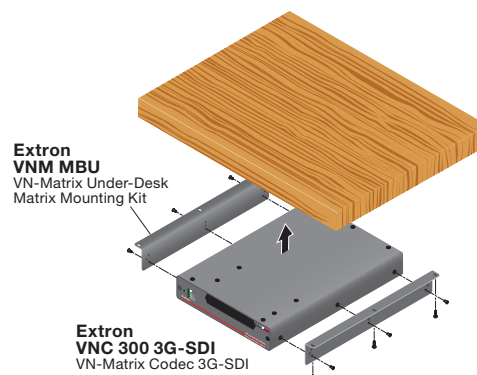
Specifications

VN-Matrix 225 Series

VIDEO INPUT

Number/signal type	1 DVI-I: analog RGBHV, RGsB, HDTV component video or single link digital DVI (DVI-D)
Resolution range	640x480 to1600x1200, 1920x1200 (with reduced blanking) @ 23.97 Hz to 85 Hz Also 525i, 625i, 720p, 1080i, 1080p

VIDEO PROCESSING

Digital sampling	24 bit, 8 bits per color, 165 MHz standard
Analog sampling	205 MHz
Colors	16.78 million
Compression	PURE3® Codec
Frame rate delay	35 ms (70 ms encoding/decoding)
Bit rate	1 Mbps to 200 Mbps
Bit and frame rate control	Selectable
Frame rate	Up to 60 fps @ 1080p

VIDEO OUTPUT

Number/signal type	1 DVI-I: analog RGBHV, RGsB, or single link digital DVI

SYNC

Input type	RGBHV, RGsB, bi-level component video
Output type	RGBHV

AUDIO INPUT/OUTPUT

Number/signal type	1 S/PDIF
Source formats	PCM encoded audio, AES/EBU

CONTROL/REMOTE — Local Host — Codec, Encoder, Decoder

Serial control port	(1) RS-232, male 9-pin D connector, for host configuration
Keyboard/mouse ports VNC 225 DVI	2 PS/2 mouse ports: 1 input, 1 loop through 2 PS/2 keyboard ports): 1 input, 1 loop through
Ethernet control ports	2* female RJ-45
System control	VN-Matrix Enterprise Controller, VN-Matrix Enterprise Retundant Controller, VN-Matrix Web server

NETWORK TRANSPORT

Ethernet data rate	10/100/1000Base-T, half/full duplex with autodetect
Ethernet protocol Streaming Transport All supported	 RTP, RTCP TCP, UDP (unicast or multicast) ICMP (ping), IP, TCP, RTP, RTCP, UDP, DHCP, HTTP, SNMP V3, Telnet

GENERAL

Power supply	External Input: 100-240 VAC, 50-60 Hz Output: 12 VDC, 5 A, 60 watts
Power consumption	30 watts nominal, 60 watts max.; 12 VDC
Temperature/humidity	Operating: +41 to +95 °F (5 to +35 °C) / 10% to 85%, noncondensing
Enclosure	1.7" H* x 8.75" W x 12.2" D (1U high, half rack wide) (4.3 cm H* x 22.2 cm W x 30.9 cm D)
Product weight	4.1 lbs (1.9 kg) each
Regulatory compliance Safety EMI/EMC	 CE, c-UL, UL CE, C-tick, FCC Class A, ICES, VCCI
Warranty	3 years parts and labor

Model	Version Description	Part number
VNC 225 DVI	Codec for DVI-I, Audio/Keyboard/Mouse	60-1118-02
VNE 225 DVI	Encoder for DVI-I & Digital Audio	60-1119-02
VND 225 DVI	Decoder for DVI-I & Digital Audio	60-1120-02

VN-Matrix 300 Series

VIDEO

Signal type	SDI, HD-SDI, 3G-SDI digital video
Resolution	8 or 10 bits, automatic
Data rates	270 Mbps, 1.485 Gbps, 2.970 Gbps.
Operation standards	SMPTE 259M, SMPTE 296M, SMPTE 424M

VIDEO INPUT AND LOOP THROUGH — ENCODER

Number/signal type	1 digital component video with loop through 10 bit, 4:2:2, with auto-detection
Connectors	2 female BNC: 1 for input, 1 for loop through
Resolution range	525i, 625i, 720p, 1080i, 1080p, 1080psf

VIDEO PROCESSING — DECODER

Compression	PURE3™ Codec
Frame rate delay	35 ms (70 ms encoding/decoding end-to-end)
Bit rate	6 Mbps to 250 Mbps
Bit and frame rate control	Selectable

VIDEO OUTPUT — DECODER

Number/signal type	1 digital component video 10 bit, 4:2:2, with auto-detection

AUDIO INPUT AND OUTPUT

Number/signal type	4 groups of 4 channels, embedded with video signal
Source formats	SMPTE 299M, SMPTE 272M
Connectors	1 female BNC (shared with video input)

AUDIO PROCESSING

Standards	SMPTE 299M, SMPTE 272M-A
Sampling rates	20 or 24 bit digital audio 48 kHz (synchronous), 32 - 48 kHz (asynchronous)

CONTROL/REMOTE — Local Host — Codecs, Decoders

Serial control port	(1) RS-232, male 9-pin D connector
Ethernet control port	1 female RJ-45 1 female SPF IP module
System control	VN-Matrix Enterprise Controller, VN-Matrix Enterprise Retundant Controller, VN-Matrix Web server

NETWORK TRANSPORT

Ethernet data rate	10/100/1000Base-T, half/full duplex with autodetect
Ethernet protocol Streaming Transport All supported	 RTP, RTCP TCP, UDP (unicast or multicast) ICMP (ping), IP, TCP, RTP, RTCP, UDP, DHCP, HTTP, SNMP V3, Telnet

GENERAL

External power supply	100 VAC to 240 VAC, 50-60 Hz, external; to 12 VDC, 5 A max.
Power consumption	30 watts nominal, 60 watts max.
Temperature/humidity	Operating: +41 to +95 °F (5 to +35 °C) / 10% to 85%, noncondensing
Enclosure	1.75" H* x 8.5" W x 12.2" D (1U high, half rack wide) (4.4 cm H* x 21.5 cm W x 30.9 cm D)
Product weight	2.8 lbs (1.3 kg) each
Regulatory compliance Safety EMI/EMC	 CE, UL CE, EN60950-1
Warranty	3 years parts and labor

Model	Version Description	Part number
VNC 300 3G-SDI	Codec for SDI, HD-SDI & 3G-SDI	60-1124-01

For complete specifications, please go to www.extron.com
Specifications are subject to change without notice.

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