**SECTION 27 41 16**

**INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT**

**GUIDE SPECIFICATION**

*Specifier: The Specifier/Design Professional is responsible for the accuracy of all project specifications, including system application and coordination with related sections. This guide specification is provided as a convenience and requires editing to match actual project requirements. CRESTRON ELECTRONICS, INC. SHALL NOT BE LIABLE FOR ANY DAMAGES ARISING OUT OF THE USE OF ANY OF ITS GUIDE SPECIFICATIONS. For Crestron design assistance and design review please contact Sales Support Services Department at 800.237.2041 or techsales@crestron.com.*

*Specifier: Please see PART 4 for a listing of products specified in this Guide Specification.*

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# **GENERAL**

*Specifier shall Specify PART 1 administrative and procedural requirements as needed.*

# **PRODUCTS**

## **AV Encoder and Decoder**

### Basis of Design 4K60 4:4:4 Encoder/Decoder Device

#### DM-NVX-360

*Specifier Note:*

*Crestron® DM NVX® technology transports ultra high-definition 4K60 4:4:4 video over standard Gigabit Ethernet with no perceptible latency or loss of quality. Using standard network switches and CAT5e UTP wiring, a DM NVX system delivers a high-performance virtual matrix routing solution that is economically advantageous and infinitely scalable for any enterprise or campus-wide 4K content distribution application. Professional onboard scaling, HDR (High Dynamic Range) support, and HDCP 2.3 compliance ensure the ultimate in picture quality and compatibility for all of today’s varied media sources.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-360*

#### DM-NVX-360C

*Specifier Note:*

*This is the card cage chassis version of the DM-NVX-360*

*Crestron® DM NVX® technology transports ultra high-definition 4K60 4:4:4 video over standard Gigabit Ethernet with no perceptible latency or loss of quality. Using standard network switches and CAT5e UTP wiring, a DM NVX system delivers a high-performance virtual matrix routing solution that is economically advantageous and infinitely scalable for any enterprise or campus-wide 4K content distribution application. Professional onboard scaling, HDR (High Dynamic Range) support, and HDCP 2.3 compliance ensure the ultimate in picture quality and compatibility for all of today’s varied media sources.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-360C*

#### DM-NVX-363

*Specifier Note:*

*Crestron® DM NVX® technology transports ultra high-definition 4K60 4:4:4 video over standard Gigabit Ethernet with no perceptible latency or loss of quality. Using standard network switches and CAT5e UTP wiring, a DM NVX system delivers a high-performance virtual matrix routing solution that is economically advantageous and infinitely scalable for any enterprise or campus-wide 4K content distribution application. Professional onboard scaling, HDR (High Dynamic Range) support, and HDCP 2.3 compliance ensure the ultimate in picture quality and compatibility for all of today’s varied media sources*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-363*

#### DM-NVX-363C

*Specifier Note:*

*This is the card cage chassis version of the DM-NVX-363*

*Crestron® DM NVX® technology transports ultra high-definition 4K60 4:4:4 video over standard Gigabit Ethernet with no perceptible latency or loss of quality. Using standard network switches and CAT5e UTP wiring, a DM NVX system delivers a high-performance virtual matrix routing solution that is economically advantageous and infinitely scalable for any enterprise or campus-wide 4K content distribution application. Professional onboard scaling, HDR (High Dynamic Range) support, and HDCP 2.3 compliance ensure the ultimate in picture quality and compatibility for all of today’s varied media sources.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-363C*

### Basis of Design 4K60 4:2:0 Encoder and Decoder Devices

#### DM-NVX-E20

*Specifier Note:*

*The Crestron DM-NVX-E20 is a compact AV over IP encoder designed to transmit video with resolutions up to 4K60 4:2:0 over standard Gigabit Ethernet. Featuring secure web based control and management, an HDMI® input, an analog audio output, AES67 transmit and receive capability, and copper Ethernet connectivity with PoE support, the DM-NVX-E20 provides an encoder solution that offers price and performance optimization in a DM NVX network AV installation of any size.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-E20*

#### DM-NVX-D200

*Specifier Note:*

*Similar to the DM-NVX-D20 with added scaler.*

*The Crestron DM-NVX-D200 is a compact AV over IP decoder designed to receive video with resolutions up to 4K60 4:2:0 over standard Gigabit Ethernet. Featuring secure web based control and management, an HDMI® output with 4K60 video scaler, an analog audio output, AES67 transmit and receive capability, and copper Ethernet connectivity with PoE+ support, the DM-NVX-D200 provides a decoder solution that offers price and performance optimization in a DM NVX® network AV installation of any size.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-D200*

#### DM-NVX-D20

*Specifier Note:*

*The Crestron DM-NVX-D20 is a compact AV over IP decoder designed to receive video with resolutions up to 4K60 4:2:0 over standard Gigabit Ethernet. Featuring secure web based control and management, an HDMI® output, an analog audio output, AES67 transmit and receive capability, and copper Ethernet connectivity with PoE support, the DM-NVX-D20 provides a decoder solution that offers price and performance optimization in a DM NVX network AV installation of any size*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-D20*

### Basis of Design 1080p60 4:4:4 Encoder and Decoder Devices

#### DM-NVX-E10

*Specifier Note:*

*The Crestron DM-NVX-E10 is a compact AV over IP encoder designed to transmit video with resolutions up to 1080p 4:4:4 over standard Gigabit Ethernet. Featuring secure web based control and management, an HDMI® input, an analog audio output, AES67 transmit and receive capability, and copper Ethernet connectivity with PoE support, the DM-NVX-E10 provides an encoder solution that offers price and performance optimization in a DM NVX network AV installation of any size.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-E10*

#### DM-NVX-D10

*Specifier Note:*

*The Crestron DM-NVX-D10 is a compact AV over IP decoder designed to receive video with resolutions up to 1080p 4:4:4 over standard Gigabit Ethernet. Featuring secure web based control and management, an HDMI® output, an analog audio output, AES67 transmit and receive capability, and copper Ethernet connectivity with PoE support, the DM-NVX-D10 provides a decoder solution that offers price and performance optimization in a DM NVX network AV installation of any size.*

*https://www.crestron.com/Products/Video/DigitalMedia-Streaming-Solutions/Encoder-Decoders/DM-NVX-D10*

### Encoder Decoder Point to Point Functions

#### Encoder and Decoder devices when connected together shall support point to point AV streaming without setup or configuration.

## **HDBaseT Encoder**

### Basis of Design Encoder Device

#### DM-NVX-E760

*Specifier Note:*

*The DM-NVX-E760 is an NVX encoder with support for DM, DM-Light, or HDBaseT source formats.*

*Features Specific to DM-NVX-E760(C)*

*•The ONLY AV over IP encoder with direct support for HDbaseT sources.*

*•Support for DM and DM Lite Transmitters*

*•Wall-plate transmitters (DM and DM-Light) can become part of an NVX system with minimal additional hardware components.*

*•Transmitter (DM and DM-Light) may be powered from the E760*

*•Requires power pack, POE+, 802.3bt, and UPOE*

*•Supports AES67 audio*

#### DM-NVX-E760C

*Specifier Note:*

*This is the card cage chassis version of the DM-NVX-E760*

### Encoder Functions

#### Supported input formats

##### HDBaseT

###### HDBaseT outputs on HDBaseT Certified products

###### DigitalMedia

*Specifier Note:*

*Crestron's DigitalMedia is a proprietary format.*

###### DigitalMedia-Lite

*Specifier Note:*

*Crestron's DigitalMedia-Light is a proprietary format.*

## **AV over IP System**

### Primary Function

#### The System's primary function shall be to facilitate Audio and Video Distribution over a standard 1 Gigabit network. System components Shall include support for Real-Time content transmission.

##### Maximum Common Resolutions Supported:

###### Progressive

4096x2160 DCI 4K & 3840x2160 4K UHD

24 Hz / 4:4:4 / 36 bit

30 Hz / 4:4:4 / 36 bit

60 Hz / 4:2:2 / 36 bit

60 Hz / 4:4:4 / 24 bit

2560x1600 WQXGA

60 Hz / 4:4:4 / 36 bit

1920x1080 HD 1080p

60 Hz / 4:4:4 / 36 bit

###### Interlaced (Input only)

1920x1080 HD 1080i

30 Hz / 4:4:4 / 36 bit

##### Encoder to Decoder transmission shall support other custom resolutions at pixel clock rates up to 600 MHz.

### Transmission: 4K60 4:4:4 Devices

#### 1 Gigabit transmission of video over Ethernet with support for the following resolutions:

##### Progressive

###### 4096x2160 DCI 4K & 3840x2160 4K UHD

24 Hz / 4:4:4 / 36 bit

30 Hz / 4:4:4 / 36 bit

60 Hz / 4:2:2 / 36 bit

60 Hz / 4:4:4 / 24 bit

###### 2560x1600 WQXGA

60 Hz / 4:4:4 / 36 bit

###### 1920x1080 HD 1080p

60 Hz / 4:4:4 / 36 bit

##### Interlaced (Input only)

###### 1920x1080 HD 1080i

30 Hz / 4:4:4 / 36 bit

### Transmission: 4K60 4:2:0 Devices

#### 1 Gigabit transmission of video over Ethernet with support for the following resolutions:

##### Progressive

###### 4096x2160 DCI 4K & 3840x2160 4K UHD

24 Hz / 4:4:4 / 24 bit

30 Hz / 4:4:4 / 24 bit

30 Hz / 4:2:2 / 36 bit

60 Hz / 4:2:0 / 24 bit

###### 2560x1600 WQXGA

60 Hz / 4:4:4 / 24 bit

###### 1920x1080 HD 1080p

60 Hz / 4:4:4 / 36 bit

### Transmission: 1080p60 Devices

#### 1 Gigabit transmission of video over Ethernet with support for the following resolutions:

##### Progressive

###### 640x480@60Hz to 2048x1152@60Hz

*Specifier Note:*

*Full list of resolutions: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 852x480@60Hz, 854x480@60Hz, 1024x768@60Hz, 1024x852@60Hz, 1024x1024@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1365x1024@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, 2048x1080@24Hz, 2048x1152@60Hz, plus any other resolution allowed by HDMI up to 165MHz pixel clock*

### Advanced Encoder and Decoder Functions

#### 4K60 4:4:4 Devices:

##### Decoder Functions

###### Background Image Display

Device shall support display of a static image from a designated file location.

Images may be stored locally or on a networked server.

###### Still Image Detection

Decoder shall detect a still image streamed from encoder and allow source switching or display of a selected background image.

##### Encoder Functions

###### Encoder devices shall support test pattern generation as source signal.

Test patterns shall be generated within the encoder based on user configuration. Transmission of fixed images as test patterns shall not be excepted.

### Scalability

#### The System shall be capable of supporting an unlimited number of endpoints.

#### The Maximum bandwidth requirement per encoder or decoder stream shall be 1 Gigabit.

### System Integration

#### The System shall support native integration with a single enterprise grade software management platform to provide complete system monitoring, management, and control.

##### Management platform shall be available in web-based cloud and on premises deployment options.

##### Supported Native Integrated sub-systems:

###### Audio-Video Systems

###### HVAC Systems

###### Lighting Systems

###### Window Shade Systems

##### The enterprise cloud management platform by same manufacturer shall support the following functions:

###### Automatic Device Configuration

Cloud Management Platform shall push firmware updates, security patches, device settings, room or device control modules, and user interfaces to supported devices by same manufacturer.

Cloud Management Platform shall be capable of managing feature licenses for applicable devices.

Cloud software pushes shall not require custom programming.

#### Supported native integrated activities and control functions via control processor or management platform:

##### Automation of room scheduling and device control

##### Occupancy sensor feedback

##### Reporting of asset usage and scheduling

##### Room scheduling

### System Architecture

#### The System shall be composed of the following elements as specified in this specification:

##### Hardware Encoder and Decoder Devices

##### Network Switch

#### AV over IP Optional System Components:

##### Control Processor

##### Switching and Management Appliance

###### The AV over IP System manufacturer shall offer an optional Network Appliance providing the following:

Management and single point of control of end points

Easy to use Graphic user interface

Creation and management of virtual routing matrices including descriptive endpoint naming

Diagnostic tool interface and firmware updater

Direct endpoint routing

###### The Network Appliance graphical user interface and built-in dashboard functions shall not require custom or project specific programming or API development.

### Device integration and management

#### Network appliance by same manufacturer shall support the following:

##### Virtual matrix switcher supporting connected encoders and decoders

##### Inter domain routing of encoders and decoders

##### Multiple control system support

##### Central updates for encoder and decoder user names and passwords

### System Control

#### The System shall support the following control capabilities when integrated with a control processor by same manufacturer:

##### Full Native control of encoder and decoder embedded functionality via keypad, touch screen, or management platform by same manufacturer or iOS, Android, Windows or Mac devices running custom control Apps.

##### Control of 3rd party equipment via Encoder and Decoder built-in control ports

*Specifier Note: Card cage units do NOT include control ports for control of other devices. CEC control via the HDMI connector is supported.*

###### IR control

###### RS-232 serial control

###### CEC

#### Encoders and Decoders shall support control by a REST interface.

*Specifier Note:*

*See crestron.developer.com for DM NVX REST API information. The documentation describes the REST (Representation State Transfer) interface for the DM NVX series of AV encoders and decoders, called the DM NVX REST API. REST is a set of constraints for architectures that typically communicate over HTTP.*

##### An Application Programming interface shall be made available to authorized programmers and or integrators.

*Specifier Note:*

*See the following link:*

*https://www.crestron.com/developer*

## **Adaptive Bit Rate**

### Automatic bit rate adjustment

#### Encoder shall support automatic bit rate adjustment. The active bit rate function shall set the bit rate required for the input resolution of the stream.

## **Network Requirements**

### Infrastructure

#### AV over IP system shall operate on CAT5e or better infrastructure.

#### The AV over IP network shall utilize standard 1 Gigabit Ethernet.

### Constraints

#### The AV over IP System shall not require proprietary network management software or hardware.

#### The AV over IP hardware shall not require proprietary or manufacturer specific Ethernet switches.

#### Audio Video Bridging (AVB) shall not be required for operation of AV over IP system.

### Minimum network requirements:

#### 1 Gigabit port for each connected encoder or decoder endpoint device

## **AV Over IP Hardware Requirements**

### All Encoders and Decoders

#### Encoder and Decoder Network Requirements

##### Maximum network requirement per encoder or decoder: 1GB network

##### Encoder/Decoder units shall support web based control and management

#### Enterprise-Grade Security

##### Encoder and Decoder shall employ advanced security features and protocols including:

###### 802.1x authentication

###### AES encryption

###### Active Directory credential management

###### HTTPS

###### PKI certification

###### SSH

###### CIP

#### Device Control

##### The free standing Encoder and Decoder Unit shall include built-in RS-232 and IR control ports for control of the connected display or device.

*SPECIFIER NOTE: Card units (DM-NVX-360C, DM-NVX-363C) do not include control ports (IR and COM ports for control of third party devices).*

#### Power supply modes:

##### Local or remote DC power source.

##### Remote power supplied PoE+ switch or power injector from same manufacturer.

### 4K60 4:4:4 Devices:

#### Communication

##### Ethernet Port

###### Three 8-wire RJ-45 ports

One 100BASE-TX/1000-BASE-T ethernet port, POE+ PD port

One 100BASE-TX/1000-BASE-T ethernet port

One 100BASE-TX Ethernet port

###### One SFP port

#### Audio and Video Functions:

##### Audio-Video Transmission

###### Forward Error Correction

Encoder and decoder units shall utilize Forward Error Correction to minimize vulnerability to interruption from environmental noise and other network issues.

##### Decoder Mode

###### Breakaway Audio - Decoder may select and combine separate video and audio signals from two different inputs, including two different encoders.

###### Decoder unit shall support de-embedding of stereo audio signal from HDMI output.

###### HDMI digital video/audio output

One (1) 19-pin Type A HDMI female connector

Supports: HDCP 2.3, EDID, CEC

##### Encoder Mode

###### Encoder shall include one HDMI input.

###### One (1) HDMI video, audio, and control input:

CEC device control: Through a compatible control processor, the Encoder/Decoder unit shall include a gateway for controlling devices through their HDMI connections using the CEC signal embedded in HDMI.

Digital Audio Formats: Dolby Digital®, Dolby Digital EX, Dolby Digital Plus, Dolby TrueHD, Dolby Atmos, DTS®, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio, DTS:X, LPCM up to 8 channels

Input Signal Types: HDMI w/HDR10+, Deep Color, and 4K60 4:4:4 support (Dual-Mode DisplayPort and DVI compatible)

Supports DVI-D with adaptor

Supports DisplayPort Dual-Mode

Supports HDMI: HDCP 2.3, EDID, CEC

###### Analog stereo audio input:

Left and Right channel stereo; analog balanced or unbalanced

Encoder shall support embedding of stereo audio into HDMI input.

##### Network Audio

###### Encoders and decoders shall support two channel AES67 network audio.

###### Dante audio and surround audio downmix capability

*Specifier Note:*

*The DM-NVX-363 and DM-NVX363C support for surround downmixing and Dante audio.*

#### Network Port Selection

*Specifier Note:*

*Divide DM NVX network traffic based on system or project needs. Firmware release 4.1 allows separation of the AES67 or Dante audio stream data from the primary video and control network providing separate audio, video, control or USB Traffic onto 2 separate networks. This update is beneficial for customers who prefer a dedicated audio network to not interfere with video/control*

##### Multiple network ports shall be capable of separating audio stream and USB from video and control stream.

#### Video Preview Stream

*Specifier Note:*

*Thumbnail Preview Stream*

*The thumbnail preview function creates a second video stream at about one frame per second for a preview on a Crestron touch screen interface. Small, Medium or Large image resolution are available depending on the application. Preview is supported only for non-HDCP content.*

##### Devices shall support a video preview stream for non-HDCP content.

##### Preview shall be viewable on touch screen user interface by same manufacturer.

#### Device Architecture

##### Single hardware component design

###### A single hardware device shall support Encoding mode or Decoding mode.

##### Encoder/Decoder devices shall be available in the following form factors:

###### Card unit for card chassis mounting

*SPECIFIER NOTE: Card units (DM-NVX-360C, DM-NVX-363C) do not include control ports (IR and COM ports for control of third party devices).*

###### Freestanding unit for surface, shelf, or rack rail mounting.

##### A rack mount chassis shall be available for mounting and powering high density card versions of encoder/decoder units.

###### Unit front panel shall indicate status of unit and installed cards.

###### Unit front panel shall support network setup of installed cards.

###### Unit shall support hot swappable card interchange.

###### Rack chassis shall include a built-in 100-240VAC power supply.

#### Device Setup

##### Encoder and Decoder units shall be configurable via a web browser or software tool provided by manufacturer.

## **Commissioning and Diagnostics**

### Software Tool

#### The AV over IP hardware manufacturer shall make available a commissioning and diagnostic software tool.

*Specifier Note:*

*The Crestron® Commissioning and Diagnostic Tool for DM NVX® AV Encoders and Decoders (SW-DMNVXTOOL) is designed to ease configuration and troubleshooting of a DM NVX system. The Commissioning and Diagnostic Tool serves as a single-pane view of key settings within the DM NVX system, allowing a user to identify and resolve inconsistencies between devices quickly.*

*The Commissioning and Diagnostic Tool allows users to manage most key settings for a DM NVX system deployment, including IGMP settings, EDID and HDCP settings, subscription lists, and firmware updates. All devices and endpoints within a deployment can be managed through the tool.*

*https://www.crestron.com/Products/Control-Hardware-Software/Software/Development-Software/SW-DMNVXTOOL*

##### The software tool shall provide:

###### Live status of Encoder and Decoder endpoints in a dashboard view

###### Confirm and modify system settings

###### Manage global IGMP settings for multiple devices

###### Manage EDID and HDCP settings for multiple endpoints

###### Update firmware for multiple devices

## **Manufacturer**

### Technical Support

#### The AV over IP System manufacturer shall provide free 24 hour a day, 7 days a week technical support.

# **EXECUTION**

*NOT USED in this Guide Specification. Specifier shall Specify PART 3 On-Site work as needed.*

# **APPENDICES**

## **SPECIFIED PRODUCTS**

*Specifier Note: This Article includes Crestron products specified in this Guide Specification document. This Article is for reference only and should not be required in actual project manual unless included in an overall system equipment list.*

### Crestron SW-DMNVXTOOL

### Crestron DM-NVX-E20

### Crestron DM-NVX-D200

### Crestron DM-NVX-D20

### Crestron DM-NVX-E10

### Crestron DM-NVX-D10

### Crestron DM-NVX-360

### Crestron DM-NVX-360C

### Crestron DM-NVX-363

### Crestron DM-NVX-363C

### Crestron DM-NVX-E760

### Crestron DM-NVX-E760C

### Crestron DM-NVX-DIR-80

### Crestron DM-NVX-DIR-160

### Crestron DM-NVX-DIR-ENT