SECTION 27 41 16

INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

AV OVER IP

STANDARD SPECIFICATION

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# GENERAL

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

# PRODUCTS

## System

### Primary Function

#### The System's primary function shall be to facilitate Audio and Video Distribution over a standard 1 Gigabit network. System includes support for Real-Time 4K60/4:4:4 and HDR 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/Decoder unit shall support other custom resolutions at pixel clock rates up to 600 MHz

### Transmission

#### 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

#### System end-to-end latency shall not exceed 1 frame of latency at 60 fps (including encoding/decoding and scaling operations).

### 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.

### System Control

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

##### Full Native control of encoder/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/Decoder built-in control ports

###### IR control

###### RS-232 serial control

###### IP control

###### CEC

## Network Requirements

### Infrastructure

#### System shall support fiber optic network connection through hardware options.

#### 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

### Encoder and Decoder Network Requirements

#### Network Connectivity

##### Encoder and Decoder units shall support connection to a fiber optic network by inserting an appropriate SFP transceiver module into the SFP port on the Encoder/Decoder.

###### The Encoder and Decoder manufacturer shall offer a selection of modules to accommodate various multimode and single-mode fiber types.

Encoder/Decoder units shall have native support for single-mode and multimode fiber, external adaptors shall not be required.

Available SFP types shall include: Multimode fiber: 850nm, Single-Mode fiber: 1310nm, and 1310/1490 uplink and 1790/1310 downlink.

##### The Encoder and Decoder shall include two RJ45 1000Base-T LAN ports. Either port may be used as the primary LAN connection, allowing the other to be used to provide a network connection for an additional device.

###### Secondary LAN port may also be used to daisy-chain multiple Encoder/Decoder units feeding a single-source video wall or individual displays all showing the same video image.

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

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

### Enterprise-Grade Security

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

##### 802.1x authentication

##### AES encryption

##### Active Directory credential management

##### HTTPS

##### PKI certification

##### SSH

##### CIP

### Communication

#### Ethernet Port

##### SFP transceiver module port

##### At least (2) 8-wire RJ-45 ports

###### 10/100/1000 Mbps, auto-switching, auto negotiating, auto-discovery, full/half duplex, DHCP

### Audio and Video Functions:

#### Audio-Video Transmission

##### Decoder units shall provide integrated scaling with no additional latency.

##### System decoder scaling shall support arbitrary input resolutions up to 4096x2160 4:4:4 @ 60fps.

##### Switching transition between encoders shall not be greater than 2 seconds.

##### Switching between sources of the same framerate shall transition cleanly, (i.e. no black frame during the transition).

##### 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

##### Decoder unit shall include HDMI inputs for connection of local HDMI sources.

###### HDMI inputs and streaming input may be switched via the control processor, web browser interface, input select button on unit or, auto switch mode.

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

##### Decoder unit shall be capable of receiving multiple streams, one stream for video and embedded audio output through the HDMI connector and one for stereo audio for output through the analog audio output connector.

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

##### Text Overlay - The Encoder/Decoder shall be capable of displaying dynamic or fixed text on screen.

##### Video Wall Processing

###### The Decoder shall support video wall functionality.

###### Video walls composed of up to 64 individual displays shall be supported with configurations using multiple Decoder units.

###### Each Decoder shall provide fully-adjustable zoom capability and bezel compensation.

###### One Decoder is required per display, supporting configurations of up to eight wide by up to eight high.

##### HDMI digital video/audio output

###### Supports: HDCP 2.2, EDID, CEC

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

##### Audio DSP

###### The Decoder shall include the ability to decode the incoming multichannel surround sound signal from the network and downmix that signal to stereo. The stereo downmix signal is automatically routed to the onboard analog output.

The following formats shall be supported by downmix function:

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

#### Encoder

##### Encoder shall include dual HDMI inputs with integrated switcher.

##### Two (2) 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)

###### Inputs shall support the following switching modes:

Automatic Switching

Manual switching via onboard input select button.

Remotely via web browser

Switching via control processor from same manufacturer

###### Supports DVI-D with adaptor

###### Supports DisplayPort Dual-Mode

###### Supports HDMI: HDCP 2.2, 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.

##### Audio DSP

###### The Encoder shall include the ability to decode the incoming surround sound signal from an HDMI input, and downmix that signal to stereo. The stereo downmix signal is automatically routed to the onboard analog output.

The following formats shall be supported by downmix function:

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

###### The Encoder unit distributes both stereo and multichannel signals simultaneously over the network, allowing either signal to be selected at any decoder on the network.

### Device Architecture

#### Single hardware component design

##### A single unit Encoder/Decoder shall be configurable to operate as:

###### AV over IP decoder

###### AV over IP encoder

###### Encoder/Decoder mode of unit shall be switchable from control processor by same manufacturer.

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

##### Card unit for card chassis mounting

##### 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.

### USB and KVM Functionality

#### KVM routing shall not add additional latency to AV transmission.

#### USB routing shall not add additional latency to AV transmission.

#### USB and KVM routing shall be independent of AV routing.

#### USB peripheral device switching functionality shall support:

##### Whiteboards, Touch screens, Game controllers, Cameras, Mobile devices, Headsets, Flash drives

#### Encoder/Decoder USB ports shall be capable of linking with networked USB extender hardware by same manufacturer.

#### Encoder/Decoder Units shall include USB ports capable of linking to other Encoders and Decoders in the system.

#### Built-in USB ports:

##### One (1) USB Type B port

##### One (1) USB Type A port

### Power supply modes:

#### Local or remote DC power source.

#### Remote power supplied UPoE switch or power injector from same manufacturer.

### Device Control

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

### Device Setup

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

## Manufacturer

### Extended Warranty

#### The AV-over-IP System manufacturer shall provide options for extended warranties on system hardware.

### Technical Support

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

### Training

#### The AV over IP System manufacturer shall provide free Professional Networking and Design Training at worldwide locations.