



**Audio Video Upgrade
City Hall Council Chambers**

**Historic City Hall
830 N Boonville Ave
3rd Floor
Springfield, MO 65802**

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PART 1 General

1.1 SUMMARY

New Digital Audio and Video System for City of Springfield Council Chambers. To include: Digital Matrix, Transmitters, Receivers, Projection Screens, Projectors, Control, Lighting Modules, and Voting System.

1.2 BILL OF MATERIALS

<i>A. Crestron</i>		
1.	<i>CP3N</i>	<i>1EA</i>
2.	<i>TSW-1050-B-S</i>	<i>4EA</i>
3.	<i>TSW-1050-TTK-B</i>	<i>4EA</i>
4.	<i>TSW-550-B-S</i>	<i>8EA</i>
5.	<i>TSW-550-TTK-B</i>	<i>8EA</i>
6.	<i>DGE-100</i>	<i>1EA</i>
7.	<i>C2N-CBD-P</i>	<i>3EA</i>
8.	<i>CRESNET-P</i>	<i>1000'</i>
9.	<i>GLPAC-DIMFLV8-PM</i>	<i>1EA</i>
10.	<i>DM-MD-16x16 Option 1</i>	<i>1EA</i>
11.	<i>DM-MD-8x8 Option 2</i>	<i>1EA</i>
12.	<i>DMC-4K-C-DSP</i>	<i>3EA</i>
13.	<i>DMC-SDI</i>	<i>4EA</i>
14.	<i>DMC-4K-HD-DSP</i>	<i>1EA</i>
15.	<i>DM-TX-201-C</i>	<i>3EA</i>
16.	<i>DM-RMC-SCALER-C</i>	<i>4EA</i>
17.	<i>DMC-4K-CO-HD</i>	<i>2EA</i>
18.	<i>DMC-4k-HDO</i>	<i>2EA</i>
19.	<i>HD-SCALER-HD-E</i>	<i>4EA</i>
20.	<i>DM-CBL-8G-P-SP1000</i>	<i>2EA</i>
<i>B. Hitachi</i>		
1.	<i>CP-WU8700W + SL-712</i>	<i>4EA</i>
2.	<i>RPA-203W</i>	<i>4EA</i>
3.	<i>Lamps DTO1881</i>	<i>4EA</i>
<i>C. Da-Lite</i>		
1.	<i>34502L</i>	<i>2EA</i>
2.	<i>34492L</i>	<i>2EA</i>
<i>D.</i>	<i>HDMI to SDI Converter Scaler Option 1 MD-HX</i>	<i>4Ea</i>
<i>E.</i>	<i>HDMI to SDI Converter Scaler Option 2 Teranex 2D</i>	<i>4Ea</i>
<i>F.</i>	<i>Network Switch OFE</i>	

1.3 WARRANTY

Supplier must be a direct dealer for all products and provide direct replacement during the first 90 Days after purchase of all products. Replacement products should arrive no more than 48 hours from time of issue. Each product under this section should carry a 3 year full warranty.

PART 2 Products

2.1 CONTROL PROCESSOR

A. Control Processor

1. Central control processor for automation and control systems. Control processor is capable of integrated system control including native intersystem communication with equipment and processors by same manufacturer as well as scheduling and management servers. Control processor shall be the central connecting point for equipment and devices under control in a specified system. As the central element of communication for system devices under control, and all devices and sensors providing status, and feedback, the control processor integrates multiple disparate devices and systems without requiring multiple third party protocol adaptors, translators, or gateways. The control processor is also capable of sharing status, state, and feedback information from other connected devices.

B. Manufacturers

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of **Crestron Electronics, Inc., Rockleigh, NJ 07647**, Phone 800-237-2041, Fax: 201-767-1903, www.crestron.com with the following components and characteristics.

C. Basis of Design Product:

1. **Crestron CP3N**

D. Minimum Characteristics:

1. Operating System:
 - a. Modular architecture supports multiple simultaneous running programs.
 - 1) Number of simultaneously running user programs: 10
 - b. Real-time, preemptive multithreaded/multitasking kernel.
 - c. Vector floating point coprocessor.
 - d. Utilize a real time, event driven, multi-tasking, multi-threaded operating system.
2. Communication:
 - a. Control Processor shall support direct communication with the following devices:
 - 1) Connected Ethernet devices.
 - 2) Devices connected to built-in control ports.

- 3) Proprietary control network devices.
 - 4) BACnet IP devices.
 - 5) Control processors of same type.
3. Native BACnet/IP
 - a. Number of BACnet objects supported: 1000
 4. File Structure:
 - a. Transaction-safe extended FAT32 file system
 5. Memory:
 - a. RAM:
 - 1) 512 MB
 - b. Flash:
 - 1) Built-In: 4 GB
 - 2) USB or MMC slot: up to 32 GB
 - c. External Storage
 - 1) Supports up to 1 TB.
 6. Network:
 - a. Two built-in 10/100/1000BaseT Ethernet ports.
 - 1) Primary LAN port:
 - a) Isolated WAN connection
 - 2) Subnet port
 - a) The control processor shall automatically discover and assign IP addresses to compatible devices.
 - b. Built-In Web Server: IIS v.6.0
 - c. SNMP remote management.
 - d. Active Directory support.
 - e. IPv6 ready.
 - f. TCP/IP Communications
 - g. DHCP and DNS Support
 - h. Native Email Client
 - i. Remote Diagnostics
 - j. Remote Program Loading and Administration
 - k. SSL security plug in
 - l. Support user assigned or dynamic IP address.
 7. External Ports

The control system shall be equipped with the following external connection ports:

 - a. Infrared Output Port

- 1) Number of built-in ports: 8
 - 2) Connector: 2 8-pin 3.5mm detachable terminal blocks.
 - 3) Signal:
 - a) One-way infrared: up to 1.2 MHz
 - b) One-way serial output: TTL/RS-232 (0-5 Volts)
 - c) Baud rate: 9600 to 115,200 baud
- b. Serial Communication Port - Type 1
- 1) Number of built-in ports: 1
 - 2) Connector: 5-pin 3.5mm detachable terminal blocks.
 - 3) Signal:
 - a) Bidirectional RS-232
 Baud rate: 1200 to 115,000 baud
 Software handshaking: off or XON
 - b) Bidirectional RS-422 or RS-485
 Baud rate: 1200 to 115,000 baud
 Hardware handshaking: CTS, RTS, or RTS/CTS
 Software handshaking: off or XON
- c. Serial Communication Port - Type 2
- 1) Number of built-in ports: 2
 - 2) Connector: 3-pin 3.5mm detachable terminal blocks.
 - 3) Signal:
 - a) Bidirectional RS-232
 Baud rate: up to 115,000 baud
 Software handshaking.
- d. Input Output Port
- 1) Number of built-in ports: 8
 - 2) One 9-pin 3.5mm detachable terminal block.
 - 3) Individual programmable 2Kohm pull-up resistor.
 - 4) Individually configurable to one of three modes.
 - 5) Digital Input Mode
 - a) Digital contact closure inputs
 - b) Rating:
 - 0-24 VDC
 - Impedance: 20Kohm
 - Logic threshold High: >3.125V
 - Logic threshold Low: < 1.875V
 - c) Rated for 0-24 Volts DC, referenced to GND.
 - 6) Digital Output Mode

- a) Rating:
 - 250 mA sync from maximum 24 VDC
 - 7) Analog Input Mode
 - a) Rating:
 - 0-10 VDC
 - Protection: 24 VDC maximum
 - Impedance: 21Kohm
- e. Relay Port
 - 1) Number of built-in ports: 8
 - 2) Two 8-pin 3.5mm detachable terminal blocks.
 - a) Normally open, isolated relays.
 - b) Rating:
 - 1 Amp, 30 Volts AC/DC.
 - c) MOV arc suppression across contacts.
- f. Ethernet
 - 1) Number of built-in ports: 2
 - a) Port 1: Primary LAN
 - b) Port 2: Control Subnet
 - 2) Two 8-wire RJ45 with 2 LED indicators.
 - a) 10/100/1000BaseT Ethernet port.
 - b) Connection speed LED indicator.
 - c) Ethernet activity LED indicator.
- g. Communication Network
 - 1) Number of built-in ports: 1
 - 2) Four 4-pin 3.5mm detachable terminal block.
 - a) Master net communications port.
- h. USB Type 1
 - 1) Programming and configuration interface.
 - a) Number of built-in ports: 1
 - b) Connector:
 - USB Type-B female USB 2.0
- i. USB Type 2
 - 1) Memory storage device port.
 - 2) Number of built-in ports: 1
 - 3) Connector:
 - a) USB Type-A female USB 2.0

- j. Memory Expansion Card Slot
 - 1) Number of built-in slots: 1
 - a) Slot Type: MMC
 - b) Slot Capacity: 32 GB maximum

8. BACnet Protocol Implementation:

- a. BACnet Standardized Device Profile:
 - 1) Application Specific Controller (B-ASC)
- b. BACnet Interoperability Building Blocks Supported:
 - 1) Data Sharing-ReadProperty-A (DS-RP-A)
 - 2) Data Sharing-ReadProperty-B (DS-RP-B)
 - 3) Data Sharing - ReadProperty Multiple - A (DS-RPM-A)
 - 4) Data Sharing - ReadProperty Multiple - B (DS-RPM-B)
 - 5) Data Sharing-WriteProperty-A (DS-WP-A)
 - 6) Data Sharing-WriteProperty-B (DS-WP-B)
 - 7) Data Sharing – COV – A (DS-COV-A)
 - 8) Data Sharing – COV – B (DS-COV-B)
 - 9) Device Management-Dynamic Device Binding-A (DM-DDB-A)
 - 10) Device Management-Dynamic Device Binding-B (DM-DDB-B)
 - 11) Device Management-Dynamic Object Binding-B (DM-DOB-B)
 - 12) Device Management-DeviceCommunicationControl-B (DM-DCC-B)
- c. Standard Object Types Supported:
 - 1) Device Object
 - 2) Analog Input Object
 - 3) Analog Value Object
 - 4) Binary Input Object
 - 5) Binary Value Object
 - 6) Multi-State Input
 - 7) Multi-State Value
- d. Data Link Layer Options:
 - 1) BACnet IP
 - 2) BACnet IP, Foreign Device
- e. Network Options:
 - 1) BACnet/IP Broadcast Management Device (BBMD)
 - a) Supports registration by foreign devices.
- f. Character Set Supported:

- 1) ANSI X3.4
9. Mounting
 - a. Standard 19 inch rack mount, 1 rack unit high.
 - b. Rack mounting ears shall be removable for free standing applications.
10. Front Panel Controls
 - a. Hardware reset button
 - b. Software reset button
11. Front Panel Indicators
 - a. Power
 - b. Control Network Communication
 - c. Control Processor Error
12. Power Requirements:
 - a. 15 Watts at 24 VDC

2.2 USER INTERFACES

- A. Touch Screen Type 1: Controls lighting and AV settings along with other modular dimming controller functions.
 1. 5 inch TFT active-matrix color LCD touch screen 800 by 480 WVGA resolution display.
 - a. Basis of design: **Crestron TSW-550-B-S Touch Screen.**
 2. 18-bit 262k colors, and dual-window HD video, HDTV, and high-resolution RGB streaming multimedia, IP intercom, and web browsing capabilities. Dynamic graphics and text capability. Enables custom control screen programming.
 3. Hard keys: 5 push buttons.
 4. Communication:
 - a. Bidirectional 10/100 Mbps Ethernet communication.
 5. Streaming Video:
 - a. H.264
 - b. MJPEG
 6. Audio
 - a. Built-in microphone and speaker.
 - b. Intercom:
 - 1) Compatible with SIP capable devices from same manufacturer.
 7. Power:
 - a. IEEE 802.3af Class 3 PoE Powered Device
 8. Mounting:

- a. Provide Table Top Kit **TSW-550-TTK-B**.
 - 9. Color: Black
- B. Touch Screen Type 2: Controls lighting and AV settings along with other modular dimming controller functions.
 - 1. 10.1 inch TFT active-matrix color LCD touch screen 1280 by 800 WXGA resolution display.
 - a. Basis of design: **Crestron TSW-1050-B-S Touch Screen**.
 - 2. 24-bit 16.7M colors.
 - 3. Hard keys: 5 pushbuttons.
 - 4. Communication:
 - a. Bidirectional 10/100 Mbps Ethernet communication.
 - 5. Streaming Video:
 - a. H.264
 - b. MJPEG
 - 6. Audio
 - a. Built-in microphone and speaker.
 - b. Intercom:
 - 1) Compatible with SIP capable devices from same manufacturer.
 - 7. Power:
 - a. IEEE 802.3af Class 3 PoE Powered Device
 - 8. Mounting:
 - a. Provide Table Top Kit **TSW-1050-TTK-B**.
 - 9. Color: Black
- C. KEYPAD:
 - 1. Remote Keypad Controls: Field-configurable remote keypad with auto-adjusting backlight illuminating replaceable, engravable programmable buttons in number indicated, with white LED indicators, configured to fit in standard single-gang box.
 - a. Basis of Design: **Crestron, Cameo Series Keypad Model C2N-CBD-P Series**.
 - b. Color: White
 - c. Faceplates: Electrical Contractor Provided.

2.3 CONDUCTORS AND CABLING

- A. Power Supply Side of Remote-Control Power Sources: Comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors."
- B. UTP Cable: 100-ohm, UTP. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

1. Communications Control Cable, Plenum Rated: 22 AWG data pair stranded bare copper, and 18 AWG power pair stranded bare copper, Type CM.
 - a. Basis of Design Product: **Crestron CRESNET-P-1000'**.
2. Video Cable: F/UTP with four twisted pairs, inner jacket, drain, overall foil shield and overall jacket. NEC Article 800; UL subject 444, type CMP; CSA Type CMP; ANSI/TIA/EIA-568-B.2 Category 5e
 - a. Basis of Design Product: **Crestron DM-CBL-8G-P-SP1000'**.

2.4 VIDEO PROJECTORS

- A. Video Projector; Native 1920x1080 high definition resolution; 7000 ANSI Lumen; 10000:1 contrast with HGBHV, HDMI, HDBaseT, RS232 Control, with Throw distance compatibility with standard lens as indicated on the drawings. Middle Throw Lens 1.2-1.8:1
- B. Basis of Design Product: **Hitachi CP-WU8700W with SL-712**
- C. Provide 1 Spare OEM BULB per Projector: **DT01881**

2.5 VIDEO PROJECTION SCREENS

- A. **Type 1:** 139"x87" Projection 16:10 electrically operated 120 Volt, 2.5 Amp. To have seamless surfaces with black masking borders standard on flame retardant and mildew resistant fabric mounted on rigid metal roller. Each side of the fabric to have tab guide cable system to maintain even lateral tension and hold surface flat. Custom slat bar with added weight maintains vertical tension on the screen surface. The ends of the slat to be protected by heavy duty plastic caps enclosing a preset adjustable mechanism for screen tensioning. Shall have specially designed motor mounted inside the roller, to be three wire with ground, quick reversal type, oiled for life, with automatic thermal overload cut-out, integral gears, capacitor and an electric brake to prevent coasting. To have preset but adjustable limit switches to automatically stop picture surface in the "up" and "down" position. Case to be powder coated white 21-gauge steel, hexagon in shape with flat back to prevent scraping fabric. Case end caps to be heavy duty, allowing no exposed roller pins. Caps shall form sturdy brackets for wall or ceiling installation. To be complete with three position control switch with cover plate. Screen to be listed by Underwriters' Laboratories.

1. Basis of Design Product: **Da-lite-Tensioned Cosmopolitan Electrol-34502L**

- B. **Type 2:** 110"x69" Projection 16:10 electrically operated 120 Volt, 2.5 Amp. To have seamless surfaces with black masking borders standard on flame retardant and mildew resistant fabric mounted on rigid metal roller. Each side of the fabric to have tab guide cable system to maintain even lateral tension and hold surface flat. Custom slat bar with added weight maintains vertical tension on the screen surface. The ends of the slat to be protected by heavy duty plastic caps enclosing a preset adjustable mechanism for screen tensioning. Shall have specially designed motor mounted inside the roller, to be three wire with ground, quick reversal type, oiled for life, with automatic thermal overload cut-out, integral gears, capacitor and an electric brake to prevent coasting. To have preset but adjustable limit switches to automatically stop picture surface in the "up" and "down" position. Case to be powder coated white 21-gauge steel, hexagon in shape with flat back to prevent scraping fabric. Case end caps to be heavy duty, allowing no exposed roller pins. Caps shall form sturdy brackets for wall or ceiling installation. To be complete

with three position control switch with cover plate. Screen to be listed by Underwriters' Laboratories.

1. Basis of Design Product: **Da-lite-Tensioned Cosmopolitan Electrol-34492L**

2.6 DIGITAL MATRIX (Option 1)

A. Manufacturers:

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Crestron Electronics, Inc., Rockleigh, NJ 07647, Phone (800)237-2041, Fax: (201)767-1903, www.crestron.com, with the following components and characteristics.

B. System Description

1. The Digital AV Matrix system utilizes card-cage architecture. Main chassis, input and output cards shall be selected based on overall system requirements. [see system drawings]. Matrix System shall support cascading of matrix units, and long distance transmitter and receiver devices by same manufacturer.
2. Chassis shall support switching for 4K Ultra HD built in.
3. Basis-of-Design Product Manufacturer: **Crestron DM-MD16x16**

C. System Capacity

1. Configurable Chassis Options—Main chassis shall be available in the following input to output capacities:
 - a. 16X16
 - 1) Maximum input capacity: 16 discrete inputs
 - 2) Minimum input capacity: 1 discrete inputs
 - 3) Maximum output capacity: 16 discrete outputs
 - 4) Minimum output capacity: 2 discrete outputs

D. System Operation

1. Switching and Routing
 - a. Switch Type:
 - 1) Audio-Video Matrix switching—Any source input switchable to one or more outputs
 - 2) USB HID Routing—Any USB type-A port routable to one or more type-B ports
2. Media Signal Types—The Matrix Switcher shall provide matrix switching for the following video formats and standards through custom selected interchangeable input modules.
 - a. Analog Video:
 - 1) Standard encoding systems:
 - a) NTSC.

- b) PAL.
 - 2) Analog Signal Formats:
 - a) Composite video.
 - b) S-Video.
 - c) RGBHV video.
 - d) Component video.
- b. Digital Video:
 - 1) Digital Standards and formats:
 - a) HDCP v. 1.2.
 - b) Deep Color.
 - c) 3D format.
 - 2) Digital Signal Formats:
 - a) HDMI.
 - b) DisplayPort Multimode.
 - c) DVI.
 - d) SDI.
 - e) HDBaseT.
 - f) 3-Cable Transmission Protocol.
 - g) Single Cable Transmission Protocol.
 - h) Dual Fiber Transmission Protocol.
 - i) Single Fiber Transmission Protocol.
 - j) Single-Mode Long Distance Fiber Transmission Protocol.
- c. Resolutions—The Matrix Switcher shall have native support for the following resolutions:
 - 1) 640x480@60Hz.
 - 2) 20x480@60Hz (480p).
 - 3) 720x576@50Hz (576p).
 - 4) 800x600@60Hz.
 - 5) 848x480@60Hz.
 - 6) 852x480@60Hz.
 - 7) 854x480@60Hz.
 - 8) 1024x768@60Hz.
 - 9) 1024x852@60Hz.
 - 10) 1024x1024@60Hz.
 - 11) 1280x720@50Hz (720p50).
 - 12) 1280x720@60Hz (720p60).
 - 13) 1280x768@60Hz.
 - 14) 1280x800@60Hz.
 - 15) 1280x960@60Hz.
 - 16) 1280x1024@60Hz.
 - 17) 1360x768@60Hz.

- 18) 1365x1024@60Hz.
- 19) 1366x768@60Hz.
- 20) 1400x1050@60Hz.
- 21) 1440x900@60Hz.
- 22) 1600x900@60Hz.
- 23) 1600x1200@60Hz.
- 24) 1680x1050@60Hz.
- 25) 1920x1080@24Hz (1080p24).
- 26) 1920x1080@25Hz (1080p25).
- 27) 1920x1080@50Hz (1080p50).
- 28) 1920x1080@60Hz (1080p60).
- 29) 1920x1200@60Hz.
- 30) 2048x1080@24Hz.
- 31) 2048x1152@60Hz.
- 32) 720x480@30Hz (480i).
- 33) 720x576@25Hz (576i).
- 34) 1920x1080@25Hz (1080i25).
- 35) 1920x1080@30Hz (1080i30).
- 36) Other resolutions allowed by HDMI up to 165MHz pixel clock
- 37) SMPTE 425M (3G-SDI) 4:2:2 Colorspace: 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60).
- 38) SMPTE 425M (3G-SDI) 4:4:4 Colorspace: 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30).
- 39) SMPTE 260M (HD-SDI): 1920x1035@60Hz (1035i60).
- 40) SMPTE 295M (HD-SDI): 1920x1080@50Hz (1080i50).
- 41) SMPTE 274M (HD-SDI): 1920x1080@24Hz (1080p24), 1920x1080@24Hz (1080sF24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30).
- 42) SMPTE 296M (HD-SDI): 1280x720@50Hz (720p50), 1280x720@60Hz (720p60).
- 43) SMPTE 259M-C (SD-SDI): 720x480@59.94 (NTSC), 720x576@50i (PAL).

3. Audio Matrix Switching.

- a. The Matrix Switcher shall provide matrix switching for the following audio formats and standards through custom selected interchangeable input modules.

- 1) Analog Stereo.
 - 2) Analog 2-channel.
 - 3) Dolby Digital Plus.
 - 4) Dolby TrueHD.
 - 5) DTS-HD High Res.
 - 6) DTS HD Master Audio.
 - 7) 8 channel PCM.
 - 8) Dolby Digital.
 - 9) Dolby Digital EX.
 - 10) DTS.
 - 11) DTS-EX.
 - 12) DTS 96/24.
 - 13) 2 channel PCM.
4. USB Matrix Switching.
- a. The Matrix Switcher shall provide USB matrix switching for the following devices through custom selected interchangeable input modules and transmitter and receiver units.
 - 1) USB HID compatible keyboard.
 - 2) USB HID compatible mouse.
 - b. The Matrix Switcher shall route connected USB type A host devices to USB type-B controller devices.
5. Long Distance Transmission
- a. System shall achieve long distance transmission of all switched and managed signals and data through the selected input/output cards over the following cable types:
 - 1) UTP and STP cable
 - 2) Multi-mode fiber
 - 3) Single-mode fiber
 - b. Transmission shall require one cable per channel.
 - c. The single cable transmission format shall be capable simultaneously passing the following:
 - 1) Video
 - 2) Audio
 - 3) USB HID
 - 4) Ethernet
 - 5) Special purpose device control signals:
 - a) Infrared (IR) control signal data
 - b) Bidirectional serial control data

- c) Digital relay control data
- 6. Network integration: 10/100 Ethernet integrated into long distance transmission protocol.
 - a. Integrated Operating System Software Architecture
- 7. Stand-Alone System Architecture—System shall be capable of performing all matrix switching and content management functions without external processing or control equipment.
- 8. System shall natively control and manage the following using a single software platform:
 - a. System Configuration
 - 1) Setup of overall input and output types and quantities.
 - b. System Setup
 - 1) Individual sources and sink setup.
 - c. System Operation
 - 1) Routing
 - a) Selection and execution of source to sink or source to multiple sinks routes.
 - 2) Management
 - a) EDID
 - b) CEC
 - d. System Status Monitor
 - 1) Resolution and format information for inputs and outputs
 - 2) Input resolution and format information
 - 3) Output resolution and format information
 - e. System diagnostics

2.7 DIGITAL MATRIX (Alternate Product Option 2)

- A. Manufacturers:
 - 1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Crestron Electronics, Inc., Rockleigh, NJ 07647, Phone (800)237-2041, Fax: (201)767-1903, www.crestron.com, with the following components and characteristics.
- B. System Description
 - 1. The Digital AV Matrix system utilizes card-cage architecture. Main chassis, input and output cards shall be selected based on overall system requirements. [see system drawings]. Matrix System shall support cascading of matrix units, and long distance transmitter and receiver devices by same manufacturer.
 - 2. Chassis shall support switching for 4K Ultra HD built in.
 - 3. Basis-of-Design Product Manufacturer: **Crestron DM-MD8x8**

C. System Capacity

1. Configurable Chassis Options—Main chassis shall be available in the following input to output capacities:
 - a. 8X8
 - 1) Maximum input capacity: 8 discrete inputs
 - 2) Minimum input capacity: 1 discrete inputs
 - 3) Maximum output capacity: 8 discrete outputs
 - 4) Minimum output capacity: 2 discrete outputs

D. System Operation

1. Switching and Routing
 - a. Switch Type:
 - 1) Audio-Video Matrix switching—Any source input switchable to one or more outputs
 - 2) USB HID Routing—Any USB type-A port routable to one or more type-B ports
 2. Media Signal Types—The Matrix Switcher shall provide matrix switching for the following video formats and standards through custom selected interchangeable input modules.
 - a. Analog Video:
 - 1) Standard encoding systems:
 - a) NTSC.
 - b) PAL.
 - 2) Analog Signal Formats:
 - a) Composite video.
 - b) S-Video.
 - c) RGBHV video.
 - d) Component video.
 - b. Digital Video:
 - 1) Digital Standards and formats:
 - a) HDCP v. 1.2.
 - b) Deep Color.
 - c) 3D format.
 - 2) Digital Signal Formats:
 - a) HDMI.
 - b) DisplayPort Multimode.
 - c) DVI.
 - d) SDI.
 - e) HDBaseT.
 - f) 3-Cable Transmission Protocol.
 - g) Single Cable Transmission Protocol.
 - h) Dual Fiber Transmission Protocol.
 - i) Single Fiber Transmission Protocol.

j) Single-Mode Long Distance Fiber Transmission Protocol.

c. Resolutions—The Matrix Switcher shall have native support for the following resolutions:

- 1) 640x480@60Hz.
- 2) 20x480@60Hz (480p).
- 3) 720x576@50Hz (576p).
- 4) 800x600@60Hz.
- 5) 848x480@60Hz.
- 6) 852x480@60Hz.
- 7) 854x480@60Hz.
- 8) 1024x768@60Hz.
- 9) 1024x852@60Hz.
- 10) 1024x1024@60Hz.
- 11) 1280x720@50Hz (720p50).
- 12) 1280x720@60Hz (720p60).
- 13) 1280x768@60Hz.
- 14) 1280x800@60Hz.
- 15) 1280x960@60Hz.
- 16) 1280x1024@60Hz.
- 17) 1360x768@60Hz.
- 18) 1365x1024@60Hz.
- 19) 1366x768@60Hz.
- 20) 1400x1050@60Hz.
- 21) 1440x900@60Hz.
- 22) 1600x900@60Hz.
- 23) 1600x1200@60Hz.
- 24) 1680x1050@60Hz.
- 25) 1920x1080@24Hz (1080p24).
- 26) 1920x1080@25Hz (1080p25).
- 27) 1920x1080@50Hz (1080p50).
- 28) 1920x1080@60Hz (1080p60).
- 29) 1920x1200@60Hz.
- 30) 2048x1080@24Hz.
- 31) 2048x1152@60Hz.
- 32) 720x480@30Hz (480i).
- 33) 720x576@25Hz (576i).

- 34) 1920x1080@25Hz (1080i25).
- 35) 1920x1080@30Hz (1080i30).
- 36) Other resolutions allowed by HDMI up to 165MHz pixel clock
- 37) SMPTE 425M (3G-SDI) 4:2:2 Colorspace: 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60).
- 38) SMPTE 425M (3G-SDI) 4:4:4 Colorspace: 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30).
- 39) SMPTE 260M (HD-SDI): 1920x1035@60Hz (1035i60).
- 40) SMPTE 295M (HD-SDI): 1920x1080@50Hz (1080i50).
- 41) SMPTE 274M (HD-SDI): 1920x1080@24Hz (1080p24), 1920x1080@24Hz (1080sF24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30).
- 42) SMPTE 296M (HD-SDI): 1280x720@50Hz (720p50), 1280x720@60Hz (720p60).
- 43) SMPTE 259M-C (SD-SDI): 720x480@59.94 (NTSC), 720x576@50i (PAL).

3. Audio Matrix Switching.

- a. The Matrix Switcher shall provide matrix switching for the following audio formats and standards through custom selected interchangeable input modules.
 - 1) Analog Stereo.
 - 2) Analog 2-channel.
 - 3) Dolby Digital Plus.
 - 4) Dolby TrueHD.
 - 5) DTS-HD High Res.
 - 6) DTS HD Master Audio.
 - 7) 8 channel PCM.
 - 8) Dolby Digital.
 - 9) Dolby Digital EX.
 - 10) DTS.
 - 11) DTS-EX.
 - 12) DTS 96/24.
 - 13) 2 channel PCM.

4. USB Matrix Switching.

- a. The Matrix Switcher shall provide USB matrix switching for the following devices through custom selected interchangeable input modules and transmitter and receiver units.
 - 1) USB HID compatible keyboard.
 - 2) USB HID compatible mouse.
 - b. The Matrix Switcher shall route connected USB type A host devices to USB type-B controller devices.
- 5. Long Distance Transmission
 - a. System shall achieve long distance transmission of all switched and managed signals and data through the selected input/output cards over the following cable types:
 - 1) UTP and STP cable
 - 2) Multi-mode fiber
 - 3) Single-mode fiber
 - b. Transmission shall require one cable per channel.
 - c. The single cable transmission format shall be capable simultaneously passing the following:
 - 1) Video
 - 2) Audio
 - 3) USB HID
 - 4) Ethernet
 - 5) Special purpose device control signals:
 - a) Infrared (IR) control signal data
 - b) Bidirectional serial control data
 - c) Digital relay control data
- 6. Network integration: 10/100 Ethernet integrated into long distance transmission protocol.
 - a. Integrated Operating System Software Architecture
- 7. Stand-Alone System Architecture—System shall be capable of performing all matrix switching and content management functions without external processing or control equipment.
- 8. System shall natively control and manage the following using a single software platform:
 - a. System Configuration
 - 1) Setup of overall input and output types and quantities.
 - b. System Setup
 - 1) Individual sources and sink setup.
 - c. System Operation
 - 1) Routing

- a) Selection and execution of source to sink or source to multiple sinks routes.
- 2) Management
 - a) EDID
 - b) CEC
- d. System Status Monitor
 - 1) Resolution and format information for inputs and outputs
 - 2) Input resolution and format information
 - 3) Output resolution and format information
- e. System diagnostics

2.8 DIGITAL TRANSMITTERS

A. Description

1. The signal transmitters shall extend HDMI video, audio, and data over a single UTP/STP cable to compatible transmission receiver modules or ports. The following source formats shall be supported:
 - a. HDMI
 - b. DVI-I
 - c. RGBHV
 - d. YPbPr
 - e. VGA
 - f. Y/C
 - g. Composite
 - h. Analog 2-channel audio
 - i. USB HID (Human Interface Device)
2. Switching:
 - Transmitter shall include integrated switching with signal sensing.
 - b. Switching modes:
 - 1) Automatic: switcher shall switch to the last detected input.
 - 2) Controlled: control processor controls source switching and audio break-away switching.
3. Basis of design product: **Crestron DM-TX-201C** DigitalMedia transmitter.

2.9 DIGITAL RECEIVERS

A. Description

1. The signal receiver shall receive long distance transmission from compatible transmitter modules or ports. Receiver shall include the following outputs types and connections:
 - a. HDMI
 - b. USB HID (Human Interface Device)
2. Receiver shall include the following control port types for remote device control.
 - a. Serial RS-232 communication.
 - b. Infrared (IR) control.
 - c. Basis of design product: **Crestron DM-RMC-SCALER-C**.

B. Performance

1. The receiver shall meet the following minimum requirements:
 - a. HDMI digital video, audio, and control output:
 - 1) One (1) 19-pin Type A HDMI female connector
 - 2) Supports HDMI with Deep Color and 3D.
 - 3) Supports DVI-D with adaptor.
 - 4) Supports HDCP.
 - 5) HDMI audio Support:
 - a) Dolby Digital, Dolby Digital EX, Dolby TrueHD, DTS, DTS-ES, DTS 96/24, DTS-HD Master Audio, and up to 8 channel PCM.
 - 6) CEC device control.
 - b. Integrated HD video scaling:
 - 1) Deinterlacing and interlacing.
 - 2) Frame rate conversion.
 - 3) Deep Color support.
 - 4) 3D to 2D conversion.
 - 5) Content adaptive noise reduction.
 - 6) Wide screen format selection:
 - a) Zoom.
 - b) Stretch.
 - c) Maintain source aspect ratio.
 - d) 1:1.
 - 7) Video wall processing:
 - a) 2x2.
 - b) 3x2.
 - c) 3x3.
 - d) 4x3.
 - e) 4x4.
 - c. One (1) bidirectional RS-232 port:
 - 1) One (1) 5-pin 3.5mm detachable terminal block.

- 2) GND, TX, RX, CTS, RTS support.
- 3) Up to 115.2k baud, hardware and software handshaking support.
- d. Two (2) IR/Serial ports:
 - 1) One (1) 4-pin 3.5mm detachable terminal block.
 - 2) IR output up to 1.1 MHz.
 - 3) 1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud.
- e. One (1) USB HID port.
 - 1) USB type A female.
- f. One (1) 10/100 LAN port.
- g. Single UTP/STP cable transmission connection
 - 1) Supports HDBaseT signal specifications.
 - 2) Supports CAT5e
 - 3) Signal transmission up to 330 feet
- h. Power supply:
 - 1) Local or remote DC power source.
- i. Mounts on a US 2-gang electrical box

2.10 DMC-SDI INPUT CARD

- A. Description
1. The HD-SDI input card shall accept an HD-SD signal. This signal shall be available as an output on the matrix.
 2. Basis of design product: **Crestron DMC-SDI** DigitalMedia input card.
 3. Modular Design: Input card shall be a modular unit with the following characteristics:
 - a. Input card module shall be one of many available input modules available from same manufacturer.
 - b. Modular component of compatible card frame matrix switcher.
 - c. Occupy 1 input card slot in compatible matrix switcher.
 - d. Include 1 HDMI pass through output.
 - 1) HDMI output includes audio and video from source.
 - e. Include 1 stereo analog audio output:
 - 1) Two channels of audio extracted from SDI source signal.
 - f. Field installable plug-in card.
 4. HD-SDI input:
 - a. Connector: female BNC
 - b. Format:

- 1) SD-SDI (SMPTE 259M)
 - 2) HD-SDI (SMPTE 292M)
 - 3) 3G-SDI (SMPTE 424M)
- c. Input video resolutions:
- 1) SMPTE 425M (3G-SDI) 4:2:2 Colorspace: 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60);
SMPTE 425M (3G-SDI) 4:4:4 Colorspace: 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30);
SMPTE 260M (HD-SDI): 1920x1035@60Hz (1035i60);
SMPTE 295M (HD-SDI): 1920x1080@50Hz (1080i50);
SMPTE 274M (HD-SDI): 1920x1080@24Hz (1080p24), 1920x1080@24Hz (1080sF24), 1920x1080@25Hz (1080p25), 1920x1080@30Hz (1080p30), 1920x1080@50Hz (1080i50 or 1080sF25), 1920x1080@60Hz (1080i60 or 1080sF30);
SMPTE 296M (HD-SDI): 1280x720@50Hz (720p50), 1280x720@60Hz (720p60);
SMPTE 259M-C (SD-SDI): 720x480@59.94 (NTSC), 720x576@50i (PAL)
5. HD-SDI Pass-through Output:
 - a. Connector: female BNC
 6. Video output:
 - a. Local HDMI output:
 - 1) Connector: 19-pin Type A female HDMI.
 - 2) HDMI signal includes:
 - a) Video source signal at native resolution.
 - b) Embedded 2-channel audio signal.
 - b. Matrix backplane:
 - 1) HDMI signal includes:
 - a) Source video at native resolution.
 - b) Embedded source audio signal.
 7. Audio formats:
 - a. 2 channel PCM via SDI, HDMI, & DM; 2-channel analog
 8. Analog audio output.
 - a. 2 female RCA connectors.
 - b. Digital to analog conversion:
 - 1) 24 bit 48 kHz

2.11 SINGLE CABLE UTP/STP INPUT CARD 4K

- A. Description
1. The single cable UTP or STP input card shall receive transmission from compatible transmitters, supporting distance of up to 330 feet (100 km).
 2. The single cable UTP or STP input card shall accept transmitted signal and convert to HDMI signal and separate audio output. This signal shall be available as an output on the matrix.
- B. Basis of design product: **Crestron DMC-4k-C-DSP** DigitalMedia input card.
- C. Modular Design: Input card shall be a modular unit with the following characteristics:
1. Input card module shall be one of many available input modules available from same manufacturer.
 2. Modular component of compatible card frame matrix switcher.
 3. Occupy 1 input card slot in compatible matrix switcher.
 4. Include 1 HDMI pass through output.
 - a. HDMI output includes audio and video from transmission source.
 5. Include 1 stereo analog audio output:
 - a. Stereo audio extracted from HDMI source signal.
 6. Field installable plug-in card.
- D. Transmitter receive input:
1. Connector: 1 female shielded RJ-45 connector
 2. Convert compatible transmitter signal to HDMI and stereo audio for local output.
 3. Convert compatible transmitter signal to HDMI, surround/stereo audio, and Ethernet link for connection to matrix switcher backplane.
 4. Format:
 - a. HDMI with Deep Color and 3D
 - b. HDCP content protection
 5. Input video resolutions:
 - a. Progressive video resolutions:
 - 1) 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.

- b. Interlaced video resolutions:
 - 1) 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by HDMI up to 165MHz pixel clock.
- E. Transmitter remote power supply capability
 - 1. Power compatible transmitter through single CAT5e cable.
- F. Video output:
 - 1. Local HDMI output:
 - a. Connector: 19-pin Type A female HDMI.
 - b. HDMI signal includes:
 - c. Video source signal at native resolution.
 - d. Embedded stereo audio signal.
 - 2. Matrix backplane:
 - a. HDMI signal includes:
 - 1) Source video at native resolution.
 - 2) Embedded source audio signal.
- G. Audio/surround formats:
 - 1. Dolby Digital®, Dolby Digital EX, Dolby Digital Plus, Dolby® TrueHD, DTS®, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio™, Up to 8ch PCM.
 - a. Analog audio output.
 - 2. 2 female RCA connectors.
 - 3. Stereo source pass through.
 - 4. Digital to analog conversion:
 - a. 24 bit 48 kHz
 - 5. Surround formats shall be mixed to stereo in optional version of input card.

2.12 HDMI 4K INPUT CARD

- A. Description
 - 1. The HDMI input card shall accept one 4K HDMI signal.
 - 2. 4K Operation:
 - a. When installed in the matrix chassis, the input signal shall be switchable to installed 4K output cards for 4K signal transmission.
- B. Basis of design product: **Crestron DMC-4K-HD-DSP** DigitalMedia input card.
- C. Modular Design: Input card shall be a modular unit with the following characteristics:
 - 1. Input card module shall be one of many available input modules available from same manufacturer.

2. Modular component of compatible card frame matrix switcher.
3. Occupy 1 input card slot in compatible matrix switcher.
4. Include 1 HDMI pass through output.
 - a. HDMI output includes audio and video from source.
5. Include 1 stereo analog audio output:
 - a. Stereo audio extracted from HDMI source signal.
6. Field installable plug-in card.

D. HDMI input:

1. Connector: 19-pin type A female HDMI
2. Format:
 - a. HDMI with Deep Color and 3D
 - b. 4K HDMI
 - c. HDCP content protection
3. Input video resolutions:
 - a. Progressive video resolutions:
 - 1) 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, 2560x1440@60Hz, 2560x1600@60Hz, 3840x2160@24Hz, 3840x2160@30Hz, 4096x2160@24Hz, plus any other resolution allowed by HDMI up to 300MHz pixel clock.
 - b. Interlaced video resolutions:
 - 1) 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by HDMI up to 300MHz pixel clock.

E. Video output:

1. Local HDMI output:
 - a. Connector: 19-pin Type A female HDMI.
 - b. HDMI signal includes:
 - 1) Video source signal at native resolution.
 - 2) Embedded source audio signal.
2. Matrix backplane:

- a. HDMI signal includes:
 - 1) Source video at native resolution.
 - 2) Embedded source audio signal.
- F. USB:
 - 1. Local USB 1.1 port
 - a. Connector: USB Type A female connector
 - b. Support for:
 - 1) USB HID devices
- G. Audio/surround formats:
 - 1. Dolby Digital®, Dolby Digital EX, Dolby Digital Plus, Dolby® TrueHD, DTS®, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio™, Up to 8ch PCM.
- H. Analog audio output.
 - 1. 2 female RCA connectors.
 - 2. Stereo source pass through.
 - 3. Digital to analog conversion:
 - a. 24 bit 48 kHz
 - 4. Surround formats shall be mixed to stereo in optional version of input card.

2.13 SINGLE UTP/STP CABLE 4K TRANSMISSION OUTPUT CARD

- A. Description
 - 1. The Output Card shall provide transmission of any routed source signal, within the matrix chassis.
 - 2. The output card shall transmit over manufacturer suggested STP cable, CAT5e or CAT6 cable, or better.
 - a. Contact manufacturer prior to cable installation and use manufacturers suggested transmission cable, connectors, and installation methods for all segments of signal path.
 - 3. The Output Card shall provide 2 discrete outputs.
 - 4. The Output Card shall interface with HDBaseT supported single cable transmission receivers.
 - 5. The card shall provide 1 HDMI output for every 2 single cable transmission outputs:
 - a. HDMI output shall be a parallel signal to the single cable transmission output.
 - 6. 4K Operation:
 - a. The Output Card shall support transmission of 4K HDMI signals from compatible source to compatible sink using 4K switching, transmission and interfacing components from Output Card manufacturer.
- B. Basis of design product: **Crestron DMC-4K-CO-HD**

- C. Modular Design:
 - 1. Output card shall be a modular unit with the following characteristics:
 - a. Output card module shall be one of many available output modules available from same manufacturer.
 - b. Modular component of compatible card frame matrix switcher.
 - c. Occupy output card slot space in compatible matrix switcher.
 - d. Field installable plug-in card.

- D. Output Card Source:
 - 1. All outputs shall be sourced by the matrix backplane. Matrix backplane shall include all sources connected to matrix input cards.

- E. Outputs:
 - 1. Connectors:
 - a. Female shielded RJ-45 connector for each transmission output.
 - b. Female 19-pin Type A HDMI for parallel output channels.
 - 2. Format:
 - a. HDMI with Deep Color and 3D
 - b. 4K HDMI
 - c. HDCP content protection
 - d. Signal includes:
 - 1) Video source signal at native resolution.
 - 2) Embedded audio signal
 - 3) Embedded Ethernet
 - 3. Remote Power Sourcing:
 - a. Output Card, through RJ-45 output connection shall be capable of remotely powering transmission receivers through optional power supply.

2.14 HDMI 4K SCALING OUTPUT CARD

- A. Description
 - 1. The Output Card shall provide transmission of any routed source signal, within the matrix chassis.
 - 2. The output card shall transmit over manufacturer suggested HDMI cable, or better.
 - a. Contact manufacturer prior to cable installation and use manufacturers suggested transmission cable, connectors, and installation methods for all segments of signal path.
 - 3. The Output Card shall provide 2 discrete outputs.
 - 4. The card shall provide 2 HDMI output for every 2 single cable transmission outputs:
 - 5. 4K Operation Scaling Operation

- a. The Output Card shall support transmission of 4K HDMI signals from compatible source to compatible sink using 4K switching, transmission and interfacing components from Output Card manufacturer.
- B. Basis of design product: **Crestron DMC-4K-HDO**
- C. Modular Design:
 - 1. Output card shall be a modular unit with the following characteristics:
 - a. Output card module shall be one of many available output modules available from same manufacturer.
 - b. Modular component of compatible card frame matrix switcher.
 - c. Occupy output card slot space in compatible matrix switcher.
 - d. Field installable plug-in card.
- D. Output Card Source:
 - 1. All outputs shall be sourced by the matrix backplane. Matrix backplane shall include all sources connected to matrix input cards.
- E. Outputs:
 - 1. Connectors:
 - a. 5 Pin Phoenix Left and Right Audio
 - b. Female 19-pin Type A HDMI for parallel output channels.
 - 2. Format:
 - a. HDMI with Deep Color and 3D
 - b. 4K HDMI
 - c. HDCP content protection
 - d. Signal includes:
 - 1) Video source signal at native resolution.
 - 2) Embedded audio signal
 - 3) Embedded Ethernet

2.15 HDMI SCALER

- A. Description
 - 1. HD Video Scaler and Deinterlacer, Noise Reduction, 3:2,2:2 pull down detection and recovery, aspect ratio selection, picture and RGB Color Adjustments, OSD Setup, Analog Audio embedding and de-embedding.
- B. Basis of design product: Crestron **HD-SCALER-HD-E**
- C. Inputs:
 - 1. Connectors:

- a. HDMI (DisplayPort Multimode) and Analog Stereo
 - 2. Format:
 - a. HDMI with Deep Color and 3D
 - b. HDMI
 - c. HDCP content protection
 - d. Signal includes:
 - 1) Video source signal at native resolution.
 - 2) Embedded audio signal
- D. Outputs:
 - 1. Connectors:
 - a. HDMI and Analog Stereo
 - 2. Format:
 - a. HDMI with Deep Color and 3D
 - b. HDMI
 - c. HDCP content protection
 - d. Signal includes:
 - 1) Video source signal at native resolution.
- E. Resolutions
 - a. Progressive video resolutions:
 - 1) 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, plus any other resolution allowed by HDMI up to 165MHz pixel clock.
 - b. Interlaced video resolutions:
 - 1) 1920x1080@25/30Hz (1080i25/30)

2.16 DIGITAL GRAPHIC ENGINE

- A. Description
 - 1. The Graphics Processor shall provide HDMI output of Custom Graphics.
 - 2. The Graphics Processor shall provide HDMI input.

- a. Contact manufacturer prior to cable installation and use manufacturers suggested transmission cable, connectors, and installation methods for all segments of signal path.
 - 3. HDCP Support.
- B. Basis of design product: **Crestron DGE-100**
- C. Graphics Engine:
 - 1. Crestron®Smart Graphics™, landscape or portrait orientation, local and remote annotation, multi-language Web browser[1], multi-touch support, multi-language on-screen keyboard, screensaver, fully-scalable dual video windowing (displays any combination of HDMI®and/or streaming sources)
- D. Memory:
 - 1. DDR3 SDRAM: 2GB
 - 2. Flash: 4GM
 - 3. Maximum Project Size: 1GB
- E. Communications:
 - 1. Ethernet: 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, IEEE 802.3af and 802.3at Type 1 compliant
 - 2. USB Host: Supports the Crestron TSD-2020 touch screen display and most third-party USB HID compliant touch screens, mice, and keyboards
 - 3. USB Device: For computer console (installer setup and firmware update)
 - 4. RS-232: 2-way device control and monitoring up to 115.2k baud with hardware and software handshaking
 - 5. IR/Serial: 1-way device control via infrared up to 1.1 MHz or serial TTL/RS-232 (0-5 Volts) up to 19.2k baud
 - 6. HDMI: HDCP 1.2, EDID, CEC

NOTE: Supports management of HDCP; supports management of CEC between the connected HDMI display device and a control system
- F. Video:
 - 1. Input Signal Types: HDMI (DVI & Dual-Mode DisplayPort compatible)
 - 2. Output Signal Types: HDMI (DVI compatible)
 - 3. Input Resolutions, Progressive: 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), plus any other resolution allowed by HDMI
up to 148MHz pixel clock

4. Input Resolutions, Interlaced: 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by HDMI up to 148MHz pixel clock
5. Output Resolutions: 640x480@60Hz, 800x600@60Hz, 1024x768@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x800@60Hz, 1366x768@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz

G. Audio

1. Input Signal Types: HDMI (Dual-Mode DisplayPort compatible)
2. Output Signal Types: HDMI
3. Input/Output Format: 2-channel PCM
4. Audio Feedback Formats: MP3

H. Connectors

1. CONSOLE, USB: (1) USB Micro-A female;
2. USB computer console port; Type A to Micro-A USB cable included
3. IR 1 – 2: (1) 4-pin 3.5 mm detachable terminal block; Comprises (2) IR/Serial ports; IR output up to 1.1 MHz; 1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud
4. COM: (1) 5-pin 3.5 mm detachable terminal block; Bidirectional RS-232 port; Up to 115.2k baud, hardware and software handshaking support
5. HDMI INPUT: (1) 19-pin Type A HDMI female; HDMI digital video/audio input (DVI & Dual-Mode Displayport compatible)

2.17 HDMI to SDI Converter Scaler (Option 1)

A. SDI Formats

1. 3G:SMPTE 424M@2.97 and 2.967Gb/s
2. 1080p@60/59.94/50Hz
3. HD:SMPTE 292M/274M/296M@1.485 and 1.435Gb/s
4. 1080i@60/59.94/50Hz
5. 1080p/psf@30/29.97/25/24/23.98Hz
6. 720p@60/59.94/50/30/29.97/25/24/23.98Hz SD:SMPTE 259M@270Mb/s
7. 625i50

- 8. 525i59.94
- B. Inputs
 - 1. 1 x HDMI Input
 - 2. 1 x (3G/HD/SD) SDI Input
- C. Outputs
 - 1. 1 x HDMI
 - 2. (3G/HD/SD)-SDI Active Loop-through or addition outputs
 - 3. 2 x (3G/HD/SD)-SDI outputs
- D. Power
 - 1. +5V to +32V DC
 - 2. Positive Centre Pin
- E. Basis of design product: **Decimator MD-HX**

2.18 HDMI to SDI Converter Scaler (Alternate Product Option 2)

- A. SDI Video Input
 - 1. 1x 10-bit SD, HD, 3Gb/s HD and 2K switchable.
- B. SDI Video Loop
 - 1. 1x reclocked 10-bit SD, HD, 3Gb/s HD and 2K switchable.
- C. SDI Video Output
 - 1. 2x 10-bit SD, HD, 3Gb/s HD and 2K switchable.
- D. Analog Video Input
 - 1. 1x Component YUV on 3 BNCs switchable to Composite. Component supports HD and SD.
- E. Analog Video Output
 - 1. 1x Component YUV on 3 BNCs switchable to Composite. Component supports HD and SD.
- F. HDMI Video Input
 - 1. 1x HDMI type A connector.
- G. HDMI Video Output
 - 1. 1x HDMI type A connector.
- H. Analog Audio Input
 - 1. 4x inputs of professional balanced analog audio on DB-25 for 4 audio channels. Pinout compatible with Yamaha™, Mackie™, Sony™ and Apogee™ connectors. 2x inputs of unbalanced analog audio on RCA connectors for consumer equipment.

- I. **Analog Audio Output**
 - 1. 4x outputs of professional balanced analog audio on DB-25 for 4 audio channels. Pinout compatible with Yamaha™, Mackie™, Sony™ and Apogee™ connectors.
- J. **AES/EBU Audio Input**
 - 1. 4x AES/EBU pairs on DB-25 for 8 audio channels. Sample rate converted. Pinout compatible with Yamaha™, Mackie™, Sony™ and Apogee™ connectors.
- K. **AES/EBU Audio Output**
 - 1. 4x AES/EBU pairs on DB-25 for 8 audio channels. Pinout compatible with Yamaha™, Mackie™, Sony™ and Apogee™ connectors.
- L. **SDI Audio Input**
 - 1. 16 channels in SD, HD, 3Gb/s HD and 2K. (16 channels in HD and 2K, and 8 channels in SD for capture via Thunderbolt port).
- M. **SDI Audio Output**
 - 1. 16 channels in SD, HD, 3Gb/s HD and 2K. (16 channels in HD and 2K, and 8 channels in SD for playback via Thunderbolt port).
- N. **HDMI Audio Input**
 - 1. 8 Channels
- O. **HDMI Audio Output**
 - 1. 8 Channels
- P. **Dolby Support Built-In**
 - 1. Dolby AC-3 pass through in all conversions. Dolby E pass through except during video frame rate conversions.
- Q. **Timecode Input**
 - 1. Support for VITC/ATC. No support for LTC.
- R. **Timecode Output**
 - 1. Support for VITC/ATC. No support for LTC.
- S. **Multi Rate Support**
 - 1. SDI, HDMI and component analog video connections are switchable between standard definition and high definition. SDI switches between 270 Mb/s standard definition SDI, 1.5 Gb/s HD-SDI and 2K SDI and 3 Gb/s HD-SDI.
- T. **Sync Input**
 - 1. Blackburst in SD or TriSync HD.
- U. **Device Control**
 - 1. Sony™ compatible RS-422 deck control port. Serial ports TxRx direction-reversible under software control.

- V. Computer Interface
 1. Thunderbolt port for capture and playback of video and audio. *USB 2.0* mini B port for software updates and configuration.
- W. Processor Interface
 1. Illuminated pushbuttons, status LEDs and LCD with easy to use onscreen menus.
- X. Basis of design product: **Teranex 2D**

2.19 Modular Dimming Controls

- A. Power Switching Modules and Dimming
 1. Switching Module, High Inrush:
 - a. Basis of Design Product: Electronic Power Switching Module **Crestron GLPAC-DIMFLV-8-PM**
 - b. Channels of Switching: 8 channel high inrush switching.
 - c. Maximum Load:
 - Lighting: 16A per channel.
 - Motor: 1HP at 120V per channel.
 2. Switching Module, High Inrush:
 - a. Basis of Design Product: Crestron Electronic Power Switching Module Model Part of No. GLPAC-DIMFLV-8-PM-**GLXP-HSW**
 - b. Channels of Switching: 8 channel high inrush switching.
 - c. Maximum Load:
 - Lighting: 16A per channel.
 - Motor: 1HP at 120V per channel.
 3. Switching Module, 0 – 10V Dimmable Fluorescent Ballast Load Switching Module:
 - a. Basis of Design Product: Crestron Electronic power switching module Model Part of No. GLPAC-DIMFLV-8-PM
 - b. Channels of Switching and Power Management: 8 channel high inrush switching.
 - c. Maximum Non-dimmable Load:
 - Incandescent, HID, magnetic low voltage (MLV), electronic low voltage (ELV), neon/cold cathode, and fluorescent ballasts: 16A per channel.
 - Motor: 1/2HP at 120V per channel.
 - d. Maximum Dimmable Load:
 - Lighting: 0 - 10V dimmable fluorescent ballasts.