The University of Georgia
Office of University Architects for Facilities Planning

27 41 00.01
AUDIO-VISUAL CONTROL SYSTEM

1. **GENERAL**
   A. Related sections:
      i. 00 00 13 – Designing Learning Environments
      ii. 00 73 01 – Sole Source/Sole Brand
      iii. 01 77 00 – Project Closeout
      iv. 11 52 00 – Audio-Visual Equipment
      v. 11 52 13 – Projection Screens
      vi. 12 56 52 – Audio-Visual Furniture
      vii. 26 09 36 – Modular Dimming Controls
      viii. 26 09 43.16 – Addressable Fixture Lighting Control
      ix. 27 00 00 – General Communications Requirements
      x. 27 41 00 – General Audio-Visual System Requirements
   B. This section, 27 41 00.01 – Audio-Visual Control System, is intended as a minimum requirement for single projector classrooms with standard source devices and room infrastructure. More complicated installations (multiple projectors, video conference, etc.) will require additional design coordination with the Project Manager, Design Professional, and the CTL. UGA will provide existing example touch panel files for these more complicated systems. Regardless of system complexity the basic operation will still be as described here.

2. **PRODUCTS**
   A. The UGA requires AMX (by Harman) hardware and software touch panel interfaces for classrooms, conference rooms, and other spaces with sophisticated audio-visual technology. This is a sole brand (see section 00 73 01 Sole Source/Sole Brand). This section describes the minimum functionality required to insure uniformity of UGA systems. An example touch panel layout is included at the end of this section, and this, along with an accompanying AMX touch panel layout file (AMX touchpanel filename: egUGA, CR4,Rev2_51_X700_dn.TP4) provide a general overview of how the final controls system shall function. A program viewer to read the TP4 file and the TP4 file are available for download at www.architects.uga.edu/standards. Every aspect of the required system is not specified as project specific modifications and final programming are ultimately unique to each project.

3. **EXECUTION**
   A. Final versions of all source code and touch panel files will be provided by the Contractor as part of the Closeout Submittal. All support files, code modules, IR files, etc. required to compile and reload a room shall be provided (to be included in the complete closeout submittal package that is given to FMD).
   B. Most recent source code should also be stored on each control processor.
   C. Software will be written in such a way that equipment changes can be made without major rewrite. Use prebuilt AMX NetLinx or Duet modules wherever they are available for a specific projector or hardware device.
   D. All bi-directional controlled devices (Ethernet, RS232, AXLINK, ICSNET, etc.) should provide true feedback on touchpanel buttons:
      i. Projector ON , OFF and BLANK buttons feedback state will be based upon serial responses from projector (eg. Projector ON button will be unlit when projector

is off. Button will flash when in transition warming up. Button will light when projector is fully on). Periodic polling of projector status will regularly update this feedback.

 ii. System ON button feedback state will be combination of projector state AND system power state (eg. System ON button will light and stay on only if sequencer has been turned on AND projector is fully on. Button will flash while projector is in transition AND sequencer is on. Button will be off if projector is on but sequencer is off.) Periodic polling of projector status will regularly update this feedback.

 iii. System OFF button feedback state will be combination of projector state AND system power state (eg. Button will light and stay on only if sequencer has been turned off AND projector is fully off. Button will be off if projector is off but sequencer is still on). Periodic polling of projector status will regularly update this feedback.

 iv. Projector Closed Caption button feedback will light to follow the status of the closed caption decoder reported by projector.

 v. Document camera power ON, OFF, and LIGHT buttons will be based upon serial responses from document camera.

 vi. Volume mute buttons will follow state of audio volume control hardware.

 vii. Volume bargraph will smoothly track actual audio level.

E. Unidirectional controlled devices (DVD, and etc.) should not simulate feedback on touch panel, eg. the DVD transport buttons should have momentary feedback lighting only when the user presses the button.

F. Program source select buttons (eg. Desktop Computer, Laptop VGA, Laptop HDMI, Document, DVD, etc.) shall be located along left side of touchpanel layout:

 i. Button press will route all the signals necessary to send that multimedia source to the projector and to the audio system.

 ii. Feedback to source select buttons will remain lit indicating the most recently selected source (radio button style).

 iii. Most recently selected source button will remain lit even when the system is turned off. This simplifies the user experience since the most commonly used input is already preselected.

 iv. When hardware is turned on (projector, switcher, etc.) they will be re-initialized to route the most recently selected source.

G. If there is not sufficient space for all the source buttons to fit along the left side of the touchpanel, additional sub-select buttons may be added on transport pages:

 i. The computer sub-select buttons on transport page (eg. Laptop VGA, Laptop HDMI, Windows PC or Mac Computer) will remain lit indicating the most recently selected source.

 ii. The auxiliary sub-select buttons on transport page (eg. Lectern Aux In, AV Cart Feed, or Control Rm Feed) will remain lit indicating the most recently selected source.

 iii. The most recently selected source should remain routed and lit even when the system power cycles. This simplifies the user experience if the most commonly used input stays preselected.

    iv.   Pressing one of the main source buttons (along left of touchpanel, eg. Laptop Select or Aux Select) will also reselect the previously selected sub-select source. Routing signals as previously selected and lighting the sub-select button eg. Laptop VGA or Laptop HDMI .

H.   Alternate audio source buttons are provided along the bottom of some of the transport pages.

    i.   These buttons will allow break-away audio routing such that the currently selected video source can be combined with audio from another source device (eg. Sheet music on doc cam and audio from CD player).

    ii.   Some HDMI laptops provide audio embedded on HDMI. Some digital video devices don't provide embed audio and must use the analog headphone jack (using 3.5mm audio cable which is provided for VGA laptops). The alternate audio buttons (Laptop HDMI and Laptop 3.5mm) allow the user to route the active audio regardless of the laptop's default system settings.

    iii.   Alternate audio source select buttons will be unlit unless pressed. Once pressed the alternate source buttons will light showing the most recently selected source (radio button style).

    iv.   Pressing any of the main Program source buttons (along left of touchpanel) will disable the break-away routing and un-light all of the alternate audio source buttons.

I.   Projector ON button press will start the following process:

    i.   Un-blank the projector.

    ii.   Turn projector on.

    iii.   Turn on power sequencer to enable signal routing components for use.

    iv.   Open "Power Up" pop-up page informing user of remaining time until projector will light (depending on projector may be 30-60 seconds for cold start and as long as 60-120 seconds for cool down and restart).

    v.   Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.

    vi.   Flash projector ON button while the projector is warming up.

    vii.   While the projector is warming up ignore button presses of the projector power ON , OFF , BLANK and System ON and System OFF buttons. During this warm up time a repeat button press should open "Message Box" pop-up page telling the user to be patient.

    viii.   Poll the projector until it responds indicating either:

        a.   It cannot start normally and reports an error then open "Message Box" pop-up page and report error to user. Also update RMS.

        b.   It doesn't light within normal time (depends on projector model) then open "Message Box" pop-up page and report error to user. Also update RMS.

        c.   It has started normally then stop flashing and light the ON button.

    ix.   Initialize all of the signal routing hardware to display the source device which was most recently selected. Disable any break-away audio routing and un-light alternate audio source buttons.

    x.   Poll projector after power-up and write lamp hours to variable text field 5 on projector tabbed pop-up page and update RMS.

UGA DESIGN & CONSTRUCTION
SUPPLEMENTAL GENERAL REQUIREMENTS & STANDARDS   AUDIO-VISUAL CONTROL SYSTEM
AUGUST 1, 2016   27 41 00.01-3

J. Projector OFF button press will start the following process:
   i. Open "Power Down" pop-up page with 20 second count-down bar graph. Querying user if they in fact want to turn off the projector.
   ii. Immediately blank the projector image.
   iii. If the user hits CANCEL then close pop-up page, un-blank the projector and do nothing else.
   iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the projector (same as below).
   v. If the user hits TURN OFF then do the following:
      a. Turn the projector off.
      b. The projector OFF button will flash indication that the projector is cooling down.
      c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
      d. While the projector is cooling ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "message box" telling the user to be patient.
      e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

K. Projector BLANK button can be used to temporarily hide the projected image. The projector will remain on but show only a black screen so that the image can be immediate re-displayed as required by the user. The BLANK button is a toggling function and will follow the blank status reported by the projector.

L. If user leaves projector "blanked" for longer than 60 minutes then start the following process:
   i. Touchpanel should beep once loudly.
   ii. Open "Power Down" pop-up page with 20 second count-down bar graph. Querying user if they in fact want to turn off the projector.
   iii. If the user hits CANCEL then close pup-up page and do nothing.
   iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the projector (same as below).
   v. If the user hits TURN OFF then do the following:
      a. Turn the projector off.
      b. Projector OFF button will flash indication that the projector is cooling down.
      c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
      d. While the projector is cooling ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "Message Box" pop-up page telling the user to be patient.
      e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

M. System ON button press will start the following process:

    i. Un-blank the projector.

    ii. Turn projector on.

    iii. Turn on power sequencer to enable signal routing components for use.

    iv. Open "Power Up" pop-up page informing user of remaining time until projector will light (depending on projector may be 30-60 seconds for cold start and as long as 60-120 seconds for cool down and restart).

    v. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.

    vi. Flash projector ON and System ON button while the projector is warming up.

    vii. While the projector is warming up ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this warm up time a repeat button press should open pop-up "message box" telling the user to be patient.

    viii. Poll the projector until it responds indicating either:

        a. It cannot start normally and reports an error then open "message box" and report error to user. Also update RMS.

        b. It doesn't light within normal time (depends on projector model) then open "Message Box" pop-up page and report error to user. Also update RMS.

        c. It has started normally then stop flashing and light the projector ON and System ON buttons.

    ix. Poll projector after power-up and write lamp hours to variable text 5 field on projector tabbed pop-up page and update RMS.

    x. Projection screen down.

    xi. Set lights to a scene appropriate for projection. Refer to section 26 09 36 – Modular Dimming Controls.

    xii. Initialize all of the signal routing hardware to display the source device which was most recently selected. Disable any break-away audio routing and un-light alternate audio source buttons.

    xiii. After the power up sequence is complete unmute the audio and return levels to where they were when last used.

N. System OFF button press will start the following process:

    i. Open "Power Down" pop-up page with 20 second count-down bar graph. Querying user if they in fact want to turn off the system.

    ii. Immediately blank the projector image.

    iii. If the user hits CANCEL then close pup-up page, unblank the projector and do nothing else.

    iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the system (same as below).

    v. If the user hits TURN OFF then do the following:

        a. Turn the projector off.

        b. System OFF button will flash indication that the projector is cooling down.

  c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.

  d. While the projector is cooling down ignore button presses of the projector power ON , OFF , BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "Message Box" pop-up page telling the user to be patient.

  e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

  f. Document camera turned off.

  g. Mute all audio levels.

  h. Projection screen up.

  i. Lights set to normal on scene. Refer to section 26 09 36 – Modular Dimming Controls.

  j. Window shades open.

  k. Power sequencer turned off.

  l. Do not turn off power to players with removable media (DVD,etc.) so that users will be able to remove media after system is off.

  m. Do not turn off power to desktop computers and peripheral devices. Computer shutdown should be properly performed as controlled by the operating system.

  n. Turn off other devices as appropriate.

 vi. The projector's built-in Closed Caption decoder will be used to provide onscreen captions for composite video sources. There is a toggling Closed Caption button on the projector control tabbed page and on each of the AUX IN, DVD, transport pages (button feedback lit based on projector response).

O. Audio controls consist of two sets of audio level control with up, down, mute and bar graph:

 i. One set will simultaneously control both the right and left channels of the program audio. There will be no balance control on the touch panel.

 ii. In rooms which have a dedicated voice amplification system a second set of controls will set the master audio output level of the microphone mix.

 iii. Mute button will toggle mute on and off.

 iv. Up button will cancel mute and raise volume.

 v. Up button will turn on power sequencer to enable audio components for use (microphones, computer audio, etc.).

 vi. Down button will lower volume but will not affect mute.

 vii. Volume bar graph will smoothly follow the actual level of the volume device.

 viii. Volume bar graph will go to zero when the volume mute is activated.

P. Lighting control will be provided by bi-directional communication interface (either RS232 or Ethernet) to an external dedicated lighting controller. The command language of this external lighting controller should include:

 i. Command for recalling preset lighting scenes.

 ii. Command for turning on a specific circuit (relay or dimmer).

 iii. Command for turning off a specific circuit (relay or dimmer).

Q. Lighting scene buttons on the touchpanel will simply recall preset lighting scenes from the external lighting controller. These preset lighting scenes are setup independently

UGA DESIGN & CONSTRUCTION
SUPPLEMENTAL GENERAL REQUIREMENTS & STANDARDS   AUDIO-VISUAL CONTROL SYSTEM
AUGUST 1, 2016   27 41 00.01-6

using the keypad on the external lighting control system. The preset lighting scenes stored on the external controller will depend on the rooms use and size but might include:

    i. Lights On – all normal room lights on.

    ii. Projection Mode – lights near screen turned off, rest of room on.

    iii. Cinema Mode – lights near screen turned off, rest of room dim.

    iv. Whiteboard Mode – lights near white board all on, rest of room 50%.

    v. Stage Mode – directional lights ON, front lighting on, rest of room 50%.

    vi. Video Conference Mode – directional spotlights on, lights near screen off, rest of room on.

    vii. Lights Off – all lights off.

R. A "more controls" lighting pop-up page will provide discrete control of each of the electrical lighting circuits. This will allow the user to fine tune the lighting beyond those choices provided in the presets above.

S. If electric window shades are controlled from the touchpanel then include up and down controls on the tabbed lighting controls pop-up page.

T. The document camera control page will function as follows:

    i. Power ON button will turn on document camera.

    ii. Top Light button will toggle upper lamp on and off.

    iii. Bottom Light button will toggle lower lamp on and off.

    iv. Power OFF button will turn off document camera.

    v. Zoom, iris and focus buttons will send start command on press and stop command on release.

    vi. RESET button will reset all setting to default (usually provided by resending power on command to document camera).

U. When the control processor is reset perform the following initialization:

    i. Trigger an RMS event recording the fact that the control processor has been reset.

    ii. Initialize RS232 connected hardware to simplify equipment replacement. Equipment swapped by technicians should not require manual configuration.

    iii. Initialize the switcher so that all VGA inputs will provide proper extended display identification data (EDID) information to the connected computers. The EDID table should be either:

        a. The exact EDID table as generated by the projector.

        b. Or an edited version of the projector EDID table (edited to limit resolution or other issues).

        c. Or an EDID table generated internally by the switcher with the maximum resolution matching the native resolution of the projector.

    iv. Initialize the switcher so that all HDMI inputs will provide proper EDID information to the connected computer. The EDID table should be either:

        a. The exact EDID table as generated by the projector.

        b. Or an edited version of the projector EDID table (edited to limit resolutions or to handle embedded audio or other issues).

    v. On each of the pages for Desktop and Laptop computers write the native resolution of the projectors. This provides a guide for the user if they need to

UGA DESIGN & CONSTRUCTION
SUPPLEMENTAL GENERAL REQUIREMENTS & STANDARDS   AUDIO-VISUAL CONTROL SYSTEM
AUGUST 1, 2016   27 41 00.01-7

manually set their computer to the correct resolution to match the projector. Touchpanel variable text field 7.

    vi. Write AV help desk telephone number (as requested by End-User) to touchpanel variable text field 3.

    vii. Write current lamp hours as reported by projector to touchpanel variable text field 5.

    viii. Write maximum lamp hours to the projector pop-up page as a guide to user (maximum as defined in projector manual). This will be printed beside the current lamp hours, in variable text field 4, as a guide to the user.

V. When the touch panel wakes from sleep mode the "help_page" pop-up page should be displayed for 15 seconds and then closed to expose whatever pages had last been visible.

W. Periodically poll the projector for power state and error status. Update feedback on all touchpanel power buttons. Also update all fields linked to RMS for projector monitoring, error status and theft detection.

X. When the touchpanel wakes from sleep mode poll the projector for power state and update feedback on all touchpanel power buttons.

Y. Hidden button in upper left-hand corner of touch panel must be held for 3 seconds and then panel will switch to technician's page (refer to "Technician" page on sample touch panel file).

Z. Technician page should allow user to enter time of day for daily shutdown of the projector (default 23:59 midnight). At the designated shutdown time do the following:

    i. Touchpanel should beep once loudly.

    ii. Open "Power Down" pop-up page with 20 second count-down bar graph. Querying user if they in fact want to turn off the projector.

    iii. Immediately blank the projector image.

    iv. If the user hits CANCEL then close pup-up page, unblank the projector and do nothing else.

    v. If the user hits Turn Off then turn off projector (same as below).

    vi. If the user does not intervene to cancel the process then:

        a. Turn the projector off.

        b. Projector OFF and System OFF buttons will flash indication that the projector is cooling down.

        c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.

        d. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

AA. The control system software should include code to interface with UGA's campus-wide "AMX RMS Enterprise" asset management system. This will allow remote control and monitoring as follows:

    i. Report device status: System power state, Projector power state, bulb life, online status of system devices, etc.

    ii. Report alarms: projector bulb error, projector filter error, projector offline (or stolen?), system offline, system rebooting, etc.

    iii. Record usage statistic for each source device. Usage time will be based on a count of minutes during which a source is selected while projector is on.

UGA DESIGN & CONSTRUCTION
SUPPLEMENTAL GENERAL REQUIREMENTS & STANDARDS   AUDIO-VISUAL CONTROL SYSTEM
AUGUST 1, 2016   27 41 00.01-8

      iv. Maintain server database of all equipment serial numbers in real-time for inventory purposes.

      v. Synchronize controller date and time with RMS server.

      vi. Support RMS server scripting to remotely shut down and control equipment.

      vii. Provide links to touchpanel web control pages (see below).

BB. A secure web control interface will be provided allowing access to all of the touch panel pages via a web browser. Both password protection and network security should protect this interface from being misused.
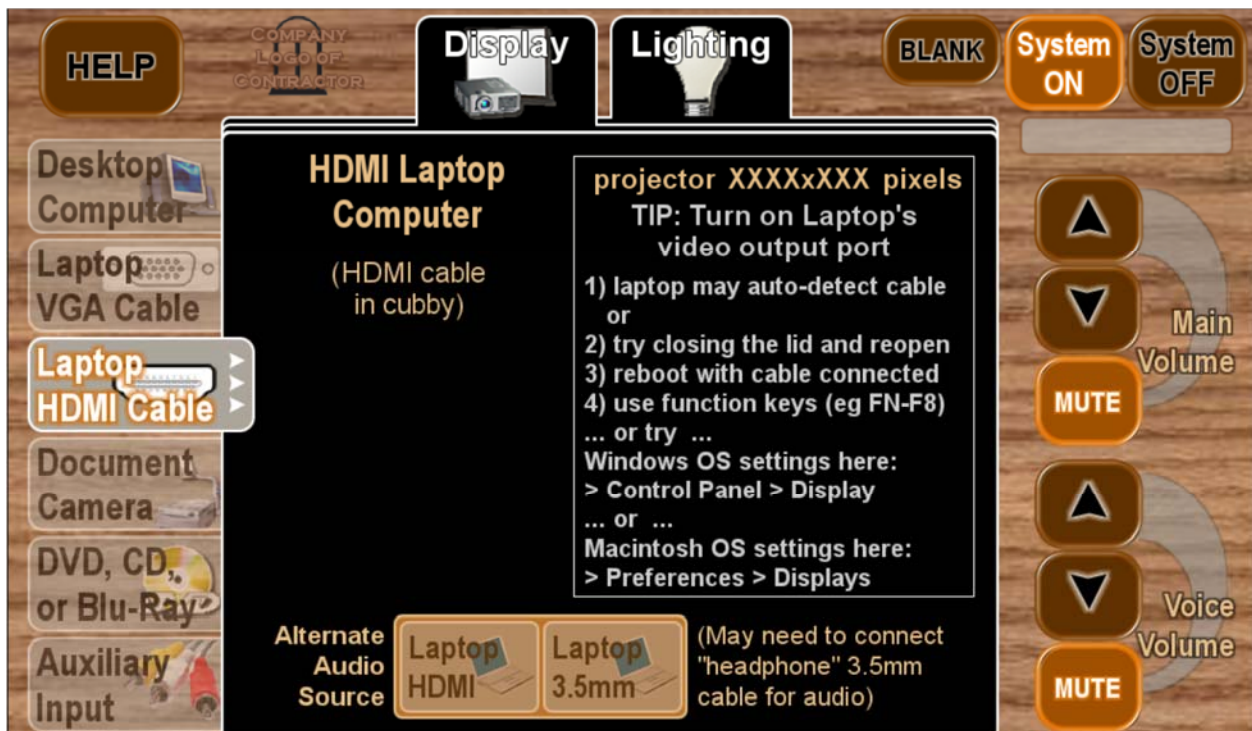
CC. Ethernet connected Audio-Video control devices should use DHCP in private 172.19.xx.xx range which are part of the campus-wide VLAN1024.   (Do not manually configure NIC or use public 128.192.153.xx ranges or shared VLAN with PC. This avoids interference due to other traffic, IP conflicts due to typos and does not allow off-campus connectivity.)

      i. EITS will designates new 172.19.xx.xx range with adequate space for AV equipment in building on VLAN1024.

      ii. Provide MAC addresses to CTL for all AV devices for registration using the Proteus management system for DHCP.

      iii. EITS extends VLAN1024 to building edge device. This VLAN1024 has open TCP ports to RMS server and other maintenance requirements and doesn't allow any off campus connectivity.

      iv. Multiple dedicated Ethernet jack must be activated. Lectern tether has dedicated cables to connect AV devices (Computer and other non-AV devices must have separate Ethernet cabling).

    v. Label jack to indicate that it is for AV devices on VLAN1024 (also label other jacks for PC, etc. to avoid confusion).

    vi. EITS will extend VLAN1024 only to specific jack with AV devices connected.

    vii. Jacks configured for VLAN1024 <u>must not connect Non-AV devices</u> such as Computers, VC CODECs, and other devices with off-campus access or which might interfere.

    viii. AV devices receive DHCP service to setup IP address, mask, gateway and DNS settings for network interface card.

    ix. Configuration of AMX System number should use the convention: RRRBB where RRR = first three digits are room number and BB = last two digits are building number defined by CTL.

    x. Peripheral AMX devices should connect to Master device using AMX "Auto-connect" mode pointing at the master system number.

    xi. Where practical the touchpanel should connect directly to the processors ICSLAN bus RJ45. This isolates the touchpanel from the building LAN for reliability. The touchpanel will receive DHCP service directly from the control processor in the range 198.18.xx.xx (in this case there is no need to register MAC address with CTL).

    xii. NetLinx code for Non-AMX devices must use URL names and <u>must not be hardcoded with numeric IP addresses</u>.

    xiii. During installation and testing the device security settings can use default passwords. But after commissioning the systems will be configured for LDAPS access control using UGA MyID authentication.

    xiv. Connectivity to RMS server will require the inclusion of SDK code modules into control processor code. When the control processor see RMS server it will initiate connections and await approval by RMS server administrator. After administrator approval the SDK code will communicate to auto-populate database on RMS server.

UGA DESIGN & CONSTRUCTION
SUPPLEMENTAL GENERAL REQUIREMENTS & STANDARDS   AUDIO-VISUAL CONTROL SYSTEM
AUGUST 1, 2016   27 41 00.01-10